APPENDIX I

FAUNA SURVEY METHODOLOGY

FAUNA SURVEY METHODOLOGY

Introduction

Fauna survey methods used by *Conacher Travers Pty Ltd* are based upon the standard methods utilised by the NSW National Parks and Wildlife Service (NPWS 1999), State Forests of NSW (York *et al*. 1991), LHCCREMS (2002) and Wyong Shire Council (Forest Fauna Surveys *et al*. 1999) and adapted to those specific requirements within local Council Flora and Fauna Survey Guidelines. Specific fauna groups are targeted using methods specific to that group. This appendix provides specific information on each of the fauna survey methods applied for this survey. During each of the methods used the following data is gathered relating to weather conditions:

- Air temperature;
- Moon (where relevant) (eg none, 1/4 moon, 1/2 moon, 3/4 moon, full moon);
- Rain (eg none, light drizzle, heavy drizzle, heavy rain);
- Recent rain events (where relevant);
- Wind Strength eg calm, light (leaves rustle), moderate (moves branches), strong (moves tree crowns).

The survey methods outlined below are the standard survey methods utilised by *Conacher Travers Pty Ltd.* The specific survey methods used for each site will depend upon the site characteristics such as size of the site, number of vegetation communities and amount of disturbance. The specific fauna survey methods used are outlined within Section 3 of this report.

1. *Diurnal Birds*

a. Bird Census

- A diurnal bird census is undertaken on each day of the survey. Each census involves a 1-2 hour census throughout the site. Birds may be recorded by the observer traversing the subject site or from targeted census points within the site. A bird census is undertaken during peak activity periods (6am-9am and 3pm-6pm or later depending on season) and birds are identified through observation and call identification. Specific habitats of threatened species are also targeted across the study areas either during the bird census or opportunistically.

- Opportunistic bird counts are also made while undertaking other survey work and during spotlight surveys of the site.

- Birds are observed and identified using binoculars. Calls are generally identified in the field by the observer. If an unknown call is heard it is recorded and identified using reference libraries.

b. Opportunistic Sampling

- When carrying out any particular method of fauna survey, any birds observed or heard are recorded. Signs of birds such as feeding stations are also noted and analysed. This provides a wider opportunity for observation of species.

c. Habitat Searches

- Habitat searches involve targeted searches for signs of likely bird activity such as nesting or hollow tree use. Signs of feeding such as the characteristic chew marks of Allocasuarina cones are also targeted during searches.

2. *Nocturnal Birds*

a. Spotlighting

- Spotlight surveys are conducted in the evening for 1 hour after sunset in small or highly disturbed sites and for 2 hours in large, undisturbed sites. Surveys are carried out by one or more persons and involve the use of a 55 watt spotlight powered by a 12 volt rechargeable battery. Spotlighting is carried out along existing tracks and/or roads, animal paths, boundary fence lines, woodland or forest with open understorey, individual trees, and where accessible, trapping transects.

b. Owl Call Playback

- The recorded calls of the Powerful, Barking, Masked, and Sooty Owls are broadcast at the completion of spotlighting via a 13 watt battery operated loudspeaker. Calls are broadcast separately for 5 minutes followed by a listening period of 2 minutes. The immediate area is then surveyed with a spotlight to detect any responses. Calls for each species are played separately. Calls are broadcast from different locations depending on the size of the site and the length of the survey.

c. Stagwatch

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

3. *Arboreal Mammals*

a. Elliott Trapping

- Arboreal mammal trapping involves the use of either Type A or Type B Elliott Traps or a combination of both. Elliott Traps are small folding box traps available in two sizes, Type A (330 x 100 x 100 mm) and Type B (450 x 150 x 150 mm) (Elliott Scientific Co., Victoria). Traps are secured with rubber bands onto mounts that are attached to the trunk of large trees (Diameter at Breast Height - DBH > 100mm) at heights ranging from approximately two to three metres.

- The trap mounts consist of 500mm long hardwood planks bolted onto a steel angle bracket. These mounts are then nailed onto the tree trunk at an incline to facilitate drainage. All traps are placed in an open-ended plastic bag to provide captured animals with insulation and protection from inclement weather conditions.

- Traps are placed along transects or within grids. Traps are mounted at intervals to the nearest large trees in transects or grids of 5 to 10 traps each depending upon the size of the site and type and number of vegetation communities present. This gives transects of approximately 100-200 metres in length or grids approximately 1 hectare in size.

- Traps are set for a period of 3-4 continuous nights.

- Traps are baited with a mixture of peanut butter, rolled oats and honey. A 50/50 solution of honey and water is sprayed on the tree trunk, trap and mount to act as an attractant for arboreal mammals.

- All traps are checked each morning and closed to prevent unwanted diurnal captures. Traps are reset each afternoon and rebaited if necessary.

- When released, captured animals are traced to their den sites if possible.

b. Spotlighting

- Spotlight surveys are conducted in the evening for 1 hour after sunset in small or highly disturbed sites and for 2 hours in large, undisturbed sites. Surveys are carried out by one or more persons and involve the use of a 55 watt spotlight powered by a 12 volt rechargeable battery. Spotlighting is carried out along existing tracks and/or roads, animal paths, boundary fence lines, woodland or forest with open understorey, individual trees, and where accessible, trapping transects.

c. Hair Tubes

- Hair tubes consist of a 200mm length of PVC stormwater pipe (90mm diameter) fitted with a PVC plug and cap at one end which creates a bait chamber. Bait is placed in the bait chamber between the cap and the plug which has several holes drilled into it. This allows the smell of the bait to permeate from the tube without allowing access to the bait chamber. Strips of Schafco Advance Tape are placed around the inner surface of the tube opening to catch the hairs of fauna visiting the hair tubes.

- For arboreal fauna surveying hair tubes are placed on the trunk of trees at approximately two metres height using nails and rubber bands. Tubes are baited with a mixture of rolled oats, peanut butter and honey with a 50/50 honey water mix sprayed on the trunk of the tree. Tubes are placed along transects or within grids with the open side down to prevent rain effecting the adhesiveness of tapes.

- When the hair tubes are collected, the hair samples are sent to Barbara Triggs for analysis.

d. Stagwatch

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

4. *Terrestrial Mammals*

a. Elliott Trapping

- Terrestrial mammal trapping involves the combined use of both Type A and Type B Elliott Traps. Elliott Traps are small folding box traps available in two sizes, Type A (330 x 100 x 100 mm) and Type B (450 x 150 x 150 mm) (Elliott Scientific Co., Victoria). All traps are placed in an open-ended plastic bag to provide captured animals with insulation and protection from inclement weather conditions.

- Traps are placed on the ground in transects or grids of 5 to 10 traps each depending upon the size of the site and type and number of vegetation communities present. This gives transects of approximately 100-200 metres in length or grids approximately 1 hectare in size.

- Traps are baited with a mixture of rolled oats, honey and peanut butter and set in suitable locations next to animal diggings, burrows, fallen logs, tree trunks and animal runways.

- All traps are checked each morning and closed to prevent unwanted diurnal captures. Traps are reset each afternoon and rebaited if necessary.

- Traps are set for a period of 3-4 continuous nights.

- When released, captured animals are traced to their den sites if possible.

b. Spotlighting

- Spotlight surveys are conducted in the evening for 1 hour after sunset in small or highly disturbed sites and for 2 hours in large, undisturbed sites. Surveys are carried out by one or more persons and involve the use of a 55 watt spotlight powered by a 12 volt rechargeable battery. Spotlighting is carried out along existing tracks and/or roads, animal paths, boundary fence lines, woodland or forest with open understorey, individual trees, and where accessible, trapping transects.

c. Hair Tubes

- Hair tubes consist of a 200mm length of PVC stormwater pipe (90mm diameter) fitted with a PVC plug and cap at one end which creates a bait chamber. Bait is placed in the bait chamber between the cap and the plug which has several holes drilled into it. This allows the smell of the bait to permeate from the tube without allowing access to the bait chamber. Strips of Schafco Advance Tape are placed around the inner surface of the tube opening to catch the hairs of fauna visiting the hair tubes.

- For terrestrial fauna surveying hair tubes are placed along transects or in grids and left in place for approximately 10 days. Along each of the hair tube transects, tubes are baited either with chicken meat or with peanut butter, rolled oats and honey.

- For terrestrial fauna surveying hair tubes are placed along transects or in grids and left in place for approximately 10 days. Along each of the hair tube transects, tubes are baited either with chicken meat or with peanut butter, rolled oats and honey.

- When the hair tubes are collected, the hair samples are sent to Barbara Triggs for analysis.

d. Cage Trapping

- Terrestrial cage mammal trapping involves the use of wire cage traps. Wire cage traps are made of collapsible wire mesh and designed for the capture of larger size mammals.

- Traps are baited with chicken or rolled oats, peanut butter and honey and placed within transect lines or grids, usually in conjunction with Elliott trapping.

- Traps are checked each morning and triggered to prevent unwanted diurnal captures. All traps are placed in sheltered locations to provide protection from inclement weather.

- Traps are set for a period of 3-4 continuous nights.

5. *Bats*

a. Sonar Detection

- The ultrasonic calls of Microchiropteran bats are recorded to audio cassette tapes using an Anabat II echolocation call detector. Recordings are made at suitable locations within the study area for a 45 minute continuous recording or all night call activated recording.

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

- A survey for Flying-foxes can be conducted by spotlighting potential food trees and by identifying their characteristic social calls.

b. Harp Traps

- Harp traps are placed within suitable "flyways" such as across tracks, trails or creeks to maximise the likelihood of captures. Harp traps are placed within suitable vegetation types for a minimum of three nights.

- Harp traps are checked each morning of the survey with all captured bats identified using field identification guides. Bats are then released at the point of capture or placed under bark or within trunk splits of nearby trees.

c. Stagwatch

- Stagwatch surveys are conducted in the evening for approximately 15 minutes prior to and 45 minutes after sunset. Hollow trees identified with habitat potential are observed for use by microchiropteran bats. Any bats observed leaving hollows are identified by Anabat II detectors positioned at the base of the tree.

6. *Amphibians*

a. Habitat Search

- Habitat searches involve searching likely niches such as dense undergrowth, around trees, under logs and rocks, and aquatic and gully habitats. Amphibian species observed during habitat searches are noted and the calls of species not observed are 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.

- If aquatic habitats are present on the site they are sampled for the presence of particular fish species to gather information on any predatory fish species such as *Gambusia holbrooki*. A small dip net is passed through the waterbody a number of times to sample the fish stock of the aquatic habitat.

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

- Field traverses are made across the study area 0.5 hours at a time. Optimal times for conducting habitat searches are early morning, late afternoon or when favourable weather conditions for a particular species prevail.

b. Call Identification

- Where suitable habitats are present, areas frogs are heard calling are targeted and any frogs heard calling are identified in the field or recorded onto cassette for later identification. This method is specifically used during times of peak calling activity, that is, after rain/storms and in periods of warm weather.

- Field traverses are made across the study area 0.5 hours at a time. Optimal times for conducting habitat searches are early morning, late afternoon or when favourable weather conditions for a particular species prevail.

7. *Reptiles*

a. Habitat Search

- Habitat searches involve searching likely niches such as dense undergrowth, around trees, under logs and rocks, and aquatic and gully habitats. Destructive searches whereby bark, logs, debris, rocks and ant-nests are displaced are also carried out. Reptile species observed during habitat searches are noted and if individuals are captured they are identified on site using field reference texts and released.

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

- Field traverses are made across the study area for up to 3 hours at a time, usually by one person. Optimal times for conducting habitat searches are between 6am to 9am and 3pm to 6pm, or in suitable weather conditions depending on the season.

b. Spotlighting

- Spotlight surveys are conducted in the evening for 1 hour after sunset in small or highly disturbed sites and for 2 hours in large, undisturbed sites to target nocturnal reptile species. Both terrestrial and arboreal habitats are searched during nocturnal searches. Surveys are carried out by one or more persons and involve the use of a 55 watt spotlight powered by a 12 volt rechargeable battery. Spotlighting is carried out along existing tracks and/or roads, animal paths, boundary fence lines, woodland or forest with open understorey, individual trees, and where accessible, trapping transects.

REFERENCES

Forest Fauna Surveys, EcoPro Pty Ltd and Fly By Night Bat Surveys Pty Ltd. (1999) *Flora and Fauna Survey Guidelines*. Prepared for Wyong Shire Council.

Lower Hunter Central Coast Regional Environmental Management (2002) *Flora and Fauna Survey Guidelines* Lower Hunter Central Coast Region.

NSW National Parks and Wildlife Service. (1999) *NSW Comprehensive Regional Assessments - Vertebrate Fauna Surveys (1996-97) Summer Survey Season Field Survey Methods*. Amended January 1997. Prepared by NSW National Parks and Wildlife Service.

York, A., Binns, D. and Shields, J. (1991) *Flora and Fauna Assessment in NSW State Forests. Survey Guidelines*. Report by Forest Ecology and Silviculture Section, Wood Technology and Forest Research Division, Forestry Commission of NSW.

APPENDIX II

FLORA QUADRAT DATA

Family	Scientific Name	Common Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
TREES																									
Araliaceae	*Schefflera actinophylla*	Umbrella Tree																							
Araucariaceae	*Araucaria cunninghamii*	Hoop Pine																							
Arecaceae	*Archontophoenix cunninghamiana*	Bangalow Palm											x												
Casuarinaceae	*Allocasuarina littoralis*	Black She-oak					x		x													x		x	
	Casuarina glauca	Swamp Oak						x			x			x	x		x		x						x
Eleocarpaceae	*Elaeocarpus reticulatus*	Blueberry Ash				x			x	x															
Euphorbiaceae	*Glochidion ferdinandii*	Cheese Tree				x	x		x	x			x	x	x		x								
Fabaceae: Faboideae	*Castanospermum australe*	Black Bean																							
	*Erythrina crista-galli**	Cockspur Coral Tree																							
	*Bauhinia variegata**	Orchid Tree																							
Lauraceae	*Cinnamomum camphora**	Camphor Laurel																							
	Cryptocarya triplinervis	Three-veined Cryptocarya																							
	Endiandra sieberi	Corkwood																							
Moraceae	*Ficus coronata*	Sandpaper Fig											x												
	*Ficus elastica**	Rubber Plant																							
	Ficus macrophylla	Moreton Bay Fig																							
Myoporaceae	*Myoporum acuminatum*	Mangrove Boobialla																							
Myrtaceae	*Acmena smithii* 'small-leaved race'	Lillypilly									x	x													
	Angophora costata	Smooth-barked Apple					x																		
	Corymbia intermedia	Pink Bloodwood	x						x		x								x						
	Eucalyptus grandis	Flooded Gum																							
	Eucalyptus microcorys	Tallowwood																							
	Eucalyptus pilularis	Blackbutt																							
	Eucalyptus resinifera subsp. *hemilampra*	Red Mahogany				x	x																		
	Eucalyptus robusta	Swamp Mahogany	x		x					x					x		x						x	x	
	Eucalyptus siderophloia	Northern Grey Ironbark																							
	Eucalyptus tereticornis	Forest Red Gum	x					x								x	x							x	x
	Lophostemon confertus	Brush Box																						x	

Family	Scientific Name	Common Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
TREES (Cont.)	*Lophostemon suaveolens*	Swamp Turpentine	x		x	x	x																x		
	Melaleuca quinquenervia	Broad-leaved Paperbark	x	x	x	x	x	x	x	x	x		x	x	x	x	x		x	x		x	x	x	x
	Syzygium australe	Brush Cherry																							
	Syzygium luehmannii	Small-leaved Lilypilly																							
Proteaceae	*Banksia integrifolia* subsp. *integrifolia*	Coast Banksia							x	x	x	x		x					x						
Rutaceae	*Acronychia imperforata*	Beach Acronychia								x	x	x													
Sapindaceae	*Cupaniopsis anacardioides*	Tuckeroo								x	x	x	x						x						
	Guioa semiglauca	Guioa									x														
SHRUBS																									
Apocynaceae	*Nerium oleander**	Oleander Bush																							
Araliaceae	*Polyscias elegans*	Celery Wood																							
	Polyscias sambucifolia	Elderberry Panax								x															
Asclepidaceae	*Gomphocarpus fruiticosus**	Narrow Leaf Cotton Bush												x	x	x			x	x					
Asteliaceae	*Cordyline stricta*	Narrow-leaf Palm Lily											x												
Asteraceae	*Baccharis halimifolia**	Groundsel Bush				x									x	x	x		x						x
	Chrysanthemoides monilifera subsp. *monilifera**	Bitou Bush							x	x	x	x	x						x						
	Ozothamnus diosmifolius	Ball Everlasting																							
Epacridaceae	*Epacris microphylla*	-																				x			
	Epacris obtusifolia	-																							
	Epacris pulchella	NSW Coral Heath			x																				
	Leucopogon lanceolatus	Lance Beard-heath								X															
	Leucopogon leptospermoides	-				x			x																
	Monotoca elliptica	Tree Broom-heath							x	x															
Euphorbiaceae	*Breynia oblongifolia*	Coffee Bush								x	x			x			x								
	Phyllanthus gunnii	-												x											
Fabaceae: Caesalpinioideae	*Senna pendula var. glabrata**	-							x	x	x	x	x	x			x		x						

Family	Scientific Name	Common Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
SHRUBS (Cont.)																									
Fabaceae:																									
Faboideae	*Aotus ericoides*	Aotus							x																
	Bossiaea heterophylla	Variable Bossiaea							x																
	Gompholobium pinnatum	-																				x			
	Mirbelia rubiifolia	-																							
	Pultenaea linophylla	-																							
	Pultenaea retusa	-				x	x		x								x					x	x		
	Pultenaea villosa	-							x	x															
	Phyllota phylicoides	Heath Phyllota																							
Fabaceae: Mimosoideae	*Acacia floribunda*	Sally Wattle																							
	Acacia longifolia var. *longifolia*	Golden Wattle				x			x	x				x											x
	Acacia longifolia var. *sophorae*	Coastal Wattle									x	x													
	Acacia longissima	Narrow-leaved Wattle				x																			
	Acacia myrtifolia	Red Stem Wattle																							
	*Acacia saligna**	Orange Wattle												x											
	Acacia suaveolens	Sweet Scented Wattle							x	x	x			x											
Malvaceae	*Hibiscus syriacus**	-																							
	Hibiscus sp. (cultivar)	Hibiscus																							
	*Malvaviscus arboreus**	Sleepy Mallow																							
Meliaceae	*Synoum glandulosum*	Scentless Rosewood							x																
Monimiaceae	*Wilkiea heugeliana*	Wilkiea																							
Myrsinaceae	*Rapanea howittiana*	Brush Muttonwood																							
	Rapanea variabilis	Muttonwood				x				x															
Myrtaceae	*Callistemon pachyphyllus*	Wallum Bottlebrush	x				x	x								x				x					
	Callistemon sp. (cultivar)	-																							
	Leptospermum juniperinum	Prickly Tea-tree		x	x		x									x				x			x	x	
	Leptospermum liversidgei	-																				x	x		
	Leptospermum polygalifolium subsp. *cismontanum*	Lemon Scented Tea Tree																							
	Melaleuca nodosa	Ball Honey Myrtle		x	x				x													x	x		

Family	Scientific Name	Common Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
SHRUBS (Cont.)	*Melaleuca sieberi*	-		x	x	x	x																x	x	
	Melaleuca squamea	-																							
	Melaleuca thymifolia	Thyme Honey Myrtle	x	x	x	x	x	x								x				x		x	x	x	
Ochnaceae	*Ochna serrulata**	Mickey Mouse Plant																	x						
Oleaceae	*Ligustrum sinense**	Small-leaved Privet																							
	Notelaea longifolia	Mock Olive							x	x	x								x						
	Notelaea ovata	Mock Olive			x	x	x		x	x									x			x			
Phytolaccaceae	*Phytolacca octandra**	Inkweed																							
Pittosporaceae	*Pittosporum revolutum*	Yellow Pittosporum																							
Proteaceae	*Banksia oblongifolia*	-		x	x		x															x	x	x	
	Banksia spinulosa	Hairpin Banksia		x	x		x															x	x	x	
	Grevillea sp. (cultivar)																								
	Hakea actites	-																							
	Hakea dactyloides	Broad-leaved Hakea		x	x		x																x	x	
	Persoonia conjuncta	-			x																				
	Persoonia stradbrokensis	-							x	x	x						x								
	Persoonia virgata	-																							
Rubiaceae	*Psychotria loniceroides*	-				x																			
Sapindaceae	*Alectryon coriaceus*	Beach Alectryon																							
	Dodonaea triquetra	Hop Bush							x	x	x											x			
Solanaceae	*Duboisia myoporoides*	Corkwood							x	x	x			x					x						
	*Solanum mauritianum**	Wild Tobacco																							
	Solanum pungetium	Eastern Nightshade																							
Verbenaceae	*Clerodendrum floribundum*	-									x														
	Clerodendrum tomentosum	-																							
	*Lantana camara**	Lantana							x	x	x						x		x						
GROUNDCOVERS																									
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower								x									x						
	*Thunbergia alata**	Black-eyed Susan																							
Agavaceae	*Yucca aloifolia**	-																							

Family	Scientific Name	Common Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
GROUNDCOVERS (Cont.)																									
Amaranthaceae	*Alternanthera denticulata*	Lesser Joyweed													x										
Amaryllidaceae	*Crinum pedunculatum*	Swamp Lily																							
Anthericaceae	*Caesia parviflora* var. *parviflora*	Pale Grass Lily		x	x																				
	*Chlorophytum comosum**	Spider Plant											x												
	Thysanotus tuberosus	Fringed Lily	x	x			x									x							x	x	
	Tricoryne elatior	Yellow Rush Lily	x	x	x	x	x							x		x	x								x
Apiaceae	*Centella asiatica*	Swamp Pennywort				x	x		x	x			x		x	x	x		x	x					x
	*Ciclospermum leptophyllum**	Slender Celery														x									
	*Foeniculum vulgare**	Fennel											x												
	*Hydrocotyle bonariensis**	Kurnell Curse / Pennywort													x										
	Hydrocotyle peduncularis	Pennywort													x										x
	Trachymene incisa subsp. *incisa*	Native Parsnip																							
Apocynaceae	*Vinca major**	Blue Periwinkel																							
Asparagaceae	*Protasparagus aethiopicus**	Asparagus Fern							x																
	*Protasparagus plumosus**	Climbing Asparagus Fern																							
Asteraceae	*Ambrosia artemisiifolia**	Annual Ragweed								x	x	x	x	x	x										x
	*Aster subulatus**	Wild Aster																							x
	*Ageratina adenophora**	Crofton Weed																							
	*Bidens pilosa**	Cobbler's Pegs																							
	*Cirsium vulgare**	Spear Thistle																							
	*Conyza albida**	Fleabane								x															
	*Conyza bonariensis**	Flax-leaf Fleabane												x											
	Eclipta platyglossa	-																							
	*Hypochaeris radicata**	Flatweed												x					x						
	Lagenifera stipitata	-	x		x	x	x																x	x	
	Leptinella longipes	-																							
	Pseudognaphalium luteoalbum	Jersey Cudweed				x																			
	*Senecio madagascariensis**	Fireweed																							
	Vernonia cinerea	-				x										x	x		x						
	Vittadinia hispidula var. *setosa*	-																							

Family	Scientific Name	Common Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
GROUNDCOVERS (Cont.)																									
Baueraceae	*Bauera microphylla*	-				x			x																
Blechnaceae	*Blechnum indicum*	Swamp Water Fern											x		x										
Caryophyllaceae	*Cerastium glomeratum**	Mouse-ear Chickweed																							
	*Stellaria media**	Common Chickweed																							
Clusiaceae	*Hypericum gramineum*	Small St Johns Wort	x	x	x		x																	x	x
Commelinaceae	*Commelina cyanea*	Scurvy Weed													x										
Convolvulaceae	*Dichondra repens*	Kidney Weed														x	x		x						
	Polymeria calycina	-	x	x	x	x	x	x								x	x		x	x			x	x	x
Cyperaceae	*Baumea articulata*	-																							
	Baumea juncea	-		x				x										x			x				
	Baumea rubignosa	Twig Rush	x	x					x										x						
	Baumea teretifolia	Wrinkle-nut Twig Rush																		x				x	
	Bolboschoenus cardwellii	-																							
	Carex appressa	-					x			x			x						x						
	Carex inversa	Knob Sedge																							
	Chorizandra cymbaria	Heron Bristle Rush																							
	Chorizandra sphaerocephala	Round-headed Bristle Rush																							
	Cyperus eglobosus	-																							
	Cyperus odoratus	-									x														
	Cyperus polystachyos	-									x			x	x										x
	Cyperus sanguinolentus	-														x									
	*Cyperus sesquiflorus**	-																							
	Eleocharis sphacelata	Tall Spike-rush																			x				
	Fimbristylis dichotoma	-				x								x		x	x							x	
	Fimbristylis ferruginea	-	x																						
	Fimbristylis velata	-														x									
	Gahnia sieberiana	Red-fruited Saw-sedge															x		x						
	Lepidosperma laterale	Variable Sword-sedge			x				x	x															
	Lepidosperma longitudinale	Pithy Sword Sedge																							
	Ptilothrix deusta	-		x	x	x	x															x	x	x	

Family	Scientific Name	Common Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
GROUNDCOVERS (Cont.)																									
	Schoenoplectus mucronatus	-									x									x					
	Schoenus apogon	Fluke Bog-rush																							
	Schoenus lepidosperma subsp. *pachylepis*	-																							
Davalliaceae	*Nephrolepis cordifolia**	Fish-bone Fern																							
Dennstaedtiaceae	*Pteridium esculentum*	Bracken							x	x	x			x	x	x	x		x						
Dilleniaceae	*Hibbertia aspera*	Rough Guinea Flower				x	x										x		x					x	x
	Hibbertia pedunculata	-																				x			
	Hibbertia vestita	-	x	x	x		x		x	x									x			x	x	x	
Euphorbiaceae	*Phyllanthus tenellus**	-																							x
	Poranthera microphylla																								
Fabaceae: Faboideae	*Medicago polymorpha**	Burr Medic																							
Goodeniaceae	*Dampiera stricta*	Blue Dampiera		x	x		x		x													x	x	x	
	Goodenia hederacea var. *hederacea*	Ivy-leaved Goodenia	x		x		x									x	x					x		x	x
	Goodenia paniculata	Swamp Goodenia			x			x								x				x				x	x
	Goodenia rotundifolia	-																							
	Scaveola calendulacea	Scented Fan Flower																							
	Scaveola ramosissima	-																				x			
Haemodoraceae	*Haemodorum planifolium*	Bloodroot		x					x																
Haloragaceae	*Gonocarpus micranthus* subsp. *ramosissimus*	-						x																	
	Gonocarpus tetragynus	Poverty Raspwort	x																						
	Gonocarpus teucrioides	-		x	x	x	x	x								x				x			x	x	
Iridaceae	*Gladiolus sp.**	-																							
Juncaceae	*Juncus cognatus**	-																							
	Juncus continuus	-																							
	Juncus krausii	Sea Rush																							
	Juncus mollis	-																							

Family	Scientific Name	Common Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
GROUNDCOVERS (Cont.)																									
	Juncus polyanthemus	-													x										
	Juncus usitatus	Common Rush													x	x									
Lindsaeaceae	*Lindsaea linearis*	Screw Fern			x		x		x													x			
Lobeliaceae	*Lobelia alata*	-				x										x									x
	Pratia purpurascens	Whiteroot	x			x	x			x							x		x						x
Loganiaceae	*Mitrasacme polymorpha*	Mitrewort																							
	Mitrascme alsinoides	Mitrewort																							
Lomandraceae	*Lomandra filiformis* var. *filiformis*	Wattle Mat-rush					x																		
	Lomandra longifolia	Spiky-headed Mat-rush	x	x	x	x	x		x		x			x			x		x						
	Lomandra multiflora subsp. *multiflora*	Many-flowered Mat-rush																							
Malvaceae	*Sida rhombifolia**	Paddy's Lucerne											x	x											
Melanthiaceae	*Ciliva miniata**	Bush Lily																							
Menyanthaceae	*Villarsia exaltata*	-													x	x									
Nymphaeaceae	*Nymphaea capensis**	Cape Waterlily																			x				
Orchidaceae	*Dipodium variegatum*	Blotched Hyacinth Orchid																							
	Spiranthes sinensis subsp. *australis*	Austral Ladies Tresses																							
Oxalidaceae	*Oxalis exilis*	-				x				x				x			x		x						
	*Oxalis latifolia**	Pink Fishtail																							
	*Oxalis pes-caprae**	Soursob																							
Phormiaceae	*Dianella caerulea*	Flax Lily	x		x	x			x	x						x									
	Dianella congesta	-									x														
Phylydraceae	*Phylidrum lanuginosum*	Woolly Frogsmouth														x					x				
Plantaginaceae	*Plantago lanceolata**	Ribwort																							
Poaceae	*Arundo donax**	Giant Reed										x													
	Aristida ramosa	-			x																				
	Aristida warburgii	-			x																			x	
	*Arundo donax**	Giant Reed																							
	*Bromus cartharticus**	Prairie Grass																							
	*Chloris gayana**	Rhodes Grass										x													

Family	Scientific Name	Common Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
GROUNDCOVERS (Cont.)																									
	Cymbopogon refractus	Barbwire Grass				x			x										x						
	Cynodon dactylon	Common Couch												x	x				x						
	Digitaria parviflora	Small-flowered Finger Grass			x	x			x	x	x								x					x	x
	Digitaria ramularis	-	x	x		x				x										x					
	*Digitaria sanguinalis**	Crab Grass				x		x						x	x	x			x						x
	Echinopogon caespitosus var. *caespitosus*	Tufted Hedgehog Grass				x																			
	Echinopogon ovatus	Forest Hedgehog Grass															x		x						
	Entolasia marginata	Bordered Panic		x		x	x		x	x			x		x				x			x			
	Entolasia stricta	Wiry Panic		x	x		x		x	x												x	x	x	x
	Eragrostis brownii	Brown's Lovegrass		x	x																		x		
	*Eragrostis curvula**	African Lovegrass									x														
	Eragrostis elongata	Clustered Lovegrass															x						x		
	Eragrostis leptostachya	Paddock Lovegrass	x	x										x		x								x	
	Imperata cylindrica var. *major*	Blady Grass		x		x	x		x	x				x	x	x	x		x						x
	Ischaemum australe	-		x	x	x	x									x	x		x	x				x	x
	Ischaemum triticeum	-						x															x		
	Microlaena stipoides var. *stipoides*	Weeping Rice Grass				x	x																		
	Oplismenus aemulus	Basket Grass				x			x	x	x								x						
	Oplismenus imbecillis	-							x	x									x						
	Panicum paludosum	Swamp Panic				x		x												x		x	x	x	x
	Panicum simile	Two Colour Panic	x	x	x		x			x												x		x	
	*Paspalum ciliatifolium**	One-spiked Paspalum				x																			
	*Paspalum dilatatum**	Paspalum		x							x			x	x	x	x		x	x					x
	*Paspalum urvillei**	Vasey Grass				x				x		x	x	x	x										
	*Pennisetum clandestinum**	Kikuyu																							
	*Phalaris aquatica**	Phalaris						x												x					
	Phragmites australis	Common Reed																			x				
	Poa labillardieri	Tussock								x						x									
	*Setaria gracilis**	Slender Pigeon Grass													x										x

Family	Scientific Name	Common Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
GROUNDCOVERS (Cont.)																									
	*Sporobolus africanus**	Parramatta Grass								x				x			x								
	Sporobolus creber	Slender Rat's Tail Grass	x			x																			
	Sporobolus elongatus	Slender Rat's Tail Grass												x											
	Sporobolus virginicus	Sand Couch																x							
	*Stenotaphrum secundatum**	Buffalo Grass												x											
	Themeda australis	Kangaroo Grass	x	x	x	x	x	x		x					x	x	x		x	x		x		x	x
Polygalaceae	*Comesperma defoliatum*	-			x																				
Polygonaceae	*Rumex brownii*	Swamp Dock																							
	*Rumex crispus**	Curled Dock																							
Primulaceae	*Anagallis arvensis* var. *caerulea**	Blue Pimpernel																							
	*Anagallis arvensis**	Scarlet Pimpernel																							
	Samolus repens	Creeping Brookweed																							
Restionaceae	*Lepyrodia scariosa*	-																				x			
Rubiaceae	*Opercularia aspera*	Common Stinkweed																							
	Opercularia diphylla	-					x																	x	
	Pomax umbellata	Pomax									x								x						
Scrophulariaceae	*Bacopa monniera*	-																							
Solanaceae	*Solanum nigrum**	Black Nightshade																							
Stackhousiaceae	*Stackhousia nuda*	-																							
	Stackhousia spathulata	-																					x		
	Stackhousia viminea	Slender Stackhousia		x															x				x	x	
Thymelaeaceae	*Pimelea linifolia* subsp. *linifolia*	Slender Rice Flower	x	x	x		x	x	x							x				x			x	x	x
Verbenaceae	*Verbena bonariensis**	Purpletop																							
Violaceae	*Viola hederacea*	Ivy-leaved Violet											x		x	x			x						
Xanthorrhoaceae	*Xanthorrhoea fulva*	-		x	x																		x		
Xyridaceae	*Xyris operculata*	-				x																			
VINES																									
Apocynaceae	*Parsonsia straminea*	Common Silkpod											x		x				x						
Convolvulaceae	*Convolvulus erubescens*	Austrialian Bindweed																							

Family	Scientific Name	Common Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
VINES (Cont.)	*Ipomoea cairica**	Coastal Morning Glory										x	x												
Dilleniaceae	*Hibbertia scandens*	Climbing Guinea-flower								x	x								x						
Fabaceae: Faboideae	*Canavalia rosea*	Beach Bean									x														
	Desmodium gunnii	-																							
	Desmodium nemorosum	-								x															
	Glycine clandestina	Twining Glycine															x								
	Glycine tabacina	Twining Glycine															x								
	Glycine tomentella	Woolly Glycine																							
	Hardenbergia violacea	False Sarsaparilla									x														
	Kennedia rubicunda	Dusky Coral Pea									x	x													
Lauraceae	*Cassytha glabella* forma *glabella*	Devil's Twine							x		x														
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry								x	x			x	x		x		x						
	Geitonoplesium cymosum	Scrambling Lily							x	x							x								
Menispermiaceae	*Stephania japonica* var. *discolor*	Snake Vine										x							x						
Nyctaginaceae	*Bougainvillea* sp.*	Bougainvillea												x											
Passifloraceae	*Passiflora suberosa**	Cork Passionflower																	x						
Pittosporaceae	*Billardiera scandens* var. *scandens*	Apple Dumplings							x		x														
Rosaceae	*Rubus hillii*	Molucca Bramble																	x						
	Rubus parvifolius	Native Raspberry								x	x	x													
Rubiaceae	*Morinda jasminoides*	-													x										
Smilacaceae	*Smilax australis*	Lawyer Vine							x	x		x	x		x				x						
	Smilax glyciphylla	Sarsaparilla							x	x	x														
Vitaceae	*Cissus antarctica*	Native Grape																							
EPIPHYTES																									
Orchidaceae	*Cymbidium suave*	Native Cymbidium											x												
Polypodiaceae	*Platycerium bifurcatum* subsp. *bifurcatum*	Elkhorn																							

Species name^{TS} = Threatened Species * = Introduced Species

APPENDIX III

DESCRIPTIONS OF ENDANGERED FLORA POPULATIONS AND ENDANGERED ECOLOGICAL COMMUNITIES KNOWN IN THE LOCAL AREA

APPENDIX III

Details on endangered flora populations and endangered ecological communities known to be present in the local area are provided below.

1. ENDANGERED FLORA POPULATIONS

One flora species, *Zieria smithii* has been listed as an endangered population in the Coffs Harbour local area on Part 2 of Schedule 1 of the *TSC Act* (1995). The endangered population of *Zieria smithii* refers to a population of a few specimens located on Diggers Headland within dwarf heath vegetation north of Coffs Harbour. The population of *Zieria smithii* within the Coffs Harbour Local Government Area is situated approximately 15km north-east of the subject site. This population has been identified as morphologically distinct from other populations of *Zieria smithii.* It is considered that the subject site does not contain any habitat currently associated with the Diggers Headland population of *Zieria smithii.*

Zieria smithii is considered unlikely to occur within the site and was not observed within the subject site during detailed flora surveys.

2. ENDANGERED ECOLOGICAL COMMUNITIES

There are eight (8) Endangered Ecological Communities known to occur within the Coffs Harbour LGA. These are:

I) Coastal Saltmarsh;
II) Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions;
III) Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner bioregions;
IV) Lowland Rainforest on Floodplain in the NSW North Coast bioregion.
V) Subtropical Coastal Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions;
VI) Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions; and
VII) Swamp Sclerophyll Forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions;
VIII) Themeda Grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South-east Corner Bioregions.

Descriptions and details on the diagnostic species and habitat requirements of these ecological communities are provided below.

I) *COASTAL SALTMARSH*

General Description
This community occurs in the NSW North Coast, Sydney Basin and South East Corner bioregions. This ecological community occurs in the intertidal zone on the shores of estuaries and lagoons along the NSW coast.

Habitat Requirements
- Topography: Low lying intertidal zone on the shores of coastal estuaries and lagoons.
- Characteristic Species: *Baumea juncea, Isolepis nodosa, Juncus kraussii, Samolus repens, Sarcocornia quinqueflora, Selliera radicans, Sporobolus virginicus, Suadea australis, Triglochin striata* and *Zoysia micrantha.*

Conservation Status and Distribution
This community occurs in the NSW North Coast, Sydney Basin and South East Corner bioregions. Coastal saltmarsh occurs in a number of conservation reserves including Towra Point and Kooragang Island Nature Reserves.

Key Threatening Processes
The invasion of mangroves and weeds due to increases in nutrient levels, pollution, recreational vehicles, fire or sea level rise may lead to a change in the structure and function of the community.

Occurrence in Subject Site
Many of the floristic characteristics and specific habitat requirements of this community were observed within the G –Sedgeland vegetation community. This community will be completely retained and buffered as part of the proposal.

II) *FRESHWATER WETLANDS ON COASTAL FLOODPLAINS (FWCF)*

General Description
A variable complex of wetland communities on floodplains, which is distinct from the Endangered Ecological Community Sydney Freshwater Wetlands.

Habitat Requirements
- Geology / Soils: Alluvial soils which are subject to periodic or semi-permanent inundation by freshwater.
- Topography: Depressions, flats, drainage lines, lagoons and lakes of coastal floodplains.
- Characteristic Species: Sedgelands and reedlands, to herbfields, in which woody plants are generally scarce.

Conservation Status and Distribution
Occurs generally at elevations of less than 20 metres AHD, along the length of coastal NSW. Small areas are conserved in existing conservation reserves, including Ukerebagh, Tuckean, Tabbimobile Swamp, Hexham Swamp, Pambalong and Pitt Town Nature Reserves and Bungawalbin, Scheyville and Seven Mile Beach National Parks.

Key Threatening Processes
Clearing of native vegetation; alteration to the natural flow regimes of rivers, streams, floodplains and wetlands; Invasion of native plant communities by exotic perennial grasses; Predation, habitat destruction, competition and disease transmission by feral pigs; and Anthropogenic climate changes.

Occurrence in Subject Site
Habitat requirements and species that characterise this community were not located on the subject site. As such, it is considered that this ecological community does not occur on the subject site.

III) *LITTORAL RAINFOREST*

General Description
This community occurs in the NSW North Coast, Sydney Basin and South East Corner bioregions. Littoral rainforest is a closed forest, with structure and composition strongly influenced by proximity to the ocean. Most littoral rainforest occur within 2km of the sea, but may occasionally be found further inland, but within reach of maritime influences (NSW Scientific Committee 2004).

Habitat Requirements

- Topography: Coastal sand dunes and headlands.
- Characteristic Species: Littoral rainforest comprises the *Cupaniopsis anacardioides – Acmena* spp. Alliance (Floyd 1990). This alliance comprises of five sub-alliances which are geographically restricted to areas along the north, central and south coast of NSW. These sub-alliances are as follows;

    - *Syzygium leuhmannii – Acmena hemilampra;*
    - *Cupaniopsis anacardioides;*
    - *Lophostemon confertus;*
    - *Drypetes – Sacromelicope – Cassine – Podocarpus;* and
    - *Acmena smithii – Ficus – Livistona – Podocarpus.*

Conservation Status and Distribution

This community occurs in the NSW North Coast, Sydney Basin and South East Corner bioregions. Littoral rainforest occurs in numerous small stands and comprises of less than 1% of the total area of rainforest in NSW (NSW Scientific Committee 2004). Many of the stands are conserved under SEPP 26 Littoral Rainforest. A total of 14 stands of littoral rainforest have been identified under SEPP 26 within the Coffs Harbour LGA (Department of Urban Affairs & Planning (2001).

Key Threatening Processes

The invasion of weed species, loss of canopy integrity arising from salt spray and wind damage as a result of clearing or damage to stand margins, clearing of the understorey, grazing of the understorey, inappropriate collection of s range of plant species (eg: epiphytes), fire, visitor disturbance, dumping of rubbish, loss of fauna leading to a reduction in pollinators and seed dispersal agents and fragmentation (NSW Scientific Committee 2004)

Occurrence in Subject Site

Some of the habitat requirements and a small number of species that characterise this community were located on the subject site. However, it is considered that this ecological community does not occur on the subject site.

IV) LOWLAND RAINFOREST ON FLOODPLAIN

General Description

This community occurs in the North Coast Bioregion on floodplains. When in an undisturbed state this community is a closed canopy forest. In disturbed stands the canopy continuity may be broken, or the canopy may be smothered by exotic vines.

Habitat Requirements

- Topography: Low lying riverine floodplains.
- Characteristic Species: *Archontophoenix cunninghamiana, Ficus coronata, Cryptocarya obovata, Dendrocnide excelsa, Araucaria cunninghamii,*

Conservation Status and Distribution

Distribution of this ecological community is throughout the North Coast Bioregion. Small areas of this complex have been reported in Big Scrub, Boatharbour, Brunswick Heads, Coocumbac Island, Coramba, Hortons Creek, Moore Park, Scotts Island and Susan Island Nature Reserves.

Key Threatening Processes
Clearing, fragmentation, isolation, fire, grazing, rubbish dumping, dissection by vehicular and foot tracks and disturbance to pollinator vectors.

Occurrence in Subject Site
Habitat requirements and species that characterise this community were not located on the subject site. As such, it is considered that this ecological community does not occur on the subject site.

V) *SUBTROPICAL COASTAL FLOODPLAIN FOREST*

General Description
The ecological community associated with clay-loams and sandy loams on periodically inundated alluvial flats, drainage lines and river terraces of coastal floodplains, in the North Coast Bioregion.

Habitat Requirements
Geology / Soils: Alluvial soils of fluvial origin.
Topography: Flood plains and associated flats and terraces.
Characteristic Species: *Eucalyptus tereticornis, Eucalyptus siderophloia*, *Corymbia intermedia* and *Lophostemon suaveolens.* Other prominent species are: *Eucalyptus moluccana, Eucalyptus propinqua*, *Eucalyptus seeana, Angophora subvelutina, Eucalyptus robusta, Eucalyptus resinifera* subsp. *hemilampra, Eucalyptus acmenoides, Angophora woodsiana, Angophora paludosa*, *Ficus* spp. and *Cupaniopsis* spp.

Conservation Status and Distribution
Small areas of Subtropical Coastal Floodplain Forest are contained within existing conservation reserves, including: Stotts Island NR, Ukerebagh NR, Limeburners Creek NR, Bundjalung NP and Myall Lakes NP.

Key Threatening Processes
Clearing of native vegetation; alteration to the natural flow regimes of rivers, streams, floodplains and wetlands; invasion of native plant communities by exotic perennial grasses; predation, habitat destruction, competition and disease transmission by feral pigs; anthropogenic climate change; high frequency fire and removal of dead wood and dead trees.

Occurrence in Subject Site
Some of the habitat requirements and a small number of species that characterise this community were located within the west of the subject site. However, it is considered that this ecological community does not occur on the subject site.

VI) *SWAMP OAK FLOODPLAIN FOREST*

General Description
The ecological community associated with grey-black clay-loams, where the groundwater is saline or sub-saline, on waterlogged or periodically inundated flats, drainage lones.

Habitat Requirements
- Geology / Soils: Alluvial soils of fluvial or estuarine origin, with significant salinity.
- Topography: Flood plains in areas with saline soils and flats adjoining estuaries.
- Characteristic Species: Dominant canopy species is *Casuarina glauca.*

Conservation Status and Distribution
Small areas of Swamp Oak Floodplain Forest are contained within existing conservation reserves, including: Stotts Island NR, Ukerebagh NR, Tuckean NR, Pambalong NR, Towra Point NR, Cullendulla Creek NR, Bongil Bongil NP, Myall Lakes NP and Conjola NP.

Key Threatening Processes
Clearing of native vegetation; alteration to the natural flow regimes of rivers, streams, floodplains and wetlands; invasion of native plant communities by exotic perennial grasses; predation, habitat destruction, competition and disease transmission by feral pigs; anthropogenic climate change and high frequency fire.

Occurrence in Subject Site
Some of the habitat requirements and a small number of species that characterise this community were located on the subject site. However, it is considered that this ecological community does not occur on the subject site.

VII) SWAMP SCLEROPHYLL FOREST ON COASTAL FLOODPLAINS

General Description
The ecological community associated with humic clay loams and sandy loams on waterlogged or periodically inundated alluvial flats and drainage lines of coastal floodplains.

Habitat Requirements
- Geology / Soils: Waterlogged or periodically inundated humic clay loams and sandy loams.
- Topography: Alluvial flats and drainage lines of coastal floodplains.
- Drainage: Occur below 1:100 year flood recurrence interval.
- Characteristic Species include: *Eucalyptus robusta, Melaleuca quinquenervia and eucalyptus botryoides.* Other prominent species are: *Callistemon salignus, Casuarina glauca*, *Eucalyptus resinifera subsp. hemilampra, Livistona australis,* and *Lophostemon suaveolens.*

Conservation Status and Distribution
Areas of Swamp Sclerophyll Forest on Coastal Floodplains are contained within existing conservation reserves, including: Bungawalbin NR, Tuckean NR, Moonee Beach NR, Hat Head NP, Crowdy Bay NP, Wallingat NP, Garigal NP and Myall Lakes NP.

Key Threatening Processes
Clearing of native vegetation; alteration to the natural flow regimes of rivers, streams, floodplains and wetlands; invasion of native plant communities by exotic perennial grasses; predation, habitat destruction, competition and disease transmission by feral pigs; anthropogenic climate change; high frequency fire and removal of dead wood and dead trees.

Occurrence in Subject Site
Habitat requirements and species that characterise this community were located on the subject site within the vegetation community C – Swamp Sclerophyll Forest and to a lesser extent vegetation community B/C – Eucalypt/Swamp Sclerophyll Transition Forest. These communities are located on the alluvial soils of the floodplain (below the 1:100 year flood recurrence interval) within the central and south-west of Hearnes Lake. The vegetation community G – Sedgeland also contains a number of the characteristic species and habitat requirements of a sedgeland variant of this EEC ,however, for assessment purposes has been considered to be more representative of the EEC, Coastal Salt Marsh.

VIII) THEMEDA GRASSLAND ON SEACLIFFS AND COASTAL HEADLANDS

General Description
The ecological community is typically characterised by closed tussock grassland to open shrubland on seacliffs and coastal headlands of NSW.

Habitat Requirements
- Geology / Soils: this community is found on a range of substrates, however stands on sandstone are infrequent. Large stands are known from basalt and relic sand dunes.
- Topography: Seacliffs and coastal headlands.
- Characteristic species: The most widespread dominant species is the grass Themeda australis, however, the scattered shrubs *Pimelea linifolia, Banksia integrifolia* and *Westringia fruticosa* may also be common.

Conservation Status and Distribution
Within the locality small areas of this community are known from Munmorah State Recreation Area and Glenrock Nature Reserve.

Key Threatening Processes
Clearing of native vegetation; invasion of native plant communities by exotic perennial grasses; predation, habitat destruction, anthropogenic climate change; high frequency fire and removal of dead wood and dead trees.

Occurrence in Subject Site
Few of the habitat requirements and a small number of species that characterise this community were located on the subject site. As a result, it is considered that this ecological community does not occur on the subject site.

APPENDIX IV

ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT REFERRAL AND DETERMINATION

ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT (1999)

REFERRAL FORM

PROPOSED RESIDENTIAL DEVELOPMENT

AT

PART LOT 2 DP 813954
PACIFIC HIGHWAY
SANDY BEACH NORTH

JULY 2006
(REF: 6129-EPBC)

Conacher Travers Pty Ltd - ABN 49 083 610 173

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Environment Protection and Biodiversity Conservation Act 1999

Referral Form

Important Note:

Please read the Referral Guide and associated Fact Sheets (available at http://www.deh.gov.au/epbc) carefully. The guide and Fact Sheets will help you to complete the form correctly and ensure that your referral is in a form that can be processed. The completed form, together with the required maps and any other information you may wish to submit, should be sent to the EPBC Act Referrals Section, Approvals and Wildlife Division, Department of the Environment and Heritage, GPO Box 787, Canberra, ACT, 2601 and/or by email to epbc.referrals@deh.gov.au (see Referral Guide for allowable electronic formats).

1. Contacts and proponent

1.1 Person making the referral

(Note: The term "person" can refer to an individual or a corporation)

The person making the referral can be either the person proposing to take the action, an agent acting on their behalf (eg, a consultant), or a government agency making the referral in relation to an action to be taken by another person. *(Include name, postal address, telephone, fax, email.)*

Contact: Mr Phillip Conacher
C/- *Conacher Travers*
PO Box 7128
KARIONG NSW 2250
Ph: (02) 4340 0677
Fax: (02) 4340 2367
Email: ecology@conachertravers.com.au

1.2 Person(s) proposing to take the action

This is the person who proposes to carry out the action, or who is otherwise responsible for the action. If approval is necessary, this is the person to whom the approval will be granted, and they will be responsible for meeting any conditions of approval. *(Include name postal address, telephone, fax, email – if same as person making the referral, write "as above".)*

Contact: Mr Peter Darby
C/- Sandy Shores Development Pty Ltd
PO Box J402
COFFS HARBOUR NSW 2450
Ph: (02) 6650 9219
Fax: (02) 6650 9039
Email: peter@bcps.com.au

Contact person – Project Manager
Mr John Oliver
c/- Blue Grass Nominees Pty Ltd
33 Windsor Crescent
BROWNSVILLE NSW 2530
Ph: (02) 4262 5073
Fax: (02) 4262 5073
Email: bluegras@optusnet.com.au

If a corporation is proposing to take the action, please ensure you provide the name of a contact officer for this matter.

1.3 Person(s) who will be the proponent for the action

The proponent is responsible for preparing all documentation for the assessment process, if the action requires approval. If the proponent is the same as the person proposing to take the action, write 'as above'. If the proponent is different from the person proposing to take the action, the signature of both is required (at Section 7.3). ***(Include name(s), postal address, telephone, fax, email)***

As above

If a corporation is the proponent for the action, please also provide the name of a contact officer for this matter.

As above

2. Description of the proposal

2.1 Provide a *summary description* of the action (two or three sentences)

It is proposed to develop parts of the subject site as a community title residential subdivision. This will incorporate a mixture of single residential dwellings, medium density units and an area for future development as a tourist / commercial precinct. The development is in 4 precincts and will comprise of a total; of 260 residential allotments. Areas of open space / environmental protection will be retained between allotments and Hearns Lake. This area will incorporate a perimeter emergency access way which will also function as a combined pedestrian / cycleway and a Open Space and drainage reserve area.

A buffer of variable width will be retained around the shore of Hearns Lake protecting the ecological values within the lake and foreshores. Vegetation and habitats will also be retained within Open Space areas in the north-east, central and south-east portions of the site.

As part of the proposed subdivision a comprehensive water quality management system incorporating stormwater retention ponds, roadside bio-swales and nutrient filter strips will be implemented. These measures will ensure treatment of water quality prior to stormwater runoff entering the nearby watercourses and coastal lagoons.

The retention and protection of Hearns Lake and its shoreline areas along with the retention of other bushland and drainage areas within the site are likely to continue to provide habitats for locally occurring flora and fauna species. This will include the retention of suitable habitat areas within the site for those threatened fauna species observed within the site during surveys.

Asset protection zones for bushfire protection purposes will be created around the allotments where appropriate in accordance with standard bushfire protection measures detailed within *'Planning for Bushfire Protection 2001.'*

2.2 Details of the *location* of the project area

Where the project is of less than 1 km^2 in size, provide the location as a single pair of latitude and longitude references. Latitude and longitude references should be used instead of AMG and/or digital coordinates.

Locality:
The subject site is approximately 49 hectares in size situated immediately north of Sandy Beach township and is situated approximately 22km north of Coffs Harbour NSW. The approximate AMG map grid coordinates are 518800 E, 6665500 N. The site is bounded on the western side by the Pacific Highway, the southern side by Sandy Beach township, the eastern side by North Sandy Beach which is separated from the subject site by a narrow Crown Reserve, and on the northern side by the northern half of Hearns Lake and surrounding pasture.

Latitude:	30	degrees:	08	minutes:	30	seconds:
Longitude:	153	degrees:	11	minutes:	40	seconds:

Where the project area is greater than 1 km^{2,} or any dimension is greater than 1 km, provide additional coordinates to enable accurate identification of the location of the project area.

The western boundary is the longest boundary and is approximately 1km long.
The Latitude of the northern end is 30° 08' 17" while the southern end is 30° 08' 50".

Please provide a brief physical description of the project area, including the size of the development footprint or work area in hectares (a more detailed description is required at Part 3 of this form). The street address and cadastral description of the proposed action (if relevant) should also be provided. Identify the Local Government Area in which the development will occur, if relevant.

The subject site is approximately 49 hectares in size. The proposed development will create approximately 260 residential lots of varying sizes within 4 precincts. The eastern precinct occupies 2.07ha, while the southern, south-western and northern precincts occupy 9.3, 13.0 and 4.4 hectares respectively. The central parts of the site (20.2ha) will be retained as an Environmental Protection Area

The proposed development will occupy a total of approximately 20.8 hectares (approximately 42% of the site) and will retain approximately 20.2 hectares of wetland and foreshore/lower slope areas (approximately 41% of the site) as an Environmental Protection Area which will be retained and managed.

An additional Buffer area of approximately 8 hectares (approximately16% of the site) will be retained between the wetland/foreshore Environmental Protection Area and the development as vegetated Open Space containing a perimeter emergency access way which will also function as a combined pedestrian / cycleway, open space, buffer, bioswale and stormwater runoff management area.

The additional 8ha Buffer area between the Environmental Protection Area and the development will also be managed as bushfire Asset Protection Zones (APZs). The APZs will supplement the 20.2ha of retained wetland and foreshore vegetation within the Environment Protection Area and increase the total of vegetated areas within the site to approximately 28.2 hectares (approximately 57% of the site).

Attach an A4/A3 size map/plan(s) showing the location and approximate boundaries of the area in which the project is to occur (this map, or a second attached map, should also show features mentioned in responses to questions in Part 3 of this referral, for example, conservation reserves, areas of remnant native vegetation, streams and roads).

See attached Schedules 1 & 2 - Bushfire Protection Measures from the Bushfire Protection Assessment (*Conacher Travers Pty Ltd* October 2005 Ref: 5091B).

See also Figures 2.1 and 3.1 from the Flora and Fauna Assessment Report (*Conacher Travers Pty Ltd* October 2005 Ref: 5091F).

2.3 Provide the *timeframe* in which the action is proposed to occur. Include start and finish dates where applicable.

The proposed development is expected to commence within six months of approval of the development application, with completion within 18 months of commencement.

2.4 Provide a *description* of the action, including *all activities* proposed to be carried out as part of the proposed action.

The subject site is approximately 49 hectares in size, however the proposed development footprint will occupy a total of only 28.8 hectares including bushfire Asset Protection Zones (APZs). It is proposed to develop part of the subject site as a community title residential subdivision within 3 precincts. This will incorporate a mixture of single residential dwellings and medium density units. An additional area for future development as a tourist / commercial precinct is planned for the eastern (beach) precinct. The proposed development will create approximately 260 residential lots of varying sizes within 3 of the precincts and includes the associated bushfire Asset Protection Zones (APZs) for each precinct. The remainder of the site (20.2ha) will be managed as areas of open space / environmental protection which will be retained between the allotments and Hearns Lake. This area will incorporate a perimeter emergency access way which will also function as a combined pedestrian / cycleway.

The large majority of the subject site has a history of disturbance including grazing, slashing, clearing and burning. The development proposes the retention of vegetation and habitats as part of Open Space and drainage reserve areas. A buffer of variable width will be retained around the shore of Hearns Lake protecting the ecological values within the lake and foreshores. Vegetation and habitats will also be retained within Open Space areas in the north-east, central and south-east portions of the site.

As part of the proposed subdivision a comprehensive water quality management system incorporating stormwater retention ponds, roadside bio-swales and nutrient filter strips will be implemented. These measures will ensure treatment of water quality prior to stormwater runoff entering the nearby watercourses and coastal lagoons.

The retention and protection of Hearns Lake and its shoreline areas along with the retention of other bushland and drainage areas within the site are likely to continue to provide habitats for locally occurring flora and fauna species. This will include the retention of suitable habitat areas within the site for those threatened fauna species observed within the site during surveys.

2.5 Provide an *explanation of the context* in which the action is proposed to take place, including any relevant planning framework (for example, relevant management plans or State or Local Government approvals). Indicate whether, and in what way, the action is *related to other actions or proposals* that may have already occurred, are occurring, or are likely to occur, at a future date. You should also provide the name(s) of the Local Council and/or Local Government Area the action will take place in, if relevant.

The proposed action is situated within the Coffs Harbour City Council Local Government Area.

The subject site is within the area covered by the Eastern Precinct described in the Hearns Lake / Sandy Beach Development Control Plan (DCP). Within this DCP the objectives, specific strategies, constraints and limitations for various areas are described.

The proposed residential development Precincts as shown in Schedules 1 and 2, form a new northern extension of the existing Sandy Beach Township. The proposed development precincts are mostly located in areas mapped as Residential 2A Low Density as shown in the DCP. The DCP also shows Environmental Protection Areas adjacent to the residential areas.

The Hearns Lake / Sandy Beach Development Control Plan (DCP) also outlines the planning / development of adjoining areas to the north of the subject site (Northern Precinct) and the adjoining area to the west of the Pacific Highway bounded by Graham Drive (Western Precinct). The western precinct is expected to incorporate sports fields, playgrounds, a BMX track and pedestrian access/ cycle-ways.

2.6 If you are considering making a referral of a stage or component of a larger action, you must provide information about the larger action and details of any interdependency between the stages/components and the larger action. If appropriate, you may also provide justification as to why you believe it is reasonable for the proposed action, that is the subject of this referral, to be considered separately from the larger proposal (see the Referral Guide).

Section 74A of the EPBC Act provides that the Environment Minister may not accept a referred action that is a component of a larger action. If the Environment Minister does not accept the referral, he or she is not permitted to make a decision on whether the action is a controlled action. The Environment Minister may request the person proposing to take the action to refer the larger action for consideration under the EPBC Act (see also Fact Sheet).

This referral is restricted to the proposed development of Part Lot 2 DP 813954 Pacific Highway, Sandy Beach which is situated within the Eastern Precinct as defined in the Hearns Lake / Sandy Beach Development Control Plan (DCP) and is not part of the development of any other precincts (Western or Northern) as defined in the DCP.

For the purposes of this referral and accompanying documentation the Eastern Precinct of the DCP has been further split into the Southern, South-western, Northern and Eastern Precincts as shown in the attached Schedules 1 and 2.

This development is part of a larger action with respect to the DCP however the referral of the other future development areas encompassed by the DCP are matters separate to this project.

3. Description of the project area and the affected area

Note: You must include a *map(s)/plan(s)* clearly showing the location of the action, and any relevant features referred to in 3.1. (A general location map (eg, 1:250 000 scale) and a more detailed map/*plan* showing the elements of the proposal may be appropriate. If available, an aerial photograph or other photograph of the site can be included.)

3.1 Describe the affected area referring, as appropriate, to attached maps, plans and aerial photos. In particular, indicate on the map the location of any of the following features: World Heritage properties, National Heritage places, Ramsar wetlands, listed threatened species or communities and/or known habitat for these species or communities, listed migratory species and/or known habitat for these species, Commonwealth marine areas and Commonwealth land, listed Commonwealth Heritage places, conservation reserves/parks, and areas of remnant native vegetation.

Location

The subject site is approximately 49 hectares in size situated immediately north of Sandy Beach township and is situated approximately 22km north of Coffs Harbour NSW. The approximate AMG map grid coordinates are 518800 E, 6665500 N. The site is bounded on the western side by the Pacific Highway, the southern side by Sandy Beach Township, the eastern side by North Sandy Beach which is separated from the subject site by a narrow Crown Reserve and on the northern side by the northern half of Hearns Lake and surrounding pasture.

Soils

Two soil types occur within the subject site, the Coffs Harbour and Newports Creek Soil Landscapes (Milford H. B., 1996).

The Coffs Harbour Soil consists of deep, moderately to poorly drained Podzols, with sandy Acid Peats and Peaty Podzols in swamps. This soil type is derived from Quaternary (Pleistocene) beach and dune sand.

The Newports Creek soil consists of deep, poorly drained Yellow Podzolic Soils and Humic Gleys. This soil type is derived from Holocene clayey and silty alluvium (generally over 1m deep) overlying Pleistocene mottled grey estuarine clays.

Topography
The topography is low lying flat land and dune slopes.

Gradients are less than 5% with various aspects, mostly south-easterly and north-easterly. The elevation of the site is less than 10m AHD (Australian Height Datum).

The site is located around the fringes of Hearns Lake which is a lagoon situated to the rear of the sand mass forming North Sandy Beach. This lagoon is fed by Double Crossing Creek that enters from the west.

Vegetation
A total of ten (10) vegetation communities have been identified within the subject site. These are:

A	Low Forest (*Banksia* dominated);
B	Forest (*Eucalypt* dominated);
C	Swamp Sclerophyll Forest;
B/C	Eucalypt / Swamp Sclerophyll Transition Forest;
D	Sandplain Forest (*Melaleuca / Corymbia* dominated);
E	Wet Heath;
F	Wallum Heath;
G	Sedgeland;
H	Disturbed Woodland;
I	Sandplain Forest (*Melaleuca* / Mesophyllic sp. dominated)

Land Use
The subject site has a history of various agricultural disturbances. The site is presently used for grazing.

World Heritage Properties
An EPBC Act Protected Matters Report was generated using a point search with a 10km buffer. No World heritage Properties were located within this area.

National Heritage Places
An EPBC Act Protected Matters Report was generated using a point search with a 10km buffer. No National heritage Places were located in this area.

Ramsar Wetlands
An EPBC Act Protected Matters Report was generated using a point search with a 10km buffer. One Ramsar wetland was listed within the same catchment as the subject site, this was at Little Llangothlin Nature Reserve which is situated south of Glen Innes, in excess of 150km to the west (upstream) of the subject site.

Commonwealth Marine Areas
An EPBC Act Protected Matters Report was generated using a point search with a 10km buffer. No Commonwealth marine Areas were listed within this area. However the Commonwealth Marine Area extends from 3 nautical miles to two hundred nautical miles from the coast.

Threatened Ecological Communities

An EPBC Act Protected Matters Report was generated using a point search with a 10km buffer. No Threatened Ecological Communities listed in the EPBC Act (1999) are known in the local area.

Threatened Species

An EPBC Act Protected Matters Report was generated using a point search with a 10km buffer. A total of 48 threatened species were listed within the 10km buffer area, these species are listed in Table 1:

TABLE 1
THREATENED SPECIES

Species Name	Status	Comment
Birds		
Diomedea amsterdamensis Amsterdam Albatross	Endangered	Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross	Vulnerable	Species or species habitat may occur within area
Diomedea dabbenena Tristan Albatross	Endangered	Foraging may occur within area
Diomedea exulans Wandering Albatross	Vulnerable	Species or species habitat may occur within area
Diomedea gibsoni Gibson's Albatross	Vulnerable	Species or species habitat may occur within area
Lathamus discolor Swift Parrot	Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant-Petrel	Vulnerable	Species or species habitat may occur within area
Pterodroma leucoptera leucoptera Gould's Petrel	Endangered	Species or species habitat may occur within area
Pterodroma neglecta neglecta Kermadec Petrel (western)	Vulnerable	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe	Vulnerable	Species or species habitat may occur within area
Thalassarche bulleri Buller's Albatross	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta Shy Albatross	Vulnerable	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross	Vulnerable	Species or species habitat may occur within area
Xanthomyza phrygia Regent Honeyeater	Endangered	Species or species habitat likely to occur within area
Frogs		
Litoria aurea Green and Golden Bell Frog	Vulnerable	Species or species habitat may occur within area
Litoria olongburensis Wallum Sedge Frog	Vulnerable	Species or species habitat likely to occur within area

TABLE 1 (Cont.) THREATENED SPECIES		
Species Name	**Status**	**Comment**
Frogs (Cont.)		
Mixophyes balbus Stuttering Frog, Southern Barred Frog (in Victoria)	Vulnerable	Species or species habitat likely to occur within area
Mixophyes iteratus Southern Barred Frog, Giant Barred Frog	Endangered	Species or species habitat likely to occur within area
Insects		
*Phyllodes imperialis (southern subsp. - ANIC 3333)*a moth	Endangered	Species or species habitat likely to occur within area
Mammals		
Balaenoptera musculus Blue Whale	Endangered	Species or species habitat may occur within area
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat	Vulnerable	Species or species habitat may occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population)	Endangered	Species or species habitat likely to occur within area
Eubalaena australis Southern Right Whale	Endangered	Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale	Vulnerable	Species or species habitat known to occur within area
Petrogale penicillata Brush-tailed Rock-wallaby	Vulnerable	Species or species habitat may occur within area
Potorous tridactylus tridactylus Long-nosed Potoroo (SE mainland)	Vulnerable	Species or species habitat may occur within area
Pteropus poliocephalus Grey-headed Flying-fox	Vulnerable	Roosting known to occur within area
Ray-finned fishes		
Nannoperca oxleyana Oxleyan Pygmy Perch	Endangered	Species or species habitat likely to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle	Vulnerable	Species or species habitat may occur within area
Coeranoscincus reticulatus Three-toed Snake-tooth Skink	Vulnerable	Species or species habitat may occur within area
Dermochelys coriacea Leathery Turtle, Leatherback Turtle, Luth	Vulnerable	Species or species habitat may occur within area
Emydura signata Bellinger River Emydura (Bellinger River, NSW)	Vulnerable	Species or species habitat likely to occur within area

TABLE 1 (Cont.) THREATENED SPECIES		
Species Name	**Status**	**Comment**
Sharks		
Carcharias taurus (east coast population) Grey Nurse Shark (east coast population)	Critically Endangered	Congregation or aggregation known to occur within area
Carcharodon carcharias Great White Shark	Vulnerable	Species or species habitat may occur within area
Rhincodon typus Whale Shark	Vulnerable	Species or species habitat may occur within area
Plants		
Boronia umbellata a shrub	Vulnerable	Species or species habitat likely to occur within area
Cynanchum elegans White-flowered Wax Plant	Endangered	Species or species habitat likely to occur within area
Marsdenia longiloba Clear Milkvine	Vulnerable	Species or species habitat likely to occur within area
Parsonsia dorrigoensis Milky Silkpod	Endangered	Species or species habitat likely to occur within area
Phaius australis Lesser Swamp-orchid	Endangered	Species or species habitat likely to occur within area
Quassia sp. Mooney Creek (J.King s.n. 1949)	Endangered	Species or species habitat likely to occur within area
Thesium australe Austral Toadflax, Toadflax	Vulnerable	Species or species habitat likely to occur within area
Tylophora woollsii	Endangered	Species or species habitat likely to occur within area
Zieria prostrata J.A.Armstrong ms.	Endangered	Species or species habitat likely to occur within area

It is considered that some threatened species that are wholly marine, such as sharks, turtles, whales and some birds are not likely to utilise the subject site due to lack of suitable habitat.

Listed Migratory Species

An EPBC Act Protected Matters Report was generated using a point search with a 10km buffer. A total of thirty-six (36) migratory species were listed as occurring in the local area, these species are shown in Table 2:

TABLE 2 MIGRATORY SPECIES		
Species Name	**Status**	**Comment**
Birds		
Haliaeetus leucogaster White-bellied Sea-Eagle	Migratory	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail	Migratory	Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch	Migratory	Breeding may occur within area
Monarcha trivirgatus Spectacled Monarch	Migratory	Breeding likely to occur within area
Myiagra cyanoleuca Satin Flycatcher	Migratory	Breeding likely to occur within area
Rhipidura rufifrons Rufous Fantail	Migratory	Breeding may occur within area

TABLE 2 (Cont.) MIGRATORY SPECIES		
Species Name	**Status**	**Comment**
Birds (Cont.)		
Xanthomyza phrygia Regent Honeyeater	Migratory	Species or species habitat likely to occur within area
Migratory Wetland Species		
Birds		
Gallinago hardwickii Latham's Snipe, Japanese Snipe	Migratory	Species or species habitat may occur within area
Rostratula benghalensis s. lat. Painted Snipe	Migratory	Species or species habitat may occur within area
Migratory Marine Birds		
Diomedea amsterdamensis Amsterdam Albatross	Migratory	Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross	Migratory	Species or species habitat may occur within area
Diomedea dabbenena Tristan Albatross	Migratory	Foraging may occur within area
Diomedea exulans Wandering Albatross	Migratory	Species or species habitat may occur within area
Diomedea gibsoni Gibson's Albatross	Migratory	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel	Migratory	Species or species habitat may occur within area
Macronectes halli Northern Giant-Petrel	Migratory	Species or species habitat may occur within area
Pterodroma leucoptera leucoptera Gould's Petrel	Migratory	Species or species habitat may occur within area
Puffinus leucomelas Streaked Shearwater	Migratory	Species or species habitat may occur within area
Puffinus pacificus Wedge-tailed Shearwater	Migratory	Breeding known to occur within area
Thalassarche bulleri Buller's Albatross	Migratory	Species or species habitat may occur within area
Thalassarche cauta Shy Albatross	Migratory	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross	Migratory	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross	Migratory	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross	Migratory	Species or species habitat may occur within area
Migratory Marine Species		
Mammals		
Balaenoptera edeni Bryde's Whale	Migratory	Species or species habitat may occur within area
Balaenoptera musculus * Blue Whale	Migratory	Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale	Migratory	Species or species habitat may occur within area
Eubalaena australis * Southern Right Whale	Migratory	Species or species habitat likely to occur within area

TABLE 2 (Cont.) MIGRATORY SPECIES		
Species Name	**Status**	**Comment**
Mammals (Cont.)		
Lagenorhynchus obscurus Dusky Dolphin	Migratory	Species or species habitat may occur within area
Megaptera novaeangliae * Humpback Whale	Migratory	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca	Migratory	Species or species habitat may occur within area
Reptiles		
Caretta caretta * Loggerhead Turtle	Migratory	Breeding known to occur within area
Chelonia mydas * Green Turtle	Migratory	Species or species habitat may occur within area
Dermochelys coriacea * Leathery Turtle, Leatherback Turtle, Luth	Migratory	Species or species habitat may occur within area
Sharks		
Carcharodon carcharias Great White Shark	Migratory	Species or species habitat may occur within area
Rhincodon typus Whale Shark	Migratory	Species or species habitat may occur within area

It is considered that some migratory species that are wholly marine, such as sharks, turtles, whales and some birds are not likely to utilise the subject site due to lack of suitable habitat.

3.2 Provide a *description of important features* of the project area and the affected area and show these on the attached map, including (if relevant to the project area or affected area) information about:

(a) soil and vegetation characteristics;

Soils
Two soil types occur within the subject site, the Coffs Harbour and Newports Creek Soil Landscapes (Milford H. B., 1996).

The Coffs Harbour Soil consists of deep, moderately to poorly drained Podzols, with sandy Acid Peats and Peaty Podzols in swamps. This soil type is derived from Quaternary (Pleistocene) beach and dune sand.

The Newports Creek soil consists of deep, poorly drained Yellow Podzolic Soils and Humic Gleys. This soil type is derived from Holocene clayey and silty alluvium (generally over 1m deep) overlying Pleistocene mottled grey estuarine clays.

Vegetation
A total of ten (10) vegetation communities have been identified within the subject site. These are:

A Low Forest (*Banksia* dominated);
B Forest (*Eucalypt* dominated);
C Swamp Sclerophyll Forest;
B/C Eucalypt / Swamp Sclerophyll Transition Forest;
D Sandplain Forest (*Melaleuca* / *Corymbia* dominated);
E Wet Heath;
F Wallum Heath;
G Sedgeland;
H Disturbed Woodland;
I Sandplain Forest (*Melaleuca* / Mesophyllic sp. dominated)

A flora species list is provided in Table 2.1 while a general description of the vegetation communities is provided below. Figure 2.1 shows the distribution of the vegetation on the site.

A. LOW FOREST (*Banksia* dominated)

***Structure*:**

Trees: To 20 metres high with a Projected Foliage Cover (PFC) of 45-50%.

Shrubs: To 6 metres high with a 55 - 60% PFC.

Groundlayer: To 1.5 metres high with variable 40 - 65% PFC.

Floristics:

(Main Species Present)

Trees: *Banksia integrifolia* subsp. *integrifolia* (Coast Banksia), *Melaleuca quinquenervia* (Broad-leaved Paperbark), *Corymbia intermedia* (Pink Bloodwood), *Lophostemon suaveolens* (Swamp Turpentine), *Casuarina glauca* (Swamp She-Oak) and *Eucalyptus tereticornis* (Forest Red Gum).

Shrubs: *Chrysanthemoides monilifera* subsp. *monilifera* (Bitou Bush), *Baccharis hamimifolia* (Groundsel Bush), *Acacia longifolia* var. *longifolia* (Golden Wattle), *Dodonea triquetra* (Hop Bush), *Alectryon coriaceus* (Beach Alectryon), *Acacia suaveolens* (Sweet Scented Wattle), *Syzygium australis* (Brush Cherry) and *Acacia saligna* (Orange Wattle).

Groundlayer: *Paspalum dilatatum* (Paspalum), *Eragrostis cilianensis* (Stinkgrass), *Sporobolus africanus* (Parramatta Grass), *Chloris gayana* (Rhodes Grass), *Imperata cylindrica* var. *major* (Blady Grass) and *Pteridium esculentum* (Bracken).

Weeds: *Chrysanthemoides monilifera* subsp. *monilifera* (Bitou Bush), *Acacia saligna (*Orange Wattle), *Lantana camara* (Lantana), *Paspalum dilatatum* (Paspalum), *Eragrostis cilianensis* (Stinkgrass), *Sporobolus africanus (*Parramatta Grass).

Location and Distribution:

This vegetation community occurs in the eastern portion of the site and located on the leeward side of the current fore-dune complex.

Variation:

There is slight variation within this vegetation community with low lying areas of high moisture content associated with higher densities of *Melaleuca quinquenervia* (Broad-leaved Paperbark) and *Casuarina glauca* (Swamp She-Oak).

Areas of re-growth were found to contain floristic similarities to a regenerating example of this community. Previous clearing and grazing of these areas has led to an altered structure within parts of this community. Parts of this vegetation community have been underscrubbed. Infestations of *Acacia saligna* dominate much of the tree and shrub re-growth, however juvenile regrowth of *Banksia integrifolia* subsp. *integrifolia* (Coast Banksia), *Melaleuca quinquenervia, Corymbia intermedia* (Pink Bloodwood), *Eucalyptus tereticornis*, and *Lophostemon suaveolens* occur within the re-growth areas.

Disturbance:

This community has been disturbed by extensive weed invasion in both the shrub and ground layers. The entire community has been affected by a history of grazing and rural activities. Currently several tracks bisect the community along with several old barbwire fences.

Weed Invasion:
This community exhibits extensive weed invasion in both the shrub and ground layers. Large areas of *Chrysanthemoides monilifera* subsp. *monilifera* (Bitou Bush), *Acacia saligna* (Orange Wattle) and *Baccharis hamimifolia* (Groundsel Bush) dominate the shrub layer.

B. FOREST (*Eucalypt* dominated)

Structure:

Canopy: To 16 - 20 metres high with 35 - 45% Projected Foliage Cover (PFC).

Shrubs: To 3 metres high with a variable cover of less than 5 to 35% PFC.

Ground-layer: From 1 to 1.5 metres high with 75 - 85% PFC.

Floristics:
(Main Species Present)

Canopy: *Melaleuca quinquenervia* (Broad-leaved Paperbark), *Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus resinifera* subsp. *hemilampra* (Red Mahogany), *Angophora costata* (Smooth-barked Apple), *Lophostemon suaveolens* (Swamp Turpentine), *Corymbia intermedia* (Pink Bloodwood), *Eucalyptus robusta* (Swamp Mahogany) and *Lophostemon suaveolens* (Swamp Turpentine).

Shrubs: *Baccharis hamimifolia* (Groundsel Bush), *Pultenaea linophylla, Pimelea linifolia* subsp. *linifolia* (Rice Flower), *Melaleuca quinquenervia* (Broad-leaved Paperbark) *Melaleuca sieberi*, *Banksia spinulosa* (Hairpin Banksia), *Banksia oblongifolia*, *Callistemon pachyphyllus* (Wallum Bottlebrush), *Hakea dactyloides* (Broad-leaved Hakea) and *Acacia longifolia* var. *longifolia* (Golden Wattle).

Groundlayer: *Themeda australis* (Kangaroo Grass), *Sporobolus africanus* (Parramatta Grass), *Eragrostis cilianensis* (Stinkgrass), *Polymeria calycina*, *Ptilothrix deusta*, *Eragrostis elongata* (Clustered Lovegrass), *Hibbertia aspera* (Rough Guinea Flower), *Imperata cylindrica var. major* (Blady Grass), *Hibbertia vestita*, *Baumea rubiginosa* (Twig Rush), *Polymeria calycina* and *Dichondra repens* (Kidney Weed).

Weeds: *Baccharis hamimifolia* (Groundsel Bush), *Sporobolus africanus* (Parramatta Grass) and *Eragrostis cilianensis* (Stinkgrass).

Location and Distribution:
This community occurs in the western portion of the site on slightly higher elevations and occupies approximately 6.5 hectares.

Variation:
Previous clearing, removal of the shrub layer, fire, formation of access tracks and grazing of some areas have led to an altered structure within some areas of this community. Some areas within this community are dominated by *Angophora costata*. Juvenile regrowth of *Melaleuca quinquenervia, Eucalyptus tereticornis*, *Eucalyptus robusta* and *Lophostemon suaveolens* occur scattered throughout this community.

Disturbance:
The entire community has been affected from a history of grazing and rural activities. Weed invasion, current grazing, soil compaction, a recent fire event and historic clearing of the shrub and ground layer have reduced the ecological integrity of this community.

Weed Invasion:
Weed invasion is generally low, with some areas of moderate weed invasion associated with edge effects along the Pacific Highway fenceline and the effects of grazing.

C. SWAMP SCLEROPHYLL FOREST

This community corresponds to the listed endangered ecological community, Swamp Sclerophyll Forest on Coastal Floodplains. (NSW Scientific Committee 2004)

***Structure*:**

Trees: From 18 to 24 metres high with a Projected Foliage Cover (PFC) of 40 - 60%.

Shrubs: To 4 metres high with a variable PFC of 5 - 50%.

Groundlayer: To 1.5 metres high with a variable PFC of 15 - 60%.

Floristics:

(Characteristic Species)

Trees: *Melaleuca quinquenervia* (Broad-leaved Paperbark), *Eucalyptus robusta* (Swamp Mahogany) and *Casuarina glauca* (Swamp She-Oak),

Shrubs: *Glochidion ferdinandi* (Cheese Tree), *Polyscias sambucifolia* (Elderberry Panax), *Acronychian imperforata* (Beach Acronychia), *Myoporum acuminatum* (Mangrove Boobialla), *Chrysanthemoides monilifera* subsp. *monilifera* (Bitou Bush) and *Acacia longifolia* var. *longifolia* (Golden Wattle).

Groundlayer: *Paspalum dilatatum* (Paspalum), *Imperata cylindrica* var. *major* (Blady Grass), *Pteridium esculentum* (Bracken), *Eragrostis cilianensis* (Stinkgrass), *Entolasia marginata* (Bordered Panic), *Gahnia sieberiana* (Red-fruited Saw Sedge), *Blechnum indicum* (Swamp Fern) and *Gonocarpus tetragynus* (Poverty Raspwort)

Weeds: *Chrysanthemoides monilifera* subsp. *monilifera* (Bitou Bush), *Baccharis hamimifolia* (Groundsel Bush) and *Paspalum dilatatum* (Paspalum).

Location and Distribution:

This community occurs as an area of vegetation fringing the southern portion of Hearns Lake. One fragmented area of this community occurs along the southern boundary, while other very small areas of this community occur to the west of Hearns Lake.

Disturbance:

The main disturbance to this community has been from current and previous grazing and weed invasion.

Variation:

There is slight variation within this community. A mesic understorey comprising of *Glochidion ferdinandi, Livistona australis and Acronychia imperforata* dominates the southern portion of this community, whilst the area fringing Herns Lake contains higher levels of *Casuarina glauca* and *Myoporum acuminatum*.

Weed Invasion:

Weed invasion is moderate in the shrub and groundlayer of this community.

B/C. EUCALYPT / SWAMP SCLEROPHYLL TRANSITION FOREST

***Structure*:**

Trees: From 18 to 24 metres high with a Projected Foliage Cover (PFC) of 40 - 60%.

Shrubs: To 4 metres high with a variable PFC of 5 - 50%.

Groundlayer: To 1.5 metres high with a variable PFC of 15 - 60%.

Floristics:
(Characteristic Species)

Trees: *Melaleuca quinquenervia* (Broad-leaved Paperbark), *Eucalyptus robusta* (Swamp Mahogany), *Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus resinifera* subsp. *hemilampra* (Red Mahogany), *Angophora costata* (Smooth-barked Apple), *Lophostemon suaveolens* (Swamp Turpentine) and *Casuarina glauca* (Swamp She-Oak),

Shrubs: *Glochidion ferdinandi* (Cheese Tree)*, Pultenaea linophylla, Pimelea linifolia* subsp. *linifolia* (Rice Flower), *Callistemon pachyphyllus* (Wallum Bottlebrush), *Polyscias sambucifolia* (Elderberry Panax), *Acronychian imperforata* (Beach Acronychia), *Hakea dactyloides* (Broad-leaved Hakea), *Myoporum acuminatum* (Mangrove Boobialla), *Chrysanthemoides monilifera* subsp. *monilifera* (Bitou Bush) and *Acacia longifolia* var. *longifolia* (Golden Wattle).

Groundlayer: *Paspalum dilatatum* (Paspalum), *Imperata cylindrica* var. *major* (Blady Grass), *Pteridium esculentum* (Bracken), *Eragrostis cilianensis* (Stinkgrass), *Themeda australis* (Kangaroo Grass), *Sporobolus africanus* (Parramatta Grass), *Ptilothrix deusta*, *Entolasia marginata* (Bordered Panic), *Polymeria calycina*, *Dichondra repens* (Kidney Weed), *Gahnia sieberiana* (Red-fruited Saw Sedge), *Blechnum indicum* (Swamp Fern) and *Gonocarpus tetragynus* (Poverty Raspwort).

Weeds: *Chrysanthemoides monilifera* subsp. *monilifera* (Bitou Bush), *Baccharis hamimifolia* (Groundsel Bush), *Sporobolus africanus* (Parramatta Grass), *Eragrostis cilianensis* (Stinkgrass) and *Paspalum dilatatum* (Paspalum).

Location and Distribution:
This community occurs as an area of vegetation approximately 1.5 hectares in size situated to the south-west of Hearns Lake.

Disturbance:
The main disturbance to this community has been from current and previous grazing and low levels of weed invasion.

Variation:
There is little variation within this community.

D. SANDPLAIN FOREST (*Melaleuca* / *Corymbia* dominated)

***Structure*:**

Trees: To 18-20 metres high with a Projected Foliage Cover (PFC) of 30-45%.

Shrubs: To 6 metres high with a 55 - 70% PFC.

Groundlayer: To 1.5 metres high with variable 40 - 75% PFC.

Floristics:
(Main Species Present)

Trees: *Corymbia intermedia* (Pink Bloodwood), *Melaleuca quinquenervia* (Broad-leaved Paperbark) and *Eucalyptus robusta* (Swamp Mahogany).

Shrubs: *Dodonea triquetra* (Hop Bush), *Acacia suaveolens* (Sweet Scented Wattle), *Elaeocarpus reticulatus* (Blueberry Ash), *Chrysanthemoides monilifera* subsp. *monilifera* (Bitou Bush), *Persoonia stradbrokensis*, *Baccharis hamimifolia* (Groundsel Bush), *Pultenaea retusa*, *Acacia longifolia* var. *longifolia* (Golden Wattle) and *Allocasuarina littoralis* (Black She-oak).

Groundlayer: *Pteridium esculentum* (Bracken), *Entolasia marginata* (Boardered Panic), *Oplismenus aemulus* (Basket grass), *Imperata cylindrica var*. *major* (Blady Grass), *Lepidosperma laterale* (Variable Saw-sedge), *Lomandra longifolia* (Spiky-headed Mat-rush) and *Hibbertia vestita.*

Weeds: *Chrysanthemoides monilifera* subsp. *monilifera* (Bitou Bush), *Lantana camara* (Lantana), *Baccharis hamimifolia* (Groundsel Bush), *Senna pendula* var. *glabrate* and *Protasparagus aethiopicus* (Asparagus Fern).

Location and Distribution:
This vegetation community occurs in the eastern portion of the site and is located on the westward side of the main beach dune.

Variation:
There is slight variation within this vegetation community with low lying areas of high moisture content associated with higher densities of *Melaleuca quinquenervia* (Broad-leaved Paperbark) and *Eucalyptus robusta* (Swamp Mahogany), whilst slightly higher elevated areas are dominated by *Corymbia intermedia* (Pink Bloodwood). Scattered occurrences of *Eucalypts grandis* (Flooded Gum) and *E. microcorys* (Tallowwood) were also recorded from this community.

Disturbance:
This community has been disturbed by extensive weed invasion in both the shrub and ground layers. The entire community has been affected from a history of grazing and rural activities. More recently the majority of this vegetation community has been underscrubbed.

Weed Invasion:
This community exhibits extensive weed invasion in both the shrub and ground layers. Large areas of *Chrysanthemoides monilifera* subsp. *monilifera* (Bitou Bush), *Lantana camara* (Lantana) and *Baccharis hamimifolia* (Groundsel Bush) dominate the shrub layer.

E. WET HEATH

Structure:

Canopy: To 16 metres high with <5% Projected Foliage Cover (PFC).

Shrubs: To 6 metres high with 45-70% PFC.

Ground-layer: To 1.5 metres high with 35-55% PFC.

Floristics:
(Main Species Present)

Canopy: *Melaleuca quinquenervia* (Broad-leaved Paperbark).

Shrubs: *Melaleuca sieberi*, *Melaleuca nodosa* (Ball Honey Myrtle), *Banksia oblongifolia*, *Banksia spinulosa* (Hairpin Banksia), *Callistemon pachyphyllus* (Wallum Bottlebrush), *Leptospermum polygalifolium* subsp. *cismontanum* (Lemon Scented Tea Tree) and *Hakea dactyloides* (Broad-leaved Hakea).

Groundlayer: *Ptilothrix deusta*, *Themeda australis* (Kangaroo Grass), *Baumea rubiginosa* (Twig Rush), *Melaleuca thymifolia* (Thyme Honey Myrtle), *Polymeria calycina*, *Hibbertia vestita*, *Goodenia paniculata* (Swamp Goodenia), *Pimelea linifolia* subsp. *linifolia* (Rice Flower), *Stackhousia viminea* (Slender Stackhousia) and *Dampiera stricta* (Blue Damperia).

Location and Distribution:
This community occurs on the western side of Hearns Lake and is associated with low-lying moist soils.

Variation:
There is slight variation within this vegetation community with lower lying areas dominated by *Callistemon pachyphyllus*, whilst slightly higher elevated areas are dominated by *Banksia* and *Hakea* species. Stock grazing and previous clearing have reduced floristic diversity in the southern portion of this community.

Disturbance:
The main disturbances to this community have been from a recent fire and access tracks. Stock grazing has impacted southern areas of this community; however weed invasion is generally low with high levels of natural regeneration.

Weed Invasion:
Weed invasion within this community is generally low with high levels of native regeneration evident in the shrub and groundlayer.

F. WALLUM HEATH

Structure:

Canopy: To 8 metres high with <5% Projected Foliage Cover (PFC).

Shrubs: To 2 metres high with 45-70% PFC.

Ground-layer: To 1.5 metres high with 35-55% PFC.

Floristics:
(Main Species Present)

Canopy: *Melaleuca quinquenervia* (Broad-leaved Paperbark).

Shrubs: *Callistemon pachyphyllus* (Wallum Bottlebrush), *Pimelea linifolia* subsp. *linifolia* (Rice Flower) and *Melaleuca thymifolia* (Thyme Honey Myrtle),

Groundlayer: *Ischaemum triticeum*, *Ptilothrix deusta*, *Baumea rubiginosa* (Twig Rush), *Gonocarpus tetragynus* (Poverty Raspwort), *Polymeria calycina*, *Goodenia paniculata* (Swamp Goodenia) and *Panicum simile* (Two Colour Panic).

Location and Distribution:
This community occurs on the western side of Hearns Lake and is associated with low-lying poorly drained soils.

Variation:
The shrub layer in part of this community in the south-west of the site is dominated by *Melaleuca thymifolia* (Thyme Honey Myrtle), *Pimelea linifolia* subsp. *linifolia* (Rice Flower) and *Leptospermum juniperinum* (Prickly Tea-tree) with lower densities of *Callistemon pachyphyllus* (Wallum Bottlebrush). Scattered regrowth of *Melaleuca quinquenervia* (Broad-leaved Paperbark) and *Eucalyptus tereticornis* (Forest Red Gum) also occurs throughout this variant area.

Disturbance:
The main disturbances to this community are from a recent fire and access tracks. Stock grazing has also occurred within this community; however weed invasion is generally low with high levels of natural regeneration.

Weed Invasion:
Weed invasion within this community is generally low with high levels of native regeneration evident in the shrub and groundlayer.

G. SEDGELAND

This community also corresponds to the Sedgeland structural variant of the listed endangered ecological community, Swamp Sclerophyll Forest on Coastal Floodplains. (NSW Scientific Committee 2004)

***Structure*:**

Trees: No trees occur within the sedgeland community

Shrubs: Sparsely scattered shrubs to 2 metres in height with a PFC less than 5%.

Groundlayer: Sedges to 0.5 metres with a PFC of 80-95%.

Floristics:
(Characteristic Species)

Trees: Nil

Shrubs: *Casuarina glauca* (Swamp She-Oak)

Groundlayer: *Baumea juncea* (Bore Twig Rush), *Baumea rubiginosa* (Twig Rush), *Sporobolus virginicus* (Sand Couch), and *Samolus repens* (Creeping Brookweed).

Location and Distribution:
This community is located on low-lying, permanently water logged soils fringing Hearns Lake.

Variation:
There is very little variation within this vegetation community.

Disturbance:
Fire has impacted on the landward edge of this community.

Weed Invasion:
Weed invasion within this community is generally low.

H. DISTURBED WOODLAND

Structure:

Canopy: To 16 - 20 metres high with 35 - 45% Projected Foliage Cover (PFC).

Shrubs: To 3 metres high with <5% PFC.

Ground-layer: To 1 metres high with 75 - 85% PFC.

Floristics:
(Main Species Present)

Canopy: *Melaleuca quinquenervia* (Broad-leaved Paperbark), *Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus robusta* (Swamp Mahogany), *Banksia integrifolia* subsp. *integrifolia* (Coast Banksia), *Corymbia intermedia* (Pink Bloodwood), *Casuarina glauca* (Swamp She-Oak) and *Lophostemon suaveolens* (Swamp Turpentine).

Shrubs: *Baccharis hamimifolia* (Groundsel Bush), *Pultenaea linophylla, Pimelea linifolia* subsp. *linifolia* (Rice Flower), *Melaleuca quinquenervia* (Broad-leaved Paperbark), *Acacia longifolia* var. *longifolia* (Golden Wattle). *Chrysanthemoides monilifera* subsp. *monilifera* (Bitou Bush), *Dodonea triquetra* (Hop Bush), *Alectryon coriaceus* (Beach Alectryon), *Acacia suaveolens* (Sweet Scented Wattle), *Syzygium australis* (Brush Cherry) and *Acacia saligna* (Orange Wattle).

Groundlayer: *Themeda australis* (Kangaroo Grass), *Sporobolus africanus* (Parramatta Grass), *Eragrostis cilianensis* (Stinkgrass), *Baumea rubiginosa* (Twig Rush), *Polymeria calycina* and *Dichondra repens* (Kidney Weed).

Weeds: *Baccharis hamimifolia* (Groundsel Bush), *Sporobolus africanus* (Parramatta Grass) and *Eragrostis cilianensis* (Stinkgrass).

Classification:
This vegetation community has been highly modified by clearing, grazing, fire and other anthropomorphic changes over a long period of time. It is considered that this vegetation does not correspond to any native vegetation mapped in the local area.

Location and Distribution:
This community occurs in large patches in the southern and central-western portions of the site.

Variation:
There is little variation within this vegetation community.

Disturbance:
The entire community has been affected by a long history of grazing and rural activities. Weed invasion, current grazing, soil compaction, a recent fire event and historic clearing of the shrub and ground layer have reduced the ecological integrity of this community.

Weed Invasion:
Weed invasion is low to moderate within this vegetation community and is primarily associated with edge effects and grazing.

I. SANDPLAIN FOREST (*Melaleuca* / Mesophyllic species dominated)

Structure:

Canopy: To 16 metres high with up to 30% Projected Foliage Cover (PFC).

Shrubs: To 3 metres high with <5% PFC.

Ground-layer: To 1 metre high with 75 - 85% PFC.

Floristics:
(Main Species Present)

Canopy: *Melaleuca quinquenervia* (Broad-leaved Paperbark), *Archontophoenix cunninghamii (Bangalow Palm), Ficus coronata (Sandpaper Fig), Acronchia imperforata, Glochidion ferdinandi (Cheese Tree), Cupaniopsis anarcoides* and *Lophostemon suaveolens* (Swamp Turpentine).

Shrubs: *Baccharis hamimifolia* (Groundsel Bush), *Pultenaea linophylla, Pimelea linifolia* subsp. *linifolia* (Rice Flower), *Melaleuca quinquenervia* (Broad-leaved Paperbark), *Acacia longifolia* var. *longifolia* (Golden Wattle). *Chrysanthemoides monilifera* subsp. *monilifera* (Bitou Bush), *Dodonea triquetra* (Hop Bush), *Alectryon coriaceus* (Beach Alectryon), *Acacia*

suaveolens (Sweet Scented Wattle), *Syzygium australis* (Brush Cherry), *Acacia saligna* (Orange Wattle), *Elaeocarpus reticulatus* (Blueberry Ash), *Persoonia stradbrokensis*, *Pultenaea retusa* and *Allocasuarina littoralis* (Black She-oak).

Groundlayer: *Themeda australis* (Kangaroo Grass), *Sporobolus africanus* (Parramatta Grass), *Eragrostis cilianensis* (Stinkgrass), *Baumea rubiginosa* (Twig Rush), *Polymeria calycina*, *Dichondra repens* (Kidney Weed), *Pteridium esculentum* (Bracken), *Entolasia marginata* (Bordered Panic), *Oplismenus aemulus* (Basket grass), *Imperata cylindrica* var. *major* (Blady Grass), *Lepidosperma laterale* (Variable Saw-sedge), *Lomandra longifolia* (Spiky-headed Mat-rush) and *Hibbertia vestita.*

Weeds: *Baccharis hamimifolia* (Groundsel Bush), *Sporobolus africanus* (Parramatta Grass) and *Eragrostis cilianensis* (Stinkgrass).

Location and Distribution:
This community occurs in two patches on the western flank of the main dune in the south-eastern portion of the subject site.

Variation:
There is little variation within this vegetation community.

Disturbance:
The entire community has been affected from a long history of grazing and rural activities. Weed invasion, current grazing, soil compaction, a recent fire event and historic clearing and ongoing underscrubbing or slashing of the shrub and ground layer have reduced the ecological integrity of this community.

Weed Invasion:
Weed invasion is low to moderate within this vegetation community and is primarily associated with edge effects and grazing.

TABLE 3
FLORA SPECIES OBSERVED ON THE SUBJECT SITE

Family	Scientific Name	Common Name
TREES		
Araliaceae	*Schefflera actinophylla*	Umbrella Tree
Araucariaceae	*Araucaria cunninghamii*	Hoop Pine
Arecaceae	*Archontophoenix cunninghamiana*	Bangalow Palm
Casuarinaceae	*Allocasuarina littoralis*	Black She-oak
	Casuarina glauca	Swamp Oak
Eleocarpaceae	*Elaeocarpus reticulatus*	Blueberry Ash
Euphorbiaceae	*Glochidion ferdinandii*	Cheese Tree
Fabaceae: Faboideae	*Castanospermum australe*	Black Bean
	*Erythrina crista-galli**	Cockspur Coral Tree
	*Bauhinia variegata**	Orchid Tree
Lauraceae	*Cinnamomum camphora**	Camphor Laurel
	Cryptocarya triplinervis	Three-veined Cryptocarya
	Endiandra sieberi	Corkwood
Moraceae	*Ficus coronata*	Sandpaper Fig
	*Ficus elastica**	Rubber Plant
	Ficus macrophylla	Moreton Bay Fig
Myoporaceae	*Myoporum acuminatum*	Mangrove Boobialla
Myrtaceae	*Acmena smithii* 'small-leaved race'	Lillypilly
	Angophora costata	Smooth-barked Apple

TABLE 3 (Cont.)
FLORA SPECIES OBSERVED ON THE SUBJECT SITE

Family	Scientific Name	Common Name
TREES (Cont.)		
	Corymbia intermedia	Pink Bloodwood
	Eucalyptus grandis	Flooded Gum
	Eucalyptus microcorys	Tallowwood
	Eucalyptus pilularis	Blackbutt
	Eucalyptus resinifera subsp. *hemilampra*	Red Mahogany
	Eucalyptus robusta	Swamp Mahogany
	Eucalyptus siderophloia	Northern Grey Ironbark
	Eucalyptus tereticornis	Forest Red Gum
	Lophostemon confertus	Brush Box
	Lophostemon suaveolens	Swamp Turpentine
	Melaleuca quinquenervia	Broad-leaved Paperbark
	Syzygium australe	Brush Cherry
	Syzygium luehmannii	Small-leaved Lilypilly
Proteaceae	*Banksia integrifolia* subsp. *integrifolia*	Coast Banksia
Rutaceae	*Acronychia imperforata*	Beach Acronychia
Sapindaceae	*Cupaniopsis anacardioides*	Tuckeroo
	Guioa semiglauca	Guioa
SHRUBS		
Apocynaceae	*Nerium oleander**	Oleander Bush
Araliaceae	*Polyscias elegans*	Celery Wood
	Polyscias sambucifolia	Elderberry Panax
Asclepidaceae	*Gomphocarpus fruiticosus**	Narrow Leaf Cotton Bush
Asteliaceae	*Cordyline stricta*	Narrow-leaf Palm Lily
Asteraceae	*Baccharis halimifolia**	Groundsel Bush
Asteraceae	*Chrysanthemoides monilifera* subsp. *monilifera**	Bitou Bush
	Ozothamnus diosmifolius	Ball Everlasting
Epacridaceae	*Epacris microphylla*	-
	Epacris obtusifolia	-
	Epacris pulchella	NSW Coral Heath
	Leucopogon lanceolatus	Lance Beard-heath
	Leucopogon leptospermoides	
	Monotoca elliptica	Tree Broom-heath
	Pultenaea linophylla	-
	Pultenaea retusa	-
	Pultenaea villosa	-
	Phyllota phylicoides	Heath Phyllota
Fabaceae: Mimosoideae	*Acacia floribunda*	Sally Wattle
	Acacia longifolia var. *longifolia*	Golden Wattle
	Acacia longifolia var. *sophorae*	Coastal Wattle
	Acacia longissima	Narrow-leaved Wattle
	Acacia myrtifolia	Red Stem Wattle
	*Acacia saligna**	Orange Wattle
	Acacia suaveolens	Sweet Scented Wattle
Malvaceae	*Hibiscus syriacus**	-
	Hibiscus sp. (cultivar)	Hibiscus
	*Malvaviscus arboreus**	Sleepy Mallow
Meliaceae	*Synoum glandulosum*	Scentless Rosewood
Monimiaceae	*Wilkiea heugeliana*	Wilkiea
Myrsinaceae	*Rapanea howittiana*	Brush Muttonwood
	Rapanea variabilis	Muttonwood

TABLE 3 (Cont.)
FLORA SPECIES OBSERVED ON THE SUBJECT SITE

Family	Scientific Name	Common Name
SHRUBS (Cont.)		
Myrtaceae	*Callistemon pachyphyllus*	Wallum Bottlebrush
	Callistemon sp. (cultivar)	-
	Leptospermum juniperinum	Prickly Tea-tree
	Leptospermum liversidgei	-
	Leptospermum polygalifolium subsp. *cismontanum*	Lemon Scented Tea Tree
	Melaleuca nodosa	Ball Honey Myrtle
	Melaleuca sieberi	-
	Melaleuca squamea	-
	Melaleuca thymifolia	Thyme Honey Myrtle
	Rhodamnia rubescens	Brush Turpentine
Ochnaceae	*Ochna serrulata**	Mickey Mouse Plant
Oleaceae	*Ligustrum sinense**	Small-leaved Privet
	Notelaea longifolia	Mock Olive
	Notelaea ovata	Mock Olive
Phytolaccaceae	*Phytolacca octandra**	Inkweed
Pittosporaceae	*Pittosporum revolutum*	Yellow Pittosporum
Polygalaceae	*Comesperma ericinum*	Matchheads
Proteaceae	*Banksia oblongifolia*	-
	Banksia spinulosa	Hairpin Banksia
	Grevillea sp. (cultivar)	
	Hakea actites	-
	Hakea dactyloides	Broad-leaved Hakea
	Persoonia conjuncta	-
	Persoonia stradbrokensis	-
	Persoonia virgata	-
Rubiaceae	*Psychotria loniceroides*	-
Sapindaceae	*Alectryon coriaceus*	Beach Alectryon
	Dodonaea triquetra	Hop Bush
Solanaceae	*Duboisia myoporoides*	Corkwood
	*Solanum nigrum**	Black Nightshade
	*Solanum mauritianum**	Wild Tobacco
	Solanum pungetium	Eastern Nightshade
Verbenaceae	*Clerodendrum floribundum*	-
	Clerodendrum tomentosum	-
	*Lantana camara**	Lantana
GROUNDCOVERS		
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower
	*Thunbergia alata**	Black-eyed Susan
Agavaceae	*Yucca aloifolia**	-
Amaranthaceae	*Alternanthera denticulata*	Lesser Joyweed
Amaryllidaceae	*Crinum pedunculatum*	Swamp Lily
Anthericaceae	*Caesia parviflora* var. *parviflora*	Pale Grass Lily
	*Chlorophytum comosum**	Spider Plant
	Thysanotus tuberosus	Fringed Lily
	Tricoryne elatior	Yellow Rush Lily
Apiaceae	*Centella asiatica*	Swamp Pennywort
	*Ciclospermum leptophyllum**	Slender Celery
	*Foeniculum vulgare**	Fennel
	*Hydrocotyle bonariensis**	Kurnell Curse / Pennywort

TABLE 3 (Cont.)
FLORA SPECIES OBSERVED ON THE SUBJECT SITE

Family	Scientific Name	Common Name
GROUNDCOVERS (Cont.)		
	Hydrocotyle peduncularis	Pennywort
	Trachymene incisa subsp. *incisa*	Native Parsnip
Apocynaceae	*Vinca major**	Blue Periwinkel
Asparagaceae	*Protasparagus aethiopicus**	Asparagus Fern
	*Protasparagus plumosus**	Climbing Asparagus Fern
Asteraceae	*Ambrosia artemisiifolia**	Annual Ragweed
	*Aster subulatus**	Wild Aster
	*Ageratina adenophora**	Crofton Weed
Asteraceae	*Bidens pilosa**	Cobbler's Pegs
	*Cirsium vulgare**	Spear Thistle
	*Conyza albida**	Fleabane
	*Conyza bonariensis**	Flax-leaf Fleabane
	Eclipta platyglossa	-
	*Hypochaeris radicata**	Flatweed
	Lagenifera stipitata	-
	Leptinella longipes	-
	Pseudognaphalium luteoalbum	Jersey Cudweed
	*Senecio madagascariensis**	Fireweed
	Vernonia cinerea	-
	Vittadinia hispidula var. *setosa*	-
Baueraceae	*Bauera microphylla*	-
Blechnaceae	*Blechnum cartilagineum*	Gristle Fern
	Blechnum indicum	Swamp Water Fern
Caryophyllaceae	*Cerastium glomeratum**	Mouse-ear Chickweed
	*Stellaria media**	Common Chickweed
Clusiaceae	*Hypericum gramineum*	Small St Johns Wort
Commelinaceae	*Commelina cyanea*	Scurvy Weed
Convolvulaceae	*Dichondra repens*	Kidney Weed
	Polymeria calycina	-
Cyperaceae	*Baumea articulata*	-
	Baumea juncea	-
	Baumea rubignosa	Twig Rush
	Baumea teretifolia	Wrinkle-nut Twig Rush
	Bolboschoenus cardwellii	-
	Carex appressa	-
	Carex inversa	Knob Sedge
	Chorizandra cymbaria	Heron Bristle Rush
	Chorizandra sphaerocephala	Round-headed Bristle Rush
	Cyperus eglobosus	-
	Cyperus odoratus	-
	Cyperus polystachyos	-
	Cyperus sanguinolentus	-
	*Cyperus sesquiflorus**	-
	Eleocharis sphacelata	Tall Spike-rush
	Fimbristylis dichotoma	-
	Fimbristylis ferruginea	-
	Fimbristylis velata	-
	Gahnia aspera	Saw Sedge
	Gahnia sieberiana	Red-fruited Saw-sedge
	Lepidosperma laterale	Variable Sword-sedge

TABLE 3 (Cont.)
FLORA SPECIES OBSERVED ON THE SUBJECT SITE

Family	Scientific Name	Common Name
GROUNDCOVERS (Cont.)		
	Lepidosperma longitudinale	Pithy Sword Sedge
	Ptilothrix deusta	-
	Schoenoplectus mucronatus	-
	Schoenus apogon	Fluke Bog-rush
	Schoenus lepidosperma subsp. *pachylepis*	-
Davalliaceae	*Nephrolepis cordifolia**	Fish-bone Fern
Dennstaedtiaceae	*Pteridium esculentum*	Bracken
Dilleniaceae	*Hibbertia aspera*	Rough Guinea Flower
	Hibbertia pedunculata	-
	Hibbertia vestita	-
Euphorbiaceae	*Phyllanthus tenellus**	-
	Poranthera microphylla	
Fabaceae	*Medicago polymorpha**	Burr Medic
Goodeniaceae	*Dampiera stricta*	Blue Dampiera
	Goodenia hederacea var. *hederacea*	Ivy-leaved Goodenia
	Goodenia ovata	-
	Goodenia paniculata	Swamp Goodenia
	Goodenia rotundifolia	-
	Scaveola calendulacea	Scented Fan Flower
	Scaveola ramosissima	-
Haemodoraceae	*Haemodorum planifolium*	Bloodroot
Haloragaceae	*Gonocarpus micranthus* subsp. *ramosissimus*	-
	Gonocarpus tetragynus	Poverty Raspwort
	Gonocarpus teucrioides	-
Iridaceae	*Gladiolus sp.**	-
	Patersonia glabrata	Leafy Purple-flag
Juncaceae	*Juncus cognatus**	-
	Juncus continuus	-
	Juncus krausii	Sea Rush
	Juncus mollis	-
	Juncus polyanthemus	-
	Juncus usitatus	Common Rush
Lindsaeaceae	*Lindsaea linearis*	Screw Fern
Lobeliaceae	*Lobelia alata*	-
	Pratia purpurascens	Whiteroot
Loganiaceae	*Mitrasacme polymorpha*	Mitrewort
	Mitrascme alsinoides	Mitrewort
Lomandraceae	*Lomandra filiformis* var. *filiformis*	Wattle Mat-rush
	Lomandra longifolia	Spiky-headed Mat-rush
	Lomandra multiflora subsp. *multiflora*	Many-flowered Mat-rush
Malvaceae	*Sida rhombifolia**	Paddy's Lucerne
Melanthiaceae	*Ciliva miniata**	Bush Lily
Menyanthaceae	*Villarsia exaltata*	-
Nymphaeaceae	*Nymphaea capensis**	Cape Waterlily
Orchidaceae	*Diuris* sp. Aff. *Chrysantha*	-
	Dipodium variegatum	Blotched Hyacinth Orchid
	Spiranthes sinensis subsp. *australis*	Austral Ladies Tresses
Oxalidaceae	*Oxalis exilis*	-
	*Oxalis latifolia**	Pink Fishtail
	*Oxalis pes-caprae**	Soursob

TABLE 3 (Cont.)
FLORA SPECIES OBSERVED ON THE SUBJECT SITE

Family	Scientific Name	Common Name
GROUNDCOVERS (Cont.)		
Phormiaceae	*Dianella caerulea*	Flax Lily
	Dianella congesta	-
Phylydraceae	*Phylidrum lanuginosum*	Woolly Frogsmouth
Plantaginaceae	*Plantago lanceolata**	Ribwort
Poaceae	*Arundo donax**	Giant Reed
Poaceae	*Agrostis avenacea*	Blown Grass
	*Andropogon virginicus**	Whisky Grass
	Aristida ramosa	-
	Aristida warburgii	-
	*Arundo donax**	Giant Reed
	*Bromus cartharticus**	Prairie Grass
	*Chloris gayana**	Rhodes Grass
	Cymbopogon refractus	Barbwire Grass
	Cynodon dactylon	Common Couch
	Digitaria parviflora	Small-flowered Finger Grass
	Digitaria ramularis	-
	*Digitaria sanguinalis**	Crab Grass
	Echinopogon caespitosus var. *caespitosus*	Tufted Hedgehog Grass
	Echinopogon ovatus	Forest Hedgehog Grass
	Entolasia marginata	Bordered Panic
	Entolasia stricta	Wiry Panic
	Eragrostis brownii	Brown's Lovegrass
	*Eragrostis curvula**	African Lovegrass
	Eragrostis elongata	Clustered Lovegrass
	Eragrostis leptostachya	Paddock Lovegrass
	Imperata cylindrica var. *major*	Blady Grass
	Ischaemum australe	-
	Ischaemum triticeum	-
	Microlaena stipoides var. *stipoides*	Weeping Rice Grass
	Oplismenus aemulus	Basket Grass
	Oplismenus imbecillis	-
	Panicum paludosum	Swamp Panic
	Panicum simile	Two Colour Panic
	*Paspalum ciliatifolium**	One-spiked Paspalum
	*Paspalum dilatatum**	Paspalum
	*Paspalum urvillei**	Vasey Grass
	*Pennisetum clandestinum**	Kikuyu
	*Phalaris aquatica**	Phalaris
	Phragmites australis	Common Reed
	Poa labillardieri	Tussock
	*Setaria gracilis**	Slender Pigeon Grass
	*Sporobolus africanus**	Parramatta Grass
	Sporobolus creber	Slender Rat's Tail Grass
	Sporobolus elongatus	Slender Rat's Tail Grass
	Sporobolus virginicus	Sand Couch
	*Stenotaphrum secundatum**	Buffalo Grass
	Themeda australis	Kangaroo Grass
Polygalaceae	*Comesperma defoliatum*	-
Polygonaceae	*Rumex brownie*	Swamp Dock

TABLE 3 (Cont.)
FLORA SPECIES OBSERVED ON THE SUBJECT SITE

Family	Scientific Name	Common Name
GROUNDCOVERS (Cont.)		
	*Rumex crispus**	Curled Dock
Primulaceae	*Anagallis arvensis* var. *caerulea**	Blue Pimpernel
	*Anagallis arvensis**	Scarlet Pimpernel
	Samolus repens	Creeping Brookweed
Restionaceae	*Lepyrodia scariosa*	-
Rubiaceae	*Opercularia aspera*	Common Stinkweed
	Opercularia diphylla	-
	Pomax umbellata	Pomax
Scrophulariaceae	*Bacopa monniera*	-
Solanaceae	*Solanum nigrum**	Black Nightshade
Stackhousiaceae	*Stackhousia nuda*	-
	Stackhousia spathulata	-
	Stackhousia viminea	Slender Stackhousia
Thymelaeaceae	*Pimelea linifolia* subsp. *linifolia*	Slender Rice Flower
Verbenaceae	*Verbena bonariensis**	Purpletop
	*Verbena officinalis**	Common Verbena
	*Verbena rigida**	Veined Verbena
Violaceae	*Viola hederacea*	Ivy-leaved Violet
Xanthorrhoaceae	*Xanthorrhoea fulva*	-
Xyridaceae	*Xyris operculata*	-
VINES		
Apocynaceae	*Parsonsia straminea*	Common Silkpod
Convolvulaceae	*Convolvulus erubescens*	Austrialian Bindweed
	*Ipomoea cairica**	Coastal Morning Glory
Dilleniaceae	*Hibbertia scandens*	Climbing Guinea-flower
Fabaceae	*Canavalia rosea*	Beach Bean
	Desmodium gunnii	-
	Desmodium nemorosum	-
	Glycine clandestina	Twining Glycine
	Glycine tabacina	Twining Glycine
	Glycine tomentella	Woolly Glycine
	Hardenbergia violacea	False Sarsaparilla
	Kennedia rubicunda	Dusky Coral Pea
Lauraceae	*Cassytha glabella* forma *glabella*	Devil's Twine
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry
	Geitonoplesium cymosum	Scrambling Lily
Menispermiaceae	*Stephania japonica* var. *discolor*	Snake Vine
Nyctaginaceae	*Bougainvillea* sp.*	Bougainvillea
Passifloraceae	*Passiflora suberosa**	Cork Passionflower
Pittosporaceae	*Billardiera scandens* var. *scandens*	Apple Dumplings
Rosaceae	*Rubus hillii*	Molucca Bramble
	Rubus parvifolius	Native Raspberry
Rubiaceae	*Morinda jasminoides*	-
Smilacaceae	*Smilax australis*	Lawyer Vine
	Smilax glyciphylla	Sarsaparilla
Vitaceae	*Cissus antarctica*	Native Grape
EPIPHYTES		
Orchidaceae	*Cymbidium suave*	Native Cymbidium
Polypodiaceae	*Platycerium bifurcatum* subsp*. bifurcatum*	Elkhorn

Species name^{TS} = Threatened Species * = Introduced Species

(b) water flows, including rivers, creeks and impoundments;
Double Crossing Creek flows from the west near the northern boundary of the subject site. The flow from Double Crossing Creek is impounded within Hearns Lake which periodically discharges into the sea.

(c) the presence of outstanding natural features, including caves;
There are no outstanding natural features present on this site except for Hearns Lake.

(d) gradient;
Gradients within the site are mostly flat with some areas of less than 5% slope

(e) any buildings or other infrastructure;
There are no buildings on site, however there are some water tanks. The subject site has a history of agricultural pursuits including tree felling, slashing, burning, subsequent regrowth, grazing, and construction of water tanks, drainage ditches, barbed wire fences and informal vehicular tracks.

(f) any marine areas;
There are no wholly marine areas within the subject site as the site is situated west of the beach dune barrier. However, Hearns Lake is occasionally open to the sea and may provide spawning or food resource habitat for some marine species tolerant of high levels of fresh water.

(g) kinds of fauna in the area;
The subject site contains a range of fauna habitats associated with the Forest variants, Heath and Sedgeland vegetation communities. The majority of the subject site has a history of disturbance through clearing, grazing and slashing and as such the habitats are of decreased value for locally occurring fauna species.

The nectar, seed, fruit and flower producing tree and shrub species of the Forest variants provide suitable foraging habitat for a range of locally occurring bird, arboreal mammal and bat species. The shrub and ground layers of sections of the Forest variants has been removed and is of decreased value for fauna due to a lack of foraging and shelter opportunities. The hollow bearing trees of the Forest variants provide suitable roost, den and breeding opportunities for a range of locally occurring bird, arboreal mammal and microchiropteran bat species. Quadrat data, as shown in Table 4, was used to survey the hollow tree abundance within the subject site.

TABLE 4
HOLLOW BEARING TREE DATA

	Total trees	Total trees with hollows	% Hollow Bearing Trees
Quadrat 1 (50m x 50m)	50	4	8%
Quadrat 2 (50m x 50m)	26	8	31%
Quadrat 3 (50m x 50m)	101	12	12%
Quadrat 4 (50m x 50m)	33	12	36%

The Heath Communities provide high levels of nectar feeding habitat for bird and mammal species within the various native shrubs. The less disturbed areas of Wet Heath provide shelter opportunities for a number of bird and terrestrial mammal species. This community is highly disturbed having suffered constant slashing, burning and grazing over a long period and was in a period of regrowth during the fauna survey.

The Wallum Heath and Sedgeland vegetation communities occur in low lying areas of the site and area associated with habitats prone to periodic inundation and drying. These vegetation communities provide suitable habitat types for a range of amphibian species and limited habitat for small terrestrial mammal, wading bird and reptile species.

The aquatic habitats associated with Hearns Lake provide suitable habitats for a range of aquatic and semi-aquatic fauna species. These aquatic habitats support a number of fish and wading bird species.

The movements of amphibians, reptiles terrestrial mammals and arboreal mammals through the subject site from other areas of suitable habitat are restricted by the presence of the Pacific Highway to the west, the Tasman Sea to the east, residential development to the south, and the deep waters of Double Crossing Creek to the north. It is considered however that a thin line of connectivity exists along the coastal dunes within the lands zoned 6A Open Space Public Recreation.

Fauna Observed On-Site
The fauna species observed within the subject site during surveys are listed within Table 5.

Five threatened fauna species as listed in Schedule 2 of the TSC Act NSW 1995 were detected within the subject site during surveys. These species were the Wallum Froglet (*Crinia tinnula*), Black-necked Stork (*Ephippiorhyncus asiaticus*), Osprey (*Pandion haliaetus*), Eastern Freetail-bat (*Mormopterus norfolkensis*) and Greater Broad-nosed Bat (*Scoteanax rueppellii*). All other species as listed in Table 5 are considered relatively common within the local area.

Wallum Froglets were detected calling from two low lying areas containing surface water during surveys in March 2004 following several days of rainfall. The location of these observations are shown in Figure 3.1 within the Flora and Fauna Assessment Report (*Conacher Travers Pty Ltd* April 2005 Ref: 5091F) and include an area of Low Wallum Heath along the western areas of Hearns Lake and a similar area of vegetation in the south-west part of the site where runoff from the Pacific Highway enters the site.

An individual Black-necked Stork was observed on the afternoon of 17th December 2003 roosting and foraging just north of the subject site within the sedge lands bordering Hearns Lake. A single Black-necked Stork was also observed foraging within Hearns Lake on 17th August 2004. No evidence of breeding by this species was detected within the subject site during surveys.

An individual Osprey was observed over-flying the subject site on several occasions during surveys. The bird flew in from a north-eastern direction and crossed the subject site without landing continuing flying toward more elevated lands west of the Pacific Highway. A nesting pair of Osprey was observed nesting within a dead tree approximately 125m west of the subject site across the Pacific Highway during surveys conducted in August 2004. No evidence of nesting by this species within the subject site was detected.

Chewed *Allocasuarina* cones, likely evidence of foraging by Glossy Black-Cockatoo was observed during a site inspection on the 26th October 2005. The chewed cones were observed within the open forest of the north western sector of the subject site.

The Eastern Freetail-bat was detected foraging within the ecotone between the drainage line and the cleared area toward the southern end of the subject site during Anabat call detection surveys conducted on the evening of the 16th December 2003. There are numerous hollow bearing trees throughout the subject site, which may provide suitable breeding and roosting habitat for this species however no evidence of use of hollows as roost or maternity sites was observed during surveys.

The Greater Broad-nosed Bat was detected foraging within the ecotone between the drainage line and the cleared area and the Open Forest toward the southern end of the subject site during Anabat call detection surveys conducted on the evening of the 12th October 2004. There are numerous hollow bearing trees throughout the subject site, which may provide suitable breeding and roosting habitat for this species however no evidence of use of hollows as roost or maternity sites was observed during surveys.

TABLE 5
FAUNA SPECIES OBSERVED ON THE SITE AND ADJOINING AREAS

Scientific name	Common name	Dec 2003	Aug 2004	Oct 2004
AMPHIBIANS				
Wallum Froglet [TS]	*Crinia tinula*		OPC+ (March 04)	
Eastern Common Froglet	*Crinia signifera*		C	
Bleating Tree Frog	*Litoria dentata*			C
Dwarf Tree Frog	*Litoria fallax*			C
BIRDS				
Brown Quail	*Coturnix ypsilophora*	O	OC	
Australian Wood Duck	*Chenonetta jubata*	OC		OC
Pacific Black Duck	*Anas superciliosa*	OC	O	
Grey Teal	*Anas gracilis*	OC		
Little Pied Cormorant	*Phalacrocorax melanoleucos*	O		O
Little Black Cormorant	*Phalacrocorax sulcirostris*	O	O	
Pied cormorant	*Phalacrocorax varius*	O	O	
Great Cormorant	*Phalacrocorax carbo*		O	O
Australian Pelican	*Pelecanus conspicillatus*	O	O	
Lewin's Rail	*Rallus pectoralis*			O
White-faced Heron	*Egretta novaehollandiae*	OC	O	
Little Egret	*Egretta garzetta*	O	O	
Great Egret	*Ardea alba*	O	O	O
Cattle Egret	*Ardea ibis*	O	O	O
Australian White Ibis	*Threskiornis molucca*	O	O	
Straw-necked Ibis	*Threskiornis spinicollis*		O	
Royal Spoonbill	*Platalea regia*	O		
Black-necked Stork [TS]	*Ephippiorhynchus asiaticus*	O	O	
Brahminy Kite	*Haliastur Indus*		OC	
Osprey [TS]	*Pandion haliaetus*	O	OC	O
White-bellied Sea-Eagle	*Haliaeetus leucogaster*		OC	
Brown Falcon	*Falco berigora*		O	
Masked Lapwing	*Vanellus miles*	OC	OC	
Silver Gull	*Larus novaehollandiae*	OC	OC	OC
Caspian Tern	*Sterna caspia*	OC		
Rock Dove *	*Columba livia*	OC	O	
Spotted Turtle-Dove *	*Streptopelia chinensis*	OC	O	OC
Crested Pigeon	*Ocyphaps lophotes*	O	OC	
Bar-shouldered Dove	*Geopelia humeralis*	OC	OC	OC
Peaceful Dove	*Geopelia striata*			O
Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*	OC	OC	OC
Glossy Black-Cockatoo [TS]	*Calyptorhynchus lathami*			Sc 10/05
Galah	*Cacatua roseicapilla*	OC	OC	OC
Rainbow Lorikeet	*Trichoglossus haematodus*	OC	OC	OC
Scaly-breasted Lorikeet	*Trichoglossus chlorolepidotus*	OC	OC	OC
Eastern Rosella	*Platycercus eximius*	OC	OC	OC
Channel-billed Cuckoo	*Scythrops novaehollandiae*	OC		
Common Koel	*Eudynamys scolopacea*	C		
Fan-tailed Cuckoo	*Cacomantis flabelliformis*	OC		
White-throated Needletail	*Hirundapus caudacutus*	O		
Laughing Kookaburra	*Dacelo novaeguineae*	OC	OC	OC
Sacred Kingfisher	*Todiramphus sanctus*	OC		OC
Rainbow Bee-eater	*Merops ornatus*	OC		
Dollarbird	*Eurystomus orientalis*	OC		OC

TABLE 5 (Cont.) FAUNA SPECIES OBSERVED ON THE SITE AND ADJOINING AREAS				
Scientific name	**Common name**	**Dec 2003**	**Aug 2004**	**Oct 2004**
BIRDS (Cont.)				
Superb Fairy-wren	*Malurus cyaneus*	OC	OC	OC
Variegated Fairy-wren	*Malurus lamberti*	OC		
Weebill	*Smicromis brevirostris*	OC		
White-throated Gerygone	*Gerygone olivacea*	OC		OC
Brown Thornbill	*Acanthiza pusilla*	OC	OC	OC
Red Wattlebird	*Anthochaera carunculata*	OC	OC	OC
Little Wattlebird	*Anthochaera chrysoptera*	OC	OC	OC
Noisy Friarbird	*Philemon corniculatus*	OC	OC	OC
Blue-faced Honeyeater	*Entomyzon cyanotis*	OC	OC	OC
Noisy Miner	*Manorina melanocephala*	OC	OC	
Lewin's Honeyeater	*Meliphaga lewinii*	O	OC	OC
Yellow-faced Honeyeater	*Lichenostomus chrysops*	OC	OC	OC
Brown Honeyeater	*Lichmera indistincta*	OC	OC	OC
White-naped Honeyeater	*Melithreptus lunatus*	OC	OC	
White-cheeked Honeyeater	*Phylidonyris nigra*	OC	OC	OC
Eastern Spinebill	*Acanthorhynchus tenuirostris*	OC	OC	OC
Scarlet Honeyeater	*Myzomela sanguinolenta*		OC	OC
Eastern Whipbird	*Psophodes olivaceus*	OC	O	O
Varied Sittella	*Daphoenositta chrysoptera*	OC	OC	OC
Rufous Whistler	*Pachycephala rufiventris*	OC	OC	OC
Grey Fantail	*Rhipidura fuliginosa*	OC	OC	OC
Willie Wagtail	*Rhipidura leucophrys*	OC	OC	OC
Leaden Flycatcher	*Myiagra rubecula*			OC
Magpie-lark	*Grallina cyanoleuca*	OC	OC	OC
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	OC	OC	OC
Cicadabird	*Coracina tenuirostris*	O		
White-winged Triller	*Lalage sueurii*	OC		
Olive-backed Oriole	*Oriolus sagittatus*	OC	OC	OC
White-breasted Woodswallow	*Artamus leucorynchus*	OC	OC	OC
Grey Butcherbird	*Cracticus torquatus*	OC	OC	
Pied Butcherbird	*Cracticus nigrogularis*	OC	OC	OC
Australian Magpie	*Gymnorhina tibicen*	OC	OC	OC
Pied Currawong	*Strepera graculina*	OC	OC	OC
Australian Raven	*Corvus coronoides*	OC	OC	OC
Spangled Drongo	*Dicrurus bracteatus*			OC
Double-barred Finch	*Taeniopygia bichenovii*	OC		
Red-browed Finch	*Neochmia temporalis*	OC	OC	
Tawny Grassbird	*Megalurus timoriensis*			OC
Golden-headed Cisticola	*Cisticola exilis*	OC		
Welcome Swallow	*Hirundo neoxena*	O	OC	OC
REPTILES				
Garden Skink	*Lampropholis guichenoti*	OS		OS
Eastern Blue Tongue	*Tiliqua scincoides*	OS		
Bearded Dragon	*Pogona barbata*	OS		
MAMMALS				
Eastern Grey Kangaroo	*Macropus giganteus*		O, Sp	O, Sp
Common Brushtail Possum	*Trichosurus vulpecula*	E	Sp	Sp
Gould's Wattled Bat	*Chalinolobus gouldii*	A	A	A
Eastern Freetail-bat [TS]	*Mormopterus norfolkensis*	A		
Freetail-bat	*Mormopterus spp 2*	A	A	
Greater Broad-nosed Bat [TS]	*Scoteanax ruppellii*			A
Broad-nosed Bat	*Scotorepens spp.*	A		A
Eastern Forest Bat	*Vespadelus pumilus*	A		

TABLE 5 (Cont.)
FAUNA SPECIES OBSERVED ON THE SITE AND ADJOINING AREAS

MAMMALS (Cont.)				
Eastern Broad-nosed Bat	*Scotorepens orion*	A		
Horse *	*Equus caballus*	O		
Cow *	*Bos taurus*	O	O	O
Cat *	*Felis cattus*	O Sp		
Dog *	*Canis familiaris*	O	OC	OC

Key to Methods of Observation

O	-	Observation	S	-	Search
C	-	Call identification	A	-	Anabat II
Sp	-	Spotlight	Sc	-	Scat, Track or Sign
E	-	Elliott Trap	OP	-	Opportunistic Observation

Note: * indicates introduced species
^{TS} indicates threatened species (TSC Act 1995)
+ Species identification not yet confirmed

(h) the current state of the environment in the area, including information about the extent of erosion, whether the area is infested with weeds or feral animals and whether the area is covered by native vegetation or crops;

Erosion: There is little evidence of erosion within the subject site. The site is mostly flat and is depositional in character.

Vegetation: The various vegetation types within the subject site can best be generally described as 'Disturbed Native Vegetation'. This is due to the levels of weed invasion and the long history of agricultural (grazing) disturbances previously mentioned (tree felling, slashing, burning, subsequent regrowth, grazing, and construction of water tanks, drainage ditches, barbed wire fences and informal vehicular tracks).

Clearing: Some time in the past the subject site has been partially cleared for agricultural (grazing) purposes. Subsequently, selective tree felling and regular slashing have been undertaken. Patchy regrowth has occurred over several areas within the site.

Agriculture: The subject site appears to have a long history of agricultural pursuits, mostly grazing.

Introduced weeds: The subject site has been impacted by a variety of introduced weeds, the majority of which are pasture, urban fringe or disturbed area weeds. Some significant incursions or patches of weeds were observed within the site, notably *Chrysanthemoides monilifera* subsp. *monilifera* (Bitou Bush), *Lantana camara* (Lantana) and *Sporobolus africanus* (Parramatta Grass).

Feral, Introduced and Domestic Fauna: Native fauna within the subject site is likely to have been impacted upon by the predation of European Red Fox *Vulpes vulpes,* Cats *Felis catus* and Dogs *Canis familiaris*. In addition to the affects of predation, impacts associated with grazing by horses / cattle including soil compaction, spread of weed species, and nutrient loading via livestock faeces have had an effect on natural habitats for indigenous flora.

Habitat Disturbance: The aforementioned impacts have resulted in a measurable impact upon the habitat values within the subject site. This has resulted in a slight to moderate deterioration of native shrub and groundcover quality throughout the site. A number of hollow-bearing trees provide a variety of hollows within the subject site, with the tree canopy providing habitat for a number of commonly occurring bird species.

(i) known Indigenous heritage values; and

There are no known indigenous heritage sites within the subject site.

(j) any other characteristics or important features of the receiving environment if the action is by a Commonwealth agency or may affect Commonwealth land.

The proposed development is not an action to be undertaken by any commonwealth agency. The proposed action is not expected to have any effect upon any Commonwealth Land.

> The description of important features should highlight any attributes of the environment if the action is being undertaken by a Commonwealth agency or will occur on, or potentially affect, Commonwealth land. Important features may include physical, natural, cultural, indigenous or other human attributes and values (see *Principal Significance Guidelines 1.2 for Actions on, or impacting upon, Commonwealth land, and actions by Commonwealth agencies* at http://www.deh.gov.au/epbc).

3.3 What is the *tenure* of the project area (for example is it freehold, leasehold or some other tenure)? If practicable, show on the attached map.

The land is freehold.

3.4 What are the current and/or proposed *land uses* for the project area?

Current
The subject site has a long-term history of agricultural pursuits (grazing). The site is presently grazed and maintained by regular slashing of some areas. Infrastructure for grazing such as water tanks and fences are currently present and maintained.

Proposed
It is proposed to develop parts of the subject site as a community title residential subdivision. This will incorporate a mixture of single residential dwellings, medium density units and an area for future development as a tourist / commercial precinct. The development is in 4 precincts and will comprise of a total; of 260 residential allotments. Areas of open space / environmental protection will be retained between allotments and Hearns Lake. This area will incorporate a perimeter emergency access way which will also function as a combined pedestrian / cycleway. Asset protection zones for bushfire protection purposes will be created around the allotments where appropriate in accordance with standard bushfire protection measures detailed within *'Planning for Bushfire Protection 2001.'*

As part of the proposed subdivision a comprehensive water quality management system incorporating stormwater retention ponds, roadside bio-swales and nutrient filter strips will be implemented. These measures will ensure treatment of water quality prior to stormwater runoff entering the nearby watercourses and coastal lagoons.

4. Nature and extent of the likely impacts of the action

4.1 Describe, as relevant to your project, the nature and extent of *likely impacts* on the following matters of national environmental significance protected by the EPBC Act:

(a) the world heritage values of a declared World Heritage property; or

An EPBC Act Protected Matters Report was generated using a point search with a 10km buffer. No World Heritage Properties were listed as being located within this area, therefore there are no likely impacts from the proposed development.

(b) the heritage values of a listed National Heritage place; or

An EPBC Act Protected Matters Report was generated using a point search with a 10km buffer. No National Heritage Places were located within this 10km search area, therefore there are no likely impacts from the proposed development.

(c) the ecological character of a declared Ramsar wetland; or

No Ramsar Wetlands are known within 10km of the subject site. However, Little Llangothlin Nature Reserve is situated some distance (in excess of 150km) to the west of the subject site. Little Llangothlin Nature Reserve is within the same catchment as the proposed development. It is expected that the proposed development will have little or no effect on the ecological character of Little Llangothlin Nature Reserve as the subject site is situated a large distance downstream of Little Llangothlin Nature Reserve.

(d) the members of a listed threatened species (except a conservation-dependent species) or any threatened ecological community, or their habitat, or

1) A Flora and Fauna Assessment Report was undertaken for the proposed development (*Conacher Travers Pty Ltd*, April 2005, Ref:5091F).

   No threatened flora species listed in the TSC Act (1995) or the EPBC Act (1999) were observed within the subject site during surveys.

   No threatened fauna species listed in the the EPBC Act (1999) were observed within the subject site during surveys.

   Five (5) threatened fauna species listed in the TSC Act (1995) were detected during surveys; these were Wallum Froglet, Osprey, Black-necked Stork, Glossy Black-Cockatoo, Eastern Freetail Bat and Greater Broad-nosed Bat. Additionally Council has previously recorded Glossy Black-cockatoo within the site.

   One Endangered Ecological Community (Swamp Sclerophyll Forest on Coastal Floodplains) listed in the TSC Act (1995) was observed on site.

2) The subject site contains suitable or sub-optimal habitat for a number of Threatened Species listed in the EPBC Act (1999). The threatened species with Suitable or Sub-optimal habitat within the subject site are listed in Table 6. There is no suitable habitat for wholly marine species such as sharks, turtles, whales and some birds; as a result they have been omitted from Table 6.

TABLE 6
EPBC LISTED THREATENED SPECIES WITH SUITABLE OR SUB-OPTIMAL HABITAT ON-SITE

Species	EPBC Status	Comment
Birds		
Lathamus discolor * Swift Parrot	Endangered	Suitable habitat on-site. Not observed on-site.
Rostratula australis * Australian Painted Snipe	Vulnerable	Sub-optimal habitat on-site. Not observed on-site.
Xanthomyza phrygia * Regent Honeyeater	Endangered	Suitable habitat on-site. Not observed on-site.
Frogs		
Litoria aurea * Green and Golden Bell Frog	Vulnerable	Sub-optimal habitat on-site. Not observed on-site.
Litoria olongburensis * Wallum Sedge Frog	Vulnerable	Suitable foraging habitat on-site. Not observed on-site.
Insects		
*Phyllodes imperialis (southern subsp. - ANIC 3333)** a moth	Endangered	Suitable habitat on-site. Not observed on-site.

TABLE 6 (Cont.) EPBC LISTED THREATENED SPECIES WITH SUITABLE OR SUB-OPTIMAL HABITAT ON-SITE		
Species	**EPBC Status**	**Comment**
Mammals		
Chalinolobus dwyeri * Large-eared Pied Bat, Large Pied Bat	Vulnerable	Suitable habitat on-site. Not observed on-site.
*Dasyurus maculatus maculatus (SE mainland population)** Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population)	Endangered	Sub-optimal habitat on-site. Not observed on-site.
*Potorous tridactylus tridactylus** Long-nosed Potoroo (SE mainland)	Vulnerable	Sub-optimal habitat on-site. Not observed on-site.
Pteropus poliocephalus * Grey-headed Flying-fox	Vulnerable	Suitable habitat on-site. Not observed on-site.
Reptiles		
Emydura signata * Bellinger River Emydura (Bellinger River, NSW)	Vulnerable	Sub-optimal habitat on-site. Not observed on-site.
Plants		
Parsonsia dorrigoensis * Milky Silkpod	Endangered	Sub-optimal habitat on-site. Not observed on-site.
Phaius australis * Lesser Swamp-orchid	Endangered	Suitable habitat on-site. Not observed on-site.
Quassia sp. Mooney Creek (J.King s.n. 1949)	Endangered	Sub-optimal habitat on-site. Not observed on-site.
Thesium australe * Austral Toadflax, Toadflax	Vulnerable	Suitable habitat on-site. Not observed on-site.

Despite detailed targeted searches, none of the threatened species listed in Table 6 were observed within the subject site or in the immediate area. Due to the retention of the Swamp Sclerophyll Forest, the wetland areas, and a wide buffer between the wetland and the proposed development it is expected that there will be no likely impacts from the proposed development upon EPBC listed threatened species that may use the site or their habitats.

(e) the members of a listed migratory species or their habitat; or

The subject site contains suitable or sub-optimal habitat for a number of Migratory Species listed in the EPBC Act (1999). The migratory species with Suitable or Sub-optimal habitat within the subject site are listed in Table 7. There is no suitable habitat for wholly marine species such as sharks, turtles, whales and some birds, as a result they have been omitted from Table 7.

TABLE 7 EPBC LISTED MIGRATORY SPECIES WITH SUITABLE OR SUB-OPTIMAL HABITAT ON-SITE		
Haliaeetus leucogaster White-bellied Sea-Eagle	Migratory	Suitable habitat on-site. Not observed on-site.
Hirundapus caudacutus White-throated Needletail	Migratory	Suitable habitat on-site. Not observed on-site.
Monarcha melanopsis Black-faced Monarch	Migratory	Suitable breeding habitat on-site. Not observed on-site.
Monarcha trivirgatus Spectacled Monarch	Migratory	Suitable breeding habitat on-site. Not observed on-site.
Myiagra cyanoleuca Satin Flycatcher	Migratory	Suitable breeding habitat on-site. Not observed on-site.
Rhipidura rufifrons Rufous Fantail	Migratory	Suitable breeding habitat on-site. Not observed on-site.
Xanthomyza phrygia Regent Honeyeater	Migratory	Suitable habitat on-site. Not observed on-site.
Migratory Wetland Species		
Birds		
Gallinago hardwickii Latham's Snipe, Japanese Snipe	Migratory	Suitable habitat on-site. Not observed on-site.
Rostratula benghalensis s. lat. Painted Snipe	Migratory	Suitable habitat on-site. Not observed on-site.

Despite detailed targeted searches, none of the migratory species listed in Table 7 were observed within the subject site or in the immediate area. Due to the retention of the Swamp Sclerophyll Forest, the wetland areas, and a wide buffer between the wetland and the proposed development it is expected that there will be no likely impacts from the proposed development upon EPBC listed migratory species that may use the site or their habitats.

(f) the environment in part of the Commonwealth marine area.

No impact is likely as the site is not part of any Commonwealth Marine Area.

4.2 Describe, as relevant to your project, the nature and extent of likely impacts on the environment for the following category of proposed actions (in addition to the specific matters addressed above in 4.1):

(a) a nuclear action; or
The proposed development is not a nuclear action.

(b) an action by the Commonwealth or by a Commonwealth agency; or
The proposed development is not an action by the Commonwealth or by a Commonwealth agency.

(c) an action that will be taken on Commonwealth land or that may affect Commonwealth land; or
The action will not be undertaken on any Commonwealth land, nor will it affect any Commonwealth land.

(d) an action taken by the Commonwealth or by a Commonwealth agency that may affect a listed Commonwealth Heritage place or a place listed on the Register of the National Estate.
The proposed development is not an action taken by the Commonwealth or by a Commonwealth agency that may affect a listed Commonwealth Heritage place or a place listed on the Register of the National Estate.

5. Measures aimed at avoiding or reducing significant impacts on matters protected under the EPBC Act

5.1 Describe any specific measures proposed as part of the action to avoid or lessen significant impacts on matters protected under the EPBC Act. Include a timeframe or workplan for implementation of any relevant measures.

Examples of relevant measures may include the timing of works to avoid critical periods for listed species, avoidance of habitat important for listed species from direct and indirect impacts, application of specific design measures to avoid or reduce impacts, or adoption of specific work practices to reduce or avoid impacts (see Referral Guide, Fact Sheet and 'Particular Manner' Guideline at http://www.deh.gov.au/epbc).

The proposed development will incorporate the retention of vegetation and habitats as part of Open Space and drainage reserve areas. A vegetated buffer of variable width will be retained around the shore of Hearns Lake protecting the ecological values within the lake and foreshores. Vegetation and habitats will also be retained within Open Space areas in the north-east, central and south-east portions of the site.

As part of the proposed subdivision a comprehensive water quality management system incorporating stormwater retention ponds, roadside bio-swales and nutrient filter strips will be implemented. These measures will ensure treatment of water to maintain water quality prior to stormwater runoff entering the nearby watercourses and coastal lagoons.

The retention and protection of Hearns Lake and its shoreline areas along with the retention of other bushland and drainage areas within the site are likely to continue to provide habitats for locally occurring flora and fauna species. This will include the retention of suitable habitat areas within the site for those threatened fauna species observed within the site during surveys and also for migratory species.

The implementation of the Open Space, buffer, bioswale areas and the stormwater control structures will be undertaken in conjunction with the proposed works to maximise the protection of the existing habitat quality.

5.2 Describe any consultations undertaken with Indigenous stakeholders regarding the action, if relevant. Identify relevant stakeholders and the status of consultations at the time of referral.

It is unknown if the local indigenous stakeholders were consulted regarding the proposed action.

6. Information sources

6.1 List relevant references

Conacher Travers Pty Ltd (April 2005) *Flora and Fauna Assessment Report: Proposed Residential Development, Part Lot 2, DP 813954 Pacific Highway, Sandy Beach North* (Ref: 5091F).

Conacher Travers Pty Ltd (April 2005) *Bushfire Protection Assessment: Proposed Residential Development, Part Lot 2, DP 813954 Pacific Highway, Sandy Beach North* (Ref: 5091B).

Milford, H. B. (1996) *Soil Landscapes of the Coffs Harbour 1:100,000 scale Map Sheet*, Soil Conservation Service of NSW, Sydney.

You should also attach a copy of any relevant reports or documents that support the arguments and conclusions made in this referral. For example, any flora and fauna surveys or desktop investigations should be provided.

Relevant reports attached:

Conacher Travers Pty Ltd (April 2005) *Flora and Fauna Assessment Report: Proposed Residential Development, Part Lot 2, DP 813954 Pacific Highway, Sandy Beach North* (Ref: 5091F).

Conacher Travers Pty Ltd (April 2005) *Bushfire Protection Assessment: Proposed Residential Development, Part Lot 2, DP 813954 Pacific Highway, Sandy Beach North* (Ref: 5091B).

EPBC Act Protected Matters Report (5 June 2006) Point search at Lat. -30.14166°, Long. 153.1944° with 10km buffer. DEH Website.

6.2 For information given in sections 3 and 4 of this referral, please indicate:

(a) the source of the information; and

The information contained within this referral has been sourced from flora and fauna field surveys and observations undertaken within and adjacent to the study area (*Conacher Travers Pty Ltd*, Dec 2003, Mar 2004, Aug 2004, Oct 2004 and Mar 2005). Additionally 10km radius database searches were made using the Atlas of NSW Wildlife (DEC, Jan 2005) and via a point search with a 10km buffer on the EPBC Act Protected Matters tool on the Department of the Environment and Heritage Website (DEH June 2006).

(b) how recent the information is; and

The flora and fauna surveys were in Dec 2003, Mar 2004, Aug 2004, Oct 2004 and Mar 2005. The DEC Atlas of NSW Wildlife database was updated and accessed in Jan 2005. The Protected Matters tool on the Department of the Environment and Heritage Website was accessed in June 2006.

(c) how the reliability of the information was tested; and

The information was compiled using standard recognised flora and fauna survey and assessment methods in respect of matters required to be considered in the *Environmental Planning & Assessment Act (Section 5 Part A)* (1979) and relating to the species / provisions of the *Threatened Species Conservation Act* (1995) and the *Fisheries Management Act* (1994) with background data (Atlas of NSW Wildlife) supplied by the Department of Environment and Conservation (DEC) and further information supplied by the Department of Environment and Heritage (DEH) website.

The Bushfire Protection assessment was undertaken in accordance with the *Environmental Planning and Assessment Act* (Section 79BA), *Rural Fires Act* (1997) Sections 100B and 63(2), and the document '*Planning for Bushfire Protection'* (2001) published by Planning NSW (2001).

(d) any uncertainties in the information.

There are no known uncertainties in the information provided in this referral form.

7. Signatures and Declarations

Section 489 of the EPBC Act states that the provision of false or misleading information is an offence punishable on conviction by imprisonment and fine.

7.1. Signature of person making the referral

I, PHILLIP ANTHONY CONACHER *(full name)*, declare that the information contained in this form is, to my knowledge, true and not misleading.

Signature 

Date 24/07/06

7.2. Signature of person proposing to take the action

I, PETER STANLEY DARBY *(full name)*, declare that the information contained in this form is, to my knowledge, true and not misleading.

Signature 

Date 18/7/06

7.3. Declaration of person nominated as proponent in Section 1.3, if different from person proposing to take the action

I, ... *(full name)*, being (or agent acting on behalf of) the person nominated in Section 1.3 of this referral form as the nominated proponent agree to be designated as the proponent for the action described above if it is decided that the action requires approval under Part 9 of the EPBC Act.

Signature

Date

Signature of person proposing to take the action

Date

---

7. Signatures and Declarations

Section 489 of the EPBC Act states that the provision of false or misleading information is an offence punishable on conviction by imprisonment and fine.

7.1. Signature of person making the referral

I, ……(*full name*), declare that the information contained in this form is, to my knowledge, true and not misleading.

Signature

Date

7.2. Signature of person proposing to take the action

I, …… (*full name*), declare that the information contained in this form is, to my knowledge, true and not misleading.

Signature

Date

7.3. Declaration of person nominated as proponent in Section 1.3, if different from person proposing to take the action

I, ……*(full name*), being (or agent acting on behalf of) the person nominated in Section 1.3 of this referral form as the nominated proponent agree to be designated as the proponent for the action described above if it is decided that the action requires approval under Part 9 of the EPBC Act.

Signature

Date

Signature of person proposing to take the action

Date

Fill in Section 7.4 if you believe that the proposal is not likely to have a significant impact on matters protected by the EPBC Act and that the proposal is therefore not a controlled action. Fill in Section 7.5 if you believe that the proposal is likely to have a significant impact on a protected matter and that the proposal is therefore a controlled action. (Note: This Section must be completed in *all cases* except where the referral is made by a State or Territory or a Commonwealth agency in relation to an action to be taken by another person.)

7.4. ***If you think your proposed action is not likely to have a significant impact on any of the matters listed in the table below, then you should select and complete the following statement and you should not mark any of the boxes in the table below.***

I *PHILLIP CONACHER (full name*), being the person making this referral and the person proposing to take the action (or agent acting on behalf of the person) believe that the action described in this referral **is not a controlled action.**

Briefly provide reasons why you believe your proposed action is not a controlled action:
(Note: For an explanation of the term "controlled action", see the Referral Guide.)

No threatened species, migratory species or ecological community listed in the EPBC Act (1999) were observed within or immediately adjacent to the subject site. The subject site does contain potential or sub-optimal habitat for a number of species listed in the EPBC Act (1999).

The proposed development will develop a total of approximately 20.8 hectares (approximately 42% of the site) and will retain approximately 20.2 hectares of wetland and foreshore/lower slope areas (approximately 41% of the site) containing native vegetation and habitat. An additional Buffer area of approximately 8 hectares (approximately16% of the site) will be retained between the wetland/foreshore Environment Protection Area and the development as vegetated areas which will incorporate stormwater retention ponds, roadside bio-swales and nutrient filter strips, this area will also be managed as bushfire Asset Protection Zones (APZs). The APZs will supplement the 20.2ha of retained wetland and foreshore vegetation and increase the total of vegetated areas within the site to approximately 28.2 hectares (approximately 57% of the site).

Due to the retention of large areas of wetland and foreshore vegetation and habitat and the management of a wide buffer, the proposed action is not a controlled action upon any threatened species, migratory species, ecological community or Commonwealth Land as defined in the schedules of the EPBC Act (1999).

OR

7.5. ***If you think that your proposed action is likely to have a significant impact on any of the matters listed in the table below, then you should select and complete the following statement. You must then mark 'Yes' against those matters on which you think it will have a significant impact, in the table below.***

I …….*(full name*), being the person making this referral and the person proposing to take the action (or agent acting on behalf of the person) believe that the action described in this referral **is a controlled action because of the following provisions of the Act**:

Significant Impact Likely	Controlling Provision
	World Heritage property (Sections 12 and 15A - significant impacts on the values of a World Heritage property)
	National Heritage places (Sections 15B and 15C – significant impacts on the values of a National Heritage place)
	Ramsar Wetland (Sections 16 and 17B - significant impacts on the ecological character of a Ramsar wetland)
	Threatened species or ecological communities (Section 18 and Section 18A - significant impacts on a listed threatened species or a listed threatened ecological community)
	Migratory species (Sections 20 and 20A - significant impacts on a listed migratory species)
	Nuclear action (Sections 21 and 22A - nuclear actions)
	Commonwealth marine area (Sections 23, 24 and 24A - actions relating to the Commonwealth marine area and fishing in coastal waters managed by the Commonwealth)
	Commonwealth land (Sections 26 and 27A - actions relating to Commonwealth land)
	Commonwealth action (Section 28 - actions by the Commonwealth having a significant impact on the environment)

Briefly provide reasons why you believe your proposed action is a controlled action:
(Note: For an explanation of the term "controlled action", see the Referral Guide.)

If the person making this referral is, or is representing, a *small business* (a business having fewer than 20 employees), please provide an estimate of the time taken to complete this form.

Please Include

- The time spent reading the instructions, working on the questions and obtaining the information; and
- The time spent by all employees in collecting and providing this information.

RS = 15 hours minutes

END OF FORM

PC
4.9.06

Australian Government

Department of the Environment and Heritage

Mr Philip Conacher
Director
Conacher Travers Pty Ltd
PO Box 7128
KARIONG NSW 2250

Dear Mr Conacher

Sandy Shores Development Pty Ltd/Urban and commercial new development/Sandy Beach /NSW/Community Title Residential Subdivision, 22km North of Coffs Harbour (EPBC Reference: 2006/2970)

Thank you for the above referral, received on 1 August 2006, for decision whether or not approval is needed under Chapter 4 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The referral has now been considered under the EPBC Act and I have decided that the action is not a controlled action. Approval is therefore not needed under Part 9 of the Act before the action can proceed.

Please note that this decision only relates to the potential for significant impact on the specific matters of *national* environmental significance protected by the Australian Government under the EPBC Act. There may be a need for separate State or Local Government environmental assessment and approval to address potential impacts on State, regional or local environmental values.

A copy of the document recording my decision is attached for your information. I have written separately to Mr Peter Darby of Sandy Shores Development Pty Ltd to advise of my decision.

Yours sincerely

Ms Alex Rankin
Assistant Secretary
Environment Assessment Branch

31 August 2006

GPO Box 787 Canberra ACT 2601 Telephone (02) 6274 1111 Facsimile (02) 6274 1666
Internet: www.deh.gov.au

COMMONWEALTH OF AUSTRALIA

ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

DECISION THAT ACTION IS NOT A CONTROLLED ACTION

I, ALEX RANKIN, Assistant Secretary, Environment Assessment Branch, Department of the Environment and Heritage, a delegate of the Minister for the Environment and Heritage for the purposes of section 75 of the *Environment Protection and Biodiversity Conservation Act 1999*, decide that the proposed action, set out in the Schedule, is not a controlled action.

SCHEDULE

The proposed action to develop a community title residential subdivision, at Part Lot 2 DP 813954, Pacific Highway, Sandy Beach North, New South Wales, and as described in the referral received under the Act on 1 August 2006 (EPBC 2006/2970).

Dated this 31ST day of AUGUST 2006

.....

ASSISTANT SECRETARY
ENVIRONMENT ASSESSMENT BRANCH
DEPARTMENT OF THE ENVIRONMENT AND HERITAGE

APPENDIX V

KOALA HABITAT ASSESSMENT

CONACHER TRAVERS

environmental consultants

KOALA HABITAT ASSESSMENT

PROPOSED RESIDENTIAL DEVELOPMENT
PART LOT 2 DP 813954 PACIFIC HIGHWAY
SANDY BEACH NORTH

APRIL 2007
(REF: 6107)

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KOALA HABITAT ASSESSMENT

1.0 INTRODUCTION AND BACKGROUND

This Koala Habitat Assessment Report (the Assessment) has been prepared by *Conacher Travers Pty Ltd* in response to Key Issue 2.3 "*Address the relevant controls within Council's Koala Plan of Management*" of the Director General's Requirements for Environmental Assessment (the DGR's). The purpose of the Assessment is to identify the habitat characteristics of land proposed for residential subdivision of Lot 22 DP 1070182 Pacific Highway, Sandy Beach North.

The Assessment has been carried out in accordance with the Coffs Harbour Koala Plan of Management (CHKPOM).

Small areas of the subject site have been mapped as Secondary Koala Habitat within the CHKPOM. There are no other occurrences of any mapped Koala habitat type (Primary Koala Habitat, Tertiary Koala Habitat) within the site. Despite the occurrence of mapped Secondary Koala Habitat within the site, the Koala has not been recorded within the site during extensive survey by *Conacher Travers* in 2003, 2004 and 2005. A search of the NSW Wildlife Atlas (DEC 2007) revealed no Koala records within 2km of the subject site. Other local area surveys completed as part of the preliminary stages of the Coffs Harbour Koala Plan of Management (1999) did not locate any Koalas within the site or immediate area. This data suggests that the site is not likely to be significant habitat to the local Koala population.

The site is not mapped as being a significant habitat link for the Koala in the CHKPOM. The closest significant habitat link is approximately 10km south of the subject site.

Notwithstanding the above finding, as the site has been mapped as having Secondary Koala Habitat, it must be assessed in accordance with the CHKPOM.

The CHKPOM identifies considerations and criteria to be addressed for development applications within areas containing Secondary Koala Habitat. The CHKPOM states the following:

In assessing an application the consent authority shall take into consideration:

- that there will be minimal net loss of Secondary Koala Habitat
- the level of significance to Koalas of the trees proposed to be removed
- the number of trees proposed to be removed in relationship to the extent and quality of adjacent or nearby Primary and/or Secondary Koala Habitat
- the threats to Koalas which may result from the development
- all other options for protecting Koalas as listed above
- the impacts to existing or potential Koala movement corridors
- whether the land is accredited under the *Timber Plantation (Harvest Guarantee) Act* 1995

These criteria are addressed in Section of the Assessment.

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

- the proposal will not result in significant barriers to Koala movement
- boundary fencing does not prevent the free movement of Koalas

- lighting and Koala exclusion fencing is provided where appropriate on roadways adjacent to Koala habitat
- listed tree species (preferred Koala feed trees) are retained where possible
- new local roads are designed to reduce traffic speed up to 40km/h in potential Koala blackspots
- preferred Koala trees are used in landscaping where possible
- threats to Koalas by dogs have been minimised i.e. banning of dogs or confining of dogs to koala proof yards
- fire protection zones, including fuel reduced zones and radiation zones, are provided generally outside of Secondary Koala Habitat

2.0 LAND DESCRIPTION AND ZONING

The site has an area of 49 hectares. The land is zoned part Residential 2A (low density), part Residential 2E (residential Tourist), Part 7A Environmental Protection Habitat and Catchments and part 7B Environmental Protection/Scenic Buffer). Approximately 10.8 hectares of the subject site is zoned 7A and 7B and the remaining 38.2 hectares of the site is zoned 2A and 2E.

3.0 KOALA HABITAT WITHIN THE SITE

The Coffs Harbour Council Koala Plan of Management (1999) has mapped areas within the site as containing Secondary Koala Habitat. These areas generally correspond to the occurrence of some Open Forest variant vegetation communities on the site. An extract of the Coffs Harbour Koala Plan of Management Habitat mapping is attached that shows the extent of Secondary Koala Habitat within the site.

The subject site also contains a number of tree species identified within the Coffs Harbour LGA as preferred tree species. These are *Eucalyptus microcorys* (Tallowwood), *Eucalyptus grandis* (Flooded Gum), *Eucalyptus pilularis* (Blackbutt), *Eucalyptus robusta* (Swamp Mahogany), *Eucalyptus tereticornis* (Forest Red Gum) and *Melaleuca quinquinervia* (Broad-leaved Paperbark).

4.0 METHODOLOGY

Conacher Travers has undertaken extensive field survey of the subject site. Surveys were undertaken on **15, 16, 17 December 2003**, **16, 17, 18, 19 September 2004**, **10 March 2005 and 12, 13, 15 October 2005.**

The subject site was assessed for activity by Koalas using the following methods:

i. A search of the Atlas of NSW Wildlife (DEC 2007)

ii. The Spot Assessment Technique for determining the significance of habitat utilisation by Koalas (Phillips & Callaghan 1995) was conducted over fourteen (14) 20x20m quadrats with all trees within the quadrats inspected for signs of Koala use. Trees within each quadrat were identified and inspected for sightings, indicative scratches on the trunk and droppings around the base of each tree. The locations for the Koala Spot Assessment Techniques are shown as Figure 1.

iii. Koalas were also targeted during spotlight surveys.

iv. Spotlighting surveys during the Koala Breeding Period in 2004.

Koala scat and track searches were carried out at 14 locations as per the methodology discussed above. No koalas were observed during spotlight surveys. No evidence of use of the site by Koalas was observed during these targeted track and scat searches.

5.0 LOCAL AREA RECORDS FOR THE KOALA

Despite the subject site containing suitable habitat for the Koala, it was not observed during extensive surveys. Additionally, there was no evidence of Koala habitation in the area. A search of the Atlas of NSW Wildlife (DEC, 2007) database found 5 records of Koala habitation within a 5 km radius from the study area. The record closest to the study area was approximately 2.69 km to the south west in 1998. The most recent record within 5 km was in 2002, approximately 3.18 km to the south-west.

There are no records within the vicinity of the subject site on the eastern side of the Pacific Highway.

During preparation of the CHKPOM, targeted field surveys of the local area to detect the presence of the Koala were undertaken by Council to classify Koala habitat. Additionally, Council also made requests to local residents to report any previous sightings of Koalas within the local area. Despite these efforts, there were no recordings of Koala being sighted within the site or in the local area.

6.0 KOALA HABITAT SIGNIFICANCE

The opportunity for the site to function as Koala habitat is substantially decreased due to the isolation of the site from larger areas of habitat to the west. The isolation of the site is reinforced by (a) the Pacific Highway at the western boundary of the site which presents a barrier to movement of Koalas into the site from the west; and (b) partial isolation of similar vegetation and habitat to the south due to the residential development at the southern boundary of the site.

It is considered that, while the site may contain suitable Koala feed trees and may contain areas of Open Forest mapped as Secondary Koala Habitat within the CHKPOM (Lunney et al 1999), the presence of the Koala within the site is unlikely due to:

(a) the lack of records for the Koala within the site (NPWS 2007);
(b) the absence of indicative signs of presence of the koala during surveys carried out by *Conacher Travers*;
(c) the barrier of movement to and the biogeographical isolation of the site due to the presence of the Pacific Highway; and
(d) the fragmented state of the local vegetation and landscape.

It is considered that the above points are reinforced by the earlier statements of there being no recordings of any sightings of Koalas either on the site or in this particular part of the locality.

The site has approximately 1.05km of frontage to the Pacific Highway on the western boundary and is considered to be a major barrier to the movement of the local Koalacommunity. The Pacific Highway does **not** contain Koala proof fencing and the only safe Koala movement across the Pacific Highway is limited to one area that contains an underground crossing. Despite this, the area has **not** been identified as a major or minor

"blackspot" within the CHKPOM, suggesting a very low level of Koala activity within this area.

7.0 ASSEESSMENT CRITERIA OF THE KOALA PLAN OF MANAGEMENT

Each of the criteria required to be assessed by the consent authority as part of the CHKPOM is considered individually below:

- *that there will be minimal net loss of Secondary Koala Habitat;*

The subject site contains five small areas of Secondary Koala habitat. While an amount of Secondary Koala Habitat will be removed, it is considered that given the lack of recordings of the Koala within the site as well as extensive targeted surveys, coupled with a lack of recordings within the local area, the actual value or potential of the site as Koala habitat is considered to be low.

The landscaping and revegetation programs proposed for the site include the replanting of significant numbers of locally preferred Koala trees *Eucalyptus microcorys* (Tallowwood), *Eucalyptus grandis* (Flooded Gum), *Eucalyptus pilularis* (Blackbutt), *Eucalyptus robusta* (Swamp Mahogany), *Eucalyptus tereticornis* (Forest Red Gum) and *Melaleuca quinquinervia* (Broad-leaved Paperbark).

- *the level of significance to Koalas of the trees proposed to be removed;*

It is considered that, due to a lack of recordings of sightings of the Koala within the site (despite extensive targeted surveys) and a lack of recordings of sightings within the vicinity of the site, any trees to be removed from the site are not of any significance for the purposes of either feeding or habitat for the Koala within the Coffs Harbour Shire Local Government Area.

- *the number of trees proposed to be removed in relationship to the extent and quality of adjacent or nearby Primary and/or Secondary Koala Habitat;*

As can be seen on the Mapping, there is no Primary or Tertiary Koala Habitat within the site or within the locality of the site.

There are areas of Secondary Koala Habitat to the south of Sandy Beach, to the north of Hearns Lake, as well as other occurrences of Secondary Koala Habitat and Tertiary Koala Habitat across the Pacific Highway to the west. This totals approximately 47 hectares of Secondary Koala Habitat within the Sandy Beach locality.

There is approximately seven hectares of Secondary Koala Habitat within the subject site. Of this total approximately between 3 and 5 hectares will be removed by the proposed development.

- *the threats to Koalas which may result from the development;*

It is considered that, due to there being no sightings or recordings of sightings of the Koala within the site (despite the extensive targeted surveys) coupled with the lack of recordings of sightings within the vicinity of the site, the proposed development will not be a direct or indirect threat to any known Koala population.

It is considered that, for the reasons set out above there is strong support for a conclusion that the site is not likely to form part of an actual movement or habitat linkage area within the

CHKPOM. Therefore, the removal of vegetation and residential construction is not considered likely to result in an interruption on any current Koala habitat linkage area.

Further given the lack of recordings of sightings either within the site or in the locality, factors such as the likely increase in local traffic and the possible presence of domestic dogs associated with the proposed development, are low level potential threats to the Koala population within the local area.

- *all other options for protecting Koalas as listed above;*

Due to a lack of observation of sightings of the Koala within the site notwithstanding the extensive targeted surveys and lack of recordings of sightings either within the site or within the vicinity of the site, it is considered that the proposed development does not propose a threat, direct or indirect, to any known Koala population that may be within the site or within the vicinity of the site.

- *the impacts to existing or potential Koala movement corridors*

The site is **not** part of a recognised movement or habitat linkage area within the CHKPOM. It is considered that the proposed development is not likely to have any impact on existing or potential Koala movement corridors.

- *whether the land is accredited under the Timber Plantation (Harvest Guarantee) Act 1995*

The land is not accredited under the *Timber Plantation (Harvest Guarantee) Act* 1995

8.0 CONCLUSION

The subject site is mapped as Secondary Koala Habitat within the CHCKPOM. Despite this, the Koala has not been recorded within the subject site during extensive surveys in 2003, 2004 and 2005. A lack of records during these and earlier surveys, combined with a lack of records from relevant local sources (DEC 2007) suggests that this area is not of significance to the local Koala population and the Koala is unlikely to occur within the site.

The subject site is not mapped as being a significant habitat link for the Koala in the CHKPOM. The closest significant habitat link is approximately 10km south of the subject site.

It is Recommended that, due to the occurrence of mapped Secondary Koala Habitat within the site, the following could be considered as options in any design and environmental management initiatives for the site:

- Retention of preferred Koala feed trees
- Planting of preferred Koala feed tress as part of landscaping and vegetation management strategies
- Education programs instigated for local residents
- Measures to mitigate potential road impacts (signage, speed limiting)

REFERENCES

Conacher Travers (2207) Flora and Fauna Assessment Report Proposed Residential Development Part Lot 2 DP 813954 Pacific Highway Sandy Beach North

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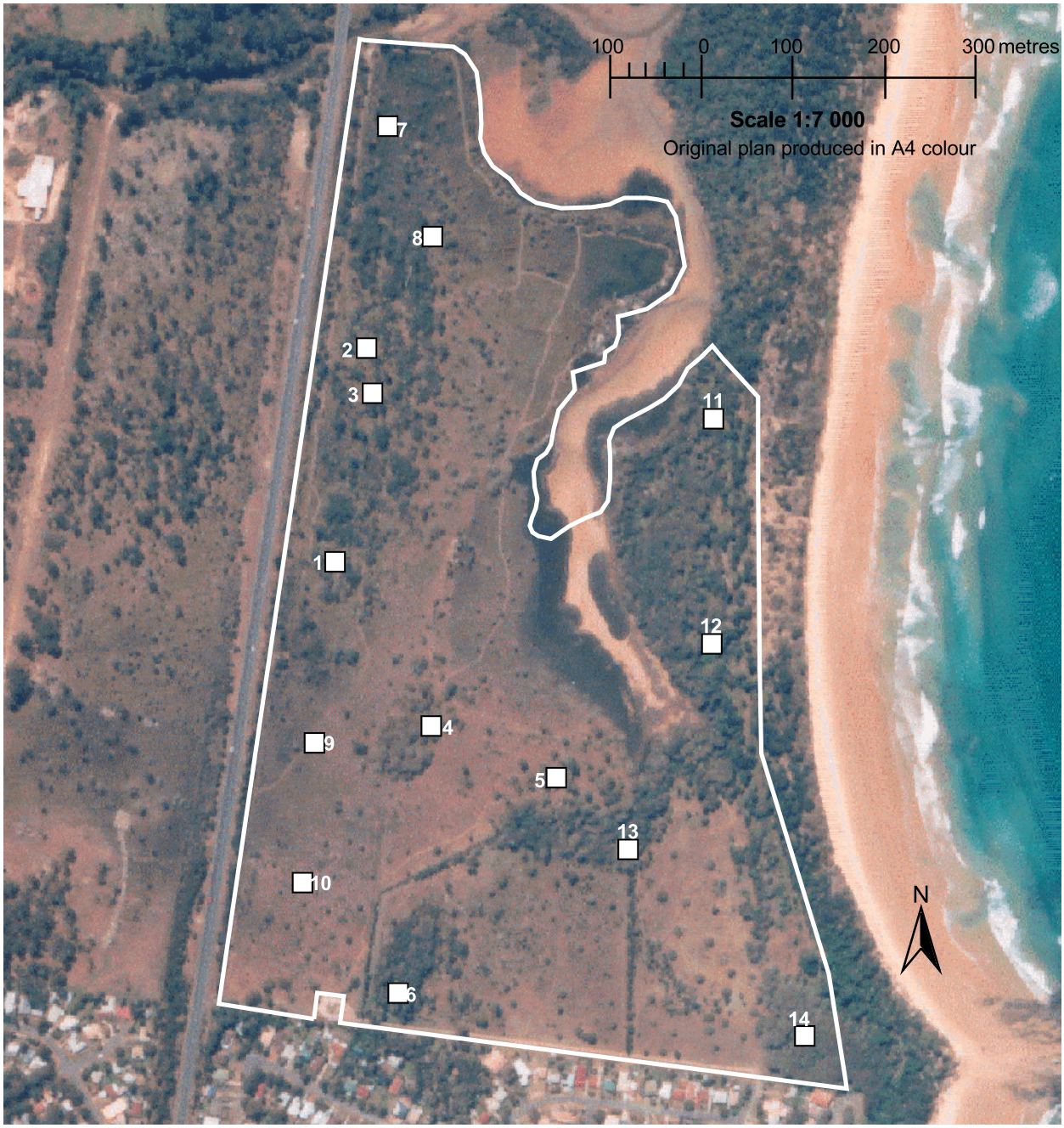
Phillips, S. and Callaghan, J. (1995) The Spot assessment for Determining the Significance of Habitat Utilisation by Koalas. Pp 66-70 in *Proceedings of a Conference on the Status of the Koala in 1995.* Australian Koala Foundation, Brisbane.



Fauna survey locations are approximate and have not been fixed by land survey. **Subject Site boundary subject to final survey*

Legend

*Subject Site Boundary

1 Koala Scat Assessment Quadrat 1 - 14

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Figure 1 -
Koala Scat Assessment Locations
Pacific Highway, Sandy Beach

Ver.F3.1-BB
24/04/07
Ref.No.6107

Source: DLWC 1:25,000 Aerial Photograph,

APPENDIX VI

HISTORIC LAND USE ASSESSMENT

HISTORIC LAND USE
ECOLOGICAL ASSESSMENT

PART LOT 2 DP 813954 PACIFIC HIGHWAY
SANDY BEACH NORTH

MAY 2007
(REF: 6107)

Conacher Travers Pty Ltd - ABN 49 083 610 173

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HISTORIC LAND USE ECOLOGICAL ASSESSMENT REPORT

PART LOT 2 DP 813954 PACIFIC HIGHWAY
SANDY BEACH NORTH

MAY 2007

Conacher Travers

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PREFACE

Conacher Travers Pty. Ltd. has been engaged by *Sandy Shores Development* at the request of *Planning Workshops Australia* to prepare an ecological assessment of the likely pre and post European settlement landscape of land at Part Lot 2 DP 813954 Pacific Highway Sandy Beach. The assessment has been completed to provide a discussion of the current condition of the vegetation and habitats within the site in comparison to that likely to have occurred prior to and after settlement and European land use within the site.

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1. INTRODUCTION

Conacher Travers Pty. Ltd. has been engaged by *Sandy Shores Development* at the request of *Planning Workshop Australia* to prepare an ecological assessment of the likely pre and post European settlement landscape of land at Part Lot 2 DP 813954 Pacific Highway Sandy Beach. The assessment has been completed to provide a discussion of the current condition of the vegetation and habitats within the site in comparison to that likely to have occurred prior to and after settlement and European land use within the site.

In particular *Conacher Travers* were engaged to address the following;

- ***An indication of the likely floristic mosaic and fauna/habitat immediately prior to European occupation of the site and the locality;***

- ***the nature and degree of the impact of the European occupation on the floristic mosaic and fauna/habitat on the site and the locality;***

- ***given the foregoing, what is the comparative nature and quality of the floristic mosaic now with that which was likely to have been there at the pre European occupation.***

2. METHODS

To address the above particulars *Conacher Travers* utilised the results and assessment of the sites current ecological condition completed within the Flora and Fauna Assessment Report (*Conacher Travers* 2006). This assessment utilised extensive flora and fauna field surveys completed throughout the subject site to identify and assess the existing vegetation and fauna habitats within the subject site. The methods of the surveys are provided in detail within the Flora and Fauna Assessment Report (*Conacher Travers* 2006).

The likely pre-European vegetation and habitat reconstruction utilized the following methodology:

2.1 Literature Review

A review of available literature for the area and previous studies within the subject site was undertaken to obtain reference material and background information for this study. This included a review of the;

- Geological and soils mapping of the subject site
- Existing natural vegetation within the local area
- Local historical information (Tuck 2007)
- Review of Atlas of NSW Wildlife (DEC 2007) for historical records of flora and fauna within the area

2.2 Aerial Photo Interpretation

Aerial photographs were utilised to identify the extent of vegetation with respect to the site and surrounding areas. Vegetation community boundaries were initially identified using aerial-photo interpretation of vegetation within the subject site. Analysis of the aerial photos identified past land use practices, disturbances and native vegetation regrowth, changes in vegetation structure and floristics throughout the subject site.

This analysis provided an initial split of the vegetation communities within the subject site into simple structural and disturbance classifications.

2.3 Remnant Canopy Trees

Mapping and reconstructions based on the location, species type and age estimates of remnant mature trees within the subject site was completed. This process assisted in the identification of species specific communities, particularly where large mature remnants were likely to have been present prior to the beginning of the substantial European occupation of the site in the 1940s.

3. DISCUSSION

3.1 An indication of the likely floristic mosaic and fauna/habitat immediately prior to European occupation of the site and the locality

Flora

The natural vegetation of the subject site prior to European occupation is likely to have been typically representative of the coastal lowlands of the NSW mid-north coast. These areas consisted of mosaics of estuarine and freshwater sedgelands/wetlands, coastal wet heaths, and Swamp Forests on the poorly drained low lying areas, while the well drained beach ridges and sandplains are typically associated with the Dry Coastal Heaths and Woodlands/Forests dominated by Angophoras, Mahoganys, Blackbutts, Pink Bloodwoods and Lophostemons. Areas of low undulating topography with an underlying geology not comprised of alluvial/estuarine sediments and coastal marine sands are dominated by diverse arrays of Open Forest communities including Ironbark, Tallowwood and Blackbutt.

It is considered that the subject site is likely to have contained five (5) broad vegetation community associations prior to European settlement. These are:

1. Coastal Eucalypt Forests
2. Swamp Sclerophyll Forests
3. Wet/Wallum Heaths
4. Dry Coastal Heaths
5. Sedgelands

The likely distribution of these communities across the subject site is provided in Figure 1. While a brief description of the likely species is provided below.

COASTAL EUCALYPT FORESTS

(Main Species Present)

Canopy: *Melaleuca quinquenervia* (Broad-leaved Paperbark), *Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus resinifera* subsp. *hemilampra* (Red Mahogany), *Angophora costata* (Smooth-barked Apple), *Lophostemon spp.*, *Corymbia intermedia* (Pink Bloodwood) and *Eucalyptus robusta* (Swamp Mahogany).

Shrubs: *Pultenaea linophylla, Pimelea linifolia* subsp. *linifolia* (Rice Flower), *Banksia spinulosa* (Hairpin Banksia), *Banksia oblongifolia*, *Callistemon pachyphyllus* (Wallum Bottlebrush), *Hakea dactyloides* (Broad-leaved Hakea) and *Acacia longifolia* var. *longifolia* (Golden Wattle).

Groundlayer: *Themeda australis* (Kangaroo Grass), *Polymeria calycina*, *Ptilothrix deusta*, *Hibbertia aspera* (Rough Guinea Flower), *Imperata cylindrica var. major* (Blady Grass), *Hibbertia vestita*, *Baumea rubiginosa* (Twig Rush), *Polymeria calycina* and *Dichondra repens* (Kidney Weed).

Location and Distribution:

This community would have occupied the western portion of the site on slightly higher elevations.

SWAMP SCLEROPHYLL FORESTS

Floristics:

(Characteristic Species)

Trees: *Melaleuca quinquenervia* (Broad-leaved Paperbark), *Eucalyptus robusta* (Swamp Mahogany) and *Casuarina glauca* (Swamp She-Oak),

Shrubs: *Glochidion ferdinandi* (Cheese Tree)*, Polyscias sambucifolia* (Elderberry Panax), *Acronychian imperforata* (Beach Acronychia), *Myoporum acuminatum* (Mangrove Boobialla) and *Acacia longifolia* var. *longifolia* (Golden Wattle).

Groundlayer: *Imperata cylindrica* var. *major* (Blady Grass), *Pteridium esculentum* (Bracken), *Entolasia marginata* (Bordered Panic), *Gahnia sieberiana* (Red-fruited Saw Sedge), *Blechnum indicum* (Swamp Fern) and *Gonocarpus tetragynus* (Poverty Raspwort).

Location and Distribution:

This community would have occupied the site's low poorly drained areas not associated with Wallum/Wet Heaths, particularly within the southern portion of the site and surrounding Hearns Lake. There was also potentially a littoral rainforest variation of this community located within the lee of the dune ridge within the south-eastern corner of the subject site.

DRY COASTAL HEATHS

Floristics:
(Main Species Present)

Trees: *Corymbia intermedia* (Pink Bloodwood) and *Eucalyptus tereticornis* (Forest Red Gum).

Shrubs: *Banksia integrifolia* subsp. *integrifolia* (Coast Banksia), *Acacia longifolia* var. *longifolia* (Golden Wattle), *Dodonea triquetra* (Hop Bush), *Alectryon coriaceus* (Beach Alectryon), *Acacia suaveolens* (Sweet Scented Wattle) and *Syzygium australis* (Brush Cherry).

Groundlayer: *Imperata cylindrica* var. *major* (Blady Grass) and *Pteridium esculentum* (Bracken).

Location and Distribution:
This vegetation community would have occurred in the eastern portion of the site and located on the leeward side of the current fore-dune complex.

WET/WALLUM HEATH

Floristics:
(Main Species Present)

Canopy: *Melaleuca quinquenervia* (Broad-leaved Paperbark).

Shrubs: *Melaleuca sieberi*, *Melaleuca nodosa* (Ball Honey Myrtle), *Banksia oblongifolia*, *Callistemon pachyphyllus* (Wallum Bottlebrush), *Leptospermum polygalifolium* subsp. *cismontanum* (Lemon Scented Tea Tree) and *Hakea dactyloides* (Broad-leaved Hakea).

Groundlayer: *Ptilothrix deusta*, *Themeda australis* (Kangaroo Grass), *Baumea rubiginosa* (Twig Rush), *Melaleuca thymifolia* (Thyme Honey Myrtle), *Polymeria calycina*, *Hibbertia vestita*, *Goodenia paniculata* (Swamp Goodenia), *Pimelea linifolia* subsp. *linifolia* (Rice Flower), *Stackhousia viminea* (Slender Stackhousia) and *Dampiera stricta* (Blue Damperia).

Location and Distribution:
This community occupied the western side of Hearns Lake and is associated with low-lying moist soils with.

SEDGELAND

Floristics:
(Characteristic Species)

Shrubs: *Casuarina glauca* (Swamp She-Oak)

Groundlayer: *Baumea juncea* (Bore Twig Rush), *Baumea rubiginosa* (Twig Rush), *Sporobolus virginicus* (Sand Couch), and *Samolus repens* (Creeping Brookweed).

Location and Distribution:
This community was located on low-lying, permanently water logged estuarine soils fringing Hearns Lake.

Fauna and Habitats

The habitats and fauna within the site pre-settlement would be typical of that found within the low lying vegetation types of the coastal zone. Given the likely diversity of vegetation community type (Eucalypt Forest, Swamp Sclerophyll Forest, Wet Wallum Heath, Dry Coastal Heath, Sedgeland) the habitats present would provide suitable foraging, refuge and breeding resources for a relatively diverse range of local fauna. Given the known threatening processes caused as a result of anthropogenic impacts (habitat clearing, exotic species, altered fire regimes etc) it is considered that abundance and diversity of those species occurring within the site immediately prior to European settlement is likely to have been relatively high.

The Atlas of NSW Wildlife (DEC 2007) was used to gather information on historical records of fauna within the Coffs Harbour area. However, the earliest records occur from 1911(two records) with only isolated fauna recordings up to the 1960's. Thus an accurate identification or estimate of the fauna species known to occur within the site immediately prior to European settlement is difficult to make.

Given the lower amount and degree of disturbance within the coastal reserves of the local area, the fauna record pre-european settlement within the site would have been similar to that currently present within reserves such as Yuraygir National Park, Coffs Coast Regional Park, Moonee Beach Nature Reserve and Bongil Bongil National Park,

3.2 The nature and degree of the impact of the European occupation on the floristic mosaic and fauna/habitat on the site and the locality

Pre 1949

The initial impacts between 1900s and 1949 are described as minor coastal grazing (Tuck 2007). This is likely to have resulted in only very minor reductions in the natural floristic diversity; however, this grazing will have led to the introduction of a number of the exotic groundcovers transported by stock and potentially the introduction of exotic pasture species depending on the degree of pasture improvement implemented. It appears from aerial photographs that the subject site was not initially subjected to significant logging or clearing.

1949-1960s

Historic records of significant ring barking across the property by the 1960s (Tuck 2007), supported by the changes observed in the aerial photos dated 1949 and 1956, which clearly shows areas of past clearing within the site and significant reduction in the canopy layer. This period is also likely to have been associated with an intensification of grazing and possible pasture improvement resulting in a significant decline in the natural

floristic diversity of portions of the Swamp Forests and Eucalypt forests classified as disturbed woodlands in the sites present vegetation mapping (*Conacher Travers* 2006). These areas are likely to have had a reduction in the natural groundcover layers, particularly the small perennial herbs and terrestrial orchid species which are affected by the soils compaction from hard hoofed stock and competition from the incursions from exotic species.

The introduction of large scale clearing of the tree and shrub layer is likely to have had significant impact in the form of a reduction in the type, amount and quality of habitat. The removal of trees and shrubs will have decreased the amount of foraging habitat for bird and arboreal mammal species. The loss of mature and senescing trees will have decreased the amount of nest, den and breeding sites for hollow dependent fauna. The decrease in the tree and shrub layers would also have increased the vulnerability of fauna to predation. The introduction of grazing cattle, and most probably rabbits, is also likely to have had competitive effects upon native grazing species.

Due to these alterations and decreases in habitat type and quality the diversity of those native species within the site is likely to have shifted to a predominance of those species with adaptive qualities and a decrease in those native fauna species susceptible to the effects of habitat loss, predation and increased competition.

1960s to Present

By the end of the 1960s to early 1970s the agricultural activities of clearing and grazing appeared to have intensified, resulting by 1974 in the extent of the sites remnant vegetation largely being representative of the present day vegetation. The intensification of the sites agricultural activities would have resulted in the sites Forest and Swamp Forest communities being further degraded due to the reduction in structural complexity, particularly through the removal of the shrub layers via slashing and the floristic simplification of the understorey due to increased grazing. While the impacts of the sites clearing and agricultural use had largely peaked by the mid 1970s (Tuck 2007), a number of additional activities have further reduced the condition of parts of the sites existing remnant vegetation, habitats and fauna.

The first of these was the commencement and associated impacts of the sand mining operation along the site eastern boundary before 1970. This operation is likely to have had significant impacts on the sites remnant coastal dune vegetation described as Low Forest in the vegetation mapping (*Conacher Travers* 2005). This community would have been subjected to severe disturbances including clearing, construction of an access road, edge effects, compaction, erosion and the likely incursion of the significant coastal weeds *Chrysanthemoides monilifera* subsp. *monilifera* (Bitou Bush) and *Lantana camara* (Lantana) during the post mining landscape. The removal of native vegetation and incursion and dominance of exotic species is likely to have decreased the diversity of native fauna species.

The second was construction of the Pacific Highway and associated infrastructure by the 1980s along the sites western boundary. This construction would have further reduced the extent of the remnant Forest community and increased the edge effects and weed distribution throughout the western portion of the site. The construction of the Pacific Highway will also have reduced the fauna habitat quality and function of the site by increasing partial local fragmentation of the landscape and isolation limiting terrestrial,

and possibly arboreal, fauna movement in an east west direction between the subject site and lands to the west of the site.

The third was the construction of the Sandy Beach Development to the south of the subject site, which is likely to have led to an increase in the spread of exotic species and edge effects along the southern boundary of the site. More importantly however were the impacts of the canals cut through the southern portion of the subject site as part of the Sandy Beach development drainage strategy. The subsequent regrowth Swamp Oaks restricted to the backs of these canals, are a direct result of their construction, however these drainage lines are not considered to have significantly altered or influenced the type and condition of the vegetation within the larger area surrounding the canals. These areas were likely to have been occupied previously by similar swamp forest communities already associated with the poorly drained soils around the southern parts of Hearns Lake.

3.3 Comparative nature and quality of the floristic mosaic now with that which was likely to have been there at the pre European occupation.

The majority of the subject site has been significantly impacted by a history of agricultural activities and land use practices. These activities have led to significant changes in the floristic and structural characteristics of many of the sites vegetation communities, however, a number of the stands of remnant vegetation have also retained a relatively high degree of natural integrity.

In particular the Wallum/Wet Heaths and Sedgeland communities have largely retained their natural structural characteristics and exhibit relatively undisturbed floristic assemblages without significant incursion of exotic weed species. The extent and characteristics of these communities present within the subject site, with the exception of a small area of Wallum Heath within the southwest, are largely considered to be similar to those communities exiting prior to European arrival

It is considered that the Eucalypt Forest present within the subject sites western portion has undergone a slight reduction in its extent prior to European occupation on the site. However, the floristic and structural characteristics are considered to have been significantly altered. In particular, a noticeable thinning of the canopy trees has occurred within this community, either as a result of the agriculture grazing activities, or selective logging. Furthermore, it is also likely that this community has had its understorey shrub layer significantly thinned by a history of grazing and slashing. The moderate incursion of the exotic weed species *Chrysanthemoides monilifera* subsp. *monilifera* (Bitou Bush), *Baccharis hamimifolia* (Groundsel Bush) and *Paspalum dilatatum* (Paspalum) have also further degraded the floristic integrity of this vegetation community.

The Swamp Forest communities have undergone the most significant reduction in extent of all of the natural vegetation communities within the site. The majority of this community was subject to the most intensified agricultural use over the period of European occupation, which has resulted in wide spread clearing, compaction and pasture improvement throughout. Despite this wide spread alteration and clearing a small number of remnants still remain around the southern portions of Hearns Lake and the property. It is considered that while the remnant stands of this community within the subject site are likely to have been floristically and structurally simplified they still contain

a number of the characteristic species likely to have been present prior to European occupation.

The Dry Coastal Heath community observed within the subject site is essentially a regrowth community resulting from the massive clearing and disturbance associated with the previous sand mining operation and access road construction. As would be expected this community contains a number of significant exotic weeds or species that are commonly associated with coastal restoration activities within its floristic assemblage. However, it does contain a number of characteristic native species regenerating throughout.

4. CONCLUSIONS

The site has undergone an amount of disturbance since the commencement of European settlement in the district. This disturbance, particularly grazing and clearing, is has altered the condition of the vegetation within the site in comparison to those disturbed pre-settlement landscapes. This has, in turn, altered habitat type, extent and quality which has had flow on effects on the biodiversity of the native fauna within the site.

Based on a comparative analysis of the findings as set out above, it is considered that the condition of the vegetation, habitats and biodiversity values are lower when compared to that which was present within the site at the time of pre European settlement, occupation and land use within the locality.

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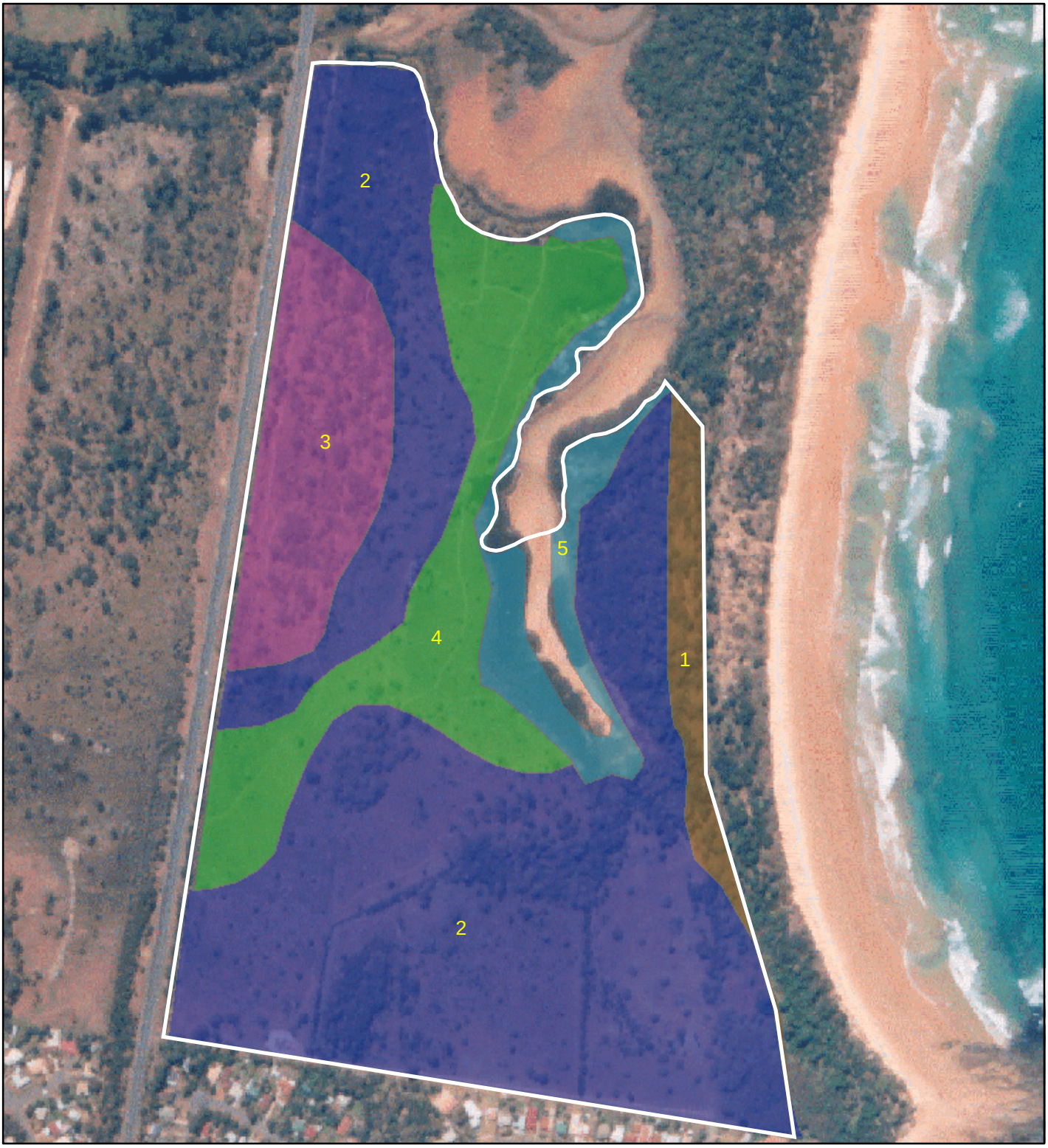
Tuck, D. (2007) European Cultural Heritage Assessment Sandy Beach North.

Conacher Travers (2006) Flora and Fauna Assessment Proposed Residential Development Part Lot 2 DP 813954 Pacific Highway Sandy Beach.

Department of Environment and Conservation (2007) Atlas of NSW Wildlife, Coffs Harbour 1: 100,000 Scale Map Sheet.



Flora and fauna survey locations are approximate and have not been fixed by land survey.

*Subject Site boundary subject to final survey

*Study Area boundary subject to final survey

0 100 200 300

Metres

1:6,000

Original plan produced in A4 colour

N

Legend

Property Boundary		3	Coastal Eucalypt Forests
1	Dry Coastal Heath	4	Wet/Wallum Heath
2	Swamp Sclerophyll	5	Sedgelands

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Figure 1 -
Estimated Pre-European Vegetation Communities
Pacific Hwy, Sandy Beach

Ver.F1
08/05/07
Ref.No.6107

Source: DLWC 1:25,000 Aerial Photograph,

APPENDIX VII

7-PART TESTS

As identified in Section 5(A) of the *EP&A Act* (1979) the following matters need to be addressed to determine whether or not a significant effect on threatened species, populations or ecological communities or their habitats is likely to result from the proposed development. The following 7-part test has been completed for those threatened species and endangered ecological communities observed within the subject during surveys.

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,

Wallum Froglet (*Crinia tinnula*)
The Wallum Froglet is generally found within the acidic paperbark swamps and wallum country. This species utilises different habitats for refuge and breeding. Refuge habitat consists of dense groundcover interspersed with tree canopy cover. The Wallum Froglet does not utilise open or free water swamps, preferring the vegetated, muddy edges of temporary and permanent pools. Breeding usually occurs in ephemeral sites such as larger puddles in heath and larger puddles along watercourses and creeklines (White 1995).

In NSW this species has a northern limit at Tweed Heads and a southern limit at Kurnell (NPWS 1999). This species has a patchy distribution throughout its range.

Within the North Coast Bioregion the Wallum Froglet has a relatively continuous coastal distribution north from Port Stephens to the QLD Border. This species is known to occur within Broadwater, Bundjalung, Myall Lakes and Yuraygir National Parks and Limeburners Creek Nature Reserve.

Within the Coffs Harbour area this species has been recorded at Corindi, Boambee Creek and Newports Creek (NPWS 2008). This species has also been recorded at Red Rock, Orara River and Coffs Harbour Botanic Gardens (Ehmann 1997).

The Wallum Froglet was opportunistically observed within the subject site during flora surveys after rain in March 2004 and March 2005. The calls heard opportunistically were restricted to the Wallum Heath vegetation community.

The Wallum Heath vegetation within the subject site provides suitable breeding, shelter and foraging habitat for the Wallum Froglet. Based on the opportunistic identification of this species while calling after heavy rain it is difficult to give an estimate of the number of individuals within the site. It is considered that the calling male individuals observed within the site are part of a local population that is periodically restricted to Wallum Heath areas however may disperse into other inundated vegetation communities within the subject site during periods of local flooding and inundation.

The development proposes the retention of areas of suitable habitat within the subject site for this species. Additionally the implementation of water quality control measures is proposed to ensure that the quality of runoff water is appropriately managed. These measures also include the provision of bio-retention swales that may provide areas of compensatory habitat. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species such that a viable local population of the species 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 and Higgins 1990). This species feed mainly on fish but will also eat reptiles, frogs, crabs, insects, rodents and carrion (Schodde & Tidemann 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). This species utilises a range of waterbodies including extensive areas of shallow water over grassland and sedgeland, shallow swamps with small emergent vegetation and abundant aquatic life, permanent billabong's and pools on floodplains, freshwater meadows, wet heathland, semi-permanent swamps with tall emergent vegetation and occasionally in small artificial waterbodies such as farm dams, irrigation storages and sewage ponds (Marchant & Higgins 1990).

The Black-necked stork is known in coastal areas from the Hunter River to the QLD border. The majority (>90%) of the NSW population of the species occurs in the Richmond and Clarence River valleys (DECC 2007). The Black-necked Stork is distributed around the north and east coasts of Australia, occurring as a rare vagrant in Victoria (Schodde & Tidemann 1986). In NSW this species has a northern limit at Tweed Heads and a southern limit at Nowra.

There are 34 recent records for the Black-necked Stork within the Coffs Harbour 100,000 map sheet area (NPWS 2008). These records extend from Corindi to south of Bonville. Eight of these records occur within a five kilometre radius of the subject site.

The Black-necked Stork was observed on two occasions within the subject site by *Conacher Travers* (2007) in September 2003 and August 2004. An individual bird was observed foraging south of the subject site in December 2003. A single bird was also observed foraging within Hearnes Lake in August 2004. It is likely that these records are of the same individual as adults are known to be sedentary showing fidelity to particular habitat areas.

The subject site contains suitable foraging and potential breeding habitat for the Black-necked Stork. It is likely that an individual of this species uses the aquatic habitats within the subject site for foraging and refuge as part of regular migratory movements. No evidence of breeding was observed within the subject site.

The development proposes the retention of areas of suitable habitat within the subject site for this species. This includes a buffer area around the shoreline of Hearnes Lake. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species such that a viable local population of the species is likely to be placed at risk of extinction.

Osprey *(Pandion haliaetus)*

The Osprey is generally found in association with waterbodies including coastal waters, inlets, lakes, estuaries, beaches, offshore islands and sometimes along inland rivers (Schodde & Tidemann 1986; Clancy 1991; Olsen 1995). These habitat locations usually have a sufficient supply of fish for food and possible nesting sites (Clancy 1991). Osprey may nest on the ground on sea cliffs or in trees (Olsen 1995). Osprey generally prefer emergent trees, often dead or partly dead with a broken off crown (Olsen 1995).

Within the North Coast Bioregion the Osprey has been recorded in Booti Booti, Broadwater, Bundjalung, Hat Head and Yuraygir National Parks and Broken Head, Iluka and Limeburners Creek Nature Reserves.

A search of the Atlas of NSW Wildlife (NPWS 2008) reveals 106 records for this species within the Coffs Harbour 1:100,000 map sheet. The distribution of this species within the map sheet area is strictly coastal and widespread from Arrawarra Headland in the north to Urunga in the south.

Within the local area this species has been observed at Sandy Beach, Moonee Beach, Woolgoolga, Woolgoolga Lake, Darkum Creek and Arrawarra (NPWS 2008).

An Osprey was observed during surveys conducted in December 2003 flying over the subject site carrying nesting material. A single Osprey, one of a known pair, was also observed on several occasions flying over the subject site during August and October 2004 surveys. No evidence of nesting by this species within the subject site was detected.

This single bird is most likely part of a pair of Osprey observed nesting within a dead tree approximately 125m west of the subject site across the Pacific Highway during surveys conducted in August 2004. The male bird has also selected a large dead tree, which is approximately 50m west of the subject site adjacent to the Pacific Highway as a roost tree where he has been observed preparing captured fish for presentation to the female bird on the nest. A nest tree was recently observed on the western side of the Pacific Highway at Emerald Beach (*Conacher Environmental Group pers. obs.* 2008) .

The habitat surrounding the nest site is similar in vegetation structure to large areas of the subject site. The local area contains large areas of suitable habitat for this species. The development proposes the retention of areas of suitable habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species such that a viable local population of the species 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 casuarinas. Foraging within Casuarinas tends to be concentrated on trees with greater crops of cones (Clout 1989). This species nests in large trees with large hollows (dead and alive). The Glossy Black-Cockatoo usually forages close to the nest but is capable of travelling up to 20km away thus requiring a water source (Environment Australia 2000). The Glossy Black-Cockatoo breeds only in Autumn –Winter (NPWS, 1999).

Chewed *Allocasuarina* cones, likely evidence of Glossy Black-Cockatoo foraging, were detected within the north western sector of the site during a site inspection on October 26 2005. This species has also been recorded throughout the coastal areas of NSW from Tweed Heads to south of Eden.

Within the North Coast Bioregion this species has been recorded within a relatively large number of conservation reserves including Barrington Tops, Border Rangees, Bundjalung, Crowdy Bay, Dorrigo, Guy Fawkes River, Hat Head, New England, Nymboida, Oxley Wild Rivers, Washpool, Werrikimbe, Woko and Yuraygir National Parks.

There are a relatively large number of records (47) for this species locally (NPWS 2008). The Glossy Black-Cockatoo has been recorded throughout the local area in areas where Allocasuarina species are present.

The NSW Bird Atlases (48) and Birds Australia (10) also record a relatively large number of records for this species locally. This species has been recorded on several occasions within the locality in the Sandy Beach, Emerald Beach, Arrawarra, Woolgoolga area.

The subject site contains suitable foraging habitat for this species within the *Allocasurina litttoralis* present. The Atlas of NSW Wildlife (NPWS 2008) has recorded an observation of this species within the subject site dating back to 1987. Evidence of foraging by this species was detected within the subject site during surveys. Council officers have identified that the Glossy Black-Cockatoo has been observed foraging on the subject site. The development proposes the retention and replanting of areas of suitable habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species such that a viable local population of the species 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 occurs as well as providing refuge (Strahan, 1995).

The Atlas of NSW Wildlife (NPWS 2008) has twenty two (22) records for this species within ten (10) kilometres of the subject site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

The subject site contains suitable foraging habitat for this species. No roost or campsites were observed during surveys. This species was not observed within the subject site during surveys. This species has been recorded previously within the subject site (NPWS 2008). No camps or roost sites are present within the subject site for this species.

The development proposes the retention of areas of suitable foraging habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species such that a viable local population of the species is likely to be placed at risk of extinction.

Eastern Freetail-bat *(Mormopterus norfolkensis)*

The Eastern Freetail-Bat forages above and within the canopy of open forests and woodlands, feeding on small insects (Allison & Hoye 1995). The Eastern Freetail-Bat is thought to roost predominantly in tree hollows and occasionally in buildings (Allison & Hoye 1995).

The Eastern Freetail-bat is distributed south from Fraser Island, Queensland through to Pambula (Allison & Hoye 1995, Parnaby 1992). In NSW the distribution of this species is poorly known with a northern limit to the north of Tenterfield and a southern limit at Pambula.

There are few local records for this species. The nearest record for this species is from Boambee, 20 km to the south of the subject site (NPWS 2008).

The subject site contains suitable foraging habitat and potential roosting habitat within tree hollows for this species. The Eastern Freetail-bat was observed foraging within the subject site during surveys in December 2003. It is likely that this species would use the tree canopy and vegetated edges within the subject site to forage periodically. This species is likely to forage throughout the local area within similar suitable vegetation types.

The development proposes the retention of areas of suitable foraging habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species such that a viable local population of the species is likely to be placed at risk of extinction.

Greater Broad-nosed bat (*Scoteanax rueppellii*)

Greater Broad-nosed Bats roost in hollow tree trunks and branches as well as the roofs of old buildings. They prefer moist gullies in mature coastal forest, or rainforest, east of the Great Dividing Range (Churchill, 1998). They have also been found to inhabit cool temperate to tropical moist hardwood forest and woodland and in gullies associated with these forest types (Richards, 1991; Strahan, 1992; Churchill, 1998). Has been commonly found at woodland clearing ecotones foraging over the understorey (Richards, 1991).

The Greater Broad-nosed Bat is restricted to the east coast region from the Queensland to the Victorian border (Parnaby, 1992). Within the North Coast Bioregion this species has been recorded at Border Ranges, Broadwater, Nymboides and Westpool National Park. Locally there is a single record for this species at Conglomerate State Forest, 10 kilometres west of the subject site (NPWS 2008).

The subject site contains suitable foraging habitat and potential roosting habitat within tree hollows for this species. The Greater Broad-nosed Bat was observed foraging within the subject site during surveys in October 2004. It is likely that this species would use the tree canopy and vegetated edges within the subject site to forage periodically. This species is likely to forage throughout the local area within similar suitable vegetation types.

The development proposes the retention of areas of suitable foraging habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species such that a viable local population of the species is likely to be placed at risk of extinction.

Oxleyan Pygmy Perch (*Nannoperca oxleyana*)

Oxleyan Pygmy Perch occur in creeks, swamps and lakes of coastal 'wallum' (Banksia-dominated coastal heath). These waters are often dark stained, low in salinity and are usually acidic. Populations are most common on the coastal floodplains of NSW where they disperse between water bodies during localised flood events. They seem to prefer slow-moving or still waters and shelter within dense aquatic vegetation or undercut, root-filled banks. The species is known only from south-eastern Queensland and north-eastern NSW from Woolgoolga north.

The development proposes the retention of areas of suitable habitat for this species within Hearnes Lake. The proposal includes the implementation of suitable water and ecological management strategies for the protection of aquatic habitats within Hearnes Lake. There are large areas of suitable and similar quality habitat within the conservation reserves of the

local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park and Yuraygir National Park. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species such that a viable local population of the species 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,

One flora species, *Zieria smithii* has been listed as an endangered population in the Coffs Harbour local area within the *TSC Act* (1995). The endangered population of *Zieria smithii* refers to a population of a few specimens located on Diggers Headland within dwarf heath vegetation north of Coffs Harbour. This population has been identified as morphologically distinct from other populations of *Zieria smithii.* No specimens of *Zieria smithii* were observed within the subject site. It is considered that the subject site does not contain any habitat currently associated with the Diggers Headland population of *Zieria smithii.* It is considered that the proposed development is not likely to have an adverse effect on the life cycle of a species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

The Emu (*Dromaius novaehollandiae*) is listed within he TSC Act (1995) as and endangered population within the NSW North Coast Bioregion. The Emu was not observed within the subject site during surveys. The subject site is of low habitat quality for this endangered population. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of a species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

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

The subject site does not contain any Critically Endangered Ecological Communities.

The subject site contains two endangered ecological communities. These are Coastal Saltmarsh and Swamp Sclerophyll Forest on Coastal Floodplains.

All areas of Coastal Saltmarsh will be retained and protected by the proposal. Areas of Swamp Sclerophyll Forest on Coastal Floodplains will require removal however the large majority will be retained as part of site specific conservation strategies within Open Space and riparian protection areas. While the removal of areas of these EEC's will have an adverse effect on its local extent it is considered that its local occurrence is not 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 subject site does not contain any Critically Endangered Ecological Communities.

The subject site contains the endangered ecological communities Coastal Saltmarsh and Swamp Sclerophyll Forest on Coastal Floodplains.

All areas of Coastal Saltmarsh will be retained and protected by the proposal. Areas of Swamp Sclerophyll Forest on Coastal Floodplains will require removal however the large majority will be retained as part of site specific conservation strategies within Open Space and riparian protection areas. It is considered that the proposed development is not likely 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

The proposal will require the removal of vegetation and habitats for the construction of dwellings, services and asset protection zones. Based on the concept plan the proposed development will require approximately 27 hectares of vegetation to be removed or modified. The concept plan proposes the retention, protection and management of approximately 21 hectares of higher quality vegetation including those areas of the endangered ecological communities Coastal Saltmarsh and areas of Swamp Sclerophyll Forest on Coastal Floodplains.

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

The subject site is bordered by the Pacific Highway to the west existing residential to the south, Double Crossing Creek to the north and Crown Reserve of Sandy Beach to the east.

The vegetation and habitats within the subject site are part of a disturbed and fragmented landscape. The bushland areas of the site are part of remnant areas of similar habitat type that extend west beyond the Pacific Highway. Due to the existence of unsuitable habitat areas to the south and east the removal of vegetation within the subject site is not likely to further fragment the landscape and isolate currently interconnected areas of vegetation. It is considered that the proposed action is not likely to further isolate or fragment ant currently connected areas of vegetation or habitat.

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

The subject site contains suitable habitat for a number of threatened flora and fauna species and known presence seven threatened fauna species and two endangered ecological communities. Given the presence of these threatened species and endangered ecological communities within the subject site it is considered that the native, intact vegetation to be removed is of some importance to threatened species and endangered ecological communities in the locality.

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

The subject site has not been classed as critical habitat within the provisions of the *Threatened Species Conservation Act* (1995). Therefore it is considered that the proposed development will not have an adverse effect on critical habitat (either directly or indirectly).

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

With respect to the threatened flora species and EECs assessed within this report there are no draft or final Recovery Plans.

With respect to the threatened fauna species, assessed in this report there currently exists Recovery Plans for the Bush Stone-curlew, Large Forest Owls (Powerful Owl, Masked Owl, Sooty Owl), Yellow-bellied Glider and Oxyleyan Pygmy Perch and Draft Recovery Plans for the Green and Golden Bell Frog, Barking Owl and Koala. None of these species were observed during surveys.

It is considered that the proposed action is not inconsistent with the broader objectives of these draft recovery plans.

However these plans emphasise the need for protection of suitable habitat for these species. Therefore, despite the retention of large areas of habitat within the subject site, in this regard the removal of areas vegetation and habitat as part of the proposed development conflicts with some of the objectives of these Recovery Plans.

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 "Clearing of native vegetation" has been gazetted by the NSW Scientific Committee as a Key Threatening Process. Removal of native vegetation will occur in association with future development and is therefore classified as a threatening process. The removal of native vegetation on the subject site is not likely to significantly affect the biodiversity of the local area due to the extent of better quality natural vegetation within the local area and the small area of vegetation to be removed.

A final determination exists within the *Threatened Species Conservation Act* (1995) for "Invasion of native plant communities by exotic perennial grasses" as a Key Threatening Process. The proposal is of a class of development recognised as a threatening process due to possible incursions of grasses such as *Pennisetum clandestinum* (Kikuyu) and *Paspalum dilatatum* (Paspalum).

A final determination exists within the *Threatened Species Conservation Act* (1995) for "Removal of Dead Wood and Dead Trees" as a Key Threatening Process and as such the proposal is of a class of development recognised as a threatening process.

The "Degradation of native riparian vegetation" is listed within the Fisheries Management Act (1994) as a Key Threatening Process. While the proposal will conserve large areas of vegetation creating a buffer to Hearnes lake, some areas of riparian vegetation mat require modification for asset protection zones. As such it is considered that the proposal represents a Key Threatening Process.

REFERENCES

A full reference list is provided within the main body of this report.

ECOLOGICAL SURVEY AND ASSESSMENT REPORT

PROPOSED RESIDENTIAL DEVELOPMENT

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PACIFIC HIGHWAY
SANDY BEACH NORTH

SEPTEMBER 2008
(REF: 8108)

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ECOLOGICAL SURVEY AND ASSESSMENT REPORT

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SUMMARY

This Ecological Survey and Assessment Report has been prepared by *Conacher Environmental Group* to identify the flora and fauna characteristics and management issues for land proposed for residential subdivision at Sandy Beach North. This assessment has been carried out as part of a Masterplan to be produced for the site in accordance with a Part 3A Application within the provisions of the *Environmental Planning and Assessment Act* (1979).

This report updates and amends information contained within the Ecological Survey and Assessment report prepared for the site by *Conacher Travers* in August 2007.

The site covers approximately 49 hectares of land situated west of the Pacific Highway between the township of Sandy Beach and Double Crossing Creek.

This Ecological Survey and Assessment Report has been completed as part of a Masterplan to be produced for the subject site in accordance with the provisions of State Environmental Planning Policy (SEPP) No. 71 - Coastal Protection. The requirements for the Masterplan relate to the location of Hearnes Lake, as listed within the relevant Schedules of SEPP No. 71, within the subject site.

Detailed field surveys have identified a number of threatened fauna species within the site. These are:

- Wallum Froglet (*Crinia tinnula*);
- Black-necked Stork (*Ephippiorhynchus asiaticus*);
- Osprey (*Pandion haliaetus*);
- Glossy Black-Cockatoo (*Calyptorhynchus lathami*);
- Grey-headed Flying-fox (*Pteropus poliocephalus).*
- Eastern Freetail-bat (*Mormopterus norfolkensis*);
- Greater Broad-nosed Bat (*Scoteanax rueppellii*);

No threatened flora species were identified on the site. Two endangered ecological communities were identified within the site. These are:

- Coastal Saltmarsh;
- Swamp Sclerophyll Forest on Coastal Floodplains;

The proposal incorporates residential land and areas to be retained for conservation. The areas of vegetation proposed to be retained contain endangered ecological communities and areas of habitat for the threatened fauna species observed.

The proposal will result in the removal or modification of approximately 27.8 hectares of vegetation and habitats and retention, protection and restoration of approximately 20.7 hectares of vegetation. The conservation of vegetation and habitats within the site will occur through the preparation and implementation of an Ecological Site Management Strategy, prepared specifically for the proposal.

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SECTION 1

INTRODUCTION

1.1 INTRODUCTION

Conacher Environmental Group have been engaged to prepare an Ecological Survey and Assessment Report for Lot 22 DP 1070182 Pacific Highway, Sandy Beach North.

This report has been prepared to identify the flora and fauna characteristics of the site and other matters identified in the Director General's Requirements for the Environmental Assessment of the proposed Concept Plan for Lot 22. This Report utilises information contained within previous draft Flora and Fauna Assessment Reports (*Conacher Travers* 2004, 2005) prepared for the site for constraints identification and discussion purposes. This report also amends and updates information contained within the Ecological Survey and Assessment Report prepared for the Masterplan application by *Conacher Travers* in August 2007.

This Ecological Survey and Assessment Report has been completed as part of a Masterplan to be produced for the subject site in accordance with the provisions of State Environmental Planning Policy (SEPP) No. 71 - Coastal Protection. The requirements for the Masterplan relate to the location of Hearnes Lake, as listed within the relevant Schedules of SEPP No. 71, within the subject site.

Detailed flora and fauna surveys were completed over the whole of the subject site by *Conacher Travers* between 2003 and 2007. This Ecological Survey and Assessment Report prepared by *Conacher Environmental Group* is the result of the compilation of all previous surveys and assessment information completed for the site and the recent amendment of the site Concept Plans.

1.2 SITE CHARACTERISTICS

The planning and cadastral details of the subject site are provided in Table 1.1 while Table 1.2 summarises the geographical characteristics of the site.

TABLE 1.1
SITE DETAILS

Location	Lot 22 DP 1070182 Pacific Highway, Sandy Beach North.
Area	Approximately 49 Hectares
Topographic Map	Moonee Beach
Grid Reference	518800E 6665500N
Local Government Area	Coffs Harbour City Council
Existing Land Use	Undeveloped land currently used for grazing
Proposed Development	Residential Subdivision

TABLE 1.2 SITE CHARACTERISTICS	
Topography	Low lying flat land and dune slopes
Slope	Mostly flat less than 5% gradient.
Elevation	<10m AHD
Soil Type	Plastic mottled clays and sand podzols of the Coffs Harbour and Newport Creek Soil Landscapes
Catchment	Hearnes Lake
Drainage	Overland flow into Hearnes Lake then into Tasman Sea
Vegetation	Open Forest Variants, Wet Heath, Low Wallum Heath and Sedgeland

1.3 PROPOSED DEVELOPMENT

It is proposed to develop part of the subject site as a community title residential subdivision. The masterplan proposes a mixture of the following:

- Single residential dwellings;
- Medium density units;
- Future tourist/commercial precinct;
- Open Space areas;
- Environmental protection areas;
- Environmental buffers;
- Pedestrian walkways/cycleways;
- Asset protection zones;
- Water management facilities.

The proposed development will consist of approximately 280 lots. Areas of open space / environmental protection will be retained between allotments and Hearnes Lake forming a buffer function between the lake and developable areas. This area will incorporate a perimeter emergency access way which will also function as a combined pedestrian / cycleway. Asset protection zones for bushfire protection purposes will be created around the allotments where appropriate in accordance with standard bushfire protection measures detailed within *'Planning for Bushfire Protection 2006.'*

As part of the proposed subdivision a comprehensive water quality management system incorporating stormwater detention ponds, roadside bio-swales and nutrient filter strips will be implemented. These measures will ensure treatment of water quality prior to stormwater runoff entering the nearby watercourses and coastal lagoons.

A key component of the design in maintaining the sites ecological values is the retention of areas within conservation zones. This includes the more ecologically sensitive lands and environments within Hearnes Lake and its nearshore areas. This also includes riparian areas associated with Hearnes Lake. These conservation areas will also act as a buffer in protecting these sensitive vegetation and habitat types within Hearnes Lake from the impacts of adjacent development. It is proposed that through vegetation and habitat management planning programs, including rehabilitation and restoration, that the ecological values of these conservation areas will be improved.

The conceptual site layout is shown in Figure 1.1

SECTION 2

FLORA CHARACTERISTICS

The following sections detail the flora survey methodologies completed by *Conacher Travers* within the subject site between 2003 and 2007. These following sections also detail the results of the completion of those surveys within the subject site. This information was collected as part of the earlier stages of the Masterplanning process.

2.1 VEGETATION SURVEY METHODOLOGY

To determine the likely and actual occurrence of flora species and plant communities on the subject site field survey work was undertaken by *Conacher Travers* to supplement literature reviews and previous flora surveys of the area. The methods utilised for the flora survey are outlined below.

Literature Review

- A review of available literature for the area was undertaken to obtain reference material and background information for this study. These documents are listed in the References section of this Report.

- A search of the Atlas of NSW Wildlife (NPWS 2008) was undertaken to identify records of threatened flora species located within 10km of the site. This enabled the preparation of a predictive list of threatened flora species that could possibly occur within the habitats found on the site.

- Additionally consultation with Coffs Harbour City Council's Environment Officer Mr Mark Graham was undertaken to further identify the local occurrence of known threatened flora species within the LGA.

- A detailed vegetation survey and vegetation community mapping of Coffs Harbour LGA was completed by (Fisher et. al. 1996). This vegetation mapping formed the basis of the Vegetation Management Strategy prepared by Ecograph Ecological and Geographical Information System Consultants in 2002 (Kingston & Boulton 2002).

- The corresponding vegetation communities identified by Hager & Benson (1994) in their revie*w* of the Conservation Status of Vegetation Communities in New South Wales, Part 3 Assessment of the Conservation Status of Forest Plant Communities in North Eastern New South Wales has been provided.

Aerial Photograph Interpretation

- Aerial photographs at 1:25,000 scale were utilised to identify the extent of vegetation with respect to the site and surrounding areas.

Field Survey

- A field survey which consisted of foot traverses within vegetated areas was conducted according to Cropper (1993) to identify the occurrence of flora species and the extent and location of vegetation communities present across the subject site and to determine the positioning of more intensive survey transects. The initial flora survey was undertaken on the 15, 16 & 17 December 2003.

- A subsequent follow-up survey, sampling each vegetation community using standard 20 x 20m quadrats, was undertaken on the 16, 17 & 18 March 2004.

- Additional targeted threatened flora surveys were undertaken on the 16, 17 & 18 of August and 12 & 13 October 2004. These surveys involved foot traverses conducted according to Cropper (1993) within areas identified as potential habitat.

- A further detailed site inspection was undertaken on 10 March 2005 to verify the location of the vegetation communities and to determine the structural classification of the vegetation communities.

- Specimens of plants not readily identified in the field were collected for identification. Determination of species composition as well as structural descriptions of the vegetation on the site according to Specht *et. al.* (1995) was also carried out.

- An additional site inspection to check the condition of the site in comparison to previous surveys and mapping was undertaken on 26 July 2007.

Quadrat Survey

- A total of twenty three (23) 20 X 20 metre quadrats, sampling each vegetation community throughout the site, were surveyed for flora species.

- Each 20 x 20m plot survey recorded the presence of all vascular plant taxa and assigned an estimate cover abundance for each species based on a modified Braun-Blanquet 1-6 scale.

- Any hollow bearing trees located within the area covered by the transects or quadrats were assessed for their habitat value during this survey. Any additional hollow bearing trees located during the survey that were not within these transects were also assessed.

2.2 VEGETATION COMMUNITY DESCRIPTIONS

A total of ten (10) vegetation communities have been identified within the subject site. These are:

A Low Forest (*Banksia* dominated);
B Forest (*Eucalypt* dominated);
C Swamp Sclerophyll Forest;
B/C Eucalypt / Swamp Sclerophyll Transition Forest;
D Sandplain Forest (*Melaleuca / Corymbia* dominated);
E Wet Heath;
F Wallum Heath;
G Sedgeland*;*
H Disturbed Woodland;
I Sandplain Forest (*Melaleuca* / Mesophyllic sp. dominated).

A flora species list is provided in Table 2.1 while a general description of the vegetation communities is provided in the following sections. Figure 2.1 shows the distribution of the vegetation on the site. A full list of all flora quadrat data is attached as Appendix II.

A. LOW FOREST (*Banksia* dominated)

***Corresponding Vegetation Communities*:**

Sainty and Associates (2006) – Coastal Dune System, supporting Coastal Banksia and Pink Bloodwood.
Hager & Benson (1994)- QF120a *Banksia integrifolia*
Fisher et. al. (1996) - Map Unit N75a - Foredune Complex
NPWS (1995) - Transition between # 75 *Banksia integrifolia* subsp. *integrifolia* and # 20 *Melaleuca quinquenervia*

***Structure*:**

Trees: To 20 metres high with a Projected Foliage Cover (PFC) of 45-50%.

Shrubs: To 6 metres high with a 55 - 60% PFC.

Groundlayer: To 1.5 metres high with variable 40 - 65% PFC.

Floristics:
(Main Species Present)

Trees: *Banksia integrifolia* subsp. *integrifolia* (Coast Banksia), *Melaleuca quinquenervia* (Broad-leaved Paperbark), *Corymbia intermedia* (Pink Bloodwood), *Lophostemon suaveolens* (Swamp Turpentine), *Casuarina glauca* (Swamp She-Oak) and *Eucalyptus tereticornis* (Forest Red Gum).

Shrubs: *Chrysanthemoides monilifera* subsp. *monilifera* (Bitou Bush), *Baccharis hamimifolia* (Groundsel Bush), *Acacia longifolia* var. *longifolia* (Golden Wattle), *Dodonea triquetra* (Hop Bush), *Alectryon coriaceus* (Beach Alectryon), *Acacia suaveolens* (Sweet Scented Wattle), *Syzygium australis* (Brush Cherry) and *Acacia saligna* (Orange Wattle).

Groundlayer: *Paspalum dilatatum* (Paspalum), *Eragrostis cilianensis* (Stinkgrass), *Sporobolus africanus* (Parramatta Grass), *Chloris gayana* (Rhodes Grass), *Imperata cylindrica* var. *major* (Blady Grass) and *Pteridium esculentum* (Bracken).

Weeds: *Chrysanthemoides monilifera* subsp. *monilifera* (Bitou Bush), *Acacia saligna* (Orange Wattle), *Lantana camara* (Lantana), *Paspalum dilatatum* (Paspalum), *Eragrostis cilianensis* (Stinkgrass), *Sporobolus africanus* (Parramatta Grass).

Location and Distribution:
This vegetation community occurs in the eastern portion of the site and located on the leeward side of the current fore-dune complex.

This community is relatively common on the mid to upper slopes on the leeward side of the coastal fore-dune along the NSW North Coast and has been listed as adequately conserved within the region (Hager & Benson 1994).

Variation:
There is slight variation within this vegetation community with low lying areas of high moisture content associated with higher densities of *Melaleuca quinquenervia* (Broad-leaved Paperbark) and *Casuarina glauca* (Swamp She-Oak).

Areas of re-growth were found to contain floristic similarities to a regenerating example of this community. Previous clearing and grazing of these areas has led to an altered structure within parts of this community. Parts of this vegetation community have been underscrubbed. Infestations of *Acacia saligna* dominate much of the tree and shrub re-growth, however juvenile regrowth of *Banksia integrifolia* subsp. *integrifolia* (Coast Banksia), *Melaleuca quinquenervia, Corymbia intermedia* (Pink Bloodwood), *Eucalyptus tereticornis*, and *Lophostemon suaveolens* occur within the re-growth areas.

Disturbance:
This community has been disturbed by extensive weed invasion in both the shrub and ground layers. The entire community has been affected by a history of grazing and rural activities. Currently several tracks bisect the community along with several old barbwire fences.

Weed Invasion:
This community exhibits extensive weed invasion in both the shrub and ground layers. Large areas of *Chrysanthemoides monilifera* subsp. *monilifera* (Bitou Bush), *Acacia saligna* (Orange Wattle) and *Baccharis hamimifolia* (Groundsel Bush) dominate the shrub layer.

FOREST (*Eucalypt* dominated)

***Corresponding Vegetation Communities*:**

Sainty and Associates (2006) – Swamp Sclerophyll Forest with Subtropical Coastal Floodplain Elements.
Hager & Benson (1994)- Variant of EF099b *Eucalyptus robusta – Melaleuca quinquenervia*
Fisher et. al. (1996) - Floristic composition suggests this is a transitional community between Swamp Mahogany N52 and Dry Blackbutt N44a – *Eucalyptus pilularis*
NPWS (1995) - Variant on floristic group # 52 *Eucalyptus robusta*

Structure:

Canopy: To 16 - 20 metres high with 35 - 45% Projected Foliage Cover (PFC).

Shrubs: To 3 metres high with a variable cover of less than 5 to 35% PFC.

Ground-layer: From 1 to 1.5 metres high with 75 - 85% PFC.

Floristics:
(Main Species Present)

Canopy: *Melaleuca quinquenervia* (Broad-leaved Paperbark), *Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus resinifera* subsp. *hemilampra* (Red Mahogany), *Angophora costata* (Smooth-barked Apple), *Lophostemon suaveolens* (Swamp Turpentine), *Corymbia intermedia* (Pink Bloodwood), *Eucalyptus robusta* (Swamp Mahogany) and *Lophostemon suaveolens* (Swamp Turpentine).

Shrubs: *Baccharis hamimifolia* (Groundsel Bush), *Pultenaea linophylla, Pimelea linifolia* subsp. *linifolia* (Rice Flower), *Melaleuca quinquenervia* (Broad-leaved Paperbark) *Melaleuca sieberi*, *Banksia spinulosa* (Hairpin Banksia), *Banksia oblongifolia*, *Callistemon pachyphyllus* (Wallum Bottlebrush), *Hakea dactyloides* (Broad-leaved Hakea) and *Acacia longifolia* var. *longifolia* (Golden Wattle).

Groundlayer: *Themeda australis* (Kangaroo Grass), *Sporobolus africanus* (Parramatta Grass), *Eragrostis cilianensis* (Stinkgrass), *Polymeria*

calycina, *Ptilothrix deusta*, *Eragrostis elongata* (Clustered Lovegrass), *Hibbertia aspera* (Rough Guinea Flower), *Imperata cylindrica var. major* (Blady Grass), *Hibbertia vestita*, *Baumea rubiginosa* (Twig Rush), *Polymeria calycina* and *Dichondra repens* (Kidney Weed).

Weeds: *Baccharis hamimifolia* (Groundsel Bush), *Sporobolus africanus* (Parramatta Grass) and *Eragrostis cilianensis* (Stinkgrass).

Location and Distribution:
This community occurs in the western portion of the site on slightly higher elevations and occupies approximately 6.5 hectares.

Within the Coffs Harbour LGA this community has been identified as occurring on poorly drained saline soils near the coast between Bundagen and Arrawarra (Fisher et. al. 1996). This vegetation type has been listed as adequately conserved within the region (Hager & Benson 1994).

Variation:
Previous clearing, removal of the shrub layer, fire, formation of access tracks and grazing of some areas have led to an altered structure within some areas of this community. Some areas within this community are dominated by *Angophora costata*. Juvenile regrowth of *Melaleuca quinquenervia, Eucalyptus tereticornis*, *Eucalyptus robusta* and *Lophostemon suaveolens* occur scattered throughout this community.

Disturbance:
The entire community has been affected from a history of grazing and rural activities. Weed invasion, current grazing, soil compaction, a recent fire event and historic clearing of the shrub and ground layer have reduced the ecological integrity of this community.

Weed Invasion:
Weed invasion is generally low, with some areas of moderate weed invasion associated with edge effects along the Pacific Highway fenceline and the effects of grazing.

C. SWAMP SCLEROPHYLL FOREST

This community corresponds to the listed endangered ecological community, Swamp Sclerophyll Forest on Coastal Floodplains. (NSW Scientific Committee 2004)

***Corresponding Vegetation Communities*:**

Sainty and Associates (2006) – Swamp Sclerophyll Forest.
Hager & Benson (1994)- Floristic similarities with EF099b *Eucalyptus robusta – Melaleuca quinquenervia.*
Fisher et. al. (1996) - Swamp Mahogany N52 and Paperbark N20
NPWS (1995) - Floristic group # 52 *Eucalyptus robusta*

***Structure*:**

Trees: From 18 to 24 metres high with a Projected Foliage Cover (PFC) of 40 - 60%.

Shrubs: To 4 metres high with a variable PFC of 5 - 50%.

Groundlayer: To 1.5 metres high with a variable PFC of 15 - 60%.

Floristics:
(Characteristic Species)

Trees: *Melaleuca quinquenervia* (Broad-leaved Paperbark), *Eucalyptus robusta* (Swamp Mahogany) and *Casuarina glauca* (Swamp She-Oak),

Shrubs: *Glochidion ferdinandi* (Cheese Tree), *Polyscias sambucifolia* (Elderberry Panax), *Acronychian imperforata* (Beach Acronychia), *Myoporum acuminatum* (Mangrove Boobialla), *Chrysanthemoides monilifera* subsp. *monilifera* (Bitou Bush) and *Acacia longifolia* var. *longifolia* (Golden Wattle).

Groundlayer: *Paspalum dilatatum* (Paspalum), *Imperata cylindrica* var. *major* (Blady Grass), *Pteridium esculentum* (Bracken), *Eragrostis cilianensis* (Stinkgrass), *Entolasia marginata* (Bordered Panic), *Gahnia sieberiana* (Red-fruited Saw Sedge), *Blechnum indicum* (Swamp Fern) and *Gonocarpus tetragynus* (Poverty Raspwort)

Weeds: *Chrysanthemoides monilifera* subsp. *monilifera* (Bitou Bush), *Baccharis hamimifolia* (Groundsel Bush) and *Paspalum dilatatum* (Paspalum).

Location and Distribution:
This community occurs as an area of vegetation fringing the southern portion of Hearnes Lake. One fragmented area of this community occurs along the southern boundary, while other very small areas of this community occur to the west of Hearnes Lake.

Disturbance:
The main disturbance to this community has been from current and previous grazing and weed invasion.

Within the Coffs Harbour LGA this community has been identified as occurring on poorly drained saline soils near the coast between Bundagen and Arrawarra (Fisher *et. al.* 1996). This vegetation type has been listed as adequately conserved within the region (Hager & Benson 1994).

Variation:
There is slight variation within this community. A mesic understorey comprising of *Glochidion ferdinandi, Livistona australis and Acronychia imperforata* dominates the southern portion of this community, whilst the area fringing Herns Lake contains higher levels of *Casuarina glauca* and *Myoporum acuminatum*.

Weed Invasion:
Weed invasion is moderate in the shrub and groundlayer of this community.

B/C. EUCALYPT / SWAMP SCLEROPHYLL TRANSITION FOREST

This community corresponds to the listed endangered ecological community, Swamp Sclerophyll Forest on Coastal Floodplains. (NSW Scientific Committee 2004)

***Corresponding Vegetation Communities*:**

Sainty and Associates (2006) – Swamp Sclerophyll Forest.
Hager & Benson (1994)- Floristic similarities with EF099b *Eucalyptus robusta – Melaleuca quinquenervia.*

Fisher *et. al.* (1996) - Swamp Mahogany N52
NPWS (1995) - Floristic group # 52 *Eucalyptus robusta*

***Structure*:**

Trees: From 18 to 24 metres high with a Projected Foliage Cover (PFC) of 40 - 60%.

Shrubs: To 4 metres high with a variable PFC of 5 - 50%.

Groundlayer: To 1.5 metres high with a variable PFC of 15 - 60%.

Floristics:
(Characteristic Species)

Trees: *Melaleuca quinquenervia* (Broad-leaved Paperbark), *Eucalyptus robusta* (Swamp Mahogany), *Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus resinifera* subsp. *hemilampra* (Red Mahogany), *Angophora costata* (Smooth-barked Apple), *Lophostemon suaveolens* (Swamp Turpentine) and *Casuarina glauca* (Swamp She-Oak),

Shrubs: *Glochidion ferdinandi* (Cheese Tree)*, Pultenaea linophylla, Pimelea linifolia* subsp. *linifolia* (Rice Flower), *Callistemon pachyphyllus* (Wallum Bottlebrush), *Polyscias sambucifolia* (Elderberry Panax), *Acronychian imperforata* (Beach Acronychia), *Hakea dactyloides* (Broad-leaved Hakea), *Myoporum acuminatum* (Mangrove Boobialla), *Chrysanthemoides monilifera* subsp. *monilifera* (Bitou Bush) and *Acacia longifolia* var. *longifolia* (Golden Wattle).

Groundlayer: *Paspalum dilatatum* (Paspalum), *Imperata cylindrica* var. *major* (Blady Grass), *Pteridium esculentum* (Bracken), *Eragrostis cilianensis* (Stinkgrass), *Themeda australis* (Kangaroo Grass), *Sporobolus africanus* (Parramatta Grass), *Ptilothrix deusta*, *Entolasia marginata* (Bordered Panic), *Polymeria calycina*, *Dichondra repens* (Kidney Weed), *Gahnia sieberiana* (Red-fruited Saw Sedge), *Blechnum indicum* (Swamp Fern) and *Gonocarpus tetragynus* (Poverty Raspwort).

Weeds: *Chrysanthemoides monilifera* subsp. *monilifera* (Bitou Bush), *Baccharis hamimifolia* (Groundsel Bush), *Sporobolus africanus* (Parramatta Grass), *Eragrostis cilianensis* (Stinkgrass) and *Paspalum dilatatum* (Paspalum).

Location and Distribution:
This community occurs as an area of vegetation approximately 1.5 hectares in size situated to the south-west of Hearnes Lake.

Within the Coffs Harbour LGA this community has been identified as occurring on poorly drained saline soils near the coast between Bundagen and Arrawarra (Fisher et. al. 1996). This vegetation type has been listed as adequately conserved within the region (Hager & Benson 1994).

Disturbance:
The main disturbance to this community has been from current and previous grazing and low levels of weed invasion.

Variation: There is little variation within this community.

D. SANDPLAIN FOREST (*Melaleuca* / *Corymbia* dominated)

Sainty and Associates (2006) – Coastal Dune System, supporting Coastal Banksia and Pink Bloodwood.
Hager & Benson (1994)- Floristic similarities with with EF099b *Eucalyptus robusta – Melaleuca quinquenervia* & QF120a *Banksia integrifolia.*
Fisher *et. al*. (1996) - N20 Paperbark & N75a - Foredune Complex
NPWS (1995) – NA

***Structure*:**

Trees: To 18-20 metres high with a Projected Foliage Cover (PFC) of 30-45%.

Shrubs: To 6 metres high with a 55 - 70% PFC.

Groundlayer: To 1.5 metres high with variable 40 - 75% PFC.

Floristics:
(Main Species Present)

Trees: *Corymbia intermedia* (Pink Bloodwood), *Melaleuca quinquenervia* (Broad-leaved Paperbark) and *Eucalyptus robusta* (Swamp Mahogany).

Shrubs: *Dodonea triquetra* (Hop Bush), *Acacia suaveolens* (Sweet Scented Wattle), *Elaeocarpus reticulatus* (Blueberry Ash), *Chrysanthemoides monilifera* subsp. *monilifera* (Bitou Bush), *Persoonia stradbrokensis*, *Baccharis hamimifolia* (Groundsel Bush), *Pultenaea retusa*, *Acacia longifolia* var. *longifolia* (Golden Wattle) and *Allocasuarina littoralis* (Black She-oak).

Groundlayer: *Pteridium esculentum* (Bracken), *Entolasia marginata* (Boardered Panic), *Oplismenus aemulus* (Basket grass), *Imperata cylindrica* var. *major* (Blady Grass), *Lepidosperma laterale* (Variable Saw-sedge), *Lomandra longifolia* (Spiky-headed Mat-rush) and *Hibbertia vestita.*

Weeds: *Chrysanthemoides monilifera* subsp. *monilifera* (Bitou Bush), *Lantana camara* (Lantana), *Baccharis hamimifolia* (Groundsel Bush), *Senna pendula* var. *glabrate* and *Protasparagus aethiopicus* (Asparagus Fern).

Location and Distribution:
This vegetation community occurs in the eastern portion of the site and is located on the westward side of the main beach dune.

Within the Coffs Harbour LGA these communities have been identified as occurring on poorly drained saline soils near the coast between Bundagen and Arrawarra (N20) and common along the entire coast (N75A) (Fisher et. al. 1996). These vegetation types have been listed as adequately conserved within the region (Hager & Benson 1994).

Variation:
There is slight variation within this vegetation community with low lying areas of high moisture content associated with higher densities of *Melaleuca quinquenervia* (Broad-leaved Paperbark) and *Eucalyptus robusta* (Swamp Mahogany), whilst slightly higher elevated areas are dominated by *Corymbia intermedia* (Pink Bloodwood). Scattered occurrences of

Eucalypts grandis (Flooded Gum) and *E. microcorys* (Tallowwood) were also recorded from this community.

Disturbance:
This community has been disturbed by extensive weed invasion in both the shrub and ground layers. The entire community has been affected from a history of grazing and rural activities. More recently the majority of this vegetation community has been underscrubbed.

Weed Invasion:
This community exhibits extensive weed invasion in both the shrub and ground layers. Large areas of *Chrysanthemoides monilifera* subsp. *monilifera* (Bitou Bush), *Lantana camara* (Lantana) and *Baccharis hamimifolia* (Groundsel Bush) dominate the shrub layer.

E. WET HEATH

***Corresponding Vegetation Communities*:**

Sainty and Associates (2006) – Heath.
Hager & Benson (1994) - WTF003b *Melaleuca sieberi – Melaleuca nodosa* (Hager &
Fisher *et. al*. (1996) - Map Unit SG5502 – Wet Heath
NPWS (1995) - NA

Structure:

Canopy: To 16 metres high with <5% Projected Foliage Cover (PFC).

Shrubs: To 6 metres high with 45-70% PFC.

Ground-layer: To 1.5 metres high with 35-55% PFC.

Floristics:
(Main Species Present)

Canopy: *Melaleuca quinquenervia* (Broad-leaved Paperbark).

Shrubs: *Melaleuca sieberi*, *Melaleuca nodosa* (Ball Honey Myrtle), *Banksia oblongifolia*, *Banksia spinulosa* (Hairpin Banksia), *Callistemon pachyphyllus* (Wallum Bottlebrush), *Leptospermum polygalifolium* subsp. *cismontanum* (Lemon Scented Tea Tree) and *Hakea dactyloides* (Broad-leaved Hakea).

Groundlayer: *Ptilothrix deusta*, *Themeda australis* (Kangaroo Grass), *Baumea rubiginosa* (Twig Rush), *Melaleuca thymifolia* (Thyme Honey Myrtle), *Polymeria calycina*, *Hibbertia vestita*, *Goodenia paniculata* (Swamp Goodenia), *Pimelea linifolia* subsp. *linifolia* (Rice Flower), *Stackhousia viminea* (Slender Stackhousia) and *Dampiera stricta* (Blue Damperia).

Location and Distribution:
This community occurs on the western side of Hearnes Lake and is associated with low-lying moist soils.

Within the Coffs Harbour LGA this community is primarily associated with low lying, poorly drained impervious clay subsoils along the coast between the Arrawarra, Woolgoolga and Moonee area (Fisher et. al. 1996). This vegetation type has been listed as adequately conserved in northern NSW (Hager & Benson 1994).

Variation:
There is slight variation within this vegetation community with lower lying areas dominated by *Callistemon pachyphyllus*, whilst slightly higher elevated areas are dominated by *Banksia* and *Hakea* species. Stock grazing and previous clearing have reduced floristic diversity in the southern portion of this community.

Disturbance:
The main disturbances to this community have been from a recent fire and access tracks. Stock grazing has impacted southern areas of this community, however weed invasion is generally low with high levels of natural regeneration.

Weed Invasion:
Weed invasion within this community is generally low with high levels of native regeneration evident in the shrub and groundlayer.

F. WALLUM HEATH

***Corresponding Vegetation Communities*:**

Sainty and Associates (2006) – Prior Swamp Sclerophyll Woodland.
Hager & Benson (1994) - WTF003b *Melaleuca sieberi – Melaleuca nodosa* (Hager &
Fisher *et. al*. (1996) - Map Unit SG5502 – Wet Heath
NPWS (1995) - NA

Structure:

Canopy: To 8 metres high with <5% Projected Foliage Cover (PFC).

Shrubs: To 2 metres high with 45-70% PFC.

Ground-layer: To 1.5 metres high with 35-55% PFC.

Floristics:
(Main Species Present)

Canopy: *Melaleuca quinquenervia* (Broad-leaved Paperbark).

Shrubs: *Callistemon pachyphyllus* (Wallum Bottlebrush), *Pimelea linifolia* subsp. *linifolia* (Rice Flower) and *Melaleuca thymifolia* (Thyme Honey Myrtle),

Groundlayer: *Ischaemum triticeum*, *Ptilothrix deusta*, *Baumea rubiginosa* (Twig Rush), *Gonocarpus tetragynus* (Poverty Raspwort), *Polymeria calycina*, *Goodenia paniculata* (Swamp Goodenia) and *Panicum simile* (Two Colour Panic).

Location and Distribution:
This community occurs on the western side of Hearnes Lake and is associated with low-lying poorly drained soils.

Within the Coffs Harbour LGA this community is primarily associated with low lying, poorly drained impervious clay subsoils along the coast between the Arrawarra, Woolgoolga and Moonee area (Fisher et. al. 1996). This vegetation type has been listed as adequately conserved in northern NSW (Hager & Benson 1994).

Variation:
The shrub layer in part of this community in the south-west of the site is dominated by *Melaleuca thymifolia* (Thyme Honey Myrtle), *Pimelea linifolia* subsp. *linifolia* (Rice Flower) and

Leptospermum juniperinum (Prickly Tea-tree) with lower densities of *Callistemon pachyphyllus* (Wallum Bottlebrush). Scattered regrowth of *Melaleuca quinquenervia* (Broad-leaved Paperbark) and *Eucalyptus tereticornis* (Forest Red Gum) also occurs throughout this variant area.

Disturbance:
The main disturbances to this community are from a recent fire and access tracks. Stock grazing has also occurred within this community, however weed invasion is generally low with high levels of natural regeneration.

Weed Invasion:
Weed invasion within this community is generally low with high levels of native regeneration evident in the shrub and groundlayer.

G. SEDGELAND

This community corresponds with both the Sedgeland structural variant of the listed endangered ecological community, Swamp Sclerophyll Forest on Coastal Floodplains. (NSW Scientific Committee 2004) and Coastal Salt Marsh in NSW.

***Corresponding Vegetation Communities*:**

Sainty and Associates (2006) – Coastal Salt Marsh.
Hager & Benson (1994) - WTF003b *Melaleuca sieberi – Melaleuca nodosa* (Hager &
Fisher et. al. (1996) - Map Unit SG6402 – Sedgeland / Rushland Complex
NPWS (1995) - NA

***Structure*:**

Trees: No trees occur within the sedgeland community

Shrubs: Sparsely scattered shrubs to 2 metres in height with a PFC less than 5%.

Groundlayer: Sedges to 0.5 metres with a PFC of 80-95%.

Floristics:
(Characteristic Species)

Trees: Nil

Shrubs: *Casuarina glauca* (Swamp She-Oak)

Groundlayer: *Baumea juncea* (Bore Twig Rush), *Baumea rubiginosa* (Twig Rush), *Sporobolus virginicus* (Sand Couch), and *Samolus repens* (Creeping Brookweed).

Location and Distribution:
This community is located on low-lying, permanently water logged soils fringing Hearnes Lake.

Within the Coffs Harbour LGA this community occurs in areas subject to waterlogging along the coast between in the Woolgoolga, Moonee and Bonville areas (Fisher et. al. 1996). This vegetation community occurs in 7a – Environmental Protection and type has been listed as adequately conserved in northern NSW (Hager & Benson 1994).

Variation:
There is very little variation within this vegetation community.

Disturbance:
Fire has impacted on the landward edge of this community.

Weed Invasion:
Weed invasion within this community is generally low.

H. DISTURBED WOODLAND

***Corresponding Vegetation Communities*:**
This vegetation community has been highly modified by extensive underscrubbing or slashing, clearing, grazing, fire and other anthropomorphic changes over a long period of time. It is considered that this vegetation does no longer corresponds to any native vegetation mapped in the local area.

Structure:

Canopy: To 16 - 20 metres high with 35 - 45% Projected Foliage Cover (PFC).

Shrubs: To 3 metres high with <5% PFC.

Ground-layer: To 1 metres high with 75 - 85% PFC.

Floristics:
(Main Species Present)

Canopy: *Melaleuca quinquenervia* (Broad-leaved Paperbark), *Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus robusta* (Swamp Mahogany), *Banksia integrifolia* subsp. *integrifolia* (Coast Banksia), *Corymbia intermedia* (Pink Bloodwood), *Casuarina glauca* (Swamp She-Oak) and *Lophostemon suaveolens* (Swamp Turpentine).

Shrubs: *Baccharis hamimifolia* (Groundsel Bush), *Pultenaea linophylla, Pimelea linifolia* subsp. *linifolia* (Rice Flower), *Melaleuca quinquenervia* (Broad-leaved Paperbark), *Acacia longifolia* var. *longifolia* (Golden Wattle). *Chrysanthemoides monilifera* subsp. *monilifera* (Bitou Bush), *Dodonea triquetra* (Hop Bush), *Alectryon coriaceus* (Beach Alectryon), *Acacia suaveolens* (Sweet Scented Wattle), *Syzygium australis* (Brush Cherry) and *Acacia saligna* (Orange Wattle).

Groundlayer: *Themeda australis* (Kangaroo Grass), *Sporobolus africanus* (Parramatta Grass), *Eragrostis cilianensis* (Stinkgrass), *Baumea rubiginosa* (Twig Rush), *Polymeria calycina* and *Dichondra repens* (Kidney Weed).

Weeds: *Baccharis hamimifolia* (Groundsel Bush), *Sporobolus africanus* (Parramatta Grass) and *Eragrostis cilianensis* (Stinkgrass).

Classification:
This vegetation community has been highly modified by clearing, grazing, fire and other anthropomorphic changes over a long period of time. It is considered that this vegetation does not correspond to any native vegetation mapped in the local area.

Location and Distribution:
This community occurs in large patches in the southern and central-western portions of the site.

Variation:
There is little variation within this vegetation community.

Disturbance:
The entire community has been affected by a long history of grazing and rural activities. Weed invasion, current grazing, soil compaction, a recent fire event and historic clearing of the shrub and ground layer have reduced the ecological integrity of this community.

Weed Invasion:
Weed invasion is low to moderate within this vegetation community and is primarily associated with edge effects and grazing.

I. SANDPLAIN FOREST (*Melaleuca* / Mesophyllic species dominated)

***Corresponding Vegetation Communities*:**

Sainty and Associates (2006) – Prior Swamp Sclerophyll Woodland/ Coastal Dune System.
Hager & Benson (1994)- QF120a *Banksia integrifolia*
Fisher *et. al. (*1996) - Map Unit N75a - Foredune Complex
NPWS (1995) - Transition between # 75 *Banksia integrifolia* subsp. *integrifolia* and # 20 *Melaleuca quinquenervia*

Structure:

Canopy: To 16 metres high with up to 30% Projected Foliage Cover (PFC).

Shrubs: To 3 metres high with <5% PFC.

Ground-layer: To 1 metre high with 75 - 85% PFC.

Floristics:
(Main Species Present)

Canopy: *Melaleuca quinquenervia* (Broad-leaved Paperbark), *Archontophoenix cunninghamii (Bangalow Palm), Ficus coronata (Sandpaper Fig), Acronchia imperforata, Glochidion ferdinandi (Cheese Tree), Cupaniopsis anarcoides* and *Lophostemon suaveolens* (Swamp Turpentine).

Shrubs: *Baccharis hamimifolia* (Groundsel Bush), *Pultenaea linophylla, Pimelea linifolia* subsp. *linifolia* (Rice Flower), *Melaleuca quinquenervia* (Broad-leaved Paperbark), *Acacia longifolia* var. *longifolia* (Golden Wattle). *Chrysanthemoides monilifera* subsp. *monilifera* (Bitou Bush), *Dodonea triquetra* (Hop Bush), *Alectryon coriaceus* (Beach Alectryon), *Acacia suaveolens* (Sweet Scented Wattle), *Syzygium australis* (Brush Cherry), *Acacia saligna* (Orange Wattle), *Elaeocarpus reticulatus* (Blueberry Ash), *Persoonia stradbrokensis*, *Pultenaea retusa* and *Allocasuarina littoralis* (Black She-oak).

Groundlayer: *Themeda australis* (Kangaroo Grass), *Sporobolus africanus* (Parramatta Grass), *Eragrostis cilianensis* (Stinkgrass), *Baumea rubiginosa* (Twig Rush), *Polymeria calycina*, *Dichondra repens* (Kidney

Weed), *Pteridium esculentum* (Bracken), *Entolasia marginata* (Bordered Panic), *Oplismenus aemulus* (Basket grass), *Imperata cylindrica* var. *major* (Blady Grass), *Lepidosperma laterale* (Variable Saw-sedge), *Lomandra longifolia* (Spiky-headed Mat-rush) and *Hibbertia vestita.*

Weeds: *Baccharis hamimifolia* (Groundsel Bush), *Sporobolus africanus* (Parramatta Grass) and *Eragrostis cilianensis* (Stinkgrass).

Location and Distribution:
This community occurs in two patches on the western flank of the main dune in the south-eastern portion of the subject site.

Variation:
There is little variation within this vegetation community.

Disturbance:
The entire community has been affected from a long history of grazing and rural activities. Weed invasion, current grazing, soil compaction, a recent fire event and historic clearing and ongoing underscrubbing or slashing of the shrub and ground layer have reduced the ecological integrity of this community.

Weed Invasion:
Weed invasion is low to moderate within this vegetation community and is primarily associated with edge effects and grazing.

TABLE 2.1
FLORA SPECIES OBSERVED ON THE SUBJECT SITE

Family	Scientific Name	Common Name
TREES		
Araliaceae	*Schefflera actinophylla*	Umbrella Tree
Araucariaceae	*Araucaria cunninghamii*	Hoop Pine
Arecaceae	*Archontophoenix cunninghamiana*	Bangalow Palm
Casuarinaceae	*Allocasuarina littoralis*	Black She-oak
	Casuarina glauca	Swamp Oak
Eleocarpaceae	*Elaeocarpus reticulatus*	Blueberry Ash
Euphorbiaceae	*Glochidion ferdinandii*	Cheese Tree
Fabaceae: Faboideae	*Castanospermum australe*	Black Bean
	*Erythrina crista-galli**	Cockspur Coral Tree
	*Bauhinia variegata**	Orchid Tree
Lauraceae	*Cinnamomum camphora**	Camphor Laurel
	Cryptocarya triplinervis	Three-veined Cryptocarya
	Endiandra sieberi	Corkwood
Moraceae	*Ficus coronata*	Sandpaper Fig
	*Ficus elastica**	Rubber Plant
	Ficus macrophylla	Moreton Bay Fig
Myoporaceae	*Myoporum acuminatum*	Mangrove Boobialla
Myrtaceae	*Acmena smithii* 'small-leaved race'	Lillypilly
	Angophora costata	Smooth-barked Apple
	Corymbia intermedia	Pink Bloodwood
	Eucalyptus grandis	Flooded Gum

TABLE 2.1 (Cont.) FLORA SPECIES OBSERVED ON THE SUBJECT SITE		
Family	**Scientific Name**	**Common Name**
TREES Cont.		
	Eucalyptus microcorys	Tallowwood
	Eucalyptus pilularis	Blackbutt
	Eucalyptus resinifera subsp. *hemilampra*	Red Mahogany
	Eucalyptus robusta	Swamp Mahogany
	Eucalyptus siderophloia	Northern Grey Ironbark
	Eucalyptus tereticornis	Forest Red Gum
	Lophostemon confertus	Brush Box
	Lophostemon suaveolens	Swamp Turpentine
	Melaleuca quinquenervia	Broad-leaved Paperbark
Ochnaceae	*Ochna serrulata**	Mickey Mouse Plant
Oleaceae	*Ligustrum sinense**	Small-leaved Privet
	Notelaea longifolia	Mock Olive
	Notelaea ovata	Mock Olive
Phytolaccaceae	*Phytolacca octandra**	Inkweed
Pittosporaceae	*Pittosporum revolutum*	Yellow Pittosporum
Polygalaceae	*Comesperma ericinum*	Matchheads
Proteaceae	*Banksia oblongifolia*	-
	Banksia spinulosa	Hairpin Banksia
	Grevillea sp. (cultivar)	
	Hakea actites	-
	Hakea dactyloides	Broad-leaved Hakea
	Persoonia conjuncta	-
	Persoonia stradbrokensis	-
	Persoonia virgata	-
Rubiaceae	*Psychotria loniceroides*	-
Sapindaceae	*Alectryon coriaceus*	Beach Alectryon
	Dodonaea triquetra	Hop Bush
Solanaceae	*Duboisia myoporoides*	Corkwood
	*Solanum nigrum**	Black Nightshade
	*Solanum mauritianum**	Wild Tobacco
	Solanum pungetium	Eastern Nightshade
Verbenaceae	*Clerodendrum floribundum*	-
	Clerodendrum tomentosum	-
	*Lantana camara**	Lantana
GROUNDCOVERS		
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower
	*Thunbergia alata**	Black-eyed Susan
Agavaceae	*Yucca aloifolia**	-
Amaranthaceae	*Alternanthera denticulata*	Lesser Joyweed
Amaryllidaceae	*Crinum pedunculatum*	Swamp Lily
Anthericaceae	*Caesia parviflora* var. *parviflora*	Pale Grass Lily
	*Chlorophytum comosum**	Spider Plant
	Thysanotus tuberosus	Fringed Lily

TABLE 2.1 (Cont.) FLORA SPECIES OBSERVED ON THE SUBJECT SITE		
Family	**Scientific Name**	**Common Name**
GROUNDCOVERS Cont.		
	Tricoryne elatior	Yellow Rush Lily
Apiaceae	*Centella asiatica*	Swamp Pennywort
	*Ciclospermum leptophyllum**	Slender Celery
	*Foeniculum vulgare**	Fennel
	*Hydrocotyle bonariensis**	Kurnell Curse / Pennywort
	Hydrocotyle peduncularis	Pennywort
	Trachymene incisa subsp. *incisa*	Native Parsnip
Apocynaceae	*Vinca major**	Blue Periwinkel
Asparagaceae	*Protasparagus aethiopicus**	Asparagus Fern
	*Protasparagus plumosus**	Climbing Asparagus Fern
Asteraceae	*Ambrosia artemisiifolia**	Annual Ragweed
	*Aster subulatus**	Wild Aster
	*Ageratina adenophora**	Crofton Weed
Asteraceae	*Bidens pilosa**	Cobbler's Pegs
	*Cirsium vulgare**	Spear Thistle
	*Conyza albida**	Fleabane
	*Conyza bonariensis**	Flax-leaf Fleabane
	Eclipta platyglossa	-
	*Hypochaeris radicata**	Flatweed
	Lagenifera stipitata	-
	Leptinella longipes	-
	Pseudognaphalium luteoalbum	Jersey Cudweed
	*Senecio madagascariensis**	Fireweed
	Vernonia cinerea	-
	Vittadinia hispidula var. *setosa*	-
Baueraceae	*Bauera microphylla*	-
Blechnaceae	*Blechnum cartilagineum*	Gristle Fern
	Blechnum indicum	Swamp Water Fern
Caryophyllaceae	*Cerastium glomeratum**	Mouse-ear Chickweed
	*Stellaria media**	Common Chickweed
Clusiaceae	*Hypericum gramineum*	Small St Johns Wort
Commelinaceae	*Commelina cyanea*	Scurvy Weed
Convolvulaceae	*Dichondra repens*	Kidney Weed
	Polymeria calycina	-
Cyperaceae	*Baumea articulata*	-
	Baumea juncea	-
	Baumea rubignosa	Twig Rush
	Baumea teretifolia	Wrinkle-nut Twig Rush
	Bolboschoenus cardwellii	-
	Carex appressa	-
	Carex inversa	Knob Sedge
	Chorizandra cymbaria	Heron Bristle Rush
	Chorizandra sphaerocephala	Round-headed Bristle Rush
	Cyperus eglobosus	-

TABLE 2.1 (Cont.) FLORA SPECIES OBSERVED ON THE SUBJECT SITE		
Family	**Scientific Name**	**Common Name**
GROUNDCOVERS Cont.		
	Cyperus odoratus	-
	Cyperus polystachyos	-
	Cyperus sanguinolentus	-
	*Cyperus sesquiflorus**	-
	Eleocharis sphacelata	Tall Spike-rush
	Fimbristylis dichotoma	-
	Fimbristylis ferruginea	-
	Fimbristylis velata	-
	Gahnia aspera	Saw Sedge
Dennstaedtiaceae	*Pteridium esculentum*	Bracken
Dilleniaceae	*Hibbertia aspera*	Rough Guinea Flower
	Hibbertia pedunculata	-
	Hibbertia vestita	-
Euphorbiaceae	*Phyllanthus tenellus**	-
	Poranthera microphylla	
Fabaceae	*Medicago polymorpha**	Burr Medic
Goodeniaceae	*Dampiera stricta*	Blue Dampiera
	Goodenia hederacea var. *hederacea*	Ivy-leaved Goodenia
	Goodenia ovata	-
	Goodenia paniculata	Swamp Goodenia
	Goodenia rotundifolia	-
	Scaveola calendulacea	Scented Fan Flower
	Scaveola ramosissima	-
Haemodoraceae	*Haemodorum planifolium*	Bloodroot
Haloragaceae	*Gonocarpus micranthus* subsp. *ramosissimus*	-
	Gonocarpus tetragynus	Poverty Raspwort
	Gonocarpus teucrioides	-
Iridaceae	*Gladiolus sp.**	-
	Patersonia glabrata	Leafy Purple-flag
Juncaceae	*Juncus cognatus**	-
	Juncus continuus	-
	Juncus krausii	Sea Rush
	Juncus mollis	-
	Juncus polyanthemus	-
	Juncus usitatus	Common Rush
Lindsaeaceae	*Lindsaea linearis*	Screw Fern
Lobeliaceae	*Lobelia alata*	-
	Pratia purpurascens	Whiteroot
Loganiaceae	*Mitrasacme polymorpha*	Mitrewort
	Mitrascme alsinoides	Mitrewort
Lomandraceae	*Lomandra filiformis* var. *filiformis*	Wattle Mat-rush
	Lomandra longifolia	Spiky-headed Mat-rush
	Lomandra multiflora subsp. *multiflora*	Many-flowered Mat-rush

TABLE 2.1 (Cont.) FLORA SPECIES OBSERVED ON THE SUBJECT SITE		
Family	**Scientific Name**	**Common Name**
GROUNDCOVERS Cont.		
Malvaceae	*Sida rhombifolia**	Paddy's Lucerne
Melanthiaceae	*Ciliva miniata**	Bush Lily
Menyanthaceae	*Villarsia exaltata*	-
Nymphaeaceae	*Nymphaea capensis**	Cape Waterlily
Orchidaceae	*Diuris* sp. Aff. *Chrysantha*	-
	Dipodium variegatum	Blotched Hyacinth Orchid
	Spiranthes sinensis subsp. *australis*	Austral Ladies Tresses
Oxalidaceae	*Oxalis exilis*	-
	*Oxalis latifolia**	Pink Fishtail
	*Oxalis pes-caprae**	Soursob
Phormiaceae	*Dianella caerulea*	Flax Lily
	Dianella congesta	-
Phylydraceae	*Phylidrum lanuginosum*	Woolly Frogsmouth
Plantaginaceae	*Plantago lanceolata**	Ribwort
Poaceae	*Arundo donax**	Giant Reed
Poaceae	*Agrostis avenacea*	Blown Grass
	*Andropogon virginicus**	Whisky Grass
	Aristida ramosa	-
	Aristida warburgii	-
	*Arundo donax**	Giant Reed
	*Bromus cartharticus**	Prairie Grass
	*Chloris gayana**	Rhodes Grass
	Cymbopogon refractus	Barbwire Grass
	Cynodon dactylon	Common Couch
	Digitaria parviflora	Small-flowered Finger Grass
	Digitaria ramularis	-
	*Digitaria sanguinalis**	Crab Grass
	Echinopogon caespitosus var. *caespitosus*	Tufted Hedgehog Grass
	Echinopogon ovatus	Forest Hedgehog Grass
	Entolasia marginata	Bordered Panic
	Entolasia stricta	Wiry Panic
	Eragrostis brownii	Brown's Lovegrass
	*Eragrostis curvula**	African Lovegrass
	Eragrostis elongata	Clustered Lovegrass
	Eragrostis leptostachya	Paddock Lovegrass
	Imperata cylindrica var. *major*	Blady Grass
	Ischaemum australe	-
	Ischaemum triticeum	-
	Microlaena stipoides var. *stipoides*	Weeping Rice Grass
	Oplismenus aemulus	Basket Grass
	Oplismenus imbecillis	-
	Panicum paludosum	Swamp Panic
	Panicum simile	Two Colour Panic
	*Paspalum ciliatifolium**	One-spiked Paspalum

TABLE 2.1 (Cont.) FLORA SPECIES OBSERVED ON THE SUBJECT SITE		
Family	**Scientific Name**	**Common Name**
GROUNDCOVERS Cont.		
	*Paspalum dilatatum**	Paspalum
	*Paspalum urvillei**	Vasey Grass
	*Pennisetum clandestinum**	Kikuyu
	*Phalaris aquatica**	Phalaris
	Phragmites australis	Common Reed
	Poa labillardieri	Tussock
	*Setaria gracilis**	Slender Pigeon Grass
	*Sporobolus africanus**	Parramatta Grass
	Sporobolus creber	Slender Rat's Tail Grass
	Sporobolus elongatus	Slender Rat's Tail Grass
	Sporobolus virginicus	Sand Couch
	*Stenotaphrum secundatum**	Buffalo Grass
	Themeda australis	Kangaroo Grass
Polygalaceae	*Comesperma defoliatum*	-
Polygonaceae	*Rumex brownie*	Swamp Dock
	*Rumex crispus**	Curled Dock
Primulaceae	*Anagallis arvensis* var. *caerulea**	Blue Pimpernel
	*Anagallis arvensis**	Scarlet Pimpernel
	Samolus repens	Creeping Brookweed
Restionaceae	*Lepyrodia scariosa*	-
Rubiaceae	*Opercularia aspera*	Common Stinkweed
	Opercularia diphylla	-
	Pomax umbellata	Pomax
Scrophulariaceae	*Bacopa monniera*	-
Solanaceae	*Solanum nigrum**	Black Nightshade
Stackhousiaceae	*Stackhousia nuda*	-
	Stackhousia spathulata	-
	Stackhousia viminea	Slender Stackhousia
Thymelaeaceae	*Pimelea linifolia* subsp. *linifolia*	Slender Rice Flower
Verbenaceae	*Verbena bonariensis**	Purpletop
	*Verbena officinalis**	Common Verbena
	*Verbena rigida**	Veined Verbena
Violaceae	*Viola hederacea*	Ivy-leaved Violet
Xanthorrhoaceae	*Xanthorrhoea fulva*	-
Xyridaceae	*Xyris operculata*	-
VINES		
Apocynaceae	*Parsonsia straminea*	Common Silkpod
Convolvulaceae	*Convolvulus erubescens*	Australian Bindweed
	*Ipomoea cairica**	Coastal Morning Glory
Dilleniaceae	*Hibbertia scandens*	Climbing Guinea-flower
Fabaceae	*Canavalia rosea*	Beach Bean
	Desmodium gunnii	-
	Desmodium nemorosum	-
	Glycine clandestina	Twining Glycine

TABLE 2.1 (Cont.) FLORA SPECIES OBSERVED ON THE SUBJECT SITE		
Family	**Scientific Name**	**Common Name**
VINES Cont.		
	Glycine tabacina	Twining Glycine
	Glycine tomentella	Woolly Glycine
	Hardenbergia violacea	False Sarsaparilla
	Kennedia rubicunda	Dusky Coral Pea
Lauraceae	*Cassytha glabella* forma *glabella*	Devil's Twine
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry
	Geitonoplesium cymosum	Scrambling Lily
Menispermiaceae	*Stephania japonica* var. *discolor*	Snake Vine
Nyctaginaceae	*Bougainvillea* sp.*	Bougainvillea
Passifloraceae	*Passiflora suberosa**	Cork Passionflower
Pittosporaceae	*Billardiera scandens* var. *scandens*	Apple Dumplings
Rosaceae	*Rubus hillii*	Molucca Bramble
	Rubus parvifolius	Native Raspberry
Rubiaceae	*Morinda jasminoides*	-
Smilacaceae	*Smilax australis*	Lawyer Vine
	Smilax glyciphylla	Sarsaparilla
Vitaceae	*Cissus antarctica*	Native Grape
EPIPHYTES		
Orchidaceae	*Cymbidium suave*	Native Cymbidium
Polypodiaceae	*Platycerium bifurcatum* subsp. *bifurcatum*	Elkhorn
Species name^{TS} = Threatened Species * = Introduced Species		

2.3 RARE OR THREATENED FLORA SPECIES

A search of the Atlas of NSW Wildlife (NPWS 2008) was undertaken to identify records of threatened flora species located within 10km of the site. This allowed for a specific search for threatened flora to be undertaken to determine if any threatened flora species were present within the study site. Details on threatened flora species as listed within the relevant Schedules of the *TSC Act* (1995), with a known or possible occurrence within the local area, are provided in Table 2.2.

TABLE 2.2 THREATENED FLORA SPECIES OF THE AREA				
Species	**TSC Act**	**EPBC Act**	**Growth Form and Habitat Requirements**	**Comments**
Allocasuarina defungens	E1	E	A straggly shrub to 2m tall. Grows mainly in tall heath on sand, but may also occur on clay and sandstone soils. Occurs in coastal NSW between Nabiac in the south and Byron Bay in the north (NPWS 2002).	Suitable habitat is present. Not observed during flora survey.
Amorphospermum whitei	V	-	Small to medium sized tree. Grows in littoral and warm temperate rainforests. Distribution – north from the Macleay River, also recorded from the Port Macquarie district (Harden 1990).	Sub-optimal habitat is present. Not observed during flora survey.
Boronia umbellata	V	V	A shrub to 1m high. Grows in wet sclerophyll forest, between Athol Glen and Coramba in the Coffs Harbour district (Harden 2002).	No suitable habitat is present. Not observed during flora survey.
Chamaesyce psammogeton	E!	-	A small prostrate perennial herb. Grows in coastal sand dunes and exposed headlands on the NSW coast north from Jervis Bay. Also recorded from Lord Howe Island (NPSW 2002).	Suitable habitat is present. Not observed during flora survey.
Eleocharis tetraquetra	E1	-	A square stemed spike-rush 30-100cm tall. Grows in damp locations on stream edges and in and on the margins of freshwater swamps (NPSW 2002).	Suitable habitat is present. Not observed during flora survey.
Hicksbeachia pinnatifolia	V	V	A small tree to 10m high, often multi-stemmed from rootstock. Grows in subtropical rainforest. Flowers mostly in winter. Distribution – north from Nambucca Valley, NC & Qld.	No suitable habitat is present. Not observed during flora survey.
Lindsaea incisa	E1	-	Small fern arising from creeping rhizome. Grows in damp sandy places – open forest. Known from between Grafton and Corindi, NC & Qld.	Suitable habitat is present. Not observed during flora survey.
Macadamia tetraphylla	V	V	Small to medium sized tree to 15m with reddish new growth. Grows in subtropical rainforest in coastal areas. Flowers Aug-Oct. Distribution – north of the Clarence River, NC & Qld	No suitable habitat is present. Not observed during flora survey.

TABLE 2.2 (Cont.) THREATENED FLORA SPECIES OF THE AREA				
Species	**TSC Act**	**EPBC Act**	**Growth Form and Habitat Requirements**	**Comments**
Marsdenia longiloba	E1	V	A slender climber, latex clear, watery. Grows in rainforests, north from the Coffs Harbour area (Harden 1992).	No suitable habitat is present. Not observed during flora survey.
Phaius australis	E1	-	A pseudo bulb terrestrial orchid, Grows in swamp and sclerophyll forests, on the coast, north from Lake Cathie. Flowers Sep to Oct.	Suitable habitat is present. Not observed during flora survey.
Pultenea maritima Coast Headland Pea	V	-	Prostate mat forming shrub with hairy stems. Grows in grasslands, shrublands and heath on exposed coastal headlands. Occurs in NSW from Newcastle to Byron Bay on 16 headlands.	No suitable habitat present. Not observed during flora survey.
Quassia *sp. Moonee Creek'*	E1	E	A slender or bush shrub to 1.5m tall. Grows in shrubby layer below tall moist and dry eucalypt forest, mostly at lower altitudes. Scattered distribution from the Moonee Creek area north of Coffs Harbour to north-east of Grafton (NPWS 2002).	Sub-optimal habitat is present. Not observed during flora survey.
Senna acclinis	E1	-	A shrub to 3m tall. Grows in or adjacent to subtropical and dry rainforest. Occurs in coastal districts and adjacent tablelands from Bulahdelah in the south to Qld (NPSW 2002).	Sub-optimal habitat is present. Not observed during flora survey.
Sophora tomentosa	E1	-	A shrub or small tree to 5m high. Grows on recent sands on frontal coastal dunes. Distribution from Port Stephens in the south to Qld & NT in the north (Harden 2002).	Suitable habitat is present. Not observed during flora survey.
Thesium australe	V	V	A small herb to 40cm tall. Grows in grassland or grassy eucalypt woodland in association with *Themeda australis*. Occurs on grassy headlands on the coast, is widespread but uncommon in eastern Australia from Vic. To south-east Qld (NPWS 2002).	Suitable habitat is present. Not observed during flora survey.

TABLE 2.2 (Cont.) THREATENED FLORA SPECIES OF THE AREA				
Species	**TSC Act**	**EPBC Act**	**Growth Form and Habitat Requirements**	**Comments**
Typhonium sp. aff. *brownii*	E1	-	A deciduous perennial herb. Grows in rainforest margins, sheltered gullies and along creek banks. Flowers in summer. Distribution NC, CC, NT, CT & CWS.	No suitable habitat is present. Not observed during flora survey.
Zieria prostrata	E1	E	A prostrate shrub forming mats about 05.m in diameter. Grows in low grassy heath on exposed sites. Restricted to four coastal headlands in the Coffs Harbour area (NPWS 2002).	No suitable habitat is present. Not observed during flora survey.
E1 = Endangered Species V = Vulnerable Species				

Following detailed consideration of the site and species listed in Table 2.2 it is considered that there is suitable and / or sub-optimal habitat on the subject site for the following species:

- *Allocasuarina defungens;*
- *Amorphospermum whitei;*
- *Chamaesyce psammogeton;*
- *Eleocharis tetraquetra;*
- *Lindsaea incisa;*
- *Phaius australis;*
- *Quassia* sp. 'Moonee Creek*;*
- *Senna acclinis;*
- *Sophora tomentosa;* and
- *Thesium australe.*

No threatened flora species as listed within the relevant Schedules of the *TSC Act (1995)* were observed on site during surveys.

In addition to the threatened flora species recorded within 10km of the site (NPWS 2008), Council officers specifically requested that the cryptic flowering species *Diuris* sp. aff. *chrysantha* (Byron Bay) be considered within targeted flora surveys of the site.

Targeted flora surveys were conducted for this species during the appropriate flowering period. During these surveys a number of *Diuris* specimens resembling *Diuris* sp. aff. *chrysantha* (Byron Bay) were observed within the site. Samples of these specimens were sent to the Royal Botanic Gardens (RBG) in Sydney for positive identification. Correspondence from the RBG dated 23rd August 2004, positively identified the specimens as *Diuris* sp. aff. *chrysantha* (North Coast).

Clarification was sought from the North Coast Threatened Species Units on the 23rd August 2004 as to whether the species, *Diuris* sp. aff. *chrysantha* (North Coast) is the same as the species *Diuris* sp. aff. *chrysantha* (Byron Bay) listed on Schedule 1, Part 1 of the TSC Act (1995). *Coacher Travers* were informed by NPWS North Coast Threatened Species Unit that the species *Diuris* sp. aff. *chrysantha* (Byron Bay) listed on Schedule 1, Part 1 of the TSC Act (1995) was not the same species as *Diuris* sp. aff. *chrysantha* (North Coast) located

within the subject site. Furthermore, it was identified the species *Diuris* sp. aff. *chrysantha* (Byron Bay) had been recently renamed *Diuris byronensis* by D.L. Jones in the journal Orchadian 14(3): 132.

Therefore, it has been determined that *Diuris* sp. aff. *chrysantha* (Byron Bay) was not present within the subject site.

2.4 ENDANGERED FLORA POPULATIONS AND ENDANGERED ECOLOGICAL COMMUNITIES

There is one Endangered Flora Population known within the Coffs Harbour LGA, this species is *Zieria smithii*. This species was not observed within the subject site and it is considered that the presence of this species on site is unlikely. Further information regarding this Endangered Population is provided in Appendix III.

Several Endangered Ecological Communities are known in the local area. These Communities are:

I) Coastal Saltmarsh;
II) Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions;
III) Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner bioregions;
IV) Lowland Rainforest on Floodplain in the NSW North Coast bioregion.
V) Subtropical Coastal Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions;
VI) Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions; and
VII) Swamp Sclerophyll Forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions;
VIII) Themeda Grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South-east Corner Bioregions.

Further information regarding the Endangered Ecological Communities known in the Coffs Harbour local government area is provided in Appendix III.

Two Endangered Ecological Communities listed within the *Threatened Species Conservation Act* (1995) are present on-site. These are Coastal Saltmarsh and Swamp Sclerophyll Forest on Coastal Floodplains.

The Coastal Saltmarsh endangered ecological community on-site corresponds to the G – Sedgeland community as described previously, and mapped in Figure 2.1 – Vegetation Communities. This area of Saltmarsh was also determined to be the Coastal Saltmarsh endangered ecological community by Sainty and Associates (2006).

The Swamp Sclerophyll Forest on Coastal Floodplains endangered ecological community on-site corresponds to the C – Swamp Sclerophyll Forest community, and to a lesser extent to the B/C – Eucalypt/Swamp Sclerophyll Transition Forest as described previously, and mapped in Figure 2.1 – Vegetation Communities. These C and B/C vegetation communities were also determined by Sainty and Associates (2006) to be commensurate with the Swamp Sclerophyll Forest on Coastal Floodplains endangered ecological community.

SECTION 3

FAUNA CHARACTERISTICS

The following sections detail the fauna survey methodologies completed by *Conacher Travers* within the subject site between 2003 and 2007. These following sections also detail the results of the completion of those surveys within the subject site. This information was collected as part of the earlier stages of the Masterplanning process.

3.1 FAUNA SURVEY METHODOLOGY

In order to detect the occurrence of threatened fauna species, specific methods for targeting these species were employed in addition to the standard fauna survey methods of nocturnal spotlighting and habitat searches.

The methods used for the fauna survey, as detailed in Appendix I are as follows:

- Nocturnal spotlighting;
- Bat echolocation call detection;
- Arboreal and terrestrial mammal trapping using Elliott Type A & B traps and cage traps;
- Arboreal and terrestrial mammal habitat searches;
- Arboreal and terrestrial mammal hair tubing;
- "Spot Assessment Technique" to determine Koala habitation;
- Hollow tree density assessment;
- Amphibian searches;
- Habitat searches;
- Playback of recorded owl calls; and
- Diurnal and nocturnal bird surveys.

Details of the above surveys and weather conditions experienced during the survey periods are provided in Table 3.2. The results of these surveys are provided in Section 3.4 and Table 3.4. Fauna survey locations are shown in Figure 3.1. Additional information regarding specific methods used is provided in Appendix I.

Literature Review

A detailed review of local resource documents and a search of the Atlas of NSW Wildlife (NPWS 2008) was undertaken to identify records of threatened fauna species located within 10km of the subject site.

3.2 FAUNA HABITATS

The subject site contains a range of fauna habitats associated with the Forest variants, Heath and Sedgeland vegetation communities. The majority of the subject site has a history of disturbance through clearing, grazing and slashing and due to the regular and prolonged disturbance the habitats are of decreased value for locally occurring fauna species.

The nectar, seed, fruit and flower producing tree and shrub species of the Forest variants provide suitable foraging habitat for a range of locally occurring bird, arboreal mammal and bat species. The shrub and groundlayers of sections of the Forest variants have been removed and are of decreased value for fauna due to a lack of foraging and shelter opportunities. The hollow bearing trees of the Forest variants provide suitable roost, den and

breeding opportunities for a range of locally occurring bird, arboreal mammal and microchiropteran bat species. Quadrat data, as shown in Table 3.1, was used to survey the hollow tree abundance within the subject site.

TABLE 3.1
HOLLOW BEARING TREE DATA

	Total trees	Total trees with hollows	% Hollow Bearing Trees
Quadrat 1 (50m x 50m)	50	4	8%
Quadrat 2 (50m x 50m)	26	8	31%
Quadrat 3 (50m x 50m)	101	12	12%
Quadrat 4 (50m x 50m)	33	12	36%
Note: See Figure 3.1 for location of quadrats.			

The Heath Communities provide nectar foraging habitat for bird and mammals species within the various native shrubs. The less disturbed areas of Wet Heath provide shelter opportunities for a number of bird and terrestrial mammal species. This community is highly disturbed having suffered constant slashing, burning and grazing over a long period and was in a period of regrowth during the fauna survey.

The Wallum Heath and Sedgeland vegetation communities occur in low lying areas of the site and areas associated with habitats prone to periodic inundation and drying. These vegetation communities provide suitable habitat types for a range of amphibian species and limited habitat for small terrestrial mammal, wading bird and reptile species.

The aquatic habitats associated with Hearnes Lake provide suitable habitats for a range of aquatic and semi-aquatic fauna species. These aquatic habitats support a number of fish and wading bird species.

The movements of amphibians, reptiles terrestrial mammals and arboreal mammals through the subject site from other areas of suitable habitat are restricted by the presence of the Pacific Highway to the west, the beach and ocean to the east, residential development to the south, and Double Crossing Creek to the north. It is considered however that a thin line of connectivity exists along the coastal dunes within the lands zoned 6A Open Space Public Recreation in the east of the site.

TABLE 3.2 FAUNA SURVEY DETAILS				
Fauna Group	**Date**	**Weather Conditions**	**Survey Method**	**Survey Effort / Time (24hr)**
Diurnal Birds	15/12/03	8/8 cloud, 5k SE wind, light rain, 23-30^{0}C	Diurnal surveys/ Opportunistic sightings	3hrs 1400-1700
	16/12/03	8/8 cloud, 5k SE wind, no rain, 20-25^{0}C	Diurnal surveys/ Opportunistic sightings	4.5hrs 0630-1100
	16/12/03	2/8 cloud, 5k NE wind, no rain, 28-30^{0}C	Diurnal surveys/ Opportunistic sightings	3hrs 1400-1700
	17/12/03	2/8 cloud, 5k SE wind, no rain, 20-28^{0}C	Diurnal surveys/ Opportunistic sightings	4.5hrs 0630-1100
	17/12/03	0/8 cloud, 5k NE wind, no rain, 28-32^{0}C	Diurnal surveys/ Opportunistic sightings	3hrs 1400-1700
	16/8/04	1/8 cloud, 5k SE wind, no rain, 18^{0}C	Diurnal surveys/ Opportunistic sightings	5hrs 1100-1600
	17/8/04	2/8-8/8 cloud, 5k S wind, no rain 11-18^{0}C	Diurnal surveys/ Opportunistic sightings	4.5hrs 0630-1100
	17/8/04	2/8 cloud, 5k S wind, no rain 18^{0}C	Diurnal surveys/ Opportunistic sightings	2hrs 1430-1630
	18/8/04	8/8 cloud, no wind, light rain, 12^{0}C	Diurnal surveys/ Opportunistic sightings	3hrs 0730-1030
	19/8/04	8/8 cloud, light S wind, light rain, 12^{0}C	Diurnal surveys/ Opportunistic sightings	2hrs 0600-0800
	12/10/04	0/8 cloud, light NE wind, 30^{0}C.	Diurnal surveys/ Opportunistic sightings	3hrs 1300-1600
	13/10/04	0/8 cloud, light NE wind, 30^{0}C.	Diurnal surveys/ Opportunistic sightings	2hrs 0700-0900
	15/10/04	6/8 cloud, mod NE wind, 19^{0}C.	Diurnal surveys/ Opportunistic sightings	2hrs 0700-0900
	10/3/05	2/8 cloud, calm, 21^{0}C	Diurnal surveys/ Opportunistic sightings	3hrs 1000-1300
Nocturnal Birds	15/12/03	2/8-5/8 cloud, no wind, 20^{o}C, no moon (late)	Owl call playback & spotlight	40mins 2020 – 2100
	16/12/03	3/8 cloud, no wind, 19^{o}C, no moon (late)	Owl call playback & spotlight	40mins 2020 – 2100
	17/12/03	0/8 cloud, no wind, 23^{o}C, no moon (late)	Owl call playback & spotlight	40mins 2020 – 2100
	16/8/04	2/8 cloud, 5kSE wind, no rain 15^{0}C, ¼ moon	Owl call playback & spotlight	50min 1840-1930
	17/8/04	6/8 cloud, no wind, no rain 12^{0}C, ¼ moon	Owl call playback & spotlight	50min 1840-1930
	18/8/04	8/8 cloud, 5kSE wind, light rain 16^{0}C, ¼ moon	Owl call playback & spotlight	1.5hrs 1800-1930
	12/10/04	0/8 cloud, light NE wind, 0/4 moon, 20^{O}C	Owl call playback & spotlight	50min 1830-1720
	14/10/04	0/8 cloud, light NE wind, 0/4 moon, 20^{O}C	Owl call playback & spotlight	30min 1815-1845
	26/7/07	3/8 cloud, calm, 2/4 moon, 16 ^{O}C	Call listening	1 hr 1800-1900

TABLE 3.2 (Cont.)
FAUNA SURVEY DETAILS

Fauna Group	Date	Weather Conditions	Survey Method	Survey Effort / Time (24hr)
Arboreal Mammals	15/12/03	2/8-5/8 cloud, no wind, 20^{o}C, no moon (late)	Elliott trapping / hair tubing / spotlighting.	1hr 2030 – 2130
	16/12/03	3/8 cloud, no wind, 19^{o}C, no moon (late)	Elliott trapping / hair tubing / spotlighting.	1hr 2030 – 2130
	17/12/03	0/8 cloud, no wind, 23^{o}C, no moon (late)	Elliott trapping / hair tubing / spotlighting	1hr 2030 – 2130 75 trap nights (A Elliot traps) 45 hair tube nights
	16/8/04	2/8 cloud, 5kSE wind, no rain 15^{0}C, ¼ moon	Elliott trapping / spotlighting	1.75hrs 1800-1945
	17/8/04	6/8 cloud, no wind, no rain 12^{0}C, ¼ moon	Elliott trapping / spotlighting	2hrs 1800-2000
	18/8/04	8/8 cloud, 5kSE wind, light rain 16^{0}C, ¼ moon	Elliott trapping / spotlighting	1.75hrs 1800-1945 75 trap nights (A & B Elliott traps) **Total Trap Nights 150 Elliott** **45 Hair tube**
	12/10/04	6/8 cloud, light NE wind, 0/4 moon, 20^{O}C	Spotlighting	1hr 1820-1720
	14/10/04	0/8 cloud, light NE wind, 0/4 moon, 20^{O}C	Spotlighting	30min 1815-1845
	26/7/07	3/8 cloud, calm, 2/4 moon, 16 ^{O}C	Spotlighting	1 hr 1800-1900
Terrestrial Mammals	15/12/03	2/8-5/8 cloud, no wind, 20^{o}C, no moon (late)	Elliott trapping / hair tubing / Cage trap Spotlighting.	1hr 2030 – 2130
	16/12/03	3/8 cloud, no wind, 19^{o}C, no moon (late)	Elliott trapping / hair tubing / Cage trap Spotlighting.	1hr 2030 – 2130
	17/12/03	0/8 cloud, no wind, 23^{o}C, no moon (late	Elliott trapping / hair tubing / Cage trap Spotlighting.	1hr 2030 - 2130 75 trap nights (B Elliot) 45 hair tube nights 12 cage trap nights (Quoll traps)
	16/8/04	2/8 cloud, 5kSE wind, no rain 15^{0}C, ¼ moon	Cage & Elliott trapping / spotlighting	1.75hrs 1800-1945
	17/8/04	6/8 cloud, no wind, no rain 12^{0}C, ¼ moon	Cage & Elliott trapping / spotlighting	2hrs 1800-2000
	18/8/04	8/8 cloud, 5kSE wind, light rain 16^{0}C, ¼ moon	Cage & Elliott trapping / spotlighting	1.75hrs 1800-1945 75 trap nights (A & B Elliott traps) 30 cage trap nights **Total Trap Nights 150 Elliott** **45 Hair tube** **30 cage trap nights**
	12/10/04	0/8 cloud, light NE wind, 0/4 moon, 20^{O}C	Spotlighting	1hr 1820-1720
	14/10/04	6/8 cloud, light NE wind, 0/4 moon, 20^{O}C	Spotlighting	1.5 hr 1820-1950
	26/7/07	3/8 cloud, calm, 2/4 moon, 16 ^{O}C	Spotlighting	1 hr 1800-1900

TABLE 3.2 (Cont.) FAUNA SURVEY DETAILS				
Fauna Group	**Date**	**Weather Conditions**	**Survey Method**	**Survey Effort / Time (24hr)**
Bats	15/12/03	2/8-5/8 cloud, no wind, 20^{o}C, no moon (late)	Anabat II / Spotlighting	45mins - 2000-2045
	16/12/03	3/8 cloud, no wind, 19^{o}C, no moon (late)	Anabat II / Spotlighting	45mins - 2000-2045
	17/12/03	0/8 cloud, no wind, 23^{o}C, no moon (late)	Anabat II / Spotlighting	45mins - 2000-2045
	16/8/04	2/8 cloud, 5kSE wind, no rain 15^{0}C, ¼ moon	Anabat II / Spotlighting	1hr 1745-1845
	17/8/04	6/8 cloud, no wind, no rain 12^{0}C, ¼ moon	Anabat II / Spotlighting	1hr 1740-1840
	18/8/04	8/8 cloud, 5kSE wind, light rain 16^{0}C,no moon	Anabat II / Spotlighting	1hr 1740-1840
	12/10/04	0/8 cloud, light NE wind, 0/4 moon, 20^{O}C	Anabat II / Spotlighting	2.5hrs 1815-1730 x 2
	14/10/04	6/8 cloud, light NE wind, 0/4 moon, 20^{O}C	Anabat II / Spotlighting	Overnight Call activated 1815-0700
	26/7/07	3/8 cloud, calm, 2/4 moon, 16 ^{O}C	Spotlighting	1hr 1800-1700
Reptiles	15/12/03	8/8 cloud, 5k SE wind, light rain, 23-30^{0}C	Habitat search	3hrs 1400-1700
	16/12/03	8/8 cloud, 5k SE wind, no rain, 20-25^{0}C	Habitat search	4.5hrs 0630-1100
	16/12/03	2/8 cloud, 5k NE wind, no rain, 28-30^{0}C	Habitat search	3hrs 1400-1700
	17/12/03	2/8 cloud, 5k SE wind, no rain, 20-28^{0}C	Habitat search	4.5hrs 0630-1100
	17/12/03	0/8 cloud, 5k NE wind, no rain, 28-32^{0}C	Habitat search	3hrs 1400-1700
	16/8/04	1/8 cloud, 5k SE wind, no rain, 18^{0}C	Habitat search	5hrs 1100-1600
	17/8/04	2/8 cloud, 5k S wind, no rain 18^{0}C	Habitat search	2hrs 1430-1630
	18/8/04	8/8 cloud, no wind, light rain, 12^{0}C	Habitat search	1hr 0930-1030
	12/10/04	0/8 cloud, light NE wind, 30^{0}C.	Habitat search	3hrs 1300-1600
Amphibians	15/12/03	8/8 cloud, 5k SE wind, light rain, 23-30^{0}C	Habitat search / listening.	3hrs 1400-1700
	15/12/03	2/8-5/8 cloud, no wind, 20^{o}C, no moon (late)	Spotlighting / Call identification	1hr 2030 – 2130
	16/12/03	3/8 cloud, no wind, 19^{o}C, no moon (late)	Spotlighting / Call identification	1hr 2030 – 2130
	17/12/03	0/8 cloud, no wind, 23^{o}C, no moon (late)	Spotlighting / Call identification	1hr 2030 – 2130
	16-18/3/04	8/8 cloud, heavy rainfall.	Opportunistic call identification	10hrs (2x 5hrs)
	16/8/04	2/8 cloud, 5kSE wind, no rain 15^{0}C, ¼ moon	Spotlighting / Call identification	1.75hrs 1800-1945
	17/8/04	6/8 cloud, no wind, no rain 12^{0}C, ¼ moon	Spotlighting / Call identification	2hrs 1800-2000
	18/8/04	8/8 cloud, 5kSE wind, light rain 16^{0}C, ¼ moon	Spotlighting / Call identification	1.75hrs 1800-1945
	12/10/04	0/8 cloud, light NE wind, 0/4 moon, 20^{O}C	Spotlighting / Call identification	1hr 1820-1720
	26/7/07	3/8 cloud, calm, 2/4 moon, 16 ^{O}C	Spotlighting / Call identification	1hr 1600-1700

3.3 THREATENED FAUNA SPECIES

A search of the Atlas of NSW Wildlife (NPWS 2008) was undertaken to identify records of threatened fauna species located within 10km of the site. This revealed a number of threatened species that may be present in the area. Details on threatened fauna species (Schedule 1 or 2), which are known to occur within the area, are provided in Table 3.3. Any threatened oceanic species known to occur within the local area will not be included due to a lack of habitat within the subject site.

TABLE 3.3
RECORDED THREATENED FAUNA SPECIES OF THE AREA

Common Name ***Scientific Name***	**TSC Act**	**EPBC Act**	**Preferred Habitat**	**Comments**
Wallum Froglet *Crinia tinnula*	V	-	Found in acidic paperbark swamps and wallum country with dense groundcover. Breeds in temporary and permanent pools and ponds of high acidity. Distribution Limit- N-Tweed Heads S-Kurnell.	Suitable foraging and shelter habitat. Observed during surveys.
Wallum Sedge Frog *Litoria olongburensis*	V	V	Found in emergent vegetation of swamps and marshes, usually in acidic tannin-stained water. N-Tweed Heads S- Coffs Harbour	Suitable foraging and shelter habitat. Not observed during surveys.
Giant Barred Frog *Mixophyes iteratus*	E	E	Terrestrial inhabitant of rainforest and open forests. Distribution Limit- N-Border Ranges National Park. S-Narooma.	No suitable habitat. Not observed during surveys.
Green and Golden Bell Frog *Litoria aurea*	E	V	Prefers the edges of permanent water, streams, swamps, creeks, lagoons, farm dams and ornamental ponds. Often found under debris. Distribution Limit - N-Byron Bay. S-South of Eden	Sub-optimal foraging and breeding habitat. Not observed during surveys
Green-thighed Frog *Litoria brevipalmata*	V	-	Found in rainforests and open forests within or at the edge of streams, swamps, lagoons, dams and ponds. Distribution Limit - N-Border Ranges National Park. S-Near Gosford	Suitable foraging and shelter habitat. Not observed during surveys.
Freckled Duck *Stictonetta naevosa*	V	-	Occurs mainly within the Murray-Darling basin and the channel country within large cool temperate to sub-tropical swamps, lakes and floodwaters with cumbungi, lignum or melaleucas. Distribution Limit - N- Tenterfield. S-Albury.	Suitable foraging and roosting habitat. Not observed during surveys.
Black Bittern *Ixobrychus flavicollis*	V	-	Freshwater & brackish streams, swamps and sheltered mudflats. Distribution Limit – N-Tweed Heads. S-South of Eden.	Suitable foraging and roosting habitat. Not observed during surveys.
Australasian Bittern *Botaurus poiciloptilus*	V	-	Inhabits shallow freshwater or brackish wetlands with tall dense beds of reeds, sedges or rush species and swamp edges. Distribution Limit - N-North of Lismore. S-Eden.	Suitable foraging and roosting habitat. Not observed during surveys.

TABLE 3.3 (Cont.) RECORDED THREATENED FAUNA SPECIES OF THE AREA				
Common Name ***Scientific Name***	**TSC Act**	**EPBC Act**	**Preferred Habitat**	**Comments**
Black-necked Stork *Ephippiorhynchus asiaticus*	E	-	Occurs in tropical to warm temperate terrestrial wetlands, estuarine and littoral habitats. Distribution Limit - N-Tweed Heads. S-Nowra.	Suitable foraging and roosting habitat. Observed foraging during surveys.
Square-tailed Kite *Lophoictinia isura*	V	-	Utilises mostly coastal and sub-coastal open forest, woodland or lightly timbered habitats and inland habitats along watercourses and mallee that are rich in passerine birds. Distribution Limit - N-Goondiwindi. S-South of Eden.	Suitable foraging and roosting habitat. Not observed during surveys.
Osprey *Pandion haliaetus*	V	-	Utilises waterbodies including coastal waters, inlets, lakes, estuaries and offshore islands with a dead tree for perching and feeding. Distribution Limit - N-Tweed Heads. S-South of Eden.	Suitable foraging and roosting habitat. Observed flying across site during surveys.
Brolga *Grus rubicundus*	V	-	Inhabitats well vegetated shallow freshwater wetlands. Distribution Limit- N Tweed Heads. S- SW New South Wales	Suitable foraging and roosting habitat. Not observed during surveys.
Great Knot *Calidris tenuirostris*	V	-	Inhabits tidal mudflats, estuaries, shallow saline and freshwater swamps. N- Tweed Heads. S- Eden.	Suitable foraging and roosting habitat. Not observed during surveys.
Black-tailed Godwit *Limosa limosa*	V	-	A mainly coastal species feeding along estuarine mudflats, beaches, mangroves and lagoons. Distribution Limit - N-Tweed Heads. S-South of Eden.	Suitable foraging and roosting habitat. Not observed during surveys.
Comb-crested Jacana *Irediparra gallinacea*	V		Deep and permanent vegetation-choked tropical and warm temperate wetlands. Distribution Limit – N-Tweed Heads. S – Ku-ring-gai Chase National Park.	No suitable habitat present.
Bush Stone-curlew *Burhinus grallarius*	E	-	Utilises open forests and savanna woodlands, sometimes dune scrub, savannah and mangrove fringes. Distribution Limit- N-Border Ranges National Park S-Near Nowra.	Suitable foraging and roosting habitat. Not observed during surveys.
Beach Stone-curlew *Esacus neglectus*	E	-	Inhabits remote and secluded beaches, coral reefs and cays, mangrove fringes and estuarine mudflats. Distribution Limit - N-Tweed Heads. S-Shoalhaven River	Suitable foraging and roosting habitat. Not observed during surveys.
Sooty Oystercatcher *Haematopus fuliginosus*	V	-	Exclusively coastal in distribution foraging along rocky coastlines and estuaries. Distribution Limit- N-Tweed Heads S-South of Eden.	No suitable habitat present. Not observed during surveys.

TABLE 3.3 (Cont.) RECORDED THREATENED FAUNA SPECIES OF THE AREA				
Common Name ***Scientific Name***	**TSC Act**	**EPBC Act**	**Preferred Habitat**	**Comments**
Pied Oystercatcher *Haematopus longirostris*	V	-	Inhabits coastal beaches and estuarine flats. Distribution Limit N-Tweed Heads S-South of Eden.	Suitable foraging and roosting habitat. Not observed during surveys.
Little Tern *Sterna albifrons*	E	-	An almost exclusively coastal species inhabiting open beaches, sheltered inlets, estuaries and occasionally lakes. Distribution Limit- N-North of Tweed Heads. S-South of Eden.	Suitable foraging and roosting habitat. Not observed during surveys.
Wompoo Fruit-dove *Ptilinopus magnificus*	V	-	Inhabits large undisturbed patches of lowland and adjacent highland rainforest and moist eucalypt forests where it feeds on fruit. Distribution Limit - N-Tweed Heads. S-Sydney.	Sub-optimal foraging and roosting habitat present. Not observed during surveys.
Rose-crowned Fruit-dove *Ptilinopus regina*	V	-	Occurs in dense rainforests with a substantial understorey where it feeds entirely on fruit. Distribution Limit - N-Tweed Heads. S-Wollongong.	Sub-optimal foraging and roosting habitat present. Not observed during surveys.
Superb Fruit-dove *Ptilinopus superbus*	V	-	Rainforests, adjacent mangroves, eucalypt forests, scrubland with native fruits. Distribution Limit - N-Border Ranges National Park. S-Bateman's Bay.	Sub-optimal foraging and roosting habitat present. Not observed during surveys.
Gang-gang Cockatoo *Callocephalon fimbriatum*	V	-	Prefers wetter forests and woodlands from sea level to > 2000m on Divide, timbered foothills and valleys, timbered watercourses, coastal scrubs, farmlands and suburban gardens. Distribution Limit –mid north coast of NSW to western Victoria	Suitable foraging and roosting habitat. Not observed during surveys.
Glossy Black-Cockatoo *Calyptorhynchus lathami*	V	-	Open forests with *Allocasuarina* species and hollows for nesting. Distribution Limit – N-Tweed Heads. S-South of Eden.	Suitable foraging and roosting habitat. Evidence of presence observed during surveys.
Swift Parrot *Lathamus discolor*	E	E	Inhabits Eucalypt forests and woodlands with winter flowering Eucalypts. Distribution Limit – N-Border Ranges National Park. S-South of Eden.	Suitable foraging habitat present. Not observed during surveys.
Barking Owl *Ninox connivens*	V	-	Inhabits principally woodlands but also open forests and partially cleared land and rbanize hollows for nesting. Distribution Limits- N-Border Ranges National Park S-Eden	Suitable foraging and roosting habitat present. Not observed during surveys.

TABLE 3.3 (Cont.) RECORDED THREATENED FAUNA SPECIES OF THE AREA				
Common Name ***Scientific Name***	**TSC Act**	**EPBC Act**	**Preferred Habitat**	**Comments**
Powerful Owl *Ninox strenua*	V	-	Forests containing mature trees for shelter or breeding & densely vegetated gullies for roosting. Distribution Limits – N-Border Ranges National Park. S-Eden	Sub-optimal foraging and roosting habitat present. Not observed during surveys.
Grass Owl *Tyto capensis*	V	-	Inhabits grassland, coastal heath and lignum swamps, sheltering in dense grass tussocks by day. Distribution Limit - N-Tweed Heads. S-Lithgow.	Suitable foraging and roosting habitat present. Not observed during surveys.
Masked Owl *Tyto novaehollandiae*	V	-	Open forest & woodlands with cleared areas for hunting and hollow trees and dense vegetation for nesting and roosting. Distribution Limit – N-Border Ranges National Park. S-Eden.	Suitable foraging and roosting habitat present. Not observed during surveys.
Sooty Owl *Tyto tenebricosa*	V	-	Tall, dense, wet forests containing trees with very large hollows. Distribution Limit - N-Border Ranges National Park. S-South of Eden.	Suitable foraging and roosting habitat present. Not observed during surveys.
Collared Kingfisher *Todiramphus chloris*	V	-	Almost exclusively inhabits mangroves but also found in other coastal habitats including dune scrub and plantations. Distribution Limit - N-Tweed Heads. S-Foster.	Sub-optimal foraging and roosting habitat present. Not observed during surveys.
Brown Treecreeper *Climacteris picumnus victoriae*	V	-	Occupies Eucalypt woodlands, open woodland lacking a dense understorey with fallen dead timber. Distribution Limit. (Sub species *victoriae)* Central NSW west of Great Div. Cumberland Plains, Hunter Valley, Richmond, Clarence , and Snowy River Valleys.	Suitable foraging and roosting habitat present. Not observed during surveys.
Painted Honeyeater *Grantiella picta*	V	-	Found in open forest, woodland and scrubland feeding on mistletoe fruits. Distribution Limit- N-Boggabilla S-Albury.	Suitable foraging and roosting habitat present. Not observed during surveys.
Regent Honeyeater *Xanthomyza phrygia*	E	E	Found in temperate Eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature trees and winter flowering eucalypts. Distribution Limit – N-Urbanville. S-Eden.	Suitable foraging habitat present. Not observed during surveys.
Hooded Robin *Melanodryas cucullata cucullata*	V	-	Found in Eucalypt woodlands, *Acacia* scrubland, open forest, and open areas adjoining large woodland blocks, with areas of dead timber. Distribution Limit N – Central Qld S – Spencer Gulf SA	Suitable foraging and roosting habitat present. Not observed during surveys.

TABLE 3.3 (Cont.) RECORDED THREATENED FAUNA SPECIES OF THE AREA				
Common Name ***Scientific Name***	**TSC Act**	**EPBC Act**	**Preferred Habitat**	**Comments**
Grey-crowned Babbler *Pomatostoomus temporalis temporalis*	V	-	Found in dry open forests, woodland scrubland, farmland with isolated trees. Distribution Limit mostly west of Great Divide except Hunter Valley. N – Qld widespread S- Mornington pen. E- se SA	Suitable foraging and roosting habitat present. Not observed during surveys.
White-eared Monarch *Monarcha leucotis*			Inhabits rainforest margins/ regrowth, dense scrubs on streams, paperbarks, and mangroves adjacent to eucalypt forests. Distribution Limit N-Tweed Heads. S- Crowdy Bay NP. (Harrington).	Suitable foraging and roosting habitat present. Not observed during surveys.
Barred Cuckoo-shrike *Coracina lineata*	V	-	Rainforests, vine scrub and margins; eucalypt forests/woodlands; secondary growth in clearings, paperbarks, timber on watercourses, plantations and gardens. Distribution Limit. N- Tweed Heads. S- Port Macquarie	Suitable foraging and roosting habitat present. Not observed during surveys.
Common Planigale *Planigale maculata*	V	-	Utilises a range of habitats including rainforest, dry open forest, grasslands and marshland with dense groundcover, a deep litter layer and log debris. Distribution Limit- N-Walgett S-Sydney.	Suitable foraging and refuge habitat present. Not observed during surveys.
Spotted-tailed Quoll *Dasyurus maculatus*	V	V	Dry and moist open forests containing rock caves, hollow logs or trees within large areas of unfragmented habitat. Distribution Limit- N-Mt Warning National Park S-South of Eden.	Sub-optimal foraging and refuge habitat present. Not observed during surveys.
Brush-tailed Phascogale *Phascogale tapoatafa*	V	E	A largely arboreal mammal of open forests and woodlands using hollows as nesting in hollow bearing trees. Distribution Limit - N-Border Ranges National Park. S-Eden.	Sub-optimal foraging and refuge habitat present. Not observed during surveys.
Koala *Phascolarctos cinereus*	V	-	Inhabits both wet & dry Eucalypt forest on high nutrient soils containing preferred feed trees. Distribution Limit – N-Tweed Heads. S-South of Eden	Suitable foraging and refuge habitat present. Not observed during surveys.
Yellow-bellied Glider *Petaurus australis*	V	-	Tall mature eucalypt forests with high nectar producing species and hollow bearing trees. Distribution Limit- N-Border Ranges National Park. S-South of Eden.	Sub-optimal foraging habitat present. Not observed during surveys.
Squirrel Glider *Petaurus norfolcensis*	V	-	Mixed aged stands of eucalypt forest & woodlands including gum barked & high nectar producing species & hollow bearing trees. Distribution Limit - N-Tweed Heads S-Albury	Suitable foraging and den habitat present. Not observed during surveys.

TABLE 3.3 (Cont.) RECORDED THREATENED FAUNA SPECIES OF THE AREA				
Common Name ***Scientific Name***	**TSC Act**	**EPBC Act**	**Preferred Habitat**	**Comments**
Squirrel Glider *Petaurus norfolcensis*	V	-	Mixed aged stands of eucalypt forest & woodlands including gum barked & high nectar producing species & hollow bearing trees. Distribution Limit - N- Tweed Heads S-Albury	Suitable foraging and den habitat present. Not observed during surveys.
Long-nosed Potoroo *Potorous tridactylus*	V	V	Coastal heath and dry and wet sclerophyll forests with a dense understorey. Distribution Limit - N-Mt Warning National Park. S-South of Eden.	Suitable foraging and refuge habitat present. Not observed during surveys.
Black Flying-fox *Pteropus alecto*	V	-	Camps of the Black Flying-fox are often located in estuary Mangroves, often consisting of hundreds of thousands of individuals (Strahan 1995). Their preferred food is the blossom of eucalypts, paperbarks and turpentines, as well as a variety of other native and introduced blossoms and fruits. In NSW the Black Flying-fox is known to occur in the Northern Rivers Region.	Suitable foraging habitat present. Not observed during surveys.
Grey-headed Flying-fox *Pteropus poliocephalus*	V	V	Inhabits a wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests and cultivated areas.	Suitable foraging habitat present. Observed during surveys.
Common Blossom Bat *Syconycteris australis*	V	-	Roosts in dense foliage in rainforest and moist hardwood forests and forages for nectar and pollen in coastal forests and heaths. Distribution Limit - N-Tweed Heads. S-Foster	Suitable foraging habitat present. Not observed during surveys.
Eastern Freetail-bat *Mormopterus norfolkensis*	V	-	Inhabits open forests and woodlands foraging above the canopy and along the edge of forests. Roosts in tree hollows, under bark and buildings. Distribution Limit - N-Woodenbong. S-Pambula.	Suitable foraging and roosting habitat present. Observed foraging during surveys.
Hoary Wattled Bat *Chalinolobus nigrogriseus*	V	-	Hoary Wattled Bats are forest dwellers that roost in tree hollows in eucalypt trees. They have also been found to roost in rock crevices. (Churchill 1998). This species diet includes a wide range of insects and other invertebrates. (Allison 1995). Distribution – Qld to Northern NSW.	Suitable foraging and roosting habitat present. Not observed during surveys.
Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris*	V	-	Rainforests, sclerophyll forests and woodlands. Distribution Limit – N-North of Walgett. S-Sydney	Suitable foraging and roosting habitat present. Not observed during surveys.

TABLE 3.3 (Cont.) RECORDED THREATENED FAUNA SPECIES OF THE AREA				
Common Name ***Scientific Name***	**TSC Act**	**EPBC Act**	**Preferred Habitat**	**Comments**
Golden-tipped Bat *Kerivoula papuensis*	V	-	Rainforest and adjoining moist open forest habitats, roosting in tree hollows and dense vegetation. Distribution Limit- N- Border Ranges Nation Park. S-South of Eden.	Suitable foraging and roosting habitat present. Not observed during surveys.
Eastern False Pipistrelle *Falsistrellus tasmaniensis*	V	-	Recorded roosting in caves, old buildings and tree hollows. Distribution Limit- N-Border Ranges National Park S-Pambula	Suitable foraging and roosting habitat present. Not observed during surveys.
Little Bentwing-bat *Miniopterus australis*	V	-	Roosts in caves, old buildings and tree hollows in the higher rainfall forests along the south coast of Australia. Distribution Limit - N-Border Ranges National Park. S-Sydney.	Suitable foraging and roosting habitat present. Not observed during surveys.
Eastern Bentwing-bat *Miniopterus schreibersii oceanensis*	V	-	Prefers areas where there are caves, old mines, old buildings, stormwater drains & well timbered areas. Distribution Limit - N-Border Ranges National Park. S-South of Eden.	Suitable foraging habitat present. Not observed during surveys.
Large-footed Myotis *Myotis adversus*	V	-	Roosts in caves, mines, tunnels, buildings, tree hollows and under bridges. Forages over open water. Distribution limits - N - Border Ranges National Park, S - South of Eden.	Suitable foraging and roosting habitat present. Not observed during surveys.
Greater Broad-nosed Bat *Scoteanax rueppellii*	V	-	Inhabits areas containing moist river & creek systems especially tree lined creeks. Distribution Limit - N-Border Ranges National Park. S-Pambula.	Suitable foraging and roosting habitat present. Observed foraging during surveys.
Eastern Chestnut Mouse *Pseudomys gracilicaudatus*	V	-	Inhabits heathland including dense wet heath and swampy areas, occasionally in woodland with grassy understorey. Distribution Limit- N-Border Ranges National Park S-Brisbane Water National Park.	Suitable foraging and roosting habitat present. Not observed during surveys.
Common Name *Scientific Name*	TSC Act	EPBC Act	Preferred Habitat	Comments
Eastern Freshwater Cod *Maccullochella ikei*	E	E	Prefers clear flowing streams with rocky beds and deep holes. Distribution – Clarence and Richmond River systems.	No suitable habitat present.
Oxleyan Pygmy Perch *Nannoperca oxleyana*	E	E	Prefers swamps, creeks and lakes of coastal 'wallum'. Distribution N – QLD S – Woolgoolga. h.	Suitable habitat present.
V = Vulnerable E = Endangered				

3.4 FAUNA OBSERVED ON THE SITE

The fauna species observed within the subject site during surveys are listed within Table 3.4. Seven threatened fauna species as listed in Schedule 2 of the *Threatened Species Conservation Act* 1995 were recorded within the subject site during surveys. These species were:

- Wallum Froglet (*Crinia tinnula*);
- Black-necked Stork (*Ephippiorhyncus asiaticus*);
- Osprey (*Pandion haliaetus*);
- Glossy Black-Cockatoo (*Calyptorhynchus lathami*);
- Grey-headed Flying-fox (*Pteropus poliocephalus*);
- Eastern Freetail-bat (*Mormopterus norfolkensis*);
- Greater Broad-nosed Bat (*Scoteanax rueppellii*).

Wallum Froglets were detected calling from two low lying areas containing surface water during surveys in March 2004 following several days of rainfall. The location of these observations are shown in Figure 3.1 and include an area of Low Wallum Heath along the western areas of Hearnes Lake and a similar area of vegetation in the south-west part of the site where runoff from the Pacific Highway enters the site.

An individual Black-necked Stork was observed on the afternoon of 17 December 2003 roosting and foraging just north of the subject site within the sedge lands bordering Hearnes Lake. A single Black-necked Stork was also observed foraging within Hearnes Lake on 17 August 2004. No evidence of breeding by this species was detected within the subject site during surveys.

An individual Osprey was observed flying over the subject site on several occasions during surveys. A nesting pair of Osprey was observed nesting within a dead tree approximately 125m west of the subject site across the Pacific Highway during surveys conducted in August 2004. No evidence of nesting by this species within the subject site was detected.

Chewed *Allocasuarina* cones which are likely evidence of foraging by the Glossy Black-Cockatoo were observed during a site inspection on 26 October 2005. Chewed cones were observed within the open forest of the north western sector of the subject site.

The Grey-headed Flying-fox was observed flying over the site and foraging within the Swamp Sclerophyll Forest in the southern part of the site.

The Eastern Freetail-bat was detected foraging within the ecotone between the drainage line and the cleared area toward the southern end of the subject site during Anabat call detection surveys conducted on the evening of 16 December 2003.

The Greater Broad-nosed Bat was detected foraging within the ecotone between the drainage line and the cleared area and the Open Forest toward the southern end of the subject site during Anabat call detection surveys conducted on the evening of 12 October 2004.

The locations of threatened fauna species observed within the subject site are included within Figure 3.1.

TABLE 3.4 FAUNA SPECIES OBSERVED ON THE SITE AND ADJOINING AREAS				
Common name	***Scientific name***	**Dec 2003**	**Aug 2004**	**Oct 2004**
AMPHIBIANS				
Wallum Froglet [TS]	*Crinia tinula*		OPC+ (March 04)	
Eastern Common Froglet	*Crinia signifera*		C	
Bleating Tree Frog	*Litoria dentata*			C
Dwarf Tree Frog	*Litoria fallax*			C
BIRDS				
Brown Quail	*Coturnix ypsilophora*	O	OC	
Australian Wood Duck	*Chenonetta jubata*	OC		OC
Pacific Black Duck	*Anas superciliosa*	OC	O	
Grey Teal	*Anas gracilis*	OC		
Little Pied Cormorant	*Phalacrocorax melanoleucos*	O		O
Little Black Cormorant	*Phalacrocorax sulcirostris*	O	O	
Pied cormorant	*Phalacrocorax varius*	O	O	
Great Cormorant	*Phalacrocorax carbo*		O	O
Australian Pelican	*Pelecanus conspicillatus*	O	O	
Lewin's Rail	*Rallus pectoralis*			O
White-faced Heron	*Egretta novaehollandiae*	OC	O	
Little Egret	*Egretta garzetta*	O	O	
Great Egret	*Ardea alba*	O	O	O
Cattle Egret	*Ardea ibis*	O	O	O
Australian White Ibis	*Threskiornis molucca*	O	O	
Straw-necked Ibis	*Threskiornis spinicollis*		O	
Royal Spoonbill	*Platalea regia*	O		
Black-necked Stork [TS]	*Ephippiorhynchus asiaticus*	O	O	
Brahminy Kite	*Haliastur Indus*		OC	
Osprey [TS]	*Pandion haliaetus*	O	OC	O
White-bellied Sea-Eagle	*Haliaeetus leucogaster*		OC	
Brown Falcon	*Falco berigora*		O	
Masked Lapwing	*Vanellus miles*	OC	OC	
Silver Gull	*Larus novaehollandiae*	OC	OC	OC
Caspian Tern	*Sterna caspia*	OC		
Rock Dove *	*Columba livia*	OC	O	
Spotted Turtle-Dove *	*Streptopelia chinensis*	OC	O	OC
Crested Pigeon	*Ocyphaps lophotes*	O	OC	
Bar-shouldered Dove	*Geopelia humeralis*	OC	OC	OC
Peaceful Dove	*Geopelia striata*			O
Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*	OC	OC	OC
Glossy Black-Cockatoo [TS]	*Calyptorhynchus lathami*			Sc 10/05
Galah	*Cacatua roseicapilla*	OC	OC	OC
Rainbow Lorikeet	*Trichoglossus haematodus*	OC	OC	OC
Scaly-breasted Lorikeet	*Trichoglossus chlorolepidotus*	OC	OC	OC
Eastern Rosella	*Platycercus eximius*	OC	OC	OC
Channel-billed Cuckoo	*Scythrops novaehollandiae*	OC		
Common Koel	*Eudynamys scolopacea*	C		
Fan-tailed Cuckoo	*Cacomantis flabelliformis*	OC		
White-throated Needletail	*Hirundapus caudacutus*	O		
Laughing Kookaburra	*Dacelo novaeguineae*	OC	OC	OC
Sacred Kingfisher	*Todiramphus sanctus*	OC		OC
Rainbow Bee-eater	*Merops ornatus*	OC		

TABLE 3.4 (Cont.) FAUNA SPECIES OBSERVED ON THE SITE AND ADJOINING AREAS				
Common name	***Scientific name***	**Dec 2003**	**Aug 2004**	**Oct 2004**
BIRDS Cont.				
Dollarbird	*Eurystomus orientalis*	OC		OC
Superb Fairy-wren	*Malurus cyaneus*	OC	OC	OC
Variegated Fairy-wren	*Malurus lamberti*	OC		
Weebill	*Smicromis brevirostris*	OC		
White-throated Gerygone	*Gerygone olivacea*	OC		OC
Brown Thornbill	*Acanthiza pusilla*	OC	OC	OC
Red Wattlebird	*Anthochaera carunculata*	OC	OC	OC
Little Wattlebird	*Anthochaera chrysoptera*	OC	OC	OC
Noisy Friarbird	*Philemon corniculatus*	OC	OC	OC
Blue-faced Honeyeater	*Entomyzon cyanotis*	OC	OC	OC
Noisy Miner	*Manorina melanocephala*	OC	OC	
Lewin's Honeyeater	*Meliphaga lewinii*	O	OC	OC
Yellow-faced Honeyeater	*Lichenostomus chrysops*	OC	OC	OC
Brown Honeyeater	*Lichmera indistincta*	OC	OC	OC
White-naped Honeyeater	*Melithreptus lunatus*	OC	OC	
White-cheeked Honeyeater	*Phylidonyris nigra*	OC	OC	OC
Eastern Spinebill	*Acanthorhynchus tenuirostris*	OC	OC	OC
Scarlet Honeyeater	*Myzomela sanguinolenta*		OC	OC
Eastern Whipbird	*Psophodes olivaceus*	OC	O	O
Varied Sittella	*Daphoenositta chrysoptera*	OC	OC	OC
Rufous Whistler	*Pachycephala rufiventris*	OC	OC	OC
Grey Fantail	*Rhipidura fuliginosa*	OC	OC	OC
Willie Wagtail	*Rhipidura leucophrys*	OC	OC	OC
Leaden Flycatcher	*Myiagra rubecula*			OC
Magpie-lark	*Grallina cyanoleuca*	OC	OC	OC
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	OC	OC	OC
Cicadabird	*Coracina tenuirostris*	O		
White-winged Triller	*Lalage sueurii*	OC		
Olive-backed Oriole	*Oriolus sagittatus*	OC	OC	OC
White-breasted Woodswallow	*Artamus leucorynchus*	OC	OC	OC
Grey Butcherbird	*Cracticus torquatus*	OC	OC	
Pied Butcherbird	*Cracticus nigrogularis*	OC	OC	OC
Australian Magpie	*Gymnorhina tibicen*	OC	OC	OC
Pied Currawong	*Strepera graculina*	OC	OC	OC
Australian Raven	*Corvus coronoides*	OC	OC	OC
Spangled Drongo	*Dicrurus bracteatus*			OC
Double-barred Finch	*Taeniopygia bichenovii*	OC		
Red-browed Finch	*Neochmia temporalis*	OC	OC	
Tawny Grassbird	*Megalurus timoriensis*			OC
Golden-headed Cisticola	*Cisticola exilis*	OC		
Welcome Swallow	*Hirundo neoxena*	O	OC	OC
REPTILES				
Garden Skink	*Lampropholis guichenoti*	OS		OS
Eastern Blue Tongue	*Tiliqua scincoides*	OS		
Bearded Dragon	*Pogona barbata*	OS		

TABLE 3.4 (Cont.) FAUNA SPECIES OBSERVED ON THE SITE AND ADJOINING AREAS				
Common name	***Scientific name***	**Dec 2003**	**Aug 2004**	**Oct 2004**
MAMMALS				
Eastern Grey Kangaroo	*Macropus giganteus*		O, Sp	O, Sp
Common Brushtail Possum	*Trichosurus vulpecula*	E	Sp	Sp
Grey-headed Flying-fox	*Pteropus poliocephalus*			
Gould's Wattled Bat	*Chalinolobus gouldii*	A	A	A
Eastern Freetail-bat TS	*Mormopterus norfolkensis*	A		
Freetail-bat	*Mormopterus spp 2*	A	A	
Greater Broad-nosed Bat TS	*Scoteanax ruppellii*			A
Broad-nosed Bat	*Scotorepens spp.*	A		A
Eastern Forest Bat	*Vespadelus pumilus*	A		
Eastern Broad-nosed Bat	*Scotorepens orion*	A		
Horse*	*Equus caballus*	O		
Cow*	*Bos Taurus*	O	O	O
Cat*	*Felis cattus*	O Sp		
Dog*	*Canis familiaris*	O	OC	OC

Key to Methods of Observation

O	-	Observation	S	-	Search
C	-	Call identification	A	-	Anabat II
Sp	-	Spotlight	Sc	-	Scat, Track or Sign
E	-	Elliott Trap	OP	-	Opportunistic Observation

Note: * indicates introduced species
TS indicates threatened species
+ Species identification not yet confirmed

3.5 ENDANGERED FAUNA POPULATIONS

The Emu *(Dromaius novaehollandiae)* within the NSW North Coast Bioregion has been listed as an endangered population in Part 2 of the TSC Act (1995). This species occupies a range of predominantly open habitats, including plains, grasslands, woodlands and shrubs, and may occur occasionally in forests (TSC Act (1995) Scientific Committee 2001).

The habitat conditions favoured by this species are present within the subject site. However due to the restrictions to animal movements caused by the Pacific Highway to the west the ocean to the east, residential development to the south and Double Crossing Creek to the north the subject site provides only limited habitat potential for this species. This species was not observed during surveys. Due to the low habitat value, isolated nature of the site and lack of observations during surveys it is not likely that this species is present within the subject site.

3.6 KOALA HABITAT ASSESSMENT

The subject site was assessed for activity by Koalas using the following methods:

i. A search of the Atlas of NSW Wildlife (NPWS 2008)

ii. The Spot Assessment Technique for determining the significance of habitat utilisation by Koalas (Phillips & Callaghan 1995) was conducted over fourteen (14) 20x20m quadrats with all trees within the quadrats inspected for signs of Koala use. Trees

within each quadrat were identified and inspected for sightings, indicative scratches on the trunk and droppings around the base of each tree.

iii. Koalas were also targeted during spotlight surveys.

A detailed Koala Habitat Assessment is provided in Appendix V. The Coffs Harbour Council Koala Plan of Management (1999) has mapped areas within the site as containing Secondary Koala Habitat. These areas generally correspond to the occurrence of some Open Forest variant vegetation communities on the site. The subject site also contains a number of tree species identified within the Coffs Harbour LGA as preferred tree species. These are *Eucalyptus microcorys* (Tallowwood), *Eucalyptus grandis* (Flooded Gum), *Eucalyptus pilularis* (Blackbutt), *Eucalyptus robusta* (Swamp Mahogany), *Eucalyptus tereticornis* (Forest Red Gum) and *Melaleuca quinquinervia* (Broad-leaved Paperbark).

Koala scat and track searches were carried out at 14 locations within the subject site. The locations of these targeted searches are included within Figure 3.1. No koalas were observed during spotlight surveys. No evidence of use of the site by Koalas was observed during these targeted track and scat searches. There are no records for the Koala within the subject site (NPWS 2008). There are nine records for the Koala within five kilometres of the subject site. These are all north of the site and west of the Pacific Highway at Darkum Creek, upper Mooney Creek, Johnsons Road and Wedding Bells State Forest (NPWS 2008).

The quality of the subject site in terms of Koala habitat is decreased by the isolation of the site from larger areas of habitat to the west. The presence of the Pacific Highway at the western boundary of the subject site presents a barrier to movement of Koalas into the site from the west. Partial isolation from similar vegetation and habitat to the south exists due to the presence of residential development at the southern boundary of the subject site.

It is considered that while the subject site contains suitable Koala feed trees and contains areas of Open Forest mapped as Secondary Koala Habitat within the Coffs Harbour City Koala Plan of Management (Lunney et al 1999) the presence of this species within the site is unlikely. This is due to the lack of records for this species within the site (NPWS 2008), the absence of presence or signs of presence of this species during surveys carried out by *Conacher Travers* and the barrier of movement to and the biogeographical isolation of the site due to the presence of the Pacific Highway and fragmented state of the local vegetation and landscape.

SECTION 4

ASSESSMENT CONSIDERATIONS

4.1 IMPACT ON VEGETATION AND FAUNA HABITATS

Vegetation Removal
The large majority of the subject site has a history of disturbance including grazing, slashing, clearing and burning. The development proposes the removal of vegetation for the construction of residential dwellings and associated services.

Based on the concept plan the proposed development will require approximately 27 hectares of vegetation to be removed or modified. The concept plan proposes the retention, protection and management of approximately 21 hectares of higher quality vegetation including those areas of the endangered ecological communities Coastal Saltmarsh and areas of Swamp Sclerophyll Forest on Coastal Floodplains.

The removal of vegetation will result in a decrease in the amount of vegetation within the local area. However, it must be noted that in its current condition the vegetation within the site is of low quality due to its exiting use and high level of disturbance. An assessment of the vegetation within the site giving regard to its historic use is provided in Appendix VI.

An Ecological Site Management Strategy will be prepared for the long term protection of those areas to be conserved within the site. This management plan will include detailed management objectives and actions for the long term protection and restoration of retained areas. This will include detailed vegetation management strategies and actions including weed removal and replanting.

Habitat Removal
The removal or modification of habitats as part of the concept proposal will result in a decrease in the amount of habitat within the site and local area. Future development of the subject site will require removal of native trees that provide suitable foraging, breeding and refuge habitat for locally occurring fauna species. In this instance ameliorative compensatory measures, as detailed within the Ecological Site Management Strategy, will be provided.

The removal of habitats may result in local decreases in biodiversity due to the decrease in habitat extent and type. However, the development proposes the removal of the more disturbed habitat areas within the site and retention and restoration of the higher quality vegetation and habitat types within the lower lying areas associated with Hearnes Lake.

The development proposes the retention of vegetation and habitats as part of Open Space and drainage reserve areas. A buffer of variable width will be retained around the shore of Hearnes Lake protecting the ecological values within the lake. The retention and protection of Hearnes Lake and its shoreline areas along with the retention of other bushland and drainage areas within the site are likely to continue to provide habitats for locally occurring flora and fauna species. This will include the retention of suitable habitat areas within the site for those threatened fauna species observed within the site during surveys.

Corridors and Habitat Fragmentation
Areas in the east of the site are mapped as regional corridors in the NPWS Regional Corridors and Key Habitats mapping. The mapped regional corridor within the east of the site is part of a regional corridor that extends from Moonee Beach Nature Reserve northward along the coast to Yuraygir National Park. This mapped regional corridor includes residential

areas within Sandy Beach and Woolgoolga. The area occupied by Hearnes Lake is mapped as key habitats within this mapping.

The site is part of a fragmented local landscape. There are larger areas of higher quality vegetation to the south of the site located on the southern side of the Sandy Beach residential area. These vegetation and habitats are part of Moonee Beach Nature Reserve. There are similar disturbed vegetation and habitat types to the west of the site on the western side of the Pacific Highway. There are small areas of vegetation and habitats associated with Double Crossing Creek that extend to the southern side of Woolgoolga.

Given the high amount of disturbance within the site including lack of continuous canopy cover and absence of understorey and groundcover in most areas the subject sites value as a local movement area is low.

The site is isolated from similar habitats to the west by the Pacific Highway. The site is bordered to the south by the residential area of Sandy Beach which interrupts any connectivity to/from the south. The dune vegetation in the east of the site forms part of a tenuous connection to vegetation to the south of the site along the immediate dune and hind dune area to north of the site. The retention of vegetation within reserve areas to the east of the site will maintain any connectivity along the dunal system between areas to the south and north of the site.

Impacts and Modification of Off-Site Habitats
Modification of off-site habitats can result from a change of land use, particularly when the land use activity is intensified. Off-site impacts are generally typified by:

- increased edge effects;
- changed hydrological regimes;
- decreased water quality.

Increased edge effects are likely to be an issue for those vegetation types to be retained in the east of the site around Hearnes Lake. Edge effects may include the following:

- increased access to sensitive areas (vehicular/pedestrian/domestic animals);
- weed infestation from adjoining areas;
- surface water runoff;
- nutrient runoff;
- rubbish dumping;
- clearing of vegetation margins.

To decrease edge effects buffers are often used as a form of impact minimisation from adjacent use. A buffer of variable width will be established around the shoreline of Hearnes Lake.

Changed hydrological regimes and decreased water quality (increased nutrients) in surface water runoff can be controlled through the appropriate use of stormwater controls, water retention basins and artificial wetlands. These measures are generally incorporated into the landscaping and stormwater design plans for future developments.

4.2 IMPACTS ON THREATENED SPECIES

An assessment of the potential impact of the proposed development on the habitats or populations of threatened species is provided below.

No threatened flora species as listed within the *Threatened Species Conservation Act 1995* were recorded within the subject site. Seven threatened fauna species the Wallum Froglet (*Crinia tinnula*), Black-necked Stork (*Ephipioryhnchus asiaticus*), Osprey (*Pandion haliatus*), Glossy Black-cockatoo (*Calyptorhynchus lathami*), Grey-headed Flying-fox (*Pteropus poliocephalus*), Greater Broad-nosed Bat (*Scoteanax rueppellii*) and Eastern Freetail-bat (*Mormopterus norfolkensis*) were observed within the subject site during surveys. A number of habitats that may support other threatened fauna Two endangered ecological communities Coastal Saltmarsh and Swamp Sclerophyll Forest on Coastal Floodplains was observed within the subject site.

An assessment of these threatened fauna species and endangered ecological communities present or with potential habitat present within the site is provided below. While a number of threatened flora species have been identified as having suitable habitat within the site, assessments have not been completed due to a lack of any observations during extensive flora surveys of the site. As such it is considered that no threatened flora species are likely to be present within the subject site.

Threatened Fauna

Wallum Froglet (*Crinia tinnula*)
The Wallum Froglet is generally found within the acidic paperbark swamps and wallum country. This species utilises different habitats for refuge and breeding. Refuge habitat consists of dense groundcover interspersed with tree canopy cover. The Wallum Froglet does not utilise open or free water swamps, preferring the vegetated, muddy edges of temporary and permanent pools. Breeding usually occurs in ephemeral sites such as larger puddles in heath and larger puddles along watercourses and creeklines (White 1995).

In NSW this species has a northern limit at Tweed Heads and a southern limit at Kurnell (NPWS 1999). This species has a patchy distribution throughout its range.

Within the North Coast Bioregion the Wallum Froglet has a relatively continuous coastal distribution north from Port Stephens to the QLD Border. This species is known to occur within Broadwater, Bundjalung, Myall Lakes and Yuraygir National Parks and Limeburners Creek Nature Reserve.

Within the Coffs Harbour area this species has been recorded at Corindi, Boambee Creek and Newports Creek (NPWS 2008). This species has also been recorded at Red Rock, Orara River and Coffs Harbour Botanic Gardens (Ehmann 1997).

The Wallum Froglet was opportunistically observed within the subject site during flora surveys after rain in March 2004 and March 2005. The calls heard opportunistically were restricted to the Wallum Heath vegetation community.

The Wallum Heath vegetation within the subject site provides suitable breeding, shelter and foraging habitat for the Wallum Froglet. Based on the opportunistic identification of this species while calling after heavy rain it is difficult to give an estimate of the number of individuals within the site. It is considered that the calling male individuals observed within the site are part of a local population that is periodically restricted to Wallum Heath areas however may disperse into other inundated vegetation communities within the subject site during periods of local flooding and inundation.

The development proposes the retention of areas of suitable habitat within the subject site for this species. Additionally the implementation of water quality control measures is proposed to ensure that the quality of runoff water is appropriately managed. These

measures also include the provision of bio-retention swales that may provide areas of compensatory habitat.

Green Thighed Frog (*Litoria breviplamata*)
The Green-thighed Frog has been found in mostly terrestrial habitats including along the grassy margins of semi-permanent and permanent ponds in late spring and summer (Cogger 2000), rainforests, moist open forest (Robinson 1993), drier open forest and woodland (McDonald 1974, Nattrass & Ingram 1993), coastal swamp forest and along the perimeter of flooded paddocks (Barker et. al. 1995).

The subject site contains suitable foraging and breeding habitat for this species. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable habitat for amphibian species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Wallum Sedge Frog (*Litoria olongburensis*)
The Wallum Sedge Frog is mostly found along creeks and in marshy or swampy lowland habitats amongst emergent vegetation and reeds. This species is commonly found within wallum type vegetation (Cogger 1999).

The subject site contains suitable foraging and breeding habitat for this species. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable habitat for amphibian species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Green and Golden Bell Frog (*Litoria aurea*)
The Green and Golden Bell Frog is largely aquatic and is found among vegetation within or at the edges of permanent water. It is frequently active during the day and can be found under debris on low, frequently flooded river flats (Cogger 1992).

The subject site contains suitable foraging and breeding habitat for this species. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable habitat for amphibian species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Freckled Duck *(Stictonetta naevosa)*
The Freckled Duck is often located within large, well vegetated permanent fresh swamps and in dry period's moves to fresh or salty permanent open lakes. The Freckled Duck roosts in lignum clumps, overhanging tea-tree branches, flood debris or old nest of Coot. Breeding takes place from September to December or after suitable rainfall. The Freckled Duck disperses to coastal areas in southeast Australia and northern Australia as a summer / winter visitor.

The subject site contains suitable foraging and breeding habitat for this species. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable habitat for amphibian species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the

local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Black Bittern (*Dupetor flavicollis*)
This species is largely confined to the margins of wetlands and quiet watercourses flowing through coastal forest, woodland, mangroves and Melaleuca swamps and forages along the shallow margins of woodland watercourses. A solitary, apparently sedentary and secretive bird that rests in riparian vegetation during the day, emerging at dusk and dawn to. This species is often found in shadowy, leafy waterside trees such as callistemon, casuarinas, paperbarks, eucalypts, mangroves, willows, and also tidal creeks, sheltered mudflats and oyster-slats.

The subject site contains suitable foraging, breeding and shelter habitat for this species. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable habitat for this species within the site including the shoreline areas around Hearnes Lake. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Australasian Bittern (*Botaurus poiciloptilus*)
The Australasian Bittern 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. Specific microhabitat vegetation examples include Phragmites, Eleocharis, Juncus, Typha, Baumea, Gahnia, and Bolboshoenus species.

The subject site contains suitable foraging, breeding and shelter habitat for this species. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable habitat for this species within the site including the shoreline areas around Hearnes Lake. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

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 and Higgins 1990). This species feed mainly on fish but will also eat reptiles, frogs, crabs, insects, rodents and carrion (Schodde & Tidemann 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). This species utilises a range of waterbodies including extensive areas of shallow water over grassland and sedgeland, shallow swamps with small emergent vegetation and abundant aquatic life, permanent billabong's and pools on floodplains, freshwater meadows, wet heathland, semi-permanent swamps with tall emergent vegetation and occasionally in small artificial waterbodies such as farm dams, irrigation storages and sewage ponds (Marchant & Higgins 1990).

The Black-necked stork is known in coastal areas from the Hunter River to the QLD border. The majority (>90%) of the NSW population of the species occurs in the Richmond and Clarence River valleys (DECC 2007). The Black-necked Stork is distributed around the north and east coasts of Australia, occurring as a rare vagrant in Victoria (Schodde & Tidemann 1986). In NSW this species has a northern limit at Tweed Heads and a southern limit at Nowra.

There are 34 recent records for the Black-necked Stork within the Coffs Harbour 100,000 map sheet area (NPWS 2008). These records extend from Corindi to south of Bonville. Eight of these records occur within a five kilometre radius of the subject site.

The Black-necked Stork was observed on two occasions within the subject site by *Conacher Travers* (2007) in September 2003 and August 2004. An individual bird was observed foraging south of the subject site in December 2003. A single bird was also observed foraging within Hearnes Lake in August 2004. It is likely that these records are of the same individual as adults are known to be sedentary showing fidelity to particular habitat areas.

The subject site contains suitable foraging and potential breeding habitat for the Black-necked Stork. It is likely that an individual of this species uses the aquatic habitats within the subject site for foraging and refuge as part of regular migratory movements. No evidence of breeding was observed within the subject site.

The development proposes the retention of areas of suitable habitat within the subject site for this species. This includes a buffer area around the shoreline of Hearnes Lake. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Square-tailed Kite *(Lophoictinia isura)*
The Square-tailed Kite is a specialist predator of the canopy. It hunts primarily over open forest, woodlands and mallee communities that are rich in birds, especially honeyeaters, as well as over adjacent heaths and other low scrubby environments. It prefers a landscape that is structurally diverse (Garnett & Crowley, 2000). This species is more common in coastal areas (NPWS 1999).

The subject site contains suitable foraging and roosting habitat for this species. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Osprey *(Pandion haliaetus)*
The Osprey is generally found in association with waterbodies including coastal waters, inlets, lakes, estuaries, beaches, offshore islands and sometimes along inland rivers (Schodde & Tidemann 1986; Clancy 1991; Olsen 1995). These habitat locations usually have a sufficient supply of fish for food and possible nesting sites (Clancy 1991). Osprey may nest on the ground on sea cliffs or in trees (Olsen 1995). Osprey generally prefer emergent trees, often dead or partly dead with a broken off crown (Olsen 1995).

Within the North Coast Bioregion the Osprey has been recorded in Booti Booti, Broadwater, Bundjalung, Hat Head and Yuraygir National Parks and Broken Head, Iluka and Limeburners Creek Nature Reserves.

A search of the Atlas of NSW Wildlife (NPWS 2008) reveals 106 records for this species within the Coffs Harbour 1:100,000 map sheet. The distribution of this species within the map sheet area is strictly coastal and widespread from Arrawarra Headland in the north to Urunga in the south.

Within the local area this species has been observed at Sandy Beach, Moonee Beach, Woolgoolga, Woolgoolga Lake, Darkum Creek and Arrawarra (NPWS 2008).

An Osprey was observed during surveys conducted in December 2003 flying over the subject site carrying nesting material. A single Osprey, one of a known pair, was also observed on several occasions flying over the subject site during August and October 2004 surveys. No evidence of nesting by this species within the subject site was detected.

This single bird is most likely part of a pair of Osprey observed nesting within a dead tree approximately 125m west of the subject site across the Pacific Highway during surveys conducted in August 2004. The male bird has also selected a large dead tree, which is approximately 50m west of the subject site adjacent to the Pacific Highway as a roost tree where he has been observed preparing captured fish for presentation to the female bird on the nest. A nest tree was recently observed on the western side of the Pacific Highway at Emerald Beach (*Conacher Environmental Group pers. obs.* 2008) .

The habitat surrounding the nest site is similar in vegetation structure to large areas of the subject site. The local area contains large areas of suitable habitat for this species. The development proposes the retention of areas of suitable habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Brolga (*Grus rubicundus*)
The Brolga inhabits terrestrial wetlands, grasslands and woodlands of tropical and temperate Australia; less common in arid and semi-arid regions. In NSW this species prefers suitable habit along major river systems on the north west slopes of the Great Dividing Range and Riverina. This species is considered rare east of Great Dividing Range and central districts between Darling, Bogan and Lachlan Rivers, and west of Darling River. Brolga's are partly migratory with some dispersive movements. In northern Australia, regularly moving between dry-season refuges and wet season breeding sites (Marchant & Higgins 1993).

The subject site contains suitable foraging habitat for this species. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Great Knot *(Calidris tenuirostris)*
The Great Knot is a non-breeding migratory bird, which breeds in far north-eastern Siberia and winters from southern China west to Pakistan and south to Australia, where it occurs mainly from October to March. This species prefers mudflats, sandy ocean and bay shores, estuaries, shallow saline and freshwater wetlands. A small portion of individuals have been recorded in inland fresh and salt-water lakes (NPWS 1999).

The subject site contains suitable foraging habitat for this species. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Black-tailed Godwit (*Limosa limosa*)
The Black-tailed Godwit is a migratory species that inhabits tidal mudflats, estuaries, sandspits, shallow river margins, sewage ponds; inland on large shallow fresh or brackish waters.

The subject site contains suitable foraging habitat for this species. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

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 areas.

The subject site contains suitable foraging and shelter habitat for this species. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Beach Stone-curlew (*Esacus negelctus*)

Beach Stone-curlews occupy beaches of all types, short stretches of muddy sand among mangroves, coralline sands on atolls and prime surf beaches. This species is primarily a nocturnal, gregarious and cryptic species. Particularly favoured are beaches associated with estuaries or near mangroves. As its habitat is essentially linear it occurs at a low density, therefore local extinctions can quickly become regional ones. (Garnett 1993).

The subject site contains suitable foraging and shelter habitat for this species. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Sooty Oystercatcher (*Haematopus fuliginosus*)

The Sooty Oystercatcher is widespread along the eastern, southern and western coastline of Australia and many off-shore Islands. The Sooty Oystercatcher inhabits intertidal rocky and coral reefs mostly on ocean shores, occasionally frequenting sandspits and tidal mudflats (Pizzey, 1997).

The subject site contains suitable foraging habitat for this species. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Pied Oystercatcher (*Haematopus longirostris*)

The Pied Oystercatcher occurs mostly in tidal areas. More commonly found on undisturbed sandy, shellgrit or pebble beaches; sandpits and sandbars, tidal mudflats and estuaries, and coastal islands. Occasionally found on rocky reefs, shores, rock stacks; brackish or saline wetlands; grassy areas. It probes for worms in wet short grass.

The subject site contains suitable foraging habitat for this species. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Little Tern (*Strena albifrons*)
This species inhabits shelter coastal lagoons, estuaries, river mouths, bays harbours of coastal eastern and northern Australia and New Zealand, especially those with exposed sandbanks or spits (Higgins & Davies 1996). They forage above shallow waters plunging into the water to take fish and crustaceans (Higgins & Davies 1996). Little Terns nest in colonies on sand spits and the banks of lakes, estuaries and ocean beaches nesting on bare scrapes on the ground (Higgins & Davies 1996). This species suffers severe nest loss through human activities and predation from foxes and cats.

The subject site contains suitable foraging habitat for this species. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

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).

The subject site contains an area of low quality habitat for this species. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

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. In NSW this species is widespread in NE, in Northern Rivers, Northern Tablelands, and Mid-North Coast Regions. 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).

The subject site contains an area of low quality habitat for this species. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Gang-gang Cockatoo (*Callocephalon fimbriatum*)
A relatively small, dark grey Cockatoo that 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, 2001). This species has been observed in eucalypt forests and exotic trees (Morris 1997), 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). The Gang-gang Cockatoo nests in hollows in large, dead trees (NSW Scientific Committee, 2001).

The subject site contains an area of low quality habitat for this species. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Superb Frit-dove (*Ptilinopus poliocephalus*)
The Superb Fruit-dove lives mainly within rainforests but will feed in adjacent mangroves or Eucalypt forests (Blakers *et al.* 1984). Nests are well hidden within the rainforest habitat and are built in trees from 10 to 30m off the ground (Recher *et al.* 1995). The nest consists of a flimsy structure of twigs, constructed in the fork of a branch.

The subject site contains an area of low quality habitat for this species. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

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 casuarinas. Foraging within Casuarinas tends to be concentrated on trees with greater crops of cones (Clout 1989). This species nests in large trees with large hollows (dead and alive). The Glossy Black-Cockatoo usually forages close to the nest but is capable of travelling up to 20km away thus requiring a water source (Environment Australia 2000). The Glossy Black-Cockatoo breeds only in Autumn –Winter (NPWS, 1999).

Chewed *Allocasuarina* cones, likely evidence of Glossy Black-Cockatoo foraging, were detected within the north western sector of the site during a site inspection on October 26 2005. This species has also been recorded throughout the coastal areas of NSW from Tweed Heads to south of Eden.

Within the North Coast Bioregion this species has been recorded within a relatively large number of conservation reserves including Barrington Tops, Border Rangees, Bundjalung, Crowdy Bay, Dorrigo, Guy Fawkes River, Hat Head, New England, Nymboida, Oxley Wild Rivers, Washpool, Werrikimbe, Woko and Yuraygir National Parks.

There are a relatively large number of records (47) for this species locally (NPWS 2008). The Glossy Black-Cockatoo has been recorded throughout the local area in areas where Allocasuarina species are present.

The NSW Bird Atlases (48) and Birds Australia (10) also record a relatively large number of records for this species locally. This species has been recorded on several occasions within the locality in the Sandy Beach, Emerald Beach, Arrawarra, Woolgoolga area.

The subject site contains suitable foraging habitat for this species within the *Allocasurina litttoralis* present. The Atlas of NSW Wildlife (NPWS 2008) has recorded an observation of this species within the subject site dating back to 1987. Evidence of foraging by this species was detected within the subject site during surveys. Council officers have identified that the Glossy Black-Cockatoo has been observed foraging on the subject site. The development proposes the retention and replanting of areas of suitable habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Swift Parrot *(Lathamus discolor)*
The Swift Parrot inhabits eucalypt forests. The Box-Ironbark woodlands west of the Great Dividing Range are particularly favoured, however other flowering eucalypts will be utilised by this bird. During winter in New South Wales the Swift Parrot inhabits eucalypt forests and woodlands foraging on winter flowering eucalypts.

The subject site contains suitable foraging habitat for this species within the winter flowering tree species present. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

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, Peter & Steele (Eds) 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).

The subject site contains suitable foraging habitat for this species within the winter flowering tree species present. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Powerful Owl (*Ninox strenua*)
The Powerful Owl inhabits mature rainforest and wet and dry eucalypt forest (Schodde Tidemann 1986). Large trees with hollows at least 0.5m deep are required for shelter and breeding (Schodde *et al.* 1980; SWC Consultancy 1993). Mated pairs of Powerful Owl roost together or separately, maintaining several roost sites throughout their territory which are used in rotation (Lindsey 1992), shifting with the availability of prey. Powerful Owls form pairs for life and are strongly territorial (Schodde Tidemann 1986). Estimates of the home range of this species vary greatly but territories are thought to be a minimum of 800 hectares (Kavanagh 1988). It is suggested that Powerful Owls forage by concentrating their activities in pockets of their large home range until they reduce their population of preferred prey below limits where it becomes difficult to catch the remaining animals (Kavanagh, 1988).

The subject site contains suitable foraging habitat for this species. No hollows of a suitable size for nesting or roosting were observed during surveys. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable foraging habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

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 (Hollands 1991; Hyem 1979). This species is often found in heavily disturbed forest where its prey of small and medium sized mammals can be readily obtained (Kavanagh Peake 1993). The Masked Owl requires old mature trees with large hollows for breeding and as diurnal roosting sites, being dependent upon hollow bearing trees all year round rather than only during the breeding season (Hyem, 1979).

The subject site contains suitable foraging habitat for this species. No hollows of a suitable size for nesting or roosting were observed during surveys. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable foraging habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Sooty Owl *(Tyto tenebricosa)*
The Sooty Owl is generally associated with tall, dense, wet closed and open forests (Schodde & Tidemann 1986). Sooty Owls can occur in logged and regenerating forests but the extent to which they hunt and catch prey in harvested areas is unknown (SFNSW 1995). The Sooty Owl requires old mature trees with very large hollows for breeding. Available evidence indicates narrow habitat requirements for nesting, with very large hollows (40 to 50cm deep and a 40 to 60cm diameter) being essential for nesting (Hyem 1979). The home range of the Sooty Owl has been estimated to be between 200 and 800 hectares (Debus 1994, Schodde & Mason 1980, Schodde & Tidemann 1986).

The subject site contains suitable foraging habitat for this species. No hollows of a suitable size for nesting or roosting were observed during surveys. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable foraging habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

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 vine scrub (Environment Australia 2000).

The subject site contains suitable foraging habitat for this species. No hollows of a suitable size for nesting or roosting were observed during surveys. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable foraging habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast

Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Grass Owl *(Tyto capensis)*
The Grass Owl inhabits mainly open tussock grasslands, usually in treeless areas. Often in marshy areas vegetated with tall dense tussocks of grass, especially Bladey Grass; often in swampy depressions or on floodplains. In NSW this species occurs mostly east of the Great Divide, with many records from the Northern Rivers, also Mid North Coast Region, from Harrington to Anna Bays. The Grass Owl feeds on small mammals, particularly rodents; also insects and birds (Higgins 1999).

The subject site contains suitable foraging and breeding habitat for this species. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable foraging habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Collared Kingfisher (*Todiramphus chloris*)
This species inhabits mangroves, tidal creeks, nearby beaches, mudflats, jetties, poles, street trees and gardens. The distribution of this species is in the coastal northern parts of Australia from the Clarence River to Shark Bay in W.A. Breeding takes place in September to March in mangrove hollows or in tree termite nests usually in excess of 10m high (Pizzey & Knight, 1999).

The subject site contains suitable foraging habitat for this species. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable foraging habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Brown Treecreeper *(Climacteris picumnus victoriae)*
This eastern sub-species of the Brown Treecreeper can be found in eucalypt woodland over much of eastern Australia. They prefer drier forests/woodlands with fallen branches and its distribution is known to coincide with that of River Red Gums and other eucalypts bordering river courses preferring rough-barked trees, especially the boxes and peppermints (Longmore 1991). Hollows in trees provide nesting chambers, roosting sites refuges from predators and sources of food for the Brown Treecreeper (Longmore 1991).

The subject site contains suitable foraging, roosting and breeding habitat for this species. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable foraging habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Painted Honeyeater *(Grantiella picta)*
The Painted Honeyeater inhabits dry forests and woodlands. Its primary food is the fruit of the mistletoes in the genus *Amyema* though it will also take nectar and insects *(*Garnett & Crowley 2000*).* The Painted Honeyeater is nomadic moving north in the winter and south in the summer over eastern Australia. usually travelling in pairs, families or small flocks. Breeding occurs between October and March.

The subject site contains suitable foraging, roosting and breeding habitat for this species. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable foraging habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Hooded Robin (*Melanodryas cucullata cucullata*)
The Hooded Robin frequents dry open forests, Eucalypt woodlands, mallee and other forms of dry *Acacia* scrub. It has a preference for areas with good levels of dry fallen timber. Largely sedentary although it will become nomadic in search of food.

The subject site contains suitable foraging, roosting and breeding habitat for this species. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable foraging habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Grey-crowned Babbler (*Pomatostomus temporalis temporalis*)
The Grey-crowned Babbler inhabits dryer more open forest habitats throughout its range. It inhabits scrubby woodlands, trees by roads and farmlands with isolated trees. The Grey-crowned Babbler occupies open woodlands dominated by mature eucalypts, with regenerating trees, tall shrubs and an intact groundcover of grass and forbs. This species forages in leaf litter and on the bark of trees (NSW Scientific Committee, 2001).

The subject site contains suitable foraging, roosting and breeding habitat for this species. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable foraging habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

White-eared Monarch (*Monarcha leucotis*)
This species occurs from sea level to 400m, recorded in low densities relative to other Monarch species. This species is found from the edges of subtropical and littoral rainforest. The White-eared Monarch feeds on insects from the upper canopy and nests in the canopy or understorey of rainforest areas.

The subject site contains suitable foraging, roosting and breeding habitat for this species. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable foraging habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Barred Cuckoo-shrike (*Coracina lineata*)
This migratory species has been recorded from subtropical, dry and littoral rainforests, and from fruiting trees in farmland and around settlements. It feed on figs and on insects in the outer foliage.

The subject site contains suitable foraging, roosting and breeding habitat for this species. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable foraging habitat for this species within the site.

There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Common Planigale (*Planigale maculata*)
The Common Planigale is a small carnivorous mammal. The Common Planigales diet consists entirely of insects. This nocturnal species has been recorded foraging across a wide range of substrates including loose bark, logs, leaf litter and open ground (Dickman 1991). The Common Planigale has been detected in habitats ranging from rainforest to dry hardwood forest, grasslands, marshlands, and rocky areas and on the fringes of urban areas (Braithwaite 1988).

The subject site contains suitable foraging and breeding habitat for this species. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable foraging habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Spotted-tailed Quoll (*Dasyurus maculatus*)
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.

The subject site contains suitable foraging and breeding habitat for this species. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable foraging habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Brush-tailed Phascogale (*Phascogale tapoatafa*)
The principle habitat of the Brush-tailed Phascogale are dry open forest and woodlands containing various associations of bloodwood, messmate, box, stringybark and ironbark trees (Cuttle 1982, 1992; Traill 1991; Traill Coates 1993) with an understorey varying between acacias, grasses and low herbs and dense leaf litter (Cuttle 1982). Tree hollows are used for shelter and nesting which can be shared by several individuals.

The subject site contains suitable foraging and breeding habitat for this species. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Squirrel Glider *(Petaurus norfolcensis)*
The Squirrel Glider is an arboreal, tree dwelling mammal that feeds on nectar, pollen, eucalypt sap, *Acacia* gum, honeydew and arthropods (Quin 1993). The Squirrel Glider feeds on sugary exudates to obtain its energy requirements and arthropods for protein (Smith 2002). The Squirrel Glider feeds on nectar of flowering tree species, honeydew and by gleaning arthropods from vegetation. This species also feeds on sap flows by incising the bark of trees. The Squirrel Glider uses tree hollows for den sites either alone or communally.

The subject site contains suitable foraging and den habitat for this species. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Yellow-bellied Glider *(Petaurus australis)*

The Yellow-bellied Glider is restricted to tall mature eucalypt forests found within high rainfall regions of temperate through to sub-tropical eastern Australia (Russell 1988). Forest areas known to support populations of this species are generally located on undulating or low relief landforms with soils of moderate to high fertility (SFNSW 1995). Preferred habitat areas for the Yellow-bellied Glider generally contain a complex mosaic of trees (Braithwaite 1984, Davey 1984, Kavanagh 1984). Yellow-bellied Gliders are dependant on the presence of large hollows within mature trees for nesting and breeding, occupying several den trees within a single home range (Henry and Craig 1984).

The subject site contains suitable foraging and den habitat for this species. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

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).

The subject site contains sub-optimal habitat for this species. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Black Flying-fox *(Pteropus alectro)*

Mangrove islands in the estuaries of most northern rivers usually contain camps of the Black Flying-fox, often consisting of hundreds of thousands of individuals (Strahan 1995). Their preferred food is the blossom of eucalypts, paperbarks and turpentines, as well as a variety of other native and introduced blossoms and fruits. (Churchill 1998). In NSW the Black Flying-fox is known to occur in the Northern Rivers Region.

The subject site contains suitable foraging habitat for this species. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Koala *(Phascolarctos cinereus)*
Koalas inhabit forested areas with acceptable Eucalypt food trees, also utilising non-Eucalypt species as a food source. Koalas inhabit both wet and dry Eucalypt forest that contain a canopy cover of approximately 10 to 70% (Reed *et al.* 1991) growing on high nutrient soils.
The subject site contains suitable foraging habitat for this species within the *Eucalyptus robusta* and *E. tereticornis* present. A detailed Koala Habitat Assessment is provided in Appendix V. This species or evidence or of its use of the subject site were not observed during surveys. The development proposes the retention of areas of suitable habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

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 occurs as well as providing refuge (Strahan, 1995).

The Atlas of NSW Wildlife (NPWS 2008) has twenty two (22) records for this species within ten (10) kilometres of the subject site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

The subject site contains suitable foraging habitat for this species. No roost or campsites were observed during surveys. This species was not observed within the subject site during surveys. This species has been recorded previously within the subject site (NPWS 2008). No camps or roost sites are present within the subject site for this species.

The development proposes the retention of areas of suitable foraging habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Common Blossom-bat *(Synconycteris australis)*
The Common Blossom-bat is found in the coastal regions from Cape York Peninsula to Northern NSW. In tropical Australia, the Common Blossom-bat roosts among rainforest foliage and feeds on nectar and pollen from a variety of rainforest trees. (Law & Spencer 1995). At the southern limits of its range, heathland and Melaleuca swamps are critical feeding habitats: *Banksia, Melaleuca, Callistemon* and certain eucalypts are favoured sources of food in these areas (Law & Spencer 1995).

The subject site contains suitable foraging habitat for this species. No roost or camp sites were observed during surveys. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable foraging habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee

Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Large-footed Myotis (*Myotis adversus*)

The Large-footed Myotis inhabits rainforests and open forests containing creeks and lakes over which it feeds and roosts in tree hollows, caves, mines, under bridges, in tunnels and occasionally buildings (Richards, 1995). The Large-footed Myotis predominantly forages along creeklines and over waterbodies where it takes insects and small fish from on and just below the waters surface (Richards, 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 development proposes the retention of areas of suitable foraging habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Greater Broad-nosed bat (*Scoteanax rueppellii*)

Greater Broad-nosed Bats roost in hollow tree trunks and branches as well as the roofs of old buildings. They prefer moist gullies in mature coastal forest, or rainforest, east of the Great Dividing Range (Churchill, 1998). They have also been found to inhabit cool temperate to tropical moist hardwood forest and woodland and in gullies associated with these forest types (Richards, 1991; Strahan, 1992;Churchill, 1998). Has been commonly found at woodland clearing ecotones foraging over the understorey (Richards, 1991).

The Greater Broad-nosed Bat is restricted to the east coast region from the Queensland to the Victorian border (Parnaby, 1992). Within the North Coast Bioregion this species has been recorded at Border Ranges, Broadwater, Nymboides and Westpool National Park. Locally there is a single record for this species at Conglomerate State Forest, 10 kilometres west of the subject site (DECC 2007).

The subject site contains suitable foraging habitat and potential roosting habitat within tree hollows for this species. The Greater Broad-nosed Bat was observed foraging within the subject site during surveys in October 2004. It is likely that this species would use the tree canopy and vegetated edges within the subject site to forage periodically. This species is likely to forage throughout the local area within similar suitable vegetation types.

The development proposes the retention of areas of suitable foraging habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)

The Eastern False Pipistrelle inhabits warm- to cool-temperate moist and dry open forests (Strahan 1988). Little is known about the biology of this species although it has been recorded in logged and unlogged areas, preferring open areas for foraging (O'Neill &Taylor 1986). The Eastern False Pipistrelle roosts mainly in tree hollows, occasionally utilising caves and abandoned buildings (Parnaby 1992, Phillips *et al.* 1985).

The subject site contains suitable foraging and roosting habitat for this species. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable foraging habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area

including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Eastern Freetail-bat *(Mormopterus norfolkensis)*
The Eastern Freetail-Bat forages above and within the canopy of open forests and woodlands, feeding on small insects (Allison & Hoye 1995). The Eastern Freetail-Bat is thought to roost predominantly in tree hollows and occasionally in buildings (Allison & Hoye 1995).

The Eastern Freetail-bat is distributed south from Fraser Island, Queensland through to Pambula (Allison & Hoye 1995, Parnaby 1992). In NSW the distribution of this species is poorly known with a northern limit to the north of Tenterfield and a southern limit at Pambula.

There are few local records for this species. The nearest record for this species is from Boambee, 20 km to the south of the subject site (DECC 2007).

The subject site contains suitable foraging habitat and potential roosting habitat within tree hollows for this species. The Eastern Freetail-bat was observed foraging within the subject site during surveys in December 2003. It is likely that this species would use the tree canopy and vegetated edges within the subject site to forage periodically. This species is likely to forage throughout the local area within similar suitable vegetation types.

The development proposes the retention of areas of suitable foraging habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Hoary Wattled Bat *(Chalinolobus nigrogris)*
The Hoary Wattled Bat is distributed across northern Australia from the Kimberley to Cape York and down the East Coast to northern NSW, becoming less common south of the tropics (Churchill, 1998). This species diet includes a wide range of insects and other invertebrates (Allison, 1995). Hoary Wattled Bats are forest dwellers that roost in tree hollows in eucalypt trees. They have also been found to roost in rock crevices (Churchill, 1998).

The subject site contains suitable foraging habitat for this species. No suitable roosting habitat is present within the subject site for this species. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable foraging habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Eastern Bentwing-bat *(Miniopterus schreibersii)*
The Eastern Bentwing-bat forages above and below the canopy within open forests and woodlands, feeding on small insects (Dwyer 1988). The Eastern Bentwing-bat is known to roost in a range of habitats including stormwater channels, under bridges, occasionally in buildings, old mines and, in particular, caves (Dwyer 1988). Roost sites in tree hollows have not been reported within the literature reviewed.

The subject site contains suitable foraging habitat for this species. No suitable roosting habitat is present within the subject site for the Eastern Benwting-bat. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable foraging habitat for this species within the site. There are large areas of

suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Little Bentwing-bat (*Miniopterus australis*)
The Little Bentwing-bat forages below the canopy within open forests and woodlands, feeding on small insects. The Little Bentwing-bat is known to roost in caves, tunnels, tree hollows and occasionally old buildings (Dwyer, 1995b).

The subject site contains suitable foraging and roosting habitat for this species. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable foraging habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*)
The Yellow-bellied Sheathtail Bat inhabits open country, mallee, eucalypt forests, rainforests, heathland and waterbodies. It roosts in tree hollows and has been found inhabiting the abandoned nests of Sugar Gliders (Richards 1988).

The subject site contains suitable foraging and roosting habitat for this species. This species was not observed within the subject site during surveys. The development proposes the retention of areas of suitable foraging habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Golden-tipped Bat (*Kerivoula papuensis*)
The Golden-tipped Bat has been generally captured or located in rainforest or adjoining open forests. (Richards 1988). Roosts sites are unclear but it appears that this species roosts in tree hollows, dense vegetation and the hanging or hanging nests of scrubwrens and gerygones (Schulz 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 development proposes the retention of areas of suitable foraging habitat for this species within the site. There are large areas of suitable and similar quality habitat within the conservation reserves of the local area including Coffs Coast Regional Park, Moonee Beach Nature Reserve, Bongil Bongil National Park, Yuraygir National Park and other local Council reserves.

Endangered Ecological Communities

Two Endangered Ecological Communities listed within the *Threatened Species Conservation Act* (1995) are present on-site. These are Coastal Saltmarsh and Swamp Sclerophyll Forest on Coastal Floodplains.

Coastal Saltmarsh
This community occurs in the NSW North Coast, Sydney Basin and South East Corner bioregions. This ecological community occurs in the intertidal zone on the shores of estuaries and lagoons along the NSW coast.

This community is associated with the low lying intertidal zone on the shores of coastal estuaries and lagoons. It most commonly contains *Baumea juncea, Isolepis nodosa, Juncus*

kraussii, Samolus repens, Sarcocornia quinqueflora, Selliera radicans, Sporobolus virginicus, Suadea australis, Triglochin striata and *Zoysia micrantha.*

Many of the floristic characteristics and specific habitat requirements of this community were observed within the G –Sedgeland vegetation community. The extent of this community is shown in Figure 2.1. This community is located around the shoreline of Hearnes Lake.

The G- Sedgeland vegetation community will be completely retained and buffered by the proposal as part of the concept plans conservation and environmental management strategies. The site specific ecological management strategies, including threatened species, vegetation and hydrology management actions will aid the long term protection of this endangered ecological community within the site.

Swamp Sclerophyll Forest on Coastal Floodplains
The ecological community associated with humic clay loams and sandy loams on waterlogged or periodically inundated alluvial flats and drainage lines of coastal floodplains. It occurs on alluvial flats and drainage lines of coastal floodplains below the 1:100 year flood level. The species characteristic of this community include *Eucalyptus robusta, Melaleuca quinquenervia and eucalyptus botryoides.* Other prominent species are: *Callistemon salignus, Casuarina glauca*, *Eucalyptus resinifera subsp. hemilampra, Livistona australis,* and *Lophostemon suaveolens.*

Habitat requirements and species that characterise this community were located on the subject site within the vegetation community C – Swamp Sclerophyll Forest and to a lesser extent vegetation community B/C – Eucalypt/Swamp Sclerophyll Transition Forest. These communities are located on the alluvial soils of the floodplain (below the 1:100 year flood recurrence interval) within the central and south-west of Hearnes Lake. The extent of this community is shown in Figure 2.1.

The large majority of these vegetation communities will be retained and buffered by the proposal as part of the concept plans conservation and environmental management strategies. The site specific ecological management strategies, including threatened species, vegetation and hydrology management actions will aid the long term protection of this endangered ecological community within the site.

4.3 COMMONWEALTH LEGISLATION

The *Environment Protection and Biodiversity Conservation Act, (1999)* requires that Commonwealth approval be obtained for certain actions. The Act provides an assessment and approvals systems for actions that have a significant impact on matters of national environment significance (NES). These may include:-

- Wetlands protected by international treaty (the Ramsar Convention);
- Nationally listed threatened species and ecological communities;
- Nationally listed migratory species.

Actions are projects, developments, undertakings, activities, and series of activities or alteration of any of these. An action that needs Commonwealth approval is known as a controlled action. A controlled action needs approval where the Commonwealth decides the action would have a significant effect on a NES matter.

Where a proposed activity is located in an area identified to be of NES, or such that it is likely to significantly affect threatened species, ecological communities, migratory species or their habitats, the matter needs to be referred to the Minister of the Department of Environment, Water, Heritage and the Arts.

No threatened flora species or endangered ecological communities listed in the EP&BC Act (1999) were identified on or near to the site. One threatened fauna species (Grey-headed Flying-fox – *Pteropus poliocephalus*) listed in the EP&BC Act (1999) was observed overflying and foraging within the site. Due to the presence of larger and better quality foraging habitat for the Grey-headed Flying-fox within the local area, it is considered that a referral of this project to Environment Australia is not required as it is not likely to impact on a significant population of nationally listed threatened species or on any nationally listed endangered ecological community. Notwithstanding, this project was referred to the Department of the Environment, Water, Heritage and Arts (DEWHA). It was determined that the proposed action is not a controlled action and that approval is not needed under Part 9 of the Act before the action can proceed (please see Appendix IV).

4.4 ENVIRONMENTAL CONSTRAINTS ASSESSMENT

A report was completed for the subject site titled Environmental Constraints Analysis, Lot 22 DP 1070182 Pacific Highway, Sandy Beach North. This report was prepared by *Sainty and Associates* under engagement by the NSW Department of Planning to review the available documentation on the ecological value of the land, identify and map lands suitable for environmental protection based on site survey and consideration of existing studies.

The *Sainty and Associates* Report identified that the areas of Eucalypt forest / woodland to the east of the Pacific Highway and other forested areas throughout the site were determined as high conservation significance. Environmental buffers of 50 metres were proposed around these vegetated areas while a 100 metre buffer was proposed around the Saltmarsh edge of Hearnes Lake to protect the habitat of migratory shorebirds. A 30 metre buffer was proposed for the dune system in the east of the site.

A response to this report was prepared by *Conacher Travers* (2006). The response concluded that the implementation of the buffer zones recommended by *Sainty and Associates* should not be adopted for the site as they:

i) Have not been determined on the basis of specific site characteristics, including site zoning.
ii) Do not incorporate any scientific assessment or justification in relation to buffer zone width.
iii) Do not incorporate any provision or consideration of ongoing management responsibilities.
iv) Have not undertaken an appropriate assessment in relation to the requirements of *the EP&A Act*. (1979).
v) Have not considered the proposed stormwater drainage and environmental impact mitigation measures.

4.5 ENVIRONMENTAL MANAGEMENT

A key component of the design in maintaining the sites ecological values is the retention of areas within conservation zones. This includes the more ecologically sensitive lands and environments within Hearnes Lake and its nearshore areas. This also includes riparian areas associated with Hearnes Lake. These conservation areas will also act as a buffer in protecting these sensitive vegetation and habitat types within Hearnes Lake from the impacts of adjacent development. It is proposed that through vegetation and habitat management planning programs, including rehabilitation and restoration, that the ecological values of these conservation areas will be improved.

The environmental management strategies for the site include the preparation of a draft Ecological Site Management Strategy. This management strategy includes site specific ecological management objectives and actions for the following:

- Vegetation Management;
- Bushfire Management;
- Provision of Ecological Buffers;
- Erosion and Sediment Control;
- Stormwater Quality and Management;
- Cultural Heritage Values and Management;
- Community Education, Vigilance and Reporting;
- Prohibited Use Identification and Management;
- Native Fauna, Habitat and Feral Pest Management;
- Access, Signage and Fencing;
- Monitoring and Reporting Regime.

The environmental management initiatives for the site also include the preparation of the following reports:

- Construction Management Plan (Patterson Britton 2007);
- Erosion and Sediment Control Plan (Patterson Britton 2007);
- Water Management Strategy (Patterson Britton 2007);
- Estuary Management Plan (WBM Oceanics 2005).

SECTION 5

CONCLUSIONS

Based on the detailed field survey and information provided in this report it is concluded that:

i. No threatened flora species were recorded on the subject site;

ii. Seven (7) threatened fauna species were detected during surveys; these were Wallum Froglet, Osprey, Black-necked Stork, Glossy Black-cockatoo, Grey-headed Flying-fox, Eastern Freetail Bat and Greater Broad-nosed Bat;

iii. Two listed endangered ecological communities, Swamp Sclerophyll Forest on Coastal Floodplains and Coastal Saltmarsh were recorded on the site;

iv. No endangered populations were recorded within the subject site;

v. The development proposes the retention of substantial areas of habitat including the endangered ecological communities Coastal Saltmarsh and Swamp Sclerophyll Forest on Coastal Floodplains to aid the conservation of the threatened species observed within the subject site. The protection and restoration of these areas will offset those areas to be removed as part of the proposal;

vi. An Ecological Site Management Strategy (Draft) has been prepared for the site detailing strategies to control and minimise the ecological impacts of the proposed development.

vii. It is considered that the proposed development is not likely to have a significant impact upon threatened species, endangered populations, endangered ecological communities or their habitats

viii. A Species Impact Statement should not be required for the proposed development;

ix. It is considered that a referral of this project to the Department of Environment, Water, Heritage and the Arts is not required as part of this application.

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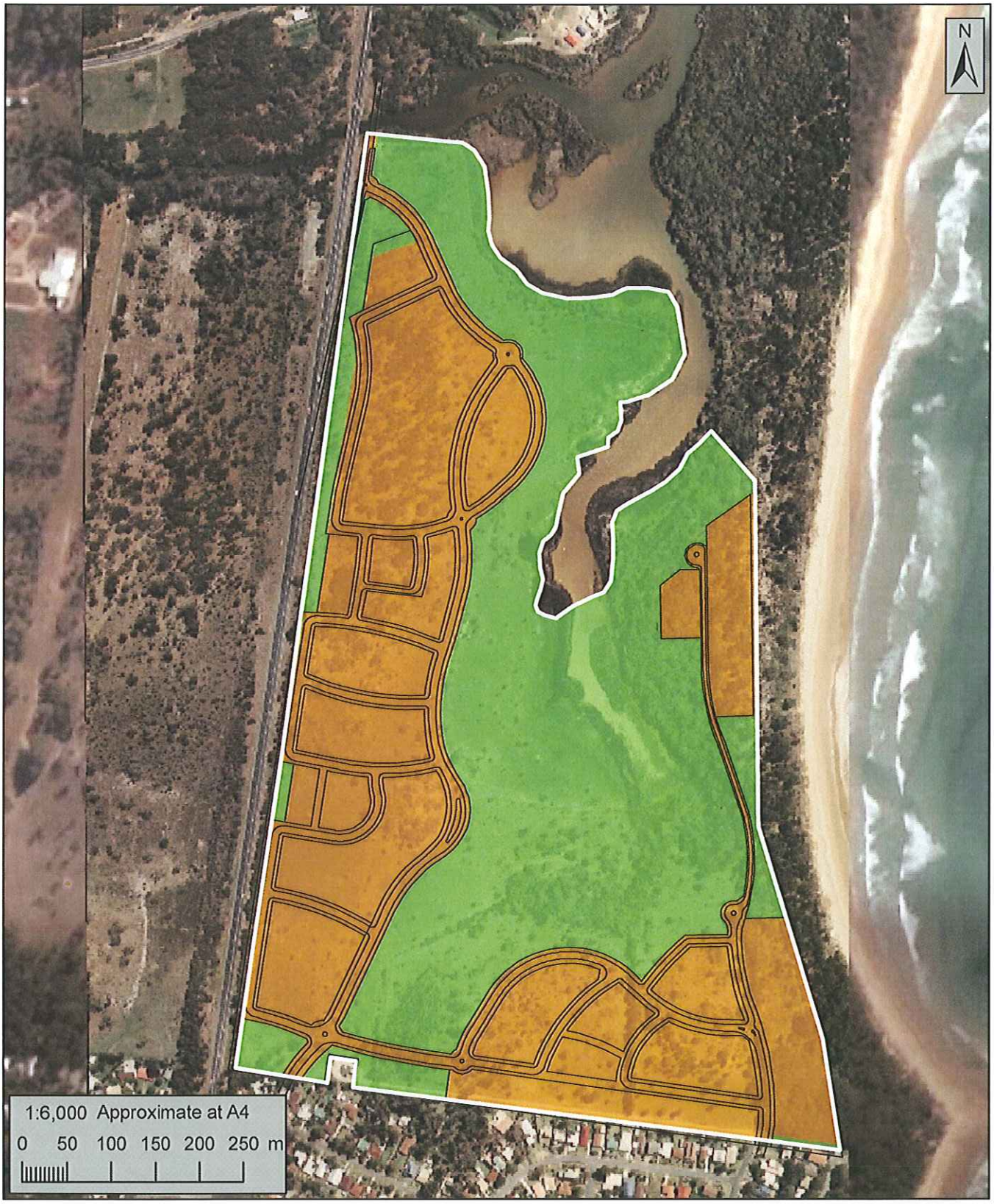


Original plan produced in A4 colour.
Plan for indicative purposes only, not for detailed measurement. Subject site boundary subject to final survey.

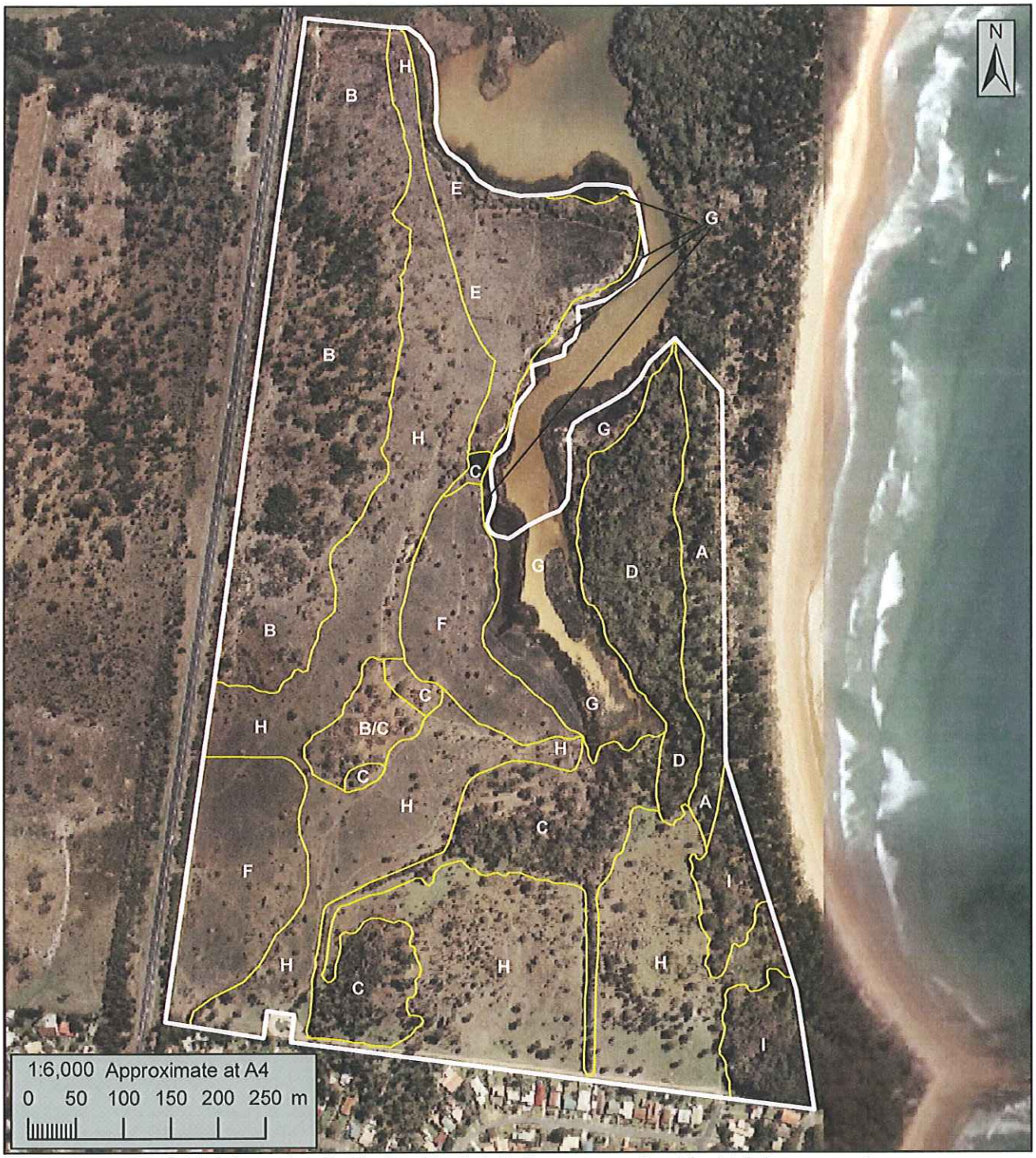
Legend

Subject Site Boundary — Proposed Development Layout — Area Retained — Area Subject to Development

conacher environmental group
ABN: 62 274 841 042
PO Box 360
369 Mann Street
Gosford NSW 2250
Ph: (02) 4324 7888
Fax: (02) 4324 7899
cegconsult@bigpond.com

Figure 1.1
Concept Master Plan
Pacific Highway, Sandy Beach

Source: Aerial © Department of Lands (2008)



Original plan produced in A4 colour. Plan for indicative purposes only, not for detailed measurement.
Subject site boundary is approximate and has not been fixed by land survey. Survey locations are approximate and have not been fixed by land survey.

Legend

- Subject Site Boundary
- A Low Forest (Banksia dominated)
- B Forest (Eucalypt dominated)
- C Swamp Sclerophyll Forest
- B/C Eucalypt/Swamp Sclerophyll Transition Forest
- D Sandplain Forest (Melaleuca/Corymbia dominated)
- E Wet Heath
- F Wallum Heath
- G Sedgeland
- H Disturbed Woodland
- I Sandplain Forest (Melaleuca/Mesophylic sp. dominated)

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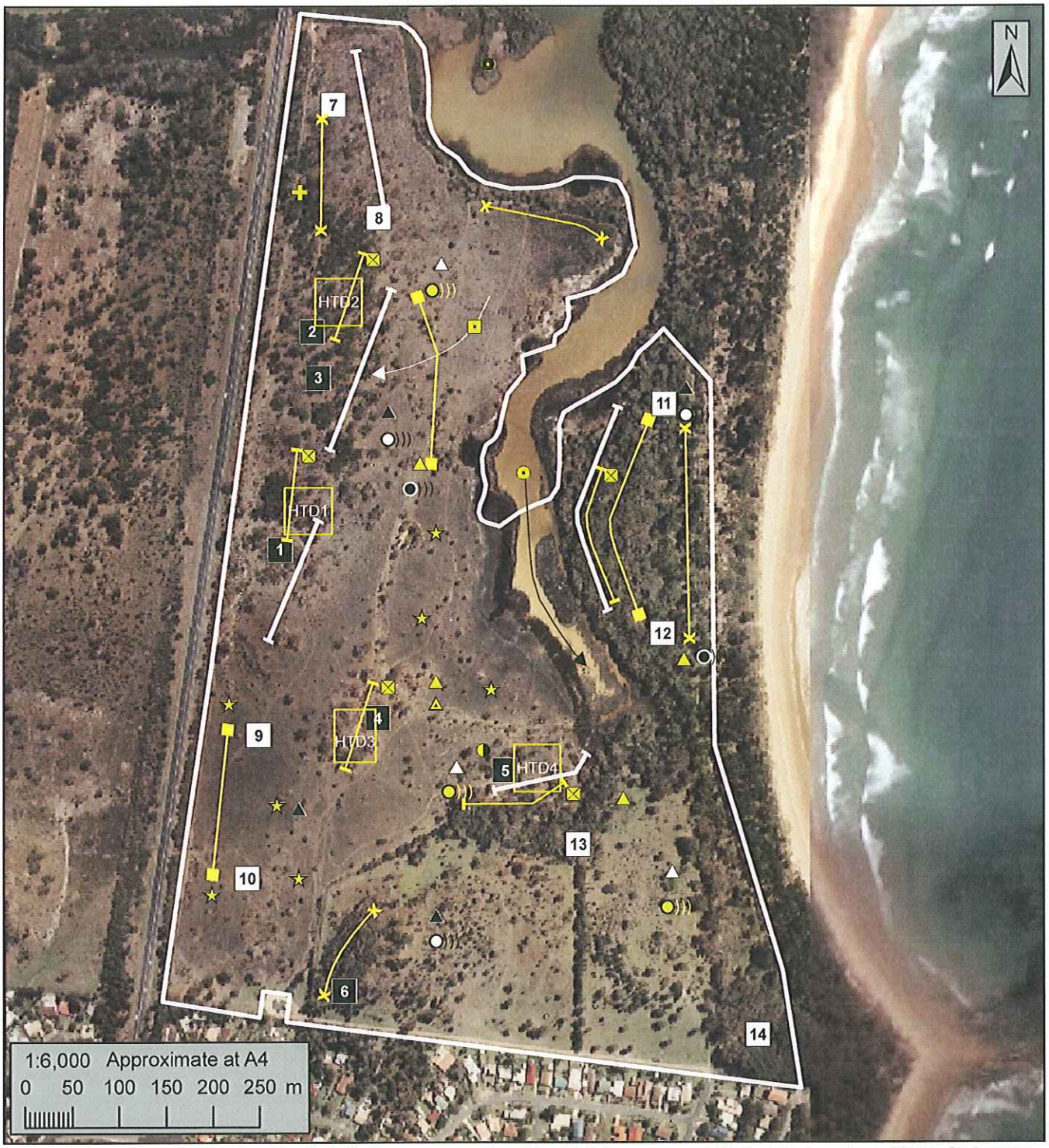
Figure 2.1
Vegetation Communities
Pacific Highway, Sandy Beach

By: JM
03/09/08
Ref No 8108

Source: Aerial © Department of Lands (2008)



Original plan produced in A4 colour. Plan for indicative purposes only, not for detailed measurement. Subject site boundary subject to final survey. Survey locations are approximate and have not been fixed by land survey.

Legend

- Subject Site Boundary
- Elliot Trap Transect 12/2003
- Elliot Trap Transect 08/2004
- Hair tube Transect 12/2003
- Cage Trap 12/2003
- Cage Trap transect 08/2004
- Anabat Recording Station 12/2003
- Anabat Recording Station 08/2004
- Anabat Recording Station 08/2004
- Owl Call Playback Station 12/2003
- Owl Call Playback Station 08/2004
- Owl Call Playback Station 10/2004
- HTD4 Hollow Tree Density Count
- 3 Koala Scat Search 12/2003
- 9 Koala Scat Search 10/2004
- Wallum Froglet Opportunic Observations
- Black-necked Stork Location & Foraging Direction 08/2004
- Black-necked Stork Dec. 2003
- Osprey location and flight direction 12/2003
- Glossy Black-Cockatoo Location 10/2005
- Eastern Freetail-bat 12/2003
- Greater Broad-nosed Bat Location 10/2004

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Figure 3.1

Fauna Survey and Threatened Species Locations

Pacific Highway, Sandy Beach

By JM 02/08/08 Ref No 1108

Source: Aerial © Department of Lands (2006)