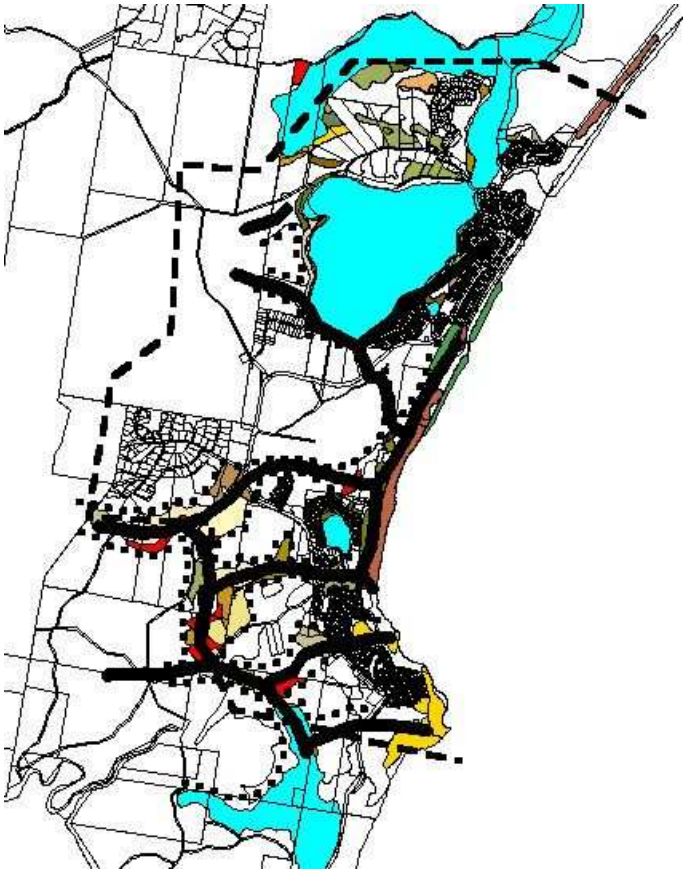
11.5 APPENDIX 5 - ECOLOGICAL ASSESSMENT OF RELEASE AREA 14

An Ecological Overview of the Area 14 Master Planning Area



Final Report - April 2003

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Preamble

Ecologically Sustainable Development (ESD) represents one of the greatest challenges facing Australia's governments, industry, business and community. The *National Strategy for Ecologically Sustainable Development* (NSED) provides both a strategy and a framework for governments to direct policy and decision making towards long-term benefits (as opposed to short-term gain) in order to ensure inter-generational equity. While there is no universally accepted definition of ESD, in 1990 the Australian Commonwealth Government proposed the following definition:

"*using, conserving and enhancing the communities resources so that ecological processes on which life depends are maintained, and the total quality of life, now and in the future, can be increased*"

Put simply, ESD is development which aims to meet the needs of Australians today, while conserving ecosystems for the benefit of future generations. To do this, our society needs to develop ways of using those environmental resources which form the basis of our economy in a way which maintains and where possible, improves their range, variety and quality.

Core objectives of the NSED are:

- to enhance individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations.
- to provide for equity within and between generations.
- to protect biological diversity and maintain essential ecological processes and life-support systems.

Prepared by the Ecologically Sustainable Development Steering Committee
Endorsed by the Council of Australian Governments
December, 1992

Introduction

This report describes the results of investigations into ecological and other land use issues associated with the preparation of a draft land-use master plan for Area 14, a large land unit located to the south of Port Macquarie between Lake Cathie and Bonny Hills on the north coast of New South Wales.

Study objectives

- Preparation of a Local Environmental Study for the Stage 1A Urban Investigation Area(s), as part of the draft Local Environmental Plan process for residential land releases, and
- Preparation of a land use Master Plan which provides an overall integrated land use and movement plan.

Scope of Work

This report addresses a small subset of the broader objectives and tasks associated with preparation of both the Local Environmental Study and the Master Planning exercise, and focuses specifically on the following issues:

- bush fire,
- significant stands of vegetation,
- wetlands and their catchments, and
- significant wildlife habitats and corridors that link such areas.

Approach to the study

The Area 14 Master Planning Area (the MPA) presents as a large area of land that has been modified by various land uses including logging, agriculture and urban development. As a consequence of these activities, the natural environment has been altered, the end result measurable in terms of cleared areas of land, habitat fragmentation, the disruption of natural ecological processes and an increased frequency in the use of fire as a land management tool. Despite this history, the MPA retains a number of outstanding natural attributes, including the presence of a spectacular coastline and significant wetland environments, important vegetation communities and a diverse array of native plants and animals.

Ecological assessment of the MPA was assisted by access to the following information:

- a vegetation map of the MPA prepared by Ecovision (1998), and
- digital data layers detailing property boundaries, contours, SEPP 14 and SEPP 26 areas.

Additionally, the potential presence of flora and fauna species currently listed on Schedules 1 and 2 of the *Threatened Species Conservation Act 1995* was determined on the basis of a search of the New South Wales National Parks and Wildlife Service's 'Wildlife Atlas' database. Four days were also spent in the field undertaking ground-based assessments of vegetation communities, along with a limited amount of fauna survey work that incorporated spotlighting, Anabat surveys and opportunistic observations.

The primary principles underpinning the recommendations of this report are based upon recognition of the core objectives of ESD, with specific regard to the issues of inter-generational equity, the protection of biological diversity and the maintenance of essential ecological processes and life-support systems.

Authors
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1. BUSHFIRE MANAGEMENT

Bushfire planning in New South Wales is now largely guided by the technical report *Planning for Bushfire Protection* (NSWRFS 2001).

The majority of vegetation communities within the MPA can be classified as 'forest' for the purposes of bush fire management. Bushfire planning guidelines propose that development setbacks be imposed where development precincts abut areas prone to bushfire. Within the MPA forest communities most typically fall into Groups 1 (Forests) and 2 (Woodlands, Heaths, open scrub) for bushfire planning purposes. These categorisations necessitate provision for development setbacks or Asset Protection Zones of between 20m and 40m where development is proposed downslope of forested areas, and between 40m and 60m where developments are proposed up slope from forested areas (Table 1).

For planning purposes, Asset Protection Zones ideally incorporate two components, an Outer Protection Area (OPA) and Inner Protection Area (IPA). The OPA is generally an area subjected to fuel reduction by way of diminishing the extent of vegetation cover and/or regular hazard reduction. In contrast, the IPA is an area in which fuel loads are minimal and which ideally contains a perimeter road or reserve (minimum road reserve width of 20m required) for access purposes in the event of bushfire. Table 1 details changes in APZ requirements as a function of differences in slope.

	IPA	OPA	Total APZ
Upslope			
> 5 °	20 +	0	= 20
5 – 0 °	20 +	10	= 30
Downslope			
> 0 – 5 °	30 +	10	= 40
> 5 – 10 °	40 +	10	= 50
>10 – 15 °	50 +	10	= 60
> 15 – 18 °	60 +	10	= 70

Table 1. Minimum APZ setback distances (in metres along a horizontal plane) required for bushfire prone developments adjoining 'forest' type vegetation communities [(Source: NSW Rural Fire Service (2001)].

2. SIGNIFICANT STANDS OF VEGETATION

The following section provides brief descriptions of vegetation communities occurring within the MPA that have been identified as significant at State, Regional and Local levels.

a) WETLANDS.

State Environmental Planning Policy No. 14 – Wetlands (SEPP 14) commenced on the 12th December 1985, its aim to preserve and protect coastal wetlands in the environmental and economic interests of the state.

The MPA contains four gazetted SEPP 14 wetlands: No. 509 (part) which comprises the Lake Cathie - Lake Innes water bodies and associated vegetation communities, No. 510 – a small wetland located within the village environs of Lake Cathie, No. 511 – within the Oceanwoods estate at Bonny Hills, and No. 512 (part) which drains south from Bonny Hills to the immediate west of the southern UIA.

Ecovision (1998) considered that vegetation communities detailed in Table 2 below also satisfied SEPP 14 selection criteria.

Code	*Community*	*Dominant species*
4003	Broad-leaved Paperbark	*M. quinquenervia*
4005	Swamp Oak	*C. glauca*
4011	Snow-in-Summer Swamp	*M. linariifolia*
4098	Swamp Mahogany /Broad-leaved Paperbark	*E. robusta, M. quinquenervia*
4099	Swamp Oak/ Broad-leaved Paperbark	*C. glauca*, *M. quinquenervia*

Table 2. Vegetation communities within the MPA that satisfy SEPP 14 selection criteria [Source: Ecovision (1998)]

Other Wetland areas

The North Coast Regional Environmental Plan (1988) extended the traditional SEPP 14 definition for wetlands to encompass all floristic formations existing within "*an area of land subject to permanent or periodic inundation and substantially retaining a cover of natural vegetation generally displaying hydrophilic characteristics*".

Based on the work of Ecovision (1998) the following vegetation communities thus warrant recognition as regionally important wetland habitat within the MPA:

- **Swamp Mahogany (4002)**

Swamp Mahogany *E. robusta,* Swamp Oak *Casuarina glauca* and Broad-leaved Paperbark *Melaleuca quinquenervia* prevail in this association which is often found in association with and adjacent to Broad-leaved Paperbark swamps and largely confined to moist clayey soils that experience periodic inundation. *Banksia robur*, an uncommon species in the Hastings LGA, sometimes occurs in this community.

- **Swamp Mahogany - *Melaleuca sieberi* swamp (4012)**

Species found in this association are predominantly Swamp Mahogany, *Melaleuca sieberi,* Swamp Oak and Broad-leaved Paperbark. This community can also contain *Banksia robur*. This association is also inadequately conserved within the Hastings River catchment.

- **Heath-leaved Banksia Swamp (5503)**

Dominated by Heath-leaved Banksia *Banksia ericifolia*, this community has a limited occurrence within the MPA, being restricted to a localised area along the eastern edge of SEPP14 Wetland No. 512 in the extreme south of the planning area.

Historically, the maintenance of wetland environments has suffered from a minimalist approach within the MPA, the end consequences of which have seen urban development extending below naturally occurring flood levels, thus necessitating management intervention at the ecological expense of pre-existing hydrological regimes (Wetland No. 509). Elsewhere, the proximity of urban developments with associated roading and drainage works has significantly altered hydrological regimes (Wetland Nos. 509, 510 & 511), so much so in the latter two instances that their longer-term ecological integrity is now compromised. A minimalist approach to buffering has also increased nutrient and sediment loads at the catchment level, placing further strain on the biological processes that assist maintenance of ecological integrity in these ecosystems.

b) LITTORAL RAINFOREST.

State Environmental Planning Policy No. 26 – Littoral Rainforest (SEPP 26) commenced on the 5th February 1998, its aim to provide a mechanism for the

consideration of applications for development that is likely to damage or destroy littoral rainforest areas with a view to preservation of those areas in a natural state.
The MPA contains one SEPP 26 area (No. 116) which extends in a narrow coastal strip southwards from Chipani Street, Lake Cathie. South of Middle Rock Road the site is currently afforded a 100m buffer for planning purposes.

In common with wetlands, the only gazetted littoral rainforest community within the MPA has long suffered from neglect. There is a significant measure of attrition in the north while several residences backing onto the area along Chipani Street (north of Middle Rock Road) are illegally making use of the reserve. The dumping of rubbish and introduction of garden waste further challenge ecological integrity while pedestrian access is largely *ad hoc*.

c) OTHER IMPORTANT VEGETATION

Additional to the above, a further five vegetation communities have been identified by Ecovision (1998) as being of regional conservation importance as follows:

- **Brush box *Lophostemon confertus* (3002)**

This association commonly consists of Brushbox *L. confertus* and Sydney Blue Gum *E. saligna* and often borders other wet sclerophyll forest types including Flooded Gum *E. grandis* and Tallowwood *E. microcorys* associations, the understorey often resembling sub-tropical rainforest, a successional stage of this type of vegetation.

- **Flooded Gum *Eucalyptus grandis* (3004)**

Common tree species in this formation are *Callicoma serratifolia,* Pink Bloodwood *C. intermedia,* Blackbutt *E. pilularis,* Northern Grey Ironbark *E. siderophloia,* Brushbox and Turpentine *Syncarpia glomulifera*. In the North Coast region this formation is inadequately reserved. Existing stands are predominantly disturbed, with few occurrences representing the true floristic and structural diversity of natural stands.

- **Wet Blackbutt *Eucalyptus pilularis* (3006)**

Species found in this association *are* Blackbutt, Pink Bloodwood, Red Bloodwood *C. gummifera,* Tallowwood, Northern Grey Ironbark and Turpentine. Frequent fire

significantly alters and simplifies the floristics and structure of this community which otherwise remains unconserved within the Hastings LGA.

- **Fore Dune Complex (9010)**

This type of community is normally composed of *Acacia, Allocasuarina, Banksia* and *Leptospermum* spp. and is strictly associated with coastal sand dunes.

- **Headland Complex (9030)**

Vegetation in this association is dominated by *Allocasuarina, Banksia, Hakea, Melaleuca* and *Leptospermum* species. This community is found exclusively on headland formations characterised by skeletal soils on bedrock. A threatened plant species associated with this community is *Thesium australe*.

Two further vegetation communities have been identified by Ecovision (1998) as being of local conservation importance:

- **Wet Pink Bloodwood (3005)**

This association often consists of Pink Bloodwood, Corkwood *Endiandra sieberi* and Blackbutt as dominant canopy species. Wet Pink Bloodwood forest is predominantly found in the Lake Cathie region. Prevailing conditions are low altitude, moist sandy-loam organic soils of reasonably high fertility. The low incidence of fire is the most likely causal factor in the continuation of this formation. The association is considered poorly known on the north coast and few occurrences have been reported.

- ***Melaleuca sieberi* Swamp (4009)**

Common tree species found in this association (other than *M. sieberi*) are *Acacia*, *Allocasuarina* and *Leptospermum* species. Often grows adjacent to Swamp Mahogany, Snow-in-Summer and wet heath associations. The occurrence of species such as *Banksia robur*, an uncommon species in the Hastings LGA, correlates well with good quality habitat. In the study area this formation is primarily found within the Laurieton to Bonny Hills region.

The location of all significant ecological communities within the MPA is detailed in Fig 1.

d) THREATENED FLORA

The NSWNPWS Wildlife Atlas provided records for 7 threatened plant species, none of which are currently known from within the MPA. This does not imply that there are no threatened plants to be considered, only that much of the area remains to be properly assessed. Indeed, the presence of threatened plant species within the MPA, and specifically within the southern UIA should be expected as a consequence of more detailed survey work.

White-flowered Wax Plant *Cynanchum elegans*

The known distribution of this rare plant extends from Yabbra State Forest in the north to Gerroa in the south and west to Merriwa in the Upper Hunter. *Cynanchum elegans* is a climbing plant that occurs primarily in the ecotone between dry subtropical rainforest and sclerophyll forest/woodland communities. Little is known of the reproductive biology of the species, however it is known to be clonal and capable of suckering in response to occasional physical disturbance. Some of the threats faced by *C. elegans* are further loss and degradation of habitat, isolation and small size of remaining populations as well as small number of individuals in each sub-population.

Allocasuarina defungens

Allocasuarina defungens is an erect scrub (1-2 m high) growing in tall heath on sand between Nabiac and Port Macquarie in NSW, favouring soils markedly deficient in nutrients (Harden, 1991). The species has a range of less than 100 km and is in serious risk of disappearing in the wild in the next 20 years under current land use practices (Kendall and Kendall, 1995) and is sensitive to threatening processes such as frequent fire, weed invasion and increased nutrient loads.

Acacia courtii

This plant grows as a tall shrub to small, somewhat pendulous tree to 20m with slightly ribbed angular branchlets; the species flowers in late spring to mid-summer. It grows in eucalypt forests on steep hillsides in stony, loamy to clayey soils. Known only from the Laurieton - Kew area of New South Wales (Royal Botanic Gardens, 2001). *Acacia courtii* is considered to be at risk of extinction in the wild within 20 to

50 years (NSW NPWS, 1999). Likely threats to the species are destruction and/or disturbance of habitat as well as weed invasion and an impoverished gene pool.

Maundia triglochinoides

This plant is an aquatic rhizomatous herb growing in coastal wetlands (Beadle *et al*. 1982). It grows in an erect fashion (up to 80 cm high) and has spongy inflated leaves (Harden, 1991). Knowledge about the biology/ecology of the species is limited. Threats to the species are likely to include altered hydrological regimes of swamps and wetlands along with direct physical disturbance and weed invasion.

Melaleuca groveana

This species grows in often exposed, higher areas of coastal heath environments from Port Stephens in the south, north to Queensland and Northern Territory. *M. groveana* grows as a scrub or small tree often 2-5 meters high. It develops white flowers in spring and fruit is small and barrel-shaped (Harden, 1991). This species is adversely affected by weed invasion, in particular bitou bush and is also at risk by too-frequent fires (NSW NPWS, 1999).

Swamp Orchid *Phaius tankervilliae*

This erect, terrestrial orchid grows up to 2 meters high and occurs from north of Lake Cathie to southern Queensland; it also occurs in Asia. *Phaius tankervilliae* grows in the edges of coastal paperbark swamps at or near sea level (Harden, 1991). Destruction of paperbark swamps is the most obvious threat but inappropriate fire regimes (both frequency and intensity) are also likely to have a deleterious effect on extant populations. Altered hydrological regimes and illegal collection are additional threats that adversely impact on populations.

Austral Toad-flax *Thesium australe*

This species is a perennial pale green or yellow-green herb with 1-30 branched stems up to 60 cm long (Beadle *et al*. 1982). The Austral Toad-flax has a wide ecological tolerance having been recorded from a range of climates and soil types. However, it is largely confined to grasslands, grassy woodlands or sub-alpine grassy heathlands. In NSW it is known from the North Coast, Central Coast and the Northern Tablelands. Disappearance of native grasslands, grazing by introduced herbivores and

inappropriate fire regimes are some of the processes threatening extant populations (Department of Sustainability and Environment, Victoria, 2002).

3. SIGNIFICANT WILDLIFE HABITAT

Resolving the issue as to exactly what constitutes significant wildlife habitat within the MPA is problematic. While water bodies such as the Lake Cathie – Lake Innes wetlands comprise habitat for many threatened bird species, the issue is more difficult to resolve for other species. For example, sustainable management of Grey-headed Flying-fox habitat requires an understanding of the flowering phenology of eucalypts and bloodwoods at a landscape scale (Table 2), mindful that not all individuals of a particular species will flower in a given year.

Species / month	J	F	M	A	M	J	J	A	S	O	N	D
E. pilularis												
E. propinqua												
C. intermedia*												
E. robusta*												
E. tereticornis*												
E. microcorys*												
E. pilularis												

Table 2. Flowering periods for commonly occurring *Eucalyptus* and *Corymbia* spp. within the MPA over the course of a given year from January (J) to December (D) (* indicates species that offer a significant floral resource).

Similarly, identifying significant habitat for Koalas is more a process of identifying where the remaining populations are located than it is simply identifying where key food resources are located. Conversely, for wide-ranging species such the Glossy Black Cockatoo, landscape-scale retention of areas that contain key food resources (*Allocasuarina torulosa* and *A. littoralis*) is required.

Hollow bearing trees.

The use of tree hollows is a prominent attribute of the ecology of many Australian vertebrate fauna. Indeed, it has been estimated that some 303 native vertebrate species – approximately 13% (27 spp.) of all terrestrial amphibians, 10% (70 spp.) of reptiles, 15% (114 spp.) of birds and 31% (83 spp.) of mammals are dependant upon tree hollows for some or all of their lives (Gibbons and Lindenmayer 2002). Within the

genus *Eucalyptus*, hollow development suitable for use by small vertebrates such as bats commences at around 80 – 100cm dbh; whereas those suitable for larger species such as Black Cockatoos more typically occur in trees with a dbh of 110 – 130cm (Wormington and Lamb 1999). The time periods that are involved in the ontogeny of hollow development at the preceding scales vary significantly between species (Table 3).

dbh (cm) / Species	*E. pilularis*	*E. microcorys*	*E. signata*
81 - 90	105 - 124	140 - 168	196 - 235
91 - 100	125 - 144	169 - 196	236 - 275
101 - 110	145 - 164	197 - 225	276 - 315
111 - 120	165 - 184	226 - 253	316 - 355
121 - 130	185 - 207	254 - 285	356^{+}

Table 3. Estimated age (in years) over a dbh range of 80 – 130cm for three *Eucalyptus* spp (Blackbutt, Tallowwood and Scribbly Gum) that commonly occur within the MPA [Source: Wormington and Lamb (1999)].

As evidenced by the preceding Table, such is the lifespan of eucalypts (300 – 500 years), that hollow loss is an incremental and not easily reversible process in the sense that ecological repercussions (of removal) persist for several hundred years (Gibbons and Lindenmayer 2002). At least five of the fourteen threatened species currently known to occur within the MPA – the Glossy Black Cockatoo, Powerful Owl, Yellow-bellied Glider and Squirrel Glider are obligate hollow dwellers, while the Little Bent-winged Bat and Greater Broad-nosed Bat also use tree hollows. Thus a minimum of 30% of those threatened species currently known to occur within the MPA require retention of hollow-bearing trees if biodiversity values are to be maintained.

Within the MPA, hollow-bearing trees are a finite resource and their retention thus becomes an integral component of longer-term planning and conservation. Hollow-bearing trees occur within the Northern UIA and Southern UIAs.

Threatened Fauna

A primary consideration that underpins identification of significant habitat relates to those areas potentially being occupied by and/or utilised by threatened species. The

NSWNPWS Wildlife Atlas provided records for 42 threatened fauna species, 17 of which were primarily associated with terrestrial ecosystems (as opposed to estuarine and/or wetland ecosystems) within the MPA. The number of threatened species inhabiting the MPA can realistically be expected to increase as a consequence of more detailed survey work. Below are brief accounts for each of seventeen threatened species known to occur within the MPA.

Amphibians

Wallum Froglet *Crinia tinnula*

The Wallum Froglet is an "Acid Frog", reliant upon water with low pH that occur in coastal areas from Fraser Island (Ingram and Corben, 1975) to south of Port Macquarie. Populations appear to be localised and there is some evidence, based on work on other *Crinia* species, that fidelity to breeding sites is maintained.

Threats to Wallum Froglet populations primarily arise from the draining and/or filling of wetlands, particularly those with chemically suitable water bodies and their associated aquatic vegetation. Habitat degradation constitutes a further threatening process where chemically suitable water bodies occur in close proximity to urban developments and are subsequently affected by siltation, pollution and eutrophication.

Locally, Wallum Froglets are known from the Queens Lake area (Phillips *unpub data*) and Lake Innes Nature Reserve (NSWNPWS Atlas). Suitable habitat, albeit localised, does occur within the MPA, primarily in association with known wetland areas.

Birds

Glossy Black Cockatoo *Calyptorhynchus lathami*

The Glossy Black Cockatoo is sparsely distributed along the east-coast and immediate inland districts from Victoria to Rockhampton in Queensland. The species is arguably the most specialised member of the genus and in northern NSW feeds almost exclusively on Forest and Black She-oaks (*Allocasuarina* spp.). The species nests in large hollows and commonly inhabits forests on sites with low nutrient status, reflecting the distribution of key food species. Threats faced by the species include destruction of nesting and food resources through clearing, logging and inappropriate fire regimes (NSW National Parks and Wildlife Service, 1999).

Locally, Glossy Black Cockatoos have been recorded from the Queens Lake State Forest (NSWNPWS Atlas) and from areas to the north and south. Suitable habitat is widespread within the MPA, particularly in vegetation communities where key food resources (*Allocasuarina* spp.) are growing.

Square-tailed Kite *Lophoictinia isura*

The Square-tailed Kite occurs in coastal to sub-coastal southeastern Australia and in southwestern WA. The species forages over forest and woodland canopy in search of bird nestlings, which provide its main source of food. The Square-tailed Kite is a specialist hunter of passerines, especially honeyeaters and also insects in the tree canopy (NSW National Parks and Wildlife Service, 1999).

Threats to the species include loss of habitat through clearing and logging, along with illegal shooting and/or collection of eggs, nest disturbance and inappropriate fire regimes (NSW National Parks and Wildlife Service, 1999).

Locally, Square-tailed Kites have been recorded in the Bonny Hills area. We also recorded this species in both the northern and southern urban investigation areas of the MPA during the course of our field inspections.

Powerful Owl *Ninox strenua*

The Powerful owl inhabits eucalypt forests and woodlands of eastern to southeastern Australia from Mackay in Queensland to eastern Victoria. The species is sedentary, living alone or in pairs, occupying a permanent territory containing a number of roost sites. The species roosts in dense foliage by day and hunts by night. Arboreal mammals constitute the major part of the Powerful Owl's diet but it may also take birds and terrestrial mammals (Blackers *et al* 1984). For nesting purposes this species requires a large hollow in trunk or limb of tree (Pizzey and Knight, 1997). Powerful Owls are adversely affected when populations of arboreal marsupials are reduced by clearing of habitat and bush fires (Blackers *et al* 1984). The species reproductive potential is also limited by hollow availability.

Locally, Powerful Owls have been recorded from the Queens Lake State Forest (NSWNPWS Atlas). Suitable habitat, albeit localised, occurs within the MPA.

Masked Owl *Tyto novaehollandiae*

The species occupies the coastal parts of the continent but is very sparse throughout its distribution, except for its stronghold in Tasmania (Blackers, *et. al*. 1984; Pizzey and Knight, 1997). The Masked Owl is sedentary and lives in eucalypt forest and woodland, requiring partial clearing or forest edge for hunting purposes, while roosting occurs in the dense cover of gullies or in caves. Prey varies from mammals and birds to insects and for nesting purposes the bird requires hollow trunk of eucalypt (Pizzey and Knight, 1997).

Its probable decline (apart from in Tasmania) has been attributed to the decline of native mammals since European settlement. Threats to the species are further reduction of prey species abundance through clearing and degradation of habitat (Blackers, *et. al*. 1984). Additional circumstances contributing to decreasing numbers may be the diminishing numbers of mature hollow bearing trees that that is to the owl necessary for nesting and reproductive purposes. The NSW NPWS Atlas returned one Masked Owl record in close proximity to the study area. Suitable habitat, albeit localised, occurs within the UIA.

Osprey *Pandion haliaetus*

The Osprey is a bird of coastal estuaries and beaches around the Australian coastline. Fidelity to nest sites is maintained by breeding pairs and notwithstanding undue disturbances, the same nests are used each year. The species feeds primarily upon fish which it captures from the surface of the water.

Threats to the species include the encroachment of urbanisation into areas containing essential roosting and nest trees. Siltation and pollution of watercourses contribute to depletion of the food resource while overhead power lines have also resulted in a number of Osprey injuries and indirect kills in northern New South Wales.

Locally, Ospreys are known from the Lake Innes Nature Reserve and general environs of Lake Cathie (NSWNPWS Atlas). Suitable habitat within the MPA is primarily associated with coastal waterbodies and adjoining forest communities.

Grass Owl *Tyto longimembris*

Distributed through northern to northeastern parts of Australia, Grass Owls forages over grassy plains and swamp areas. The Grass Owl is a nomadic species responding to abundance of prey (Pizzey and Knight, 1997). This species roosts and nests on the ground in crops, thick grass and tussocks, often in association with swamps. Prey items are often rodents and sometimes also insects (Blackers *et al* 1984).

Locally, Grass Owls are known from the Lake Innes Nature Reserve immediately to the north of the MPA boundary (NSWNPWS Atlas). Suitable habitat, albeit localised, occurs within the MPA.

Mammals

Eastern Blossom Bat *Syconycteris australis*

The Eastern Blossom Bat is the smallest member of the Megachiropteran group and occurs from New Guinea to eastern Queensland from Cape York south. In New South Wales occurrences of the species are localised and restricted to a narrow coastal strip of approximately 600 km from the Qld/NSW border to areas south of the Manning River (Law, 1992). The species appears to be solitary by nature and the protection offered by dense foliage in rainforest, adjacent wet sclerophyll forests and paperbark swamps is used for daytime roosting, the evenings spent foraging in adjoining coastal heathland (Strahan, 1995; Law, 1993). The species has been observed hovering in front of, or feeding on, the blossoms of paperbark, bottlebrushes, banksias, bloodwoods and cultivated bananas (Strahan, 1995).

Habitat destruction and modification arising from intense coastal development, weed infestation and altered fire regimes constitute major threats to the Eastern Blossom Bat. There is a significant threat to the major food source, *Banksia integrifolia*, considered to be of crucial importance because of its lengthy flowering period (Law, 1993). Many areas of *B. integrifolia* heathland are in senescence due to germination and recruitment suppression by weed infestations (Dodkin and Gilmore, 1985: Law, 1992). The low-level flying behaviour of the species also predisposes it to collisions with motor vehicles and predation by introduced animals such as foxes and cats (Phillips *et al* 2001).

Locally, Eastern Blossom Bats have been recorded from the Queens Lake and Lake Innes Nature Reserves (NSWNPWS Atlas). Suitable habitat for this species occurs in the coastal strip between Lake Cathie and Bonny Hills.

Greater Broad-nosed Bat *Scoteanax rueppellii*

The Greater Broad-nosed Bat occurs from north-eastern Victoria to the Atherton Tablelands in tropical Queensland,its stronghold in the gullies and river systems that drain the Great Dividing Range.

The Greater Broad-nosed Bat primarily roosts in tree hollows (Hoyne & Richards, In: Strahan, 1995) in a range of habitats from woodlands to dry and moist eucalypt forest and rainforest. Prior to giving birth, females of the species congregate at maternity sites located in suitable tree hollows from which males appear to be excluded.

Threats to the species are presumably similar to those of the Little bent-winged Bat, specifically disturbance to overwintering and/or maternity sites, in addition to the loss of foraging and/or roosting habitat associated with tree clearing and forest fragmentation. Locally, the species is known from the Lake Innes Nature Reserve and areas to the south of the MPA; suitable habitat is widespread within the MPA.

Little bent-wing Bat *Miniopterus australis*

The Little Bent-wing bat occurs from Cape York in eastern Queensland to northern NSW. In NSW the species appears mainly restricted to subtropical coastal lowlands (Dwyer, 1968). The species is present in low numbers in caves in NSW (Dwyer 1968) and is highly vulnerable as populations concentrate in only a few maternity caves.

Most roost sites of this species are located in or close to areas of dense vegetation, (Dwyer, 1968). Within the MPA, critical habitat can be considered to be foraging areas and any roost sites in disused mines (if they occur). Although regarded as a cave roosting species, *M. australis* has been recorded as roosting in tree hollows and it is possible that the species roosts utilises this resource within the study area. Threats to the species arise from disturbance to overwintering and/or maternity caves, in addition to the loss of foraging and/or roosting habitat associated with tree clearing and forest fragmentation.

Locally, the species is known from the Queens Lake State Forest, Lake Innes Nature Reserve and Lake Cathie environs. We also recorded calls from this species at two locations in the general vicinity of the Bonny Hills sewage treatment plant.

Grey-headed Flying-fox *Pteropus poliocephalus*

The Grey-headed Flying-fox is amongst the largest of the native Australian megachiropterans and occurs from central Queensland to eastern Victoria (Eby, 1995). Flying-foxes are phytophagous (feeding on floral resources) with the predominant food resource being the blossoms of eucalypts, paperbarks and turpentines (Strahan, 1995). They are important pollinators due to their ability to move and transport genetic material across fragmented and isolated forest remnants. The species is nomadic with food being the primary determinant of animal movements (Eby, 1995).

Environmental pressures affecting *P. poliocephalus* primarily relate to the ongoing clearing, alteration and fragmentation of roosting and foraging habitat. Deliberate disturbance of campsites and poorly regulated persecution by humans further contribute to potential threats to this species.

Locally, the species is known from the Lake Innes Nature Reserve (NSWNPWS Atlas) and various localities to the west and south. Suitable habitat is widespread within the MPA.

Coastal Planigale *Planigale maculata*

The Coastal Planigale is a small (6 - 35gms) carnivorous marsupial distributed along the eastern seaboard of Australia from Cape York to the Hunter River Valley on the central coast of NSW (Strahan, 1995).

The regional distribution and abundance of *P. maculata* is difficult to ascertain with confidence. Because of its small size and cryptic nature the species is not always detected nor is it readily censused by conventional survey methodology. The small size of this species does not suggest extensive movement and, because of this, it must be assumed that most populations will be localised.

Locally, Planigales are known from both the Queens Lake and Lake Innes Nature Reserves. Suitable habitat for the species is widespread in the MPA.

Brush-tailed Phascogale *Phascogale tapoatafa*

The Brush-tailed Phascogale has a patchy distribution around the coast of Australia. from Rockhampton in Qld to the Mt Lofty Ranges in South Australia, with isolated populations in southern Western Australia. The species prefers dry sclerophyll forest but is also found in heathland, swamps and rainforest.

Phascogales are nocturnal and feed primarily on invertebrates; individuals using their fingers to extract prey from crevices and under bark. The species nests and shelters in tree hollows, utilising many different hollows over a short time span. Mating occurs between May and July during which time males can travel distances well beyond their territories. Males die soon after mating.

Threats to the species primarily arise from loss and fragmentation of habitat through clearing for agriculture and urban development. Logging of hollow-bearing trees, inappropriate fire regimes and predation by introduced predators all threaten the survival of the species (NSW National Parks and Wildlife Service, 1999). Current records come from areas well to west of the MPA. However, suitable habitat for the species – albeit localised - does occur in the MPA.

Squirrel Glider ***Petaurus norfolcensis***

The Squirrel Glider inhabits dry sclerophyll forest and woodland in southeastern Australia with the exception of dense coastal ranges. However, in northern NSW and Qld it occurs in coastal forest and in some wet forest areas bordering on rainforest. The Squirrel Glider feeds on nectar, pollen, eucalypt sap and insects. It lives in family groups of between 2 and 10 individuals (NSW NPWS, 1999). The species nests in a bowl-shaped tree hollow.

Likely reasons for the current threatened status of the species is the clearing of woodland and forest areas for urban expansion and agriculture along with

inappropriate fire regimes and predation by cats and foxes (Strahan, 1995; NSW NPWS, 1999).

Locally, the species is known from the Queens Lake State Forest, Lake Innes Nature Reserve and Lake Cathie environs (NSWNPWS Atlas). We also recorded the species in the vicinity of the Bonny Hills Sewage treatment plant and in Dry Scribbly Gum forest immediately to the south of the Bonny Hills village.

Yellow-bellied Glider *Petaurus australis*

With a coastal distribution from southeastern Qld south to coastal parts of Victoria this large glider predominantly feed on sap of Eucalyptus species. Insects and *Eucalyptus* blossom also provide valuable components of the species diet. The Yellow-bellied Glider occurs in tall mature wet eucalypt forest at relatively low densities. The home range of an individual is remarkably large and they require (large) hollows in smooth barked trees for roosting purposes. The Yellow-bellied Glider has low breeding potential, with a single young usually produced each year, but breeding may sometimes occur in alternate years (NSW National Parks and Wildlife Service, 2002)

Threats to the species include destruction of habitat (feeding and den trees). The longer-term survival of the Yellow-bellied Glider depends upon maintaining the integrity of large areas of intact forest (Strahan, 1995).

Locally, Yellow-bellied Gliders are known from the Queens Lake State Forest and Lake Innes Nature Reserve (NSWNPWS Atlas). Suitable habitat, albeit localised, occurs within the MPA.

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Eastern Chesnut Mouse *Pseudomys gracilicaudatus*

The Eastern Chesnut Mouse can be found in the eastern parts of Queensland and NSW, favouring dense, wet heath and swampy areas. The species has a patchy distribution throughout its range and reaches maximum population densities in heathland regenerating after fire. The species is largely nocturnal and feeds on seeds, plant matter, fungi and insects. A nest is constructed of grass above ground or as part of a burrow complex for breeding purposes (Strahan, 1995).

Locally, Eastern Chestnut Mice are known from the Queens Lake Nature Reserve and Bonny Hills environs (NSWNPWS Atlas). Suitable habitat occurs within the MPA, especially within the southern UIA.

Koala *Phascolarctos cinereus*

The koala - Australia's largest arboreal marsupial - is an obligate folivore which feeds primarily on the genus *Eucalyptus*. Its distribution in eastern Australia extends from far north-eastern Qld. to the Eyre Peninsula in South Australia (Strahan, 1995). Often regarded as solitary animals, koalas actually live in well defined social hierarchies comprised of overlapping home range areas. Breeding activity is usually presided over by an alpha-male whose home range area will overlap that of several females. As a general rule, long term (*ie* many years) occupation of the same home range area is demonstrated by adult koalas in a stable breeding aggregation.

Loss of habitat, road mortalities, predation by foxes and feral dogs, and fire all threaten koala populations. Unfortunately, many contemporary declines are masked by the relative longevity of the species, with time periods of 16-20 years now being associated with localised extinction events (Phillips 2000).

State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44) commenced on the 13th February 1995, its aim to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and (to) reverse the current trend of koala population decline by:

a) requiring the preparation of plans of management before development consent can be granted in relation to areas of core koala habitat; and
b) encouraging the identification of areas of core koala habitat; and
c) encouraging the inclusion of areas of core koala habitat in environment protection zones.

Locally, Koalas are known from the Queens Lake State Forest, Lake Innes Nature Reserve and Lake Cathie environs. Suitable habitat for the species is widespread in the MPA (Fig 2), but populations are localised as evidenced by the presence of a

small breeding populations in the Bonny Hills and Lake Cathie village areas (Fig 2). Key food resources within the MPA are Tallowwood, Swamp Mahogany, Forest Red Gum and Grey Gum (Phillips 2000).

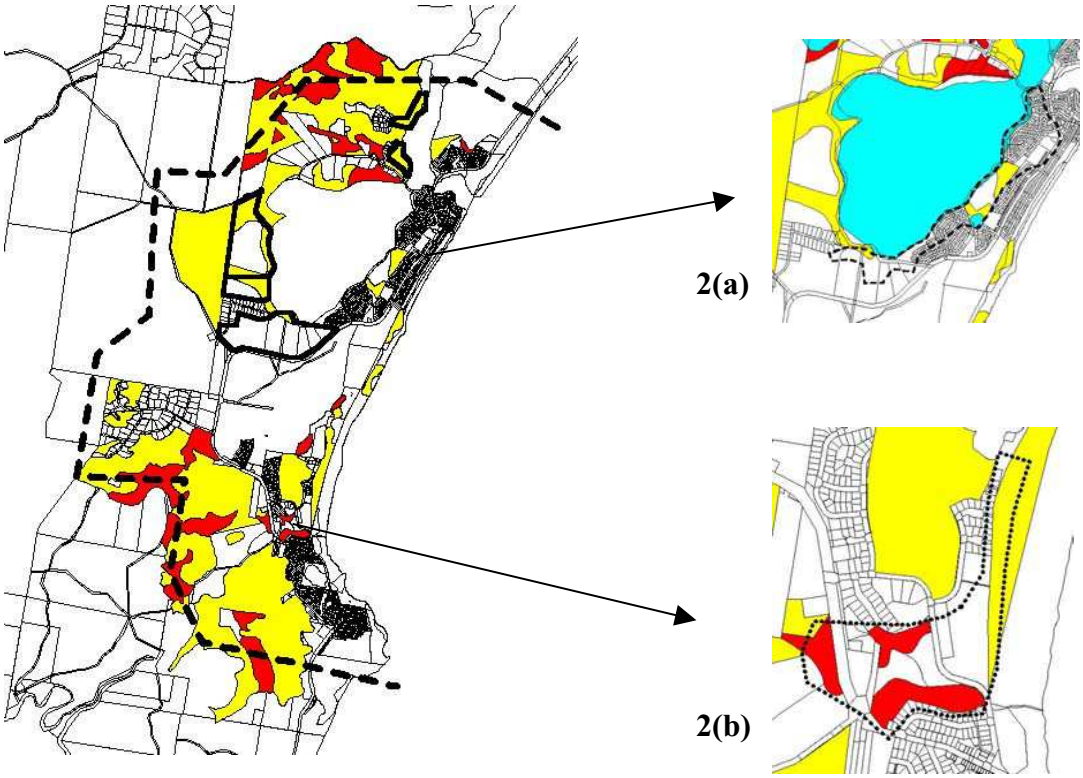

Figure 2. Categorisations of vegetation communities into Primary (red) and Secondary (yellow) Koala habitat, based on the abundance of preferred food tree species within vegetation communities mappped by Ecovision (1998). Fig. 2(a) outlines the tentative boundaries (broken line) of a small area of *Core Koala Habitat* at Lake Cathie that extends into the northern UIA, whereas Fig. 2(b) similarly details tentative boundaries of a small area of *Core Koala Habitat* at Bonny Hills. Both areas contain important stands of native vegetation that are unmapped.

4. CONCLUSIONS AND RECOMMENDATIONS

The MPA supports a diverse array of vegetation communities that provide habitat for an equally diverse array of native flora and fauna. The area is especially notable for its spectacular coastline and wetland areas, and contains a number of significant vegetation communities. At least seventeen threatened species are known to occur. In keeping with the core objectives of ESD, the following recommendations are proposed.

a) Significant stands of vegetation

Effective conservation of significant vegetation communities within the MPA is perceived as the minimum contribution that the master planning exercise can contribute towards the longer-term maintenance of existing biodiversity values. To this end the following recommendations are proposed:

- All significant areas of native vegetation within the MPA should be incorporated – in their entirety - into a system of open space reserves, habitat links and/or corridors.
- All significant areas of native vegetation within the MPA should be afforded ecotonal buffers that have a minimum width of 60 metres (including any OPA requirements associated with the provision of APZs).
- Where such buffers traverse cleared lands, they must be regenerated and/or rehabilitated accordingly.

b) Littoral Rainforest

- Maintenance of the existing 100m landward buffer from gazetted boundary.
- 20 metres development setback from buffer for bushfire planning purposes (buffer can accommodate 10m OPA).
- Assertive action to remedy processes of community attrition (particularly from northern end but also from seaward side), presumably under auspices of a site specific management plan.
- Establishment of a community-based management committee to oversee development and implementation of proposed management plan.

c) Significant wildlife habitat

- Ensure that a representative samples of native vegetation communities are retained throughout the study area, with particular emphasis on areas that contain the following:
  - mature *E. tereticornis*, *E. robusta*, *E. microcorys* and *C. intermedia* trees, and
  - stands of *Allocasuarina torulosa* and/or *A. littoralis*.
- Retain all eucalypts* with a dbh in excess of 80cm dbh while also making provision for future recruitment by identifying suitable candidate trees in the 60 – 80cm size class.
- Reassessment of proposed future land releases in the vicinity of Oceanwoods estate at Bonny Hills given the presence of *Core Koala Habitat* in the vicinity of the Rainbow Beach Caravan Park.

* includes *Corymbia* spp. but excludes *E. seeana* which commences hollow development at a smaller dbh and thus requires specific assessment.

d) Corridors & Habitat Links

By default, the retention of significant stands of vegetation, areas of primary koala habitat and associated buffer areas establish the basis for a single north-south and at least two major east-west corridors within the MPA. In order that these links realise their full potential over the longer-term, the following recommendations are proposed:

- Establishment of a designated east-west corridor with a minimum width of approximately 150m (including OPA but excluding IPA of associated APZ areas) on Lot 63 DP845590 from the intersection of Bonny View Drive and thereafter to the coast in the vicinity of Lot 11 DP629025.
- Establishment of a designated north-south corridor with a minimum width of approximately 75m (excluding APZ requirements) on Lot 63 DP845590 in the general vicinity of Lot 4 DP255923 and thereafter to the coast in a south easterly direction along existing drainage lines.

The approximate location of these proposed corridors within the MPA is detailed in Fig 3.

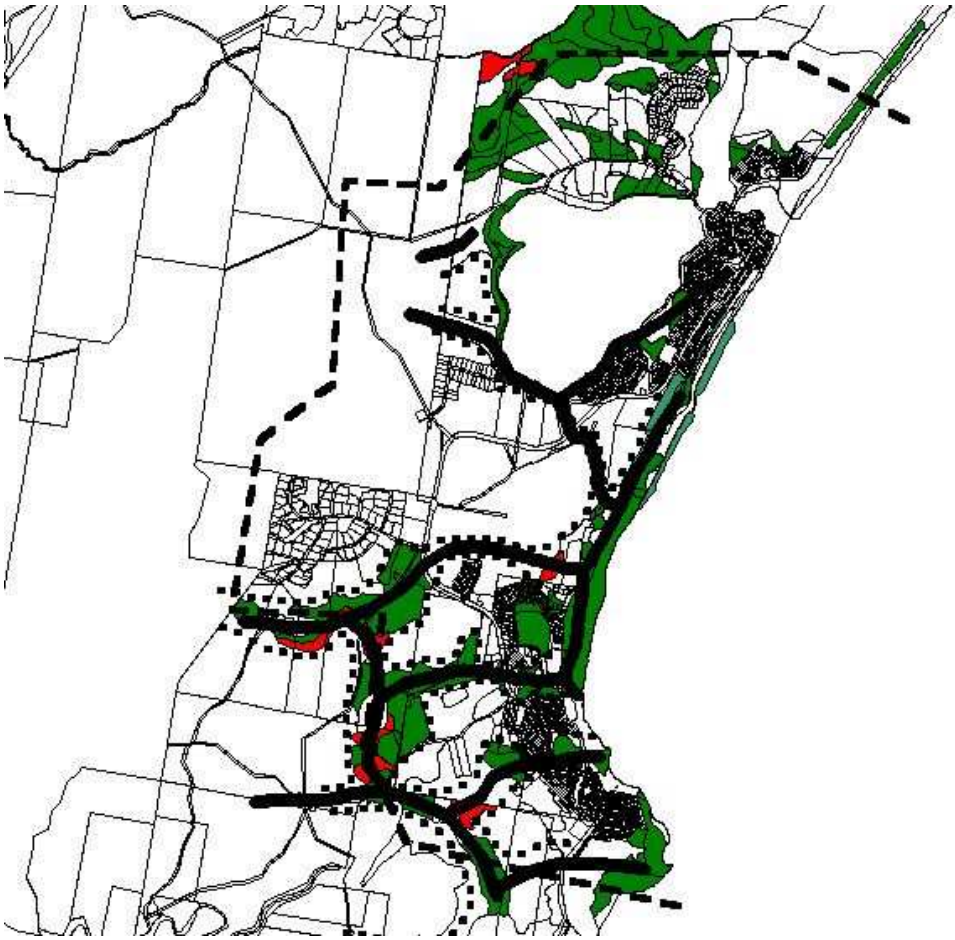

Figure 3. Schematic illustration of proposed corridor network (solid black lines) and associated buffers (broken line) within the Area 14 MPA. Green polygons represent areas of significant vegetation, while red polygons indicate areas of primary koala habitat.

e) Northern UIA

The northern UIA is largely devoid of native vegetation. The level of assessment undertaken for the purposes of this report provides sufficient data upon which to base recommendations concerning further development (refer to Appendix 1), details of which are summarised below.

- Maximising retention of native vegetation.
- Retention of the existing forested corridor on Lot 33 DP803801.
- Retention of a forested corridor on Lot 34 DP803801 (behind existing residential dwellings).
- Retention of old growth Tallowwoods on Lot 4 DP255923.
- Preparation of a Koala Plan of Management to address presence of *Core Koala Habitat* arising from presence of *potential koala habitat* and sightings of a female Koala with young at two locations (Lot 4 DP255923 and Lot 34 DP803801) within the UIA.

Sections of the northern UIA are also bush fire prone. Preliminary recommendations for bushfire planning purposes include:

- Provision for a development setback (APZ) of 30m along the western boundary, increased to 50m along the northern boundary.
- Provision for a development setback (APZ) from the proposed corridor on Lot 33 DP803801 of 30m (20m IPA, proposed corridor can accommodate 10m OPA).
- Provision for a development setback (APZ) from the proposed corridor on Lot 34 DP803801 of 30m (IPA + OPA).

f) Southern UIA

Notwithstanding the presence of both cleared areas and disturbed native bushland, the southern UIA contains a number of significant vegetation communities and is known to support a number of threatened species. The level of assessment undertaken for the purposes of this report does not (nor was it intended to) provide sufficient data upon which to base recommendations concerning further development beyond those presented in this report. Consequently, more detailed investigations of the area's flora and fauna should be undertaken prior to formulation of any LES for this area.

Appendix 1

Review of Environmental Factors

for the

Northern Urban Investigation Area 1a (part)

Introduction

This appendix relates to the preparation of a Local Environmental Study for the greater part of Area 1a of the Northern Urban Investigation Area within the Area 14 Master Planning Area. The land(s) in question (the LES area) is described as Lots 1 and 4 DP255923, Lots 2 and 3 DP706357, Lot 5 DP594793, Lot 3 DP634929, Lots 1 and 2 DP811601 and Lots 33 and 34 DP 803801.

Assessment of the LES area was undertaken as follows:

Flora

The possible presence of native plant species currently listed on Schedules 1 and 2 of the *Threatened Species Conservation Act 1995* (including endangered populations and ecological communities) was determined on the basis of a site inspection, supported by a search of the New South Wales National Parks and Wildlife Service's 'Wildlife Atlas' database. The database search area represented a window of approximately 100 km^2 defined by UTM Easting^{min} 478000, Easting ^{max} 488000; Northing ^{min} 6503000, Northing ^{max} 6513000.

Fauna

The possible presence of fauna species currently listed on Schedules 1 and 2 of the *Threatened Species Conservation Act 1995* (including endangered populations and ecological communities) was similarly determined on the basis of an on-ground inspection and search of the New South Wales National Parks and Wildlife Service's 'Wildlife Atlas' database (see above).

The LES area was inspected on the on the 23rd – 26th October, and the 16th November, 2002.

Results

The LES area has been modified by various land uses that include logging, agriculture and urban development. From an ecological perspective such activities have left the site heavily disturbed to the extent that the greater proportion of the area is now devoid of native vegetation. The general aspect is east to north-easterly with

ephemeral water courses draining into the adjoining SEPP 14 Wetland No. 509 and Lake Innes Nature Reserve.

1. Flora

Notwithstanding the fact that the greater proportion of the LES area is cleared, some unmapped stands of native vegetation remain. In the south, a remnant of Dry Sclerophyll Forest persists, the community dominated by Grey Gum *E. propinqua* growing in association with Northern Grey Ironbark *E. siderophloia*, Tallowwood *E. microcorys* and Broad-leaved White Mahogany *E. carnea*. At the southeastern periphery of the existing residential area, a linear strip of vegetation comprising Forest Red Gum *E. tereticornis*, Broad-leaved paperbark *Melaleuca quinquenervia* and Swamp Oak *Casuarina glauca* also forms a narrow riparian community immediately behind residential dwellings, the community abutting an area of regrowth *C. glauca* forest that extends to the southeast. Some hollow-bearing trees occur in the former area.

Towards the north of the LES area a narrow strip of vegetation (mapped by Ecovision as community type 3512) buffers a drainage line that links the Queens Lake State Forest in the west to Lake Innes Nature Reserve and associated SEPP 14 Wetland No. 509. Old growth attributes exist here also, specifically in the form of hollow-bearing *E. tereticornis*. The eastern and northern parts of the LES area adjoining Lake Innes Nature Reserve support vegetation communities largely dominated by *Melaleuca quinquenervia*, often growing in association with eucalypts such as Swamp Mahogany *E. robusta*. Elsewhere within the LES area, native vegetation persists in the form of smaller stands and scattered paddock trees, notable amongst which are some large, mature Tallowwoods on Lot 4 DP255923.

The 'Wildlife Atlas' database search provided records for 9 threatened plant species within the prescribed search area, accounts of which are detailed in the preceding report. No plant species listed on Schedules 1 and 2 of the *Threatened Species Conservation Act 1995* were detected within the LES area during the course of the assessment, nor does the site contain any listed critical habitat, endangered populations or ecological communities.

2. Fauna

The 'Wildlife Atlas' database search provided records for 17 threatened fauna species within the prescribed search area, details of which have been outlined in the preceding report. The history of land use and largely fragmented vegetation of the LES area render it of diminished importance (at this point in time) to some of the species listed above while key habitat attributes essentially rule out the presence of others. Nonetheless, we did record both Square-tailed Kites and Koalas within the LES area, while habitat attributes such as hollow bearing trees and the presence of ephemeral watercourses suggest that the potential presence of other species such as the Wallum froglet, Grey-headed Flying-fox, Little Bent-wing Bat and Greater Broad-nosed Bat, cannot be readily discounted. Such considerations warrant a precautionary approach for planning purposes, including the adoption of generic measures intended to minimise the potential for negative impacts on threatened species known or otherwise considered likely to utilise the general area.

The LES area does not contain any listed critical habitat, endangered populations or ecological communities.

Other considerations

SEPP 44 (Koala Habitat Protection)

State Environmental Planning Policy No. 44 (SEPP 44) commenced on the 13th February 1995, its aim to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline by:

d) requiring the preparation of plans of management before development consent can be granted in relation to areas of core koala habitat; and
e) encouraging the identification of areas of core koala habitat; and
f) encouraging the inclusion of areas of core koala habitat in environment protection zones.

The Hastings Local Government Area is listed in Schedule 1 of the policy as lands to which the policy applies. The LES area is larger than one hectare and is thus subject to Part 2 (Development Control of Koala Habitats).

Matters for Consideration

A. Presence of *Potential Koala Habitat.*

For the purposes of SEPP 44, potential koala habitat "*means areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component*."

Response:

Primary koala food trees growing in the study area are Forest Red Gum (*E. tereticornis*), Tallowwood (*E. microcorys*) Swamp Mahogany (*E. robusta*) and Grey Gum (*E. propinqua*). With few exceptions, much of the remaining vegetation within the LES area constitutes potential koala habitat on the basis that they all support one or more koala food tree species. While some may not explicitly satisfy the "15% density threshold" for preferred food tree species, we submit that the presence/absence of primary food trees provides the better indicator of potential koala habitat for SEPP 44 purposes.

B. Presence of *Core Koala Habitat.*

For the purposes of SEPP 44, *Core Koala Habitat* "*… means an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population.*"

Response:

In order to examine the extent to which potential koala habitat was being used by koalas, each of the stands of native vegetation received a cursory inspection for evidence of use by koalas, assessment focussing on inspection of preferred food trees. The trees were assessed using a faecal pellet-based methodology described by Phillips and Callaghan (submitted), that relies on the presence/absence of faecal pellets in a prescribed search area around the base of a tree. Most of the LES area did not appear to support a resident koala population at this point in time, with the exception of Lot 4

DP255923 where both faecal pellets and a female koala with young were observed. A further sighting of a female with young (presumably the same animal) was recorded on Lot 34 DP803801 during November .

Conclusion

Given the presence of a female koala with young we conclude that at least part of the LES area qualifies as *Core Koala Habitat*, thus necessitating a site specific Koala Plan of Management to be prepared in accord with Part 3 of the SEPP 44 as a component of any subsequent development applications.

General Recommendations

The recommendations below detail measures that we believe will need to be taken in order to avoid any adverse impacts on threatened species within the LES area. Justification for these recommendations are as follows.

1. The LES area contains areas of native vegetation with old-growth elements (ie tree hollows) that represent a finite resource for several of the threatened fauna species known to occur in the general area. Thus old-growth elements need to be retained in order to avoid the potential for adverse impacts.

2. In order not to adversely impact on wider-ranging threatened species such as Grey-headed Flying foxes and Square-tailed Kites, landscape-scale retention of habitat elements is necessary. In the case of the Grey-headed Flying fox, recognition of flowering phenology and the need to retain the floral resources offered by key *Eucalyptus* and *Corymbia* spp. is required. Maximizing the retention of native vegetation will benefit these and other species

3. The Lake Innes Nature Reserve and associated SEPP14 wetland areas are a significant conservation and recreational resource to which the LES area is inextricably linked, in addition to providing habitat for a range of threatened species including Jabirus and Square-tailed Kites. These areas require effective buffering in order that movement corridors, foraging, roosting and nesting habitat for threatened species are maintained and that key ecological processes related to water quality maintenance are not impaired.

4. Forest Red Gum, Tallowwood, Swamp Mahogany and Grey Gum are preferred food trees for koalas within the LES area. Thus effective conservation of above mentioned species should be seen as an *a priori* consideration in terms of koala habitat management, more so given the established presence of *Core Koala Habitat*.

Key Recommendations:

⇒ *Maximising retention of native vegetation*.

Planning should endeavour to maximise the retention of native vegetation within the LES area generally.

⇒ *Retention in its entirety of the existing forested corridor on Lot 33 DP803801*.

This corridor buffers a drainage line entering the Lake Innes Nature Reserve and associated SEPP14 wetland and should be retained for its aesthetic, hydrological and habitat values.

⇒ *Retention of a forested corridor on Lot 34 DP803801 (behind existing residential dwellings).*

This narrow corridor similarly buffers a drainage line entering the Lake Innes Nature Reserve and associated SEPP14 wetland and should be retained for its aesthetic, hydrological and habitat values. The proximity of existing residential allotments to the north has already compromised the longer-term ecological integrity of this area. A logical southern boundary (excluding any APZ requirements) exists at the ecotone of this community with the adjoining regrowth Swamp Oak forest.

⇒ *Retention of old growth Tallowwoods on Lot 4 DP255923*.

Independently of any recommendations arising from the proposed KPoM (see below), retention of the two mature Tallowwoods on this lot is advocated on aesthetic and ecological grounds, with retention accompanied by a protective buffer of approximately 30metres around each of the two trees.

⇒ *Preparation of a Koala Plan of Management*

A site specific Koala Plan of Management will ultimately be required to address the presence of *Core Koala Habitat* arising from presence of both *Potential Koala Habitat* and sightings of a female Koala with young at two locations (Lot 4 DP255923 and Lot 34 DP803801) within the LES area. In order to ensure

compatability for planning purposes, we submit that preparation of the KPoM should ideally preceed completion and public exhibition of the proposed LES.

Bush fire management

Sections of the UIA are also bush fire prone. Preliminary recommendations for bushfire planning purposes include:

⇒ Provision for a development setback (APZ) of 30m along the western boundary, increased to 50m along the northern boundary.

⇒ Provision for a development setback (APZ) from the proposed corridor on Lot 33 DP803801 of 30m (20m IPA, proposed corridor can accommodate 10m OPA).

⇒ Provision for a development setback (APZ) from the proposed corridor on Lot 34 DP803801 of 30m (IPA + OPA).

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