Lot 66 in DP 551005, Moonee Beach

Proposed Residential & Tourist Development
'Moonee Waters'

Flora & Fauna Assessment

APPENDIX 1

Plant species recorded on the Subject Site at Moonee Beach

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KEY

Status

R	Regionally significant species
*	Introduced species
N	Noxious weeds as listed on the *NSW Noxious Weeds Act 1993* for Coffs Harbour City Council
E	Endangered (listed on Schedule 1 of the TSC Act)
V	Vulnerable (listed on Schedule 2 of the TSC Act)

Plant communities

1	Heath Shrubland/Woodland
2	Open-Forest/Tall Open-forest
3	Swamp Forest/Sedgeland

Frequency of occurrence

c	common
o	occasional
u	uncommon

Threatened species listed pursuant to the *NSW Threatened Species Conservation Act 1995* (TSC Act).

STATUS	SCIENTIFIC NAME	COMMON NAME	1	2	3
	FILICOPSIDA				
	Adiantaceae				
	Adiantum aethiopicum	Maidenhair		o	o
	Aspleniaceae				
	Asplenium australasicum	Bird's Nest Fern		u	
	Blechnaceae				
	Blechnum cartilagineum	Gristle Fern		o	o
	Blechnum indicum	Swamp Water Fern		u	o
	Doodia aspera	Rasp Fern	u	u	
	Dicksoniaceae				
	Calochlaena dubia	False Bracken		o	o
	Cyatheaceae				
	Cyathea australis	Rough Tree-fern		u	
	Davalliaceae				
	Davallia solida var. *pyxidata*	Hare's Foot Fern		u	
	Dennstaedtiaceae				
	Histiopteris incisa	Batswing Fern		o	u
	Pteridium esculentum	Bracken	u	o	o
	Dryopteridaceae				
	Lastreopsis decomposita	Trim Shield Fern		u	
	Gleicheniaceae				
	Gleichenia microphylla	Coral-fern		u	o
	Lindsaeaceae				
	Lindsaea linearis	Screw fern		o	
	Polypodiaceae				
	Platycerium bifurcatum	Elk-horn Fern		o	
	Platycerium superbum	Stag-horn Fern		u	
	Schizaeaceae				
R	Lygodium microphyllum	Climbing Maidenhair			o
	Schizaea bifida	Forked Comb Fern		o	
	Thelypteridaceae				
	Christella dentata	-		u	

STATUS	NAME	COMMON NAME	1	2	3
	CONIFEROPSIDA				
	Araucariaceae				
	Araucaria cunninghamii	Hoop Pine		u	
	MAGNOLIOPSIDA: DICOTYLEDONS				
	Acanthaceae				
	Pseuderanthemum variabile	Pastel Flower	u	o	u
	Aizoaceae				
	Carpobrotus glaucescens	Pig Face	u		
	Tetragonia tetragonioides	New Zealand Spinach	u		
	Amaranthaceae				
	Alternanthera denticulata	Lesser Joyweed		u	u
	Anacardiaceae				
	Euroschinus falcata var. *falcata*	Ribbonwood		u	u
	Apiaceae				
	Centella asiatica	Heart-leaved Pennywort	o	o	o
	Hydrocotyle acutiloba (?) *H. peduncularis*	-		u	
*	*Hydrocotyle bonariensis*	Beach Pennywort	o	u	o
	Platysace ericoides	Heathy Platysace		u	
	Trachymene incisa subsp. *incisa*	-	u	u	
	Araliaceae				
	Polyscias murrayi	Pencil Cedar		u	
	Polyscias sambucifolia subsp. A	Elderberry Panax		o	u
*	*Schefflera actinophylla*	Umbrella Tree		u	u
	Apocynaceae				
	Parsonsia straminea	Common Silkpod		o	o
	Tabernaemontana pandacaqui	Banana Bush		u	
	Asclepiadaceae				
*	*Gomphocarpus fruticosus*	Narrow-leafed Cotton Bush	u		u
	Marsdenia rostrata	Common Milk Vine		o	o
	Asteraceae				
*N	*Ageratina adenophora*	Crofton Weed	o	u	o
*	*Ageratum houstonianum*	Floss Flower	o		
*	*Ambrosia artemisifolia*	Annual Ragweed	u		
*	*Aster subulatus*	Bushy Starwort			o
*N	*Baccharis halimifolia*	Groundsel Bush	u	u	o
*	*Bidens pilosa*	Cobblers Pegs	u		u
*N	*Chrysanthemoides monilifera* subsp. *rotundata*	Bitou Bush	o	u	u
*	*Conzya bonariensis*	Flax-leaf Fleabane		u	
*	*Erechtites valerianifolia*	Brazilian Fireweed	u		
	Gnaphalium sphaericum	Cudweed		u	
	Ozothamnus diosmifolius	-	u	o	u
	Senecio lautus subsp. *maritimus*	Variable Groundsel	u		u
*N	*Senecio madagascariensis*	Fireweed	u		u
	Basellaceae				
*	*Anredera cordifolia*	*Madeira Vine*			u
	Baueraceae				
	Bauera (?) microphylla	-		u	
	Bignoniaceae				
	Pandorea pandorana	Wonga Vine	u	o	u
	Caryophyllaceae				
	Drymaria cordata subsp. *diandra*	Tropical Chickweed			u
	Casuarinaceae				
	Allocasuarina littoralis	Black Oak	u	c	
	Allocasuarina torulosa	Forest Oak	u	o	
	Casuarina equisetifolia *subsp*. incana	Beach Oak	o		
	Casuarina glauca	Swamp Oak			c

STATUS	SCIENTIFIC NAME	COMMON NAME	1	2	3
	Celastraceae				
	Cassine australis var. *australis*	Red-fruited Olive-plum		o	
	Denhamia celsastroides	Orange Boxwood		u	
	Maytenus silvestris	Orangebark		u	
	Chenopodiaceae				
	Einadia hastata	Berry Saltbush	u		u
	Einadia nutans subsp. *linifolia*	Climbing Saltbush	u		
*	*Chenopodium album*	Fat Hen	u	u	u
	Convolvulaceae				
	Convolvulus erubescens	Australian Bindweed		u	
	Dichondra repens	Kidney Weed	u	u	o
*	*Ipomoea cairica*	Mile-a-minute	u	u	u
*	*Ipomoea indica*	Morning Glory	u	u	
	Ipomoea pes-caprae subsp. *brasiliensis*	Beach Morning Glory	u		
	Cunoniaceae				
	Caldcluvia paniculosa	Soft Corkwood		u	
	Callicoma serratifolia	Black Wattle		o	
	Dilleniaceae				
	Hibbertia aspera	Golden Guinea-flower	u	u	
	Hibbertia obtusifolia	Grey Guinea-flower	u	u	
	Hibbertia scandens	Climbing Guinea-flower	u	o	u
	Hibbertia vestita	Coast Guinea-flower	o		
	Droseraceae				
	Drosera spatulata	Rosy Sundew		u	
	Ebenaceae				
	Diospyros pentamera	Native Ebony		u	
	Elaeocarpaceae				
	Elaeocarpus obovatus	Hard Quandong		u	
	Elaeocarpus reticulatus	Blueberry Ash		u	u
	Epacridaceae				
	Epacris microphylla	Daphne Heath	u		
	Epacris obtusifolia	Blunt-leaf Heath	o		
	Leucopogon lanceolatus var. *gracilis*	Whitebeard	u	u	u
	Leucopogon leptospermoides	-			u
	Leucopogon parviflorus	Coastal Bearded Heath	u		
	Monotoca elliptica	Tree Broom-heath	o	u	
	Monotoca scoparia	Prickly Broom-heath	u		u
	Sprengelia sprengelioides	-	u		
	Trochocarpa laurina	Tree Heath		u	
	Euphorbiaceae				
	Breynia oblongifolia	Coffee Bush	u	o	o
	Claoxylon australe	Brittlewood		o	
	Drypetes deplanchei	Yellow Tulipwood		u	
	Glochidion ferdinandi var. *ferdinandi*	Smooth Cheese Tree	u	o	o
	Omalanthus populifolius	Bleeding Heart	u	o	u
	Pseudanthus orientalis	-	u		
	Eupomatiaceae				
	Eupomatia laurina	Bolwarra		o	
	Fabaceae: Caesalpinioideae				
*	*Senna pendula* var. *glabrata*	Cassia	u	u	u
*	*Senna septemtrionalis*	Cassia		u	
	Fabaceae: Faboideae				
	Desmodium rhytidophyllum	-		u	u
	Desmodium varians	-		u	
	Dillwynia floribunda	-	u		u
	Glycine clandestina sp. complex	Love Creeper		u	
	Gompholobium pinnatum	Pinnate Wedge-pea		u	
	Hardenbergia violacea	Purple Twining-pea	o	o	u
	Hovea longifolia	-	u	u	

STATUS	SCIENTIFIC NAME	COMMON NAME	1	2	3
	Fabaceae: Faboideae continued				
	Indigofera australis	Native Indigo		o	
	Jacksonia scoparia	Dogwood	u	o	
	Kennedia rubicunda	Dusky Coral Pea	o	u	u
	Mirbelia rubiifolia	-	u	u	
	Mucuna gigantea subsp. *gigantea*	Burny Bean	u		
	Pultenaea maritima	-	u		
	Pultenaea retusa	-		o	u
*	*Trifolium repens*	Clover	o		
	Vigna marina	Dune Bean	u		
	Fabaceae: Mimosoideae				
	Acacia binervata	Two-veined Hickory		c	
	Acacia falcata	-	o	o	
	Acacia floribunda	Sallow Wattle		u	u
	Acacia irrorata subsp. *irrorata*	-	u	o	o
	Acacia longifolia subsp. *sophorae*	Coast Golden Wattle	o	o	o
	Acacia longissima	Swamp Wattle			u
	Acacia maidenii	Maiden's Wattle		u	
	Acacia melanoxylon	Blackwood	u	o	u
	Acacia myrtifolia	Red-stemmed Wattle	u		
	Acacia suaveolens	Sweet Wattle	o		
	Acacia ulicifolia	Prickly Moses		u	
	Geraniaceae				
	Geranium homeanum	Northern Cranesbill	o		
	Goodeniaceae				
	Dampiera stricta	-	o	u	
	Goodenia paniculata	Swamp Goodenia		u	
	Scaevola calendulacea	Beach Fan Flower	u		
	Haloragaceae				
	Gonocarpus micranthus subsp. *ramosissimus*			u	u
	Gonocarpus tetragynus	Poverty Raspwort		u	
	Lamiaceae				
	Plectranthus parviflorus	Cockspur Flower		u	
	Lauraceae				
	Cassytha glabella forma *glabella*	Slender Devil's Twine	o	u	o
	Cassytha pubescens	Common Devil's Twine			u
*	*Cinnamomum camphora*	Camphor Laurel	u	u	u
	Cinnamomum oliveri	Oliver's Sassafras		u	
	Cryptocarya glaucescens			o	
	Cryptocarya microneura	Murrogun		o	u
	Cryptocarya obovata	Pepperberry		u	
	Cryptocarya (?) rigida	Forest Maple		u	
	Cryptocarya triplinervis	Three-veined Cryptocarya	u	o	o
	Endiandra muelleri	Mueller's Walnut		u	
	Endiandra sieberi	Pink Walnut		u	
	Neolitsea dealbata	Hairy-leaved Bolly-gum		u	
	Lobeliaceae				
	Lobelia alata	-	u		u
	Pratia purpurascens	Whiteroot		u	o
	Loganiaceae				
	Mitrasacme ploymorpha	-		u	u
	Loranthaceae				
	Muellerina celastroides	Mistletoe	u	u	
	Malvaceae				
*	*Sida rhombifolia*	Paddys Lucerne	o	u	u
	Meliaceae				
	Dysoxylum mollissimum	Red Bean		u	
	Dysoxylum rufum	Hairy Rosewood		u	
	Synoum glandulosum subps. *glandulosum*	Scentless Rosewood		u	u

STATUS	SCIENTIFIC NAME	COMMON NAME	1	2	3
	Menispermaceae				
	Stephania japonica var. *discolor*	Snake Vine	u	o	o
	Moraceae				
	Ficus coronata	Sandpaper Fig		u	u
	Ficus obliqua	Small-leaved Fig		u	
	Ficus rubiginosa	Port Jackson Fig		u	
	Maclura cochinchinensis	Cockspur Thorn		o	o
	Myrsinaceae				
	Embelia australiana	-		u	
	Rapanea variabilis	Mutton Wood		u	
	Myrtaceae				
	Angophora costata	Smooth-barked Apple		o	u
	Archirhodomyrtus beckleri	Rose Myrtle		u	
	Baeckea frutescens	-		u	u
	Callistemon pachyphyllus	Wallum Bottlebrush			o
	Callistemon salignus	Pinktips		o	u
	Corymbia intermedia	Pink Bloodwood	u	o	o
	Corymbia maculata	Spotted Gum		u	
	Eucalyptus acmenoides	White Mahogany		o	
	Eucalyptus (?) biturbinata	Grey Gum		u	
	Eucalyptus crebra	Narrow-leaved Ironbark		o	
	Eucalyptus grandis	Flooded Gum		u	
	Eucalyptus microcorys	Tallow Wood		o	
	Eucalyptus paniculata	Grey Ironbark		o	
	Eucalyptus pilularis	Blackbutt		c	u
	Eucalyptus planchoniana	Bastard Tallow Wood		o	
	Eucalyptus resinifera subsp. *resinifera*	Red Mahogany		u	
	Eucalyptus robusta	Swamp Mahogany		o	c
	Eucalyptus saligna	Sydney Bluegum		o	o
	Eucalyptus siderophloia	Grey Ironbark		o	
	Eucalyptus signata	Scribbly Gum		u	
	Eucalyptus tereticornis	Forest Redgum		o	
*	*Leptospermum laevigatum*	Coast Tea-tree	o		
	Leptospermum polygalifolium subsp. *cismontanum*	-		u	u
	Leptospermum liversidgei	-	u		
	Lophostemon confertus	Brush Box		o	u
	Lophostemon suaveolens	Swamp Mahogany			u
	Melaleuca nodosa	Ball Honeymyrtle	u		o
	Melaleuca quinquenervia	Broad-leaved Paperbark	u	o	c
	Melaleuca sieberi	Sieber's Paperbark			u
	Melaleuca thymifolia	-			u
	Rhodamnia rubescens	Scrub Turpentine		o	
	Rhodomyrtus psidioides	Native Guava		u	
	Syncarpia glomulifera	Turpentine		c	
	Syzygium australe	Brush Cherry		o	
	Syzygium luehmannii	Riberry		u	
	Syzygium oleosum	Blue Lilly Pilly		u	
	Tristaniopsis laurina	Water Gum		u	
	Ochnaceae				
*	*Ochna serrulata*	Mickey Mouse Bush	u	u	u
	Oleaceae				
*N	*Ligustrum sinense*	Small-leaved Privet	u	u	u
	Notelaea longifolia forma intermedia	Large-leaved Mock-olive	u	u	
	Notelaea ovata	-		u	
	Oxalidaceae				
*	*Oxalis corniculata*	Yellow Wood-sorrel	u	u	u
	Passifloraceae				
*	*Passiflora subpeltata*	White Passionflower	u	u	

STATUS	SCIENTIFIC NAME	COMMON NAME	1	2	3
	Pittosporaceae				
	Pittosporum revolutum	Rough-fruit Pittosporum		u	
	Pittosporum undulatum	Brush Daphne	u	o	o
	Plantaginaceae				
*	*Plantago lanceolata*	Plantain	u	u	u
	Polygonaceae				
	Persicaria decipiens	Spotted Knotweed			o
	Persicaria lapathifolium	Knotweed			o
*	*Rumex crispus*	Curled Dock			o
	Proteaceae				
	Banksia aemula	Wallum Banksia	u		o
	Banksia integrifolia subsp. *integrifolia*	Coast Banksia	o	o	o
	Banksia oblongifolia	-	u		u
	Banksia spinulosa var. *collina*	Hairpin Banksia		u	
	Lomatia silaifolia	Crinkle Bush	u		
	Persoonia stradbrokensis	Geebung	u	u	u
	Persoonia virgata	Geebung		u	u
	Ranunculaceae				
	Clematis glycinoides	Old Mans Beard		u	u
*	*Ranunculus (?) repens*	Buttercup			o
	Ranunculus sessiliflorus	Buttercup			o
	Rhamnaceae				
	Alphitonia excelsa	Red Ash		u	
	Rosaceae				
	Rubus moluccanus var. *trilobus*	Molucca Bramble		u	u
	Rubus parvifolius	Native Raspberry	u	u	u
	Rubus rosifolius var. *rosifolius*	-		u	
	Rubiaceae				
	Atractocarpus benthamianus (syn. *Randia benthamiana)*	-		u	
	Canthium coprosmoides	Coast Canthium		u	
	Morinda jasminoides	Jasmine Morinda		u	
	Pomax umbellata	-	u	u	u
	Psychotria loniceroides	Hairy Psychotria		u	
	Rutaceae				
	Acronychia imperforata	Beach Acronychia	u		u
	Acronychia oblongifolia	Common Acronychia		u	
	Acronychia pubescens	Hairy Acronychia		u	
	Nematolepis squamea subsp. *squamea*	Satinwood	u	u	u
	Zieria (?) laxiflora	Zieria	u		
	Santalaceae				
	Exocarpos cupressiformis	Cherry Ballart		u	u
	Leptomeria acida	Native Currant		u	
	Sapotaceae				
V	*Amorphospermum whitei*	Rusty Plum		u	
	Sapindaceae				
	Alectryon coriaceus	Beach Alectryon	u	u	
	Alectryon subcinereus	Wild Quince		u	
	Arytera divaricata	Coogera	o	u	u
	Cupaniopsis anacardioides	Tuckeroo	u	o	o
	Diploglottis australis	Native Tamarind		u	
	Dodonaea triquetra	Hop Bush	u	o	o
	Guioa semiglauca	Guioa	u	u	u
	Jagera pseudorhus var. *pseudorhus* forma *pseudorhus*	Foambark Tree		u	
	Simaroubaceae				
E	*Quassia* sp. 'Moonee Creek'	Moonee Quassia		u	

STATUS	SCIENTIFIC NAME	COMMON NAME	1	2	3
	Solanaceae				
	Duboisia myoporoides	Corkwood	u	o	u
*	*Physalis peruviana*	Cape Gooseberry			u
*	*Solanum mauritianum*	Wild Tobacco		u	u
*	*Solanum nigrum*	Black Nightshade	u	u	u
	Stackhousiaceae				
	Stackhousia (?) nuda	-	u		
	Sterculiaceae				
	Commersonia fraseri	Brown Kurrajong			u
	Thymelaeaceae				
	Pimelea linifolia subsp. *linifolia*	Rice Flower	u	u	u
	Wikstroemia indica	-	u		
	Ulmaceae				
	Trema tomentosa var. *viridis*	Native Peach		u	u
	Verbenaceae				
	Clerodendrum floribundum	-			u
	Clerodendrum tomentosum	Hairy Clerodendrum		u	
*N	*Lantana camara*	Lantana	o	u	u
*	*Verbena bonariensis*	Veined Verbena		u	
	Violaceae				
	Viola hederacea	Native Violet		o	o
	Vitaceae				
	Cayratia clematidea	Slender Grape	u	u	u
	Cissus antarctica	Kangaroo Grape		u	u
	Cissus hypoglauca	Water Vine		u	u
	MAGNOLIOPSIDA: MONOCOTYLEDONS				
	Amaryllidaceae				
	Crinum pedunculatum	Swamp Lily	u	u	u
	Anthericaceae				
	Caesia parviflora var. *parviflora*	Pale Grass Lily	u		
	Sowerbaea juncea	Vanilla Plant	u		
	Thysanotus tuberosus subsp. *tuberosus*	Fringed Violet	u		
	Tricoryne elatior	Yellow Rush Lily	u		
	Araceae				
	Alocasia brisbanensis	Cunjevoi		u	u
	Gymnostachys anceps	Settler's Flax		u	u
	Arecaceae				
	Archontophoenix cunninghamiana	Bangalow Palm		u	
	Calamus muelleri	Lawyer Vine		u	
	Linospadix monostachya	Walking-stick Palm		u	
	Livistona australis	Cabbage Palm		u	
*	*Syagrus romanzoffianum*	Cocos Palm		u	
	Asparagaceae				
*	*Protasparagus aethiopicus*	Asparagus Fern	u	u	u
	Asphodelaceae				
*	*Asphodelus fistulosus*	Onion Weed		u	
	Asteliaceae				
	Cordyline stricta	Narrow-leafed Palm Lily		o	u
	Blandfordiaceae				
	Blandfordia grandiflora	Christmas Bells	u		
	Colchicaceae				
	Burchardia umbellata	Milkmaids	u		
	Wurmbea biglandulosa	-	o		

STATUS	SCIENTIFIC NAME	COMMON NAME	1	2	3
	Commelinaceae				
	Commelina cyanea	Scurvy Weed		u	u
*	*Tradescantia fluminensis*	Wandering Jew		u	
	Cyperaceae				
	Baumea juncea	Bare Twig-rush		o	c
	Baumea rubiginosa	Soft Twig-rush			o
	Carex appressa	Sedge		u	u
	Chorizandra cymbaria	Heron Bristle-brush		u	u
	Cyperus difformis	Dirty Dora			o
*	*Cyperus eragrostis*	Umbrella Sedge		u	u
	Cyperus haspan subsp. *haspan*	-			u
	Cyperus polystachyos	-		u	u
	Gahnia aspera	Saw-sedge		o	o
	Gahnia clarkei	Saw-sedge		o	o
	Gahnia sieberiana	Saw-sedge		u	u
	Isolepis nodosa	Knobby Club-rush	u		o
	Lepidosperma laterale	Variable Sword-edge		u	u
	Ptilothrix deusta	-			c
	Schoenus apogon	Common Bog-rush			c
	Schoenus brevifolius	Bog-rush			c
	Schoenus paludosus	-			o
	Dioscoreaceae				
	Dioscorea transversa	Native Yam		u	u
	Iridaceae				
*	*Crocosmia x crocosmiflora*	Montbretia	u		
	Patersonia fragilis	Short Purple-flag	o		
	Patersonia glabrata	Leafy Purple-flag	o		
	Patersonia sericea	Silky Purple-flag	c		
*	*Watsonia meriana* 'Bulbillifera'	Bugle Lily	u		u
	Flagellariaceae				
	Flagellaria indica	Whip Vine	u		u
	Juncaceae				
	Juncus continuus	Rush		u	o
	Juncus kraussii subsp. *australiensis*	Sea Rush			
	Juncus prismatocarpus	Branching Rush		u	u
	Juncus usitatus	Common Rush	u	o	c
	Lomandraceae				
	Lomandra filiformis subsp. *filiformis*	Wattle Mat-rush	u	o	
	Lomandra longifolia	Spiny-headed Mat-rush	u	o	u
	Lomandra multiflora subsp. *multiflora*	Many-flowered Mat-rush		u	
	Luzuriagaceae				
	Eustrephus latifolius	Wombat Berry		u	u
	Geitonoplesium cymosum	Scrambling Wire Lily	u	u	u
	Orchidaceae				
	Acianthus amplexicaulis	-		u	
	Caladenia catenata	White Fingers		u	
	Dipodium variegatum	Blotched Hyacinth Orchid		u	
	Cryptostylis subulata	Cow Orchid			u
	Microtis parviflora sp. complex	Slender Onion Orchid			u
	Pandanaceae				
	Pandanus tectorius var. *australianus*	Screw Pine	u		
	Philydraceae				
	Philydrum lanuginosum	Woolly Frogmouth			u
	Phormiaceae				
	Dianella caerulea var. *caerulea*	Blue Flax Lily	u	u	u
	Dianella revoluta var. *revoluta*	Spreading Flax-lily	o	u	u

STATUS	SCIENTIFIC NAME	COMMON NAME	1	2	3
	Poaceae				
*	*Alopecurus myosuroides*	Slender Foxtail			u
*	*Andropogon virginicus*	Whisky Grass	u	u	o
	Aristida vagans	Three-awn Speargrass	u	u	
	Aristida warburgii	Kerosene Grass	u	u	
*	*Chloris gayana*	Rhodes Grass	o		o
	Chloris truncata	Windmill Grass		u	
	Cymbopogon refractus	Barbed Wire Grass		u	u
	Cynodon dactylon	Couch	o	o	o
	Dichelachne crinita	Longhair Plumegrass		u	
*	*Echinochloa crus-gallii*	Barnyard Grass	o		
*	*Ehrharta erecta*	Panic Veldtgrass	o	u	o
*	*Eleusine tristachya*	Goosegrass	o		
	Entolasia marginata	Bordered Panic	u	o	
	Entolasia stricta var. *stricta*	Wiry Panic	u	u	
	Eragrostis brownii	Brown's Love-grass	u	u	
*	*Eragrostis curvula*	African Love-grass	u		
	Eriachne glabrata	Wanderrie Grass	u		u
	Imperata cylindrica var. *major*	Blady Grass	o	o	o
	Ischaemum australe var. *australe*	-			u
*	*Melinis minutiflora*	Molasses Grass	u		
	Oplismenus aemulus	Basket Grass		o	o
	Oplismenus imbecillis	Basket Grass		o	o
	Panicum simile	Two-colour Panic	u	u	u
	Paspalidium gracile	Slender Panic		o	u
*	*Paspalum dilatatum*	Paspalum	o	u	u
	Paspalum orbiculare	Ditch Millet			u
*	*Paspalum urvillei*	Vasey Grass			o
	Phragmites australis	Reedgrass			c
	Pseudoraphis paradoxa	Slender Mudgrass			o
	Spinifex sericeus	-	c		
*N	*Sporobolus indica* var. *capensis*	Giant Parramatta Grass	u		u
	Sporobolus virginicus var. *minor*	Marine Couch	o		u
*	*Stenotaphrum secundatum*	Buffalo Grass	o		u
	Themeda australis	Kangaroo Grass	c	o	u
	Zoysia macrantha	Coast Couch	c		c
	Restionaceae				
	Leptocarpus tenax	Twine-rush			c
	Lepyrodia interrupta syn. *Sporadanthus interruptus*	Scale-rush			o
	Ripogonaceae				
	Ripogonum album	White Supplejack	u	u	u
	Smilacaceae				
	Smilax australis	-		u	u
	Smilax glyciphylla	Native Sarsparilla		u	u
	Typhaceae				
	Typha orientalis	Cumbungi			o
	Xanthorrhoeraceae				
	Xanthorrhoea fulva	Swamp Grasstree	u		u
	Xanthorrhoea macronema	-		u	
	Zingiberaceae				
	Alpinia caerulea	Wild Ginger		u	u

Lot 66 in DP 551005, Moonee Beach

Proposed Residential & Tourist Development
'Moonee Waters'

Flora & Fauna Assessment

APPENDIX 2
Habitat requirements and likely occurrence of threatened plant species within the study area.

Whelans Insites (Gunninah Environmental Consultants)
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Appendix 2 Habitat requirements and likely occurrence of threatened plant species within the study area.

Plant name	TSC	ROTAP	Habitat	Likelihood of occurrence
Acronychia littoralis	E	3ECi	Littoral rainforest on sand	Appropriate habitat in northeast of the subject site, but well searched
Chamaesyce psammogeton	E	-	Coastal sand dunes and exposed sites on headlands	Appropriate habitat along eastern section of the subject site.
Cryptostylis hunteriana	V	3VC-	Scrubby swamp fringes to steep bare hillsides in tall eucalypt forest	Appropriate habitat, especially in centre of subject site, but difficult to detect
Lindsaea incisa	E	-	Eucalypt forest on sandstone; moist eucalypt forest on metasediments	Appropriate habitat; recently recorded in Paperbark Forest in Coffs Harbour Health Campus
Marsdenia longiloba	E	3RC-	Rainforest and lowland moist eucalypt forest	Appropriate habitat along central to western section of the subject site
Plectranthus cremnus		3K	Shallow sandy soils on coastal headlands	Appropriate habitat in northeast of the subject site but well searched
Thesium australe	E	3VCi+	Grassland or Grassy eucalypt woodland, especially in association with Kangaroo Grass	Appropriate habitat in northeast of the subject site but well searched
Phaius australis	E	3VCa	*Melaleuca quinquenervia* swamps and moist eucalypt forest	Appropriate habitat along central to eastern section of the subject site
Senna acclinis	V	3RC-	Edges of subtropical and dry rainforest	Appropriate habitat along central to western section of the subject site
Quassia sp. 'Mooney Creek'	E	2E	Understorey of tall moist and tall dry eucalypt forest	Appropriate habitat in northwest of the subject site but well searched
Quassia sp. 'Mooney Creek'	E	2E	Understorey of tall moist and tall dry eucalypt forest	Recorded on or to the immediate north of the subject site
Pultenaea maritima	E	2E	Grassy coastal headlands	Appropriate habitat to the northeast of the subject site; present on Moonee Headland but no suitable habitat present on the site
Sarcochilus fitzgeraldii	V	3VC-	Subtropical rainforest, usually close to water; in gorges and on cliffs	Unlikely; no appropriate habitat
Zieria prostrata	E	2E	Low coastal heath, north of Coffs Harbour	Appropriate habitat in northeast of the subject site, but well searched
Amorphospermum whitei	V	3RCa	Warm temperate and littoral rainforests as well as tall open forest with rainforest understorey	Recorded on or to the immediate north of the subject site

TSC NSW Threatened Species Conservation Act 1995 V – Vulnerable E – Endangered
ROTAP Rare Or Threatened Australian Plants

Lot 66 DP 551005, Moonee Beach

Proposed Residential & Tourist Development

Flora & Fauna Assessment Report

APPENDIX 3

Moonee Fauna Assessment
(Prepared by Sandpiper Ecological Surveys Pty Ltd for IRC Properties Pty Ltd)

Whelans Insites (Gunninah Environmental Consultants)
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ph: 02 – 8234 8326 fax: 02 – 9262 5166 email: gecon@gunninah.com.au

LOT 66 DP 551005 MOONEE FAUNA ASSESSMENT

Prepared by Sandpiper Ecological Surveys Pty Ltd
for IRC Properties Pty Ltd

25 September 2003

Lot 66 DP 551005 Moonee
Fauna Assessment for IRC Properties Pty. Ltd.

25 September 2003

Sandpiper Ecological Surveys Pty Ltd
PO Box 401
Alstonville NSW 2477
Approved by:_____
Project Manager

CONTENTS

LIST OF TABLES

LIST OF FIGURES

page following

1 INTRODUCTION

1.1 BACKGROUND

Sandpiper Ecological Surveys Pty Ltd was commissioned by IRC Properties Pty Ltd to prepare a fauna assessment for land contained within Lot 66 DP 551005 Moonee. The purpose of the fauna survey is to identify the range of habitat types in the study area and describe the rare or threatened fauna species known or likely to occur or utilise habitat resources in the study area.

1.2 STUDY AREA LOCATION AND CHARACTERISTICS

The study area is located immediately south of the coastal village of Moonee Beach (refer to *Figure 1.1*). The study area covers approximately 114 hectares, and is bound by the Pacific Highway to the west, the Moonee Beach village to the north, the Pacific Ocean to the east and private rural property to the south.

2 ASSESSMENT METHODOLOGY

2.1 ASSESSMENT AIMS AND OBJECTIVES

The aim of the fauna assessment is to identify the extent of known and potential habitat resources in the study area for fauna species currently listed as threatened on the Commonwealth *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act) and the NSW *Threatened Species Conservation Act 1995* (TSC Act).

The specific objectives of the fauna assessment are to:

- identify and map habitat resources within the study area;
- verify the extent of koala habitat in the study area in accordance with the CHCC Koala Plan of Management (CKPoM); and
- assess habitat values on site in relation to threatened fauna species and other fauna species of conservation significance.

2.2 LITERATURE REVIEW AND DATABASE SEARCH

Existing records of threatened species in the locality (ie. within ten kilometres of the study area) were obtained from the NPWS Wildlife Atlas database. Existing vegetation mapping relevant to the study area prepared by Gary Leonard was reviewed to identify broad vegetation types in the locality. The results of an ecological assessment undertaken in the study area by Clancy (1989) were reviewed to obtain historical fauna records for the site. The Coffs Harbour CKPoM prepared by Lunney *et al*. (1999) for Coffs Harbour Council was reviewed to identify likely koala habitat values in the locality.

2.3 HABITAT ASSESSMENT

General Habitat Assessment

Vegetation communities reflect differences in community structure and plant species composition. The majority of fauna species select habitat based primarily on structural characteristics of vegetation communities rather than the composition of plant species (Barnett *et al*. 1978). One notable exception is the koala, which selects habitat based on the presence of particular tree species suitable for feeding. Structural characteristics of vegetation communities include the height of the dominant stratum, the number of vegetative strata and the density of vegetation.

Many specialised faunal groups may also rely upon the availability of water, the presence of particular tree or shrub species, or specific micro-climatic characteristics in order to survive. Human activities, particularly those that alter the structure or cover of vegetation, have the potential to change faunal habitat characteristics, which, in turn, may result in modifications to the composition of fauna within an area.

The assessment sought to identify the type and quality of fauna habitats occurring in the study area. Assessment of fauna habitat types and quality was derived from a qualitative assessment of:

- dominant vegetation type;
- structural vegetation characteristics;
- presence/abundance of hollow-bearing trees;
- density of groundcover resources (e.g. rocks, logs, vegetation and leaf litter);
- presence of foraging resources;
- presence/absence of permanent or ephemeral freshwater resources; and
- level of disturbance.

Koala Habitat Assessment

The CKPoM identifies and maps koala habitat in the Coffs Harbour LGA into three habitat types, these being "*Primary Koala Habitat*", "*Secondary Koala Habitat*" and "*Tertiary Koala Habitat*".

The CKPoM identifies the study area as containing a combination of Secondary Koala Habitat and areas of no koala habitat.

Therefore, for the purpose of this report the koala habitat assessment was to:

- detect signs of recent or current koala activity in the study area; and
- identify potential koala movement corridors through the study area.

Lunney *et al*. (1999) lists the preferred koala feed tree species for the Coffs Harbour LGA as tallowwood (*Eucalyptus microcorys*), swamp mahogany (*E. robusta*), broad-leaved paperbark (*Melaleuca quinquenervia*), flooded gum (*E. grandis*), blackbutt (*E. pilularis*), forest red gum (*E. tereticornis*), small-fruited grey gum (*E. propinqua*) and forest oak (*Allocasuarina torulosa*). The vegetation within several of the main habitat types in the study area is dominated by these tree species including swamp mahogany, forest red gum, broad-leaved paperbark, blackbutt, tallowwood and flooded gum. Therefore, the study area is likely to contain 'potential koala habitat' (as defined in SEPP 44).

The assessment of koala activity levels in the study area was based on the technique used by the Australian Koala Foundation (Phillips & Callighan 1995). A total of six plots, each covering an area of 400m^2 (20 x 20 metres), were selected in vegetation types containing potential koala habitat. The location of each sampling plot is illustrated in *Figure 2.1*. Each tree within the plot with a Diameter at Breast Height (DBH) greater than 10 centimetres was searched for koalas, scratches (consistent with those of a koala) and scats within 1.5 metres of each tree bole. A minimum number of 30 trees were searched within each plot. If fewer than 30 trees were contained within a plot then additional trees immediately adjacent to the plot were searched until a total of 30 trees were checked.

The koala activity level for each plot sampled in the study area was determined by dividing the number of trees containing one or more koala faecal pellets recorded beneath them, by the total number of trees assessed in the plot (Phillips & Callaghan 1995). The resulting value was then converted into a percentage (ie. multiplied by 100) to indicate the proportion of trees in each plot recently used by koalas.

Plots that return activity levels of approximately 30 percent or greater are considered likely to be within areas containing home range trees and/or areas of major activity currently being utilised by koalas with well defined home range areas (Phillips & Callaghan 1995). Conversely, plots that return activity levels below 30 percent are generally indicative of areas of either unsuitable habitat, little used parts of an individual koala's home range or areas of otherwise suitable habitat that are not presently supporting a socially stable koala population (Phillips & Callaghan 1995).

Hollow-bearing Tree Survey

A quantitative assessment of hollow-bearing trees within forested vegetation types in the study area was undertaken to enable an estimate of hollow abundance to be calculated. This estimate was then used to determine the likely presence of particular hollow-dependent fauna species. No quantitative assessment was conducted in areas of rainforest, sedgeland, estuarine or shrubland habitat due to a lack of mature trees capable of supporting hollows.

Each survey consisted of two people traversing a transect covering approximately one hectare (200m long x 50m wide). Information recorded along each transect included tree species, tree height, DBH, hollow size and hollow location (ie. located in trunk or branch). A total of five transects were conducted in the study area (refer to *Figure 2.1*).

2.4 FAUNA SURVEY

2.4.1 Survey Limitations

Due to the relatively short duration of the survey (ie. six consecutive days) seasonal variation in faunal composition could not be assessed. A variety of nectivorous and migratory fauna species may have been absent from the study area due to seasonal influences. Furthermore, some highly mobile fauna species with large home ranges, of which the study area may comprise a part, may not have been present within the study area during the current brief survey.

Some habitat types could not be sampled with harp trapping due to a lack of suitable harp trapping sites. Therefore, the harp trapping survey is unlikely to have sampled the full diversity of microchiropteran bat species within the study area.

Bat detection is not an effective method of sampling a particular group of bats referred to as "whispering bats". These species emit low-intensity echolocation calls that are difficult to detect and identify through bat detection. Considering the lack of suitable harp trapping sites in some habitat types present on site this group of bats is unlikely to have been adequately sampled during the current survey.

2.4.2 Survey Timing and Prevailing Weather Conditions

The fauna survey tasks were conducted over six consecutive days between the 18th and 23rd of July, 2003. The daytime weather conditions were sunny, with mild to warm temperatures (refer to *Table 2.1*). The night-time weather conditions were generally calm and dry with mild air temperatures. A brief light shower of rainfall was experienced towards the end of nocturnal surveys on 21st July. However, the timing and duration of the rainfall did not seem to hinder the undertaking of survey tasks.

Table 2.1 Weather conditions during the fauna survey period

Date	Cloud (okta)	Wind (Dir./kmh)	Max. Temp. (°C)	Min. Temp. (°C)	Rainfall (mm)
18/7/03	6	S 21	18.0	13.4	0.0
19/7/03	2	S 31	19.1	12.8	0.0
20/7/03	6	S 24	18.1	12.6	1.0
21/7/03	6	E 11	18.6	12.0	4.8
22/7/03	1	NNE 28	22.1	11.5	0.0
23/7/03	7	NNW 24	20.8	9.4	0.0

2.4.3 Survey Effort

A variety of fauna survey techniques were applied to each main habitat type in the study area. The location of fauna sampling effort is illustrated in *Figures 2.1* and *2.2*. The allocation of survey effort to each main habitat type is provided in *Table 2.2*.

Table 2.2 Allocation of survey effort per sampling site

Survey Technique	LRF	DOF	MOF	SF	SL	SHL	EST
Diurnal Bird Survey (hours*)	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Hairtubes (trapnights)	100	150	100	0	50	100	
Cage Traps (trapnights)	0	10	5	10	0	0	
Ground Elliotts (trapnights)	0	100	50	100	50	50	
Arboreal Elliotts (trapnights)	0	50	0	50	0	0	
Pitfall Traps (trapnights)	0	0	0	50	25	25	
Call Playback (hours*)	0	3	0	1	3	0	
Dusk Census (hours*)	0	2	0	1	1	0	
Spotlighting (hours*)	1	8	1	4	0	4	
Harp Trapping (trapnights)	0	4	0	4	2	2	
Bat Detection – Walking (Hours)	0.5	4	0.5	2	0	2	
Bat Detection – Remote (Hours)	0	24	0	24	12	12	

LRF Littoral Rainforest DOF Dry Open Forest EST Estuary
MOF Moist Open Forest SF Swamp Forest
SL Sedgeland SHL Shrubland
hours* represents person hours completed (ie. one hour of survey by two team members is equivalent to two person hours of survey).

2.4.4 Fauna Survey Techniques

Ground-based Elliott Trapping

Ground-based Elliott trapping was conducted in the swamp forest, dry open forest, moist open forest, shrubland and sedgeland habitats to assess the diversity and abundance of small terrestrial mammals in the study area (refer to *Figure 2.1*). The technique was also used specifically to detect the presence of the eastern chestnut mouse (*Pseudomys gracilicaudatus*) and the common planigale (*Planigale maculata*).

Each of these habitat types was sampled by a transect containing 10 ground-based Elliott traps (A-type traps) spaced approximately 10 to 20 metres apart. Due to their larger extent in the study area the swamp forest and dry open forest habitats were sampled by two transects containing 10 traps each. A total of 70 ground-based Elliott traps were set in the study area during the survey period.

The Elliott trapping transects were all set for five consecutive nights. The vegetarian baits used consisted of a mixture of honey, rolled oats and peanut butter. "Good-o" dog biscuits were used as bait in every second trap. All traps were partially contained within plastic bags in order to protect captured animals from low temperatures and precipitation.

Arboreal Elliott Trapping

Arboreal Elliott traps (Type-B traps) were used to detect threatened arboreal mammal species such as the squirrel glider (*Petaurus norfolcensis*) and brush-tailed phascogale (*Phascogale tapoatafa*). Arboreal Elliott traps were set in the dry open forest and swamp forest habitats (refer to *Figure 2.1*). Each sampling transect consisted of five traps spaced 20 to 50 metres apart (spacing varied depending on proximity of mature trees). Traps were set for five consecutive nights to achieve a total of 100 trapnights. Traps were baited with a mixture of honey, oats and peanut butter.

Pitfall Trapping

Pitfall trapping was conducted in the swamp forest and shrubland habitats to assess the diversity of small terrestrial mammals, amphibians and reptiles in the study area (refer to *Figure 2.1*). The technique was also used specifically to detect the presence of the common planigale. The sedgeland habitat could not be sampled with this technique due to the presence of a shallow water table, which would have resulted in flooded pitfalls.

Four pitfall transects were established in the study area. Each sampling transect consisted of five pitfalls (ie. buried 20 litre buckets). The pitfalls were spaced approximately four metres apart within areas of dense groundcover vegetation, and linked by barrier fencing (approximately 300 millimetres high). Each pitfall transect was set for five consecutive nights.

Cage Trapping

Cage trapping was used to detect the variety of medium to large terrestrial mammal species in the study area (refer to *Table 2.2* and *Figure 2.1*). The technique also specifically aimed to detect the spotted-tailed quoll (*Dasyurus maculatus*) and long-nosed potoroo (*Potorous tridactylus*).

Cage traps were placed in the dry open forest, moist open forest and swamp forest habitats. Each trap was baited with a vegetarian bait (ie. mixture of honey, rolled oats and peanut butter), and set for five consecutive nights.

Hairtube Sampling

Hairtube sampling was used in most habitat types to detect the variety of terrestrial mammal species present (refer to *Table 2.2* and *Figure 2.2*). The technique also specifically aimed to detect the common planigale, spotted-tailed quoll (*Dasyurus maculatus*) and long-nosed potoroo (*Potorous tridactylus*).

Most sampling sites consisted of a transect containing ten ground-based hairtubes spaced approximately 50 metres apart. The exceptions being the sedgeland site and one of the dry open forest sites, which contained only five hairtubes each. Vegetarian baits (ie. mixture of honey, rolled oats and peanut butter) and meat baits (ie. raw chicken) were used alternately along each transect. All hairtubes were left in the field for ten consecutive nights.

Dusk Census

Dusk census was conducted at five locations in the study area for approximately 45 minutes per day over five consecutive days (refer to *Figure 2.2*). Dusk census involves

quiet listening and observation to detect movement and calling of nocturnally active fauna as they leave their diurnal roost sites.

Call Playback

Call playback surveys were established at two locations within the study area to illicit response calls from threatened owl and mammal species considered likely to occur on site (refer to *Figure 2.2*). Calls were played once at each site per night over two non-consecutive nights. Each call playback survey consisted of an initial 10 minute listening period, five minutes call of each species (separated by a two minute listening period) and a ten minute listening period after the completion of all calls. The broadcasted calls included powerful owl, masked owl, barking owl, koala, squirrel glider and yellow-bellied glider. The spotlighting surveys were undertaken immediately after the call playback surveys in order to detect fauna attracted to the study area.

Two team members conducted each call playback survey. One team member was placed approximately 100 metres from the megaphone, while the other team member remained within 20 metres of the megaphone.

Call playback was also conducted on dusk over two consecutive days in the swamp forest habitat to illicit response calls from Lewin's rail and black bittern. Each call was broadcast intermittently for five minutes interspersed with short periods of quiet listening.

Spotlighting

Spotlighting was undertaken to detect nocturnally active fauna species. The location and extent of walking spotlight transects conducted for the current survey is illustrated in *Figure 2.2*. The length of each walking transect was determined by the extent and accessibility of the habitat type being sampled. Each transect was traversed two times by two survey team members over two non-consecutive nights during the survey period.

Diurnal Bird Surveys

Bird surveys were conducted at early morning in each habitat type. Each survey was conducted along a transect (approximately 100 metres long) for approximately 30 minutes duration. The bird surveys were conducted in each habitat type over three non-consecutive mornings.

Opportunistic bird observations were also recorded throughout the study area during the completion of other survey tasks.

Harp Trapping

Harp trapping was undertaken to assess habitat use by threatened microchiropteran bat species unlikely to be recorded by bat detection. Harp traps were set up at six sites across access tracks and a creekline in the study area. Habitats sampled with this technique included dry open forest (three sites), swamp forest (one site), shrubland (one site) and riparian swamp oak forest (one site).

A total of two nights trapping was conducted at each site. Tarpaulins were used to block the gaps around and under the trap, to funnel bats into the harp.

The harp traps were erected at dusk, and left in place until early morning the following day. The harp trap placed within the shrubland habitat was checked at regular intervals

(approximately every two hours) up to midnight in order to release any captured eastern blossom bats.

Bat Detection – Remote

Remote bat detection was conducted at six locations for one night per site using an Anabat II detector in conjunction with a delay switch (refer to *Figure 2.2*). Approximately 72 hours of remote bat detection were completed during the survey period.

Bat Detection – Walking Transects

Walking bat detection transects were conducted in conjunction with spotlight walking transects. Approximately nine hours of bat detection were conducted using this technique during the survey period. All recordings of bat calls were analysed by Glenn Hoye, who is a recognised expert in bat call analysis.

Herpetological Searches

All team members opportunistically recorded reptiles and amphibians in the study area (by call and visual observation) while conducting other survey tasks.

Fauna Features Searches

Opportunistic searches for fauna scats and tracks were conducted along access tracks and road edges in and adjacent to the study area. A specific search was also conducted along the Pacific Highway road verges for road mortalities.

3 ASSESSMENT RESULTS

3.1 HABITATS IN THE STUDY AREA

The study area contains seven main habitat types. These include littoral rainforest (LR), moist open forest (MOF), dry open forest (DOF), swamp forest (SF), closed sedgeland (SL), shrubland (SHL) and estuarine habitat (EST). The broad distribution of habitat types in the study area is illustrated in *Figure 3.1*. The characteristics of each habitat type are described below.

3.1.1 Littoral Rainforest (LR)

The littoral rainforest habitat is restricted to a narrow band of vegetation along the northeastern periphery of the study area. This habitat type is likely to provide suitable foraging resources for a variety of frugivorous bird and mammal species including bowerbirds, figbirds, fruit-doves and flying foxes. The dense canopy vegetation would provide suitable foraging substrate for a variety of insectivorous fauna species. The thick and moist layer of leaf litter would also provide suitable foraging habitat for ground-foraging fauna species.

The dense canopy vegetation provides suitable roosting and sheltering habitat for a variety of cover-dependent bird and mammal species. The dense leaf litter layer may also provide suitable shelter for small terrestrial mammal and reptile species.

Peripheral areas of this habitat type are currently subject to human induced disturbances including walking tracks and weed infestation.

3.1.2 Moist Open Forest (MOF)

This habitat type is generally restricted to the riparian zones along the freshwater reaches of streams and drainage lines in the study area, particularly along the northwestern and southwestern boundaries of the study area.

The myrtaceous tree species in the overstorey stratum including flooded gum, tallowwood and turpentine would provide seasonal foraging resources for nectivorous fauna. The flooded gum and tallowwood also provide suitable foraging resources for the koala. The various rainforest tree species in the midstorey and understorey strata may provide seasonal foraging resources for frugivorous fauna. The moist open forest along the northwestern study area boundary contains forest oak in the midstorey and understorey strata, which provides a seasonal foraging resource for granivorous fauna species including the threatened glossy black-cockatoo.

This habitat type has a dense layer of leaf litter that may provide suitable shelter for reptiles and small ground-dwelling mammals, and suitable foraging habitat for ground-dwelling birds. Fallen logs and branches in this habitat type may also provide shelter for small terrestrial mammals, reptiles and amphibians.

Mature trees with medium to large hollows are uncommon in this habitat type, hence there is a limited supply of potential roosting and nesting resources for larger hollow-dependent fauna species. Conversely, there is a moderate abundance of small hollows (entrance diameter up to 5cm) and decorticating bark, which would provide suitable roosting resources for microchiropteran bats and small hollow-roosting avifauna. The small hollows may also provide limited shelter for arboreal mammals able to utilise small hollows (e.g. squirrel gliders, sugar gliders and eastern pygmy-possums).

This habitat type generally occurs in close proximity to drainage lines and the swamp forest habitat, which contain ephemeral freshwater resources that are likely to provide suitable breeding habitat for a variety of amphibian species.

Moist open forest habitat along the northwestern boundary of the study area is currently subject to human induced disturbances including walking tracks and weed infestation. This area has also been subject to logging activity some time in the past. However, there is no evidence of recent logging activity.

3.1.3 Dry Open Forest (DOF)

Dry open forest is one of the more widespread habitat types in the study area. It occurs as one large remnant near the northwestern corner of the study area and another large remnant in the central southern portion of the study area. There is also a small remnant of dry open forest on the northeastern periphery of the study area.

The myrtaceous tree species in the overstorey and midstorey strata would provide seasonal foraging resources for nectivorous fauna when flowering. The variety of overstorey tree species would also provide suitable feeding resources for folivorous fauna species such as the common ringtail possum and common brushtail possum.

The black she-oak in the midstorey and understorey strata provide a seasonal foraging resource for granivorous fauna species such as the threatened glossy black-cockatoo.

The blackbutt and tallowwood in the overstorey stratum may also provide suitable foraging resources for koalas. However, no evidence of recent activity by this species was detected on site during the current survey.

There is a moderate to dense groundcover of vegetation and fallen logs in this habitat type, which would provide suitable sheltering resources for small terrestrial mammals and reptiles.

Mature trees with medium to large hollows are uncommon throughout a large proportion of this habitat type due to past intensive logging activity. However, dry open forest in the southern parts of the study area contains occasional large mature blackbutts with abundant medium-sized hollows (ie. entrance diameter 5 to 15cm) (refer to *Figure 3.1*). There is also a relatively small group of large mature trees with abundant medium and large hollows (ie. entrance diameter >15cm) in the northwestern part of the study area (refer to *Figure 3.1*). Therefore, this habitat type contains some limited potential roosting/nesting resources for larger species of hollow-dependent fauna.

Small branch-based tree hollows are relatively common throughout this habitat type, which would provide suitable roosting resources for small hollow-roosting fauna species. There are no freshwater resources in this habitat type, hence there is unlikely to be suitable breeding resources for amphibians.

This habitat type appears to have been subject to intensive logging activity some time during the past 20 to 30 years. There is also some evidence of more recent selective tree felling most likely for firewood collection. The site appears to have been subject to moderate intensity fire during the last five years. Weeds are relatively sparse throughout this habitat type.

3.1.4 Swamp Forest (SF)

Swamp forest is the most widespread habitat type in the study area, extending in a broad swathe down the centre of the site.

The swamp mahogany and broad-leaved paperbark would provide important autumn and winter foraging resources for nectivorous fauna. These tree species are also preferred koala feed tree species in the Coffs Harbour LGA. The grasses and sedges within the groundcover stratum would provide seed and stem resources for granivorous and omnivorous fauna species.

This habitat type contains areas of dense groundcover vegetation that would provide suitable shelter for reptiles, amphibians and small terrestrial mammals. The sandy substrate would also represent a suitable sheltering resource for burrowing fauna during extended dry periods.

Medium and large tree hollows are generally uncommon in this habitat type. However, there are two small areas that contain several mature trees with medium and large hollows (refer to *Figure 3.1*). Therefore, this habitat type contains some limited potential roosting/nesting resources for larger species of hollow-dependent fauna. In addition, the decorticating bark (on melaleucas) is likely to provide suitable roosting resources for some microchiropteran bat species.

The dense groundcover vegetation present and the extended periods of inundation likely to occur in this habitat type are likely to provide suitable breeding and foraging habitat for a variety of waterbird and amphibian species.

Large proportions of this habitat type appear to consist of 30 to 40 year old regrowth vegetation, as evidenced by the paucity of large mature trees in the canopy stratum. There is little evidence of weed infestation or recent fire activity within this habitat type.

3.1.5 Closed Sedgeland (SL)

The sedgeland habitat occurs as a relatively narrow swathe in the northeastern portion of the study area between the swamp forest habitat to the west and shrubland habitat to the east.

The dense layer of sedges in the groundcover stratum would provide foraging resources for granivorous and herbivorous fauna. The areas of denser sedges would provide suitable shelter for a variety of small terrestrial mammal species, which in turn would provide suitable food resources for carnivorous fauna, particularly raptors such as kites and owls.

The dense vegetative groundcover may also provide suitable sheltering resources for some ground-nesting bird species including the threatened grass owl.

3.1.6 Shrubland (SHL)

The shrubland habitat is confined to the dunal strip that extends along the eastern boundary of the study area.

Coastal banksia is the dominant canopy species, which would provide a reliable foraging resource for nectivorous fauna. The dense vegetation in the understorey stratum would provide suitable foraging habitat for cover-dependent insectivorous bird species, which in turn would provide suitable foraging resources for carnivorous bird species such as raptors.

The dense groundcover vegetation and sandy substrate would provide suitable shelter for small terrestrial mammal and reptile species. There are no freshwater resources in this habitat type, hence there is unlikely to be suitable breeding resources for amphibians.

Vegetation within this habitat type appears to be the result of sandmine rehabilitation. Extensive areas within this habitat type are subject to weed infestation by bitou bush, senna and lantana. There are also extensive walking and vehicle tracks throughout this habitat, which may have contributed to the decline in native plant species diversity.

3.1.7 Estuarine Habitat (EST)

Estuarine habitat consisting of mangrove woodland and saltwater couch is restricted to a small intertidal area on the northern boundary of the study area.

This habitat type is likely to provide important habitat resources for aquatic fauna species, which in turn would provide suitable foraging resources for a variety of terrestrial fauna species including wading birds, egrets and storks.

3.2 KOALA HABITAT

The CKPoM identifies areas of moist open forest, dry open forest and swamp forest in the study area as representing Secondary Koala Habitat. The results of the current survey generally support the findings of the CKPoM. The moist open forest, dry open forest and swamp forest habitat types are comprised of several locally preferred koala feed tree species including flooded gum, tallowwood, blackbutt, forest red gum, swamp mahogany and broad-leaved paperbark. However, no evidence of koala activity was recorded in the study area during the current survey. The results of the koala scat searches are provided in *Table 3.1*.

Table 3.1 Results of koala scat searches

Plot Number	Tree Species	No. Individuals Checked	No. Scats Detected	Proportion of Trees with Scats (%)
S1	*Eucalyptus robusta*	8	0	0
	Melaleuca quinquenervia	14	0	0
	Casuarina glauca	4	0	0
	Callistemon salignus	4	0	0
	Lophostemon suaveolens	1	0	0
S2	*M. quinquenervia*	11	0	0
	E. robusta	18	0	0
	L. suaveolens	1	0	0
D1	*E. microcorys*	1	0	0
	E. pilularis	17	0	0
	Allocasuarina littoralis	6	0	0
	E. siderophloia	1	0	0
	C. salignus	3	0	0
	Corymbia intermedia	2	0	0
	E. resinifera	1	0	0
D2	*E. microcorys*	10	0	0
	Syncarpia glomulifera	15	0	0
	E. pilularis	1	0	0
	C. intermedia	3	0	0
	E. resinifera	1	0	0
M1	*E. grandis*	12	0	0
	C. salignus	17	0	0
	M. quinquenervia	1	0	0
M2	*E. microcorys*	9	0	0
	C. intermedia	2	0	0
	E. pilularis	2	0	0
	S. glomulifera	9	0	0
	Lophostemon confertus	4	0	0
	A. torulosa	2	0	0
	Eucalyptus sp.	1	0	0

Plot Number	Tree Species	No. Individuals Checked	No. Scats Detected	Proportion of Trees with Scats (%)
	C. salignus	1	0	0

3.3 FAUNA INHABITING THE STUDY AREA

3.3.1 Amphibians and Reptiles

A total of five amphibian and two reptile species were recorded during the current survey (refer to *Table 3.2*). None of the species recorded are currently listed as threatened on the TSC Act.

Table 3.2 Amphibian and reptile species recorded during the current survey

Scientific Name	Common Name	Detection Method	Habitat
Crinia signifera	Common Eastern Froglet	Call	SF
Litoria dentata	Bleating Tree Frog	Call	DOF
Litoria jervisiensis	Jervis Bay Tree Frog	Call	SF
Limnodynastes peronii	Striped Marsh Frog	Call	SF
Pseudophryne coriacea	Red-backed Toadlet	Call	SF; DOF
Physignathus lesueurii	Eastern Water Dragon	Obs	MOF
Lampropholis delicata	Skink	Obs	DOF
Call Species identified by call		Obs Species visually observed	

3.3.2 Avifauna (Birds)

A total of 73 bird species were recorded during the current survey (refer to *Appendix A*). Of the species recorded, the osprey (*Pandion haliaetus*), glossy black-cockatoo (*Calyptorhynchus lathami*) and square-tailed kite (*Lophoictinia isura*) are currently listed as Vulnerable on Schedule 2 of the TSC Act.

3.3.3 Mammals

A total of 25 native and one introduced mammal species were recorded in the study area during the survey period (refer to *Table 3.3*). This total consisted of four small terrestrial mammal species, six medium to large terrestrial mammal species, three arboreal mammal species and 13 flying mammal species. Seven of the flying mammal species are currently listed as Vulnerable on Schedule 2 of the TSC Act. The grey-headed flying-fox is also currently listed as Vulnerable on the Commonwealth Environment Protection Biodiversity Conservation Act 1999 (EPBC Act).

Table 3.3 Mammal species recorded in the study area during the current survey

Scientific Name	Common Name	Habitat Type	Detection Method
Rattus rattus[I]	Black Rat[I]	SF; SL; MOF; DOF	GE
Rattus lutreolus	Swamp Rat	SL; SF	GE
Rattus fuscipes	Bush Rat	SF; DOF; MOF; SHL	GE; AE
Antechinu stuartii	Brown Antechinus	SF; DOF; MOF; SHL	GE; SHL
Macropus giganteus	Eastern Grey Kangaroo	SL	Obs
Macropus rufogriseus	Red-necked Wallaby	DOF	Obs
Wallabia bicolor	Swamp Wallaby	DOF; SF; SL; SHL	Obs

Scientific Name	Common Name	Habitat Type	Detection Method
Perameles nasuta	Long-nosed Bandicoot	SHL; DOF	Call; Obs
Isoodon macrourus	Northern Brown Bandicoot	SF	Cage Trap
Tachyglossus aculeatus	Short-beaked Echidna	DOF	Roadkill
Pseudocheirus peregrinus	Common Ringtail Possum	MOF	Scat
Trichosurus vulpecula	Common Brushtail Possum	SF; DOF	Spot
Acrobates pygmaeus	Feathertail Glider	DOF	Spot
Pteropus poliocephalus[VV*]	Grey-headed Flying-fox[VV*]	SHL; SF; DOF	Spot; Call
Syconycteris australis[V]	Eastern Blossom Bat[V]	SHL	Harp
Rhinolophus megaphyllus	Eastern Horseshoe Bat	SF	Anabat
Mormopterus norfolkensis[V]	Eastern Freetail Bat[V]	SF; SHL	Anabat
Chalinolobus gouldii[V]	Gould's Wattled Bat[V]	SF; SHL	Anabat
Chalinolobus morio	Chocolate Wattled Bat	DOF	Anabat
Miniopterus australis[V]	Little Bentwing Bat[V]	SHL; DOF, SF	Anabat
Miniopterus schreibersii[V]	Large Bentwing Bat[V]	DOF; SF	Anabat
Myotis adversus[V]	Large-footed Myotis[V]	EST	Anabat
Nyctophilus gouldi	Gould's Long-eared Bat	SHL	Harp
Vespadelus vulturnus	Little Forest Bat	DOF; SF	Anabat
Vespadelus pumilus	Eastern Forest Bat	DOF; SF	Harp
Tadarida australis	White-striped Mastiff Bat	SHL; DOF	Call

[V] Species currently listed as Vulnerable on the TSC Act
[V*] Species currently listed as Vulnerable on the EPBC Act
[I] Introduced Species
Call Species identified by call Obs Species visually observed

3.4 THREATENED FAUNA SPECIES KNOWN OR LIKELY TO OCCUR IN THE STUDY AREA

3.4.1 Threatened Fauna Species Previously Recorded in the Locality

The NPWS Wildlife Atlas records and surveys previously undertaken indicate that 35 fauna species currently listed as threatened on the TSC Act have been previously recorded in the locality (ie. within 10 kilometres of the study area). These species are listed in *Table* 3.4.

Table 3.4 Threatened species previously recorded in the locality

Scientific Name	Common Name	Status	Data Source
Hoplocephalus stephensii	Stephens Banded Snake	V	NPWS
Litoria aurea	Green & Golden Bell Frog	V	NPWS
Ixobrychus flavicollis	Black Bittern	V	NPWS
Ephippiorhynchus asiaticus	Black-necked Stork	V	NPWS
Irediparra gallinacea	Comb-crested Jacana	V	NPWS
Sterna albifrons	Little Tern	V	NPWS
Haematopus fuliginosus	Sooty Oystercatcher	V	NPWS; Clancy (1989)
Haematopus longirostris	Pied Oystercatcher	V	NPWS
Todiramphus sanctus	Collared Kingfisher	V	NPWS
Ninox strenua	Powerful Owl	V	NPWS
Tyto novaehollandiae	Masked Owl	V	NPWS
Tyto tenebricosa	Sooty Owl	V	NPWS
Tyto capensis	Grass Owl	V	NPWS; Clancy (1989)
Lophoictinia isura	Square-tailed Kite	V	NPWS
Pandio haliaetus	Osprey	V	NPWS; Clancy (1989)
Calyptorhynchus banksii	Red-tailed Black-cockatoo	V	NPWS
Calyptorhynchus lathami	Glossy Black-cockatoo	V	NPWS
Cyclopsitta diophthalma	Double-eyed Fig Parrot	V	NPWS
Lathamus discolor	Swift Parrot	V	NPWS
Ptilinopus magnificus	Wompoo Fruit-dove	V	NPWS
Ptilinopus regina	Rose-crowned Fruit-dove	V	NPWS
Coracina lineata	Barred Cuckoo-shrike	V	NPWS
Climacteris picumnus	Brown Treecreeper	V	NPWS
Grantiella picta	Painted Honeyeater	V	NPWS
Xanthomyza phrygia	Regent Honeyeater	V	NPWS
Pteropus poliocephalus	Grey-headed Flying-fox	*V	NPWS; Clancy (1989)
Syconycterus australis	Eastern Blossom Bat	V	NPWS
Miniopterus australis	Little Bentwing Bat	V	NPWS
Miniopterus schreibersii	Large Bentwing Bat	V	NPWS
Phoniscus papuensis	Golden-tipped Bat	V	NPWS
Petaurus australis	Yellow-bellied Glider	V	NPWS
Petaurus norfolcensis	Squirrel Glider	V	NPWS
Phascogale tapoatafa	Brush-tailed Phascogale	V	NPWS
Phascolarctos cinereus	Koala	V	NPWS; Clancy (1989)
Dasyurus maculatus	Spotted-tailed Quoll	*V	NPWS

*E species currently listed as Endangered on the Commonwealth EPBC Act;
*V species currently listed as Vulnerable on the Commonwealth EPBC Act;
E species currently listed as Endangered on Schedule 1 of the TSC Act;
V species currently listed as Vulnerable on Schedule 2 of the TSC Act.

Of the threatened species previously recorded in the locality seven fauna species were recorded in the study area during the current survey (refer to *Table 3.7*). Clancy (1989) also recorded the osprey and grass owl in the study area. Furthermore, an additional 19 fauna species previously recorded in the locality are likely to utilise habitat resources in the study area based on habitat preferences and known distribution (refer to *Appendix B*).

Although not previously recorded in the locality, the study area may also provide suitable habitat for the green-thighed frog (*Litoria brevipalmata*), common planigale (*Planigale maculata*), eastern pygmy-possum (*Cercartetus nanus*), greater broad-nosed bat (*Scoteanax rueppellii*), yellow-bellied sheathtail bat (*Saccolaimus flaviventris*) and barking owl (*Ninox connivens*).

3.4.2 Threatened Fauna Species Recorded in the Study Area during the Current Survey

The current survey recorded three bird species and six flying mammal species that are currently listed as Vulnerable on Schedule 2 of the TSC Act. These species are listed in *Table 3.5*. The large-footed myotis and eastern freetail bat represent new threatened species records for the locality.

Table 3.5 Threatened fauna species recorded in the study area during the survey period

Scientific Name	Common Name	Habitat Type	Detection Method
Pandion haliaetus	Osprey	DOF; SF; SL; RF	Obs
Lophoictinia isura	Square-tailed Kite	RF; SL	Obs
Calyptorhynchus lathami	Glossy Black-cockatoo	DOF	Feeding Signs
Pteropus poliocephalus	Grey-headed Flying-fox	SHL; SF; DOF	Spot; Call
Syconycteris australis	Eastern Blossom Bat	SHL	Harp
Mormopterus norfolkensis	Eastern Freetail Bat	SF; SHL	Anabat
Miniopterus australis	Little Bentwing Bat	SHL; DOF, SF	Anabat
Miniopterus schreibersii	Large Bentwing Bat	DOF; SF	Anabat
Myotis adversus	Large-footed Myotis	EST	Anabat

3.4.3 Habitat Resources for Threatened Fauna Species in the Study Area

The study area provides known or suitable habitat resources for 35 fauna species currently listed as threatened on the TSC Act (refer to *Table 3.6*). The extent of suitable habitat resources for each of these threatened species is discussed below.

Table 3.6 Habitat resources for threatened fauna species in the study area

Threatened Species	EST	RF	MOF	DOF	SF	SHL	SL
Stephens Banded Snake			r; f; b		r; f; b		
Green-thighed Frog			r; f; b	r; f	r; f; b		
Black Bittern	f		r; f; b		f		
Black-necked Stork	f				f		f
Pied Oystercatcher	f						
Collared Kingfisher	r; f						
Powerful Owl	f	r; f	r; f	r; f; b	f	f	f
Barking Owl	f	r; f	r; f	r; f; b	r; f	r; f	r; f
Masked Owl	f	f	f	r; f	r; f	f	f
Grass Owl					f		r; f; b
Square-tailed Kite	f	f	r; f; b	r; f; b	r; f	f	f
Osprey	f			b	b		
Red-tailed Black-cockatoo	f	f	f	f	f	f	
Glossy Black-cockatoo			f	f			
Double-eyed Fig Parrot		f					
Swift Parrot			f	r; f	r; f	f	
Wompoo Fruit-dove		r; f	r; f				
Rose-crowned Fruit-dove		r; f	r; f				
Barred Cuckoo-shrike		r; f	r; f		r; f		
Regent Honeyeater			r; f	r; f	r; f	f	
Grey-headed Flying-fox	f	r; f	f	f	f	f	
Eastern Blossom Bat		r; f			f	f	
Large Bentwing Bat	f	f	f	f	f	f	f
Little Bentwing Bat	f	f	r; f	r; f	r; f	f	f
Golden-tipped Bat	f	r; f	f	f	f	f	
Large-footed Myotis	f	f	r; f	r; f; b	r; f; b	f	f
Greater Broad-nosed Bat	f	f	r; f	r; f; b	r; f; b	f	f
Eastern Freetail Bat	f	f	r; f	r; f; b	r; f; b	f	f
Yellow-bellied Sheathtail Bat	f	f	r; f	r; f; b	r; f; b	f	f
Koala			r; f	r; f	r; f		
Yellow-bellied Glider		f	f	f	f		
Squirrel Glider		f	f	r; f; b	r; f; b	f	
Eastern Pygmy-possum		r; f; b	r; f; b	r; f; b	r; f; b	f	
Brush-tailed Phascogale			f	r; f; b			
Spotted-tailed Quoll		f	f	f	f	f	
Common Planigale					r; f; b	r; f; b	r; f; b

r Roosting Resources b Breeding Resources
f Foraging Resources

Stephen's Banded Snake

The Stephen's banded snake inhabits dry rainforest, sub-tropical rainforest, wet sclerophyll forest, dry sclerophyll forest and rock outcrops, from near sea level up to 950 metres (Gilmore and Parnaby 1994). The species utilises gaps underneath decorticating bark on trees, or in hollow trunks and limbs of dead trees (Gilmore and Parnaby 1994).

The moist open forest and swamp forest habitats in the study area are likely to provide suitable habitat resources for this species. The littoral rainforest habitat may not provide suitable habitat for the species due to a paucity of suitable sheltering resources such as tree hollows or trees with decorticating bark.

Green-Thighed Frog

This species is known to inhabit primarily rainforest and wet sclerophyll forest habitats. However, it has also been recorded in dry open forest and coastal swamp forest. Breeding

aggregations of this species utilise grassy margined, semi-permanent and permanent ponds in late spring and summer usually after heavy rainfall.

The swamp forest and moist open forest habitats in the study area are likely to provide suitable foraging, sheltering and breeding resources for the species, while the dry open forest habitat may also provide suitable foraging and sheltering resources for the species.

Black Bittern

The black bittern occurs in thick vegetation at margins of watercourses, swamps, billabongs, mudflats and mangroves in tidal creeks and rivers. Critical breeding habitat is mangrove belts along coastal waterways and densely vegetated wetlands (State Forests of NSW 1995). Nests usually consist of an untidy platform of sticks on a sheltered horizontal branch overhanging water (Pizzey and Knight 1997). The species feeds on small fish and invertebrates.

The moist open forest, estuarine and swamp forest habitats in the study area are likely to provide suitable foraging habitat for the species. There are densely vegetated riparian areas within the moist open forest, which may also provide suitable nesting habitat for the species.

Black-necked Stork

The black-necked stork inhabits riverine swamps, large permanent pools and coastal wetlands and estuaries (Blakers *et al*. 1984). Fresh, brackish and saline waters are utilised, including farm dams and sewage ponds (State Forests of NSW 1995). The bird forages in shallow waters, feeding primarily on fish and frogs (Blakers *et al*. 1984). The nest usually consists of a large flat pile of sticks, grass, rushes, high and exposed in a tall live or dead tree (Pizzey and Knight 1997). Breeding grounds for the species occur predominantly north from Coffs Harbour, NSW (Blakers *et al*. 1984).

The swamp forest, sedgeland and estuarine habitats in the study area are likely to provide minor foraging resources for this species. However, nesting sites of this species are usually associated with large riverine swamps or located near large permanent waterbodies (Blakers *et al*. 1984). Therefore, the study area is unlikely to represent suitable breeding habitat for the species.

Collared Kingfisher

The collared kingfisher is confined to mangroves and large tidal creeks, feeding on crustaceans, small fish, worms, insects, reptiles and other small tidal animals (Schodde & Tidemann 1986). The species nests in termite mounds (Schodde & Tidemann 1986).

The estuarine habitat in the study area may provide suitable foraging resources for this species. However, there do not appear to be any suitable nesting resources for the species (ie. Large arboreal termite mounds) in close proximity to the estuarine habitat, hence the study area is unlikely to represent suitable breeding habitat for the species.

Pied Oystercatcher

The pied oystercatcher inhabits intertidal mudflats, beaches, saltmarsh, reefs and rocks where it feeds on molluscs, worms, crabs and small fish (Marchant & Higgins 1993). The species nests in areas allowing good visibility on beaches, shores of tidal lagoons, estuaries, tidal creeks and occasionally in paddocks next to beaches (Newman 1992; Marchant & Higgins 1993; Lauro & Nol 1995).

The estuarine habitat in the study area may provide a small area of suitable foraging substrate for the pied oystercatcher. However, the study area is unlikely to provide any suitable nesting habitat for the species.

Threatened Forest Owls

The study area is likely to contain suitable foraging habitat for the powerful owl, masked owl and barking owl. Large tree hollows are uncommon but present within the dry open forest and swamp forest habitats, and may provide suitable nesting resources for these species or roosting resources for the masked owl. Dense canopy vegetation within the littoral rainforest and moist open forest habitat may also provide suitable roosting opportunities for the powerful owl and barking owl.

Grass Owl

The grass owl is a specialist of coastal and inland grassland (State Forests of NSW 1995). It also inhabits coastal heath, agricultural crops and swamp margins (Maciejewski 1997). Core breeding habitat is dense secluded grass tussock swards, sometimes not far from water (State Forests of NSW 1995). Rodents are the species main prey base, but birds, insects, frogs and reptiles are also taken (Shields 1994).

The sedgeland and swamp forest habitats are likely to provide suitable foraging habitat for this species. The taller denser sections of the sedgeland habitat may also provide suitable nesting habitat for the species.

Square-tailed Kite

The square-tailed kite utilises a range of habitats including heathlands, woodlands, forests, tropical and sub-tropical rainforest and timbered watercourses (Pizzey & Knight 1997). The species feeds primarily on eggs, nestlings and adult birds; often of honeyeaters and other passerines that build nests in foliage (Debus 1998). The species has also been recorded feeding on insects, reptiles, tree frogs and small mammals (Debus 1998).

The square-tailed kite tends to use the same nest site year after year (Schodde & Tidemann 1986). Nests are usually located between eight and 34 metres from the ground within forest and woodland (Debus 1998).

This species is likely to forage across the various habitat types throughout the study area. The forested habitats on site may also provide suitable nesting opportunities for the species.

Osprey

The primary habitat components of the osprey are:

- a water body (estuary, river, lake or ocean) possessing a sufficient supply of food fish (Clancy 1991);
- a supply of food (mainly fish) of appropriate size (25-35 m) to support breeding birds and their offspring (Clancy 1991);
- feeding perches close to feeding grounds and nest site (Clancy 1991); and
- a suitable nesting substrate consisting of a tall dead tree (sometimes living), with nesting material available locally (Clancy 1991).

Nesting sites are usually located within two kilometres of suitable feeding habitat (Clancy 1991).

The osprey was recorded regularly flying over the study area, and currently nests in a large senescent tree situated in predominantly cleared land immediately south of the study area. The study area is likely to provide suitable feeding perches alternative nesting sites and a source of nesting material for this species.

Red-Tailed Black-Cockatoo

The red-tailed black-cockatoo is a highly nomadic species and may only be seasonally present in some areas (Schodde & Tidemann 1986). The species is a seed eater, eating the seeds of a wide variety of trees, shrubs, grasses and mangroves (Schodde & Tidemann 1986). The species requires large hollows in tall mature trees for nesting (Gibbons & Lindenmeyer 1997; Pizzey & Knight 1997).

The species is likely to forage on a variety of shrub and tree species throughout the study area. Suitable nesting hollows for this species are uncommon in the study area, and are restricted to the dry open forest and swamp forest habitat types.

Glossy Black-Cockatoo

The distribution of the glossy black-cockatoo generally corresponds with the distribution of its primary food source, the seeds of black she-oak (*Allocasuarina littoralis*), forest oak (*A. torulosa*) and *A. verticillata* (State Forests of NSW 1995). Black she-oak is a common tree species in the dry open forest habitat on site.

The glossy black-cockatoo requires large hollows in tall mature trees for nesting (Gibbons &Lindenmayer 1997; Pizzey & Knight 1997).

Foraging activity by this species was recorded under black she-oak at numerous sites throughout the dry open forest habitat. Foraging activity was also recorded under forest oak in the moist open forest habitat along the northwestern boundary of the study area. Suitable nesting hollows for this species are uncommon in the study area, and are restricted to the dry open forest and swamp forest habitat types.

Double-eyed Fig Parrot

The double-eyed fig parrot occurs in lowland subtropical rainforest, dry rainforest, littoral and developing littoral rainforest, sub-littoral mixed scrub and riparian corridors in woodland (Garnett & Crowley 2000). The species has also been recorded feeding in isolated fig trees in agricultural and cleared areas (Garnett & Crowley 2000). The species feeds on the seeds of figs, but also takes fruit of other native and exotic trees, as well as insect larvae (Garnett & Crowley 2000). Nests are excavated in the under-side of a dead limb in the canopy of tall trees in or near rainforest (Garnett & Crowley 2000).

The littoral rainforest habitat in the study area may provide seasonal foraging resources for this species.

Swift Parrot

The swift parrot has been recorded from a variety of woodland and dry sclerophyll forest types, particularly where winter flowering eucalypts are present (Gilmore & Parnaby 1994). The species also utilises profusely flowering banksias in coastal forest and woodland (State

Forests of NSW 1995). Its diet is primarily composed of eucalypt nectar although it will feed on lerps and the honeydew secretions of psyllids (Gilmore & Parnaby 1994).

The swamp forest and dry open forest habitats contain a variety of winter flowering eucalypts and other myrtaceous tree species that are likely to provide winter foraging resources for this species.

The swift parrot breeds only in eastern and northern Tasmania, and overwinters on the mainland (Blakers *et al.* 1984). Therefore, the study area would not provide suitable nesting resources for the species.

Threatened Fruit-doves

The wompoo and rose-crowned fruit-doves inhabit sub-tropical, warm temperate and depauperate rainforests throughout their ranges (Gilmore and Parnaby 1994; State Forests of NSW 1995). These species may occasionally utilise moist open forest and riparian zones containing a rainforest understorey (Gilmore and Parnaby 1994).

The primary habitat component for these species is the existence of rainforest vegetation containing fruiting trees, particularly figs, native tamarind, myrtles, laurels, olive-berry and pigeonberry trees.

The littoral rainforest and moist open forest habitats are likely to provide suitable foraging resources for these species.

Barred Cuckoo-shrike

The preferred habitat of the barred cuckoo-shrike includes sub-tropical, dry and littoral rainforest, and adjacent eucalypt forests and regrowth (NPWS 1999). It is predominantly a frugivorous species. The species nests high in the mid-upper canopy (State Forests of NSW 1995).

The littoral rainforest and moist open forest habitat may provide suitable foraging habitat for this species. However, the species is likely to migrate further north during the breeding season.

Regent Honeyeater

This species is nomadic, occurring on the NSW coast primarily in the winter months and during periods of drought. In inland areas the species prefers to forage on large-flowers of eucalypts such as *E. sideroxylon*, *E. melliodora*, *E. camaldulensis*, *E. albens*, and *E. leucoxylon* (Gilmore and Parnaby 1994; State Forests of NSW 1995). Known breeding sites of the species in NSW include the Capertee Valley (Geering & French 1998), near Armidale (Oliver *et al*. 1998) and Albury.

Preferred habitat for the species in coastal areas is lowland coastal forests dominated by swamp mahogany (*Eucalyptus robusta*) or spotted gum (*Corymbia maculata*). The species has also been recorded foraging on the flowers of *Banksia integrifolia* and mistletoe (Gilmore and Parnaby 1994). Geering (pers. comm.) suggests that coastal habitats may be important for the continued existence of regent honeyeaters in central NSW (where probably over 75% of the total population occurs).

The swamp mahogany and broad-leaved paperbark in the swamp forest habitat are likely to provide valuable winter foraging resources for this species. Coastal banksia and other winter flowering eucalypts in the shrubland and dry open forest habitats respectively may also provide suitable foraging resources for the species.

Grey-headed Flying-fox

The grey-headed flying-fox feeds on a wide variety of fruiting and flowering plants including the fruits of native figs and palms, and the blossoms of eucalypts, angophoras, tea-trees and banksias (Tidemann 1995). The species roosts in camps, which are commonly formed in gullies, typically not far from water and usually in vegetation with a dense canopy (Tidemann 1995). Roost sites are important places for mating, birthing, rearing of young and as day-to-day refuges from predators (Tidemann 1995).

This species was recorded foraging in the swamp forest, shrubland and dry open forest habitats in the study area. The moist open forest and littoral rainforest habitats are also likely to provide suitable foraging resources for the species. No camp sites were recorded in the study area during the current survey. However, the moist open forest and littoral rainforest habitats may provide suitable temporary camp sites for the species.

Eastern Blossom Bat

The eastern blossom bat roosts primarily in littoral rainforest patches or habitats with a similar microclimate to littoral rainforest (Law 1993). The species has a highly specialised diet of nectar and pollen, which it obtains predominantly from heathland usually within four kilometres of its' roosting site (Law 1993). The species will also forage in coastal woodland and dry sclerophyll forest (NPWS n.d.). Several species of *Banksia* (particularly *Banksia integrifolia*) are significant food resources for the species (NPWS n.d.).

This species was recorded foraging on the flowers of coastal banksia within the shrubland habitat in the study area. The swamp forest and littoral rainforest habitats are also likely to provide suitable foraging resources for the species. The littoral rainforest habitat on site is also likely to provide suitable roosting habitat for the species.

Threatened Microchiropteran Bats

Several threatened microchiropteran bat species are known to utilise habitats within the study area. All habitat types within the study area are likely to provide suitable foraging resources for these species. Tree hollows and decorticating bark within the dry open forest and swamp forest habitats are also likely to provide suitable roosting and breeding habitat for hollow-dependent microchiropteran bat species.

Koala

The koala inhabits eucalypt forest and woodland (NPWS 1999). The suitability of habitat for koalas is influenced by the size and species of trees present, soil nutrients, climate, rainfall and the size and disturbance history of the habitat patches (NPWS 1999).

Although no evidence of recent koala activity was recorded in the study area during the current survey, the moist open forest, dry open forest and swamp forest habitats on site contain suitable foraging and roosting resources for the species.

Yellow-bellied Glider

This species forages over a wide range of canopy heights, and in plant communities that have an open overstorey and understorey strata (Davey 1984). The foraging behaviour of the yellow-bellied glider is diverse and responsive to changes in tree phenology such as periods of flowering and bark shedding (Kavanagh 1984). The species prefers forests with a mosaic of tree species associations, including those that flower in winter and those with

smooth bark that shed in long strips. The species requires large trees (preferably living) with large hollows (15cm diameter; 130cm deep) for shared diurnal roosting and shelter when breeding (Gibbons and Lindenmayer 1997).

The forested habitats in the study area may provide suitable foraging resources for this species. However, tree hollows large enough for use by this species are most likely too infrequent in the study area to provide adequate roosting and nesting habitat for the species.

Squirrel Glider

In NSW, the squirrel glider has been recorded primarily in dry sclerophyll forest and woodland on dry upper slopes and ridges (State Forests of NSW 1995). The species seems to prefer mature or mixed aged stands of greater than one eucalypt species (State Forests of NSW 1995). The species nests in a bowl-shaped, leaf-lined nest in a tree hollow (Suckling 1995). In Central Victoria the species feeds on insects, eucalypt sap, acacia gum, nectar and pollen (Suckling 1995).

The forested and shrubland habitats in the study area may provide suitable foraging resources for the squirrel glider. Tree hollows within the swamp forest and dry open forest habitats would also provide suitable nesting and roosting resources for this species.

Eastern Pygmy-possum

The eastern pygmy-possum inhabits a range of habitat types including rainforest, sclerophyll forests and tree heath (Turner & Ward 1995). It feeds mainly on the nectar and pollen of banksias, eucalypts and callistemons (Turner & Ward 1995). The species also feeds on insects throughout the year (Turner & Ward 1995). Its small size allows it to nest in very small spaces during the day (Turner & Ward 1995). Tree hollows are a favoured shelter, but spherical nests under bark or in a tree fork (including disused bird nests) are also used (Turner & Ward 1995).

The forested and shrubland habitats in the study area may provide suitable foraging resources for this species. Tree hollows within the swamp forest and dry open forest habitats would provide potential nesting and roosting resources for this species. The species may also be able to construct suitable roosts within the dense understorey or canopy foliage within the moist open forest and littoral rainforest habitats.

Brush-tailed Phascogale

The brush-tailed phascogale generally occurs in dry sclerophyll forest types, with a sparse groundcover of herbaceous plants, grass, scleromorphic shrubs or leaf litter (Soderquist 1995). However, the species has also been recorded in cool temperate rainforest and wet sclerophyll forest (Gilmore and Parnaby 1994). The species is mainly nocturnal, sheltering in nests in tree hollows lined with leaves or shredded bark during the day, sometimes shared with others (Gilmore and Parnaby 1994).

Females forage over home ranges of 20 to 70 hectares that rarely overlap (Soderquist 1995). Home ranges of males overlap extensively with both females and other males, and may cover over 100 hectares (Gilmore and Parnaby 1994; Soderquist 1995).

The dry open forest and moist open forest habitats may provide suitable foraging resources for this species. The dense groundcover vegetation within the swamp forest habitat may preclude use by this species. There are limited roosting and nesting resources for this species within the study area, with suitable tree hollow resources being restricted to parts of the dry open forest habitat.

Spotted-tailed Quoll

The spotted-tailed quoll inhabits a range of forest communities including wet and dry sclerophyll forest and rainforest, where it nests in rock caves, hollow logs or hollows in trees (State Forests of NSW 1995). The species has a mean home range of approximately 875 hectares, hence it requires large tracts of forest. The few forested environments in which the species has been recorded are characterised by high soil fertility and low disturbance from forestry operations and an absence or low abundance of foxes (State Forests of NSW 1995).

Although the study area appears to have been subject to intensive forestry operations in the past, the forested habitats on site may still represent suitable foraging habitat for the species. However, the study area is unlikely to provide suitable roosting habitat for the species due to previous and ongoing forms of habitat disturbance.

Common Planigale

In NSW, the common planigale has been recorded from subtropical and dry rainforest, dry sclerophyll forest, heathland and grassland, from sea level up to 400 metres ASL. Habitat selection by the species is primarily influenced by the surface cover (Gilmore and Parnaby 1994). The species is predominantly a nocturnal species that shelters in a saucer-shaped nest lined with grass and shredded bark built in crevices, hollow logs, beneath bark or under rocks (Gilmore and Parnaby 1994).

The dense groundcover vegetation within the swamp forest and sedgeland habitats may provide suitable habitat for this species. Common planigales have also been recorded using the dense groundcover provided by bitou bush infestations, which are present within the shrubland habitat on site.

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APPENDIX A – BIRD SPECIES LIST

Table A.1 Bird species recorded in the study area during the current survey

Scientific Name	Common Name	Habitat Type
Anthochaera chrysoptera	Little Wattlebird	SHL; DOF; SF
*Pandion haliaetus***	Osprey**	DOF; SF; SL; RF
Neochmia temporalis	Red-browed Finch	SHL; SF
Phylidonyris nigra	White-cheeked Honeyeater	DOF; SF; SHL; MOF
Acanthorhynchus tenuirostris	Eastern Spinebill	SHL; DOF; MOF
Eopsaltria australis	Eastern Yellow Robin	SF; DOF; MOF
Cormobates leucophaeus	White-throated Treecreeper	DOF; SF; MOF
Myzomela sanguinolenta	Scarlet Honeyeater	RF; DOF; SF; SHL
Acanthiza nana	Yellow Thornbill	SHL; DOF; SL
Geopelia humeralis	Bar-shouldered Dove	SHL
Meliphaga lewinii	Lewin's Honeyeater	RF; MOF; DOF; SF; SL
Milvus sphenurus	Whistling Kite	DOF
Haliaeetus leucogaster	White-bellied Sea-eagle	SHL; DOF
Milvus indus	Brahminy Kite	DOF; SHL
Larus novaehollandiae	Silver Gull	SHL
Trichoglossus haematodus	Rainbow Lorikeet	SHL; MOF; DOF; SF
Trichoglossus chlorolepidotus	Scaly-breasted Lorikeet	SHL; DOF; MOF
Pardalotus striatus	Striated Pardalote	SF
Pardalotus punctatus	Spotted Pardalote	SF
Coracina novaehollandiae	Black-faced Cuckoo-shrike	SF; MOF
Ardea novaehollandiae	White-faced Heron	SL
Dicaeum hirundinaceum	Mistletoebird	DOF; SF; SL; MOF
Lichenostomus chrysops	Yellow-faced Honeyeater	DOF; MOF; SF; SL
Cuculus flabelliformis	Fan-tailed Cuckoo	SF; MOF
Cuculus variolosus	Brush Cuckoo	SF
Platycercus eximius	Eastern Rosella	SF
Strepera graculina	Pied Currawong	DOF; SF
Dicrurus bracteatus	Spangled Drongo	SF; DOF
Corvus tasmanicus	Forest Raven	SF; SL; DOF
Rhipidura fuliginosa	Grey Fantail	DOF; SL; MOF; SHL
Megalurus timoriensis	Tawny Grassbird	SHL
*Calyptorhynchus lathami***	Glossy Black-cockatoo**	DOF
Sericornis frontalis	White-browed Scrubwren	DOF; SF; MOF
Malurus lamberti	Variegated Fairy-wren	SL
Malurus melanocephalus	Red-backed Fairy-wren	SL; SHL
Coturnix australis	Brown Quail	SHL; GL
Corvus orru	Torresian Crow	DOF; SF
Lichmera indistincta	Brown Honeyeater	SF; DOF
Grallina cyanoleuca	Magpie-lark	SL
Pachycephala rufiventris	Rufous Whistler	DOF
Pachycephala pectoralis	Golden Whistler	RF; SF; DOF; MOF
Calyptorhynchus funereus	Yellow-tailed Black-cockatoo	DOF; SF
Zosterops lateralis	Silvereye	SF; DOF
Anas superciliosa	Pacific Black Duck	SF
Ardea alba	Great Egret	SL
Cracticus nigrogularis	Pied Butcherbird	DOF
Psophodes olivaceus	Eastern Whipbird	SHL; SF; MOF
Elanus notatus	Black-shouldered Kite	SHL; SF
Colluricincla harmonica	Grey Shrike-thrush	SF; MOF; DOF
Oriolus sagittatus	Olive-backed Oriole	DOF
Acanthiza lineata	Striated Thornbill	DOF
Accipiter fasciatus	Brown Goshawk	DOF
Alisterus scapularis	Australian King Parrot	DOF
Glossopsitta pusilla	Little Lorikeet	DOF
Aviceda subcristata	Pacific Baza	DOF
Dacelo novaeguineae	Laughing Kookaburra	SF; DOF
Anthus novaeseelandiae	Richard's Pipit	SHL
Vanellus miles	Masked Lapwing	SF; SL
Ptilinorhynchus violaceus	Satin Bowerbird	MOF
Philemon corniculatus	Noisy Friarbird	DOF
Orthonyx temminckii	Logrunner	MOF
Sericornis magnirostris	Large-billed Scrubwren	MOF
Gymnorhina tibicen	Australian Magpie	DOF

Petroica rosea	Rose Robin	DOF
Cacatua roseicapilla	Galah	DOF
Entomyzon cyanotis	Blue-faced Honeyeater	DOF
Alcedo azurea	Azure Kingfisher	SL
Podargus strigoides	Tawny Frogmouth	MOF
Platycercus elegans	Crimson Rosella	DOF
*Lophoictinia isura***	Square-tailed Kite**	RF; SL
Colluricincla megarhyncha	Little Shrike-thrush	RF
Sericornis citreogularis	Yellow-throated Scrubwren	MOF
Rhipidura leucophrys	Willy Wagtail	SL

APPENDIX B – THREATENED SPECIES LIKELIHOOD OF OCCURRENCE IN THE STUDY AREA

3.7 Threatened species preferred habitat, known distribution and likelihood of occurrence in the study area

Threatened Species	Preferred Habitat	Known Distribution	Reference	Likelihood of Occurrence in the Study Area
Stephens Banded Snake	Wetter sclerophyll and rainforest, also recorded from dry sclerophyll forest.	Occurs along the coasts and ranges from Gosford to southern Queensland.	Cogger (1996); State Forests of NSW (1995)	Moderate to High - suitable habitat in the study area. Recorded within five kilometres of the site.
Green and Golden Bell Frog	A largely aquatic species found among vegetation within or at the edges of permanent water, including streams, swamps, lagoons, farm dams and ornamental ponds.	Eastern and south-eastern NSW and far eastern Victoria, principally at lower altitudes.	Cogger (1996)	Low – no suitable habitat in the study area.
Green-thighed Frog	Inhabits primarily rainforest and wet sclerophyll forest. Also recorded in dry open forest and coastal swamp forest. Breeding aggregations utilise grassy margined, semi-permanent and permanent ponds.	Occurs from SE Qld to Ourimbah NSW.	State Forests of NSW (1995); Cogger (1996); Anstis (2002)	Moderate – suitable habitat in the study area.
Black Bittern	Shadowy, leafy waterside trees including callistemons, casuarinas, paperbarks, eucalypts, mangroves and willows; tidal creeks, sheltered mudflats and oyster slats.	Coastal north, east and south west Australia.	Pizzey & Knight (1997)	High – Suitable habitat in the study area. Recorded within one kilometre of the site.
Black-necked Stork	Inhabits riverine swamps, large permanent pools and coastal wetlands and estuaries.	Coastal and sub-coastal northern Australia from Port Headland (WA) to the central coast of NSW.	Blakers *et al*. (1984)	High – Suitable habitat in the study area. Recorded within two kilometres of the site.

Comb-crested Jacana	Floating vegetation on slow-moving rivers and permanent lagoons, swamps, lakes and dams.	Coastal northern and eastern Australia from the Kimberleys to the Sydney District.	NPWS (2002)	Low – no suitable habitat in the study area.
Little Tern	Sheltered coastal environments including lagoons, estuaries, river mouths and deltas, lakes, bays, harbours and inlets.	Coastal northwest, north, east and southeast Australia.	Higgins & Davies (1992); Pizzey & Knight (1997)	Low – no suitable habitat in the study area.
Sooty Oystercatcher	Intertidal rocky and coral reefs; occasionally frequents tidal mudflats and sandspits.	Distributed on suitable coasts and islands around Australia and Tasmania.	Pizzey & Knight (1997)	Low – no suitable habitat in the study area.
Pied Oystercatcher	Sandy, shellgrit or pebble beaches; tidal mudflats, sandflats and estuaries.	Widely distributed around most of the Australian shoreline.	Pizzey & Knight (1997)	Low to Moderate – estuarine habitat may provide a minor foraging resource.
Collared Kingfisher	Mangroves, tidal creeks, nearby beaches, mudflats, jetties, poles, street trees and gardens.	Coastal northern Australia, north from the lower Clarence River in NSW.	Pizzey & Knight (1997)	Low to Moderate – small stand of mangroves in the estuarine habitat may provide a minor foraging resource.
Powerful Owl	Wet and dry sclerophyll forests, preferably tall, dense eucalypt forest with a dense understorey. The species also occurs in densely forested gullies and on coastal slopes.	From the mid coast of Queensland to the south-eastern corner of South Australia.	Pizzey & Knight (1997); Kavanagh & Peake (1993); Lindsey (1992)	Moderate to High – suitable habitat in the study area. Highly mobile species with large home range. Previously recorded in the locality.
Barking Owl	Open forests, woodlands, dense scrubs, foothills, river red gums and other large trees near watercourses and paperbark	Mainland Australia.	Pizzey & Knight (1997)	Moderate to High – suitable habitat in the study area. Previously recorded in the locality.

	woodlands.			
Masked Owl	Dry sclerophyll forests and woodlands with a low, sparse understorey layer. Prefers to forage in open or partly cleared country.	Widespread but sparse in coastal mainland Australia.	Kavanagh & Peake (1993); Hyem (1979); Debus & Rose (1994)	Moderate to High - suitable habitat in the study area. Recorded within five kilometres of the site.
Sooty Owl	Rainforest and tall open forest with a mesic component.	Coastal southeastern Australia from eastern Victoria to southeast Qld.	NPWS (n.d.)	Low – no suitable habitat in the study area.
Grass Owl	Occurs within grass tussocks, lignum, canegrass, and heaths, often in swampy ground.	North eastern and northern Australia.	Slater *et al.* (1989)	Known to occur in the study area. Previously recorded on site by Clancy (1989).
Square-tailed Kite	Open forest, woodland, scrub and heath in coastal areas.	Found over most of the Australian mainland, except the arid treeless central regions.	Pizzey & Knight (1997); Debus (1998)	Known to occur in the study area. Recorded on site during the current survey.
Osprey	Estuaries, inlets, large rivers, inland lakes and reservoirs.	Occurs around entire coastline of mainland Australia, although rare in Victoria. Absent in Tasmania.	Debus (1998).	Known to occur in the study area. Recorded on site during the current survey.
Red-tailed Black-cockatoo	Tall open forests, woodlands, grasslands, scrublands, floodplains, river margins, wetlands, river red gums on watercourses.	Occurs in far north-eastern NSW, and other parts of northern Australia.	Pizzey & Knight (1997)	Moderate to High – suitable habitat in the study area. Previously recorded in the locality.
Glossy Black-cockatoo	Lower rainfall dry sclerophyll forest on flat ground containing *Allocasuarina torulosa*, *A. verticillata* or *A. littoralis*.	From central Queensland to Victoria.	State Forests of NSW (1995); Pizzey & Knight (1997)	Known to occur in the study area. Feeding signs of the species recorded on site during the current survey.

Double-eyed Fig Parrot	Drier rainforests and adjacent wet eucalypt forest.	Scattered populations between Bundaberg Qld. and the Hastings River in NSW.	NPWS (2002)	Moderate – limited suitable habitat in the study area. Previously recorded in the locality.
Swift Parrot	This species has been recorded from a variety of woodland and dry sclerophyll forest types, particularly where winter flowering eucalypts are present.	From Bowen (Qld) to Tasmania	Gilmore & Parnaby (1994); Pizzey & Knight (1997)	High – suitable habitat in the study area. Previously recorded within two kilometres of the site.
Wompoo Fruit-dove	Rainforests and adjacent eucalypt forests.	Coastal eastern Australia from Cape York to lower Hunter Region.	Pizzey & Knight (1997)	High – suitable habitat in the study area. Previously recorded within one kilometre of the site.
Rose-crowned Fruit-dove	Rainforests, vine scrubs, adjacent eucalypt forests and woodlands, swamp woodlands and mangroves.	Coastal north-western, northern and eastern Australia and coastal inlands.	Pizzey & Knight (1997)	High – suitable habitat in the study area. Previously recorded within two kilometres of the site.
Barred Cuckoo-shrike	Rainforest, vine scrub and margins, eucalypt forests/woodlands, clearings in secondary growth, paperbarks, timber on watercourses, native figs and other fruit trees.	Coastal eastern Australia to Port Macquarie in the south (occasionally recorded as far south as the Hunter Valley).	Pizzey & Knight (1997)	High – suitable habitat in the study area. Previously recorded within two kilometres of the site.
Brown Treecreeper	Open woodlands, forest clearings and edges; eucalypts along watercourses.	Subcoastal environments of south-eastern Australia from Vic. to the Qld. border.	Simpson & Day (1993); Garnett & Crowley (2000)	Moderate to High - suitable habitat in the study area. Recorded within five kilometres of the site.
Painted Honeyeater	Mistletoe-infested eucalypt woodland/forest in mainly drier inland areas.	A migratory/nomadic species whose movements are influenced by rainfall. Occurs throughout eastern and Australia.	State Forests of NSW (1995); Pizzey & Knight (1997)	Low – no suitable habitat in the study area due to lack of mistletoe on site.

Regent Honeyeater	Box-ironbark eucalypt associations, and wet lowland coastal forests dominated by swamp mahogany, spotted gum and riverine casuarina woodlands.	Patchy distribution between Brisbane and Victoria within about 300km of the east coast.	Menkhorst (1997)	High – suitable habitat in the study area. Previously recorded within one kilometre of the site.
Grey-headed Flying-fox	Variety of habitats including rainforest, mangroves, paperbark swamps, wet and dry sclerophyll forests and cultivated areas.	East coast of Australia from Rockhampton (Qld) to western Victoria.	Churchill (1998)	Known to occur in the study area. Recorded on site during the current survey.
Eastern Blossom Bat	A combination of heathland and coastal rainforest	Cape York to northern NSW.	Churchill (1998)	Known to occur in the study area. Recorded on site during the current survey.
Little Bentwing Bat	Well timbered areas, including rainforest, wet and dry sclerophyll forest, *Melaleuca* swamps and coastal forests.	East coast of Australia from Cape York to the Hunter River in NSW.	Churchill (1998)	Known to occur in the study area. Recorded on site during the current survey.
Large Bentwing Bat	Well timbered areas, including rainforest, wet and dry sclerophyll forests, *Melaleuca* swamps and coastal forests.	Coastal areas from Cape York Peninsula to the south-east corner of South Australia.	Churchill (1998)	Known to occur in the study area. Recorded on site during the current survey.
Large-footed Myotis	Mangroves, paperbark swamps, rainforest, wet and dry sclerophyll forest and open woodland. The species always occurs near water primarily due to its foraging requirements.	From the Kimberley to South Australia	Richards (1995); Churchill (1998).	Known to occur in the study area. Recorded on site during the current survey.
Golden-tipped Bat	Rainforest and gullies in wet sclerophyll forest. Also recorded	East coast of Mainland Australia from Cape York south to Bega in	Churchill (1998)	Moderate to High - suitable habitat in the study area. Recorded within

	from dry sclerophyll forest.	NSW.		five kilometres of the site.
Greater Broad-nosed Bat	Woodland, wet and dry sclerophyll forest and rainforest at altitudes less than 500 metres.	From northern Queensland to southern NSW.	Churchill (1998)	Moderate – suitable habitat in the study area.
Eastern Freetail Bat	A variety of forest types ranging from rainforest to dry sclerophyll forest and woodland.	From south of Sydney to south-eastern Queensland.	Churchill (1998)	Known to occur in the study area. Recorded on site during the current survey.
Yellow-bellied Sheathtail Bat	Wet and dry sclerophyll forest, open woodland, shrubland, mallee, grasslands and desert.	Occurs throughout tropical Australia. Extends south through eastern NSW into Victoria and SA.	Churchill (1998); NPWS (2002)	Moderate – suitable habitat in the study area.
Koala	Wet and dry sclerophyll forest and woodland containing preferred food tree species.	East coast of Australia.	State Forests of NSW (1995)	High – suitable habitat resources in the study area. Previously recorded within one kilometre of the site.
Yellow-bellied Glider	Wet and dry sclerophyll forests and woodlands with mature large trees and a mosaic of tree species.	From north of the Tropic of Capricorn (Qld) to eastern Victoria.	Russell (1995); State Forests of NSW (1995); Gibbons & Lindemeyer (1997)	Moderate to High – suitable habitat in the study area. Previously recorded within five kilometres of the site.
Squirrel Glider	Dry sclerophyll forest and woodland on dry upper slopes and ridges.	From west of Cairns (Qld) to Victoria.	Suckling (1995); State Forests of NSW (1995)	Moderate to High – suitable habitat in the study area. Previously recorded within five kilometres of the site.
Eastern Pygmy-possum	Wet and dry eucalypt forests, subalpine woodland, coastal banksia woodland and wet heath.	Great Dividing Range including western slopes and coastal plains from SE Qld to SE SA.	(Menkhorst & Knight 2001)	Moderate – suitable habitat in the study area.

Brush-tailed Phascogale	Occurs in dry sclerophyll forest, with a sparse groundcover of herbaceous plants, grass, scleromorphic shrubs or leaf litter. Also recorded in cool temperate rainforest and wet sclerophyll forest.	From Hervey Bay (Qld) to Port Stephens (NSW)	Gilmore & Parnaby (1994); Soderquist (1995)	Moderate – suitable habitat in the study area. Previously recorded in the locality.
Spotted-tailed Quoll	Wet and dry sclerophyll forest and rainforest.	From south-east Queensland to eastern Victoria.	Edgar & Belcher (1995)	Moderate – suitable habitat in the study area. Previously recorded in the locality.
Common Planigale	Subtropical and dry rainforest, dry sclerophyll forest, heathland and grassland.	From Cape York to Port Stephens.	Redhead (1995)	Moderate – suitable habitat in the study area.

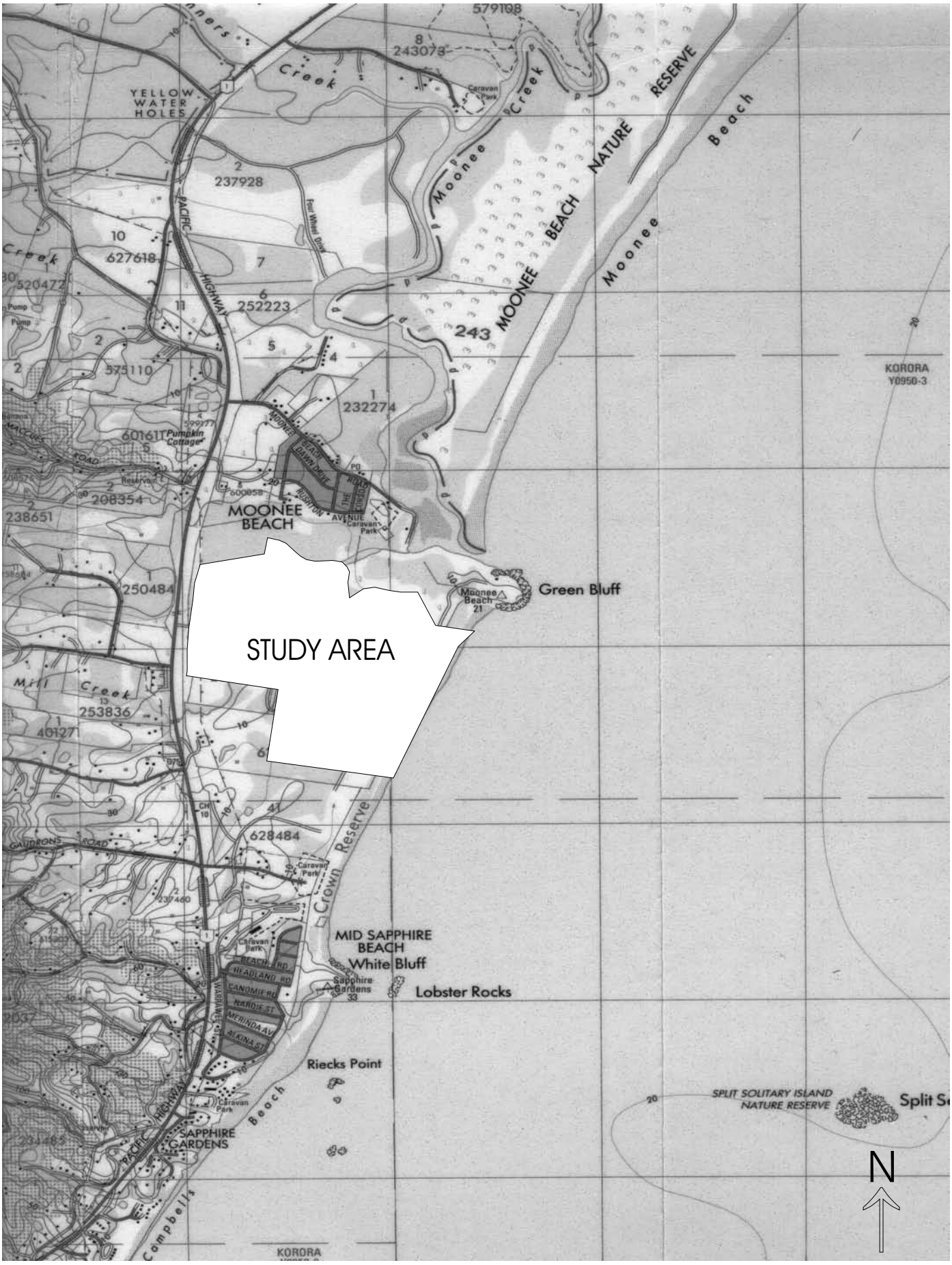

Figure 1.1: Location of the Study Area

Source: Central Mapping Authority of NSW

1 Kilometre

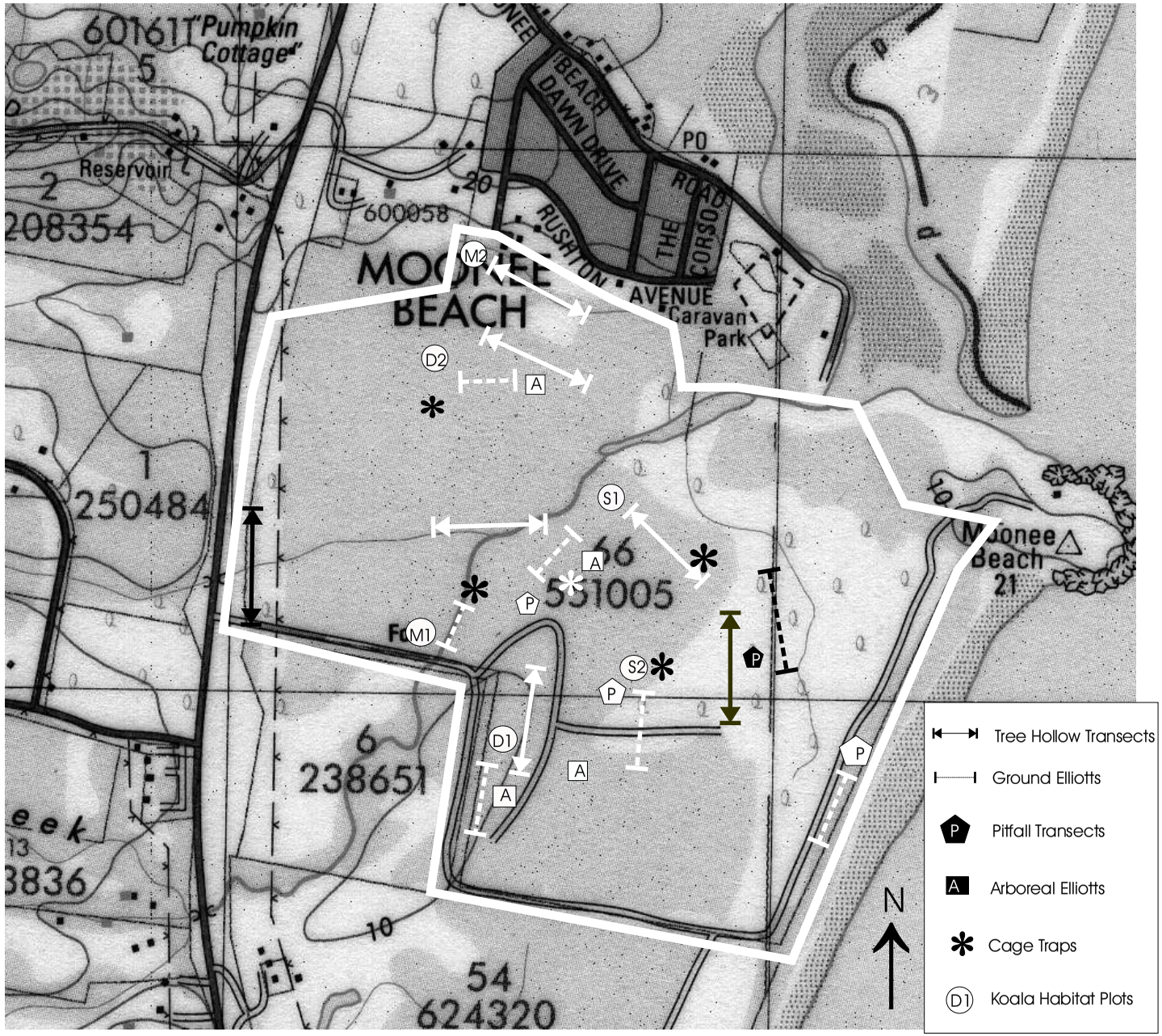

Figure 2.1: Location of Field Sampling Effort

Source: Central Mapping Authority of NSW

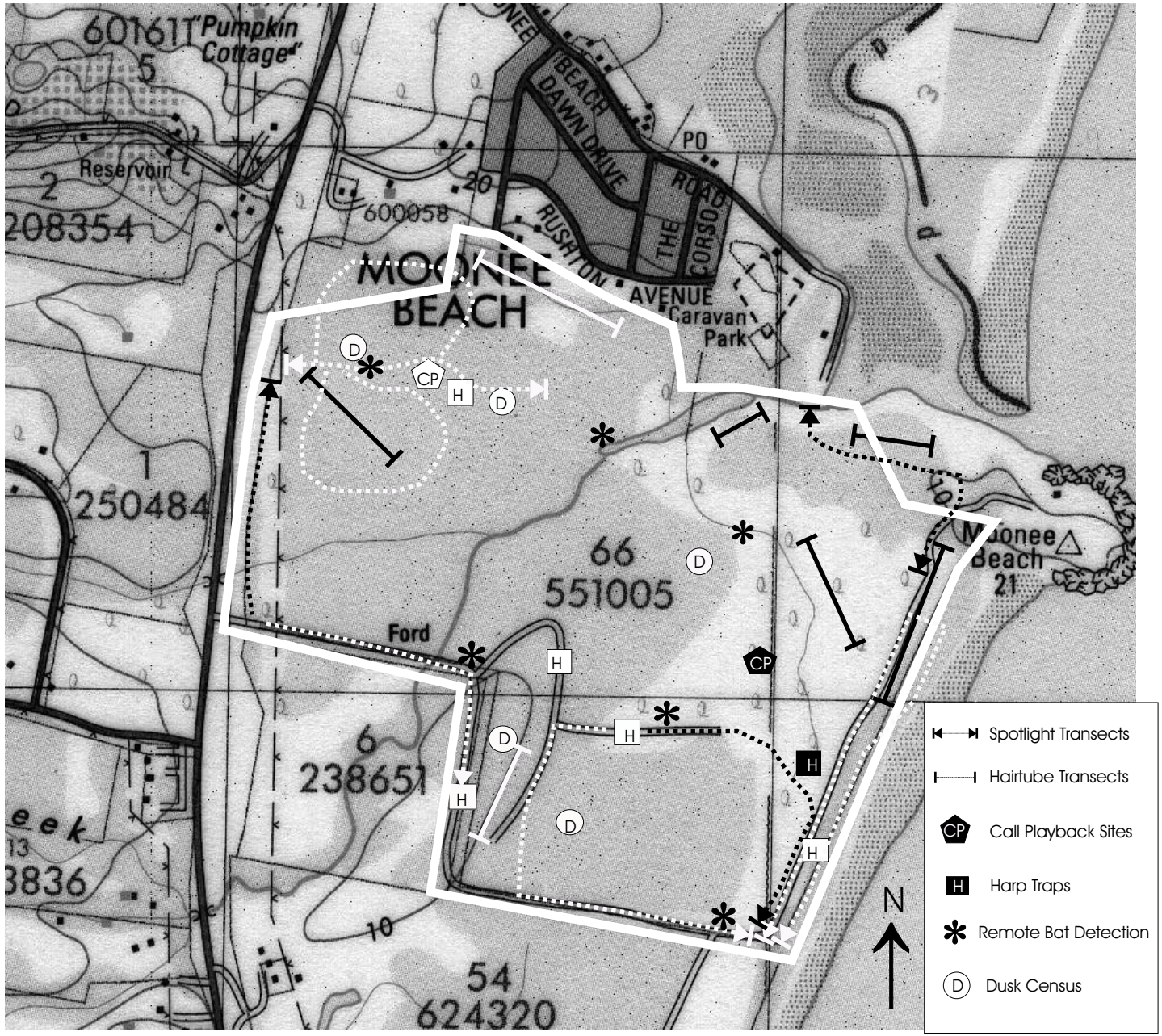

Figure 2.2: Location of Field Sampling Effort

Source: Central Mapping Authority of NSW

Lot 66 DP 551005, Moonee Beach

Proposed Residential & Tourist Development

Flora & Fauna Assessment Report

APPENDIX 4
Supplementary Fauna Assessment

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Data for Moonee Beach Fauna Survey- April 2006

12th April 2006

Survey Effort:

Method	**# surveys/ locations**	**total hours/ nights**	**total effort**	**Notes**
Spotlighting	6 nights	11:40	23:20	In DB (4 surveys) 12:20 person hours
				In SF (2 surveys) 8:00 person hours
				In Foredune (1 survey) 3:00 person hours
Pitfall traps	2 sites	3 nights	24 pit/nights	4 pits/ line
Harp traps	6 trap locations	1-2 nights per loc	10 trap nights	
Stagwatching	1 night- 2 trees	1:25 x 2	2 tree/ evenings	
Diurnal Herpetological	1	1:30	1:30 person/ hours	
Diurnal Bird	6 surveys	approx 3 hours/ morning	approx 18 hours	Surveys conducted while walking site each morning through all habitat types
Koala transect scat surveys	7 transects	7:45 hours	15:30 person/hours	
Koala SAT scat surveys	2	approx 1 hour	approx 2 person/hours	
Owl Call Playback	2 nights		2 hours	
Anabat Survey (stationary)	3	full night (approx 10.5 hours of dark)	31.5 hours	
Anabat Survey (roaming)	1		3 hours	

Notes on survey effort:

- Pitfall lines consisted of 4 pits and 30m drift fence. For each line 2 pits were 20L buckets, 2 were 60cm deep 15mm polypipe.

- Stagwatching was done on 6/4/06, in DB/SF edge, 1 Blackbutt (160cm dbh) and one Red Mahogany (130cm dbh) from 17:20- 18:45.
- Little targeted diurnal herpetological surveys were conducted because of the lack of tree with peeling bark. Active reptiles seen during other surveys were noted.
- Diurnal bird survey was a 3 hour loop each morning through all habitat types but focused on where traps located, ie DB, SF and Foredune, but also deliberately walked through Sedgeland Mangrove and other habitats to sample all habitats.
- Koala transect scat surveys involved walking through an area in a transect, checking for scats under trees as per methods of SAT surveys
- SAT surveys conducted. Method used: the 20 closest trees with a DBH of >10 cm from the location of the scats were checked for scats. Scats were searched for within 1.5m of the tree base, with between 1-3 minutes spent searching. Only where there was thick grass or other ground cover would searching generally exceed 1.5 minutes.
- Call playback species conducted: Powerful Owl, Barking Owl, Sooty Owl, Masked Owl, Grass Owl, Koala, Yellow-bellied Glider.

Survey Locations

Survey type			END (if transect)		Habitat type	notes
	easting	northing	easting	northing		
Spotlighting	*	*				*see map of nocturnal transects
Pitfall trap	515231	6657037			Foredune/ Allocasuarina ecotone	
Pitfall trap	514726	6657101			DB	
Harp	514421	6657246			R	
Harp	515318	6657182			Foredune	
Harp	514868	6657105			SF	
Harp	514307	6657645			DB	
Harp	514667	6657291			DB	
Harp	514222	6657618			DB	
Stagwatch	514735	6657001			DB/SF ecotone	
Herpetological surveys	514230	6657539			DB	
Elliott A (arboreal)	515083	6656742	515341	6657293	Foredune	10 traps, placed on branches of flowering Banskia
Elliott A (ground)	514788	6656712	514667	6657000	DB	13 traps- ground
Elliott B (arboreal)	514934	6657512	514871	6657428	SF	5 traps Tree- mounted
Elliott B (arboreal)	515073	6657259	514976	6657273	SF	5 traps Tree- mounted
Elliott B (arboreal)	514729	6657164	514666	6657285	DB	5 traps Tree- mounted
Elliott B (arboreal)	514712	6657643	514527	6657726	DB/ SF	5 traps Tree- mounted
Elliott B (arboreal)	515233	6657061	515313	6657186	Foredune	5 traps Tree- mounted
Elliott B	514724	6656828	514666	6656998	DB	5 traps Tree- mounted

(arboreal)						
Anabat (Stationary)	514800	6657626			SF/ Creek	
Anabat (Stationary)	514937	6657708			SF	
Anabat (Stationary)	514602	6656818			DB	
Call Playback	515084	6657400			SF/ Sedgeland	
Call playback	514680	6656802			DB, SF	
Koala scat transects	*	*				* see map for locations
Koala scat SAT survey	514683	6657227			DB	
Koala scat SAT survey	514710	6657043			DB	

Results

Weather

- Conditions were excellent for surveying. Little or no wind for most of the trip, winds never more than light or moderate at worst.
- Daytime temperatures around 25-30°C
- Overnight conditions warm, 15-20°C, usually 18, 19 or 20 °C
- Partial or full cloud cover for some of the survey, particularly at night, so there was little moonlight through the week.
- Evenings were warm – around 20°C, and calm
- Evidence of heavy rain occurring just before survey- ground very wet, flooded throughout SF. Frogs quite active 1st few nights and on the 5th during light rain.
- Light rain on the night of the 5th, moderate at times. Continued for 1st half of the night.

General scats tracks and traces

- Fox scats rare
- no evidence of rabbits
- No dog scats, although domestic dogs common in north of site close to caravan park
- no cat kills or scratch trees
- Macropod scats common
- No signs of echidnas or wambats
- Bandicoots digs very common except where flooded
- Chewed allocasuarina cones common. Many were chews of *Melamys burtoni*, some were chews of the Glossy Black Cockatoo (feeding on *Allocasuarina littoralis*).
- No scats of Common Ringtail or Common Brushtail Possum
- One owl pellet site found- pellets being identified
- Koala scats found- see Koala results

Koala Data

- 6 Koala scat transects conducted- see map for locations
- SAT surveys only done when time Permitting- ran out of time on the last day of survey to follow-up all koala scats- in particular scats found in the SF in scat transect 6).
- 2 SAT surveys completed- see table below for locations
- A total of 345 trees sampled, 13 scat trees found
- Survey suggests that Blackbutt, Tallowood and Swamp Mahogany are important feed trees here. At least one part of the site (Koala 2) and nearby Swamp Mahogany in the SF is a important feeding area for Koalas- 35% of trees in this area have Koala scats
- Preliminary (quick) scat transect of the SF suggests that it could be important habitat (see transect 6)

Koala Scat trees found during Koala Scat Transects

Location	easting	northing	Transect #	# scats	Tree species	Tree DBH	SAT done here?
Koala 1	514683	6657227	1	>10	Tallowood	25cm	Yes
Koala 2	514710	6657043	1	6	Blackbutt	60	Yes
Koala 3	514740	6657006	6	1*	Swamp Mahogany	60cm	No
				1*	Swamp Mahogany	70cm	No
Koala 4	514749	6657058	6	1*	Swamp Mahogany	70cm	No

* thick groundcover made it difficult to find scats during transect 6, so once 1 was found under a tree, searching was halted.

Koala Scat trees found during SAT surveys

Location	**Tree Species**	**DBH (cm)**	**# scats**	**scat condition notes**	**% of trees with koala scats**
Koala 1	Tallowood	25	>10	< 6 months old	15
	Tallowood	30	1	old	
	Acacia	25	1	very old	
Koala 2	Blackbutt	60	6	< 6 months old	35
	Blackbutt	55	2	very fresh	
	Blackbutt	25	1	< 6 months old	
	Blackbutt	25	>10	very fresh	
	Pink Bloodwood	50	1	very fresh	
	Tallowood	12	1	very old	
	Lophostamon sp.	11	2	old	

Koala Scat Transects and SAT surveys

	Koala Scat Transect #						**SAT surveys**		TOTAL TREES	Trees with Koala scats	% of trees with Koala scats
Tree Species	1	2	3	4	5	6	Koala 1	Koala 2			
	# of Trees Counted (trees with Koala Scats)										
Blackbutt	31 (1)	8	8	19	28	2	1	8 (4) *	104	4	3.8
Lophostamon sp.	7	9	1		1		1	1 (1)	20	1	5.0
Pink Bloodwood	9	1	13	7	6		1	4 (1)	41	1	2.4
Tallowood	3 (1)	3	30	4	7		4 (2) *	3 (1)	53	3	5.7
Flooded Gum	1								1		0.0
Paperbark sp.	5	3	3	6		2	7	3	29		0.0
Ironbark sp.	1	1	4	2	2		1		11		0.0
Allocasuarina/ Casuarina	3	6	1	1	1		1	1	14		0.0
Unidentified Eucalypt	1								1		0.0
Red Mahogany		5	11	2		2	2		22		0.0
Turpentine		12	8		2				22		0.0
Angophora costata		10	1						11		0.0
Grey Gum		1			1				2		0.0
Swamp Mahogany					1	11 (3)	1		13	3	23.1
Acacia sp.							1 (1)		1	1	100.0
TOTAL TREES									**345**	**13**	
total trees with koala scats	2	0	0	0	0	3	3	7			
% of trees with koala scats	3.3	0.0	0.0	0.0	0.0	17.6	15.0	35.0			

* these scat trees included the ones found during the transect, totals have been adjusted

Miscellaneous Notes

- First survey (24/3- 26/3) called off due to strong winds, continuously Strong winds with Near Gale and Gale strength gusts.
- All GPS AMG's in zone 56
- Flowering plants during survey were (in order of flowering abundance): Paperbarks, *Banksia integrafolia*, Blackbutt, Swamp Mahogany
- Most of the SF was flooded during the survey
- Owl pellet location- 514689, 6656900

Threatened Species

Date	Species	#	Sex	Location	Easting	Northing	Microhabitat	Habitat type	Observation type	Notes
24/3/06	Pied Oystercatcher	2		Offsite- near caravan park				Sand flats next to caravan park	O	
Every night	Grey-headed Flying-fox	>20 per night		All over site			UC	All	O, W	Feeding in Paperbar Banksia, Eucs
1/4/06	*Litoria brevipalmata*	2		N-W DB area	514343	6657624	OG	DB/ Turpentine	O	2 at this location, ac
2/4/06	Eastern Blossom Bat	1		On track in s-e corner	515331	6657315	FL	Foredune	O	Flying down track amongst flowering banksia
Every Day	Osprey	2	pair	Near centre of site	515016	6657481	UC	SF	O	On Stag above cano This roost was used every day so is likel be close to nest.
4/4/06	Eastern Blossom Bat	11		Track in S-E corner	515318	6657182	track	Foredune	Harp	
4/4/06	*Miniopterus australis*	2			514868	6657105	track	SF	Harp	
5/4/06	Eastern Blossom Bat	1		S-E DB area	514667	6657291	track	DB	Harp	Harp 5
5/4/06	*Litoria brevipalmata*	1		N-W part of site	514729	6657641	track	SF/ DB transition	O	
5/4/06	*Litoria brevipalmata*	1		N-W DB area	514343	6657624	OG	DB/ Turpentine	O	at same location as 1/4/06
6/4/06	Common Planigale	1	m	S-E corner	515231	6657037	OG	Foredune/ Allocasuarina	Pit	HB=62mm, TL=42r Mature or young ma developed testes.

Over several days of survey	Koala			S-W DB area and associated SF				DB, SF	Scats	See Koala data
5/4/06	*Miniopterus australis*	1			514222	6657618	track	DB	Harp	
	Glassy Black Cockatoo				514720	6656988		DB	Chews	allocasuarina littora
	Glassy Black Cockatoo				514694	6657066		DB	Chews	allocasuarina littora
	Glassy Black Cockatoo				514676	6657150		DB	Chews	allocasuarina littora
	Glassy Black Cockatoo				514677	6657171		DB	Chews	allocasuarina littora
1/4/06	*Miniopterus australis*	>150 runs			514800	6657626		SF/ Creek	Anabat	
1/4/06	*Miniopterus schreibersii*	19 runs			514800	6657626		SF/ Creek	Anabat	
1/4/06	*Myotis macropus*	2 runs			514800	6657626		SF/ Creek	Anabat	
1/4/06	*Kerivoula papuensis ?*	1 run			514800	6657625		SF/ Creek	Anabat	
2/4/06	*Miniopterus australis*	1 run		at bridge	515201	6657681			Anabat	
2/4/06	*Myotis macropus*	2 runs		at bridge	515201	6657681			Anabat	
2/4/06	*Miniopterus australis*	2 runs		s-e corner				foredune	Anabat	
2/4/06	*Saccolaimus flaviventris*	1 run		s-e corner				foredune	Anabat	
2/4/06	*Saccolaimus flaviventris*	2 runs		SF- track to the s-e of site				SF	Anabat	
2/4/06	*Miniopterus australis*	5 runs		SF- track to the s-e of site				SF	Anabat	
2/4/06	*Miniopterus*	12		DB- s-w of				DB	Anabat	

	australis	runs		site						
3/4/06	*Mormopterus norfolkensis*	9 runs			514937	6657708		SF/ Mangroves	Anabat	
3/4/06	*Miniopterus australis*	>30 runs			514937	6657708		SF/ Mangroves	Anabat	
3/4/06	*Miniopterus screibersii*	2 runs			514937	6657708		SF/ Mangroves	Anabat	
4/4/06	*Miniopterus australis*	4 runs			514602	6656818		DB	Anabat	

Appendix X. Fauna Species Found

Key

EPBC - species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.
F – migratory Family listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.
TSC - species listed under the NSW *Threatened Species Conservation Act 1995.*
Ex – exotic, introduced species

P - preliminary determinations to the NSW *Threatened Species Conservation Act 1995.*
N - nominations for listing under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*

A – Bat species found by anabat only, C= confident, P= probable and Po= possible anabat identification (See anabat analysis for a definition of these terms)

EPBC	TSC	Ex	Scientific Name	Common Name	Notes
			MAMMALS		
			Dasyuridae		
			Antechinus stuartii	Brown Antechinus	
	x		*Planigale maculata*	Common Planigale	
			Peramelidae		
			Isoodon macrourus	Northern Brown Bandicoot	
			Perameles nasuta	Long-nosed Bandicoot	
			Phascolarctidae		
	x		*Phascolarctos cinereus*	Koala	Scats
			Petauridae		
			Petaurus breviceps	Sugar Glider	
			Acrobatidae		
			Acrobates pygmaeus	Feathertail Glider	
			Phalangeridae		
			Trichosurus vulpecula	Common Brushtail Possum	
			Macropodidae		
			Macropus giganteus	Eastern Grey Kangaroo	
			Wallabia bicolor	Swamp Wallaby	
			Pteropodidae		
	x		*Syconycteris australis*	Common Blossom Bat	
x	x		*Pteropus poliocephalus*	Grey-headed Flying-fox	
			Emballonuridae		
	x		*Saccolaimus flaviventris*	Yellow-bellied Sheathtail Bat	A (C)
			Rhinolophidae		
			Rhinolophus megaphyllus	Eastern Horseshoe Bat	A (C)
			Vespertilioidae		
			Chalinolobus gouldii	Gould's Wattled Bat	A (C)
	x		*Miniopterus australis*	Little Bentwing Bat	
	x		*Miniopterus schreibersii oceanensis*	Large Bentwing Bat	A (C)

	x		*Myotis macropus*	Large-footed Myotis	A (P)
			Nyctophilus gouldi	Gould's Longeared Bat	A (C)
	x		*Kerivoula papuensis*	Golden-tipped Bat	A (Po)
			Vespadelus pumilus	Eastern Forest Bat	
			Molossidae		
	x		*Mormopterus norfolkensis*	East-coast Freetail Bat	A (C)
			Tadarida australis	White-striped Freetail Bat	
			Muridae		
			Melomys burtoni	Grassland Melomys	
			Rattus fuscipes	Bush Rat	
			Rattus lutreolus	Swamp Rat	
		x	*Rattus rattus*	Black Rat	
			Canidae		
		x	*Vulpes vulpes*	Fox	Scats
			BIRDS		
			Megapodiidae		
			Alectura lathami	Australian Brush Turkey	
			Phasianidae		
			Coturnix ypsilophora	Brown Quail	
			Pelecanidae		
			Pelecanus conspicillatus	Australian Pelican	
F			**Anatidae**		
			Anas superciliosa	Pacific Black Duck	
			Ardeidae		
			Egretta novaehollandiae	White-faced Heron	
x			*Ardea alba*	Great Egret	
			Threskiornidae		
			Threskiornis molluca	Australian White (Sacred) Ibis	
			Haematopodidae		
	x		*Haematopus longirostris*	Pied Oystercatcher	
F			**Charadriidae**		
			Vanellus miles	Masked Lapwing	
			Laridae		
			Larus novaehollandiae	Silver Gull	
			Sterna bergii	Crested Tern	
F			**Accipitridae**		
			Elanus axillaris	Black-shouldered Kite	
x	x		*Pandion haliaetus*	Osprey	
			Haliastur sphenurus	Whistling Kite	
			Haliastur indus	Brahminy Kite	
x			*Haliaeetus leucogaster*	White-bellied Sea-eagle	
			Accipiter novaehollandiae	Grey Goshawk	
			Columbidae		
			Geopelia humeralis	Bar-shouldered Dove	
			Ocyphaps lophotes	Crested Pigeon	
			Cacatuidae		
	x		*Calyptorhynchus lathami*	Glossy Black-Cockatoo	Chews
			Calyptorhynchus funereus	Yellow-tailed Black-Cockatoo	

			Eolophus roseicpilla	Galah	
			Cacatua galerita	Sulphur-crested Cockatoo	
			Psittacidae		
			Trichoglossus haematodus	Rainbow Lorikeet	
			Trichoglossus chlorolepidotus	Scaly-breasted Lorikeet	
			Glossopsitta concinna	Musk Lorikeet	
			Platycercus eximius	Eastern Rosella	
			Podargidae		
			Podargus strigoides	Tawny Frogmouth	
			Aegothelidae		
			Aegotheles cristatus	Australian Owlet-nightjar	
			Alcedinidae		
			Dacelo naxaeguineae	Laughing Kookaburra	
			Todiramphus sanctus	Sacred Kingfisher	
			Climacteridae		
			Cormobates leucophaeus	White-throated Treecreeper	
			Maluridae		
			Malurus cyaneus	Superb Fairy-wren	
			Malurus lamberti	Variegated Fairy-wren	
			Pardalotidae		
			Pardalotus punctatus	Spotted Pardalote	
			Pardalotus striatus	Striated Pardalote	
			Sericornis magnirostris	Large-billed Scrubwren	
			Sericornis frontalis	White-browed Scrubwren	
			Gerygone olivacea	White-throated Gerygone	
			Acanthiza pusilla	Brown Thornbill	
			Acanthiza nana	Yellow Thornbill	
			Acanthiza lineata	Striated Thornbill	
			Meliphagidae		
			Anthochaera chrysoptera	Little (Brush) Wattlebird	
			Philemon corniculatus	Noisy Friarbird	
			Manorina melanocephala	Noisy Miner	
			Meliphaga lewinii	Lewin's Honeyeater	
			Lichenostomus chrysops	Yellow-faced Honeyeater	
			Phylidonyris nigra	White-cheeked Honeyeater	
			Lichmera indistincta	Brown Honeyeater	
			Myzomela sanguinolenta	Scarlet Honeyeater	
			Orthonychidae		
			Orthonyx temminckii	Logrunner	
			Psophodes olivaceus	Eastern Whipbird	
			Petroicidae		
			Eopsaltria australis	Eastern Yellow Robin	
			Pachycephalidae		
			Colluricincla megarhyncha	Little Shrike-thrush	
			Colluricincla harmonica	Grey Shrike-thrush	
			Pachycephala pectoralis	Golden Whistler	
			Pachycephala rufiventris	Rufous Whistler	
			Dicruridae		

			Rhipidura fuliginosa	Grey Fantail	
x			*Rhipidura rufifrons*	Rufous Fantail	
			Rhipidura leucophrys	Willie Wagtail	
x			*Monacrha trivirgatus*	Spectacled Monarch	
			Dicrurus bracteatus	Spangled Drongo	
			Campephagidae		
			Coracina novaehollandiae	Black-faced Cuckoo-shrike	
			Coracina tenuirostris	Cicadabird	
			Lalage sueurii	White-winged Triller	
			Artamidae		
			Cracticus torquatus	Grey Butcherbird	
			Cracticus nigrogularis	Pied Butcherbird	
			Gymnorhina tibicen	Australian Magpie	
			Strepera graculina	Pied Currawong	
			Corvidae		
			Corvus coronoides	Australian Raven	
			Corvus orru	Torresian Crow	
			Hirundinidae		
			Hirundo neoxena	Welcome Swallow	
F			**Sylviidae**		
			Cisticola exilis	Golden-headed Cisticola	
			Megalurus timoriensis	Tawny Grassbird	
			Ploceidae		
			Neochmia temporalis	Red-browed Finch	
			Zosteropidae		
			Zosterops lateralis	Silvereye	
			REPTILES		
			Agamidae		
			Physignathus lesueurii	Eastern Water Dragon	
			Varanidae		
			Varanus varius	Lace Monitor	
			Scincidae		
			Egernia major	Land Mullet	
			Lampropholis delicata	Grass Skink	
			Boidae		
			Morelia spilota	Diamond / Carpet Python	
			Elapidae		
			Hemiaspis signata	Black-bellied Swamp Snake	
			Pseudechis porphyriacus	Red-bellied Black Snake	
			Rhinoplocephalus nigrescens	Eastern Small-eyed Snake	
			AMPHIBIANS		
			Myobatrachidae		
			Crinia signifera	Common Eastern Froglet	
			Limnodynastes ornatus	Ornate Burrowing Frog	
			Limnodynastes peronii	Striped Marsh Frog	
			Mixophyes fasciolatus	Barred Frog	

			Hylidae		
	x		*Litoria brevipalmata*	Green-thighed Frog	
			Litoria caerulea	Green Tree Frog	
			Litoria fallax	Eastern Dwarf Tree Frog	
			Litoria gracilenta	Dainty Tree Frog	
			Litoria latopalmata	Broad-palmed Frog	

Lot 66 in DP 551005, Moonee Beach

Proposed Residential & Tourist Development

Flora & Fauna Assessment Report

APPENDIX 5

Assessments of Significance Pursuant to Section 5A of the EP&A Act

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LOT 66 in DP 551005, MOONEE BEACH
PROPOSED RESIDENTIAL & TOURIST DEVELOPMENT

SECTION 5A ASSESSMENTS of SIGNIFICANCE

August 2006

1 INTRODUCTION

1.1 Statutory Considerations

The *NSW Threatened Species Conservation Act 1995* (TSC Act) has modified the *NSW Environmental Planning & Assessment Act 1979* (EP&A Act) by, *inter alia*, including a requirement to determine "*whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats*". Section 5A (s.5A) identifies seven factors which "*must be taken into account*" by a consent or determining authority in administering Sections 78, 79C and 112 of the EP&A Act.

The factors contained within s.5A of the EP&A Act which "*must be taken into account*" in determining "*whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats*" were amended in 2005, after proclamation of the *NSW Threatened Species Amendment Act 2002* (TSAA Act). This *Report* addresses the amended version of Section 5A and the relevant factors contained therein.

1.2 Relevant Biota

The subject site supports five "*endangered ecological communities*" - the SSFCF, SOFF, FWCF, LRF and CSM communities (as detailed below). These ecological communities are located in the low-lying and flood-prone portions of the site or (in the case of the Littoral Rainforest) in a confined area.

No listed "*endangered populations*" have been recorded on the subject site or in the immediate vicinity.

Sixteen threatened fauna species have been (or may have been) recorded on the subject site (the Little and Common Bent-wing Bats, East Coast Freetail Bat, Yellow-bellied Sheathtail Bat, Golden-tipped Bat, Large-footed Myotis, Grey-headed Flying Fox, Common Blossom Bat, Koala, Yellow-bellied Glider, Common Planigale, Regent Honeyeater, Osprey, Square-tailed Kite, Glossy Black Cockatoo and Green-thighed Frog).

Two threatened plant species have been recorded on the site (the Rusty Plum and the Moonee Quassia).

Detailed s.5A *Assessments of Significance* have been prepared for each of these threatened biota.

A number of other threatened species which could potentially occur on the subject site have been considered in a generaic s.5A *Assessment of Significance* contained within the main *Report*.

2 SECTION 5A - FACTORS for CONSIDERATION

The factors which "*must be taken into account*" pursuant to s.5A of the EP&A Act (as amended in 2005) are:

(a) in the case of 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.

(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.

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

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

  (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

(d) in relation to the habitat of a threatened species, population or ecological community:

  (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

  (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

  (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

(e) whether the action proposed is likely to 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*.

(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.

3 INTERPRETATION & DEFINITIONS

3.1 The Guidelines

The Department of Environment & Conservation (DEC) has provided a set of *Threatened Species Assessment Guidelines* (dated August 2005) which provide advice regarding the interpretation and application of the amended Section 5A of the EP&A Act.

It is of critical importance to note that the *Guidelines* state *inter alia* that the "*assessment of significance*" should not be considered a "*pass or fail test*". Further, the *Guidelines* state that "*all factors must be considered and an overall conclusion must be drawn from all factors in combination*".

3.1 Definitions Contained in the Guidelines

Study Area

The *Guidelines* define the term "*study area*" as meaning "*the subject land and any additional areas which are likely to be affected by the proposal, either directly or indirectly. The study area should extend as far as is necessary to take all potential impacts into account*".

Whilst that definition *per se* is not problematic, its further application within the *Guidelines* presents some anomalies and inappropriate definitions with respect to "*local populations*", "*local occurrences*" and the "*locality*", as discussed in some detail below.

The fundamental problem is that the definition of "*study area*" relies on an arbitrary artifical and/or cadastral basis, which rarely (if ever) bears any relationship to ecological attributes.

Local Population

With respect to "*threatened species*", the *Guidelines* define a "*local population*" of a species as "*the population that occurs in the study area*", noting the definition of "*study area*" discussed above.

This definition of "*local population*" is, in most instances, likely to be entirely inappropriate, arbitrary and devoid of any ecological basis (unless the solution discussed below is adopted) because:

- in most instances (indeed in the overwhelming majority of instances), the "*study area*" (being the area affected by the development activities, "*either directly or indirectly*") will have no relation whatsoever to the distribution of suitable habitat or the extent or distribution of a real 'population' of any native biota;
- confining the "*local population*" to the "*study area*" in almost all instances ignores the actual distribution of habitat for a species, the life cycle requirements of most fauna and flora, the actual or likely area of land and habitat occupied by a "*population*" of most species, and the circumstances of the particular site or "*study area*"; and
- in most instances, confining the "*local population*" to the "*study* area" would involve only a very small proportion of an ecologically valid or true "*local population*" of any native species.

In the case of migratory or highly mobile species for example (*eg* the Regent Honeyeater, Grey-headed Flying Fox and microchiropteran bats), confining the "*local population*" to the

"*study area*" is nonsensical and ecologically meaningless (again unless the solution provided below is adopted).

Similar considerations apply to species which occupy large home ranges (such as the Osprey, Square-tailed Kite and Glossy Black Cockatoo). There is no ecological or scientifically valid rationale for confining the "*local population*" of such species to the "*subject site*" or the "*study area*".

The same considerations apply in addressing "*endangered populations*", which will in virtually no instance be confined to the "*study area*" (unless the "*study area*" includes the whole distribution of that population).

Local Occurrence

Similar problems arise with the definition of "*local occurrence*" in the consideration of "*endangered ecological communities*". The definition of "*local occurrence*" provided in the *Guidelines* is "*the community that occurs within the study area*".

Again, confining the "*local occurrence*" of an "*endangered ecological community*" to that area of "*the community that occurs within the study area*" is generally ecologically unsound and essentially meaningless, unless the solution described below is adopted.

In the first instance, the "*study area*" is an arbitrarily defined area, which will vary substantially depending on the size of the "*subject land*" and the proposed development. These matters are determined by cadastral boundaries rather than by the distribution of ecological features. As a consequence, there is (in most instances) no correlation between the true or ecological "*local occurrence*" of a community and that which is determined by its presence within a "*study area*".

The definition provided in the *Guidelines* for "*local occurrence*" would lead in many instances to the illogical and ecologically unsound situation where just one part of a stand of a community is contained within the defined "*local occurrence*" (because it is in the "*study area*") whilst the adjoining portion of the same community (located outside the "*study* area") is not part of the "*local occurrence*". Again, this situation pertains unless the solution described below is adopted.

Furthermore, definition of the "*local occurrence"* of an "*endangered ecological community*" as confined to a "*study area*" would lead in many instances to a case of *reductio ad absurdum*. Given that, in many instances, the development would require removal of all of the "*endangered ecological community*" located within the "*study area*" or within the "*subject site*", it must automatically follow that the "*action proposed*" would lead to the "*extinction*" of the defined "*local occurrence*". That necessarily follows even if the area of vegetation to be affected constitutes only a minute proportion of a very much larger contiguous portion or stand of the "*endangered ecological community*".

Locality

In respect of Factor (d) of s.5A, the *Guidelines* provide a definition of "*locality*" as being "*the habitat that occurs within the study area*". In the application of Factor (d), that definition generally will also be both ecologically unsound and potentially a case of *reductio ad absurdum* unless the term is redefined or interpreted in accordance with the solution described below.

Confining the "*locality*", and indeed the "*local population*" of a threatened species, to the

"*study area*" makes no sense when addressing a proposed development in relation to the potential impacts upon species such as the Powerful Owl, Regent Honeyeater, Grey-headed Flying Fox or microchiropteran bats.

3.3 Potential Solution

One possible solution to the problems identified below is to consider the "*additional areas which likely to be affected … indirectly*" by the "*action proposed*" as including the total home ranges and/or distributions of the relevant "*threatened species, population or ecological communities*". On that basis, the "*study area*" extends as far as the distribution of suitable habitat for and/or the home ranges of the relevant threatened biota.

The only alternative would be to change the definitions provided in the *Guidelines*.

3.4 Definitions Used in this Assessment

Given the difficulties detailed above with respect to several of the definitions contained in the *Guidelines* provided for the *Assessment of Significance* by DEC (August 2005), an appropriate and ecologically sound series of definitions is utilised in this *Report*. These are based on ecological principles and on the solution to the quandry discussed above.

The "*local population*" of threatened fauna species is considered to include all individuals within the home range of those individuals using the subject site, as well as other pairs or individuals which are likely to interact with those present on the site. Significantly and most importantly, the "*local population*" of threatened fauna species is not limited to the individual or individuals, or the pairs, which occur on the site.

Similarly, the "*local population*" of the threatened plant species recorded on the site are not restricted to either the site itself or to the "*study area*" as defined in the DEC *Guidelines*.

The "*local occurrence*" of the "*endangered ecological communities*" present on the subject site at Moonee Beach is regarded as including the stands of the relevant communities on the subject site and those on adjoining lands to the north, south and west. All of the "*endangered ecological communities*" present on the subject site are contiguous with vegetation on adjoining lands.

The term "*locality*" is taken to be determined by the definitions for "*local population*" and "*local occurrence*" identified above. For some species, therefore, the "*locality*" may cover several thousand hectares and/or distances of up to (or even greater than) 50km.

4 FACTORS for CONSIDERATION

4.1 Endangered Ecological Communities

4.1.1 Swamp Sclerophyll Forest on Coastal Floodplains

Factor (a) Threatened Species and the Risk of Extinction

The Swamp Sclerophyll Forest on Coastal Floodplains in the NSW North Coast, Sydney Basin and South East Corner Bioregions (SSFCF) community is not a "*threatened species*".

Factor (b) Endangered Populations and the Risk of Extinction

The SSFCF community is not an "*endangered population*".

Factor (c) Endangered Ecological Communities and the Risk of Extinction

The "*local occurrence*" of the SSFCF community would include the stands of this community on the subject site, as well as contiguous vegetation on lands to the north, west and south. The approved development to the south includes the retention and protection of SSFCF vegetation.

The proposed development at Moonee Beach involves the retention of the overwhelming majority of SSFCF on the subject site. Further, the proposal incorporates the permanent protection of the community within a substantial Conservation Reserve (of approximately 70ha) which is to be managed for biodiversity conservation purposes.

With respect to the issues identified in Factor (c) in respect of the SSFCF community:

- as the overwhelming majority of the community is to be retained within the substantial Conservation Reserve on the subject site, and other parts of the "*local occurrence*" of the community are to be retained on adjoining lands, there will be little impact "*on the extent of the ecological community*".

  Given the retention of most of the habitat and of the community, and the implementation of appropriate environmental management measures (including permanent management of the Conservation Reserve), there is no possibility of the "*local occurrence*" of the SSFCF community being "*placed at risk of extinction*" (emphasis added); and
- the proposed development will not "*substantially and adversely modify the composition of the ecological community*" given the extent of its retention on the subject site and on adjoining lands, and the implementation of an appropriate management regime. Any possible adverse impacts upon the community will be extremely localised, and have no possibility of placing the "*local occurrence*" of the SSFCF community "*at risk of extinction*" (emphasis added).

Factor (d) Habitat Removal, Modification, Fragmentation, Isolation and Importance

With respect to the issues raised in Factor (d) of s.5A in terms of the habitat for the SSFCF community:

- extremely little of this community is "*to be removed or modified as a result of the action proposed*", as virtually all of the community is located within the Conservation Reserve on the subject site. The overwhelming majority of the community is to be retained in its natural condition, and rehabilitated where necessary;
- given the substantial extent of Conservation Reserve on the subject site, the retention of broad bands of vegetation across the site and connectivity of vegetation with the lands to the immediate south, no habitat for the SSFCF community will "*become fragmented or isolated from other areas of habitat as a result of the proposed action*". Conversely, the eventual upgrade of the Pacific Highway (on the western boundary of the subject site) is likely to involve further fragmentation of vegetation in this locality; and
- the very small area of habitat which may be "*removed, modified, fragmented or isolated*" as a result of the action proposed on the subject site is of no "*importance*" with respect to the "*long-term survival*" of the SSFCF community in this general locality or in general terms.

Factor (e) Critical Habitat – Direct and Indirect Effects

The TSC Act 1995 defines "*critical habitat*" as "*habitat declared to be critical habitat under Part 3*" of the Act. At the time of this *Report*, no "*critical habitat*" for the SSFCF community had been declared.

Factor (f) Recovery Plans and Threat Abatement Plans

There is currently no *Recovery Plan* with respect to the SSFCF community.

A draft *Threat Abatement Plan* has been prepared by the DEC for Bitou Bush, which is of relevance to the SSFCF community on the subject land at Moonee Beach. The VMP for the Conservation Reserve on the subject site will ensure the implementation of relevant actions identified in the *Threat Abatement Plan*, whereas there is currently no program for the removal or control of Bitou Bush either on the subject site or in the adjoining Reserve.

Factor (g) Key Threatening Processes

The "*key threatening process*" of most potential relevance to the SSFCF community is the "*clearing of native vegetation*", although a number of other "*key threatening processes*" may also be (theoretically at least) of relevance (see Chapter 7.1).

With respect to the "*clearing of native vegetation*", it must be noted that the overwhelming majority of the SSFCF community is to be retained on the subject site and protected within a substantial Conservation Reserve, which is to be managed in perpetuity for biodiversity conservation purposes. On that basis, "*the action proposed*" will not relevantly "*result in the operation of, or increase the impact of, a key threatened process*". With respect to the SSFCF community, the "*action proposed*" will not exacerbate the "*clearing of native vegetation*" to any significant extent.

Other "*key threatening processes*" which may be of some limited potential reference include:

- invasion by Bitou Bush;
- invasion by introduced grasses; and
- changes in surface flows.

With respect to these "*key threatening processes*", however, it is to be noted that:

- the overwhelming majority of the SSFCF community is to be retained within a substantial Conservation Reserve, and is to be protected and managed in the long-term for conservation purposes;
- the *Vegetation Management Plan* (VMP) for the Conservation Reserve will incorporate measures for the removal of and ongoing control of weeds such as Bitou Bush, Molasses Grass and other invasive grasses; and
- stormwater management measures have been incorporated into the development design to ensure that no adverse modifications to moisture or flooding regimes are imposed upon the SSFCF community.

Give those circumstances, the "*action proposed*" will not involve any significant imposition of any "*key threatening process*" upon the SSFCF community.

CONCLUSIONS

The eight factors which are required to be considered pursuant to s.5A of the EP&A Act in the determination of "*whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats*" are discussed in detail above with respect to the SSFCF community.

Given the retention of virtually all of the SSFCF community present on the subject site within a dedicated Conservation Reserve, and its permanent management for biodiversity conservation purposes, the proposed development is not "*likely*" to impose "*a significant effect*" on this "*endangered ecological community*".

4.1.2 Swamp Oak Floodplain Forest

Factor (a) Threatened Species and the Risk of Extinction

The Swamp Oak Floodplain Forest in the NSW North Coast, Sydney Basin and South East Corner Bioregions (SOFF) community is not a "*threatened species*".

Factor (b) Endangered Populations and the Risk of Extinction

The SOFF community is not an "*endangered population*".

Factor (c) Endangered Ecological Communities and the Risk of Extinction

The NSW Scientific Committee in its *Final Determination* states that the extent of this

community "*has not been mapped across its entire range*" but that "*Coastal Floodplain Wetlands, which include Swamp Oak Floodplain Forest, currently covers 800 - 1,400 km^2*". The *Final Determination* cites mapping of parts of the distribution of this community as involving approximately 14,550ha of SOFF.

The "*local occurrence*" of the SOFF community would include the stands of this community on the subject site, as well as contiguous vegetation on lands to the north, west and south. The approved development to the south includes the retention and protection of SOFF vegetation.

The proposed development at Moonee Beach involves the retention of the overwhelming majority of SOFF on the subject site. Further, the proposal incorporates the permanent protection of the community within a substantial Conservation Reserve (of approximately 70ha) which is to be managed for biodiversity conservation purposes.

With respect to the issues identified in Factor (c) in respect of the SOFF community:

- as the overwhelming majority of the community is to be retained within the substantial Conservation Reserve on the subject site, and other parts of the "*local occurrence*" of the community are to be retained on adjoining lands, there will be little impact "*on the extent of the ecological community*".

  Given the retention of most of the habitat and of the community, and the implementation of appropriate environmental management measures (including permanent management of the Conservation Reserve), there is no possibility of the "*local occurrence*" of the SOFF community being "*placed at risk of extinction*" (emphasis added); and

- the proposed development will not "*substantially and adversely modify the composition of the ecological community*" given the extent of its retention on the subject site and on adjoining lands, and the implementation of an appropriate management regime. Any possible adverse impacts upon the community will be extremely localised, and have no possibility of placing the "*local occurrence*" of the SOFF community "*at risk of extinction*" (emphasis added).

Factor (d) Habitat Removal, Modification, Fragmentation, Isolation and Importance

With respect to the issues raised in Factor (d) of s.5A in terms of the habitat for the SOFF community:

- extremely little of this community is "*to be removed or modified as a result of the action proposed*", as virtually all of the community is located within the Conservation Reserve on the subject site. The overwhelming majority of the community is to be retained in its natural condition, and rehabilitated where necessary;

- given the substantial extent of Conservation Reserve on the subject site, the retention of broad bands of vegetation across the site and connectivity of vegetation with the lands to the immediate south, no habitat for the SOFF community will "*become fragmented or isolated from other areas of habitat as a result of the proposed action*"; and

- the very small area of habitat which may be "*removed, modified, fragmented or isolated*" as a result of the action proposed on the subject site is of no "*importance*" with respect to the "*long-term survival*" of the SOFF community in this general locality or in general terms.

Factor (e) Critical Habitat – Direct and Indirect Effects

The TSC Act 1995 defines "*critical habitat*" as "*habitat declared to be critical habitat under Part 3*" of the Act. At the time of this *Report*, no "*critical habitat*" for the SOFF community had been declared.

Factor (f) Recovery Plans and Threat Abatement Plans

There is currently no *Recovery Plan* with respect to the SOFF community.

A draft *Threat Abatement Plan* has been prepared by the DEC for Bitou Bush, which is of relevance to the SOFF community on the subject land at Moonee Beach. The VMP for the Conservation Reserve on the subject site will ensure the implementation of relevant actions identified in the *Threat Abatement Plan*, whereas there is currently no program for the removal or control of Bitou Bush either on the subject site or in the adjoining Reserve.

Factor (g) Key Threatening Processes

The "*key threatening process*" of most potential relevance to the SOFF community is the "*clearing of native vegetation*", although a number of other "*key threatening processes*" may also be (theoretically at least) of relevance (see Chapter 7.1).

With respect to the "*clearing of native vegetation*", it must be noted that the overwhelming majority of the SOFF community is to be retained on the subject site and protected within a substantial Conservation Reserve, which is to be managed in perpetuity for biodiversity conservation purposes. On that basis, "*the action proposed*" will not relevantly "*result in the operation of, or increase the impact of, a key threatened process*". With respect to the SOFF community, the "*action proposed*" will not exacerbate the "*clearing of native vegetation*" to any significant extent.

Other "*key threatening processes*" which may be of some limited potential reference include:

- invasion by Bitou Bush;
- invasion by introduced grasses; and
- changes in surface flows.

With respect to these "*key threatening processes*", however, it is to be noted that:

- the overwhelming majority of the SOFF community is to be retained within a substantial Conservation Reserve, and is to be protected and managed in the long-term for conservation purposes;
- the *Vegetation Management Plan* (VMP) for the Conservation Reserve will incorporate measures for the removal of and ongoing control of weeds such as Bitou Bush, Molasses Grass and other invasive grasses; and
- stormwater management measures have been incorporated into the development design to ensure that no adverse modifications to moisture or flooding regimes are imposed upon the SOFF community.

Give those circumstances, the "*action proposed*" will not involve any significant imposition of any "*key threatening process*" upon the SOFF community.

CONCLUSIONS

The eight factors which are required to be considered pursuant to s.5A of the EP&A Act in the determination of "*whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats*" are discussed in detail above with respect to the SOFF community.

Given the retention of virtually all of the SOFF community present on the subject site within a dedicated Conservation Reserve, and its permanent management for biodiversity conservation purposes, the proposed development is not "*likely*" to impose "*a significant effect*" on this "*endangered ecological community*".

4.1.3 Freshwater Wetlands on Coastal Floodplains

Factor (a) Threatened Species and the Risk of Extinction

The Freshwater Wetlands on Coastal Floodplains in the NSW North Coast, Sydney Basin and South East Corner Bioregions (FWCF) community is not a "*threatened species*".

Factor (b) Endangered Populations and the Risk of Extinction

The FWCF community is not an "*endangered population*".

Factor (c) Endangered Ecological Communities and the Risk of Extinction

The NSW Scientific Committee in its *Final Determination* is uncertain about the extent of this community. The *Final Determination* cites mapping of parts of the distribution of this community as involving approximately 30,910ha of FWCF. It should be noted, however, that this is not a comprehensive estimate of the existing FWCF in NSW and is likely to be a substantial underestimate.

The "*local occurrence*" of the FWCF community would include the stands of this community on the subject site, as well as contiguous vegetation on lands to the north, west and south. The approved development to the south includes the retention and protection of FWCF vegetation.

The proposed development at Moonee Beach involves the retention of the overwhelming majority of FWCF on the subject site. Further, the proposal incorporates the permanent protection of the community within a substantial Conservation Reserve (of approximately 70ha) which is to be managed for biodiversity conservation purposes.

With respect to the issues identified in Factor (c) in respect of the FWCF community:

- as the overwhelming majority of the community is to be retained within the substantial Conservation Reserve on the subject site, and other parts of the "*local occurrence*" of the community are to be retained on adjoining lands, there will be little impact "*on the extent of the ecological community*".

  Given the retention of most of the habitat and of the community, and the implementation of appropriate environmental management measures (including

permanent management of the Conservation Reserve), there is no possibility of the "*local occurrence*" of the FWCF community being "*placed at risk of extinction*" (emphasis added); and

- the proposed development will not "*substantially and adversely modify the composition of the ecological community*" given the extent of its retention on the subject site and on adjoining lands, and the implementation of an appropriate management regime. Any possible adverse impacts upon the community will be extremely localised, and have no possibility of placing the "*local occurrence*" of the FWCF community "*at risk of extinction*" (emphasis added).

Factor (d) Habitat Removal, Modification, Fragmentation, Isolation and Importance

With respect to the issues raised in Factor (d) of s.5A in terms of the habitat for the FWCF community:

- extremely little of this community is "*to be removed or modified as a result of the action proposed*", as virtually all of the community is located within the Conservation Reserve on the subject site. The overwhelming majority of the community is to be retained in its natural condition, and rehabilitated where necessary;
- given the substantial extent of Conservation Reserve on the subject site, the retention of broad bands of vegetation across the site and connectivity of vegetation with the lands to the immediate south, no habitat for the FWCF community will "*become fragmented or isolated from other areas of habitat as a result of the proposed action*"; and
- the very small area of habitat which may be "*removed, modified, fragmented or isolated*" as a result of the action proposed on the subject site is of no "*importance*" with respect to the "*long-term survival*" of the FWCF community in this general locality or in general terms.

Factor (e) Critical Habitat – Direct and Indirect Effects

The TSC Act 1995 defines "*critical habitat*" as "*habitat declared to be critical habitat under Part 3*" of the Act. At the time of this *Report*, no "*critical habitat*" for the FWCF community had been declared.

Factor (f) Recovery Plans and Threat Abatement Plans

There is currently no *Recovery Plan* with respect to the FWCF community.

A draft *Threat Abatement Plan* has been prepared by the DEC for Bitou Bush, which is of relevance to the FWCF community on the subject land at Moonee Beach. The VMP for the Conservation Reserve on the subject site will ensure the implementation of relevant actions identified in the *Threat Abatement Plan*, whereas there is currently no program for the removal or control of Bitou Bush either on the subject site or in the adjoining Reserve.

Factor (g) Key Threatening Processes

The "*key threatening process*" of most potential relevance to the FWCF community is the "*clearing of native vegetation*", although a number of other "*key threatening processes*" may also be (theoretically at least) of relevance (see Chapter 7.1).

With respect to the "*clearing of native vegetation*", it must be noted that the overwhelming majority of the FWCF community is to be retained on the subject site and protected within a substantial Conservation Reserve, which is to be managed in perpetuity for biodiversity conservation purposes. On that basis, "*the action proposed*" will not relevantly "*result in the operation of, or increase the impact of, a key threatened process*". With respect to the FWCF community, the "*action proposed*" will not exacerbate the "*clearing of native vegetation*" to any significant extent.

Other "*key threatening processes*" which may be of some limited potential reference include:

- invasion by Bitou Bush;
- invasion by introduced grasses; and
- changes in surface flows.

With respect to these "*key threatening processes*", however, it is to be noted that:

- the overwhelming majority of the FWCF community is to be retained within a substantial Conservation Reserve, and is to be protected and managed in the long-term for conservation purposes;
- the *Vegetation Management Plan* (VMP) for the Conservation Reserve will incorporate measures for the removal of and ongoing control of weeds such as Bitou Bush, Molasses Grass and other invasive grasses; and
- stormwater management measures have been incorporated into the development design to ensure that no adverse modifications to moisture or flooding regimes are imposed upon the FWCF community.

Give those circumstances, the "*action proposed*" will not involve any significant imposition of any "*key threatening process*" upon the FWCF community.

CONCLUSIONS

The eight factors which are required to be considered pursuant to s.5A of the EP&A Act in the determination of "*whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats*" are discussed in detail above with respect to the FWCF community.

Given the retention of virtually all of the FWCF community present on the subject site within a dedicated Conservation Reserve, and its permanent management for biodiversity conservation purposes, the proposed development is not "*likely*" to impose "*a significant effect*" on this "*endangered ecological community*".

4.1.4 Littoral Rainforest

Factor (a) Threatened Species and the Risk of Extinction

The Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions (LRF) community is not a "*threatened species*".

Factor (b) Endangered Populations and the Risk of Extinction

The LRF community is not an "*endangered population*".

Factor (c) Endangered Ecological Communities and the Risk of Extinction

The "*local occurrence*" of the LRF community would include the stands of this community on the subject site, as well as contiguous vegetation on land to the immediate north.

The proposed development at Moonee Beach involves the retention of all of the LRF community on the subject site. Further, the proposal incorporates the permanent protection of the community within a substantial Conservation Reserve (of approximately 70ha) which is to be managed for biodiversity conservation purposes.

With respect to the issues identified in Factor (c) in respect of the LRF community:

- as all of this community is to be retained within the substantial Conservation Reserve on the subject site, and other parts of the "*local occurrence*" of the community are to be retained on adjoining lands, there will be no impact "*on the extent of the ecological community*".

  Given the retention of all of the suitable habitat and all of the community, and the implementation of appropriate environmental management measures (including permanent management of the Conservation Reserve), there is no possibility of the "*local occurrence*" of the FWCF community being "*placed at risk of extinction*" (emphasis added); and
- the proposed development will not "*substantially and adversely modify the composition of the ecological community*" given the extent of its retention on the subject site and on adjoining lands, and the implementation of an appropriate management regime. There is no possibility of the "*action proposed*" placing the "*local occurrence*" of the LRF community "*at risk of extinction*" (emphasis added).

Factor (d) Habitat Removal, Modification, Fragmentation, Isolation and Importance

With respect to the issues raised in Factor (d) of s.5A in terms of the habitat for the LRF community:

- none of this community is "*to be removed or modified as a result of the action proposed*", as all of the community is located within the Conservation Reserve on the subject site. The full extent of the community is to be retained in its natural condition, and rehabilitated where necessary;
- given the substantial extent of Conservation Reserve on the subject site, the retention of broad bands of vegetation across the site, no habitat for the LRF community will "*become fragmented or isolated from other areas of habitat as a result of the proposed action*"; and
- no habitat for the LRF community will be "*removed, modified, fragmented or isolated*" as a result of the action proposed on the subject site, and the action will not affect the "*long-term survival*" of the LRF community in this general locality or in general terms.

Factor (e) Critical Habitat – Direct and Indirect Effects

The TSC Act 1995 defines "*critical habitat*" as "*habitat declared to be critical habitat under*

Part 3" of the Act. At the time of this *Report*, no "*critical habitat*" for the LRF community had been declared.

Factor (f) Recovery Plans and Threat Abatement Plans

There is currently no *Recovery Plan* with respect to the LRF community.

A draft *Threat Abatement Plan* has been prepared by the DEC for Bitou Bush, which is of relevance to the LRF community on the subject land at Moonee Beach. The VMP for the Conservation Reserve on the subject site will ensure the implementation of relevant actions identified in the *Threat Abatement Plan*, whereas there is currently no program for the removal or control of Bitou Bush either on the subject site or in the adjoining Reserve.

Factor (g) Key Threatening Processes

The "*key threatening process*" of most potential relevance to the LRF community is the "*clearing of native vegetation*", although a number of other "*key threatening processes*" may also be (theoretically at least) of relevance (see Chapter 7.1).

With respect to the "*clearing of native vegetation*", it must be noted that all of the LRF community is to be retained on the subject site and protected within a substantial Conservation Reserve, which is to be managed in perpetuity for biodiversity conservation purposes. On that basis, "*the action proposed*" will not relevantly "*result in the operation of, or increase the impact of, a key threatened process*". With respect to the LRF community, the "*action proposed*" will not exacerbate the "*clearing of native vegetation*" to any relevant extent.

Other "*key threatening processes*" which may be of some limited potential reference include:

- invasion by Bitou Bush;
- invasion by introduced grasses; and
- changes in surface flows.

With respect to these "*key threatening processes*", however, it is to be noted that:

- all of the LRF community is to be retained within a substantial Conservation Reserve, and is to be protected and managed in the long-term for conservation purposes;
- the *Vegetation Management Plan* (VMP) for the Conservation Reserve will incorporate measures for the removal of and ongoing control of weeds such as Bitou Bush, Molasses Grass and other invasive grasses; and
- stormwater management measures have been incorporated into the development design to ensure that no adverse modifications to moisture or flooding regimes are imposed upon the LRF community.

Give those circumstances, the "*action proposed*" will not involve any significant imposition of any "*key threatening process*" upon the LRF community.

CONCLUSIONS

The eight factors which are required to be considered pursuant to s.5A of the EP&A Act in the determination of "*whether there is likely to be a significant effect on threatened species,*

populations or ecological communities, or their habitats" are discussed in detail above with respect to the LRF community.

Given the retention of all of the LRF community present on the subject site within a dedicated Conservation Reserve, and its permanent management for biodiversity conservation purposes, the proposed development is not "*likely*" to impose "*a significant effect*" on this "*endangered ecological community*".

4.1.5 Coastal Saltmarsh in NSW

Factor (a) Threatened Species and the Risk of Extinction

The Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions (CSM) community is not a "*threatened species*".

Factor (b) Endangered Populations and the Risk of Extinction

The CSM community is not an "*endangered population*".

Factor (c) Endangered Ecological Communities and the Risk of Extinction

The "*local occurrence*" of the CSM community would include the stands of this community on the subject site, as well as contiguous vegetation on land to the immediate north and areas of CSM in the Moonee Creek estuary.

The proposed development at Moonee Beach involves the retention of all of the CSM community on the subject site. Further, the proposal incorporates the permanent protection of the community within a substantial Conservation Reserve (of approximately 70ha) which is to be managed for biodiversity conservation purposes.

With respect to the issues identified in Factor (c) in respect of the CSM community:

- as all of this community is to be retained within the substantial Conservation Reserve on the subject site, and other parts of the "*local occurrence*" of the community are to be retained on adjoining lands, there will be no impact "*on the extent of the ecological community*".

  Given the retention of all of the suitable habitat and all of the community, and the implementation of appropriate environmental management measures (including permanent management of the Conservation Reserve), there is no possibility of the "*local occurrence*" of the CSM community being "*placed at risk of extinction*" (emphasis added); and
- the proposed development will not "*substantially and adversely modify the composition of the ecological community*" given the extent of its retention on the subject site and on adjoining lands, and the implementation of an appropriate management regime. There is no possibility of the "*action proposed*" placing the "*local occurrence*" of the CSM community "*at risk of extinction*" (emphasis added).

Factor (d) Habitat Removal, Modification, Fragmentation, Isolation and Importance

With respect to the issues raised in Factor (d) of s.5A in terms of the habitat for the CSM community:

- none of this community is "*to be removed or modified as a result of the action proposed*", as all of the community is located within the Conservation Reserve on the subject site. The full extent of the community is to be retained in its natural condition, and rehabilitated where necessary;
- given the substantial extent of Conservation Reserve on the subject site, the retention of broad bands of vegetation across the site, no habitat for the CSM community will "*become fragmented or isolated from other areas of habitat as a result of the proposed action*"; and
- no habitat for the CSM community will be "*removed, modified, fragmented or isolated*" as a result of the action proposed on the subject site, and the action will not affect the "*long-term survival*" of the CSM community in this general locality or in general terms.

Factor (e) Critical Habitat – Direct and Indirect Effects

The TSC Act 1995 defines "*critical habitat*" as "*habitat declared to be critical habitat under Part 3*" of the Act. At the time of this *Report*, no "*critical habitat*" for the CSM community had been declared.

Factor (f) Recovery Plans and Threat Abatement Plans

There is currently no *Recovery Plan* with respect to the CSM community.

A draft *Threat Abatement Plan* has been prepared by the DEC for Bitou Bush, which is of relevance to the CSM community on the subject land at Moonee Beach. The VMP for the Conservation Reserve on the subject site will ensure the implementation of relevant actions identified in the *Threat Abatement Plan*, whereas there is currently no program for the removal or control of Bitou Bush either on the subject site or in the adjoining Reserve.

Factor (g) Key Threatening Processes

The "*key threatening process*" of most potential relevance to the CSM community is the "*clearing of native vegetation*", although a number of other "*key threatening processes*" may also be (theoretically at least) of relevance (see Chapter 7.1).

With respect to the "*clearing of native vegetation*", it must be noted that all of the CSM community is to be retained on the subject site and protected within a substantial Conservation Reserve, which is to be managed in perpetuity for biodiversity conservation purposes. On that basis, "*the action proposed*" will not relevantly "*result in the operation of, or increase the impact of, a key threatened process*". With respect to the CSM community, the "*action proposed*" will not exacerbate the "*clearing of native vegetation*" to any relevant extent.

Other "*key threatening processes*" which may be of some limited potential reference include:

- invasion by Bitou Bush;
- invasion by introduced grasses; and

- changes in surface flows.

With respect to these "*key threatening processes*", however, it is to be noted that:

- all of the CSM community is to be retained within a substantial Conservation Reserve, and is to be protected and managed in the long-term for conservation purposes;
- the *Vegetation Management Plan* (VMP) for the Conservation Reserve will incorporate measures for the removal of and ongoing control of weeds such as Bitou Bush, Molasses Grass and other invasive grasses; and
- stormwater management measures have been incorporated into the development design to ensure that no adverse modifications to moisture or flooding regimes are imposed upon the CSM community.

Give those circumstances, the "*action proposed*" will not involve any significant imposition of any "*key threatening process*" upon the CSM community.

CONCLUSIONS

The eight factors which are required to be considered pursuant to s.5A of the EP&A Act in the determination of "*whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats*" are discussed in detail above with respect to the CSM community.

Given the retention of all of the CSM community present on the subject site and within a Conservation Reserve, the proposed development is not "*likely*" to impose "*a significant effect*" on this "*endangered ecological community*".

4.2 Threatened Plant Species

4.2.1 Rusty Plum *Amorphospermum whiteii*

Factor (a) Threatened Species and the Risk of Extinction

The Rusty Plum *Amorphospermum whiteii* is a small to medium-sized tree which grows in littoral and warm-temperate rainforest on the north coast of NSW and into Queensland. Several individuals of this species were recorded along the northern boundary of the subject site in Blackbutt Open Forest with a mesic understorey near the littoral rainforest along the northwestern boundary. The species was also recorded on land to the immediate south of the subject site (Parker 2004).

The proposed development will involve the removal of some individuals of this species, although it is not intended to remove the whole of the "*viable local population*" from the subject site. It is likely that individuals of this species, or a further extension of this population, is located in vegetation elsewhere along the tributary to Moonee Creek. Furthermore, individuals of the Rusty Plum which are located within the development footprint will be propagated and/or translocated to ensure the long-term survival of the population in this locality.

Given the considerations detailed above, it is not "*likely*" that a "*viable local population*" of the Rusty Plum would be "*placed at risk of extinction*" as a result of the proposed development.

Factor (b) Endangered Populations and the Risk of Extinction

There is no "*endangered population*" of the Rusty Plum.

Factor (c) Endangered Ecological Communities and the Risk of Extinction

The Rusty Plum is not an "*endangered ecological community*".

Factor (d) Habitat Removal, Modification, Fragmentation, Isolation and Importance

With respect to the Rusty Plum, most of the suitable habitat for this species on the subject site is to be retained within the substantial Conservation Reserve, particularly along Moonee Creek along and near the northern boundary of the subject site. Nevertheless, some habitat for this species is likely to be affected by the "*action proposed*", and a specific feature of the VMP for the Conservation Reserve on the subject site will involve a dedicated program of retention, protection and enhancement of habitat for this species.

Furthermore, the "*local occurrence*" of the Rusty Plum includes habitat and populations (or part of the local population) on adjoining lands to the north and west.

With respect to the issues raised in Factor (d) of s.5A of the EP&A Act in terms of habitat for the Rusty Plum:

- the majority of habitat for this species is to be retained, and only a small proportion of the habitat for the Rusty Plum "*is likely to be removed or modified as a result of the action proposed*";

- suitable habitat for this species is located in the moister forest communities and on the slopes below the more elevated parts of the subject site. The overall majority of these areas are to be retained for conservation purposes within a substantial Conservation Reserve on the site (occupying more than 70% of the subject land), in broad bands. Given those circumstances and the presence of the species on land to the immediate north of the subject site and upstream, the "*action proposed*" will not result in any "*area of habitat*" becoming "*fragmented or isolated from other areas of habitat*" for this species; and
- given the retention of habitat for and most of the population of the Rusty Plum on the subject site, and management of the Conservation Reserve on the site in perpetuity, that area of habitat for the Rusty Plum which is "*to be removed, modified, fragmented or isolated*" is not regarded as of "*importance ... to the long-term survival*" of this species "*in the locality*".

Factor (e) Critical Habitat – Direct and Indirect Effects

At the time of preparation of this *Report*, no "*critical habitat*" for the Rusty Plum had been declared by the Director-General of the NPWS.

Factor (f) Recovery Plans and Threat Abatement Plans

There is currently no *Recovery Plan* with respect to the Rusty Plum.

A draft *Threat Abatement Plan* has been prepared by the DEC for Bitou Bush, which is of potential relevance to the Rusty Plum on the subject land at Moonee Beach. The VMP for the Conservation Reserve on the subject site will ensure the implementation of relevant actions identified in the *Threat Abatement Plan*, whereas there is currently no program for the removal or control of Bitou Bush either on the subject site or in the adjoining Reserve.

Factor (g) Key Threatening Processes

The "*key threatening process*" of most potential relevance to the Rusty Plum is the "*clearing of native vegetation*", although a number of other "*key threatening processes*" may also be (theoretically at least) of relevance (see Chapter 7.1).

With respect to the "*clearing of native vegetation*", it must be noted that most of the habitat for and population of the Rusty Plum is to be retained on the subject site, and will be protected within a substantial Conservation Reserve which is to be managed in perpetuity for biodiversity conservation purposes. On that basis, "*the action proposed*" will not relevantly "*result in the operation of, or increase the impact of*" the "*clearing of native vegetation*" to any relevant extent.

Other "*key threatening processes*" which may be of some limited potential relevance include:

- invasion by Bitou Bush;
- invasion by introduced grasses; and
- changes in surface flows.

With respect to these "*key threatening processes*", however, it is to be noted that:

- most of the population of the Rusty Plum and its habitat is to be retained within a substantial Conservation Reserve, and is to be protected and managed in the

long-term for conservation purposes;

- the *Vegetation Management Plan* (VMP) for the Conservation Reserve will incorporate measures for the removal of and ongoing control of weeds such as Bitou Bush, Molasses Grass and other invasive grasses; and
- stormwater management measures have been incorporated into the development design to ensure that no adverse modifications to moisture or flooding regimes are imposed upon the Rusty Plum and its habitat.

Given those circumstances, whilst the "*action proposed*" will involve the "*operation of .. a key threatening process*", being the "*clearing of native vegetation*", the proposed development of the subject site will not significantly exacerbate that "*key threatening process*" in respect of the conservation of the Rusty Plum. Indeed, the proposal will improve the long-term prognosis for the Rusty Plum on the subject site by implementation of an appropriate VMP for the protection and enhancement of this species and its habitat.

CONCLUSIONS

The eight factors which are required to be considered pursuant to s.5A of the EP&A Act in the determination of "*whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats*" are discussed in detail above with respect to the Rusty Plum.

On the basis of the retention of most of the known and/or suitable habitat on the subject site, and the retention and/or salvage of individuals of the Rusty Plum, it is not "*likely*" that the proposed development at Moonee Beach would impose a "*significant effect*" on this species.

4.2.2 Moonee Quassia *Quassia* sp. B 'Moonee'

Factor (a) Threatened Species and the Risk of Extinction

The Moonee Quassia is distributed only in the northeastern part of NSW between Moonee and Ulmarra (to the northeast of Grafton). Most of the main distribution of this species is present in a band northwest from Moonee itself, with most of the known populations occurring in the National Parks and State Forests of this area (particularly in Wedding Bells, Conglomerate and Orara East State Forests and in Sherwood Nature Reserve).

The Moonee Quassia occurs in wet sclerophyll forest with a typical tree canopy of Tallow-wood, Brushbox and Turpentine.

On and adjacent to the subject site at Moonee Beach, the Moonee Quassia was located on the slopes along Moonee Creek, which is located north of the northern boundary of the subject site. Some of the plants are located within the subject site whilst others are located on the Crown Land along Moonee Creek. There are also a significant number of specimens along Moonee Creek to the west of the Pacific Highway, and the "*viable local population*" of this species would include specimens on the subject site, on the adjoining Crown Land through which Moonee Creek flows, and on the lands to the west of the Pacific Highway.

The majority of habitat for and specimens of the Moonee Quassia which occur on the subject site will be retained within the Conservation Reserve along the northern boundary of the site.

As noted above, many specimens of this population are located on the adjoining land to the immediate north, along the banks of Moonee Creek.

Recent disturbance by off-road bikes and bicycles has substantially degraded areas of the habitat of the Moonee Quassia in this location. It appears that a number of specimens have been damaged or their above-ground parts removed, and there is substantial degradation of soils and erosion as a result of unauthorised access and disturbance.

The proposed development of the subject site at Moonee Beach involves the implementation of a VMP for the Conservation Reserve which will focus, *inter alia*, on the protection and enhancement of habitat for and specimens of the Moonee Quassia. The proposed development will, in fact, enhance the viability of the "*local population*" of this species by implementing a dedicated management program within the Conservation Reserve. That program could, and indeed should, be co-ordinated with the adjoining landowner(s) to the immediate north, to ensure that all of the sub-population of the Moonee Quassia east of the Pacific Highway is retained and protected.

Given those considerations, there is no likelihood of the "*action proposed*" on the subject site at Moonee Beach placing the "*viable local population*" of the Moonee Quassia "*at risk of extinction*" (emphasis added).

Factor (b) Endangered Populations and the Risk of Extinction

There is no "*endangered population*" of the Moonee Quassia.

Factor (c) Endangered Ecological Communities and the Risk of Extinction

The Moonee Quassia is not an "*endangered ecological community*".

Factor (d) Habitat Removal, Modification, Fragmentation, Isolation and Importance

As noted above, most of the habitat for the Moonee Quassia present on the subject site is located along the northern boundary, adjacent to Moonee Creek. The population, and habitat for this species, extends along the creek banks north of the subject site, and west of the Pacific Highway upstream.

With respect to the matters raised in Factor (d) of s.5A:

- the majority of habitat for the Moonee Quassia is to be retained on the subject site, and the proposed development will have no effect on habitat on the adjoining lands along Moonee Creek to the north or northwest. Consequently, very little habitat for the Moonee Quassia is to be "*removed or modified as a result of the action proposed*", and habitat present on the subject site will be retained and enhanced as a result of implementation of the VMP within the Conservation Reserve on the site;
- the proposed development includes the retention of a band of vegetation along the northern side of the subject site, including parts of the banks of Moonee Creek. The Moonee Quassia is essentially restricted to the banks and immediate environs of Moonee Creek within the subject site, as well as on the land to the immediate north and land to the west of the Pacific Highway. By virtue of the retention of vegetation along the northern boundary of the subject site, the "*action proposed*" will not involve any habitat for the many Quassia becoming "*fragmented or isolated from other areas of habitat*" for this species; and

- as the overwhelming majority of habitat for the Moonee Quassia is to be retained on the subject site, and habitat on adjoining lands is not to be adversely affected, and given the implementation of the VMP within the Conservation Reserve on the subject site, no habitat which may be "*removed, modified, fragmented or isolated*" as a result of the "*action proposed*" would be regarded as of importance or significance for the "*long-term survival*" of the Moonee Quassia. Indeed, the proposed development by virtue of implementation of a VMP within the Conservation Reserve will enhance the viability of the "*local population*" of this species.

Factor (e) Critical Habitat – Direct and Indirect Effects

At the time of preparation of this *Report*, no "*critical habitat*" for the Moonee Quassia had been declared by the Director-General of the NPWS.

Factor (f) Recovery Plans and Threat Abatement Plans

A draft *Recovery Plan* has been prepared for the Moonee Quassia (dated August 2004) with a number of objectives for recovery of the species. The proposed development of the subject site at Moonee Beach does not contravene any of the objectives documented in the draft *Recovery Plan*, and, furthermore, will enhance the conservation of this species by dedication of the substantial Conservation Reserve on the site and the implementation of a *Management Plan* in perpetuity for that area of the subject site.

A draft *Threat Abatement Plan* has been prepared by the DEC for Bitou Bush, which is of potential relevance to the Moonee Quassia on the subject land at Moonee Beach. The VMP for the Conservation Reserve on the subject site will ensure the implementation of relevant actions identified in the *Threat Abatement Plan*, whereas there is currently no program for the removal or control of Bitou Bush either on the subject site or in the adjoining Reserve.

Factor (g) Key Threatening Processes

The "*key threatening process*" which is of greatest potential relevance to the Moonee Quassia on the subject site at Moonee Beach is the "*clearing of native vegetation*".

However, as discussed above, most of the habitat for the Moonee Quassia on the subject site at Moonee Beach is to be retained within the Conservation Reserve in the northern part of the subject site. In addition, much of the habitat for this species is located along the banks of Moonee Creek to the north of the site, as well as to the west of the Pacific Highway.

On that basis, and given the implementation of a VMP within the conserved lands on the subject site, the "*action proposed*" does not involve any significant increase in or exacerbation of the "*key threatening process*" known as "*the clearing of native vegetation*" with respect to the Moonee Quassia.

Other "*key threatening processes*" which could potentially be of some relevance to the Moonee Quassia include invasion of Bitou Bush, competition from introduced and invasive grasses, and xx. However, the proposed development (as discussed above) includes the implementation of a VMP within the substantial conserved land on the subject site (more than 70% of the site), and there will be a specific program for the protection and enhancement of the population of the Moonee Quassia and of its habitat. Consequently, the "*action proposed*" will not exacerbate any of these additional "*key threatening processes*".

CONCLUSIONS

The eight factors which are required to be considered pursuant to s.5A of the EP&A Act in the determination of "*whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats*" are discussed in detail above with respect to the Moonee Quassia.

On the basis of the retention of most of the known and/or suitable habitat on the subject site, and the retention and/or salvage of individuals of the Moonee Quassia, it is not "*likely*" that the proposed development at Moonee Beach would impose a "*significant effect*" on this species.

4.3 Threatened Fauna Species

4.3.1 Little Bent-wing Bat

Factor (a) Threatened Species and the Risk of Extinction

The Little Bent-wing Bat is a small cave-dwelling bat species found along the east coast of Australia, from Cape York through to the central NSW (Strahan 1995; Churchill 1998; Gunninah *pers obs*). It is known to inhabit rainforests, *Melaleuca* swamps and dry sclerophyll habitats, foraging for small insects beneath the canopy (Dwyer 1995; Strahan 1995; Law & Chidel 2002). This microchiropteran bat species is also known to share maternity colonies in New South Wales with the Common Bent-wing Bat (Churchill 1998).

The subject site does support foraging resources (*ie* open forest) for the Little Bent-wing Bat. However, there are no roosting resources on the subject site, suitable for this cave-dependent species. Additional suitable foraging, and roosting resources, for the species are broadly distributed and widely available in the region and within the vicinity of the subject site.

Given the high mobility and wide-ranging nature of this species, and the lack of significant roosting resources for the Little Bent-wing Bat on the site, there is no likelihood that a "*viable local population*" of this recorded species could rely exclusively or even substantially on the subject site. Moreover, there is no likelihood that any such population (even if present) would be "*placed at risk of extinction*" by the proposed development, especially considering the retention of suitable foraging habitat.

It is not likely that the "*life cycle*" of the Little Bent-wing Bat would be "*disrupted*" by the proposed development, and no "*viable local population*" of this species would be "*placed at risk of extinction*" (emphasis added) as a result of the proposed development at Moonee Beach.

Factor (b) Endangered Populations and the Risk of Extinction

The Little Bent-wing Bat is not eligible for listing as an "*endangered population*".

Factor (c) Endangered Ecological Communities and the Risk of Extinction

The Little Bent-wing Bat is not an "*endangered ecological community*".

Factor (d) Habitat Removal, Modification, Fragmentation, Isolation and Importance

The Little Bent-wing Bat is likely to utilise all or most of the forest communities over the subject site as well as the wetland areas of the site for foraging purposes. Given that the majority of the subject site is to be dedicated as a Conservation Reserve (in excess of 70% of the site), most of the suitable foraging habitat for the Little Bent-wing Bat will be retained and protected in the long-term.

This species roosts occasionally in tree-hollows and under loose bark, but relies primarily on caves, tunnels and mine adits for roosting and breeding purposes. Whilst the proposed development will remove some hollow-bearing trees, a substantial resource of tree-hollows

and mature trees will be retained on the subject site and conserved in perpetuity within the extensive Conservation Reserve. Consequently, potential roosting habitat for the Little Bent-wing Bat will also be substantially retained on the subject site.

With respect to the relevant matters raised in Factor (d) of s.5A of the EP&A Act "*in relation to the habitat*" of the Little Bent-wing Bat:

- the majority of habitat for the Little Bent-wing Bat present on the subject site at Moonee Beach is to be retained and will not "*be removed or modified as a result of the action proposed*". More than 70% of the subject site is to be retained within a Conservation Reserve, and all of that area is likely to be used by the Little Bent-wing Bat;
- given the high mobility of the Little Bent-wing Bat and the retention of the overwhelming majority of habitat for this species on the subject site, there is no likelihood of habitat for this species becoming "*fragmented or isolated from other areas of habitat as a result of the proposed action*"; and
- given the high mobility of the Little Bent-wing Bat and the extent of habitat to be retained and protected in the long-term for this species on the subject site at Moonee Beach, the small area of forest habitat which is to be "*removed*" or "*modified*" for this species on the subject site is not regarded as of "*importance .. to the long-term survival of the species .. in the locality*". Given the circumstances, no habitat for this species is likely to become "*fragmented or isolated*" as a result of the "*action proposed*".

Factor (e) Critical Habitat – Direct and Indirect Effects

At the time of preparation of this *Report*, no "*critical habitat*" for the Little Bent-wing Bat had been declared by the Director-General of the NPWS.

Factor (f) Recovery Plans and Threat Abatement Plans

There is currently no *Recovery Plan* for the Little Bent-wing Bat.

None of the current *Threat Abatement Plans* are of particular relevance for the Little Bent-wing Bat or its habitat.

Factor (g) Key Threatening Processes

The "*key threatening processes*" of most potential relevance to the Little Bent-wing Bat in respect of the proposed development of the subject site at Moonee Beach are the "*clearing of native vegetation*" and the "*removal of dead wood and dead trees*".

Within the development portion of the subject site, both of these "*key threatening processes*" will operate. Conversely, most of the forest vegetation on the subject site is to be retained and protected within a substantial Conservation Reserve, and managed in perpetuity for conservation purposes. Notwithstanding the imposition of those "*key threatening processes*" over the development portions of the subject site at Moonee Beach, no significant impact on the "*viable local population*" of the Little Bent-wing Bat is anticipated given the extent of habitat and resources to be retained and the commitment to long-term conservation of 70ha of the subject site.

CONCLUSIONS

The eight factors which are required to be considered pursuant to s.5A of the EP&A Act in the determination of "*whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats*" are discussed in detail above with respect to the Little Bent-wing Bat.

Given the high mobility of this species, the extent of available foraging resources in the area and the retention of foraging resources on the subject site, the proposed development at Moonee Beach will not involve the imposition of "*a significant effect*" on the Little Bent-wing Bat.

4.3.2 Common Bent-wing Bat

Factor (a) Threatened Species and the Risk of Extinction

The Common Bent-wing Bat occupies a range of forested environments (including wet and dry sclerophyll forests), along the coastal portion of eastern Australia and through to Cape York (Churchill 1998). This highly mobile species forages for insects above the tree canopy, and is capable of large regional movements in response to seasonal differences in reproductive behaviour and winter hibernation (Gilmore & Parnaby 1994). The Common Bent-wing Bat is reliant on large caves for the rearing of its young, between October and February (Churchill 1998). This species roosts in caves, although it has also been recorded in mines, culverts, stormwater channels and buildings (Churchill 1998), and occasionally tree-hollows. It occupies a range of hibernation roosts within specific territorial ranges usually within 300km of the maternity cave (Churchill 1998), and may travel large distances between roost sites (Dwyer 1995).

The subject site does support foraging resources (*ie* open forest) for the Common Bent-wing Bat. However, there are no roosting resources on the subject site, suitable for this cave-dependent species. Additional suitable foraging, and roosting resources, for the species are broadly distributed and widely available in the region and within the vicinity of the subject site.

Given the high mobility and wide-ranging habits of the Common Bent-wing Bat, the lack of unique or critical foraging resources on the study site and the extensive areas of similar habitat in the immediate vicinity and region, there is no likelihood that a "*viable local population*" of this species (if one occurs) would be "*disrupted*" by the proposal. It is not likely that a "*viable local population*" of this species will be "*placed at risk of extinction*" (emphasis added) as a result of the proposed development.

Factor (b) Endangered Populations and the Risk of Extinction

There is no relevant "*endangered population*" of the Common Bent-wing Bat.

Factor (c) Endangered Ecological Communities and the Risk of Extinction

The Common Bent-wing Bat is not an "*endangered ecological community*".

Factor (d) Habitat Removal, Modification, Fragmentation, Isolation and Importance

Like the Little Bent-wing Bat, the Common Bent-wing Bat is likely to utilise all or most of the forest communities over the subject site as well as the wetland areas of the site for foraging purposes. Given that the majority of the subject site is to be dedicated as a Conservation Reserve (in excess of 70% of the site), most of the suitable foraging habitat for the Common Bent-wing Bat will be retained and protected in the long-term.

This species roosts occasionally in tree-hollows and under loose bark, but relies primarily on caves, tunnels and mine adits for roosting and breeding purposes. Whilst the proposed development will remove some hollow-bearing trees, a substantial resource of tree-hollows and mature trees will be retained on the subject site and conserved in perpetuity within the extensive Conservation Reserve. Consequently, potential roosting habitat for the Common Bent-wing Bat will also be substantially retained on the subject site.

With respect to the relevant matters raised in Factor (d) of s.5A of the EP&A Act "*in relation to the habitat*" of the Common Bent-wing Bat:

- the majority of habitat for the Common Bent-wing Bat present on the subject site at Moonee Beach is to be retained and will not "*be removed or modified as a result of the action proposed*". More than 70% of the subject site is to be retained within a Conservation Reserve, and all of that area is likely to be used by the Common Bent-wing Bat;
- given the high mobility of the Common Bent-wing Bat and the retention of the overwhelming majority of habitat for this species on the subject site, there is no likelihood of habitat for this species becoming "*fragmented or isolated from other areas of habitat as a result of the proposed action*"; and
- given the high mobility of the Common Bent-wing Bat and the extent of habitat to be retained and protected in the long-term for this species on the subject site at Moonee Beach, the small area of forest habitat which is to be "*removed*" or "*modified*" for this species on the subject site is not regarded as of "*importance .. to the long-term survival of the species .. in the locality*". Given the circumstances, no habitat for this species is likely to become "*fragmented or isolated*" as a result of the "*action proposed*".

Factor (e) Critical Habitat – Direct and Indirect Effects

At the time of preparation of this *Report*, no "*critical habitat*" relevant to the Common Bent-wing Bat had been declared by the Director-General of the NPWS.

Factor (f) Recovery Plans and Threat Abatement Plans

There is currently no *Recovery Plan* for the Common Bent-wing Bat.

None of the current *Threat Abatement Plans* are of particular relevance for the Common Bent-wing Bat or its habitat.

Factor (g) Key Threatening Processes

The "*key threatening processes*" of most potential relevance to the Common Bent-wing Bat in respect of the proposed development of the subject site at Moonee Beach are the "*clearing of native vegetation*" and the "*removal of dead wood and dead trees*".

Within the development portion of the subject site, both of these "*key threatening processes*" will operate. Conversely, most of the forest vegetation on the subject site is to be retained and protected within a substantial Conservation Reserve, and managed in perpetuity for conservation purposes. Notwithstanding the imposition of those "*key threatening processes*" over the development portions of the subject site at Moonee Beach, no significant impact on the "*viable local population*" of the Common Bent-wing Bat is anticipated given the extent of habitat and resources to be retained and the commitment to long-term conservation of 70ha of the subject site.

CONCLUSIONS

The eight factors which are required to be considered pursuant to s.5A of the EP&A Act in the determination of "*whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats*" are discussed in detail above with respect to the Common Bent-wing Bat.

Given the high mobility of this species, the extent of available foraging resources in the area and the retention of foraging resources on the subject site, the proposed development at Moonee Beach will not involve the imposition of "*a significant effect*" on the Common Bent-wing Bat.

4.3.3 Eastern Freetail Bat

Factor (a) Threatened Species and the Risk of Extinction

The Eastern Freetail Bat occupies a range of forest and woodland in eastern Australia, and forages for insects through and above the tree canopy. It roosts in tree-hollows and under loose bark.

This species was recorded by its echolocation calls on the subject site, and is likely to forage widely over the large tracts of forest and woodland throughout the surrounding landscape.

Whilst a 'population' or a number of individuals of this species could be resident on the subject site, it is not considered likely that "*a viable local population*" of the Eastern Freetail Bat would be dependent upon or confined to the subject site in isolation. It is not likely that the subject site *per se*, or the "*study area*", would support "*a viable local population*" of the species.

Given the high mobility and wide-ranging habits of the Eastern Freetail Bat, the lack of unique or critical foraging resources on the study site and the extensive areas of similar habitat in the immediate vicinity and region, there is no likelihood that a "*viable local population*" of this species (if one occurs) would rely exclusively or substantially on the subject site.

On the basis of the above considerations, it is not likely that the "*life cycle*" of the Eastern Freetail Bat will be "*disrupted*" by the proposal. No "*viable local population*" of this species will be "*placed at risk of extinction*" (emphasis added) as a result of the proposed development.

Factor (b) Endangered Populations and the Risk of Extinction

There is no relevant "*endangered population*" of the Eastern Freetail Bat.

Factor (c) Endangered Ecological Communities and the Risk of Extinction

The Eastern Freetail Bat is not an "*endangered ecological community*".

Factor (d) Habitat Removal, Modification, Fragmentation, Isolation and Importance

The Eastern Freetail Bat is likely to utilise all or most of the forest communities over the subject site as well as the wetland areas of the site for foraging purposes. Given that the majority of the subject site is to be dedicated as a Conservation Reserve (in excess of 70% of the site), most of the suitable foraging habitat for the Eastern Freetail Bat will be retained and protected in the long-term.

This species roosts in tree-hollows and under loose bark. Whilst the proposed development will remove some hollow-bearing trees, a substantial resource of tree-hollows and mature trees will be retained on the subject site and conserved in perpetuity within the extensive Conservation Reserve. Consequently, potential roosting habitat for the Eastern Freetail Bat will also be substantially retained on the subject site.

With respect to the relevant matters raised in Factor (d) of s.5A of the EP&A Act "*in relation to the habitat*" of the Eastern Freetail Bat:

- the majority of habitat for the Eastern Freetail Bat present on the subject site at Moonee Beach is to be retained and will not "*be removed or modified as a result of the action proposed*". More than 70% of the subject site is to be retained within a Conservation Reserve, and all of that area is likely to be used by the Eastern Freetail Bat;
- given the high mobility of the Eastern Freetail Bat and the retention of the overwhelming majority of habitat for this species on the subject site, there is no likelihood of habitat for this species becoming "*fragmented or isolated from other areas of habitat as a result of the proposed action*"; and
- given the high mobility of the Eastern Freetail Bat and the extent of habitat to be retained and protected in the long-term for this species on the subject site at Moonee Beach, the small area of forest habitat which is to be "*removed*" or "*modified*" for this species on the subject site is not regarded as of "*importance .. to the long-term survival of the species .. in the locality*". Given the circumstances, no habitat for this species is likely to become "*fragmented or isolated*" as a result of the "*action proposed*".

Factor (e) Critical Habitat – Direct and Indirect Effects

At the time of preparation of this *Report*, no "*critical habitat*" relevant to the Eastern Freetail Bat had been declared by the Director-General of the NPWS.

Factor (f) Recovery Plans and Threat Abatement Plans

There is currently no *Recovery Plan* for the Eastern Freetail Bat.

None of the current *Threat Abatement Plans* are of particular relevance for the Eastern Freetail Bat or its habitat.

Factor (g) Key Threatening Processes

The "*key threatening processes*" of most potential relevance to the Eastern Freetail Bat in respect of the proposed development of the subject site at Moonee Beach are the "*clearing of native vegetation*" and the "*removal of dead wood and dead trees*".

Within the development portion of the subject site, both of these "*key threatening processes*" will operate. Conversely, most of the forest vegetation on the subject site is to be retained and protected within a substantial Conservation Reserve, and managed in perpetuity for conservation purposes. Notwithstanding the imposition of those "*key threatening processes*" over the development portions of the subject site at Moonee Beach, no significant impact on the "*viable local population*" of the Eastern Freetail Bat is anticipated given the extent of habitat and resources to be retained and the commitment to long-term conservation of 70ha of the subject site.

CONCLUSIONS

The eight factors which are required to be considered pursuant to s.5A of the EP&A Act in the determination of "*whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats*" are discussed in detail above with respect to the Eastern Freetail Bat.

Given the high mobility of this species, the extent of available foraging resources in the area and the retention of foraging resources on the subject site, the proposed development at Moonee Beach will not involve the imposition of "*a significant effect*" on the Eastern Freetail Bat.

4.3.4 Large-footed Myotis

Factor (a) Threatened Species and the Risk of Extinction

The Large-footed Myotis roosts in mines, culverts, stormwater channels, bridges and buildings (Churchill 1998), and forages over ponds, dams and water bodies for small fish and insects.

This species was recorded on the subject site, but there are no roosting resources present and few areas of suitable foraging habitat. Moonee Creek and the farm dams in the locality are more suitable for this species.

It is not likely that "*a viable local population*" of the Large-footed Myotis would be resident on or dependent upon the subject site. Suitable resources are present widely in the general landscape, but are extremely limited on the site itself.

Given the mobility and habits of the Large-footed Myotis, the lack of unique or critical resources on the study site and the extent of suitable resources and habitat in the immediate

vicinity and region, there is no likelihood that a "*viable local population*" of this species would be reliant on the subject site.

On the basis of the above considerations, it is not likely that the "*life cycle*" of the Large-footed Myotis will be "*disrupted*" by the proposal. No "*viable local population*" of this species will be "*placed at risk of extinction*" (emphasis added) as a result of the proposed development.

Factor (b) Endangered Populations and the Risk of Extinction

There is no relevant "*endangered population*" of the Large-footed Myotis.

Factor (c) Endangered Ecological Communities and the Risk of Extinction

The Large-footed Myotis is not an "*endangered ecological community*".

Factor (d) Habitat Removal, Modification, Fragmentation, Isolation and Importance

Microchiropteran bats are highly mobile and wide-ranging, and the Large-footed Myotis is capable of utilising modified features (such as dams, bridges and culverts), and travelling over substantial distances in an evening of foraging. In any case, the proposed development will not involve the fragmentation or isolation of stands of vegetation, or sever any vegetated 'corridors' in the locality.

With respect to the matters contained in Factor (d) of s.5A of the EP&A Act:

- essentially no habitat of relevance for the Large-footed Myotis will be "*removed or modified as a result of the action proposed*". Rather, all of the potentially suitable habitat for this species on the subject site is to be retained within the extensive Conservation Reserve and protected and managed for biodiversity conservation purposes in perpetuity;
- no habitat for the Large-footed Myotis will "*become fragmented or isolated from other areas of habitat*" for this species given the retention of all of the low-lying land on the subject site (which contains potentially relevant habitat) and the high mobility of the Large-footed Myotis; and
- even if small areas of potential habitat for the Large-footed Myotis were to be "*removed, modified, fragmented or isolated*", the overwhelming majority of suitable habitat on the subject site would be retained and any habitat which may be affected is of no importance to the "*long-term survival*" of the Large-footed Myotis "*in the locality*".

Factor (e) Critical Habitat – Direct and Indirect Effects

At the time of preparation of this *Report*, no "*critical habitat*" relevant to the Large-footed Myotis had been declared by the Director-General of the NPWS.

Factor (f) Recovery Plans and Threat Abatement Plans

There is currently no *Recovery Plan* for the Large-footed Myotis.

None of the current *Threat Abatement Plans* are of particular relevance for the Large-footed Myotis or its habitat.

Factor (g) Key Threatening Processes

Two "*key threatening processes*" could potentially or theoretically be of relevance to the Large-footed Myotis – the "*clearing of native vegetation*" and "*alterations to stream flows*". However:

- essentially no vegetation of relevance to the Large-footed Myotis is to be removed from the subject site, and it appears unlikely that the "*clearing of native vegetation*" as a result of the proposed development would impact upon the Large-footed Myotis on the subject site or in the immediate vicinity; and
- the development concept incorporates a range of design features and environmental management measures intended to maintain drainage patterns and water flows within watercourses on the subject site.

Given those circumstances, the "*action proposed*" on the subject site at Moonee Beach will not involve "*the operation of, or increase the impact of, a key threatening process*" with respect to the Large-footed Myotis. Even if the proposed development of the subject site did involve some implementation of a "*key threatening process*", the impact of the proposal on the Large-footed Myotis would be insignificant and inconsequential.

CONCLUSIONS

The eight factors which are required to be considered pursuant to s.5A of the EP&A Act in the determination of "*whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats*" are discussed in detail above with respect to the Large-footed Myotis.

Given the mobility of this species and the limited resources present on the subject site, the proposed development at Moonee Beach will not involve the imposition of "*a significant effect*" on the Large-footed Myotis.

4.3.5 Golden-tipped Bat

Factor (a) Threatened Species and the Risk of Extinction

The Golden-tipped Bat mostly utilises rainforest and rainforest gullies in moist forest communities in eastern Australia, and feeds predominantly on spiders (Churchill 1998). This species roosts in abandoned nests of small birds, but has also been recorded roosting in dead foliage and the roofs of huts in Niugini.

This species was recorded by its echolocation calls on the subject site, and is likely to forage primarily through the moist forest and rainforest vegetation on the subject site and through the surrounding landscape.

Whilst a 'population' or a number of individuals of this species could be resident on the subject site, it is not considered likely that "*a viable local population*" of the Golden-tipped Bat would be dependent upon or confined to the subject site in isolation. It is not likely that the

subject site *per se*, or the "*study area*", would support "*a viable local population*" of the species. In any case, most of the suitable habitat for the Golden-tipped Bat is located within the Conservation Reserve, and will be managed in perpetuity for conservation purposes.

Given the high mobility and habitat preferences of the Golden-tipped Bat, the distribution of preferred foraging resources on the subject site, and the extent of habitat in the immediate vicinity and region, there is no likelihood that a "*viable local population*" of this species (if one occurs) would rely exclusively or substantially on the subject site.

On the basis of the above considerations, it is not likely that the "*life cycle*" of the Golden-tipped Bat will be "*disrupted*" by the proposal. No "*viable local population*" of this species will be "*placed at risk of extinction*" (emphasis added) as a result of the proposed development.

Factor (b) Endangered Populations and the Risk of Extinction

There is no relevant "*endangered population*" of the Golden-tipped Bat.

Factor (c) Endangered Ecological Communities and the Risk of Extinction

The Golden-tipped Bat is not an "*endangered ecological community*".

Factor (d) Habitat Removal, Modification, Fragmentation, Isolation and Importance

The Eastern Freetail Bat is likely to utilise most of the moister forest communities on the subject site and on adjoining lands for foraging purposes, and may also roost in these communities. The majority of the moist forest and rainforest vegetation on the subject site is to be retained and protected in the long-term within the Conservation Reserve.

This species roosts in tree-hollows and under loose bark. Whilst the proposed development will remove some hollow-bearing trees, a substantial resource of tree-hollows and mature trees will be retained on the subject site and conserved in perpetuity within the extensive Conservation Reserve. Consequently, potential roosting habitat for the Eastern Freetail Bat will also be substantially retained on the subject site.

With respect to the relevant matters raised in Factor (d) of s.5A of the EP&A Act "*in relation to the habitat*" of the Golden-tipped Bat:

- the majority of habitat for the Golden-tipped Bat present on the subject site at Moonee Beach is to be retained and will not "*be removed or modified as a result of the action proposed*". Most of the vegetation likely to be used by the Golden-tipped Bat is to be retained within the Reserve;
- given the high mobility of the Golden-tipped Bat and the retention of the overwhelming majority of suitable habitat for this species on the subject site, there is no likelihood of habitat for this species becoming "*fragmented or isolated from other areas of habitat as a result of the proposed action*"; and
- given the mobility of the species and the extent of habitat to be retained and protected in the long-term for the Golden-tipped Bat on the subject site at Moonee Beach, the area of drier forest habitat which is to be "*removed*" or "*modified*" for this species on the subject site is not regarded as of "*importance .. to the long-term survival of the species .. in the locality*". Given the circumstances, no habitat for this species is likely to become "*fragmented or isolated*" as a result of the "*action proposed*".

Factor (e) Critical Habitat – Direct and Indirect Effects

At the time of preparation of this *Report*, no "*critical habitat*" for the Golden-tipped Bat had been declared by the Director-General of the NPWS.

Factor (f) Recovery Plans and Threat Abatement Plans

There is currently no *Recovery Plan* for the Golden-tipped Bat.

None of the current *Threat Abatement Plans* are of particular relevance for the Golden-tipped Bat or its habitat.

Factor (g) Key Threatening Processes

The "*key threatening processes*" of most potential relevance to the Eastern Freetail Bat in respect of the proposed development of the subject site at Moonee Beach are the "*clearing of native vegetation*" and the "*removal of dead wood and dead trees*".

Within the development portion of the subject site, both of these "*key threatening processes*" will operate. Conversely, most of the forest vegetation on the subject site is to be retained and protected within a substantial Conservation Reserve, and managed in perpetuity for conservation purposes. Notwithstanding the imposition of those "*key threatening processes*" over the development portions of the subject site at Moonee Beach, no significant impact on the "*viable local population*" of the Eastern Freetail Bat is anticipated given the extent of habitat and resources to be retained and the commitment to long-term conservation of 70ha of the subject site.

CONCLUSIONS

The eight factors which are required to be considered pursuant to s.5A of the EP&A Act in the determination of "*whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats*" are discussed in detail above with respect to the Golden-tipped Bat.

Given the high mobility of this species, the extent of available foraging resources in the area and the retention of foraging resources on the subject site, the proposed development at Moonee Beach will not involve the imposition of "*a significant effect*" on the Golden-tipped Bat.

4.3.6 Yellow-bellied Sheathtail Bat

Factor (a) Threatened Species and the Risk of Extinction

The Yellow-bellied Sheathtail Bat occupies a range of forest and woodland in eastern Australia, and forages for insects through and above the tree canopy. It roosts in tree-hollows and under loose bark.

This species was recorded by its echolocation calls on the subject site, and is likely to forage widely over the large tracts of forest and woodland throughout the surrounding landscape.

Whilst a 'population' or a number of individuals of this species could be resident on the subject site, it is not considered likely that "*a viable local population*" of the Yellow-bellied Sheathtail Bat would be dependent upon or confined to site in isolation. It is not likely that the subject site *per se*, or the "*study area*", would support "*a viable local population*" of the species.

Given the high mobility and wide-ranging habits of the Yellow-bellied Sheathtail Bat, the lack of unique or critical foraging resources on the subject site and the extensive areas of similar habitat in the immediate vicinity and region, there is no likelihood that a "*viable local population*" of this species (if one occurs) would rely exclusively or substantially on the subject site.

On the basis of the above considerations, it is not likely that the "*life cycle*" of the Yellow-bellied Sheathtail Bat will be "*disrupted*" by the proposal. No "*viable local population*" of this species will be "*placed at risk of extinction*" (emphasis added) as a result of the proposed development.

Factor (b) Endangered Populations and the Risk of Extinction

There is no relevant "*endangered population*" of the Yellow-bellied Sheathtail Bat.

Factor (c) Endangered Ecological Communities and the Risk of Extinction

The Yellow-bellied Sheathtail Bat is not an "*endangered ecological community*".

Factor (d) Habitat Removal, Modification, Fragmentation, Isolation and Importance

The Yellow-bellied Sheathtail Bat is likely to utilise all or most of the forest communities over the subject site as well as the wetland areas of the site for foraging purposes. Given that the majority of the subject site is to be dedicated as a Conservation Reserve (in excess of 70% of the site), most of the suitable foraging habitat for the Yellow-bellied Sheathtail Bat will be retained and protected in the long-term.

This species roosts in tree-hollows and under loose bark. Whilst the proposed development will remove some hollow-bearing trees, a substantial resource of tree-hollows and mature trees will be retained on the subject site and conserved in perpetuity within the extensive Conservation Reserve. Consequently, potential roosting habitat for the Yellow-bellied Sheathtail Bat will also be substantially retained on the subject site.

With respect to the relevant matters raised in Factor (d) of s.5A of the EP&A Act "*in relation to the habitat*" of the Yellow-bellied Sheathtail Bat:

- the majority of habitat for the Yellow-bellied Sheathtail Bat present on the subject site at Moonee Beach is to be retained, and will not "*be removed or modified as a result of the action proposed*". More than 70% of the subject site is to be retained within a Conservation Reserve, and most of that area is likely to be used by the Yellow-bellied Sheathtail Bat;
- given the high mobility of the Yellow-bellied Sheathtail Bat and the retention of the overwhelming majority of habitat for this species on the subject site, there is

no likelihood of habitat for this species becoming "*fragmented or isolated from other areas of habitat as a result of the proposed action*"; and

- given the high mobility of the Eastern Freetail Bat and the extent of habitat to be retained and protected in the long-term for this species on the subject site at Moonee Beach, the small area of forest habitat which is to be "*removed*" or "*modified*" for this species on the subject site is not regarded as of "*importance .. to the long-term survival of the species .. in the locality*". Given the circumstances, no habitat for this species is likely to become "*fragmented or isolated*" as a result of the "*action proposed*".

Factor (e) Critical Habitat – Direct and Indirect Effects

At the time of preparation of this *Report*, no "*critical habitat*" relevant to the Yellow-bellied Sheathtail Bat had been declared by the Director-General of the NPWS.

Factor (f) Recovery Plans and Threat Abatement Plans

There is currently no *Recovery Plan* for the Yellow-bellied Sheathtail Bat.

None of the current *Threat Abatement Plans* are of particular relevance for the Yellow-bellied Sheathtail Bat or its habitat.

Factor (g) Key Threatening Processes

The "*key threatening processes*" of most potential relevance to the Yellow-bellied Sheathtail Bat in respect of the proposed development of the subject site at Moonee Beach are the "*clearing of native vegetation*" and the "*removal of dead wood and dead trees*".

Within the development portion of the subject site, both of these "*key threatening processes*" will operate. Conversely, most of the forest vegetation on the subject site is to be retained and protected within a substantial Conservation Reserve, and managed in perpetuity for conservation purposes. Notwithstanding the imposition of those "*key threatening processes*" over the development portions of the subject site at Moonee Beach, no significant impact on the "*viable local population*" of the Yellow-bellied Sheathtail Bat is anticipated given the extent of habitat and resources to be retained and the commitment to long-term conservation of 70ha of the subject site.

CONCLUSIONS

The eight factors which are required to be considered pursuant to s.5A of the EP&A Act in the determination of "*whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats*" are discussed in detail above with respect to the Yellow-bellied Sheathtail Bat.

Given the high mobility of this species, the extent of available foraging resources in the area and the retention of foraging resources on the subject site, the proposed development at Moonee Beach will not involve the imposition of "*a significant effect*" on the Yellow-bellied Sheathtail Bat.

4.3.7 Grey-headed Flying Fox

Factor (a) Threatened Species and the Risk of Extinction

The Grey-headed Flying Fox is a megachiropteran bat species endemic to the east coast of Australia, with a distribution from Bundaberg (Queensland) in the north to Melbourne (Victoria) in the south, and from the western slopes of the Great Dividing Range to the coast (NSW Scientific Committee 2001b). The species is a canopy-feeding frugivore, blossom-eater and nectarivore, and occurs in rainforest, woodlands, paperbark swamps and *Banksia* woodlands (NSW Scientific Committee 2001b).

Grey-headed Flying Fox camps are generally located near a river or creek, and the species utilises a range of vegetation communities including rainforest, wet sclerophyll forest, *Melaleuca* woodland, *Casuarina* forest and mangroves (Eby 2000). No Grey-headed Flying Fox camps were identified on the subject site during the field investigations.

Whilst individuals of the Grey-headed Flying Fox have been recorded on the site (Sandpiper 2003), no "*viable local population*" of the Grey-headed Flying Fox could be reliant on the resources present on the subject site for its survival. In any case, the proposed development allows for the retention of substantial potential foraging resources for this species on the site.

Given that the subject site does not support a known camp site for the Grey-headed Flying Fox or a "*viable local population*" of the species, and given the retention of foraging resources on the site (and the mobility of the species), the proposed development of the subject site is not "*likely*" to place a "*viable local population*" of the Grey-headed Flying Fox "*at risk of extinction*" (emphasis added).

Factor (b) Endangered Populations and the Risk of Extinction

There is no "*endangered population*" of the Grey-headed Flying Fox.

Factor (c) Endangered Ecological Communities and the Risk of Extinction

The Grey-headed Flying Fox is not an "*endangered ecological community*".

Factor (d) Habitat Removal, Modification, Fragmentation, Isolation and Importance

The Grey-headed Flying Fox is a highly mobile species which forages over extensive distances in a single evening. This species would feed in the rainforest on the site during the fruiting and flowering seasons, and would also use flowering eucalypts to some extent. During the winter months, Coast Banksias provide valuable nectar, and the species also utilises resources within highly urbanised environments.

Given that the majority of the subject site is to be dedicated as a Conservation Reserve (in excess of 70% of the site), most of the suitable foraging habitat for the Yellow-bellied Sheathtail Bat will be retained and protected in the long-term.

With respect to the relevant matters raised in Factor (d) of s.5A of the EP&A Act "*in relation to the habitat*" of the Grey-headed Flying Fox:

- the majority of foraging resources of value for the Grey-headed Flying Fox on the subject site at Moonee Beach are to be retained, and will not "*be removed or*

modified as a result of the action proposed". Most of the subject site is to be retained within a Conservation Reserve, and much of that area is likely to be used for foraging by the Grey-headed Flying Fox;

- given the high mobility of the Grey-headed Flying Fox and its wide-ranging habits, and the retention of most of the foraging resources for this species on the subject site at Moonee Beach, there is no likelihood of habitat for this species becoming "*fragmented or isolated from other areas of habitat as a result of the proposed action*"; and
- given the high mobility of the Grey-headed Flying Fox and the extent of habitat to be retained and protected in the long-term, the small area of forest habitat which is to be "*removed*" or "*modified*" on the subject site is not regarded as of "*importance .. to the long-term survival of the species .. in the locality*". Given the circumstances, no habitat for this species is likely to become "*fragmented or isolated*" as a result of the "*action proposed*".

Factor (e) Critical Habitat – Direct and Indirect Effects

At the time of preparation of this *Report*, no "*critical habitat*" for the Grey-headed Flying Fox had been declared by the Director-General of the NPWS.

Factor (f) Recovery Plans and Threat Abatement Plans

There is currently no *Recovery Plan* for the Grey-headed Flying Fox.

None of the current *Threat Abatement Plans* are of particular relevance for the Grey-headed Flying Fox or its habitat.

Factor (g) Key Threatening Processes

The NSW Scientific Committee states that "*the main threat to Grey-headed Flying Foxes in NSW is clearing or modification of native vegetation particularly winter-spring feeding habitat in north-eastern NSW*". The proposed development will involve the clearing of only a very a small proportion of the likely or potential foraging habitat on the subject site, although the most valuable foraging habitat for the Grey-headed Flying Fox is to be incorporated within the Conservation Reserve. Furthermore, the site constitutes only a minute proportion of the suitable habitat for this species in the locality and region.

The most relevant "*key threatening process*" for the Grey-headed Flying Fox (the "*clearing of native vegetation*") will be imposed within the development portion of the subject site. However, most of the forest vegetation on the subject site, and the majority of appropriate foraging resources, are to be retained and protected within the substantial Conservation Reserve on the site.

Notwithstanding the "*clearing of native vegetation*" from the development portions of the subject site at Moonee Beach, no significant impact on the "*viable local population*" of the Grey-headed Flying Fox is "*likely*" given the extent of habitat and resources to be retained and the commitment to long-term conservation of 70ha of the subject site.

CONCLUSIONS

The eight factors which are required to be considered pursuant to s.5A of the EP&A Act in the determination of "*whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats*" are discussed in detail above with respect to the Grey-headed Flying Fox.

Given the retention of foraging resources within the Conservation Reserve on the subject site, and the mobility of the species and the extent of resources in the locality, the proposed development at Moonee Beach is not "*likely*" to impose "*a significant effect*" on the Grey-headed Flying Fox.

4.3.8 Common Blossom Bat

Factor (a) Threatened Species and the Risk of Extinction

The Common Blossom Bat is a small megachiropteran bat species endemic to the east coast of Australia, with a distribution north from about Port Stephens to the top of Cape York. In NSW, the species is a blossom-eater and nectarivore, roosting predominantly in coastal rainforest and feeding on a variety of eucalypts and banksias (Churchill 1998; Law XXXX).

Individuals of the Common Blossom Bat were recorded in Coast Banksias behind the frontal dune in the eastern part of the subject site (Appendix 4), and could roost in the rainforst vegetation in the northeastern part of the site. However, no "*viable local population*" of the Common Blossom Bat would be reliant on the resources present on the subject site in isolation. In any case, the proposed development provides for the retention of most of the potential foraging resources for this species on the site.

Given those circumstances, and given the mobility of the species, the proposed development of the subject site is not "*likely*" to place a "*viable local population*" of the Common Blossom Bat "*at risk of extinction*" (emphasis added).

Factor (b) Endangered Populations and the Risk of Extinction

There is no "*endangered population*" of the Common Blossom Bat.

Factor (c) Endangered Ecological Communities and the Risk of Extinction

The Common Blossom Bat is not an "*endangered ecological community*".

Factor (d) Habitat Removal, Modification, Fragmentation, Isolation and Importance

The Common Blossom Bat is a highly mobile species which forages over distances of up to 6km in a single evening. This species would feed in the swamp forest and coastal heath vegetation, and would also use flowering eucalypts to some extent. During the winter months, Coast Banksias provide a significant food resource.

Given that the majority of the subject site is to be dedicated as a Conservation Reserve (in excess of 70% of the site), most of the suitable foraging habitat for the Common Blossom Bat and all of the suitable roosting habitat will be retained and protected in the long-term.

With respect to the relevant matters raised in Factor (d) of s.5A of the EP&A Act "*in relation to the habitat*" of the Common Blossom Bat:

- the overwhelming majority of foraging resources of value for the Common Blossom Bat on the subject site at Moonee Beach are to be retained, and will not "*be removed or modified as a result of the action proposed*";
- given the mobility of the Common Blossom Bat and the distribution of foraging and potential roosting habitat, and given the retention of most of the resources for this species on the subject site at Moonee Beach, there is no likelihood of habitat for this species becoming "*fragmented or isolated from other areas of habitat as a result of the proposed action*"; and
- given the high mobility of the Common Blossom Bat and the extent of habitat to be retained and protected in the long-term, the small area of forest habitat which is to be "*removed*" or "*modified*" on the subject site is not regarded as of "*importance .. to the long-term survival of the species .. in the locality*". Given the circumstances, no habitat for this species is likely to become "*fragmented or isolated*" as a result of the "*action proposed*".

Factor (e) Critical Habitat – Direct and Indirect Effects

At the time of preparation of this *Report*, no "*critical habitat*" for the Common Blossom Bat had been declared by the Director-General of the NPWS.

Factor (f) Recovery Plans and Threat Abatement Plans

There is currently no *Recovery Plan* for the Common Blossom Bat.

None of the current *Threat Abatement Plans* are of particular relevance for the Common Blossom Bat or its habitat.

Factor (g) Key Threatening Processes

Theoretically at least, the most relevant "*key threatening process*" for the Grey-headed Flying Fox (the "*clearing of native vegetation*") will be imposed within the development portion of the subject site. However, most of the forest vegetation on the subject site, and the overwhelming majority of appropriate foraging and roosting resources for the Common Blossom Bat, are to be retained and protected within the substantial Conservation Reserve on the site.

Notwithstanding the "*clearing of native vegetation*" from the development portions of the subject site at Moonee Beach, no significant impact on the "*viable local population*" of the Common Blossom Bat is "*likely*" given the extent of habitat and resources to be retained and the commitment to long-term conservation of 70ha of the subject site.

CONCLUSIONS

The eight factors which are required to be considered pursuant to s.5A of the EP&A Act in the determination of "*whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats*" are discussed in detail above with respect to the Common Blossom Bat.

Given the retention of foraging and roosting resources within the Conservation Reserve on the subject site, and the mobility of the species and the extent of resources in the locality, the proposed development at Moonee Beach is not "*likely*" to impose "*a significant effect*" on the Common Blossom Bat.

4.3.9 Koala

Factor (a) Threatened Species and the Risk of Extinction

Previous investigations on the subject site at Moonee Beach and on surrounding lands had produced only rare and scattered records of Koalas in this locality (Yarranbella undated; G & V Clancy 1989, 1990, 1998; Sandpiper 2003; Parker 2004). There had been one record of Koalas on the subject site itself, and two road kills of Koalas reported on the Pacific Highway to the immediate west.

The supplementary fauna survey undertaken in early 2006 (Appendix 4) has identified some limited Koala use in the southern part of the subject site, on and in the vicinity of the southern development area on the site. Only a very small number of Koala scats or droppings were recorded under a few trees on the site (see Appendix 4), and the data obtained indicates that there is only very limited use of the subject site by Koalas on an occasional basis. There is clearly no substantial Koala population on the subject site, and those areas of the site proposed for development activities could not be considered likely to support a "*viable local population*" of the Koala.

The proposed development will remove some areas of habitat which are currently used to a limited extent by Koalas, and may displace one or more Koalas as a consequence of the removal of vegetation and subsequent development of portions of the site. Conversely, substantial habitat and resources for Koalas are to be retained within the 70% of the site which is to be protected for conservation purposes, particularly including substantial stands of the Swamp Mahogany in the low-lying portions of the site as well as Tallow-wood and other relevant tree species on the slopes and more elevated parts of the site.

The proposed development of the subject site is not "*likely to have an adverse effect on the life cycle*" of the Koala "*such that a viable local population of the species is likely to be placed at risk of extinction*" (emphasis added) because:

- there is only limited use of the subject site by an individual Koala or Koalas;
- there is no evidence for a "*viable local population*" being dependent on the site itself, and there is no likelihood that any "*viable local population*" would be reliant on the subject site in isolation;
- the majority of resources for Koalas (particularly Swamp Mahoganies and other suitable foraging habitat) is to be retained within the substantial Conservation Reserve on the subject site;

- appropriate management measures would be incorporated into the long-term management of the site as such that both individuals and any "*local population*" of the species will be protected and retained.

Factor (b) Endangered Populations and the Risk of Extinction

There is no relevant "*endangered population*" of the Koala.

Factor (c) Endangered Ecological Communities and the Risk of Extinction

The Koala is not an "*endangered ecological community*".

Factor (d) Habitat Removal, Modification, Fragmentation, Isolation and Importance

Development of the subject site as proposed will involve the removal of forest vegetation, some of which is suitable habitat for the Koala. In particular, areas of forest vegetation which support the Tallow-wood and to a lesser extent the bloodwoods provide preferred foraging resources, although these species tend to be relatively sparsely scattered through the drier Blackbutt forest community on the site.

With respect to the relevant considerations in Factor (d) of s.5A of the EP&A Act:

- approximately 20-30% of forest vegetation which has been identified as 'secondary habitat' for the Koala by CHCC (reference) will be removed by the proposed development of the subject site. It is to be noted that much of the vegetation to be removed, which is dominated by Blackbutt, Turpentine and and other eucalypt species, is not of high value for Koalas, as identified both by the CHCC mapping and by the sparsity of Koala records on the subject site.

  Furthermore, the majority of preferred foraging resources (being the Tallow-wood and Swamp Mahogany) are to be retained within the substantial Conservation Reserve on the site. As that area is to be maintained and protected in perpetuity for biodiversity conservation purposes, the majority of potential high value foraging habitat for the Koala will be retained.

  Given the design of the proposed development on the subject site, and the retention of forest vegetation dominated by the Swamp Mahogany, it would appear that approximately only 20-30% of potential secondary foraging habitat for the Koala on the subject site at Moonee Beach would be "*removed or modified as a result of the action proposed*";

- given the substantial area of the conserved land proposed on the subject site, and the design of the development to ensure broad bands of contiguous vegetation through the site, no habitat for the Koala will "*become fragmented or isolated from other areas of habitat*" for this species. Areas of vegetation are to be retained through the subject site, and potential connections between the subject site and vegetation on other lands (particularly to the south and west) will be retained.

  It should also be noted that Koalas are capable of utilising urban environments, and that appropriate measures can be provided to ensure safe Koala movement through such locations; and

- whilst some habitat for the Koala will be "*removed or modified as a result of the action proposed*", no habitat will become "*fragmented or isolated*" for this species. Furthermore, the habitat that is to be removed for the development of the subject

site as currently proposed is only of relatively limited value for Koalas given the low density of Koala activity which has been recorded to date. The majority of preferred Koala food trees on the subject site are to be retained in the substantial Conservation Reserve present in the proposed development of the site.

Given those considerations, and the very low density and apparent infrequent use of the site by Koalas (based on the densities and ages of Koala scats recorded – see Appendix 4), those portions of the subject site which are to be affected by the proposed development cannot be regarded as of "*importance .. to the long-term survival*" of the Koala "*in the locality*".

On the basis of the considerations detailed above, the impact of the proposed development of the subject site on the habitat of the Koala is regarded as of limited concern. Most of the suitable foraging habitat for this species on the subject site will be retained and protected in perpetuity within the substantial Conservation Reserve proposed.

Factor (e) Critical Habitat – Direct and Indirect Effects

At the time of this *Report*, no "*critical habitat*" for the Koala had been declared by the Director-General of NPWS.

Factor (f) Recovery Plans and Threat Abatement Plans

A draft *Recovery Plan* for the Koala was prepared by the NPWS (DEC) in 2003, and has not yet been finalised.

Whilst the proposed development of the subject site at Moonee will involve development in areas where some Koala activity has been recorded, the level of use of the site by Koalas appears very low. Further, the majority of potential Koala resources on the site are to be retained and protected within the Conservation Reserve, and managed in perpetuity for conservation purposes. The VMP for the Conservation Reserve will include a specific section detailing measures to be implemented for conservation of the Koala on the subject site.

Given the approach which has been adopted for conservation of the Koala, and the dedication of 70ha of the site for conservation purposes, much of which contains suitable foraging habitat for the Koala, the proposed development of the site at Moonee can and will satisfy the objectives of the draft *Recovery Plan* for Koalas.

None of the current *Threat Abatement Plans* are of particular relevance for the Koala or its habitat.

Factor (g) Key Threatening Processes

Development of the subject site as proposed will involve the "*clearing of native vegetation*" which is listed as a "*key threatening process*" on the TSC Act. The proposed development will involve the removal of or modification to approximately 30ha of existing native forest, some of which is used to a limited extent by Koalas for foraging purposes.

Thus, whilst the "*action proposed*" does not itself constitute a "*key threatening process*", the residential development of the site as proposed will "*result in the operation of, or increase the impact of, a key threatening process*" on the subject site which is of relevance to the Koala.

Conversely, in considering whether the "*action proposed*" would impose a "*significant effect*" on the Koala including *inter alia* by the "*clearing of native vegetation*", it is necessary to consider the value of the vegetation which is to be removed or modified to the Koala in both the short-term and long-term. The simple fact that an action or activity would "*result in the operation, or increase the impact of, a key threatening process*" does not of itself determine that the "*action proposed*" would constitute a "*significant effect*" on the relevant species or its habitats.

In this regard, it is relevant to note that:

- the available data demonstrate only a very low level of Koala activity on the subject site;
- those portions of the subject site which are to be affected by the removal modification of forest vegetation do not generally support high densities of preferred Koala food trees;
- most of the preferred Koala food trees (particularly the Swamp Mahogany) are to be retained within the extensive Conservation Reserve on the subject site; and
- management of the Conservation Reserve will *inter alia* provide dedicated protection for the Koala and its habitat, and a specific management protocol for Koalas on the subject site would be incorporated into the VMP for the Conservation Reserve.

CONCLUSIONS

The eight factors which are required to be considered pursuant to s.5A of the EP&A Act in the determination of "*whether there is likely to be a significant effect on threatened species, populations or ecological communities*, *or their habitats*" are discussed in detail above with regard to the Koala.

On the basis of the above considerations, the proposed development on the subject site at Moonee Beach is not considered "*likely*" to impose "*a significant effect*" on the Koala.

4.3.10 Yellow-bellied Glider

Factor (a) Threatened Species and the Risk of Extinction

The Yellow-bellied Glider has apparently been recorded on the subject land (G & V Clancy 1998), although it was not recorded during the detailed and extensive investigations undertaken by Sandpiper for this project (Sandpiper 2003). This species tends to prefer taller and moister forest communities than are generally present on the subject site, although it is doubtless possible that Yellow-bellied Gliders are present in the moister areas of Blackbutt and Flooded Gum Forest along the edges of the low-lying land.

The record of G & V Clancy in 1998 appears to be located in the southwestern part of the site, in tall forest associated with such a drainage line. This species has not subsequently been recorded on the site, but the area indicated by G & V Clancy is to be retained within the Conservation Reserve in any case.

Furthermore, even if there is a "*viable local population*" of the Yellow-bellied Glider in the general area, both the subject site in general and (particularly) the areas proposed for

development represent only a small proportion of habitat which could be utilised by such a "*population*". The total area proposed for development on the subject site represents only the normal home range of a single family group of the Yellow-bellied Glider (which consists of 30-65ha), and most of the preferred habitat type is located in the Conservation Reserve on the subject site.

Neither the subject site *in toto* nor those areas proposed for development activities could be regarded as critical for the survival of a "*viable local population*" of the Yellow-bellied Glider, even if that species does occur on the site. Consequently, it is not "*likely*" that the proposed development would render a "*viable local population*" of the Yellow-bellied Glider (if present) likely to be "*placed at risk of extinction*" (emphasis added).

Factor (b) Endangered Populations and the Risk of Extinction

There is no relevant "*endangered population*" of the Yellow-bellied Glider.

Factor (c) Endangered Ecological Communities and the Risk of Extinction

The Yellow-bellied Glider is not an "*endangered ecological community*".

Factor (d) Habitat Removal, Modification, Fragmentation, Isolation and Importance

The proposed development concept for the subject site involves the retention of approximately 70% of the site for conservation purposes. This Conservation Reserve will contain the majority of the most suitable habitat for the Yellow-bellied Glider, noting that the habitats generally on the subject site are not regarded as preferred habitat for this species.

Furthermore, the development design has specifically incorporated the retention of broad bands of vegetation through the site providing potential connection to other forested land to the west of the Pacific Highway.

With respect to the relevant matters raised in Factor (d) of s.5A of the EP&A Act "*in relation to the habitat*" of the Yellow-bellied Glider:

- the majority of suitable habitat for this species on the subject site at Moonee Beach is to be retained and will not "*be removed or modified as a result of the action proposed*". Most of the vegetation likely to be used by the Yellow-bellied Glider is to be retained within the Reserve;
- given the retention of the majority of suitable habitat for this species on the subject site, and the provision of broad bands of forest through the site, there is no likelihood of habitat for this species becoming "*fragmented or isolated from other areas of habitat as a result of the proposed action*"; and
- given the extent of habitat to be retained and protected in the long-term for the Yellow-bellied Glider on the subject site at Moonee Beach, the area of drier forest habitat which is to be "*removed, modified, fragmented or isolated*" for this species on the subject site is not regarded as of "*importance .. to the long-term survival of the species .. in the locality*".

Factor (e) Critical Habitat – Direct and Indirect Effects

At the time of this *Repor*t, no "*critical habitat*" for the Yellow-bellied Glider had been declared by the Director-General of NPWS.

Factor (f) Recovery Plans and Threat Abatement Plans

A final *Recovery Plan* for the Yellow-bellied Glider was prepared by the NPWS (DEC) in 2003.

The majority of potential habitat for the Yellow-bellied Glider on the site is to be retained and protected within the extensive Conservation Reserve, and will be managed in perpetuity for conservation purposes. Given that approach, and the uncertainty that the species is actually present on the site, the proposed development of the site at Moonee can and will satisfy the objectives of the draft *Recovery Plan* for the Yellow-bellied Glider.

None of the current *Threat Abatement Plans* are of particular relevance for the Yellow-bellied Glider or its habitat.

Factor (g) Key Threatening Processes

Whilst the proposed development of the subject site at Moonee Beach does involve the clearing of "*native vegetation*" as defined in the TSC Act, that removal will not involve the loss of significant areas of suitable habitat for the Yellow-bellied Glider.

Most of the more suitable habitat (in the moister forest communities) for this species is located along the periphery of the low-lying land, and will be retained within the substantial Conservation Reserve on the subject site. Conversely, the drier forest communities are of less value for this species, and their loss is unlikely to be of significance for the Yellow-bellied Glider on even a site-specific basis.

CONCLUSIONS

The eight factors which are required to be considered pursuant to s.5A of the EP&A Act in the determination of "*whether there is likely to be a significant effect on threatened species, populations or ecological communities*, *or their habitats*" are discussed in detail above with regard to the Yellow-bellied Glider.

On the basis of the above considerations, the proposed development on the subject site at Moonee Beach is not considered "*likely*" to impose "*a significant effect*" on the Yellow-bellied Glider.

4.3.11 Common Planigale

Factor (a) Threatened Species and the Risk of Extinction

The Common Planigale occurs in a range of vegetation types but on the north coast of NSW is most commonly recorded in swamp forest vegetation with a dense sedge understorey. The species was recorded in 2006 in such vegetation in the northeastern part of the subject site, in the foredune/Swamp Oak community.

The areas proposed for development on the subject site do not represent particularly relevant or suitable habitat for the Common Planigale. Most of the preferred habitat for this species is located in the Conservation Reserve on the subject site.

Most of the habitat of relevance for a "*viable local population*" of the Common Planigale is to be retained within the Conservation Reserve on the subject site. It is not "*likely*" that the proposed development of the site at Moonee Beach would render a "*viable local population*" of the Common Planigale likely to be "*placed at risk of extinction*" (emphasis added).

Factor (b) Endangered Populations and the Risk of Extinction

There is no relevant "*endangered population*" of the Common Planigale.

Factor (c) Endangered Ecological Communities and the Risk of Extinction

The Common Planigale is not an "*endangered ecological community*".

Factor (d) Habitat Removal, Modification, Fragmentation, Isolation and Importance

The proposed development concept for the subject site involves the retention of approximately 70% of the site for conservation purposes. This Conservation Reserve will contain the majority of the most suitable habitat for the Common Planigale.

With respect to the relevant matters raised in Factor (d) of s.5A of the EP&A Act "*in relation to the habitat*" of the Common Planigale:

- the majority of suitable habitat for this species on the subject site at Moonee Beach is to be retained and will not "*be removed or modified as a result of the action proposed*". Most of the swamp forest vegetation likely to be used by the Common Planigale is to be retained within the Reserve;
- given the retention of the majority of suitable habitat for this species on the subject site, and the provision of broad bands of forest through the site, there is no likelihood of habitat for this species becoming "*fragmented or isolated from other areas of habitat as a result of the proposed action*"; and
- given the extent of habitat to be retained and protected in the long-term for the Common Planigale on the subject site at Moonee Beach, the area of drier forest habitat which is to be "*removed, modified, fragmented or isolated*" for this species on the subject site is not regarded as of "*importance .. to the long-term survival of the species .. in the locality*".

Factor (e) Critical Habitat – Direct and Indirect Effects

At the time of this *Repor*t, no "*critical habitat*" for the Common Planigale had been declared by the Director-General of NPWS.

Factor (f) Recovery Plans and Threat Abatement Plans

There is currently no *Recovery Plan* for the Common Planigale.

None of the current *Threat Abatement Plans* are of particular relevance for the Common Planigale or its habitat.

Factor (g) Key Threatening Processes

Whilst the proposed development of the subject site at Moonee Beach does involve the "*clearing of native vegetation*" as defined in the TSC Act, that removal will not involve the loss of significant areas of suitable habitat for the Common Planigale.

Similarly, the proposal involves a range of measures to avoid or prevent relevant or significant alterations to water regimes or freshwater flows. There is not likely too be any significant impacts on the swamp forest communities on the site which are or may be of relevance to the Common Planigale.

Most of the suitable habitat (in the moister forest and swamp forest communities) for this species is located along the periphery of the low-lying land and in the swamp forest vegetation, and will be retained within the substantial Conservation Reserve on the subject site. Conversely, the drier forest communities are of less value for this species, and their loss is unlikely to be of significance for the Common Planigale on even a site-specific basis.

CONCLUSIONS

The eight factors which are required to be considered pursuant to s.5A of the EP&A Act in the determination of "*whether there is likely to be a significant effect on threatened species, populations or ecological communities*, *or their habitats*" are discussed in detail above with regard to the Yellow-bellied Glider.

On the basis of the above considerations, the proposed development on the subject site at Moonee Beach is not considered "*likely*" to impose "*a significant effect*" on the Yellow-bellied Glider.

4.3.12 Osprey

Factor (a) Threatened Species and the Risk of Extinction

The Osprey inhabits coasts and estuaries, foraging along beaches and hunting fish in waterbodies and the ocean. This species constructs large nests of sticks, generally in exposed (often dead) trees and on artificial structures.

Ospreys have been recorded flying over the subject site at Moonee Beach. However, there are no Osprey nests on the site (although a large nest is located in a substantial dead tree on an adjoining paddock to the immediate south). There are no foraging resources for the Osprey on the site itself.

There is no likelihood that a "*viable local population*" of the Osprey, or even a family, would be "*placed at risk of extinction*" (emphasis added) by the proposed development. It is also not likely that the "*life cycle*" of the Osprey would be "*disrupted*" by the proposed development site at Moonee Beach to any relevant extent.

Factor (b) Endangered Populations and the Risk of Extinction

There is no "*endangered population*" of the Osprey.

Factor (c) Endangered Ecological Communities and the Risk of Extinction

The Osprey is not an "*endangered ecological community*".

Factor (d) Habitat Removal, Modification, Fragmentation, Isolation and Importance

Whilst the Osprey has been recorded flying over the subject site, there are no Osprey nests on the site itself (although there is one on the land to the immediate south). Potential foraging habitat for this species within the subject site is limited to a small area of the tidal parts of Moonee Creek and its southern tributary. There is, as noted above, no possibility of the subject site itself supporting a "*viable local population*" of the Osprey.

With respect to the relevant considerations in Factor (d) of s.5A of the EP&A Act:

- no habitat of particular or known value for the Osprey is "*to be removed or modified as a result of the action proposed*". To the contrary, the overwhelming majority of potential habitat for this species on the subject site is to be retained within the extensive Conservation Reserve proposed;
- given the high mobility of the Osprey and its habitat preferences, there is no possibility of any habitat for this species becoming "*fragmented or isolated from other areas of habitat as a result of the proposed action*"; and
- none of the vegetation which is to be "*removed, modified, fragmented or isolated*" (to the extent that those actions may operate) is of "*importance .. to the long-term survival*" of the Osprey "*in the locality*".

Factor (e) Critical Habitat – Direct and Indirect Effects

At the time of this *Repor*t, no "*critical habitat*" for the Osprey had been declared by the Director-General of NPWS.

Factor (f) Recovery Plans and Threat Abatement Plans

There is currently no *Recovery Plan* for the Osprey.

None of the current *Threat Abatement Plans* are of particular relevance for the Osprey or its habitat.

Factor (g) Key Threatening Processes

Given the nature of its habitat requirements and the extent and distribution of relevant resources for the Osprey, the proposed development of the subject site at Moonee Beach will not involve "*the operation of, or increase the impact of, a key threatening process*".

CONCLUSIONS

The eight factors which are required to be considered pursuant to s.5A of the EP&A Act in the determination of "*whether there is likely to be a significant effect on threatened species, populations or ecological communities*, *or their habitats*" are discussed in detail above with regard to the Osprey.

On the basis of the above considerations, the proposed development on the subject site at Moonee Beach is not "*likely*" to impose "*a significant effect*" on the Osprey.

4.3.13 Square-tailed Kite

Factor (a) Threatened Species and the Risk of Extinction

The Square-tailed Kite is a highly mobile and wide-ranging raptor that utilises a mosaic of woodland and grassland landscapes for hunting. This species constructs large stick nests in the forest canopy.

Individuals of the Square-tailed Kite were recorded flying over the subject site on a number of occasions, doubtless using the site as part of a larger foraging home range. No nests of the species were sighted and it is not likely that the site either supports or is critical for the survival of even a single pair of this species.

Whilst the proposed development will remove some forest and woodland vegetation, the majority of the suitable foraging resources for this species will be retained. Furthermore, potential nest sites will also be retained on the subject site.

There is no evidence or likelihood that a "*viable local population*" of the Square-tailed Kite is reliant on the subject site for its survival. It is not "*likely*" that even individuals of this species would be "*placed at risk of extinction*" (emphasis added) by the proposed development, or that the "*life cycle*" of the Square-tailed Kite would be "*disrupted*" by the proposed development site at Moonee Beach to any relevant extent.

Factor (b) Endangered Populations and the Risk of Extinction

There is no "*endangered population*" of the Square-tailed Kite, as defined under the TSC Act, on the subject site or in the locality.

Factor (c) Endangered Ecological Communities and the Risk of Extinction

The Square-tailed Kite is not an "*endangered ecological community*".

Factor (d) Habitat Removal, Modification, Fragmentation, Isolation and Importance

As noted above, whilst Square-tailed Kites have been recorded flying over the subject site, no nests of this species have been recorded in the forest vegetation present. Thus, it would appear that the subject site constitutes part of the home range for an individual or individuals of this species, and substantial areas of forest suitable or potentially suitable for both nesting by and foraging by the Square-tailed Kite will be retained in any case.

With respect to the relevant considerations in factor (d) of S.5A:

- whilst some potentially suitable habitat for the Square-tailed Kite in respect both of possible nest sites and foraging resources will be "*removed or modified as a result of the action proposed*", the majority of forest and woodland vegetation on the subject site is to be retained within the substantial Conservation Reserve proposed. Thus, the potential loss of habitat for this species represents only a small proportion of potential habitat on the site (approximately 20-30%) and represents an insignificant area of habitat for the Square-tailed Kite with respect to the home range of even a single individual of this species;
- given the substantial retention of forest habitats on the subject site in broad bands across the land, and the high mobility of the Square-tailed Kite, no habitat for this species "*is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action*"; and
- the areas of forest habitat which are to be "*removed or modified as a result of the action proposed*" are not of "*importance .. to the long-term survival of the species .. in the locality*" given the substantial home ranges of the Square-tailed Kite, the extent of habitat to be retained on the subject site and the extent of habitat present in the locality.

Factor (e) Critical Habitat – Direct and Indirect Effects

At the time of this *Repor*t, no "*critical habitat*" for the Square-tailed Kite had been declared by the Director-General of NPWS.

Factor (f) Recovery Plans and Threat Abatement Plans

There is currently no *Recovery Plan* for the Square-tailed Kite.

None of the current *Threat Abatement Plans* are of particular relevance for the Square-tailed Kite or its habitat.

Factor (g) Key Threatening Processes

Whilst the proposed development of the subject site at Moonee Beach does involve the clearing of "*native vegetation*" as defined in the TSC Act, that removal will not involve the loss of significant areas of habitat for the Square-tailed Kite.

This species has not been recorded nesting on the site, and occupies substantial home ranges (of which the subject site would constitute just a part). The loss of some forested habitat is therefore not regarded as of consequence, particularly given the extent of habitat and resources in the vicinity (including in the Moonee Nature Reserve) and the extent of the Conservation Reserve proposed on the subject site.

Given those considerations, the proposed development of the subject site at Moonee Beach will not involve "*the operation of, or increase the impact of, a key threatening process*" of relevance to the Square-tailed Kite to any significant extent.

CONCLUSIONS

The eight factors which are required to be considered pursuant to s.5A of the EP&A Act in the determination of "*whether there is likely to be a significant effect on threatened species, populations or ecological communities*, *or their habitats*" are discussed in detail above with regard to the Square-tailed Kite.

On the basis of the above considerations, the proposed development on the subject site at Moonee Beach is not considered "*likely*" to impose "*a significant effect*" on the Square-tailed Kite.

4.3.14 Glossy Black Cockatoo

Factor (a) Threatened Species and the Risk of Extinction

The Glossy Black Cockatoo feeds almost exclusively on the seeds of she-oaks (*Allocasuarina* species) in the coastal part of its distribution, and nests in large tree-hollows.

Evidence for this species on the subject site at Moonee Beach was obtained from patches of Black She-oak *Allocasuarina littoralis* beneath which piles of chewed cones were present. There has been no sign of nesting by the Glossy Black Cockatoo on the subject site, however, and few tree-hollows of sufficient size are present.

The proposed development will remove some forest and woodland vegetation containing foraging resuorces for the Glossy Black Cockatoo, but other resources will be retained within the Conservation Reserve on the subject site.

There is no evidence for or likelihood that a "*viable local population*" of the Glossy Black Cockatoo is reliant on the subject site for its survival. It is not "*likely*" that a "*viable local population*" of this species would be "*placed at risk of extinction*" (emphasis added) by the proposed development, or that the "*life cycle*" of the Glossy Black Cockatoo would be "*disrupted*" by the proposed development site at Moonee Beach to any relevant extent.

Factor (b) Endangered Populations and the Risk of Extinction

There is no relevant "*endangered population*" of the Glossy Black Cockatoo, as defined under the TSC Act, on the subject site or in the locality.

Factor (c) Endangered Ecological Communities and the Risk of Extinction

The Glossy Black Cockatoo is not an "*endangered ecological community*".

Factor (d) Habitat Removal, Modification, Fragmentation, Isolation and Importance

The proposed development concept for the subject site involves the retention of approximately 70% of the site for conservation purposes. This Conservation Reserve will contain foraging resources for the Glossy Black Cockatoo, noting that the habitats generally on the subject site are not regarded as preferred habitat for this species.

Furthermore, the development design has specifically incorporated the retention of broad bands of vegetation through the site providing potential connection to other forested lands to the west of the Pacific Highway and to the south.

With respect to the relevant matters raised in Factor (d) of s.5A of the EP&A Act "*in relation to the habitat*" of the Glossy Black Cockatoo:

- suitable habitat for this species is to be retained on the subject site at Moonee Beach, and only a small proportion of the resources for a "*viable local population*" will "*be removed or modified as a result of the action proposed*";
- given the retention of suitable habitat for this species on the subject site, and the provision of broad bands of forest through the site, there is no likelihood of habitat for this species becoming "*fragmented or isolated from other areas of habitat as a result of the proposed action*"; and
- given the extent of habitat to be retained and protected in the long-term for the Glossy Black Cockatoo on the subject site at Moonee Beach, and the extent of resources for this species in the locality, the area of habitat which is to be "*removed, modified, fragmented or isolated*" for this species as a result of "*the action proposed*" on the subject site is not regarded as of "*importance .. to the long-term survival of the species .. in the locality*".

Factor (e) Critical Habitat – Direct and Indirect Effects

At the time of this *Repor*t, no "*critical habitat*" for the Glossy Black Cockatoo had been declared by the Director-General of NPWS.

Factor (f) Recovery Plans and Threat Abatement Plans

There is currently no *Recovery Plan* for the Glossy Black Cockatoo.

None of the current *Threat Abatement Plans* are of particular relevance for the Glossy Black Cockatoo or its habitat.

Factor (g) Key Threatening Processes

Whilst the proposal does involve the clearing of "*native vegetation*", that removal will not involve the loss of significant areas of foraging habitat for the Glossy Black Cockatoo from the subject site. Substantial areas of suitable foraging habitat will be retained in the extensive Conservation Reserve on the site.

Whilst the Glossy Black Cockatoo uses the site for foraging purposes, this species has not been recorded nesting on the site (although there are tree-hollows of sufficient size present). The Glossy Black Cockatoo also occupies substantial home ranges, of which the subject site would constitute just a part. The loss of some forested habitat is therefore not regarded as of consequence, particularly given the extent of habitat and resources in the vicinity (including

in the Moonee Nature Reserve) and the extent of the Conservation Reserve proposed on the subject site.

Given those considerations, the proposed development of the subject site at Moonee Beach will not involve "*the operation of, or increase the impact of, a key threatening process*" of relevance to the Glossy Black Cockatoo to any significant extent.

CONCLUSIONS

The eight factors which are required to be considered pursuant to s.5A of the EP&A Act in the determination of "*whether there is likely to be a significant effect on threatened species, populations or ecological communities*, *or their habitats*" are discussed in detail above with regard to the Glossy Black Cockatoo.

On the basis of the above considerations, the proposed development on the subject site at Moonee Beach is not considered "*likely*" to impose "*a significant effect*" on the Glossy Black Cockatoo.

4.3.15 Regent Honeyeater

Factor (a) Threatened Species and the Risk of Extinction

The Regent Honeyeater is a non-breeding seasonal visitor to parts of coastal NSW from its more inland breeding habitats. This species is highly mobile and relatively high wide-ranging, and utilises coastal forest communities for winter foraging.

The Regent Honeyeater has been recorded on the subject site at Moonee Beach (G & V Clancy 1998), and has also been recorded elsewhere in the general locality. It was not, however, recorded during the dedicated field investigations conducted during 2003 and 2006 (Appendices 3 and 4) for this project.
The most relevant resources for the Regent Honeyeater on the subject site are located in the Swamp Forest communities on the low-lying land, where winter-flowering trees are common. By contrast, the drier forest communities are of little relevance for this species.

It is not likely that the subject site itself, or even forested areas in the general locality, support a "*viable local population*" of the Regent Honeyeater. Furthermore, the relevant habitats and resources on the subject site are to be retained in the extensive Conservation Reserve on the subject site.

Given those considerations, there is no likelihood that development of the subject site as proposed would involve a "*viable local population*" of this species being "*placed at risk of extinction*" (emphasis added).

Factor (b) Endangered Populations and the Risk of Extinction

There is no relevant "*endangered population*" of the Regent Honeyeater, as defined under the TSC Act, on the subject site or in the locality.

Factor (c) Endangered Ecological Communities and the Risk of Extinction

The Regent Honeyeater is not an "*endangered ecological community*".

Factor (d) Habitat Removal, Modification, Fragmentation, Isolation and Importance

The proposed development concept for the subject site involves the retention of approximately 70% of the site for conservation purposes. This Conservation Reserve will contain the majority of the most suitable habitat for the Regent Honeyeater, in the areas of moist forest and swamp forest vegetation.

Furthermore, the development design has specifically incorporated the retention of broad bands of vegetation through the site providing potential connection to other forested land to the west of the Pacific Highway and to the south.

With respect to the relevant matters raised in Factor (d) of s.5A of the EP&A Act "*in relation to the habitat*" of the Regent Honeyeater:

- the majority of suitable habitat for this species on the subject site at Moonee Beach is to be retained within the substantial Conservation Reserve, and will not "*be removed or modified as a result of the action proposed*". Most of the development areas do not support vegetation likely to be used by the Regent Honeyeater to any significant extent;
- given the retention of the majority of suitable habitat for this species on the subject site, and the provision of broad bands of forest through the site, there is no likelihood of habitat for this species becoming "*fragmented or isolated from other areas of habitat as a result of the proposed action*"; and
- given the extent of habitat to be retained and protected in the long-term for the Regent Honeyeater on the subject site at Moonee Beach, and the wide-ranging habits of this species, the area of drier forest habitat which is to be "*removed, modified, fragmented or isolated*" for the proposed development on the subject site is not regarded as of "*importance .. to the long-term survival of the species .. in the locality*".

Factor (e) Critical Habitat – Direct and Indirect Effects

At the time of this *Repor*t, no "*critical habitat*" for the Regent Honeyeater had been declared by the Director-General of NPWS.

Factor (f) Recovery Plans and Threat Abatement Plans

There is currently no *Recovery Plan* for the Regent Honeyeater.

None of the current *Threat Abatement Plans* are of particular relevance for the Regent Honeyeater or its habitat.

Factor (g) Key Threatening Processes

Whilst the proposal does involve the clearing of "*native vegetation*", that removal will not involve the loss of significant areas of habitat for the Regent Honeyeater from the subject site. Substantial areas of suitable foraging habitat will be retained in the extensive Conservation Reserve on the site.

Given those considerations, the proposed development of the subject site at Moonee Beach will not involve "*the operation of, or increase the impact of, a key threatening process*" of relevance to the Regent Honeyeater to any significant extent.

CONCLUSIONS

The eight factors which are required to be considered pursuant to s.5A of the EP&A Act in the determination of "*whether there is likely to be a significant effect on threatened species, populations or ecological communities*, *or their habitats*" are discussed in detail above with regard to the Regent Honeyeater.

On the basis of the above considerations, the proposed development on the subject site at Moonee Beach is not considered "*likely*" to impose "*a significant effect*" on the Regent Honeyeater.

4.3.16 Green-thighed Frog

Factor (a) Threatened Species and the Risk of Extinction

The Green-thighed Frog is distributed along the east coast of Australia and in the adjoining ranges from the NSW central coast to southeastern Queensland. This species occupies a range of vegetated habitats from rainforest and moist eucalypt forest to dry eucalypt forest and heath, typically in areas where surface water gathers after rain (DEC 2006). This species is thought to forage through the leaf litter in these habitats, and breeding occurs following heavy rainfall during the late spring and summer, "*with frogs aggregating around grassy semi-permanent ponds and flood-prone grassy areas*" within or adjacent to the forested habitats.

Green-thighed Frogs were located in the northwestern part of the subject site, within the area proposed for development activities. It should be noted in this regard that survey efforts were concentrated in those areas proposed for development activities, and that this species is likely to utilise many of the other forested habitats across the subject site.

Clearly, it has to be assumed that there is a "*viable local population*" of the Green-thighed Frog on the subject site at Moonee Beach. Conversely, substantial areas of suitable habitat for this species will be retained in the moist forest communities located between the swamp areas and the elevated portions of the site on which development activities are proposed. Thus, substantial habitat for the Green-thighed Frog is to be retained and protected in the long-term by implementation of a VMP within the substantial Conservation Reserve on the site.

Given the extent of habitat to be retained and the implementation of appropriate management of the Conservation Reserve, it cannot be regarded as "*likely*" that a "*viable local population*" of the Green-thighed Frog would be "*placed at risk of extinction*" (emphasis added).

Factor (b) Endangered Populations and the Risk of Extinction

There is no relevant "*endangered population*" of the Green-thighed Frog, as defined under the TSC Act, on the subject site or in the locality.

Factor (c) Endangered Ecological Communities and the Risk of Extinction

The Green-thighed Frog is not an "*endangered ecological community*".

Factor (d) Habitat Removal, Modification, Fragmentation, Isolation and Importance

The Green-thighed Frog occupies a range of forests and habitats including rainforests, moist sclerophyll forests, dry eucalypt forests and heathlands, particularly in places where rainfall gathers following heavy rain. Much of the subject site, with the probable exception of the open swamp areas, would be suitable habitat for the Green-thighed Frog, and it is anticipated that this species would particularly utilise the areas of damp forest between the swamps and the dry forest communities.

With respect to the relevant matters addressed in Factor (d) of s.5A, with respect to the Green-thighed Frog:

- only a relatively small part of the areas of the site proposed for development activities would constitute particularly suitable habitat for the Green-thighed Frog, given the localised occurrence of areas in which surface water is likely to gather following heavy rain. Only parts of the proposed development areas would be potentially suitable habitat, and there are also extensive areas of suitable habitat in the adjoining portions of the subject site which are to be retained;

  Given those considerations, only a small part (less than 20%) of suitable habitat for the Green-thighed Frog on the subject site at Moonee Beach is likely to be "*removed or modified as a result of the action proposed*". Conversely, substantial areas of potentially suitable habitat for this species will be retained within the extensive Conservation Reserve, and managed in perpetuity for biodiversity conservation purposes;

- given the extent of habitat to be retained within the Conservation Reserve on the subject site, and the apparent ability of the Green-thighed Frog to move widely across the landscape, it is not likely that suitable habitat for this species would become "*fragmented or isolated from other areas of habit t as a result of the proposed action*"; and

- given the extent of habitat for the Green-thighed Frog which is to be retained within the extensive Conservation Reserve on the subject site at Moonee Beach, that area of habitat which is to be "*removed, modified, fragmented, or isolated* " as a result of the proposed activities is not regarded as of particular "*importance*" when considering "*the long-term survival of the species .. in the locality*".

Factor (e) Critical Habitat – Direct and Indirect Effects

At the time of this *Repor*t, no "*critical habitat*" for the Green-thighed Frog had been declared by the Director-General of NPWS.

Factor (f) Recovery Plans and Threat Abatement Plans

There is currently no *Recovery Plan* for the Green-thighed Frog.

None of the current *Threat Abatement Plans* are of particular relevance for the Green-thighed Frog or its habitat.

Factor (g) Key Threatening Processes

Whilst the proposal does involve the "*clearing of native vegetation*" (which is listed as a "*key threatening process*" on the TSC Act), that removal will not involve the loss of significant areas of habitat for the Green-thighed Frog from the subject site. Substantial areas of suitable habitat for this species will be retained within the extensive Conservation Reserve on the site.

Given those considerations, the proposed development of the subject site at Moonee Beach will not involve "*the operation of, or increase the impact of, a key threatening process*" of relevance to the Green-thighed Frog to any significant extent. As noted above, the proposal is not considered "*likely*" to place a "*viable local population*" of the Green-thighed Frog "*at risk of extinction*" (emphasis added), notwithstanding the removal of some native vegetation from the site.

CONCLUSIONS

The eight factors which are required to be considered pursuant to s.5A of the EP&A Act in the determination of "*whether there is likely to be a significant effect on threatened species, populations or ecological communities*, *or their habitats*" are discussed in detail above with regard to the Green-thighed Frog.

On the basis of the above considerations, the proposed development on the subject site at Moonee Beach is not considered "*likely*" to impose "*a significant effect*" on the Green-thighed Frog.