Appendix H

ECOLOGICAL CONTRAINTS - CATHERINE HILL BAY AND MOONEE

STATEMENT OF EFFECT

ON THREATENED FLORA AND FAUNA

for the
Proposed Development

of

Part Lot 2 DP809795
CATHERINE HILL BAY, NSW

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February 2004

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1.0 INTRODUCTION

Flora, fauna and habitat studies as part of a Statement of Effect on Threatened Flora and Fauna have been undertaken over Lot 2 DP809795 Catherine Hill Bay, NSW (Figure 1). The investigations have been undertaken in accordance with the requirements of the Environmental Planning and Assessment Act 1979 (EPA Act) and the Threatened Species Conservation Act 1995 (TSC Act). The results are presented here in the form of a Statement of Effect on Threatened Flora and Fauna, incorporating an assessment of the site under the provisions of State Environmental Planning Policy (SEPP) No. 14 – 'Coastal Wetlands', State Environmental Planning Policy No. 44 – 'Koala Habitat Protection' and the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

This Statement of Effect attempts to determine any potential impacts upon any threatened flora and fauna as a result of the proposal. This Statement of Effect is not intended to be a Species Impact Statement (SIS) and nothing in the report should be taken as a presumption of the need for an SIS on this site.

1.1 GENERAL DESCRIPTION OF THE SITE

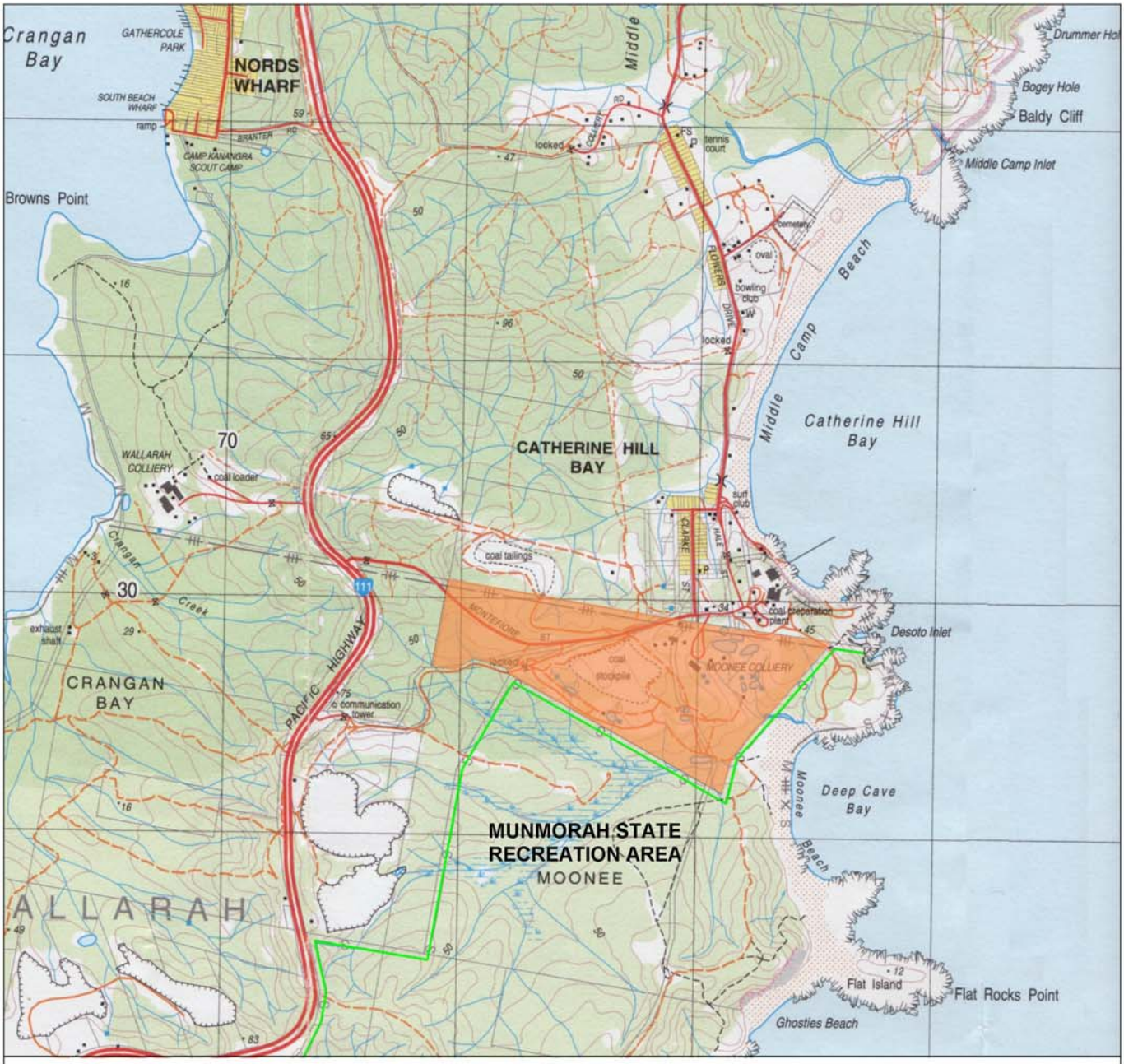
1.1 GENERAL DESCRIPTION OF THE STUDY AREA

The study area covers approximately 90ha of land and is located to the south of the township of Catherine Hill Bay and is bounded by Munmorah State Recreation Area to the south and east (Figure 1). The site has been subject to a significant number of past disturbances and forms part of the decommissioned Wallarah/Moonee Colliery, which is located between the Munmorah State Recreation Area to the south and Cams Wharf to the north. A number of roads traverse the site and provide pedestrian access to Moonee Beach to the east.

A coal dumping area dominates the central portion of the site and consists of a completely cleared area of approximately 4.5ha in size (Figures 2 and 3). This area has until recently been used to store the coal before being prepared and exported. Administration buildings and associated car parking facilities were located within the northeastern portion of the site. These buildings did not appear to have been used for some time and the landscaped areas were overgrown.

Also noted were approximately twenty constructed ponds of varying sizes within the eastern half of the site. These ponds were used as water retention ponds during the operation of the Colliery. At the time of the field survey some of the ponds were dry whilst others appeared to be near full (Figures 4 and 5).

In general, the majority of the site has been cleared as a result of the mining activities and remains in a disturbed form. Regenerating vegetation was noted in the northeastern corner of the site and around



Source: LPI (2001) 1:25,000 Topographic Map Sheet 9231-4S 'Catherine Hill Bay'

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0 250 500 750m 1km

N W E S

Figure 1: Locality Map

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Constructed Retention Ponds
Drainage Line
Site Boundary

Figure 2: Study Area

N

0 100 200 300 400 500
Scale (m)

Figure 3: Photo of Coal Dumping Area, December 2003.

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Figure 4: Photo of retention ponds, December 2003.

Figure 5: Photo of retention ponds, December 2003.

the edges of the coal dump. Weed invasion was evident over much of the site.

The topography of the site was variable with sheltered slopes ($0\text{-}5^0$, $5\text{-}10^0$ and $10\text{-}15^0$) occurring in the south-eastern and north-western portions of the site (Figure 2). These slopes were dominated by Narrabeen Wallarah Sheltered Grassy Forest. Within the central and north eastern portions of the site the land slopes gently ($0\text{-}5^0$ and $5\text{-}10^0$) towards Munmorah State Recreation Area to the south and Moonee Beach to the east. The vegetation within these areas was dominated by Coastal Headland Complex (Tall Scrub Variant), Coastal Headland Complex (Shrubland Variant) and Coastal Sand Wallum Heath-Scrub

A drainage line was noted within the south eastern portion of the site which drains through a small wetland area (Figure 6) located in the south eastern corner of the site (Figure 2). A drain and old pumping station was noted on the northern side of this water body and it is envisaged that it was also used during the operation of the Colliery. A wetland area borders the site to the south and has been identified as State Environmental Planning Policy 14 (SEPP 14) Wetland No. 891. This coastal wetland did not appear to be connected to the above drainage line although it may be influenced by surface runoff as it is located downslope of the site.

Soils on site were dominated by the Awaba Soil Landscape as described by Murphy (1993). This erosional landscape comprises rolling low hills on predominantly coarse-grained sediments of the Narrabeen Group and Newcastle Coal Measures in the Awaba Hills. Soils comprised conglomerate, sandstone, tuff, siltstone and black coal. Rock outcrop is generally absent and this landscape is exposed to strong salt-laden southerly winds in coastal areas. Areas of the Belmont Swamp Soil Landscape also border the site to the south. This swamp landscape is described by Murphy (1993) as being level to very gently undulating coastal swamps with a permanent water table usually present within 30cm of the soil surface. Soils consist of unconsolidated Quaternary sandy peats, peats and mud.

1.2 DESCRIPTION OF THE DEVELOPMENT PROPOSAL

No detailed development plans had been prepared for this site at the time of report writing and for the purposes of this study the proposal has been assessed as covering the entire site.

Figure 6: Photo of wetland located in south-eastern corner of the site, December 2003.

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2.0 SCOPE OF THE STUDY

This study was designed to map the plant communities and habitats present, to survey the fauna using the study area, as well as address the possibility of this study area being significant for any additional Schedule 1 and 2 (endangered and vulnerable) flora and fauna species. Survey methods have been confined to the study area, although surrounding habitats have been considered in the Section 5A assessments.

2.1 LEGISLATIVE REQUIREMENTS

This Statement of Effect on Threatened Flora and Fauna has been structured upon the guidelines laid down in Section 5A of the Environmental Planning and Assessment (EPA) Act (1979) and the Threatened Species Conservation (TSC) Act (1995), which requires consideration of the impact of the proposal upon any 'Endangered' or 'Vulnerable' (collectively referred to as 'threatened') species and their habitats expected or found on site. Consideration has also been afforded to the Wyong Shire Squirrel Glider Conservation Management Plan (Smith, 2002) and the Commonwealth legislation via the Environment Protection and Biodiversity Conservation Act 1999. Assessments have been made to determine whether or not the proposal or activity will have a significant effect on a matter of National Environmental Significance.

As Koalas have been recorded within the locality, an assessment under State Environmental Planning Policy No. 44 – 'Koala Habitat Protection' has been undertaken.

As the study area borders SEPP 14 Wetland No. 891, an assessment under State Environmental Planning Policy No. 14 – 'Wetland Protection' has also been included.

Fieldwork was conducted under the NSW National Parks and Wildlife Service (NPWS) Scientific Licence S10475 – Joanne Woodhouse. Fieldwork undertaken by Wildthing Environmental Consultants is also covered by the University of Newcastle's Animal Care and Ethics Committee (Approval Number 647 1102). Wildthing Environmental Consultants is also accredited as an Animal Research Establishment with the NSW Department of Agriculture (Reference No. 98/087).

3.0 METHODOLOGY

3.1 VEGETATION SURVEY METHODOLOGY

Flora investigations in accordance with Wyong Shire Council's Flora and Fauna Survey Guidelines (Appendix E) were undertaken after determining that the site was in the area class of 11-100ha. Accordingly, this then led to the establishment and consideration of seven vegetation survey plots each 20m × 20m in area and six walking transects, each 200m long. Within each plot, the height (m) of each primary structural layer, and relative cover abundance (%) of species occurring therein was recorded as well as its location, elevation, slope, aspect and general soil type. Similarly, during transect surveys, all species observed within 2m either side of the tape were recorded as well as the physical attributes of the surrounding area. In addition to the above, general flora investigations across the study area were undertaken in the manner described by Cropper (1993) as the 'Random Meander Technique'. This involves walking throughout the study area, visiting the full range of potential habitats and recording every plant seen. During fieldwork, targeted habitat searches were undertaken for any threatened flora species identified by literature and database searches.

A full list of vegetation species recorded during fieldwork is listed in Appendix B. The results of the vegetation plots and transects are provided in Appendix C.

The 'Natural Vegetation of the Wyong Local Government Area, Central Coast, New South Wales' report (Bell, 2002) was also reviewed in order to assess the occurrence of regionally and/or locally significant vegetation communities in the local area, which has been further addressed in Sections 4.1.3 of this report.

3.2 HABITAT SURVEY METHODOLOGY

Habitat may be defined as the physical and biological environment required for the survival of a specific population of a species. In modern usage, habitat has also come to be regarded as an association of landform and plant life which provides sustenance and shelter for a particular fauna assemblage. While the former definition is often that invoked by legislation requiring the consideration of the impact of a development on a threatened species, the latter probably has equal validity from an ecological point of view. In this report both approaches will be undertaken.

The methodology employed by this habitat survey used the vegetation community data combined, where relevant, with geomorphological features to provide a basis for a subjective habitat assessment aimed at placing the ecological status of this site within a local perspective.

3.2.1 GENERAL HABITAT FOR NATIVE SPECIES

From the vegetation assessment and general description of the site and surrounding areas, a subjective assessment of the general habitat value of the site was made. Considered in this assessment were:

- occurrence of that habitat type in the general vicinity;
- degree of disturbance and degradation;
- area occupied by that habitat on site;
- continuity with similar habitat adjacent to the site, or connection with similar habitat off site, by way of corridors; and
- structural and floral diversity.

3.2.2 HABITAT FOR THREATENED SPECIES

The study area was evaluated as potential habitat for each of the threatened species reported on the NPWS Wildlife Database and Environment Australia's online database from within 10km of the study area. This evaluation was based mainly on the specific requirements of each species in regards to home range, feeding, roosting, breeding, movement patterns and corridor requirements for fauna, and vegetation associations, topography, soil, light and hydrological requirements for flora.

3.3 FAUNA SURVEY METHODOLOGY

The fauna surveys undertaken consisted of the production of an Expected Fauna Species List (Appendix D), an assessment of the potential use of the study area by any threatened species identified in the NPWS's and Environment Australia's databases and the confirmation and supplementation of the Expected Fauna Species List by observation, trapping and recording.

The fieldwork was undertaken in accordance with Wyong Shire Council's Flora and Fauna Survey Guidelines (Appendix E) after determining that the site was in the area class of 11-100ha and comprised of four main vegetation assemblages. Accordingly, this then led to the establishment and consideration of four fauna survey plots.

3.3.1 SMALL TERRESTRIAL MAMMAL SURVEY

Small terrestrial mammal trapping using forty Elliott Type A traps (8×10×33cm) was undertaken across the site. The position of the traplines is shown in Figure 7. The traps were set approximately 20m apart giving a total of four traplines at least 200m in length. The traps were hidden in thick grass, under shrubs or near fallen logs and were camouflaged with vegetation where the ground cover was sparse or it was thought interference by humans might occur. The baits used were a mixture of rolled oats and honey, Good-O's (dry dog food) and peanut butter. The traps were set out for 4 nights each, giving a total of 160 small terrestrial trap nights. The traps were checked early each morning and, where necessary, reset and rebaited.

Figure 7: Trap Locations

3.3.2 MEDIUM TERRESTRIAL MAMMAL SURVEY

Twenty-four medium (21×23×53cm) cage traps were used during the medium terrestrial mammal trapping programme, with six traps distributed along each of the four small terrestrial mammal traplines (Figure 7). The traps were set out for four nights each giving a total of 96 medium terrestrial cage trap nights.

3.3.3 ARBOREAL MAMMAL SURVEY

Under the Wyong Shire Council (1999) guidelines the arboreal mammal survey involves two survey techniques, being trapping and spotlighting. Due to the highly disturbed nature of the site and the young age of the regenerating vegetation, only 15 of the 24 arboreal mammal traps required by the Wyong Shire Council (1999) guidelines were used in this instance.

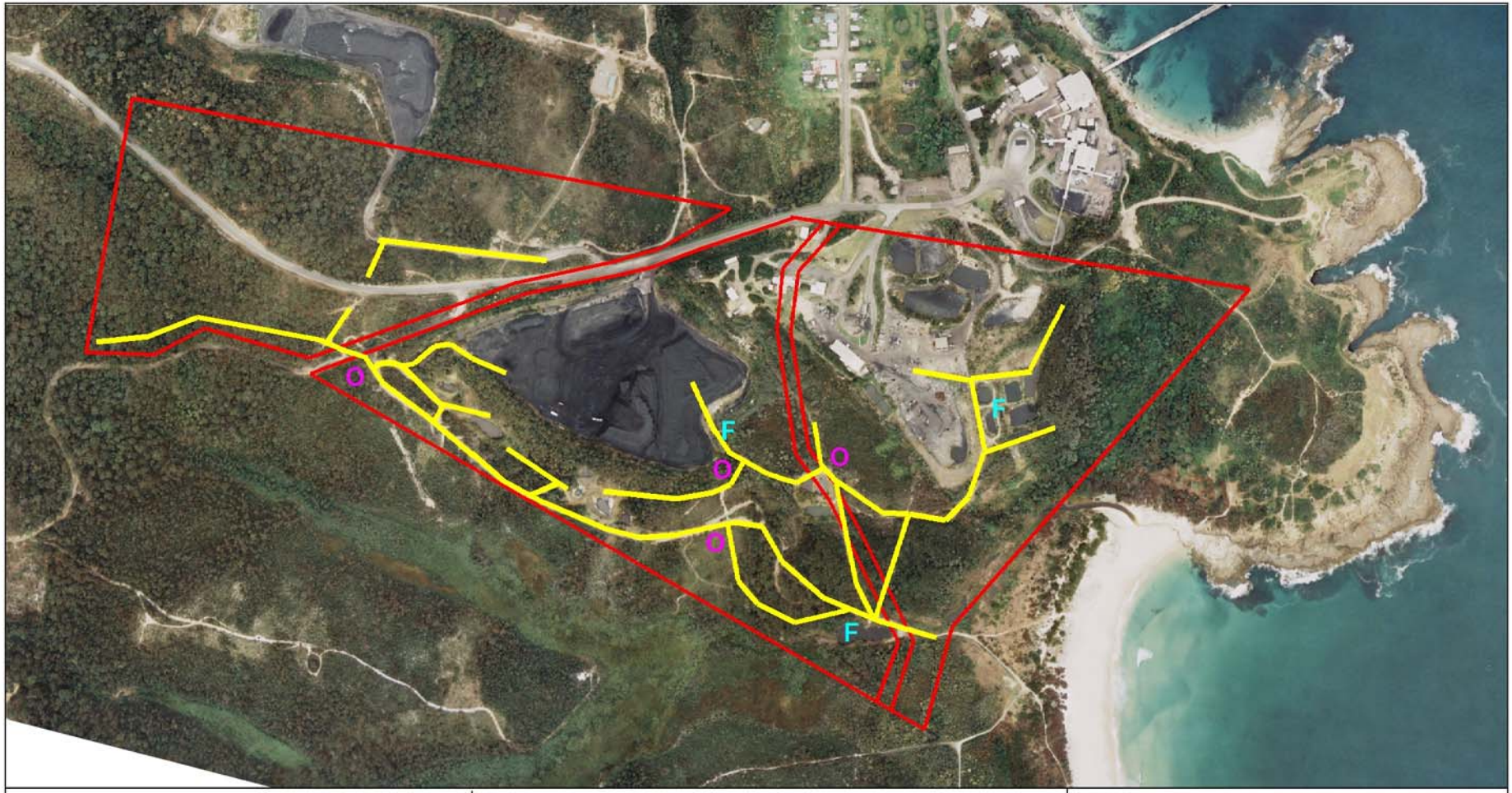
Fifteen Elliott Type B traps (15×15.5×45cm) were placed in trees to determine the presence of arboreal mammals on site, especially *Petaurus norfolcensis* (Squirrel Glider) which was recorded on the NPWS database as being present within two kilometres of the site. The arboreal traps were placed in or near trees which were considered to be potentially utilised by arboreal animals. Trees which were targeted contained hollows, were flowering or had scratches present on the boles. The traps were placed around 3 metres above ground level on platforms mounted on tree trunks. The baits used consisted of a rolled oats and honey mixture, peanut butter and an aniseed ring (sugar coated sweet). The arboreal traps were sprayed with vanilla essence mixed in water before being placed in the trees to disguise the smell of human contact. The traps were set out for 4 nights each, giving a total of 60 arboreal mammal trap nights.

Spotlighting surveys were undertaken across the site during the two-week survey period for a total of 9 person hours. The surveys were undertaken using hand-held 55 Watt torches and involved walking throughout the site as indicated in Figure 8.

3.3.4 MICROCHIROPTERAN BAT SURVEY

The Wyong Shire Council (2001) guideline requirements in regards to microchiropteran bat surveys for this site included the use of both harp traps and echolocation call recording.

The guidelines require that harp trapping constitute at least two harp trap nights per fauna survey site (i.e. eight harp trap nights). The location of these harp trapping sites is indicated in Figure 7. The monofilament harp traps used have a catch surface area of approximately 4.2m^2. The trapping locations were positioned along flyways considered likely to be used by bats and were selected on the basis of the potential hunting appeal to sub-canopy microchiropteran bat species. In particular, the



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O Owl Call Broadcast Location
F Frog Recording Site
Spotlight and Anabat Route
Site Boundary

Figure 8: Nocturnal Surveys

N

0 100 200 300 400 500
Scale (m)

threatened *Mormopterus norfolkensis* (East Coast Freetail-Bat), *Miniopterus australis* (Little Bentwing-bat) and *Scoteanax rueppellii* (Greater Broad-nosed Bat). The traps were checked early each morning with any species captured being identified using dichotomous keys and commercially available field guides.

Bat echolocation call recording was undertaken using a mobile Anabat detector in order to effectively cover the study area (shown on Figure 8). This survey was designed to indicate both the presence of higher flying threatened bat species which may have been missed by the harp trapping survey, specifically *Miniopterus schreibersii* (Large Bentwing-bat), and also lower flying species targeted in the harp trapping survey. The bat detecting was undertaken for a total of three hours over three separate evenings. The transformed calls were analysed using an Anabat Zero Crossing Analysis Interface feeding into a computer and identified by comparison with sample bat calls supplied by the manufacturer of the equipment.

3.3.5 MEGACHIROPTERAN BAT SURVEY

The Wyong Shire Council (1999) guideline requirements in regards to megachiropteran bat surveys for this site entailed a combination of both spotlighting and listening.

This requirement has been satisfied through the undertaking of 9 person hours of spotlighting with the aid of hand-held 55 Watt torches. During these surveys a walking rate of approximately 1km/hr was applied and a careful watch was kept overhead and in the tops of trees for the presence of megachiropteran bat species, in particular the threatened *Pteropus poliocephalus* (Grey-headed Flying-fox) which has been previously recorded within the local area. The spotlighting route is shown in Figure 8.

3.3.6 AMPHIBIAN SURVEY

The Wyong Shire Council (1999) guideline requirements for amphibian surveys for this site included both nocturnal and diurnal searches.

The requirement of diurnal amphibian searches has been satisfied with one person hour searches having been completed, on three separate days in conjunction with the reptile searches as described below. Searches in likely habitat, especially along drainage lines and areas of thicker vegetation, were undertaken for frogs during these surveys.

During nocturnal amphibian searches, spotlighting and the playback of recorded frog calls of the threatened species *Crinia tinnula* (Wallum Froglet) and *Litoria aurea* (Green and Golden Bell Frog) were undertaken (Figure 8). Specific spotlighting searches were satisfied by undertaking one person

hour of searches in appropriate habitat on three separate nights. Frogs were identified by call or sight. Any frog calls heard on the site were recorded and then identified by auditory comparison with commercially available frog call recordings.

3.3.7 REPTILE SURVEY

The Wyong Shire Council (1999) guideline requirements in regards to reptile surveys for this site included nocturnal, diurnal and specific habitat searches.

The requirement that diurnal searches constitute at least one person hour on three separate days has been satisfied by the accumulated amount of diurnal fieldwork undertaken during the course of investigations together with one person hour of amphibian/reptile surveys, on three days being undertaken. The requirement that nocturnal searches be conducted has been satisfied through the undertaking of 9 person hours of spotlighting with the aid of hand-held 55 Watt torches.

3.3.8 AVIFAUNA SURVEY

The requirement of diurnal avifauna searches has been satisfied by conducting a plot census of at least one hour for each of the vegetation communities. Surveys were conducted during periods of high activity ie. early morning or late afternoon. All bird species seen or heard were identified by the use of dichotomous keys and commercially available avifauna field guides.

The requirement that nocturnal avifauna surveys include one point census/square kilometre has been satisfied through the broadcasting of pre-recorded calls of *Tyto novaehollandiae* (Masked Owl) and *Ninox strenua* (Powerful Owl) were undertaken through an amplification system designed to project the sound for at least 1km under still night conditions. The calls were repeated several times in four different directions and replies were listened for after each call. The locations of the call playback censuses are shown in Figure 8.

3.3.9 SECONDARY INDICATIONS AND INCIDENTAL OBSERVATIONS

Both opportunistic sightings and targeted searches of secondary indications (scratches, scats, diggings, tracks etc.) of resident fauna were undertaken and included searches for whitewash and regurgitation pellets from Owls, chewed (*Allo*)*Casuarina* cones from Black-Cockatoos, fruit remains from Fruit-Doves, and other obvious features such as raptor nests. Searches were also undertaken for arboreal mammal scats in conjunction with the SEPP 44 plots (see Section 7.1 of this report).

3.4 SURVEY DATES, TIMES & WEATHER CONDITIONS

A summary of the time spent on site during fieldwork and the prevailing weather conditions at the time is contained below in Table 1.

Table 1: Survey Dates, Times and Weather Conditions

DATE	TIME	ACTIVITY	WEATHER
8/12/03	1230 - 1400 1400 - 1715 1715 – 1930 1930 – 2015 2015 - 2130	General observations Setting out traps Vegetation plot and transect Set up harp trap Spotlighting, microchiropteran bat call survey and owl call playback census	Clear sky, light easterly winds ≈17°C Clear sky, still ≈20°C Warm, 3/8 cloud cover, still ≈17°C. Full moon.
9/12/03	0500 – 0700 0700 – 0800 0800 – 0930 1030 – 1130 1615 – 1730	Checking traps Bird census and general observations Diurnal frog and reptile survey Vegetation plots and transects Set up harp traps	Warm, overcast, still ≈16°C. Overcast, still ≈17°C. Overcast, light south easterly winds ≈22°C. Clear, light south easterly wind ≈25°C.
10/12/03	0515 – 0715 0715 – 0800 0800 – 1030 1030 – 1130 1615 – 1730	Checking traps Bird census and general observations Vegetation plots and transects Diurnal frog and reptile survey Set up harp traps	Warm, overcast, still ≈17°C. Clear, still ≈22°C. 2/8 cloud cover, still ≈22°C. Clear, light south easterly wind ≈25°C.
11/12/03	0515 – 0715 0715 – 0745 0745 – 0945 0945 – 1030 1930 –2015 2015 - 2130	Checking traps Bird census Vegetation plots and transects Diurnal frog and reptile survey and searches for secondary indications Set up harp traps Spotlighting, microchiropteran bat call survey and owl call playback census	Cool ≈17°C, 3/8 cloud cover. Warm ≈19°C, 2/8 cloud cover. ≈25°C, 4/8 cloud cover, still and humid.
12/12/03	0515 – 0900	Collecting traps	Warm ≈20°C, still and overcast. Showers @ 0730.
16/12/03	2015 – 2030 2030 - 2230	Bird census Spotlighting, microchiropteran bat call survey and owl call playback census	Warm ≈22°C, light north westerly breeze and clear Clear ≈17°C, still and 1/8 cloud cover. Full moon rising
17/12/03	0815 - 1530	Vegetation plots and transects, SEPP 44 plots and arboreal mammal faecal counts	Cool ≈17-21°C, clear, still
18/12/03	0830 - 1330	General observations and targeted flora survey.	Warm ≈28°C, still

3.5 SIGNIFICANT SPECIES

The following threatened species have been recorded on the NPWS Wildlife Database from within 10km of the study area and on the Environment Australia's Database indicating the availability of potential habitat within 10km of the site.

1. *Acacia bynoeana*	Tiny Wattle
2. *Angophora inopina*	Charmhaven Apple
3. *Caladenia tessellata*	Thick-lipped Spider-orchid
4. *Callistemon linearifolius*	
5. *Chamaesyce psammogeton*	Coastal Spurge
6. *Cryptostylis hunteriana*	Leafless Tongue-orchid
7. *Diuris praecox*	Double-tailed Orchid
8. *Eucalyptus camfieldii*	Camfield's Stringybark
9. *Microtis angusii*	Onion Orchid
10. *Syzygium paniculatum*	Magenta Lillypilly
11. *Tetratheca juncea*	Black-eyed Susan
12. *Crinia tinnula*	Wallum Froglet
13. *Heleioporus australiacus*	Giant Burrowing Frog
14. *Litoria aurea*	Green and Golden Bell Frog
15. *Litoria littlejohni*	Littlejohn's Tree Frog
16. *Mixophyes iteratus*	Southern Barred Frog
17. *Hoplocephalus bungaroides*	Broad-headed Snake
18. *Chelonia mydas*	Green Turtle
19. *Dermochelys coriacea*	Leathery Turtle
20. *Calidris tenuirostris*	Great Knot
21. *Charadrius leschenaultii*	Greater Sand-Plover
22. *Charadrius mongolus*	Lesser Sand-Plover
23. *Ephippiorhynchus asiaticus*	Black-necked Stork
24. *Ixobrychus flavicollis*	Black Bittern
25. *Haematopus fuliginosus*	Sooty Oystercatcher
26. *Haematopus longirostris*	Pied Oystercatcher
27. *Puffinus assimilis*	Little Shearwater
28. *Puffinus carneipes*	Flesh-footed Shearwater
29. *Sterna albifrons*	Little Tern
30. *Limosa limosa*	Black-tailed Godwit
31. *Limicola falcinellus*	Broad-billed Sandpiper
32. *Rostratula benghalensis australis*	Painted Snipe
33. *Lathamus discolor*	Swift Parrot
34. *Xanthomyza phrygia*	Regent Honeyeater
35. *Ptilinopus regina*	Rose-crowned Fruit-Dove
36. *Ptilinopus superbus*	Superb Fruit-Dove
37. *Climacteris picumnus victoriae*	Brown Treecreeper
38. *Stagonopleura guttata*	Diamond Firetail
39. *Calyptorhynchus lathami*	Glossy Black-Cockatoo
40. *Pandion haliaetus*	Osprey
41. *Ninox strenua*	Powerful Owl
42. *Tyto novaehollandiae*	Masked Owl
43. *Dasyurus maculatus*	Tiger Quoll
44. *Planigale maculata*	Common Planigale
45. *Phascolarctos cinereus*	Koala
46. *Petaurus norfolcensis*	Squirrel Glider
47. *Pteropus poliocephalus*	Grey-headed Flying-fox
48. *Petrogale penicillata*	Brush-tailed Rock Wallaby
49. *Potorous tridactylus*	Long-nosed Potoroo

50. *Chalinolobus dwyeri*	Large-eared Pied Bat
51. *Mormopterus norfolkensis*	Eastern Freetail-bat
52. *Miniopterus australis*	Little Bentwing-bat
53. *Miniopterus schreibersii*	Large Bentwing-bat
54. *Myotis adversus*	Large-footed Myotis
55. *Scoteanax rueppellii*	Greater Broad-nosed Bat

4.0 RESULTS

4.1 VEGETATION SURVEY RESULTS

A general description of the flora assemblages identified on site is given below. A full list of the flora species recorded during fieldwork is listed in Appendix B. Further vegetation data detailing the results of transect and plot surveys is given in Appendix C.

4.1.1 FLORA ASSEMBLAGES

The site was found to support five vegetation assemblages as defined in 'Vegetation Survey, Classification and Mapping: Lower Hunter and Central Coast Region' (NPWS, 2000), being:

- Coastal Plains Smooth-barked Apple Woodland;
- Coastal Wet Sand Cyperoid Heath;
- Coastal Sand Wallum Woodland-Heath;
- Coastal Clay Heath; and
- Coastal Sand Scrub.

The 'Natural Vegetation of the Wyong Local Government Area, Central Coast, New South Wales' Report (Bell, 2002) has identified these communities within the Wyong Local Government Area (LGA) as four communities, being:

- Narrabeen Wallarah Sheltered Grassy Forest;
- Coastal Headland Complex (Tall Scrub Variant;)
- Coastal Headland Complex (Shrubland Variant); and
- Coastal Sand Wallum Heath-Scrub.

For the purposes of this assessment, the vegetation communities on site have been addressed as those contained in Bell (2002). Also noted within the bounds of the study area were areas of regenerating vegetation evidenced by the young, uniform age of the dominant species. These areas were located within the vicinity of the highly disturbed coal dump and administration areas. Whilst these areas have been mapped, they have not been described here as they were found to share similar species and community characteristics with all of the communities described below.

The relative distribution of the vegetation communities is shown in Figure 9*. A full list of the flora species recorded during fieldwork is listed in Appendix B. Further vegetation data detailing the results of transect and plot surveys is given in Appendix C.

> *Note on Vegetation Community Distribution Map: A map of vegetation of any area seeks to describe the distribution of the plant species in that area by defining a number of vegetation units (assemblages or communities) which are relatively internally homogenous. Whilst such mapping is a convenient tool, it greatly oversimplifies the real situation. Plants rarely occur in well defined communities with distinct boundaries. Accordingly vegetation units used for the accompanying map should be viewed as indicative of their extent rather than being precise edges of communities.

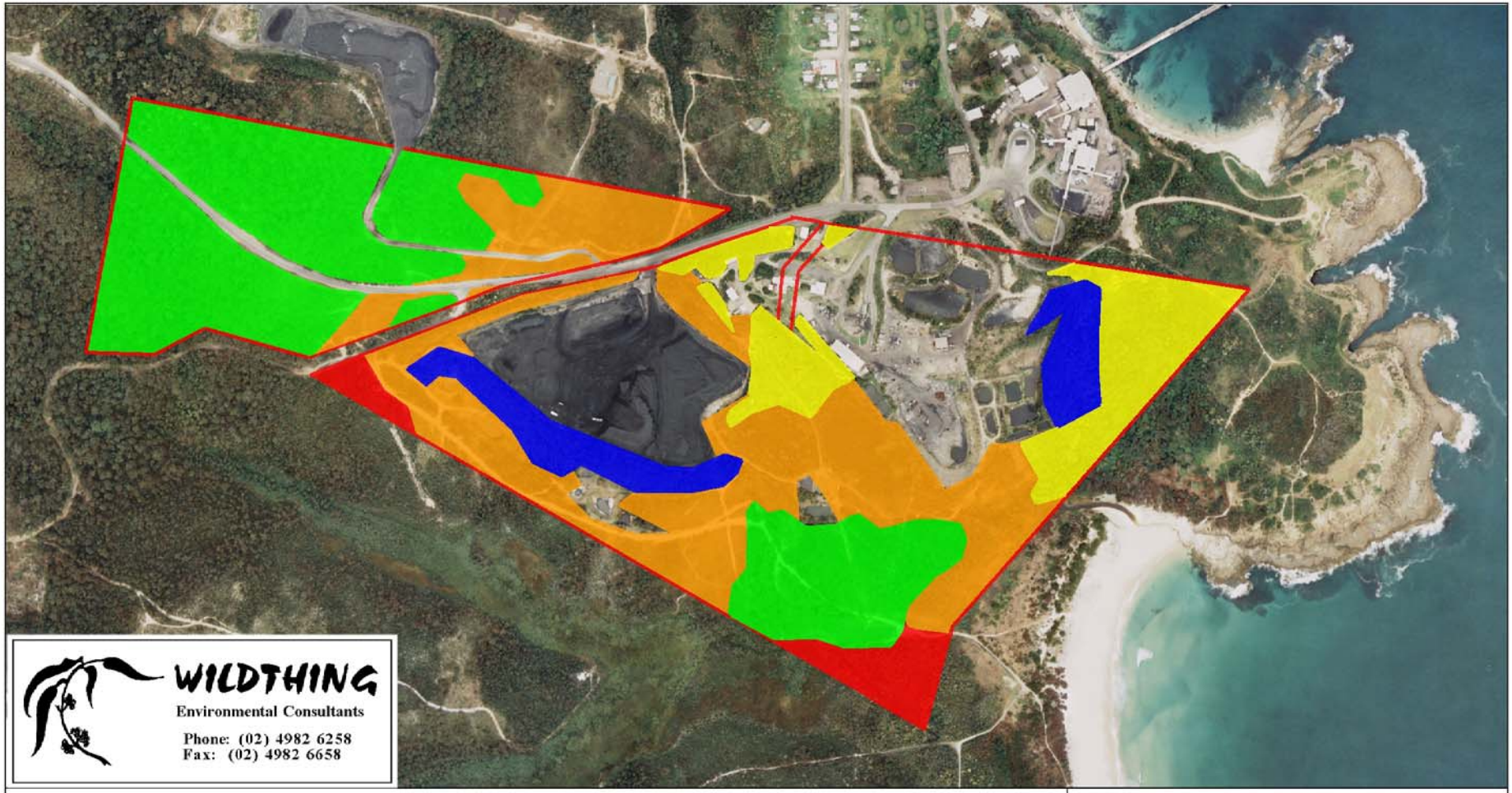

Figure 9: Vegetation Communities

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January 2003

- **Narrabeen Wallarah Sheltered Grassy Forest**

This community dominated the western portion of the study area as well as along the drainage line in the south eastern portion of the site. Narrabeen Wallarah Sheltered Grassy Forest occurs on the slopes and ridges of the Wallarah Peninsula in the north east of the Wyong LGA (Bell, 2002). On site, this community was characterised by *Angophora costata* (Smooth-barked Apple), *Eucalyptus piperita* (Sydney Peppermint) and *Eucalyptus haemastoma* (Scribbly Gum). *Eucalyptus capitellata* (Brown Stringybark), *Eucalyptus acmenoides* (White Mahogany) and *Corymbia gummifera* (Red Bloodwood) were also noted throughout.

Allocasuarina littoralis (Black She-Oak) and *Glochidion ferdinandi* var. *ferdinandi* (Cheese Tree) dominated the relatively sparse understorey with *Macrozamia communis* (Burrawang), *Banksia* species, *Lambertia formosa* (Mountain Devils), *Xanthorrhoea media* (Grass Tree), *Dodonaea triquetra* (Common Hop Bush) and *Acacia* species co-dominating the dense shrub layer.

The ground cover varied in density across this community and was composed of *Calochlaena dubia* (False Bracken), *Pteridium esculentum* (Bracken), *Cassytha glabella* (Devils Twine), *Geitonoplesium cymosum* (Scrambling Lily), *Pratia purpurascens* (White Root), *Goodenia heterophylla* (Variable Leafed Goodenia), *Entolasia stricta, Themeda triandra* (Kangaroo Grass), *Lomandra longifolia* (Spiny Mat Rush) and *Gahnia aspera. Tetratheca juncea* (Black-eyed Susan) was also found to be dominant within some of the vegetation plots as detailed in Appendix C. This species is recognised as threatened and has been further assessed in Section 5A of the EPA Act in Appendix A and Section 5.0 of this report.

- **Coastal Headland Complex**

The Coastal Headland Complex occurs on headlands and slopes exposed to onshore winds. As described by Bell (2002), this community forms a complex of merging vegetation types dependant on local soil conditions and disturbance history (Figure 10).

<u>Shrubland Variant</u>

The shrubland variant occurs on less exposed areas in the central portion of the site and supported localised dense thickets of *Allocasuarina distyla* towards the eastern extent of the community with species such as *Lambertia formosa* (Mountain Devils), *Grevillea sericea* (Pink Spider Flower), *Dodonea triquetra* (Common Hop Bush), *Acacia myrtifolia* (Myrtle Wattle) and *Pultenaea villosa* dominant throughout. Stunted *Eucalyptus piperita* and *Angophora costata* were noted in small pockets of this community, particularly where it bordered areas of Open Forest.

Figure 10: Photo of Heath Vegetation dominating the eastern portion of the site, December 2003.

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The ground cover varied in density in response to the canopy cover and supported species such as *Themeda triandra* (Kangaroo Grass), *Pimelea linifolia* ssp. *linifolia* (Rice Flower), *Lomandra obliqua* (Fishbones), *Lepidosperma laterale* (Sword Sedge) and *Pratia purpurascens* (White Root).

Tall Scrub Variant

The Tall Scrub Variant was identified in the eastern and central portions of the site and was characterised by tall scrub clearly dominated by *Leptospermum laevigatum* (Coastal Teatree). The shrublayer and ground cover were relatively sparse and were composed of those species identified within the Shrubland Variant as described above.

Chrysanthemoides monilifera (Bitou Bush) was also noted within the Coastal Headland Complex vegetation variants. Invasion of Native Plant Communities by *Chrysanthemoides monilifera* (Bitou Bush) is recognised as a Key Threatening Process under Schedule 3 of the TSC Act 1995 and has been further assessed under Section 5A of the EPA Act.

- **Coastal Sand Wallum Heath-Scrub**

The Coastal Sand Wallum Heath-Scrub generally occurs on the older coastal dune systems in more exposed areas than the better structured forests/woodlands and represents a community with no apparent tree layer, although small localised patches of stunted tree species may occur (Bell, 2002).

This community was identified along the southern boundary of the site and was characterised by the presence of *Banksia aemula* although distinct boundaries between Coastal Sand Wallum Heath Scrub and Coastal Headland Complex was hard to distinguish due to similar structure and common species such as *Pimelea linifolia* ssp. *linifolia* (Rice Flower), *Allocasuarina distyla, Acacia myrtifolia* (Myrtle Wattle), *Lambertia formosa* (Mountain Devils) and *Lomandra longifolia* (Spiny Mat Rush). Additional species noted within the shrublayer included *Acacia terminalis* (Sunshine Wattle), *Woollsia pungens* (Snow Wreath) and *Haemodorum planifolium* (Blood Root). *Chrysanthemoides monilifera* (Bitou Bush) was also noted within this community.

The ground cover varied in density in response to the canopy cover and was composed of species such as *Entolasia stricta*, *Pimelea linifolia* ssp. *linifolia* (Rice Flower) and *Pratia purpurascens* (White Root).

4.1.2 THREATENED PLANTS AND ECOLOGICAL COMMUNITIES

Eleven threatened flora species have been previously identified and recorded on the NPWS and the EA Databases within 10km of the study area, being

Acacia bynoeana	Tiny Wattle
Angophora inopina	Charmhaven Apple
Caladenia tessellata	Thick-lipped Spider-orchid
Callistemon linearifolius	
Chamaesyce psammogeton	
Cryptostylis hunteriana	Leafless Tongue-orchid
Diuris praecox	Double-tailed Orchid
Eucalyptus camfieldii	Camfield's Stringybark
Microtis angusii	Onion Orchid
Syzygium paniculatum	Magenta Lillypilly
Tetratheca juncea	Black-eyed Susan

The fieldwork undertaken included targeted searches for these threatened flora species. Careful cross –checking was undertaken where similar species were noted.

It must be noted that the fieldwork was undertaken outside of the known flowering period for *Diuris praecox* and *Microtis angusii* and at the beginning of the flowering period for *Cryptostylis hunteriana.* Accordingly, it is recommended that targeted searches for these species be undertaken within their respective flowering periods as contained within Table 2 below. The surveys should be undertaken in accordance with the guidelines contained in the Wyong Shire Guidelines (1999) and the Wyong Ground Orchid Survey (Guninnah, 2003) and be limited to those areas identified as containing potential habitat (Figure 11).

Table 2: Flowering Times of Selected Threatened Flora in Wyong Shire

	Summer			Autumn			Winter			Spring		
Orchid Species	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Cryptostylis hunteriana	■	■	■									■
Diuris praecox										■	■	
Microtis angusii										■	■	
Tetratheca juncea	■	■							■	■	■	■

Eight plants of *Tetratheca juncea* were identified across the western portion of the site within the areas of Narrabeen Wallarah Sheltered Grassy Forest. The locations of these plants have been indicated in Figure 11. Seed set was also noted on a number of the plants, which indicates that the plants on site form part of a viable, reproducing population. Whilst this species is recognised as being adequately conserved on a regional scale, the proposed development of this site may significantly

Figure 11: Location of Tetratheca juncea plants, December 2003.

impact upon the local population of this species. Accordingly, it is recommended that additional surveys be undertaken within the areas of potential habitat to more accurately indicate the extent of this population and to recommend ameliorative/protective measures if any significant impact is likely to result from development. Such surveys should be undertaken 2-3 times during the flowering season as indicated above in Table 2. These surveys should follow the guidelines outlined by Payne (2003).

None of the remaining threatened flora species were identified on site during the survey period.

None of the vegetation communities identified on site are recognised as Endangered Ecological Communities. Although, it is recognised that the Norah Head Variant of the Coastal Sand Wallum Heath-Scrub has been identified as the endangered Ecological Community 'Low Woodland with Heathland on Indurated Sands' although there appears to be some questions as to the significance of the community. (Bell, 2002)

4.1.3 LOCALLY AND REGIONALLY SIGNIFICANT PLANTS AND VEGETATION COMMUNITIES

The following species recorded on site have been identified on the Wyong Shire Significant Species Schedule (Bell, 2002; Wyong Shire Council DCP 14, 2002).

Table 3: Locally and Regionally Significant Plant Species Recorded on Site

Species	Regionally Significant	Locally Significant	Protected Species (NPWS Act 1994)	Keystone Species
Acacia binervia	✓			
Acacia buxifolia	✓			
Acacia elata	✓			
Acacia elongata	✓			
Adiantum aethiopicum Common Maidenhair Fern			✓	
Allocasuarina torulosa Forest Oak				✓
Angophora costata Smooth-barked Apple				✓
Banksia marginata Silver Banksia	✓			
Banksia species				✓
Bossiaea rhombifolia	✓			
Calystegia marginata	✓			
Calytrix tretagona	✓			
Cassinia uncata Bent Cassinia	✓			

Species	Regionally Significant	Locally Significant	Protected Species (NPWS Act 1994)	Keystone Species
Comesperma defoliatum Fairies' Wings	✓			
Corymbia gummifera Red Bloodwood				✓
Duboisia myoporoides Corkwood	✓			
Eucalyptus haemastoma Scribbly Gum				✓
Eucalyptus piperita Sydney Peppermint				✓
Eucalyptus punctata Grey Gum				✓
Eucalyptus robusta Swamp Mahogany		✓		✓
Eucalyptus tereticornis Sydney Red Gum				✓
Isopogon anemonifolius Drumsticks	✓			
Lepidosperma viscidum	✓			
Melaleuca species				✓
Notelaea ovata Mock Olive	✓			
Pultenaea daphnoides				
Quintinia seeberi Rough Possumwood	✓			
Symplocos thwaitesii Buff Hazelwood	✓			
Xanthorrhoea media Grass Tree	✓			

As indicated in Table 3 above, seventeen flora species identified on site are considered to be significant on a local or regional scale. Specimens of these species will be retained within the recommended vegetation corridor as discussed in Section 4.2.2 of this report. These areas of retained vegetation would also provide connection to similar vegetation off site.

One species is listed as 'Protected Species' as contained in Schedule 13 of the NPWS Act (1974). These plants cannot be picked without first obtaining a licence from NPWS. This species occurs within the drainage line complex. If this vegetation complex is to be disturbed during any future development works, council may request that a Vegetation Management Plan or other approvals as outlined in Development Control Plan 14 – Tree Management be undertaken. As previously mentioned, any work within the drainage line may also require a Part 3A permit under the Rivers and Foreshores Improvement Act (1948), in which a Vegetation Management Plan may also be required

to accompany the permit application.

Ten species have been identified as 'Key Stone Species' and are considered to be functionally important links in the wildlife food chain. These species are typically widespread and common in Wyong but clearing and fragmentation have significantly reduced the occurrence of some species. (Wyong Shire Guidelines, 1999). It is therefore further recommended that all areas of vegetation proposed to be retained in the future should form a corridor between similar habitat to the north and south rather than isolated patches in order to minimise the affects of habitat fragmentation.

In regards to vegetation communities, the Coastal Headland Complex has been identified as being both locally and regionally significant (Bell, 2002) due to its restricted occurrence in the region (<1000ha) as well as being relatively fragile following major disturbance. This entire complex is considered to be significant despite much of its distribution falling within Munmorah State Recreation Area and Wyrrabalong National Park (Bell, 2002). This community on site has been subject to disturbance as a result of the past mining activities across the site as well as the noted invasion of Bitou Bush. It is therefore believed that this community on site does not represent a significant sample of Coastal Headland Complex. However, it is recommended that the areas of Coastal Headland Complex occurring along the eastern boundary of the site, in connection with similar habitat to the east should be retained to form a protective buffer for those areas of less disturbed vegetation occurring off site. Within these areas of retained vegetation, on-going weed control measures should be implemented.

The Narrabeen Wallarah Sheltered Grassy Forest dominated the western portion of the site and has also been identified as being locally significant due to its restricted occurrence in the north eastern corner of the Wyong Shire. This community extends into the Lake Macquire LGA to the north but is restricted there also. Whilst there is a minor representation of this community in the Munmorah State Recreation Area, the majority of this community is located on mining land such as the subject site. It is therefore recommended that the proposed development provides for the retention of at least some of this vegetation community on site. It is also important that any retained vegetation provide a connection with similar vegetation off site to the west.

Coastal Sand Wallum Heath-Scrub is not considered to be either locally or regionally significant although it is recognised that the Norah Head variant of this community has been identified as an Endangered Ecological Community as discussed in Section 4.1.2.

4.1.4 GENERAL CONDITION OF THE VEGETATION

All four vegetation assemblages delineated in the study area show various levels of disturbance. The

Narrabeen Wallarah Sheltered Grassy Forest showed signs of fire events having passed through the area i.e. blackened trunks, epicormic growth on some trees and dense, isolated stands of *Dodonaea triquetra* (Common Hop Bush) and *Pteridium esculentum* (Bracken Fern). Only a relatively small number of weed species were noted throughout the Narrabeen Wallarah Sheltered Grassy Forest, mainly along the tracks that dissect the area. Weeds were most common along the tracks and within the Coastal Headland Complex (grassland variant) and regenerated areas where past clearing has resulted in an open understorey and increased weed invasion. Weed invasion within the Coastal Headland Complex (shrubland variant) and Coastal Sand Wallum Heath-Scrub Forest was dominated by *Chrysanthemoides monilifera* (Bitou Bush).

Bitou Bush was also noted scattered throughout, particularly within the eastern half of the site as mentioned above. Invasion of Native Plant Communities by *Chrysanthemoides monilifera* (Bitou Bush) is recognised as a Key Threatening Process under Schedule 3 of the TSC Act 1995 and has been further assessed under Section 5A of the EPA Act. The consideration of weed control within any future management plan is recommended to ensure that populations of weed species across the site are managed so as to minimise any impacts on native flora and fauna as well as preventing their spread to areas of neighboring bushland. It is envisaged that such measures would be focused on the areas of native vegetation to be retained.

4.2 HABITAT SURVEY RESULTS

4.2.1 HABITAT DESCRIPTION & DISTRIBUTION IN THE VICINITY

Based on the results of the vegetation survey it is believed that there are two habitat types in the study area being Open Forest (Narrabeen Wallarah Sheltered Grassy Forest) and Heath (combining the shrubland and tall scrub variants of Coastal Headland Complex and Coastal Sand Wallum Heath-Scrub).

The Open Forest habitat adjoins large areas of a similar habitat type to the west as well as to the north over Montefiore Road. The Heath habitat type also continues to the north, east and south along the coastal strip with large areas occurring within the adjacent Munmorah State Recreation Area.

The trees of the Open Forest habitat provide a variety of resources for native fauna. Nectivorous avifaunal and mammal species i.e. Honeyeaters and Gliders are provided with seasonally available flowers from both the eucalypts and Banksias present. This resource is available year-round (i.e. *Corymbia gummifera* flowers January – April, *Angophora costata* flowers in October - January and *Banksia serrata* flowers December - March). Insectivorous species such as Treecreepers are also catered for with the trees providing a wide range of foraging substrates. Mature *Angophora costata* are abundant within the Open Forest, providing various sized hollows for species dependent upon this resource such as Parrots, Possums, Gliders and Owls. This resource is available across the western half of the site only.

Small terrestrial mammals, reptiles and frogs may find shelter and foraging resources within the dense grass layer of the Open Forest and the deep leaf litter over much of the site. The more open areas of the site such as the numerous tracks as well as the cleared areas associated within the mining activities provide suitable basking areas for reptiles and the sandy substrate is ideal as foraging habitat for Bandicoots.

The study area also constitutes potential hunting habitat for owls, raptors and a number of microchiropteran bat species. The noted presence of passerines and small mammals would be the main potential prey species on site for owls and raptors. The areas of grassy habitats may also provide foraging habitat for macropod species.

The drainage line provides a drinking water resource for a large variety of native species whilst the numerous ponds within the eastern half of the site provide habitat for many species of aquatic avifauna and frogs.

4.2.2 CONSIDERATION OF REGIONAL CORRIDORS

Corridors are important for linking remnant areas of vegetation and for facilitating the many ecological processes required to sustain biodiversity. Corridors are seen to promote opportunities for faunal movement and the long term viability of species as they reduce the effect of isolation of small remnant patches of vegetation (Wyong Shire Council, 2003).

Wyong Council has prepared a report entitled the 'draft Wyong Conservation Strategy'. This draft policy document addresses ecological constraints on a Shire wide basis. The draft policy is in the process of adoption by Council. The intention of this document is to secure a biodiversity conservation baseline for the Shire. This draft policy sets conservation targets and identifies the land that should be allocated to meet these targets. Following the completion of the final development plans for this site, this document should be assessed in regards to corridor requirements.

In general, the study area forms part of a large vegetated corridor running along the coastline extending from Munmorah State Recreation Area in the south, into Lake Macquarie LGA to the north. It is therefore recommended that the development proposal retain this vegetated corridor. The corridor should run in a basic north-south direction through the western portion of the study area to retain connection with vegetation off site and may contain the areas of *Tetratheca juncea* which may be required to be retained following the supplementary surveys recommended in Section 4.1.3 of this report.

In regards to the planning and maintenance requirements of such corridors, the following points should be taken into consideration:

- The corridors should maintain a connection with similar habitat attributes to the north and south of the site;
- The corridors should be designed in such a manner as to decrease the edge to ratio effect (i.e. a straight edged corridor is seen to be more effective than a winding corridor).
- If fences are to be erected around the boundary of the site, consideration should be given to facilitation of the movement of terrestrial fauna over or under the fences. This may include the use of dispersal poles or trees plantings along the fence lines for arboreal species such as possums and gliders. Smaller terrestrial mammals would require a minimum 20cm gap underneath the fence.
- On-going weed control would need to be undertaken within the corridors. Such measures would include the physical removal of weeds, education of future residents on the effects of green waste dumping and limiting access into the vegetated areas of the site.

- In regards to the long term conservation of *Tetratheca juncea* populations access into the corridors should be restricted.

4.2.3 HABITAT FOR THREATENED SPECIES

An assessment of habitat has been undertaken for the threatened species which have been identified within 10km of the site on the NPWS and EA Online Databases. The results of the assessment are displayed in Table 4 below. A detailed description of each species considered have potential habitat on site is given in Appendix A of this report. The threatened species that have been identified on site during this, and previous studies are indicated in bold.

Table 4: Habitat Assessment for Significant Species

SPECIES	HABITAT PREFERRED	HABITAT PRESENT
Acacia bynoeana Tiny Wattle	Found in heath, woodland and dry sclerophyll forests on sandy soils derived from Hawkesbury Sandstone.	Potential habitat is present within the vegetated portions of the site.
Angophora inopina Charmhaven Apple	Open woodland/forest, as well as wet-dry heath, and swamp forest communities.	Potential habitat is present within the vegetated portions of the site.
Caladenia tessellata Thick-lipped Spider-orchid	Sheltered moist places in scrub and forests, particularly in stony laterites on coastal tops. It prefers well-structured clay loam soils and is often only seen following fire.	Marginal habitat is present across the vegetated portions of the site although the soils are not preferred by this species.
Callistemon linearifolius	This species grows in dry sclerophyll forest on the coast and adjacent ranges.	Potential habitat is present within the areas of Open Forest.
Chamaesyce psammogeton Coastal Spurge	This prostrate perennial herb grows on foredunes and exposed sites on headlands.	The study area provides potential habitat for this species along its eastern boundary.
Cryptostylis hunteriana Leafless Tongue-orchid	This species is a saprophyte which grows in small localised colonies on flat plains close to the coast. This species has also been recorded in mountainous areas growing in moist depressions as well as in swampy habitats.	Potential habitat is present within the vegetated portions of the site.
Diuris praecox Double-tailed Orchid	Eucalypt forests on hilltops or slopes, widespread in grassy habitats.	Potential habitat is present within the vegetated portions of the site.
Eucalyptus camfieldii Camfield's Stringybark	This species is predominantly found in dry sclerophyll forest on sandstone and laterite plateaus and ridges from the Royal National Park to Gosford. Some isolated occurrences have been found outside this area, although generally in similar habitat.	Potential habitat is present within the areas of Open Forest.

SPECIES	HABITAT PREFERRED	HABITAT PRESENT
Microtis angusii Onion Orchid	Moist sunny depressions, swampy areas and grasslands in high rainfall areas on clays, alluviums and sandy soils	Potential habitat is present within the vegetated portions of the site.
Syzygium paniculatum Magenta Lillypilly	Coastal rainforests on sandy soils or stabilised coastal dunes.	Potential habitat is present within the sheltered slopes in the southeastern portion of the site.
Tetratheca juncea **Black-eyed Susan**	**Heath and Dry Sclerophyll Forests with a predominantly south-east aspect and sloping sites below ridgelines.**	**Potential habitat is present within the undisturbed, vegetated portions of the site.**
Crinia tinnula Wallum Froglet	Shallow acid swamps (temporary / semi-permanent) and associated connecting channels and deeper water holes (permanent) consisting of hard-leafed heaths, shrubs and woodland on coastal plains and dunes and associated sedgelands and swamps in low lying areas collectively known as wallum.	Potential habitat is present on site for this species within the areas of heath, particularly those areas bordering potential habitat to the south.
Heleioporus australiacus Giant Burrowing Frog	Banks of semi-permanent to ephemeral sand or rock based streams and has also been identified in dams, drainage ditches and roadside culverts.	Potential habitat is present within the drainage line and the numerous retention ponds.
Litoria aurea Green and Golden Bell Frog	Swamps, lagoons, streams and ponds as well as dams, drains and storm water basins.	Potential habitat is present within the drainage line and the retention ponds.
Litoria littlejohni Littlejohn's Tree Frog	Habitats include wet and dry sclerophyll forest, coastal woodland and heath. Associated characteristics include rocky streams and sandstone outcrops, semi-permanent dams and slow flowing streams.	Potential habitat is present within the drainage line, retention ponds and associated vegetation.
Mixophyes iteratus Southern Barred Frog	Deep, damp leaf litter in rainforests, moist eucalypt forest and nearby dry eucalypt forest, at elevations below 1000m. This species breeds around shallow, flowing rocky streams.	No suitable rocky streams were identified on site for this species.
Hoplocephalus bungaroides Broad-headed Snake	This species is found only in sandstone habitats. It is often found under large slabs of rock or crevices on sandstone outcrops and feeds mainly on frogs and lizards.	The study area does not constitute preferred habitat for this species due to the lack of sandstone habitats.
Chelonia mydas Green Turtle	Green Turtles occur in shallow seas where there is sufficient light to ensure an abundant growth of marine grasses. They also utilise sandy beaches for nesting.	The study area does not provide any potential habitat for this species.
Dermochelys coriacea Leathery Turtle	This species occurs in all coastal waters of Australia with substantial	The study area does not provide any potential habitat for this

SPECIES	HABITAT PREFERRED	HABITAT PRESENT
	numbers feeding off the south Queensland to central N.S.W. coasts. Adults are sighted year round in large bays, estuaries and rivers.	species.
Calidris tenuirostris Great Knot	Great Knots inhabit beaches, coastal mudflats, bay shores, estuarine environments and sometimes freshwater wetlands.	The study area does not provide any potential habitat for this species.
Charadrius leschenaultii Greater Sand-Plover	This species inhabits littoral and estuarine habitats such as sheltered, sandy, shelly or muddy beaches with large intertidal mudflats or sandbanks.	The study area does not provide any potential habitat for this species.
Charadrius mongolus Lesser Sand Plover	This species is a migratory species residing in Australia from September to March. They inhabit sheltered bays, harbours and estuaries with large intertidal sandflats or mudflats.	The study area does not provide any potential habitat for this species.
Ephippiorhynchus asiaticus Black-necked Stork	Swamps associated with river systems and large permanent pools but sometimes appears on the coast or in estuaries.	The study area does not provide any potential habitat for this species.
Ixobrychus flavicollis Black Bittern	Lives near water in mangroves and other trees which need to form only a narrow fringe of cover.	The study area does not provide any potential habitat for this species.
Haematopus fuliginosus Sooty Oystercatcher	This species prefers rocky intertidal shorelines with little foliose algae, coral reefs or sandy beaches near intertidal mud flats across which they forage for molluscs, crustaceans, polychaetes, ascidians, echinoderms and small fish.	The study area does not provide any potential habitat for this species.
Haematopus longirostris Pied Oystercatcher	Roosts on sandy beaches, spits, dunes, lagoons and inlets, particularly if there are mud flats nearby. They forage on exposed sand, mud, rock or coral for molluscs, worms, crabs and small fish.	The study area does not provide any potential habitat for this species.
Puffinus assimilis Little Shearwater	This species occurs in southern Indian, Pacific and Atlantic Oceans generally north of the Antarctic Convergence. The Little Shearwater breeds on several islands off Western Australia as well as on Lord Howe Island and Norfolk Island off eastern Australia.	The study area does not provide any potential habitat for this species.
Puffinus carneipes Flesh-footed	This species breeds in the southern hemisphere from late September	The study area does not provide any potential habitat for this

SPECIES	HABITAT PREFERRED	HABITAT PRESENT
Shearwater	through to May. This species nests in deep burrows on gentle to steep slopes in coastal forest or scrub. Birds breeding on Lord Howe Island have been found to forage for fish and cephalopods off the eastern Australian coast from Stradbroke Island (Qld.) to Maria Island (east of Tasmania).	species.
Sterna albifrons Little Tern	Sandy substrate, flat or gently sloping topography, abundant shells and pebbles and little vegetation for nesting.	The study area does not provide any potential habitat for this species.
Limosa limosa Black-tailed Godwit	This migratory species begins arriving in Australia in August each year. Habitat utilised by this species includes tidal mudflats, river edges, sandy beaches, brackish swamps as well as the shallows of lakes, reservoirs and sewage farms.	The study area does not provide any potential habitat for this species.
Limicola falcinellus Broad-billed Sandpiper	This species is a migratory species residing in Australia from late September to May. They inhabit sheltered bays, harbours and estuaries with large intertidal sandflats or mudflats.	The study area does not provide any potential habitat for this species.
Rostratula benghalensis australis Painted Snipe	Frequents the margins of swamps and streams, chiefly those covered with low and stunted vegetation. It requires shallow fresh water for breeding, though the nest is not deserted if the water dries up.	The study area does not provide any potential habitat for this species.
Lathamus discolor Swift Parrot	During winter the Swift Parrot inhabits open forest to woodland on the mainland. Preferred winter food species are *Eucalyptus sideroxylon* (Red Ironbark), *E. albens* (White Box), *E. ovata* (Swamp Gum), *E. robusta* (Swamp Mahogany) and *E. melliodora* (Yellow Gum).	Potential foraging habitat is present across the study area, particularly within the western portion where mature eucalypts were dominant.
Xanthomyza phrygia Regent Honeyeater	Temperate woodlands and open forest, including forest edges, prefers to forage on large-flowered Eucalypts (e.g. *Eucalyptus sideroxylon*, *E. melliodora*, *E. albens, E. leucoxylon*).	Potential foraging and nesting habitat is available across the study area, particularly within the western portion where mature eucalypts were dominant
Ptilinopus regina Rose-crowned Fruit-Dove	Lives in rainforest, though it also frequents nearby drier forests as well as mangroves. It usually feeds on Figs or other fruit and berry-bearing trees.	The sheltered slopes and areas of Open Forest provide some marginal habitat for this species.
Ptilinopus superbus Superb Fruit-Dove	Lives mainly in rainforest but will feed in adjacent mangroves or Eucalypt forest, venturing into coastal	The sheltered slopes and areas of Open Forest provide some marginal habitat for this species.

SPECIES	HABITAT PREFERRED	HABITAT PRESENT
	habitats at various times of the year, particularly during winter	
Climacteris picumnus victoriae Brown Treecreeper	Open eucalypt woodland with areas of open understorey	Potential habitat is available across much of the vegetated portions of the site.
Stagonopleura guttata Diamond Firetail	In NSW, this species occurs predominantly west of the Great Dividing Range, although populations are known from drier coastal areas. It occupies a variety of habitats with a grassy understorey including eucalypt woodlands, forests, *Acacia* scrubs and mallee.	Potential habitat is available across much of the site.
Calyptorhynchus lathami Glossy Black-Cockatoo	Wet and dry sclerophyll forests and woodlands. Forages primarily on the seeds of (*Allo*)*Casuarina* species.	Potential foraging habitat is available across the vegetated areas of the site with nesting habitat provided within the Open Forest in the western half of the site.
Pandion haliaetus Osprey	Open and swamp forest adjacent to the coast or estuaries and fishes in brackish or salt water, seldomly in fresh water bodies.	Potential nesting habitat is available on site with hunting habitat available in the Pacific Ocean to the east.
Ninox strenua Powerful Owl	Wide range of vegetation types from wet eucalypt forests with a rainforest understorey to dry open forests and woodlands. Requires mature trees for roosting and nesting.	Potential hunting habitat is available across much of the study area with suitable nesting habitat provided in the areas of Open Forest.
Tyto novaehollandiae Masked Owl	Inhabit a range of wooded habitats that contain both mature trees for roosting and nesting and more open areas for hunting. They are most commonly encountered within open forest with a sparse understorey as well as along the ecotones of these areas to more or less densely vegetated habitats.	Potential hunting habitat is available across much of the study area with suitable nesting habitat provided in the areas of Open Forest.
Dasyurus maculatus Tiger Quoll	Sclerophyll forests, rainforests and coastal woodlands.	Potential habitat is available within the forested portion of the site.
Planigale maculata Common Planigale	Variety of habitats ranging from rainforest, wet and dry sclerophyll forests to grasslands, marshlands and rocky areas. In these habitats it shelters under logs and rocks and any available burrows.	Potential habitat is available across much of the study area.
Phascolarctos cinereus Koala	Coastal Woodland and Open Eucalypt Forest.	The presence of Scribbly Gum, Grey Gum, Swamp Mahogany and Forest Red Gum constitutes potential habitat for this species.
Petaurus norfolcensis Squirrel Glider	Dry sclerophyll forests and woodlands. Eats a high proportion of	Potential foraging and nesting habitat is provided in the areas of

SPECIES	HABITAT PREFERRED	HABITAT PRESENT
	invertebrates from the foliage of Eucalypts and Acacias supplemented by plant exudates in the form of Eucalypt and Melaleuca sap and Acacia gum. Nests in tree hollows.	Open Forest.
Petrogale penicillata Brush-tailed Rock Wallaby	The sites occupied by *P. penicillata* mostly have a northerly aspect, so as to allow the animals to sun themselves in the early morning and late afternoon. They rest by day in rock crevices and emerge in the late afternoon to forage for grasses, leaves, flowers and seeds.	The study area does not provide any suitable potential habitat for this species.
Potorous tridactylus Long-nosed Potoroo	Rainforest, open forests and woodlands with dense groundcover, and dense, wet coastal heathlands. Soft (often sandy) substrates are preferred by this species.	Potential habitat is available across the study area.
Pteropus poliocephalus Grey-headed Flying-fox	Variety of habitats, including wet and dry sclerophyll forests, rainforest, mangroves and paperbark swamps and Banksia woodlands. Here they forage on a range of fruits and blossoms.	Potential foraging habitat only is available across much of the study area.
Chalinolobus dwyeri Large-eared Pied Bat	Dry sclerophyll forest, woodland, subalpine woodland and at the ecotone of rainforest and wet eucalypt forest. Roosts in caves and similar structures.	Potential hunting habitat is available across the entire site. Although, suitable roosting habitat is absent.
Mormopterus norfolkensis Eastern Freetail-bat	Sclerophyll forests and woodland. Small colonies have been found in tree hollows or under loose bark.	Potential hunting and roosting habitat is available across much of the site.
Miniopterus australis Little Bentwing-bat	Tropical rainforest to warm-temperate wet and dry sclerophyll forest, roosts include caves, mines, stormwater drains, disused railway tunnels and houses.	Potential hunting habitat is available across the entire site although suitable roosting habitat is absent.
Miniopterus schreibersii oceaensis Large Bentwing-bat	It is a cave roosting species although it has also been reported as utilising tree hollows. It generally feeds above the forest canopy in wet and dry tall open forest. This species has also been recorded utilising rainforest, monsoon forest, open woodland, paperbark forests and open grasslands.	Potential hunting and roosting habitat is available across much of the site.
Myotis adversus Large-footed Myotis	Seldom occurs far from suitable water bodies which range from rainforest streams to large reservoirs and even brackish water. It roosts in caves, mines and disused railway tunnels as well as dense rainforest foliage and tree hollows.	Potential hunting and roosting habitat is available within the study area.

SPECIES	HABITAT PREFERRED	HABITAT PRESENT
Scoteanax rueppellii Greater Broad-nosed Bat	Known to hunt along tree-lined creeks, the junction of woodland and cleared paddocks, and low along rainforest creeks. It may have a preference for wet gullies in tall timber country. Only found at low altitudes. Roosts in hollows.	Potential hunting and roosting habitat is available across much of the study area.

4.3 FAUNA SURVEY RESULTS

The full list of fauna species identified in the study area is displayed on the Expected Fauna Species List in Appendix D.

4.3.1 SMALL TERRESTRIAL MAMMAL TRAPPING

During the small terrestrial mammal trapping survey two species of terrestrial mammal were identified, as shown below in Table 5.

Table 5: Results of the Small Mammal Trapping Surveys

Date	Trap No.	Species
9/12/03	T27	*Antechinus stuartii* (Brown Antechinus)
10/12/03	T36	*Antechinus stuartii* (Brown Antechinus)
	T26	*Antechinus stuartii* (Brown Antechinus)
	T27	*Antechinus stuartii* (Brown Antechinus)
	T28	*Rattus rattus* (Black Rat)
	T14	*Antechinus stuartii* (Brown Antechinus)
11/12/03	T14	*Rattus rattus* (Black Rat)
	T26	*Rattus rattus* (Black Rat)
12/12/03	T26	*Antechinus stuartii* (Brown Antechinus)
	T34	*Antechinus stuartii* (Brown Antechinus)

Neither of these small terrestrial mammal species are recognised as threatened.

4.3.2 MEDIUM TERRESTRIAL MAMMAL TRAPPING

No mammals were caught during the medium terrestrial mammal trapping survey.

4.3.3 ARBOREAL MAMMAL TRAPPING

No arboreal mammals were caught during the arboreal mammal trapping survey.

During the spotlight surveys, one arboreal mammal species was directly observed utilising the resources present on site, being *Pseudocheirus peregrinus* (Common Ringtail Possum). The Ringtail Possums were most commonly observed within the western half of the site where potential foraging habitat was abundant. A large number of dreys were also noted across much of the site.

4.3.4 MICROCHIROPTERAN BAT SURVEY

There was two species of microchiropteran bat recorded on site, being *Vespadelus* sp. And *Chalinolobus gouldi* (Gould's Wattled bat).

The *Vespadelus* calls could not be distinguished to genus level as the calls of this species overlap. *V. troughtoni* (Eastern Cave Bat) is listed under Schedule 2 of the TSC Act 1995 however this species has not been recorded within 10km of the site on the NPWS Database (2001), nor has it been reported previously in the area by Wildthing Environmental Consultants. As such, it is believed that the specimen recorded on site during the recent survey is unlikely to be the threatened *V. troughtoni.* Accordingly, niether of these species are recognised as threatened.

No microchiropteran bat species were recovered from the harp trap.

4.3.5 MEGACHIROPTERAN BAT SURVEY

No species of megachiropteran bat were recorded on site during the survey.

4.3.6 AMPHIBIAN SURVEY

There were four species of amphibian heard calling on site during the fieldwork, being *Crinia signifera* (Common Eastern Froglet), *Litoria latopalmata* (Broad-palmed Frog), *Litoria fallax* (Dwarf Tree Frog) and *Limnodynastes peronii* (Striped Marsh Frog). These species were heard calling from the retention ponds during both the nocturnal and diurnal surveys. None of these species are considered threatened.

4.3.7 REPTILE SURVEY

Numerous *Lampropholis delicata* (Grass Skink) were observed within the leaf litter and around the bases of the trees across the study area and a small number of *Amphibolurus muricatus* (Jacky Lizard) were found during the targeted reptile searches. These reptilian species are not considered to be threatened and no other reptile species were observed on site.

4.3.8 AVIFAUNA SURVEY

The avifauna species commonly identified during the diurnal bird censuses were *Dacelo novaeguineae* (Laughing Kookabura), *Corvus coronoides* (Australian Raven), *Gymnorhina tibicen* (Australian Magpie), *Rhipidura fuliginosa* (Grey Fantail), *Psophodes olivaceus* (Eastern Whipbird), *Malurus cyaneus* (Superb Blue Wren), *Meliphaga lewinii* (Lewin's Honeyeater), *Phylidonyris nigra* (White-checked Honeyeater), *Acanthorhynchus tenuirostris* (Eastern Spinebill) and *Philemon corniculatus* (Noisy Friarbird). Observed flying over the site during the survey period were *Haliastur sphenurus* (Whistling Kite). Aquatic species such as *Chenonetta jubata* (Australian Wood Duck) were observed within the ponds in the eastern portion of the site.

No response was heard to the pre-recorded owl calls broadcasted during the nocturnal surveys.

A complete list of bird species noted on site is indicated in the Expected Fauna Species List in Appendix D.

4.3.9 GENERAL OBSERVATIONS

Numerous *Wallabia bicolor* (Swamp Wallaby) scats were noted across much of the study area and at least two Swamp Wallabies were observed within the areas of Heath during the survey period.

Numerous diggings consistent with *Isoodon macrourus* (Northern Brown Bandicoot), *Oryctolagus cuniculus* (Rabbit) and *Tachyglossus aculeatus* (Echidna) activity were noted across much of the site particularly within the forested areas. One Echidna was also observed within the heath in the eastern portion of the site during the survey period and numerous rabbits were observed across much of the site. Competition by the European Rabbit is recognised as a Key Threatening Process under Schedule 3 of the TSC Act 1995 and has been further assessed under Section 5A of the EPA Act.

One *Vulpes vulpes* (Fox) was observed on site during the nocturnal surveys. Predation by the European Red Fox is recognised as a Key Threatening Process under Schedule 3 of the TSC Act 1995 and has been further assessed under Section 5A of the EPA Act.

Numerous scratches and scats consistent with arboreal mammal activity were noted across much of the site and were consistent with *Pseudocheirus peregrinus* (Ringtail Possum), which was also observed on site.

A medium sized bird nest was observed within the drainage line, however it was difficult to determine the species it belonged to as no birds were seen within the immediate vicinity of the nest during the survey period. The nest is not believed to belong to any of the threatened avifauna species assessed

due to characteristics such as size and habitat type.

Additional observations included:

- No sign of any conspicuous nest consistent with Osprey were noted.
- No chewed cones indicating past feeding by Glossy Black-Cockatoos were noted.
- No regurgitation pellets or white wash from Forest Owls were noted.
- No fruit remains indicating past feeding by Fruit-Doves were noted.

4.4 SURVEY LIMITATIONS

Survey limitations were noted during the current survey of the subject site and are detailed below.

- The large size of the subject site (90ha) meant that some of the site would not be thoroughly surveyed, especially in terms of fauna methodologies. Where possible, representative areas of each vegetation community were sampled to allow the maximum coverage of habitat characteristics existing on the site.
- Limitations to the likelihood of detecting a number of threatened orchid species were also encountered during this survey as discussed in Section 4.1.3. Such limitations were generally related to the seasonal detectability of species as the fieldwork undertaken during this survey was conducted during late spring only. It has therefore been recommended that additional targeted surveys be undertaken during the known flowering periods for *Diuris praecox, Cryptostylis hunteriana* and *Microtis angusii.* Revised assessments under Section 5A of the EPA Act should then be provided following the completion of the final development plan.
- Limitations to the likelihood of detecting the full extent of the *Tetratheca juncea* population on site were noted due to the sporadic nature of this species during the flowering period. It has therefore been recommended that additional targeted surveys be undertaken 2-3 times during the known flowering period for this species. A revised assessment under Section 5A of the EPA Act should then be provided following the completion of the final development plan.

5.0 SUMMARY OF CONSIDERATIONS UNDER SECTION 5A OF THE EPA ACT

Considerations of the effects of the proposal under the guidelines of Section 5A of the Environmental Planning and Assessment Act (1995) are given in Appendix A. The species dealt with were those considered to have potential habitat available within the study area in Section 4.2.2 of this report. Of the 54 threatened species recorded from within 10km of the site, 37 are considered to have suitable habitat attributes present on site.

One species recognised as being threatened was directly recorded on site during the recent survey, being *Tetratheca juncea* (Black-eyed Susan). *Calyptorhynchus lathami* (Glossy Black-Cockatoo), *Tyto novaehollandiae* (Masked Owl), *Diuris praecox* (Double-tailed Orchid) and *Phascolarctos cinereus* (Koala) have also been previously recorded within the immediate vicinity of the site (NPWS Database, August 2003) and for the purposes of this assessment have been considered as 'recorded on site'.

Eight plants of *Tetratheca juncea* were identified across the western portion of the site within the areas of Narrabeen Wallarah Sheltered Grassy Forest as indicated within Figure 11. Whilst this species is recognised as being adequately conserved on a regional scale, the proposed development of this site may significantly impact upon the local population of this species. Accordingly, it is recommended that additional surveys be undertaken on site to more accurately indicate the extent of this population and to recommend ameliorative/protective measures. Until such time, and for the purposes of this assessment, it is believed that the proposal has the potential to significantly affect local populations of this species. As defined by the NSW NPWS (1996) 'A local population should be considered as the population that occurs within the study area, unless the existence of contiguous or proximal occupied habitat and the movement of individuals or exchange of genetic material across the boundary of the study area can be demonstrated.'

Calyptorhynchus lathami (Glossy Black-Cockatoo) has been recently recorded approximately 2km to the west of the site in similar Open Forest habitat (Wildthing Environmental Consultants, 2003). Whilst the site is recognised as providing suitable habitat in the form of hollow bearing trees for nesting and *Allocasuarina* species for foraging, no Glossy Black-Cockatoos nor any indications of their presence (i.e. chewed cones) were identified on site during the recent survey period despite targeted searches. Based on records of occurrence nearby, it is considered that the Glossy Black-Cockatoos are unlikely to be solely dependant upon the resources available on site and may only visit the site intermittently, if at all.

Tyto novaehollandiae (Masked Owl) has been previously recorded within the vicinity of the study area on the NPWS database (August, 2003) as well as a recent survey on land 2km to the west of the

subject site (Wildthing Environmental Consultants, 2003). Potential nesting/roosting habitat occurs within the areas of Open Forest in the western portion of the site and potential hunting habitat occurs over much of the site. No indication of the presence of this species was noted on site during the survey period although with the presence of at least one breeding pair within the immediate vicinity of the site it is believed likely to be used periodically as part of a much larger home range. Whilst the development of this site would be unlikely to significant affect the lifecycle of the local population, the incremental modification of potential hunting habitat is difficult to determine and it is recommended that potential habitat be retained on site with the scope of the development. This habitat retention may form part of a vegetated corridor through the western portion of the site as well as within bushfire Asset Protection Zones.

Diuris praecox has been previously recorded within the vicinity of the study area on the NPWS database (August, 2003) and potential habitat occurs within the areas of Open Forest in the western portion of the study area. If development is proposed within the areas of potential habitat, it is recommended that targeted searches be undertaken during the known flowering season for this species. Until such time, and for the purposes of this assessment, it is believed that the proposal has the potential to significantly affect local populations of this species. Although, it is recognised that the recommended habitat corridor would retain much of the potential habitat for this species.

Whilst no Koalas nor any indications of their presence (i.e. characteristic 'poc' marks or scats) were identified on site during the recent survey period, the site is recognised as providing suitable habitat in the form of Koala Feed Tree species and records of *Phascolarctos cinereus* (Koala) within 1km of the site were noted on the NPWS Database (August, 2003). Apart from the 1996 records noted above, no Koala sightings have been recorded on the database within eight kilometres of the site since 1975. Accordingly, it is believed that the local Koala population does not frequent the site and would therefore be unlikely to be solely dependant upon the resources present.

Consideration should be given to the retention or supplementary planting of Koala feed tree species, if possible, within the scope of the development proposal ie. street plantings. The trees would also provide seasonal foraging habitat for arboreal mammals and nectivorous avifauna. Additional recommendations, which will benefit most fauna species assessed, are the retention of hollow bearing trees, the use of signs warning motorists of the potential presence of wildlife in the area and a reduced speed limit along access roads. With the implementation of these ameliorative measures it is believed that any impact on any local populations of threatened fauna species assessed would be minimal and unlikely to cause risk of extinction.

6.0 SQUIRREL GLIDER HABITAT ASSESSMENT UNDER THE WYONG SHIRE SQUIRREL GLIDER CONSERVATION MANAGEMENT PLAN

This assessment is based on a ranking system contained in the Squirrel Glider Conservation Management Plan (Smith, 2002), which has been developed to assist with the determination of impact "significance" of development proposals on local populations of Squirrel Gliders within the meaning of the Threatened Species Conservation Act, 1995. In order to provide a local context for making decisions on the relative impacts of various clearing proposals, a series of impact classes ranging from 1 to 4 have been developed and take into consideration habitat suitability, habitat vulnerability and the presence/absence of resident breeding Squirrel Gliders.

6.1 HABITAT SUITABILITY

a Habitat Quality

Assess relative predominance of optimum Squirrel Glider microhabitat types according to vegetation assemblage type:

		Habitat Area	% Habitat Type Within Patch	
1	Stringybark with Acacia/Melaleuca/Grass understorey	N/a		Less optimum
2	Spotted Gum/Ironbark/Gum	N/a		
3	Stringybark with Banksia/Allocasuarina/Melaleuca understorey	N/a		
4	Sydney Red Gum/Scribbly Gum with Allocasuarina/Melaleuca understorey	N/A		
5	Sydney Red Gum/Scribbly Gum with Banksia understorey	30ha	33%	More optimum

6 If plant assemblage type does not fit well with the above describe below:

Coastal Heath	20ha	22%

b Remnant Patch Size

Assess patch size on site according to the scale outlined below:

Patch < 5 hectares in size		Less optimum
Patch > 5 hectares but less than 10 hectares in size		
Patch > 10 hectares but less than 30 hectares in size		
Patch > 30 hectares but less than 90 hectares in size	✓	More optimum

c Density Habitat Trees

Average number of trees with hollows per hectare < 2 habitat trees / hectare	✓	Less important
Average number of trees with hollows per hectare > 2 habitat trees / hectare		More important

d Abundance of Food Plants of Squirrel Glider

The proportion of Squirrel Glider food plants which occur on the site were assessed in association with the vegetation plots and transects. The results of locally occurring food resources for Squirrel Gliders is provided below:

Local Food Plants in Study Area		Food Item	Average No of Plants/ Hectare	% of Vegetation Assemblage
Angophora/	*costata*	sap, nectar & pollen	8.66	24.41
Eucalyptus	*haemastoma*	sap, nectar & pollen	4.16	11.73
	racemosa	sap, nectar & pollen	N/a	-
	robusta	sap, nectar & pollen	0.16	0.47
	siderophloia	sap, nectar & pollen	N/a	-
	paniculata	sap, nectar & pollen	N/a	-
	fibrosa	sap, nectar & pollen	0.33	0.94
	gummifera	sap, nectar & pollen	4.66	13.15
	maculata	nectar & pollen	N/a	-
Melaleuca	*linearifolia*	nectar & insect bark food	0.5	2
	nodosa	nectar & insect bark food	N/a	-
	quinquenervia	nectar & insect bark food	0.5	2
	sieberi	nectar & insect bark food	N/a	-
Acacia	*spp.*	seeds & gum	0.8	2
Banksia	*spp*	nectar & pollen	2.5	10
Xanthorrhoea	*spp.*	nectar & potential gum	5	20

6.2 HABITAT VULNERABILITY

a Edge to Width Ratio

Which shape is the patch size most similar to? Oval

Round

Oval Shaped

Narrow Linear Fragment

b Habitat Disturbance

Approximately 80% of the site has been subject to clearing/underscrubbing. The remaining areas of the site have experienced low to moderate levels of weed invasion including invasive species such as Lantana and Bitou Bush. The site also contains evidence of past fire events in the form of blackened tree trunks and regenerating vegetation.

c Proximity to Existing or Future Residential Development

Is the fragment within 200 metres of an existing or future residential development? Yes [✓] No [ ]

6.3 Resident Breeding Squirrel Gliders

~~Presence~~ / absence of resident breeding Squirrel Gliders in patch? Yes [✓] No [ ]

The details of the survey results have been provided within Section 4.0 of this report. No evidence of the presence of this species was recorded on site despite targeted arboreal mammal trapping and spotlighting activities.

In conclusion, the study area provides moderate quality habitat for Squirrel Gliders within the areas of Open Forest, providing foraging and nesting resources however, the majority of the site provides foraging habitat only. Should the final proposal result in the removal of large areas of Open Forest habitat, ameliorative measures and corridor design requirements will need to be considered for native fauna generally.

7.0 CONSIDERATIONS UNDER SEPP 44 - 'KOALA HABITAT PROTECTION'

The principal aim of State Environmental Planning Policy 44 - 'Koala Habitat Protection', is 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.

The policy applies to areas of more than one hectare or an area which has together with any adjoining land in the same ownership an area of more than one hectare, whether or not the development application applies to the whole, or only part of the land. In addressing SEPP 44 there are two questions to be considered.

7.1 FIRST CONSIDERATION-IS THE LAND 'POTENTIAL KOALA HABITAT'?

'Potential Koala Habitat' is defined as, "... an area of native vegetation where trees of the type listed in Schedule 2 (Koala feed tree species) constitute at least 15% of the total number of trees in the upper and lower strata of the tree component."

Four species of 'Koala Feed Tree' were identified on site being *Eucalyptus haemastoma* (Scribbly Gum), *E. tereticornis* (Forest Red Gum), *E. punctata* (Grey Gum) and *E. robusta* (Swamp Mahogany). The methodology used for the SEPP 44 analysis involved sampling 27 quadrats (20m×20m), which were randomly selected throughout the entire site. The location of these quadrats is shown in Figure 12. Within each quadrat, the total number of trees (>10cm diameter) and the number of Koala feed trees were counted. The results of the SEPP 44 quadrats are contained in Table 6.

Table 6: Results of SEPP 44 Quadrats.

QUADRAT	NO. TREES	NO. KOALA FEED TREES	% KOALA FEED TREES
1	5	0	0%
2	0	0	0%
3	7	0	0%
4	1	0	0%
5	0	0	0%
6	0	0	0%
7	5	3	60%
8	12	0	0%
9	8	0	0%
10	6	0	0%
11	3	0	0%
12	4	0	0%
13	5	1	20%
14	8	0	0%
15	9	0	0%

16	5	0	0%
17	1	0	0%
18	6	0	0%
19	10	0	0%
20	0	0	0%
21	24	0	0%
22	23	0	0%
23	8	0	0%
24	8	0	0%
25	12	0	0%
26	12	3	25%
27	11	0	0%

The results of the quadrat sampling showed that at least three small areas of the site contain a density of Koala Feed Trees greater than 15% of the total tree count. The site is therefore considered to constitute 'Potential Koala Habitat'.

7.2 SECOND CONSIDERATION - IS THE LAND CORE KOALA HABITAT?

'Core Koala Habitat' is defined in SEPP 44 as "... 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 Koala population."

Only two records of Koalas within 8km of the study area have been recorded on the NPWS wildlife database since 1975. The nearest record is within 1km of the centre of the site in 1996, although no further information such as exact location details were provided.

Despite extensive searches within each quadrat and throughout the site in general, no individuals or indications of their presence (such as scratches or scats) were identified. As such, the site does not constitute 'Core Koala Habitat' and accordingly no further provisions of this policy will apply to this site.

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Site Boundary

X SEPP 44 Quadrats

N

0 100 200 300 400 500

Scale (m)

Figure 12: SEPP 44 Quadrats

8.0 CONSIDERATIONS UNDER SEPP 14 – 'COASTAL WETLANDS'

The aim of State Environmental Planning Policy 14 – 'Coastal Wetlands' (SEPP14) is to ensure that the coastal wetlands are preserved and protected in the environmental and economic interests of the State. The types of wetland vegetation protected by SEPP 14 are mangroves, saltmarshes, melaleuca forests, casuarina forests, sedgelands, wet meadows, brackish swamps and freshwater swamps.

SEPP 14 only applies to the following development types when they are proposed within mapped wetlands, being clearing, levee construction, draining and filling. For clarification, 'clearing' under SEPP 14 means the removal or destruction of native plants, it does not include the careful removal or destruction of noxious plants.

As previously mentioned, the study area borders an area designated as SEPP 14 Wetland No. 891 (Figure 13). Whilst it is recognised that the proposed development of the site will not result in the clearing or filling of this area, the removal of any of the native vegetation along the outer margins of the wetland will also trigger the native vegetation clearance provisions of SEPP 14. It is therefore recommended that a 50m buffer area be maintained around the boundary of the wetland. As indicated in Figure 14, this recommended buffer area only affects a small area on the southern boundary of the site.

It is also recognised that impacts may be of a direct or indirect nature. It is believed that with the implementation of the following recommendations any proposed development will not significantly impact (either directly or indirectly) upon the wetland:

- No areas of native vegetation are to be disturbed within the 50m buffer area, which is to be fenced off with a coloured bunting fence during construction phase.
- During the construction phase, all machinery etc must stay outside of the buffer.
- After the construction has been completed if the vegetation along the outer margins of the buffer has been disturbed then it is to be rehabilitated with native flora species suitable to the wetland setting.
- Construction works are to be undertaken in dry weather and, drainage and sediment control measures are to be implemented to prevent contamination of the wetland; and,
- All contractors are to be made aware of the construction conditions before commencement of work. The construction work should also be monitored throughout its duration to ensure the that the recommendations are being implemented.

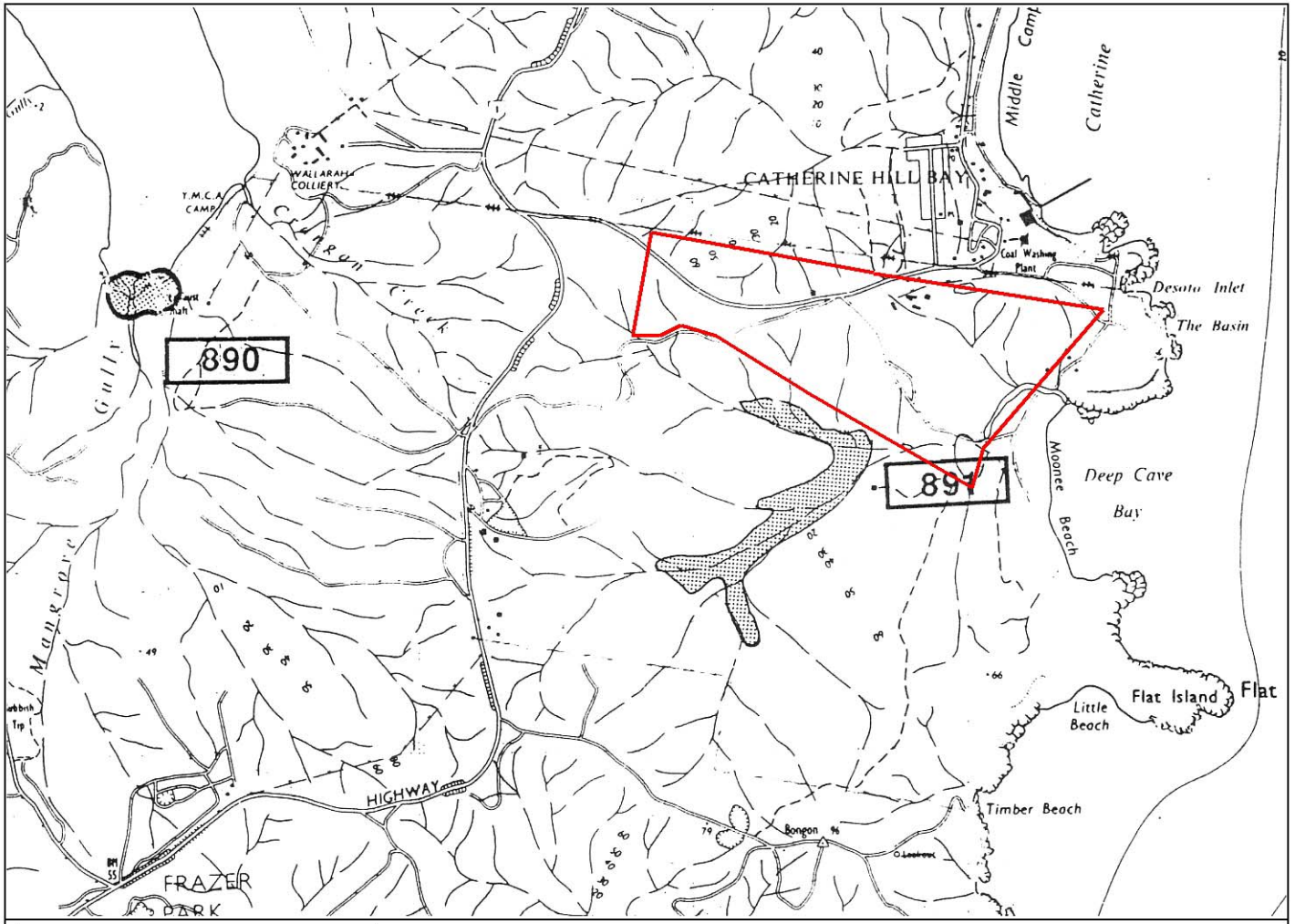

Figure 13: Location of SEPP 14 Wetland No. 891

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Site Boundary

SEPP 14 Wetland 891

50m Buffer Area

N

0 100 200 300 400 500

Scale (m)

Figure 14: SEPP 14 Wetland Buffer

9.0 CONSIDERATIONS UNDER THE COMMONWEALTH ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

Considerations have been made to the Commonwealth Environment Protection and Biodiversity Conservation (EPBC) Act 1999. Assessments have been undertaken to determine whether or not the proposal or activity has, will have, or is likely to have a significant impact on a matter of National Environmental Significance. The matters of National Environmental Significance and the appropriate responses are listed below:

- *World Heritage properties;*

The study area is not affected by World Heritage listing, nor is it likely to impact upon any World Heritage area.

- *wetlands recognised under the Ramsar convention as having international significance;*

The study area is not located within 10km of a recognised RAMSAR Wetland nor is it considered likely to impact upon any wetlands of international importance.

- *listed threatened species and communities;*

The EPBC Protected Matters Search Tool (www.ea.gov.au) for 10km around the site identified 44 threatened species considered likely to have suitable habitat available on site. However, due to the specific habitat requirements of a number of the species it is considered that this list of threatened species to be assessed may be reduced. The species considered to not be pertinent to the assessment due to their specific habitat requirements actually being absent, are:

Diomedea amsterdamensis	Amsterdam Albatross
Diomedea antipodensis	Antipodean Albatross
Diomedea dabbenena	Tristan Albatross
Diomedea exulans	Wandering Albatross
Diomedea gibsoni	Gibson's Albatross
Macronectes giganteus	Southern Giant-Petrel
Macronectes hallii	Northern Giant-Petrel
Pterodroma leucoptera leucoptera	Gould's Petrel
Pterodroma neglecta neglecta	Kermadec Petrel
Rostratula benghalensis australis	Painted Snipe
Thalassarche bulleri	Buller's Albatross
Thalassarche cauta	Shy Albatross
Thalassarche impavida	Campbell Albatross
Thalassarche salvini	Salvin's Albatross
Thalassarche steadi	White-capped Albatross
Hoplocephalus bungaroides	Broad-headed Snake
Chelonia mydas	Green Turtle
Dermochelys coriacea	Leathery Turtle
Balaenoptera musculus	Blue Whale
Eubalaena australis	Southern Right Whale
Megaptera novaeangliae	Humpback Whale
Carcharias taurus	Grey Nurse Shark

Carcharodon carcharias	Great White Shark
Rhincodon typus	Whale Shark

Those species listed in the database search considered to be pertinent are:

Acacia bynoeana	Tiny Wattle
Angophora inopina	Charmhaven Apple
Caladenia tessellata	Thick-lipped Spider-orchid
Cryptostylis hunteriana	Leafless Tongue-orchid
Diuris praecox	Double-tailed Orchid
Eucalyptus camfieldii	Camfield's Stringybark
Microtis angusii	Onion Orchid
Syzygium paniculatum	Magenta Lillypilly
Tetratheca juncea	Black-eyed Susan
Heleioporus australiacus	Giant Burrowing Frog
Litoria aurea	Green and Golden Bell Frog
Litoria littlejohni	Littlejohn's Tree Frog
Mixophyes iteratus	Southern Barred Frog
Lathamus discolor	Swift Parrot
Xanthomyza phrygia	Regent Honeyeater
Dasyurus maculatus	Tiger Quoll
Petrogale penicillata	Brush-tailed Rock-wallaby
Potorous tridactylus	Long-nosed Potoroo
Pteropus poliocephalus	Grey-headed Flying-Fox
Chalinolobus dwyeri	Large Pied Bat

All of these species, with the exception of *P. penicillata,* have been assessed under state legislation (i.e. Section 5A of the EPA Act 1979) in Appendix A of this report, with a summary of the assessments given in Section 5.0. *Petrogale penicillata* does not have any potential habitat on site and was therefore not assessed.

One of these species, being *Tetratheca juncea* was positively identified on site during the survey period. *Diuris praecox* was previously recorded within the vicinity of the site. It was determined within the Section 5A Assessment (Appendix A) that further surveys would be required in order to accurately determine the extent of the populations of both species on site and to determine the significance of any impacts on both a local and national level.

In regards to the remaining species assessed, it was determined that the proposal was unlikely to significantly impact upon these species on a local or regional level and accordingly, is unlikely to do so on a national scale.

- *migratory species protected under international agreements;*

A search of the EPBC Act online database for within 10km of the subject site identified 6 terrestrial and 6 wetland migratory species covered by the provisions of the EPBC Act, which were likely to occur within the area. The species assessed were:

Haliaeetus leucogaster	White-bellied Sea-Eagle
Hirundapus caudacutus	White-throated Needletail
Monarcha melanopsis	Black-faced Monarch
Monarcha trivirgatus	Spectacled Monarch
Myiagra cyanoleuca	Satin Flycatcher
Rhipidura rufifrons	Rufous Fantail
Calidris acuminata	Sharp-tailed Sandpiper
Charadrius mongolus	Lesser Sandplover
Gallinago hardwickii	Latham's Snipe
Numiensis madagascariensis	Eastern Curlew
Pluvialis fulva	Pacific Golden Plover

Haliaeetus leucogaster (White-bellied Sea-Eagle) is migratory in ecological characteristics and any movements are likely to be nomadic rather than migratory, in response to food availability. Suitable roosting and nesting habitat is available on site for this species, although the development of this site is believed unlikely to adversely impact upon this species.

Hirundaps caudacutus (White-throated Needletail) inhabits the airspace above forests, woodlands, farmlands, plains, lakes, coasts and towns. Due to the general habitat requirements of this species it is considered unlikely that the development of the site will adversely impact upon this species.

Monarcha melanopsis (Black-faced Monarch) utilises rainforests, eucalypt woodlands, coastal scrubs, damp gullies in rainforests and eucalypt forests. During migration this species also utilises open woodlands. Although the site offers potential habitat for this species, habitat will be retained within the recommended habitat corridor and larger areas of similar quality habitat occur within the region, including the adjacent Munmorah State Recreation Area. Accordingly, it is considered unlikely that the proposed development will adversely impact upon this species on a local or national level.

Monarcha trivirgatus (Spectacled Monarch) inhabits the understorey of mountain/lowland rainforests, thickly wooded gullies and waterside vegetation. The site does not provide any preferred habitat for this species. Accordingly, it is considered unlikely that the proposed development will adversely impact upon this species on a local or national level.

Myiagra cyanoleuca (Satin Flycatcher) inhabits heavily vegetated gullies in forests and taller woodlands. During migration it utilises coastal forests, woodlands, mangroves, trees in open country and gardens. Due to the general habitat requirements of this species during migration and the recommended habitat corridor, it is considered unlikely that the proposed development will adversely impact upon this species on a local or national level.

Rhipidura rufifrons (Rufous Fantail) inhabits rainforests, wetter eucalypt forests, gullies, monsoon

forests, paperbarks, sub-inland and coastal scrubs mangroves, watercourses, parks and gardens. When migrating the Rufous Fantail also utilises farms, streets and buildings. Although the site offers potential habitat for this species, habitat will be retained within the recommended habitat corridor and larger areas of similar quality habitat occur within the region, including the adjacent Munmorah State Recreation Area. Accordingly, it is considered unlikely that the proposed development will adversely impact upon this species on a local or national level.

Calidris acuminata (Sharp-tailed Sandpiper), *Pluvialis fulva* (Pacific Golden Plover) and *Charadrius mongolus* (Lesser Sand Plover) utilise a variety of habitats such as salt, brackish or freshwater wetlands, mangroves, tidal mudflats and estuaries. The site does not provide any preferred habitat attributes for these species although limited habitat may be provided within the constructed ponds. Superior quality habitat is available within the locality and it is considered unlikely that the proposed development will adversely impact upon these species on a local or national level.

Gallinago hardwickii (Latham's Snipe) inhabits a range of habitats including soft wet ground or shallow water with tussocks and other green and dead growth, wet paddocks, saltmarsh and mangrove fringes. The site does not provide any preferred habitat for this species. Accordingly, it is considered unlikely that the proposed development will adversely impact upon this species on a local or national level.

Numenius madagascariensis (Eastern Curlew) frequents estuaries, tidal mudflats, sandspits, saltmarshes and mangroves. Occasionally it occurs in fresh or brackish lakes and bare grass near water. The site does not provide any preferred habitat for this species. Accordingly, it is considered unlikely that the proposed development will adversely impact upon this species on a local or national level.

- *nuclear activities;*

The proposal does not involve any type of nuclear activity.

- *the Commonwealth marine environment;*

The proposal does not involve the modification of the Commonwealth marine environment.

10.0 RECOMMENDATIONS

A number of recommendations have been made throughout this report and have been summarised below.

- It is recommended that additional targeted flora surveys be undertaken over the areas identified within this report as potential habitat to more accurately indicate the extent of *Tetratheca juncea* populations on site as well as to survey terrestrial orchids during their flowering period as discussed within Section 4.1.3 of the report.
- It is recommended that the drainage line in the south eastern corner of the site and its associated vegetation be retained within the scope of the development. This recommendation is based on the occurrence of Narrabeen Wallarah Sheltered Grassy Forest, which has been identified as being locally significant.
- It is recommended that a habitat corridor be established within the western portion of the site although its exact location may be dependant upon the results of the above targeted flora surveys.
- It is recommended that the areas of Coastal Headland Complex occurring along the eastern boundary of the site, in connection with similar habitat to the east should be retained to form a protective buffer for those areas of less disturbed vegetation occurring off site.
- It is recommended that all areas of vegetation proposed to be retained should form a corridor rather than isolated patches in order to minimise the affects of habitat fragmentation. In regards to the planning and maintenance requirements of such corridors, the following points should be taken into consideration:
    - The corridors should maintain a connection with similar habitat attributes to the north and south of the site;
    - The corridors should be designed in such a manner as to decrease the edge to ratio effect ie. a straight edged corridor is seen to be more effective than a winding corridor.
    - If fences are to be erected around the boundary of the site, consideration should be given to facilitating the movement of terrestrial fauna over or under the fences. This may include the use of dispersal poles or tree plantings along the fence lines for arboreal species such as possums and gliders. Smaller terrestrial mammals would require a minimum 20cm gap underneath the fence.
    - On-going weed control would need to be undertaken within the corridors to ensure that populations of weed species, particularly Bitou Bush are managed so as to minimise any impacts on native flora and fauna as well as preventing their spread to areas of neighboring bushland. Such measures would include the physical removal of

weeds, education of future residents on the effects of green waste dumping and limiting access into the vegetated areas of the site.

- In regards to the long-term conservation of *Tetratheca juncea* populations as well as critical habitat attributes such as nesting/roosting habitat for the Glossy Black-Cockatoo and Masked Owl, access into the corridors should be restricted.

- Consideration should be given to the retention or supplementary planting of Koala feed tree species, if possible, within the scope of the development proposal.
- Additional recommendations, which will benefit most terrestrial/arboreal fauna species assessed, are the retention of hollow bearing trees, the use of signs warning motorists of the potential presence of wildlife in the area and a reduced speed limit along access roads.
- Following the completion of the final development design, the Wyong Conservation Strategy will need to be assessed in regards to threatened species conservation and corridor design.
- It is recommended that a 50m buffer area be maintained around the boundary of the SEPP 14 wetland located to the south of the site. This buffer area impinges upon a very small area along the southern boundary and it is believed that with the implementation of the following recommendations the proposed development will not significantly impact (either directly or indirectly) upon the wetland:
  - No areas of native vegetation are to be disturbed within the wetland or 50m buffer area.
  - All machinery etc must stay outside of the buffer.
  - After the construction has been completed if the vegetation along the outer margins of the buffer has been disturbed then it is to be rehabilitated with native flora species suitable to the wetland setting.
  - Construction works are to be undertaken in dry weather and, drainage and sediment control measures are to be implemented to prevent contamination of the wetland;
  - All contractors are to be made aware of the construction conditions before commencement of work. The construction work should also be monitored throughout its duration to make sure the conditions stated in this report are being adhered to.
- Given that no development design has been provided to date, recommendations made are very broad and the assessments under Section 5A of the EPA Act as contained within Appendix A of this report were not conclusive. Following the completion of the development proposal the assessments for *Tetratheca juncea* (Black-eyed Susan), *Calyptorhynchus lathami* (Glossy Black-Cockatoo), *Tyto novaehollandiae* (Masked Owl), *Diuris praecox* (Double-tailed Orchid) and *Phascolarctos cinereus* (Koala) which have been recorded on site will need to be revised.

11.0 CONCLUSION

Flora, fauna and habitat studies as part of a Statement of Effect on Threatened Flora and Fauna have been undertaken over approximately 90ha of land identified as Part Lot 2 DP809795, Catherine Hill Bay, NSW. The study area is located to the south of the township of Catherine Hill Bay and is bounded by Munmorah State Recreation Area to the south and east. The site has been subject to a number of past disturbances and forms part of the decommissioned Wallarah/Moonee Colliery, which is located between the Munmorah State Recreation Area to the south and Cams Wharf to the north. A wetland was located to the south of the site and has been identified as forming State Environmental Planning Policy 14 (SEPP 14) Wetland No. 891.

The study area was found to support four vegetation communities, being Narrabeen Wallarah Sheltered Grassy Forest, Coastal Headland Complex (Tall Scrub Variant), Coastal Headland Complex (Shrubland Variant) and Coastal Sand Wallum Heath-Scrub. Also noted within the bounds of the study area were areas of regenerating vegetation evidenced by the young, uniform age of the dominant species. These areas were located within the vicinity of the highly disturbed coal dump and administration areas and were found to share similar species and community characteristics with all of the communities delineated on site.

All of these communities are dominated by native species, although weeds were noted around the edges of the communities and along the tracks which traverse the site. Invasive weeds such as Lantana and Bitou Bush were commonly encountered.

The Coastal Headland Complex has been identified as being both locally and regionally significant (Bell, 2002) due to its restricted occurrence in the region (<1000ha) as well as being relatively fragile following major disturbance. It is recommended that the areas of Coastal Headland Complex occurring along the eastern boundary of the site, in connection with similar habitat to the east should be retained to form a protective buffer for those areas of less disturbed vegetation occurring off site. Within these areas of retained vegetation, on-going weed control measures should be implemented.

The Narrabeen Wallarah Sheltered Grassy Forest dominated the western portion of the site and has also been identified as being locally significant due to its restricted occurrence in the north eastern corner of the Shire. The recommended retention of vegetation within the western portion of the site as a habitat corridor will protect a large proportion of this community and will also retain connection with similar vegetation off site to the north and south.

One species recognised as being threatened was directly recorded on site during the recent survey, being *Tetratheca juncea* (Black-eyed Susan). *Calyptorhynchus lathami* (Glossy Black-Cockatoo),

Tyto novaehollandiae (Masked Owl), *Diuris praecox* (Double-tailed Orchid) and *Phascolarctos cinereus* (Koala) have also been previously recorded within the immediate vicinity of the site (NPWS Database, August 2003) and for the purposes of this assessment have been considered as 'recorded on site'.

Eight plants of *Tetratheca juncea* were identified across the western portion of the site within the areas of Narrabeen Wallarah Sheltered Grassy Forest. Whilst this species is recognised as being adequately conserved on a regional scale, the proposed development of this site may significantly impact upon the local population of this species. Accordingly, it is recommended that additional surveys be undertaken within the areas of potential habitat to more accurately indicate the extent of this population and to recommend ameliorative/protective measures. Until such time, and for the purposes of this assessment, it is believed that the proposal has the potential to significantly affect local populations of this species.

Calyptorhynchus lathami (Glossy Black-Cockatoo) has been recently recorded approximately 2km to the west of the site in similar Open Forest habitat (Wildthing Environmental Consultants, 2003). No Glossy Black-Cockatoos nor any indications of their presence (i.e. chewed cones) were identified on site during the recent survey period despite targeted searches. Accordingly, it is believed that the local Glossy Black-Cockatoo population does not regularly utilise the site and is not solely dependant upon the resources present.

Tyto novaehollandiae (Masked Owl) has been previously recorded within the vicinity of the study area on the NPWS database (August, 2003) as well as a recent survey on land 2km to the west of the subject site (Wildthing Environmental Consultants, 2003). Potential nesting/roosting habitat occurs within the areas of Open Forest in the western portion of the site and potential hunting habitat occurs over much of the site. No indication of the presence of this species was noted on site within the survey period. Although, with the presence of at least one breeding pair within the immediate vicinity of the site it is believed likely to be used periodically as part of a much larger home range. It is therefore recommended that potential habitat be retained on site with the scope of the development. This habitat retention may form part of a vegetated corridor through the western portion of the site as well as within bushfire asset protection zones across the site.

Diuris praecox has been previously recorded within the vicinity of the study area on the NPWS database (August, 2003) and potential habitat occurs within the areas of Open Forest in the western portion of the study area. It is recommended that targeted searches be undertaken during the known flowering season for this species. Until such time, and for the purposes of this assessment, it is believed that the proposal has the potential to significantly affect local populations of this species.

Whilst no Koalas nor any indications of their presence (i.e. characteristic 'poc' marks or scats) were identified on site during the recent survey period, the site is recognised as providing suitable habitat in the form of Koala Feed Tree species and records of *Phascolarctos cinereus* (Koala) within 1km of the site were noted on the NPWS Database (August, 2003). Apart from the 1996 records noted above, no Koala sightings have been recorded on the database within eight kilometres of the site since 1975. Accordingly, it is believed that the local Koala population does not frequent the site and would therefore be unlikely to be solely dependant upon the resources present.

Additional recommendations provided, which will benefit most fauna species assessed, are the retention of a vegetated corridor through the western portion of the site, the retention of hollow bearing trees, the use of signs warning motorists of the potential presence of wildlife in the area and a reduced speed limit along access roads. With the implementation of these ameliorative measures it is believed that any impact on any local populations of threatened fauna species assessed would be minimal and unlikely to cause risk of extinction.

Assessment of the site under SEPP 14 – 'Coastal Wetlands' has resulted in a number of recommendations to ensure that the development of the site does not significantly impact (either directly or indirectly) upon SEPP 14 wetland No. 891 to the south of the site. The recommendations have been outlined in the report and include a 50m buffer area surrounding the wetland, drainage and sediment control measures and monitoring throughout the duration of construction to ensure the implementation of the recommendations.

Assessment of the site under the Environment Protection and Biodiversity Conservation Act (1999) found that the proposal was not likely to affect any items of National Environmental Significance although the assessment of *Tetratheca juncea* will have to be revised following the recommended targeted searches.

In conclusion, it is considered that with consideration given to the recommendations made through out this report including the requirement for additional targeted flora surveys and revised assessments of threatened species recorded on site, that the development of this site may be undertaken in such a manner so as to minimise any potential adverse impacts upon viable local populations or individuals of threatened species in the vicinity of the site such that a local extinction would occur.

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APPENDIX A

CONSIDERATIONS UNDER SECTION 5A OF THE EPA ACT 1979

CONSIDERATIONS UNDER SECTION 5A OF THE EPA ACT - SIGNIFICANT EFFECT ON THREATENED SPECIES, POPULATIONS OR ECOLOGICAL COMMUNITIES, OR THEIR HABITATS.

Consideration of this development under the guidelines of Section 5A of the Environmental Planning & Assessment Act (1979) as amended by the Environmental Planning and Assessment Amendment Act (1997) has been made. The heads of consideration of this section are given in italics followed by the answers applicable to this site. Each species is dealt with separately.

The species addressed are those threatened species recorded within 10km of the site on the NPWS Database and considered to have potential habitat available on site:

1. *Tetratheca juncea*	Black-eyed Susan
2. *Diuris praecox*	Double-tailed Orchid
3. *Calyptorhynchus lathami*	Glossy Black-Cockatoo
4. *Tyto novaehollandiae*	Masked Owl
5. *Phascolarctos cinereus*	Koala
6. *Acacia bynoeana*	Tiny Wattle
7. *Angophora inopina*	Charmhaven Apple
8. *Caladenia tessellata*	Thick-lipped Spider-orchid
9. *Callistemon linearifolius*	
10. *Cryptostylis hunteriana*	Leafless Tongue-orchid
11. *Eucalyptus camfieldii*	Camfield's Stringybark
12. *Microtis angusii*	Onion Orchid
13. *Syzygium paniculatum*	Magenta Lillypilly
14. *Crinia tinnula*	Wallum Froglet
15. *Heleioporus australiacus*	Giant Burrowing Frog
16. *Litoria aurea*	Green and Golden Bell Frog
17. *Litoria littlejohni*	Littlejohn's Tree Frog
18. *Mixophyes iteratus*	Southern Barred Frog
19. *Lathamus discolor*	Swift Parrot
20. *Xanthomyza phrygia*	Regent Honeyeater
21. *Ptilinopus regina*	Rose-crowned Fruit-Dove
22. *Ptilinopus superbus*	Superb Fruit-Dove
23. *Climacteris picumnus victoriae*	Brown Treecreeper
24. *Stagonopleura guttata*	Diamond Firetail
25. *Pandion haliaetus*	Osprey
26. *Ninox strenua*	Powerful Owl
27. *Dasyurus maculatus*	Tiger Quoll
28. *Planigale maculata*	Common Planigale
29. *Petaurus norfolcensis*	Squirrel Glider
30. *Potorous tridactylus*	Long-nosed Potoroo
31. *Pteropus poliocephalus*	Grey-headed Flying-fox
32. *Chalinolobus dwyeri*	Large-eared Pied Bat
33. *Mormopterus norfolkensis*	Eastern Freetail-bat
34. *Miniopterus australis*	Little Bentwing-bat
35. *Miniopterus schreibersii oceanensis*	Large Bentwing-bat
36. *Myotis adversus*	Large-footed Myotis
37. *Scoteanax rueppellii*	Greater Broad-nosed Bat

1. *Tetratheca juncea* Black-eyed Susan

Tetratheca juncea, a member the family Tremandraceae, occurs as a small shrub, with prostrate stems up to 60 cm long, usually less than 20 cm high. It has distinctly angular stems and branches with the leaves reduced to minute scales. It produces four petalled purple to pink flowers, mainly from August to November, although flowering outside these times are not uncommon. This species is distributed in generally coastal districts from about Bulahdelah south to the Lake Macquarie region. Populations were once known from the Port Jackson and Botany Bay areas, although it is thought that these may now be extinct. There appears to be a concentration of *T. juncea* occurrence in the Hunter and Central Coast.

T. juncea occurs in Heath and Dry Sclerophyll Forests throughout its range. Norton (1994) has described the preferred habitat attributes of *T. juncea* as:

- sites with clay soils derived from conglomerates with a neutral pH;
- sloping sites below ridgelines;
- sites situated between 30 and 70m above sea-level;
- sites with a predominantly south-east aspect;
- areas providing partial shade, as in Open Woodlands.

T. juncea has, however, been identified in different habitats to those described above and it is believed that the species is adaptable so long as micro-climatic conditions are favourable. The most commonly found associating species are, *Angophora costata* (Smooth-barked Apple), *Eucalyptus globoidea* (White Stringybark), *Corymbia gummifera* (Red Bloodwood), *Acacia myrtifolia* (Myrtle Wattle), *Acacia uncinatum*, *Pultenaea stipularis*, *Dillwynia retorta* (Heathy Parrot Pea), *Leptospermum trinervium* (Paperbark Tea-tree) and *Gompholobium latifolium* (Broad-leaf Wedge-pea).

Previous surveys have located 46 populations around Lake Macquarie, with numbers ranging from tens to over one thousand plants (McReaddie, 1992; Payne, 1993; SWC, 1994, Winning, 1992). Payne (2000) has condensed the previous definitions to 4 'populations', with 240 'sub-populations' (162 of which occur within the LMCC area). The estimation of the number of plants has also been modified to the frequency of 'clumps', due to the clonal and asexual reproduction of the species. Payne (1998; 2000) has also indicated that native sonicating bees are integral to the pollination of this species, and that management of *T. juncea* may be dependant upon protection of adequate habitat for these pollinators. This species has been ROTAP-coded 3VCa, although there is evidence that a coding of 3VCi may be more appropriate.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

Eight plants of *Tetratheca juncea* were identified across western portion of the site within the areas of Narrabeen Wallarah Sheltered Grassy Forest. Whilst this species is recognised as being adequately conserved on a regional scale, the proposed development of this site may significantly impact upon the local population of this species. Accordingly, to provide more accurate information regarding the extent of this species on site from which to determine the potential impact of the development, it is recommended that additional surveys for this species be undertaken in the areas of potential habitat during the next flowering season. Such surveys should be undertaken 2-3 times during the flowering season (August - January). Until such time and for the purposes of this assessment it is believed that the proposal has the potential to significantly affect local populations of this species.

b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No population of this species on site has been identified under Schedule 1, Part 2 of the TSC Act 1995.

c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

Regionally significant areas of known habitat may be removed or modified as a result of the proposal and will be further assessed following the completion of the recommended targeted surveys and the provision of a development plan. The recommended retention of a habitat corridor through the western portion of the site may off set any adverse impacts on the local population as a result of the proposal.

d) whether an area of known habitat is likely to be isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

Provided that all areas of retained vegetation remain connected to similar vegetation to the north and south of the site, no areas of known habitat are likely to be isolated as a result of the proposal.

e) whether critical habitat will be affected.

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act 1995.

f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

Tetratheca juncea is ROTAP-coded 3VCa, indicating that the species is adequately represented within the reserve system, in accordance with the Briggs and Leigh (1995) criterion. However, Payne (1998) points out that the species has a restricted geographical range and occurs sparsely in specific habitats, and that large proportions of the known reserved populations occur in Council Reserves (i.e. 6(a) zoned land) which are not always managed for conservation purposes. It has been therefore been suggested that the ROTAP-coding may need to be revised to 3VCi. Surveys within Glenrock and Munmorah State Recreation Areas and Awabakal Nature Reserve have recorded in excess of 1000 plants in the Glenrock and Munmorah State Recreation Areas (Winning, 1992). Further work by Payne (2000) has revealed that of the 239 known sub-populations throughout its range, 45 are known to be reserved in the above areas as well as in Lake Macquarie State Recreation Area. At least 5 plant clumps have also been recorded in the Blackbutt Council Reserve near Newcastle (Roderick, pers. obs.).

g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act have been listed in bold below followed by an assessment of the applicability of the threatened process in regards to the species, the site and the proposed development:

- **Clearing of Native Vegetation**: The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The clearing to accommodate the development may be viewed as contributing to the incremental decline of habitat in the local area, although it is recognised that this Key Threatening Process has already affected much of the site due to past colliery activities.. Accordingly, the development of this site is unlikely to be singularly responsible for the loss of any local population of this species provided that the recommendations regarding buffers and corridors are implemented.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands**: Alteration to the natural flow regime is recognised as a major factor contributing to the loss of biological diversity and ecological function of aquatic ecosystems. The impacts of this 'Key Threatening Process' include the reduction of habitat, increased flows causing permanent flooding, riparian zone degradation, increased habitat for invasive species and loss or disruption of ecological function. It is recognised that the study area borders a SEPP 14 wetland as well as containing a drainage line which drains towards Moonee Beach to the east. Accordingly, a number of recommendations have been made through the report to ensure that any potential impacts are minimised. In regards to this species, it is considered that the level of threat associated with this 'Key Threatening Process' is low in this instance.

- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera***: Small areas of *Chrysanthemoides monilifera* (Bitou Bush) were identified within the subject site and it may be stated that this 'Key Threatening Process' is already present on site. The level of this threat posed to this species has the potential to be significant and consideration of weed control within any future management plan is recommended to ensure that populations of weed species across the site are managed so as to minimise any impacts on native flora and fauna as well as preventing their spread to areas of neighboring bushland. It is envisaged that such measures would be focused upon the drainage line, areas of native vegetation to be retained within the required bushfire asset protection zones and any vegetation retained in the west of the site.

- **Predation by the European Red Fox *Vulpes vulpes*:** With the recording of at least one Fox during the survey period, it may stated that this 'Key Threatening Process' is already present on site. However, as Foxes do not prey upon *Tetratheca juncea*, this 'Key Threatening Process' is not applicable in this instance.

- **Predation by the Feral Cat *Felis catus***: No Feral Cats were observed on site during the survey period although they are believed likely to occur within the locality. As Feral Cats do not prey upon *Tetratheca juncea*, this 'Key Threatening Process' is not applicable in this instance.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: The site showed evidence of a past fire, although it is difficult to ascertain the disruption and structural change, if any, past fires have caused the site. The proposal is unlikely to result in any increase in frequency of fire events across the study area.

- **Competition from feral honeybees *Apis mellifera*:** No honey bees were observed on the site and as this flora species does not rely on either tree hollows or nectar resources it is not considered a 'Key Threatening Process' in this instance.

- **Bushrock Removal**: No bushrock was observed on the site and as this species does not rely on this habitat resource it is not considered a 'Key Threatening Process' in this instance.

- **Predation by *Gambusia holbrooki* (Plague Minnow)**: No Plague Minnows were noted on site

during the survey although they may occur within the locality. The proposal is unlikely to result in the introduction of this species within the site nor is it likely to increase the numbers of this species within the locality. As the Plague Minnow does not prey upon *Tetratheca juncea* this 'Key Threatening Process' does not apply.

- **Importation of Red Fire Ants *Solenopsis invicta***: This species is not known to occur on site.

- **Infection of native plants by *Phytophthora cinnamomi***: This infection is not known to occur on site.

- **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations**: No endangered Psittacine species were seen on site.

- **Loss and/or degradation of site used for hill-topping by butterflies**: Given the *Tetratheca juncea* is not a form of butterfly, this ' Key Threatening Process' is not applicable.

- **Anthropogenic Climate Change**: No species living on site are considered likely to be significantly affected by anthropogenic climate change.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** Numerous Rabbits were identified on site during the survey period and it may therefore be stated that this 'Key Threatening Process' is already present on site. The proposal is unlikely to increase the numbers of Rabbits within the locality.

- **Infection of frogs by amphibian chytrid causing disease chytridiomycosis:** No indication of amphibian chytrid was noted on site.

- **Invasion of native plant communities by exotic perennial grasses:** As a small number of exotic perennial grasses were identified on site during the survey, it may be stated that this Key Threatening Process is already present on site. The proposed development may result in the further introduction of perennial grasses to the locality, however it is unlikely to be at a scale which would significantly affect any local population of this threatened species

- **Removal of dead wood and dead trees:** As the site contains an Open Forest assemblage with fallen deris noted, the proposal will result in the removal of dead wood and dead trees. However, with consideration given to the recommended retention of Open Forest habitat within a habitat corridor, it is unlikely to be at a scale which would significantly affect any local population of threatened species.

h) whether any threatened species, population or ecological community is at the limit of its known distribution.

Neither this species nor any population in the area is at the limit of the species known standard distribution.

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2. *Diuris praecox* Donkey Orchid

Diuris praecox is a double-tailed terrestrial Orchid with small to moderate sized (25mm across) light yellow and brown flowers during July/August. It is often found growing in Eucalypt forests on hilltops or slopes (Bishop 1996). Species of the *Diuris* genus are very widespread in grassy habitats but can be easily missed because of their short flowering seasons, usually no more than two weeks. *D. praecox* is known from coastal areas between Ourimbah and Nelson Bay, and is ROTAP-coded 2VC-.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

No evidence of this species' presence was recorded during fieldwork, although it should be noted that the fieldwork was undertaken outside of its accepted flowering period. *Diuris praecox* has been previously recorded within the vicinity of the study area on the NPWS database (August, 2003) and potential habitat occurs within the areas of Open Forest in the western portion of the study area. It is recommended that supplementary targeted searches be undertaken during the known flowering season for this species. Until such time, and for the purposes of this assessment, it is believed that the proposal has the potential to significantly affect local populations of this species.

b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No population of this species on site has been identified under Schedule 1, Part 2 of the TSC Act 1995.

c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

Regionally significant areas of known habitat may be removed or modified as a result of the proposal and will be further assessed following the completion of the recommended targeted surveys. The recommended retention of a habitat corridor through the western portion of the site may off set any adverse impacts on the local population as a result of the proposal.

d) whether an area of known habitat is likely to be isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

Targeted surveys during the flowering season will confirm if any areas of known habitat occur within the bounds of the study area, although provided that all areas of retained vegetation remain connected to similar vegetation to the north and south of the site, no areas of known habitat are likely to be isolated as a result of the proposal.

e) whether critical habitat will be affected.

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act 1995.

f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

Diuris praecox is ROTAP-coded 2VC-, indicating that it occurs within the reserve system, in Glenrock State Recreation Area. The size of the population in this reserve is, however, unknown in accordance with the Briggs and Leigh (1995) criterion. As such, it is difficult to quantify whether or not this species is adequately represented in conservation reserves although additional populations have also been recorded near Crackneck Lookout in Wyrrabalong National Park (Gunninah, 2003). The adequacy of the representation of the habitat of this species is difficult to ascertain, although some areas of potential habitat occur within the aforementioned reserve as well as within Wyrrabalong and Tomaree National Parks, Munmorah State Recreation Area and Awabakal and Moffats Swamp Nature Reserves.

g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act have been listed in bold below followed by an assessment of the applicability of the threatened process in regards to the species, the site and the proposed development:

- **Clearing of Native Vegetation**: The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The clearing to accommodate the development may be viewed as contributing to the incremental decline of habitat in the local area, although it is recognised that this Key Threatening Process has already affected much of the site due to past colliery activities.. Accordingly, the development of this site is unlikely to be singularly responsible for the loss of any local population of this species provided that the recommendations regarding buffers and corridors are implemented.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands**: Alteration to the natural flow regime is recognised as a major factor contributing to the loss of biological diversity and ecological function of aquatic ecosystems. The impacts of this 'Key Threatening Process' include the reduction of habitat, increased flows causing permanent flooding, riparian zone degradation, increased habitat for invasive species and loss or disruption of ecological function. It is recognised that the study area borders a SEPP 14 wetland as well as containing a drainage line which drains towards Moonee Beach to the east. Accordingly, a number of recommendations have been made through the report to ensure that any potential impacts are minimised.

- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera***: Areas of *Chrysanthemoides monilifera* (Bitou Bush) were identified within the subject site and it may be stated that this 'Key Threatening Process' is already present on site. The level of this threat posed to this species has the potential to be significant and consideration of weed control within any future management plan is recommended to ensure that populations of weed species across the site are managed so as to minimise any impacts on native flora and fauna as well as preventing their spread to areas of neighboring bushland. It is envisaged that such measures would be focused upon the drainage line, areas of native vegetation to be retained within the required bushfire asset protection zones and any vegetation retained in the west of the site.

- **Predation by the European Red Fox *Vulpes vulpes*:** With the recording of at least one Fox during the survey period, it may stated that this 'Key Threatening Process' is already present on site. However, as Foxes do not prey upon species of terrestrial orchids, this 'Key Threatening

Process' is not applicable in this instance.

- **Predation by the Feral Cat *Felis catus***: No Feral Cats were observed on site during the survey period although they are believed likely to occur within the locality. As Feral Cats do not prey upon species of terrestrial orchids, this 'Key Threatening Process' is not applicable in this instance.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** Numerous Rabbits were identified on site during the survey period and it may therefore be stated that this 'Key Threatening Process' is already present on site. The proposal is unlikely to increase the numbers of Rabbits within the locality.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: The site showed evidence of a past fire, although it is difficult to ascertain the disruption and structural change, if any, past fires have caused the site. The proposal is unlikely to result in any increase in frequency of fire events across the study area.

- **Competition from feral honeybees *Apis mellifera*:** No honey bees were observed on the site and as this flora species does not rely on either tree hollows or nectar resources it is not considered a 'Key Threatening Process' in this instance.

- **Bushrock Removal**: No bushrock was observed on the site and as this species does not rely on this habitat resource it is not considered a 'Key Threatening Process' in this instance.

- **Predation by *Gambusia holbrooki* (Plague Minnow)**: No Plague Minnows were noted on site during the survey although they may occur within the locality. The proposal is unlikely to result in the introduction of this species within the site nor is it likely to increase the numbers of this species within the locality. As the Plague Minnow does not prey upon terrestrial orchids this 'Key Threatening Process' does not apply.

- **Importation of Red Fire Ants *Solenopsis invicta***: This species is not known to occur on site.

- **Infection of native plants by *Phytophthora cinnamomi***: This infection is not known to occur on site.

- **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations**: No endangered Psittacine species were seen on site.

- **Loss and/or degradation of site used for hill-topping by butterflies**: Given that *Diuris praecox* is not a form of butterfly, this ' Key Threatening Process' is not applicable.

- **Anthropogenic Climate Change**: No species living on site are considered likely to be significantly affected by anthropogenic climate change.

- **Infection of frogs by amphibian chytrid causing disease chytridiomycosis:** No indication of amphibian chytrid was noted on site.

- **Invasion of native plant communities by exotic perennial grasses:** As a small number of exotic perennial grasses were identified on site during the survey, it may be stated that this Key Threatening Process is already present on site. The proposed development may result in the further introduction of perennial grasses to the locality, however it is unlikely to be at a scale which would significantly affect any local population of this threatened species

- **Removal of dead wood and dead trees:** As the site contains an Open Forest assemblage with fallen deris noted, the proposal will result in the removal of dead wood and dead trees. However, with consideration given to the recommended retention of Open Forest habitat within a habitat corridor, it is unlikely to be at a scale which would significantly affect any local population of threatened species.

h) whether any threatened species, population or ecological community is at the limit of its known distribution.

Neither this species nor any population in the area is at the limit of the species known standard distribution.

Bibliography:

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3. *Calyptorhynchus lathami* Glossy Black-Cockatoo

The Glossy Black-Cockatoo inhabits Wet and Dry Sclerophyll Forests and Woodlands of eastern Victoria to central Queensland, extending to the western slopes in New South Wales. A subspecies, *C. l. halmaturinus* exists on Kangaroo Island, South Australia. It prefers highland habitats in the northern part of its range but may be found closer to the coast when and where conditions are suitable. In the south they are widespread in lowland coastal forests, dense mountain forests, semi-arid woodland and trees bordering watercourses.

Glossy Black-Cockatoos forages primarily on the seeds of (*Allo*)*Casuarina* species, but will also take wood borers from large *Acacia* stems. *Allocasuarina torulosa, A. verticillata* and *A. littoralis* are the predominant food trees in NSW. On Kangaroo Island, *Casuarina stricta* is the predominant food source. They have also been observed eating *Angophora, Acacia* and *Eucalyptus* seeds. It now appears to supplement its diet with the seeds of exotic pine trees. A sign that foraging individuals have recently fed at a site is a scattering of leaves, twigs and freshly chewed cones under the (*Allo*)*Casuarina* trees. While feeding they are tame and relatively easy to approach. Flocks of Glossy Black-Cockatoos have been seen but are not common. They are usually seen in pairs or threes (being a pair and their young), or as feeding groups consisting of 10-12 birds that are likely to be loose family aggregations. Such groups seem to occupy an area permanently and have a distinctive flight pattern of slow, shallow wing-beats. Nesting takes place from March through August in the hollows of large Eucalypts, 10-20m above the ground, where a single egg is laid.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

Calyptorhynchus lathami (Glossy Black-Cockatoo) has been recently recorded approximately 2km to the west of the site in similar Open Forest habitat. Whilst the site is recognised as providing suitable habitat in the form of hollow bearing trees for nesting and *Allocasuarina* species for foraging, no Glossy Black-Cockatoos nor any indications of their presence (i.e. chewed cones) were identified on site during the recent survey period despite targeted searches. Accordingly, it is believed that the local Glossy Black-Cockatoo population does not frequently utilise the site and would therefore be unlikely to be solely dependant upon the resources present. With consideration given to the recommended retention of a habitat corridor through the western portion of the site, it is believed that the proposed development of the site would be unlikely to affect the species lifecycle such that a local extinction would occur.

b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No population of this species in the area has been identified under Schedule 1, Part 2 of the TSC Act 1995.

c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

Known habitat resources are available on site for this species and any loss of these habitat resources may be viewed as contributing to the incremental decline of habitat on a local and regional scale. However, it is recognised potential habitat will be retained within the recommended habitat corridor.

d) whether an area of known habitat is likely to be isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

Provided that retained vegetation remains connected to similar vegetation to the north and south of the site, no areas of known habitat are likely to be isolated as a result of the proposal, particularly given the high mobility of the species.

e) whether critical habitat will be affected.

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act 1995.

f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

Records of this species in the region are known from many conservation reserve areas. These include the Watagan and Wollemi National Parks (Roderick pers. comm.) as well as within the Blue Mountains, Yengo, Bouddi, Ku-ring-gai Chase, Nattai, Brisbane Water, Cattai, Dharug, Kanangra Boyd and Marramarra National Parks (NPWS Database, 2000). As such, populations of this species are adequately represented within the reserve system in this region. The adequacy of representation of the habitat of this species is difficult to ascertain, although it appears that any of a number of reserves containing forested areas could provide some protected foraging and some potential nesting habitat for this species. As such, it could be tentatively stated that the habitat of this species is well represented in conservation reserves in this region, although the majority of potential habitat remains 'unprotected'.

g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act have been listed in bold below followed by an assessment of the applicability of the threatened process in regards to the species, the site and the proposed development:

- **Clearing of Native Vegetation**: The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The clearing to accommodate the development may be viewed as contributing to the incremental decline of habitat in the local area, although it is recognised that this Key Threatening Process has already affected much of the site due to past colliery activities.. Accordingly, the development of this site is unlikely to be singularly responsible for the loss of any local population of this species provided that the recommendations regarding buffers and corridors are implemented.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands**: Alteration to the natural flow regime is recognised as a major factor contributing to

the loss of biological diversity and ecological function of aquatic ecosystems. The impacts of this 'Key Threatening Process' include the reduction of habitat, increased flows causing permanent flooding, riparian zone degradation, increased habitat for invasive species and loss or disruption of ecological function. It is recognised that the study area borders a SEPP 14 wetland as well as containing a drainage line which drains towards Moonee Beach to the east. Accordingly, a number of recommendations have been made through the report to ensure that any potential impacts are minimised. In regards to this species, it is considered that the level of threat associated with this 'Key Threatening Process' is low in this instance.

- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera***: Small areas of *Chrysanthemoides monilifera* (Bitou Bush) were identified within the subject site and it may be stated that this 'Key Threatening Process' is already present on site. However, the level of this threat posed to the Glossy Black-Cockatoo would be negligible.

- **Predation by the European Red Fox *Vulpes vulpes*:** With the recording of at least one Fox during the survey period, it may stated that this 'Key Threatening Process' is already present on site and could pose a minimal threat to this species. However, the proposal is unlikely to result in increased numbers of this species within the locality.

- **Predation by the Feral Cat *Felis catus***: No Feral Cats were observed on site during the survey period although they are believed likely to occur within the locality. The proposal is however unlikely to result in an increase in the number of Feral Cats although any residential development may result in the increase of domestic cats.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: The site showed evidence of a past fire, although it is difficult to ascertain the disruption and structural change, if any, past fires have caused the site. The proposal is unlikely to result in any increase in frequency of fire events across the study area.

- **Competition from feral honeybees *Apis mellifera*:** No honey bees were observed on the site.

- **Bushrock Removal**: No bushrock was observed on the site and as this species does not rely on this habitat resource it is not considered a 'Key Threatening Process' for this species.

- **Predation by *Gambusia holbrooki* (Plague Minnow)**: No Plague Minnows were noted on site during the survey although they may occur within the locality. The proposed development is unlikely to result in the introduction of this species within the site nor is it likely to increase the numbers of this species within the locality. As the Plague Minnow does not prey upon the Glossy Black-Cockatoo, this Key Threatening Process does not apply in this instance.

- **Importation of Red Fire Ants *Solenopsis invicta***: This species is not known to occur on site.

- **Infection of native plants by *Phytophthora cinnamomi***: This infection is not known to occur on site.

- **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations**: No endangered Psittacine species were seen on site.

- **Loss and/or degradation of site used for hill-topping by butterflies**: Given the fact that the Glossy Black-Cockatoo is not a species of butterfly, this ' Key Threatening Process' is not applicable.

- **Anthropogenic Climate Change**: No species living on site are considered likely to be

significantly affected by anthropogenic climate change.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** Numerous Rabbits were identified on site during the survey period and it may therefore be stated that this 'Key Threatening Process' is already present on site. The proposal is unlikely to increase the numbers of Rabbits within the locality.

- **Infection of frogs by amphibian chytrid causing disease chytridiomycosis:** No indication of amphibian chytrid was noted on site.

- **Invasion of native plant communities by exotic perennial grasses:** As a small number of exotic perennial grasses were identified on site during the survey, it may be stated that this Key Threatening Process is already present on site. The proposed development may result in the further introduction of perennial grasses to the locality, however it is unlikely to be at a scale which would significantly affect any local population of this threatened species

- **Removal of dead wood and dead trees:** As the site contains an Open Forest assemblage with fallen deris noted, the proposal will result in the removal of dead wood and dead trees. However, with consideration given to the recommended retention of Open Forest habitat within a habitat corridor, it is unlikely to be at a scale which would significantly affect any local population of threatened species.

h) whether any threatened species, population or ecological community is at the limit of its known distribution.

Neither this species nor any population occurring in the area is at the limit of its known standard distribution.

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4. *Tyto novaehollandiae* Masked Owl

Masked Owls in NSW are distributed throughout the length of the Great Dividing Range and extend from the coast to the western slopes. Within this range they inhabit a range of wooded habitats that contain both mature trees for roosting and nesting and more open areas for hunting. They are most commonly encountered within Open Forest with a sparse understorey as well as along the ecotones of these areas to more or less densely vegetated habitats. There is much evidence to suggest, however, that the species is not entirely restricted to forested habitats and will readily hunt along the ecotone between wooded habitats and a range of open habitats such as pastoral land (Marchant, 1999 and references cited therein). Their diet comprises mainly ground-dwelling prey, including several species of native and introduced Rodents, *Antechinus* spp. and Bandicoots. On occasions, other prey such as Possums, Gliders and other birds are taken. Strictly nocturnal, Masked Owls will perch for long periods, up to several hours, in an exposed area, waiting to ambush a passing prey animal.

Masked Owls are recognised as being the least common of the three large forest Owls in NSW (Kavanagh and Murray, 1996). Evidence suggests that the species may be secure eastwards of the Great Divide in forests that are not intensively logged, although it may be threatened in cleared and overgrazed areas westwards of the range (Debus and Rose, 1994). The paucity of records of Masked Owls in NSW appears unusual due to the species dietary flexibility and its ability to utilise disturbed habitats (Kavanagh, 1996). This may be due to the apparent reluctance to vocalise during non-breeding periods, making the species difficult to detect for most of the year.

Masked Owls usually roost in large hollows inside large, old living trees, most often Eucalypts. Within dry forests they often choose hollow trees in gullies or drainage lines. These hollows are 1 to 5 metres deep, 40 to 50 cm wide. The trees containing these hollows are likely to be quite old (>150 years). They are also known to roost among the dense foliage of other trees such as *Pandanus, Livistona, Melaleuca* and *Acacia* species. There are also records of Masked Owls roosting in introduced pine trees and in shrubs in gardens and suburban areas (Marchant, 1999and references cited therein). The species also nests in large hollows, although there appears to be a preference for hollow tree trunks and vertical spouts of large trees. The breeding season, like that for other *Tyto* owls, is variable but there is a tendency for breeding to occur in autumn-winter. Two or three young are produced, although some pairs do not every year. Pairs appear to mate for life and occupy exclusive territories in order of 1000ha in size. A radio-tracked bird near Newcastle was found to utilise a home-range of between 1017-1178ha (Kavanagh and Murray, 1996) and another documented pair of Masked Owls in the North Lake Macquarie area may possibly be utilising a home range of up to 1700 hectares (Young, 1998).

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

Tyto novaehollandiae (Masked Owl) has been previously recorded within the vicinity of the study area on the NPWS database as well as during a recent survey on land <1km to the west of the subject site. Potential nesting/roosting habitat occurs within the areas of Open Forest in the western portion of the site and potential hunting habitat occurs over much of the site. No indication of the presence of this species was noted on site within the survey period. Although with the presence of at least one breeding pair within the immediate vicinity of the site it is believed likely to be used periodically as part of a much larger home range. Whilst the development of this site would be unlikely to significant affect the lifecycle of the local population, the incremental modification of potential hunting habitat is difficult to determine and it is recommended that potential habitat be retained on site with the scope of the development. This habitat retention may form part of a vegetated corridor through the western

portion of the site as well as within Bushfire Asset Protection zones across the site. Access into retained vegetation should be restricted in order to minimise disturbance to any local breeding pair.

b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No population of this species in the area has been identified under Schedule 1, Part 2 of the TSC Act 1995.

c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

Known habitat resources are available on site for this species and any loss of these habitat resources may be viewed as contributing to the incremental decline of habitat on a local and regional scale. However, it is recognised potential habitat will be retained within the recommended habitat corridor and Bushfire Asset Protection Zones.

d) whether an area of known habitat is likely to be isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

Provided that retained vegetation remains connected to similar vegetation to the north and south of the site, no areas of known habitat are likely to be isolated as a result of the proposal, particularly given the high mobility of the species.

e) whether critical habitat will be affected.

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act 1995.

f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

Records of this species in the region are known from several conservation reserve areas. These include Yengo National Park (Roderick, pers. comm.) and within the Blue Mountains, Bouddi, Dharug, Brisbane Waters, Ku-ring-gai Chase and Royal National Parks (NPWS Database, 2000). The species has also been recorded in the Shortland Wetlands Reserve (Lindsey, pers. comm.). As such, it appears that this species is well represented in conservation reserves in the region. The adequacy of representation of the habitat of this species in the region is difficult to determine, but it appears that a range of reserves containing forested areas could provide some protected habitat for this species. As such, it could be tentatively stated that the habitat of this species is well represented in conservation reserves in this region, although the majority of potential habitat remains 'unprotected'.

g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act have been listed in bold below followed by an assessment of the applicability of the threatened process in regards to the species, the site and the proposed development:

- **Clearing of Native Vegetation**: The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The clearing to accommodate the development may be viewed as contributing to the incremental decline of habitat in the local area, although it is recognised that this Key Threatening Process has already affected much of the site due to past colliery activities.. Accordingly, the development of this site is unlikely to be singularly responsible for the loss of any local population of this species provided that the recommendations regarding buffers and corridors are implemented.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands**: Alteration to the natural flow regime is recognised as a major factor contributing to the loss of biological diversity and ecological function of aquatic ecosystems. The impacts of this 'Key Threatening Process' include the reduction of habitat, increased flows causing permanent flooding, riparian zone degradation, increased habitat for invasive species and loss or disruption of ecological function. It is recognised that the study area borders a SEPP 14 wetland as well as containing a drainage line which drains towards Moonee Beach to the east. Accordingly, a number of recommendations have been made through the report to ensure that any potential impacts are minimised. In regards to this species, it is considered that the level of threat associated with this 'Key Threatening Process' is low in this instance.

- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera***: Small areas of *Chrysanthemoides monilifera* (Bitou Bush) were identified within the subject site and it may be stated that this 'Key Threatening Process' is already present on site. However, the level of this threat posed to this species would be negligible.

- **Predation by the European Red Fox *Vulpes vulpes*:** With the recording at least one Fox during the survey period, it may stated that this 'Key Threatening Process' is already present on site. However, as Foxes are unlikely to prey upon Masked Owls, this 'Key Threatening Process' is not applicable in this instance.

- **Predation by the Feral Cat *Felis catus***: No Feral Cats were observed on site during the survey period although they are believed likely to occur within the locality. However, the proposal is unlikely to result in an increase in the number of Feral Cats although any residential development may result in the increased numbers of domestic cats.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: The site showed evidence of a past fire, although it is difficult to ascertain the disruption and structural change, if any, past fires have caused the site. The proposal is unlikely to result in any increase in frequency of fire events across the study area.

- **Competition from feral honeybees *Apis mellifera*:** No honey bees were observed on the site.

- **Bushrock Removal**: No bushrock was observed on the site and as this species does not rely on this habitat resource it is not considered a 'Key Threatening Process' for this species.

- **Predation by *Gambusia holbrooki* (Plague Minnow)**: No Plague Minnows were noted on site during the survey although they may occur within the locality. The proposed development is

unlikely to result in the introduction of this species within the site nor is it likely to increase the numbers of this species within the locality. As the Plague Minnow does not prey upon the Masked Owl, this Key Threatening Process does not apply in this instance.

- **Importation of Red Fire Ants *Solenopsis invicta***: This species is not known to occur on site.

- **Infection of native plants by *Phytophthora cinnamomi***: This infection is not known to occur on site.

- **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations**: No endangered Psittacine species were seen on site.

- **Loss and/or degradation of site used for hill-topping by butterflies**: As this species is not a form of butterfly this ' Key Threatening Process' is not applicable.

- **Anthropogenic Climate Change**: No species living on site are considered likely to be significantly affected by anthropogenic climate change.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** Numerous Rabbits were identified on site during the survey period and it may therefore be stated that this 'Key Threatening Process' is already present on site. The proposal is unlikely to increase the numbers of Rabbits within the locality.

- **Infection of frogs by amphibian chytrid causing disease chytridiomycosis:** No indication of amphibian chytrid was noted on site.

- **Invasion of native plant communities by exotic perennial grasses:** As a small number of exotic perennial grasses were identified on site during the survey, it may be stated that this Key Threatening Process is already present on site. The proposed development may result in the further introduction of perennial grasses to the locality, however it is unlikely to be at a scale which would significantly affect any local population of this threatened species

- **Removal of dead wood and dead trees:** As the site contains an Open Forest assemblage with fallen deris noted, the proposal will result in the removal of dead wood and dead trees. However, with consideration given to the recommended retention of Open Forest habitat within a habitat corridor, it is unlikely to be at a scale which would significantly affect any local population of threatened species.

h) whether any threatened species, population or ecological community is at the limit of its known distribution.

Neither this species nor any population occurring in the area is at the limit of its known standard distribution.

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5. *Phascolarctos cinereus* Koala

The Koala occurs along the east coast of Australia and extends into woodland, mulga and River Red Gum forests west of the Great Dividing Range. Its range covers all such suitable areas of N.S.W. In drier forested areas, Koalas are generally observed as individuals in low densities. They are more abundant in coastal woodland and in open forest, where they have been found in densities as high as ten per hectare. They are rare or absent in wet forests in the south above 600 m which may be due more to distribution of Eucalypt species than climate, as the Koala is limited to areas where there are acceptable food trees. Its diet is generally restricted to that of Eucalypt leaves and much less-often, non-Eucalypt foliage. The foliage of *Eucalyptus camaldulensis* (River Red Gum), *E. tereticornis* (Forest Red Gum), *E. punctata* (Grey Gum), *E. viminalis* (Manna Gum), and *E. robusta* (Swamp Mahogany) are some of the preferred Eucalypt species. Koalas use a wide variety of tree sizes, and do not preferentially use large or tall trees in NSW forests, although this has been listed as a habitat preference in areas where trees are generally small, stunted, or nutrient deprived.

Koalas sleep in the fork of a tree during the day and feed at night with the peak of activity just after sunset. It is generally a solitary animal with a social behaviour pattern that influences its breeding biology. Breeding biology of the Koala is characterised by the occurrence of discrete core breeding groups which are sedentary. A core group may comprise up to several dozen individuals that are usually well separated from other breeding groups. These core groups produce a continual supply of dispersing nomadic sub-adults. Individual Koalas within core breeding groups occupy semi-exclusive territories. There is interaction with and marginal overlap of territories between adjacent individual animals. The territories of breeding males generally occur within a matrix of adjacent territories of breeding females. In the overlap zones of adjacent territories of breeding Koalas, individual trees occur that are habitually used for interaction between the two animals concerned. These breeding core interaction trees (sometimes termed "home range trees") are readily identifiable by scratched "trails" up the bole and copious dung deposits at the base of the tree. Breeding occurs in summer and young females produce one young (rarely twins) each year.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

Whilst no Koalas, nor any indications of their presence (i.e. characteristic 'poc' marks or scats), were identified on site during the recent survey period, the site is recognised as providing suitable habitat in the form of Koala Feed Tree species, being *Eucalyptus robusta* (Swamp Mahogany)*, Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus punctata* (Grey Gum) and *Eucalyptus haemastoma* (Scribbly Gum). One record of *Phascolarctos cinereus* (Koala) is present on the NPWS Database (August, 2003) within the immediate vicinity of the site 1996. Apart from the 1996 record, no other Koala sightings have been recorded on the database within eight kilometers of the site since 1975. Accordingly, it is believed that the local Koala population does not frequent the site and would therefore be unlikely to be solely dependant upon the resources present.

Specimens of *Eucalyptus haemastoma* (Scribbly Gum) and possibly *Eucalyptus punctata* (Grey Gum) will be retained within the recommended habitat corridor within the western portion of the site, with specimens of *Eucalyptus robusta* (Swamp Mahogany) to be retained within the drainageline vegetation. Consideration should also be given to the retention or supplementary planting of Koala feed tree species, if possible, within the scope of the development proposal. Additional recommendations, which will benefit most fauna species assessed as well as Koalas, are the use of signs warning

motorists of the potential presence of wildlife in the area and a reduced speed limit along access roads. With the implementation of these ameliorative measures it is believed that any impact on the local Koala population would be minimal and unlikely to cause extinction.

b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No population of this species on site has been identified under Schedule 1, Part 2 of the TSC Act 1995.

c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

Habitat resources are available on site for this species and any loss of these may be viewed as contributing to the incremental decline of habitat on a local and regional scale. However, it is recognised potential habitat will be retained within the recommended habitat corridor and Bushfire Asset Protection Zones.

d) whether an area of known habitat is likely to be isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No areas of known habitat are likely to be isolated as a result of the proposal provided that the recommendation regarding the retention of habitat with suitable connections to the north and south is implemented.

e) whether critical habitat will be affected.

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act 1995.

f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

Records of this species in the region exist from many conservation reserve areas. The Koala has been recorded from the Watagan National Park and from Moffats Swamp Nature Reserve (Roderick, pers. comm.). A survey conducted by Reed *et al* (1990) recorded 'regular sightings' of the Koala in the Brisbane Waters, Ku-ring-gai Chase and Marramarra National Parks. NPWS database records have further accounts of the species in the Wollemi, Yengo, Blue Mountains, Dharug, Heathcote, Nattai and Royal National Parks as well as within Parr State Recreation Area (NPWS Database, 2000). As such, it appears that this species is well represented in conservation reserves in the region. The adequacy of representation of the habitat of this species in the region is difficult to ascertain, although it appears that any of a number of reserves containing Eucalypt forests could provide some protected habitat for this species. As such, it could be tentatively stated that the habitat of this species is well represented in conservation reserves in this region, although the majority of potential habitat remains 'unprotected'.

g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act have been listed in bold below followed by an assessment of the applicability of the threatened process in regards to the species, the site and the proposed development:

- **Clearing of Native Vegetation**: The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The clearing to accommodate the development may be viewed as contributing to the incremental decline of habitat in the local area, although it is recognised that this Key Threatening Process has already affected much of the site due to past colliery activities.. Accordingly, the development of this site is unlikely to be singularly responsible for the loss of any local population of this species provided that the recommendations regarding buffers and corridors are implemented.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands**: Alteration to the natural flow regime is recognised as a major factor contributing to the loss of biological diversity and ecological function of aquatic ecosystems. The impacts of this 'Key Threatening Process' include the reduction of habitat, increased flows causing permanent flooding, riparian zone degradation, increased habitat for invasive species and loss or disruption of ecological function. It is recognised that the study area borders a SEPP 14 wetland as well as containing a drainage line which drains towards Moonee Beach to the east. Accordingly, a number of recommendations have been made through the report to ensure that any potential impacts are minimised. In regards to this species, it is considered that the level of threat associated with this 'Key Threatening Process' is low in this instance.

- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera***: Small areas of *Chrysanthemoides monilifera* (Bitou Bush) were identified within the subject site and it may be stated that this 'Key Threatening Process' is already present on site. However, the level of threat posed to the Koala would be negligible.

- **Predation by the European Red Fox *Vulpes vulpes*:** With the recording of at least one Fox during the survey period, it may stated that this 'Key Threatening Process' is already present on site and could pose a threat to this species. However, the proposal is unlikely to result in increased numbers of *Vulpes vulpes* within the locality.

- **Predation by the Feral Cat *Felis catus***: No Feral Cats were observed on site during the survey period although they are believed likely to occur within the locality. However, the proposal is unlikely to result in an increase in the number of Feral Cats.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: The site showed evidence of a past fire, although it is difficult to ascertain the disruption and structural change, if any, past fires have caused the site. The proposal is unlikely to result in any increase in frequency of fire events across the study area.

- **Competition from feral honeybees *Apis mellifera*:** No honey bees were observed on the site and as the Koala does not rely on either tree hollows or nectar resources it is not considered a 'Key Threatening Process' for this species.

- **Bushrock Removal**: No bushrock was observed on the site and as the Koala does not rely on this habitat resource it is not considered a 'Key Threatening Process' for this species.

- **Predation by *Gambusia holbrooki* (Plague Minnow)**: No Plague Minnows were noted on site

during the survey although they may occur within the locality. The proposed development is unlikely to result in the introduction of this species within the site nor is it likely to increase the numbers of this species within the locality. As the Plague Minnow does not prey upon Koalas the Key Threatening Process does not apply to the Koala.

- **Importation of Red Fire Ants *Solenopsis invicta***: This species is not known to occur on site.

- **Infection of native plants by *Phytophthora cinnamomi***: This infection is not known to occur on site.

- **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations**: No endangered Psittacine species were seen on site.

- **Loss and/or degradation of site used for hill-topping by butterflies**: Given the fact that the Koala is not a species of butterfly this 'Key Threatening Process' is not applicable.

- **Anthropogenic Climate Change**: No species living on site are considered likely to be significantly affected by anthropogenic climate change.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** Numerous Rabbits were identified on site during the survey period and it may therefore be stated that this 'Key Threatening Process' is already present on site. The proposal is unlikely to increase the numbers of Rabbits within the locality.

- **Infection of frogs by amphibian chytrid causing disease chytridiomycosis:** No indication of amphibian chytrid was noted on site.

- **Invasion of native plant communities by exotic perennial grasses:** As a small number of exotic perennial grasses were identified on site during the survey, it may be stated that this Key Threatening Process is already present on site. The proposed development may result in the further introduction of perennial grasses to the locality, however it is unlikely to be at a scale which would significantly affect any local population of this threatened species

- **Removal of dead wood and dead trees:** As the site contains an Open Forest assemblage with fallen deris noted, the proposal will result in the removal of dead wood and dead trees. However, with consideration given to the recommended retention of Open Forest habitat within a habitat corridor, it is unlikely to be at a scale which would significantly affect any local population of threatened species.

h) whether any threatened species, population or ecological community is at the limit of its known distribution.

Neither this species nor any population occurring in the local area is at the limit of its known standard distribution.

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6. *Acacia bynoeana* Tiny Wattle

Acacia bynoeana occurs from Morisset (lower Hunter Valley) to Mittagong. This species is a low bushy shrub found in heath, woodland and dry sclerophyll forests on sandy soils derived from Hawkesbury Sandstone. Commonly associated species include *Eucalyptus haemastoma* (Scribbly Gum), *Corymbia gummifera* (Red Bloodwood), *Angophora bakeri, Banksia spinulosa* (Hairpin Banksia), *B. serrata* (Old Man Banksia), *Acacia oxycedrus* and *Kunzea* spp. It is considered to be uncommon, but scattered populations have been noted throughout the Sydney region. This species can be recognised by the rough coarse hairs covering the branchlets and the phyllodes, and the thick and resinous phyllodes with parallel veins. Flowering occurs during the summer months and is characterised by a bright yellow, globular single flower located within the leaf axil. This species has been ROTAP-coded 3VC- and has recently (March 2000) been upgraded from 'Vulnerable' to 'Endangered' under the TSC Act 1995. Conserved populations occur within the Blue Mountains National Park and the Royal National Park, though the exact size of these populations is unknown.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

No evidence of this species' presence was recorded during fieldwork despite targeted searches. The forested portions of the site, particularly within the western portion of the site where associated species were identified provides potential habitat. Large areas of similar habitat attributes are also common within the locality and include the adjacent Munmorah State Recreation Area. It is therefore believed that the proposed development of the site is unlikely to disrupt the species' life cycle or place any viable local population at risk of extinction.

b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No population of this species on site has been identified under Schedule 1, Part 2 of the TSC Act 1995.

c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

No significant area of known habitat is to be removed or modified as a result of the proposal, although the development of the site may be viewed as contributing to the incremental loss of potential for this species in the region.

d) whether an area of known habitat is likely to be isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No areas of known habitat are likely to be isolated as a result of the proposal provided that the recommendation regarding the retention of habitat with suitable connections to the north and south is implemented.

e) whether critical habitat will be affected.

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act 1995.

f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

Acacia bynoeana is ROTAP-coded 3VC-, indicating that it occurs within the reserve system, although the adequacy of the reservation is not known, in accordance with the Briggs and Leigh (1995) criterion. As such, it is difficult to quantify whether or not the species is adequately represented in conservation reserves. This species is known to occur in the Royal and Blue Mountains National Parks. The adequacy of the representation of the habitat of this species is also difficult to ascertain, although large areas of potential habitat occur within the two aforementioned National Parks as well as within the Wollemi, Yengo, Dharug, Garigal, Ku-ring-gai Chase and Popran National Parks as well as within Barren Grounds Nature Reserve and Parr State Recreation Area.

g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act have been listed in bold below followed by an assessment of the applicability of the threatened process in regards to the species, the site and the proposed development:

- **Clearing of Native Vegetation**: The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The clearing to accommodate the development may be viewed as contributing to the incremental decline of habitat in the local area, although it is recognised that this Key Threatening Process has already affected much of the site due to past colliery activities.. Accordingly, the development of this site is unlikely to be singularly responsible for the loss of any local population of this species provided that the recommendations regarding buffers and corridors are implemented.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands**: Alteration to the natural flow regime is recognised as a major factor contributing to the loss of biological diversity and ecological function of aquatic ecosystems. The impacts of this 'Key Threatening Process' include the reduction of habitat, increased flows causing permanent flooding, riparian zone degradation, increased habitat for invasive species and loss or disruption of ecological function. It is recognised that the study area borders a SEPP 14 wetland as well as containing a drainage line which drains towards Moonee Beach to the east. Accordingly, a number of recommendations have been made through the report to ensure that any potential impacts are minimised. In regards to this species, it is considered that the level of threat associated with this 'Key Threatening Process' is low in this instance.

- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera***: Small areas of *Chrysanthemoides monilifera* (Bitou Bush) were identified within the subject site and it may be stated that this 'Key Threatening Process' is already present on site. The level of this threat posed to this species has the potential to be significant and consideration of weed control within any future management plan is recommended to ensure that populations of weed species across the site are managed so as to minimise any impacts on native flora and fauna as well as preventing their spread to areas of neighboring bushland.

- **Predation by the European Red Fox *Vulpes vulpes*:** With the noted presence of at least one Fox during the survey period, it may stated that this 'Key Threatening Process' is already present on site. However, as Foxes do not prey upon this flora species, this 'Key Threatening Process' is not applicable in this instance.

- **Predation by the Feral Cat *Felis catus***: No Feral Cats were observed on site during the survey period although they are believed likely to occur within the locality. However, as Feral Cats do not prey upon this flora species, this 'Key Threatening Process' is not applicable in this instance.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: The site showed evidence of a past fire, although it is difficult to ascertain the disruption and structural change, if any, past fires have caused the site. The proposal is unlikely to result in any increase in frequency of fire events across the study area.

- **Competition from feral honeybees *Apis mellifera*:** No honey bees were observed on the site and as this flora species does not rely on either tree hollows or nectar resources it is not considered a 'Key Threatening Process' in this instance.

- **Bushrock Removal**: No bushrock was observed on the site and as this species does not rely on this habitat resource it is not considered a 'Key Threatening Process' in this instance.

- **Predation by *Gambusia holbrooki* (Plague Minnow)**: No Plague Minnows were noted on site during the survey although they may occur within the locality. The proposal is unlikely to result in the introduction of this species within the site nor is it likely to increase the numbers of this species within the locality. As the Plague Minnow does not prey upon acacias this 'Key Threatening Process' does not apply.

- **Importation of Red Fire Ants *Solenopsis invicta***: This species is not known to occur on site.

- **Infection of native plants by *Phytophthora cinnamomi***: This infection is not known to occur on site.

- **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations**: No endangered Psittacine species were seen on site.

- **Loss and/or degradation of site used for hill-topping by butterflies**: Given that *Acacia bynoeana* is not a form of butterfly, this ' Key Threatening Process' is not applicable.

- **Anthropogenic Climate Change**: No species living on site are considered likely to be significantly affected by anthropogenic climate change.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** Numerous Rabbits were identified on site during the survey period and it may therefore be stated that this 'Key Threatening Process' is already present on site. The proposal is unlikely to increase the numbers of Rabbits within the locality.

- **Infection of frogs by amphibian chytrid causing disease chytridiomycosis:** No indication of amphibian chytrid was noted on site.

- **Invasion of native plant communities by exotic perennial grasses:** As a small number of exotic perennial grasses were identified on site during the survey, it may be stated that this Key Threatening Process is already present on site. The proposed development may result in the

further introduction of perennial grasses to the locality, however it is unlikely to be at a scale which would significantly affect any local population of this threatened species

- **Removal of dead wood and dead trees:** As the site contains an Open Forest assemblage with fallen deris noted, the proposal will result in the removal of dead wood and dead trees. However, with consideration given to the recommended retention of Open Forest habitat within a habitat corridor, it is unlikely to be at a scale which would significantly affect any local population of threatened species.

h) whether any threatened species, population or ecological community is at the limit of its known distribution.

Any individual or population of this species occurring in the area would not be at the limit of its known standard distribution.

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7. *Angophora inopina* Charmhaven Apple

Angophora inopina (Charmhaven Apple) is restricted in distribution to the Wyong and Lake Macquarie LGAs with further disjunct populations known from the Port Stephens LGA south of Karuah. The current distribution of the species, especially in the southern portion of its range, is thought to be a representative of a larger population that occurred prior to European settlement (Bell, 2001). The species was only discovered and described during the mid 1990s, prior to this the species was typically identified as *Angophora floribunda* (Rough-barked Apple), a species common to the area. Specific surveys of *A. inopina* have found that at the extremities of the species range hybridisation has occurred with *A. floribunda* (Bell, 2001).

Angophora inopina is described as a small tree to 8 metres tall, often multi-stemmed. The bark is persistent throughout and shortly fibrous. The adult leaves are moderately glossy, mid-green but paler on the lower surface, lanceolate to broad lanceolate, acute, 4-11cm long and 0.8-2.6cm wide. The fruits are setose, vaguely ribbed, cup-shaped to pyriform, more or less truncate, usually 3-locular, 11-15mm long, 9-12mm diameter. The valves of the fruit are broadly triangular, obtuse, enclosed and steeply raised (Hill, 1997).

Angophora inopina is found within open woodland/forest assemblages in co-dominant distribution with *Eucalyptus haemastoma* (Scribbly Gum), *Corymbia gummifera* (Red Bloodwood) and *Eucalyptus capitellata* (Brown Stringybark), as well as within wet-dry heath, and swamp forest communities. These vegetation habitat attributes are located mainly on the Doyalson, Gorokan and Wyong soil landscapes (Bell, 2001). It has been estimated by Bell (2001), that *A. inopina* occupies approximately 1418ha of habitat.

The successful germination of *A. inopina* seed is believed to be rare under natural conditions, with the maintenance of populations in the short-term facilitated by coppice growth following disturbance (Bell, 2001). At present there is insufficient information to determine the extent of migration of seed propagules and pollen between stands of *A. inopina*. The majority of the known stands of this species occur within 1km of each other, between which it is believed that the exchange of genetic material could be expected (Bell, 2001).

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

No evidence of this species' presence was recorded during fieldwork despite targeted searches. The forested portions of the site provide potential habitat for this species although larger areas of similar habitat attributes are also common within the locality and include the adjacent Munmorah State Recreation Area. It is therefore believed that the proposed development of the site is unlikely to disrupt the species' life cycle or place any viable local population at risk of extinction.

b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No population of this species on site has been identified under Schedule 1, Part 2 of the TSC Act 1995.

c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

No significant area of known habitat is to be removed or modified as a result of the proposal, although the development of the site may be viewed as contributing to the incremental loss of potential for this species in the region.

d) whether an area of known habitat is likely to be isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No areas of known habitat are likely to be isolated as a result of the proposal provided that the recommendation regarding the retention of habitat with suitable connections to the north and south is implemented.

e) whether critical habitat will be affected.

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act 1995.

f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

The adequacy of the representation of habitat is difficult to ascertain, although some areas of potential habitat may be protected within Yengo and Wyrrabalong National Parks as well as Munmorah and Lake Macquarie State Recreation Areas.

g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act have been listed in bold below followed by an assessment of the applicability of the threatened process in regards to the species, the site and the proposed development:

- **Clearing of Native Vegetation**: The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The clearing to accommodate the development may be viewed as contributing to the incremental decline of habitat in the local area, although it is recognised that this Key Threatening Process has already affected much of the site due to past colliery activities.. Accordingly, the development of this site is unlikely to be singularly responsible for the loss of any local population of this species provided that the recommendations regarding buffers and corridors are implemented.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands**: Alteration to the natural flow regime is recognised as a major factor contributing to the loss of biological diversity and ecological function of aquatic ecosystems. The impacts of this 'Key Threatening Process' include the reduction of habitat, increased flows causing permanent flooding, riparian zone degradation, increased habitat for invasive species and loss or disruption of ecological function. It is recognised that the study area borders a SEPP 14 wetland as well as containing a drainage line which drains towards Moonee Beach to the east. Accordingly, a number of recommendations have been made through the report to ensure that

any potential impacts are minimised. In regards to this species, it is considered that the level of threat associated with this 'Key Threatening Process' is low in this instance.

- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera***: Small areas of *Chrysanthemoides monilifera* (Bitou Bush) were identified within the subject site and it may be stated that this 'Key Threatening Process' is already present on site. The level of this threat posed to this species has the potential to be significant and consideration of weed control within any future management plan is recommended to ensure that populations of weed species across the site are managed so as to minimise any impacts on native flora and fauna as well as preventing their spread to areas of neighboring bushland.

- **Predation by the European Red Fox *Vulpes vulpes*:** With the noted presence of at least one Fox during the survey period, it may stated that this 'Key Threatening Process' is already present on site. However, as Foxes do not prey upon this flora species, this 'Key Threatening Process' is not applicable in this instance.

- **Predation by the Feral Cat *Felis catus***: No Feral Cats were observed on site during the survey period although they are believed likely to occur within the locality. The proposal is unlikely to result in an increase in the number of Feral Cats.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: The site showed evidence of a past fire, although it is difficult to ascertain the disruption and structural change, if any, past fires have caused the site. The proposal is unlikely to result in any increase in frequency of fire events across the study area.

- **Competition from feral honeybees *Apis mellifera*:** No honey bees were observed on the site and as this flora species does not rely on either tree hollows or nectar resources it is not considered a 'Key Threatening Process' in this instance.

- **Bushrock Removal**: No bushrock was observed on the site and as this species does not rely on this habitat resource it is not considered a 'Key Threatening Process' in this instance.

- **Predation by *Gambusia holbrooki* (Plague Minnow)**: No Plague Minnows were noted on site during the survey although they may occur within the locality. The proposal is unlikely to result in the introduction of this species within the site nor is it likely to increase the numbers of this species within the locality. As the Plague Minnow does not prey upon Angophoras this 'Key Threatening Process' does not apply.

- **Importation of Red Fire Ants *Solenopsis invicta***: This species is not known to occur on site.

- **Infection of native plants by *Phytophthora cinnamomi***: This infection is not known to occur on site.

- **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations**: No endangered Psittacine species were seen on site.

- **Loss and/or degradation of site used for hill-topping by butterflies**: Given that *Angophora inopina* is not a form of butterfly, this ' Key Threatening Process' is not applicable.

- **Anthropogenic Climate Change**: No species living on site are considered likely to be significantly affected by anthropogenic climate change.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** Numerous

Rabbits were identified on site during the survey period and it may therefore be stated that this 'Key Threatening Process' is already present on site. The proposal is unlikely to increase the numbers of Rabbits within the locality.

- **Infection of frogs by amphibian chytrid causing disease chytridiomycosis:** No indication of amphibian chytrid was noted on site.

- **Invasion of native plant communities by exotic perennial grasses:** As a small number of exotic perennial grasses were identified on site during the survey, it may be stated that this Key Threatening Process is already present on site. The proposed development may result in the further introduction of perennial grasses to the locality, however it is unlikely to be at a scale which would significantly affect any local population of this threatened species

- **Removal of dead wood and dead trees:** As the site contains an Open Forest assemblage with fallen deris noted, the proposal will result in the removal of dead wood and dead trees. However, with consideration given to the recommended retention of Open Forest habitat within a habitat corridor, it is unlikely to be at a scale which would significantly affect any local population of threatened species.

h) whether any threatened species, population or ecological community is at the limit of its known distribution.

Any individual or population of this species occurring in the area would not be at the limit of its known standard distribution.

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8. *Caladenia tessellata* Thick-lipped Spider-Orchid

Caladenia tessellata, of the family Orchidaceae, is found in sheltered moist places in scrub and forests, particularly in stony laterites on coastal tops from central-east and south-east NSW and eastern Vic. It prefers well-structured clay loam soils and is often only seen following fire. It has 1-2 flowers off a 15-30cm stem, cream to pale yellow and 30 mm wide, long, with slender glandular tips and reddish stripes. The labellum is yellowish with darker streaks and heart-shaped with thick, glandular margins and four rows of dark calli. This species is ROTAP-coded 3V.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

No evidence of this species' presence was recorded during fieldwork despite targeted searches. The study area is recognised as providing only marginal habitat as the sandy/loam/conglomerate soils of the site are not preferred by this species. Large areas of similar habitat attributes are common within the locality including the adjacent Munmorah State Recreation Area and will be retained within the recommended habitat corridor in the western portion of the site. It is therefore believed that the development of the site is unlikely to disrupt the species' life cycle or place any viable local population at risk of extinction.

b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No population of this species on site has been identified under Schedule 1, Part 2 of the TSC Act 1995.

c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

No regionally significant area of known habitat is to be removed or modified as a result of the proposal.

d) whether an area of known habitat is likely to be isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No areas of known habitat are likely to be isolated as a result of the proposal.

e) whether critical habitat will be affected.

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act 1995.

f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

Caladenia tessellata is ROTAP-coded 3V, indicating that it is not known to occur within the reserve system. As such, this species is probably not adequately represented in conservation reserves in this region. The adequacy of the representation of the habitat of this species is difficult to ascertain, although areas of potential habitat occur within Ku-ring-gai Chase, Garigal, Marramarra, Dharug, Popran and Yengo National Parks and Muogamarra Nature Reserve.

g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act have been listed in bold below followed by an assessment of the applicability of the threatened process in regards to the species, the site and the proposed development:

- **Clearing of Native Vegetation**: The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The clearing to accommodate the development may be viewed as contributing to the incremental decline of habitat in the local area, although it is recognised that this Key Threatening Process has already affected much of the site due to past colliery activities.. Accordingly, the development of this site is unlikely to be singularly responsible for the loss of any local population of this species provided that the recommendations regarding buffers and corridors are implemented.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands**: Alteration to the natural flow regime is recognised as a major factor contributing to the loss of biological diversity and ecological function of aquatic ecosystems. The impacts of this 'Key Threatening Process' include the reduction of habitat, increased flows causing permanent flooding, riparian zone degradation, increased habitat for invasive species and loss or disruption of ecological function. It is recognised that the study area borders a SEPP 14 wetland as well as containing a drainage line which drains towards Moonee Beach to the east. Accordingly, a number of recommendations have been made through the report to ensure that any potential impacts are minimised. In regards to this species, it is considered that the level of threat associated with this 'Key Threatening Process' is low in this instance.

- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera***: Small areas of *Chrysanthemoides monilifera* (Bitou Bush) were identified within the subject site and it may be stated that this 'Key Threatening Process' is already present on site. The level of this threat posed to this species has the potential to be significant and consideration of weed control within any future management plan is recommended to ensure that populations of weed species across the site are managed so as to minimise any impacts on native flora and fauna as well as preventing their spread to areas of neighboring bushland.

- **Predation by the European Red Fox *Vulpes vulpes*:** With the noted presence of at least one Fox during the survey period, it may stated that this 'Key Threatening Process' is already present on site. However, as Foxes do not prey upon this flora species, this 'Key Threatening Process' is not applicable in this instance.

- **Predation by the Feral Cat *Felis catus***: No Feral Cats were observed on site during the survey period although they are believed likely to occur within the locality. The proposal is unlikely to result in an increase in the number of Feral Cats.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: The site showed evidence of a past fire, although it is difficult to ascertain the disruption and structural change, if any, past fires have caused the site. The proposal is unlikely to result in any increase in frequency of fire events across the study area.

- **Competition from feral honeybees *Apis mellifera*:** No honey bees were observed on the site and as this flora species does not rely on either tree hollows or nectar resources it is not considered a 'Key Threatening Process' in this instance.

- **Bushrock Removal**: No bushrock was observed on the site and as this species does not rely on this habitat resource it is not considered a 'Key Threatening Process' in this instance.

- **Predation by *Gambusia holbrooki* (Plague Minnow)**: No Plague Minnows were noted on site during the survey although they may occur within the locality. The proposal is unlikely to result in the introduction of this species within the site nor is it likely to increase the numbers of this species within the locality. As the Plague Minnow does not prey upon terrestrial orchids this 'Key Threatening Process' does not apply.

- **Importation of Red Fire Ants *Solenopsis invicta***: This species is not known to occur on site.

- **Infection of native plants by *Phytophthora cinnamomi***: This infection is not known to occur on site.

- **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations**: No endangered Psittacine species were seen on site.

- **Loss and/or degradation of site used for hill-topping by butterflies**: Given that this species is not a form of butterfly, this ' Key Threatening Process' is not applicable.

- **Anthropogenic Climate Change**: No species living on site are considered likely to be significantly affected by anthropogenic climate change.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** Numerous Rabbits were identified on site during the survey period and it may therefore be stated that this 'Key Threatening Process' is already present on site. The proposal is unlikely to increase the numbers of Rabbits within the locality.

- **Infection of frogs by amphibian chytrid causing disease chytridiomycosis:** No indication of amphibian chytrid was noted on site.

- **Invasion of native plant communities by exotic perennial grasses:** As a small number of exotic perennial grasses were identified on site during the survey, it may be stated that this Key Threatening Process is already present on site. The proposed development may result in the further introduction of perennial grasses to the locality, however it is unlikely to be at a scale which would significantly affect any local population of this threatened species

- **Removal of dead wood and dead trees:** As the site contains an Open Forest assemblage with fallen deris noted, the proposal will result in the removal of dead wood and dead trees. However, with consideration given to the recommended retention of Open Forest habitat within a habitat corridor, it is unlikely to be at a scale which would significantly affect any local population of threatened species.

h) whether any threatened species, population or ecological community is at the limit of its known distribution.

Any individual or population of this species occurring in the area would not be at the limit of its known standard distribution.

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9. *Callistemon linearifolius*

Callistemon linearifolius is a shrub which grows to 3-4 metres in height. It flowers from spring to summer. *C. linearifolius* grows in dry sclerophyll forest on the coast and adjacent ranges from the Georges River to Hawkesbury River in the Sydney area, and north to Nelson Bay. In the Sydney area records are limited to the Hornsby Plateau area. This species is ROTAP-coded 2RCi.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

No evidence of this species' presence was recorded during fieldwork despite targeted searches. The forested portions of the site provide potential habitat for this species although large areas of similar habitat attributes are common within the locality including the adjacent Munmorah State Recreation Area and will be retained within the recommended habitat corridor in the western portion of the site. It is therefore believed that the development of the site is unlikely to disrupt the species' life cycle or place any viable local population at risk of extinction.

b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No population of this species on site has been identified under Schedule 1, Part 2 of the TSC Act 1995.

c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

No regionally significant area of known habitat is to be removed or modified as a result of the proposal. Although the development of the site may be viewed as contributing to the incremental loss of potential habiat for this species in the region.

d) whether an area of known habitat is likely to be isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No areas of known habitat are likely to be isolated as a result of the proposal provided that the recommendation regarding the retention of habitat with suitable connections to the north and south is implemented.

e) whether critical habitat will be affected.

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act 1995.

f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

Callistemon linearifolius is ROTAP-coded 2RCi, indicating that it occurs within the reserve system, in Ku-ring-gai Chase National Park, although the size of the population in this reserve is not adequate according to the Briggs and Leigh (1995) criterion. As such, this species may not be adequately represented in conservation reserves in this region although additional records are known from Munmorah State Recreation Area and Lower Hunter National Park (Wyong Shire Council, 2003). The adequacy of the representation of the habitat of this species is difficult to ascertain, although large areas of potential habitat occur within the aforementioned National Park as well as within the Yengo, Dharug, Garigal, Brisbane Water and Popran National Parks and Parr State Recreation Area.

g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act have been listed in bold below followed by an assessment of the applicability of the threatened process in regards to the species, the site and the proposed development:

- **Clearing of Native Vegetation**: The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The clearing to accommodate the development may be viewed as contributing to the incremental decline of habitat in the local area, although it is recognised that this Key Threatening Process has already affected much of the site due to past colliery activities.. Accordingly, the development of this site is unlikely to be singularly responsible for the loss of any local population of this species provided that the recommendations regarding buffers and corridors are implemented.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands**: Alteration to the natural flow regime is recognised as a major factor contributing to the loss of biological diversity and ecological function of aquatic ecosystems. The impacts of this 'Key Threatening Process' include the reduction of habitat, increased flows causing permanent flooding, riparian zone degradation, increased habitat for invasive species and loss or disruption of ecological function. It is recognised that the study area borders a SEPP 14 wetland as well as containing a drainage line which drains towards Moonee Beach to the east. Accordingly, a number of recommendations have been made through the report to ensure that any potential impacts are minimised. In regards to this species, it is considered that the level of threat associated with this 'Key Threatening Process' is low in this instance.

- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera***: Small areas of *Chrysanthemoides monilifera* (Bitou Bush) were identified within the subject site and it may be stated that this 'Key Threatening Process' is already present on site. The level of this threat posed to this species has the potential to be significant and consideration of weed control within any future management plan is recommended to ensure that populations of weed species across the site are managed so as to minimise any impacts on native flora and fauna as well as preventing their spread to areas of neighboring bushland.

- **Predation by the European Red Fox *Vulpes vulpes*:** With the noted presence of at least one Fox during the survey period, it may stated that this 'Key Threatening Process' is already present on site. However, as Foxes do not prey upon this flora species, this 'Key Threatening Process' is not applicable in this instance.

- **Predation by the Feral Cat *Felis catus***: No Feral Cats were observed on site during the survey period although they are believed likely to occur within the locality. The proposal is unlikely to result in an increase in the number of Feral Cats.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: The site showed evidence of a past fire, although it is difficult to ascertain the disruption and structural change, if any, past fires have caused the site. The proposal is unlikely to result in any increase in frequency of fire events across the study area.

- **Competition from feral honeybees *Apis mellifera*:** No honey bees were observed on the site and as this flora species does not rely on either tree hollows or nectar resources it is not considered a 'Key Threatening Process' in this instance.

- **Bushrock Removal**: No bushrock was observed on the site and as this species does not rely on this habitat resource it is not considered a 'Key Threatening Process' in this instance.

- **Predation by *Gambusia holbrooki* (Plague Minnow)**: No Plague Minnows were noted on site during the survey although they may occur within the locality. The proposal is unlikely to result in the introduction of this species within the site nor is it likely to increase the numbers of this species within the locality. As the Plague Minnow does not prey upon flora species this 'Key Threatening Process' does not apply.

- **Importation of Red Fire Ants *Solenopsis invicta***: This species is not known to occur on site.

- **Infection of native plants by *Phytophthora cinnamomi***: This infection is not known to occur on site.

- **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations**: No endangered Psittacine species were seen on site.

- **Loss and/or degradation of site used for hill-topping by butterflies**: Given that this species is not a form of butterfly, this ' Key Threatening Process' is not applicable.

- **Anthropogenic Climate Change**: No species living on site are considered likely to be significantly affected by anthropogenic climate change.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** Numerous Rabbits were identified on site during the survey period and it may therefore be stated that this 'Key Threatening Process' is already present on site. The proposal is unlikely to increase the numbers of Rabbits within the locality.

- **Infection of frogs by amphibian chytrid causing disease chytridiomycosis:** No indication of amphibian chytrid was noted on site.

- **Invasion of native plant communities by exotic perennial grasses:** As a small number of exotic perennial grasses were identified on site during the survey, it may be stated that this Key Threatening Process is already present on site. The proposed development may result in the further introduction of perennial grasses to the locality, however it is unlikely to be at a scale which would significantly affect any local population of this threatened species

- **Removal of dead wood and dead trees:** As the site contains an Open Forest assemblage with fallen deris noted, the proposal will result in the removal of dead wood and dead trees. However, with consideration given to the recommended retention of Open Forest habitat within

a habitat corridor, it is unlikely to be at a scale which would significantly affect any local population of threatened species.

h) whether any threatened species, population or ecological community is at the limit of its known distribution.

Neither this species nor any population in the area is at the limit of the species known standard distribution.

Bibliography:

Briggs, J.D. and Leigh, J.H. (1995). *Rare or Threatened Australian Plants*. CSIRO Publishing, Victoria.

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10. *Cryptostylis hunteriana* Leafless Tongue Orchid

Cryptostylis hunteriana, of the family Orchidaceae, is a distinctive species recognised by its leafless habit and reddish black hairy labellum with a central, raised, hairy callus. The Leafless Tongue Orchid occurs from the Gibraltar Range (N.S.W) to eastern Victoria. This species is a saprophtye which grows in small localised colonies on flat plains close to the coast. This species has also been recorded in mountainous areas growing in moist depressions as well as in swampy habitats. Flowering time is December - February. This species is ROTAP-coded 3VC-.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

No evidence of this species presence was noted on site during fieldwork, although it must be noted that fieldwork was undertaken outside of the known flowering period for this species. It is therefore recommended that supplementary targeted searches be undertaken during the known flowering season for this species. Potential habitat is available across the site, however all recorded populations of this species within the Wyong LGA occur within the Narrabeen Doyalson Coastal Woodland Unit (Wyong Shire Council, 2003), which was not identified on this site. Large areas of similar habitat are available within the locality including the adjacent Munmorah State Recreation Area. Accordingly, it is believed that provided that populations of this species are not recorded on site during the recommended targeted flora surveys to be undertaken within the known flowering period, the current proposal is unlikely to disrupt the species' life cycle or place any viable local population at risk of extinction.

b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No population of this species on site has been identified under Schedule 1, Part 2 of the TSC Act 1995.

c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

Regionally significant areas of known habitat may be removed or modified as a result of the proposal and will be further assessed following the completion of the recommended targeted surveys. The recommended retention of a habitat corridor through the western portion of the site may off set any adverse impacts on the local population as a result of the proposal.

d) whether an area of known habitat is likely to be isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No areas of known habitat are likely to be isolated as a result of the proposal provided that the recommendation regarding the retention of habitat with suitable connections to the north and south is implemented.

e) whether critical habitat will be affected.

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act 1995.

f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

Cryptostylis hunteriana is ROTAP-coded 3VC-, indicating that it occurs within the reserve system, in Gibraltar Range, Ku-ring-gai Chase, Ben Boyd and Croajingolong National Parks and William Hunter Flora Reserve. Of these, only Ku-ring-gai Chase NP occurs within this region. The size of the population in this reserve is however, unknown, according to Briggs and Leigh (1995). As such, it is difficult to quantify whether or not the species is adequately represented in conservation reserves. The adequacy of the representation of the habitat of this species is difficult to ascertain, although large areas of potential habitat occur within the aforementioned reserves as well as within Yengo, Bouddi, Dharug, Garigal, Ku-ring-gai Chase and Popran National Parks and Munmorah State Recreation Area.

g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act have been listed in bold below followed by an assessment of the applicability of the threatened process in regards to the species, the site and the proposed development:

- **Clearing of Native Vegetation**: The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The clearing to accommodate the development may be viewed as contributing to the incremental decline of habitat in the local area, although it is recognised that this Key Threatening Process has already affected much of the site due to past colliery activities.. Accordingly, the development of this site is unlikely to be singularly responsible for the loss of any local population of this species provided that the recommendations regarding buffers and corridors are implemented.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands**: Alteration to the natural flow regime is recognised as a major factor contributing to the loss of biological diversity and ecological function of aquatic ecosystems. The impacts of this 'Key Threatening Process' include the reduction of habitat, increased flows causing permanent flooding, riparian zone degradation, increased habitat for invasive species and loss or disruption of ecological function. It is recognised that the study area borders a SEPP 14 wetland as well as containing a drainage line which drains towards Moonee Beach to the east. Accordingly, a number of recommendations have been made through the report to ensure that any potential impacts are minimised. In regards to this species, it is considered that the level of threat associated with this 'Key Threatening Process' is low in this instance.

- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera***: Small areas of *Chrysanthemoides monilifera* (Bitou Bush) were identified within the subject site and it may be stated that this 'Key Threatening Process' is already present on site. The level of this threat posed to this species has the potential to be significant and consideration of weed control within any future management plan is recommended to ensure that populations of weed species across the site are managed so as to minimise any impacts on native flora and fauna as well as preventing their spread to areas of neighboring bushland.

- **Predation by the European Red Fox *Vulpes vulpes*:** With the noted presence of at least one Fox during the survey period, it may stated that this 'Key Threatening Process' is already present on site. However, as Foxes do not prey upon this flora species, this 'Key Threatening Process' is not applicable in this instance.

- **Predation by the Feral Cat *Felis catus***: No Feral Cats were observed on site during the survey period although they are believed likely to occur within the locality. The proposal is unlikely to result in an increase in the number of Feral Cats.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: The site showed evidence of a past fire, although it is difficult to ascertain the disruption and structural change, if any, past fires have caused the site. The proposal is unlikely to result in any increase in frequency of fire events across the study area.

- **Competition from feral honeybees *Apis mellifera*:** No honey bees were observed on the site and as this flora species does not rely on either tree hollows or nectar resources it is not considered a 'Key Threatening Process' in this instance.

- **Bushrock Removal**: No bushrock was observed on the site and as this species does not rely on this habitat resource it is not considered a 'Key Threatening Process' in this instance.

- **Predation by *Gambusia holbrooki* (Plague Minnow)**: No Plague Minnows were noted on site during the survey although they may occur within the locality. The proposal is unlikely to result in the introduction of this species within the site nor is it likely to increase the numbers of this species within the locality. As the Plague Minnow does not prey upon terrestrial orchids this 'Key Threatening Process' does not apply.

- **Importation of Red Fire Ants *Solenopsis invicta***: This species is not known to occur on site.

- **Infection of native plants by *Phytophthora cinnamomi***: This infection is not known to occur on site.

- **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations**: No endangered Psittacine species were seen on site.

- **Loss and/or degradation of site used for hill-topping by butterflies**: Given that this species is not a form of butterfly, this ' Key Threatening Process' is not applicable.

- **Anthropogenic Climate Change**: No species living on site are considered likely to be significantly affected by anthropogenic climate change.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** Numerous Rabbits were identified on site during the survey period and it may therefore be stated that this 'Key Threatening Process' is already present on site. The proposal is unlikely to increase the numbers of Rabbits within the locality.

- **Infection of frogs by amphibian chytrid causing disease chytridiomycosis:** No indication of amphibian chytrid was noted on site.

- **Invasion of native plant communities by exotic perennial grasses:** As a small number of exotic perennial grasses were identified on site during the survey, it may be stated that this Key Threatening Process is already present on site. The proposed development may result in the further introduction of perennial grasses to the locality, however it is unlikely to be at a scale which would significantly affect any local population of this threatened species

- **Removal of dead wood and dead trees:** As the site contains an Open Forest assemblage with fallen deris noted, the proposal will result in the removal of dead wood and dead trees. However, with consideration given to the recommended retention of Open Forest habitat within a habitat corridor, it is unlikely to be at a scale which would significantly affect any local population of threatened species.

h) whether any threatened species, population or ecological community is at the limit of its known distribution.

Neither this species nor any population in the area is at the limit of the species known standard distribution.

Bibliography:

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Briggs, J.D. and Leigh, J.H. (1995). *Rare or Threatened Australian Plants*. CSIRO Publishing, Victoria.

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11. *Eucalyptus camfieldii* Camfield's Stringybark

Eucalyptus camfieldii occurs as a mallee or small tree up to 8m high with scaly-fibrous bark throughout. The adult leaves are similar on both surfaces, thick, glossy, often mucronate and 8-12x2.5-4cm. Juvenile leaves are cordate to orbicular, often heart-shaped, as the common name suggests. Umbels are 7-15-flowered; peduncles angular terete, up to 7mm long, often covered by the fruits. The fruits are sessile, hemispherical, 4-5x8-9mm wide, convex, with a thick disk and the valves are usually enclosed. It is predominantly found in dry sclerophyll forest on sandstone and laterite plateaus and ridges from the Royal National Park to Gosford. Some isolated occurrences have been found outside this area, although generally in similar habitat. It has been reported from the Norah Head area as occurring on Aeolian sand dunes. Commonly associated species include *Eucalyptus eugenioides* (Narrow-leaved Stringybark) and *E. haemastoma* (Scribbly Gum). A summer flowering species, *E. camfieldii* is ROTAP-coded 2VCi.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

No evidence of this species' presence was recorded during fieldwork despite targeted searches. The forested portions of the site provide marginal habitat attributes, although the soils are not preferred by this species. It is also recognised that the study area is north of the known standard distribution of this species. Large areas of similar habitat attributes are common within the locality and include the adjacent Munmorah State Recreation Area. It is therefore believed that the proposed development of the site is unlikely to disrupt the species' life cycle or place any viable local population at risk of extinction.

b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No population of this species on site has been identified under Schedule 1, Part 2 of the TSC Act 1995.

c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

No significant area of known habitat is to be removed or modified as a result of the proposal, although the development of the site may be viewed as contributing to the incremental loss of potential for this species in the region.

d) whether an area of known habitat is likely to be isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No areas of known habitat are likely to be isolated as a result of the proposal provided that the recommendation regarding the retention of habitat with suitable connections to the north and south is implemented.

e) whether critical habitat will be affected.

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act 1995.

f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

Eucalyptus camfieldii is ROTAP-coded 2VCi, indicating that it does occur within the reserve system. This species occurs in Brisbane Water National Park, where the population size is not known, and in Ku-ring-gai Chase, Royal and Sydney Harbour National Parks, where the sizes of the populations are inadequate in accordance with the Briggs and Leigh (1995) criterion. As such, this species may not be adequately represented in conservation reserves in this region. The adequacy of the representation of the habitat of this species is difficult to ascertain, although some areas of potential habitat occur within the aforementioned reserves as well as within Garigal, Popran, Marramarra and Bouddi National Parks and in Parr and Munmorah State Recreation Areas.

g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act have been listed in bold below followed by an assessment of the applicability of the threatened process in regards to the species, the site and the proposed development:

- **Clearing of Native Vegetation**: The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The clearing to accommodate the development may be viewed as contributing to the incremental decline of habitat in the local area, although it is recognised that this Key Threatening Process has already affected much of the site due to past colliery activities.. Accordingly, the development of this site is unlikely to be singularly responsible for the loss of any local population of this species provided that the recommendations regarding buffers and corridors are implemented.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands**: Alteration to the natural flow regime is recognised as a major factor contributing to the loss of biological diversity and ecological function of aquatic ecosystems. The impacts of this 'Key Threatening Process' include the reduction of habitat, increased flows causing permanent flooding, riparian zone degradation, increased habitat for invasive species and loss or disruption of ecological function. It is recognised that the study area borders a SEPP 14 wetland as well as containing a drainage line which drains towards Moonee Beach to the east. Accordingly, a number of recommendations have been made through the report to ensure that any potential impacts are minimised. In regards to this species, it is considered that the level of threat associated with this 'Key Threatening Process' is low in this instance.

- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera***: Small areas of *Chrysanthemoides monilifera* (Bitou Bush) were identified within the subject site and it may be stated that this 'Key Threatening Process' is already present on site. The level of this threat posed to this species has the potential to be significant and consideration of weed control within any future management plan is recommended to ensure that populations of weed species across the site are managed so as to minimise any impacts on native flora and fauna as well as preventing their spread to areas of neighboring bushland.

- **Predation by the European Red Fox *Vulpes vulpes*:** With the noted presence of at least one Fox during the survey period, it may stated that this 'Key Threatening Process' is already present on site. However, as Foxes do not prey upon this flora species, this 'Key Threatening Process' is not applicable in this instance.

- **Predation by the Feral Cat *Felis catus***: No Feral Cats were observed on site during the survey period although they are believed likely to occur within the locality. The proposal is unlikely to result in an increase in the number of Feral Cats.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: The site showed evidence of a past fire, although it is difficult to ascertain the disruption and structural change, if any, past fires have caused the site. The proposal is unlikely to result in any increase in frequency of fire events across the study area.

- **Competition from feral honeybees *Apis mellifera*:** No honey bees were observed on the site and as this flora species does not rely on either tree hollows or nectar resources it is not considered a 'Key Threatening Process' in this instance.

- **Bushrock Removal**: No bushrock was observed on the site and as this species does not rely on this habitat resource it is not considered a 'Key Threatening Process' in this instance.

- **Predation by *Gambusia holbrooki* (Plague Minnow)**: No Plague Minnows were noted on site during the survey although they may occur within the locality. The proposal is unlikely to result in the introduction of this species within the site nor is it likely to increase the numbers of this species within the locality. As the Plague Minnow does not prey upon eucalypts this 'Key Threatening Process' does not apply.

- **Importation of Red Fire Ants *Solenopsis invicta***: This species is not known to occur on site.

- **Infection of native plants by *Phytophthora cinnamomi***: This infection is not known to occur on site.

- **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations**: No endangered Psittacine species were seen on site.

- **Loss and/or degradation of site used for hill-topping by butterflies**: Given that this species is not a form of butterfly, this ' Key Threatening Process' is not applicable.

- **Anthropogenic Climate Change**: No species living on site are considered likely to be significantly affected by anthropogenic climate change.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** Numerous Rabbits were identified on site during the survey period and it may therefore be stated that this 'Key Threatening Process' is already present on site. The proposal is unlikely to increase the numbers of Rabbits within the locality.

- **Infection of frogs by amphibian chytrid causing disease chytridiomycosis:** No indication of amphibian chytrid was noted on site.

- **Invasion of native plant communities by exotic perennial grasses:** As a small number of exotic perennial grasses were identified on site during the survey, it may be stated that this Key

Threatening Process is already present on site. The proposed development may result in the further introduction of perennial grasses to the locality, however it is unlikely to be at a scale which would significantly affect any local population of this threatened species

- **Removal of dead wood and dead trees:** As the site contains an Open Forest assemblage with fallen deris noted, the proposal will result in the removal of dead wood and dead trees. However, with consideration given to the recommended retention of Open Forest habitat within a habitat corridor, it is unlikely to be at a scale which would significantly affect any local population of threatened species.

h) whether any threatened species, population or ecological community is at the limit of its known distribution.

Any individuals or populations occurring in the vicinity of the study area would be nearing the limits of standard known distribution of this species.

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12. *Microtus angusii* Onion Orchid

Microtus angusii, as with most species of its genus, is usually found in moist sunny depressions, swampy areas and grasslands in high rainfall areas on clays, alluviums and sandy soils. Plants are 20-40cm high, with a single slender cylindrical leaf from which the flowering stem emerges via a slit. The tiny green flowers are about 6mm long and as many as 40 may be arranged spirally in an often dense spike. They are very hard to spot because of their inconspicuous shape and colouring. Little other specific information exists on this recently described species and it is not ROTAP-listed.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

No evidence of this species presence was noted on site during fieldwork, although it must be noted that fieldwork was undertaken outside of the known flowering period for this species which is September-October. The moist, low-lying south eastern portion of the site provides some potential habitat for this species, some of which will be retained within the SEPP 14 Wetland buffer and Bushfire Asset Protection Zones. Large areas of similar habitat attributes are also common within the locality and include the adjacent Munmorah State Recreation Area. Accordingly, it is believed that provided that populations of this species are not recorded on site during the recommended targeted flora surveys to be undertaken within the known flowering period, the current proposal is unlikely to disrupt the species' life cycle or place any viable local population at risk of extinction.

b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No population of this species on site has been identified under Schedule 1, Part 2 of the TSC Act 1995.

c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

No significant area of known habitat is to be removed or modified as a result of the proposal, although the development of the site may be viewed as contributing to the incremental loss of potential for this species in the region.

d) whether an area of known habitat is likely to be isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No areas of known habitat are likely to be isolated as a result of the proposal provided that the recommendation regarding the retention of habitat with suitable connections to the north and south is implemented.

e) whether critical habitat will be affected.

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act 1995.

f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

The adequacy of habitat representation for this species is difficult to ascertain, although areas of potential habitat are protected within Ku-ring-gai Chase, Garigal, Marramarra, Popran and Dharug National Parks, Muogamarra Nature Reserve and Munmorah State Recreation Area.

g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act have been listed in bold below followed by an assessment of the applicability of the threatened process in regards to the species, the site and the proposed development:

- **Clearing of Native Vegetation**: The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The clearing to accommodate the development may be viewed as contributing to the incremental decline of habitat in the local area, although it is recognised that this Key Threatening Process has already affected much of the site due to past colliery activities.. Accordingly, the development of this site is unlikely to be singularly responsible for the loss of any local population of this species provided that the recommendations regarding buffers and corridors are implemented.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands**: Alteration to the natural flow regime is recognised as a major factor contributing to the loss of biological diversity and ecological function of aquatic ecosystems. The impacts of this 'Key Threatening Process' include the reduction of habitat, increased flows causing permanent flooding, riparian zone degradation, increased habitat for invasive species and loss or disruption of ecological function. It is recognised that the study area borders a SEPP 14 wetland as well as containing a drainage line which drains towards Moonee Beach to the east. Accordingly, a number of recommendations have been made through the report to ensure that any potential impacts are minimised. In regards to this species, it is considered that the level of threat associated with this 'Key Threatening Process' is low in this instance.

- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera***: Small areas of *Chrysanthemoides monilifera* (Bitou Bush) were identified within the subject site and it may be stated that this 'Key Threatening Process' is already present on site. The level of this threat posed to this species has the potential to be significant and consideration of weed control within any future management plan is recommended to ensure that populations of weed species across the site are managed so as to minimise any impacts on native flora and fauna as well as preventing their spread to areas of neighboring bushland.

- **Predation by the European Red Fox *Vulpes vulpes*:** With the noted presence of at least one Fox during the survey period, it may stated that this 'Key Threatening Process' is already present on site. However, as Foxes do not prey upon this flora species, this 'Key Threatening Process' is not applicable in this instance.

- **Predation by the Feral Cat *Felis catus***: No Feral Cats were observed on site during the survey period although they are believed likely to occur within the locality. The proposal is unlikely to result in an increase in the number of Feral Cats.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: The site showed evidence of a past fire, although it is difficult to ascertain the disruption and structural change, if any, past fires have caused the site. The proposal is unlikely to result in any increase in frequency of fire events across the study area.

- **Competition from feral honeybees *Apis mellifera*:** No honey bees were observed on the site and as this flora species does not rely on either tree hollows or nectar resources it is not considered a 'Key Threatening Process' in this instance.

- **Bushrock Removal**: No bushrock was observed on the site and as this species does not rely on this habitat resource it is not considered a 'Key Threatening Process' in this instance.

- **Predation by *Gambusia holbrooki* (Plague Minnow)**: No Plague Minnows were noted on site during the survey although they may occur within the locality. The proposal is unlikely to result in the introduction of this species within the site nor is it likely to increase the numbers of this species within the locality. As the Plague Minnow does not prey upon terrestrial orchids this 'Key Threatening Process' does not apply.

- **Importation of Red Fire Ants *Solenopsis invicta***: This species is not known to occur on site.

- **Infection of native plants by *Phytophthora cinnamomi***: This infection is not known to occur on site.

- **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations**: No endangered Psittacine species were seen on site.

- **Loss and/or degradation of site used for hill-topping by butterflies**: Given that this species is not a form of butterfly, this ' Key Threatening Process' is not applicable.

- **Anthropogenic Climate Change**: No species living on site are considered likely to be significantly affected by anthropogenic climate change.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** Numerous Rabbits were identified on site during the survey period and it may therefore be stated that this 'Key Threatening Process' is already present on site. The proposal is unlikely to increase the numbers of Rabbits within the locality.

- **Infection of frogs by amphibian chytrid causing disease chytridiomycosis:** No indication of amphibian chytrid was noted on site.

- **Invasion of native plant communities by exotic perennial grasses:** As a small number of exotic perennial grasses were identified on site during the survey, it may be stated that this Key Threatening Process is already present on site. The proposed development may result in the further introduction of perennial grasses to the locality, however it is unlikely to be at a scale which would significantly affect any local population of this threatened species

- **Removal of dead wood and dead trees:** As the site contains an Open Forest assemblage with fallen deris noted, the proposal will result in the removal of dead wood and dead trees. However, with consideration given to the recommended retention of Open Forest habitat within

a habitat corridor, it is unlikely to be at a scale which would significantly affect any local population of threatened species.

h) whether any threatened species, population or ecological community is at the limit of its known distribution.

Any individuals or populations occurring in the vicinity of the study area would be nearing the limits of standard known distribution of this species which is in the north of Sydney.

Bibliography:

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13. *Syzygium paniculatum* Magenta Lillypilly

Syzygium paniculatum, a member of the Myrtaceae family, occurs in coastal rainforests on sandy soils or stabilised coastal dunes from Jervis Bay to Bulahdelah in NSW. This species is a small to medium tree, 3-8m high, with dark, dense foliage. White flowers are in small dense axillary cymes with unequal sepals in summer. The common name of this species is derived from the pink to red colouring of the ripe fruit. The Magenta Lillypilly has been widely cultivated, and is readily available at whole sale and retail nurseries. This species is ROTAP-coded 3ECi.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

No evidence of this species' presence was recorded during fieldwork despite targeted searches and careful cross-checking. The sheltered slopes within the south eastern portion of the site provide potential habitat for this species. Large areas of similar habitat attributes are common within the locality, including the adjacent Munmorah State Recreation Area and it is believed that the proposed development of this site is unlikely to disrupt the species' life cycle or place any viable local population at risk of extinction.

b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No population of this species on site has been identified under Schedule 1, Part 2 of the TSC Act 1995.

c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

No significant area of known habitat is to be removed or modified as a result of the proposal, although the development of the site may be viewed as contributing to the incremental loss of potential for this species in the region.

d) whether an area of known habitat is likely to be isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No areas of known habitat are likely to be isolated as a result of the proposal provided that the recommendation regarding the retention of habitat with suitable connections to the north and south is implemented.

e) whether critical habitat will be affected.

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act 1995.

f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

Syzygium paniculatum is ROTAP-coded 3ECi, indicating that it occurs within the reserve system. This species occurs within Wyrrabalong and Jervis Bay National Parks and in Wamberal Lagoon Nature Reserve, although the level of reservation within these areas is inadequate in accordance with the Briggs and Leigh (1995) criterion. As such, this species may not be adequately represented in conservation reserves in this region. The adequacy of the representation of the habitat of this species is difficult to ascertain, although large areas of potential habitat occur within the aforementioned reserves as well as within Bouddi and Royal National Parks and in Munmorah and Glenrock State Recreation Areas.

g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act have been listed in bold below followed by an assessment of the applicability of the threatened process in regards to the species, the site and the proposed development:

- **Clearing of Native Vegetation**: The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The clearing to accommodate the development may be viewed as contributing to the incremental decline of habitat in the local area, although it is recognised that this Key Threatening Process has already affected much of the site due to past colliery activities.. Accordingly, the development of this site is unlikely to be singularly responsible for the loss of any local population of this species provided that the recommendations regarding buffers and corridors are implemented.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands**: Alteration to the natural flow regime is recognised as a major factor contributing to the loss of biological diversity and ecological function of aquatic ecosystems. The impacts of this 'Key Threatening Process' include the reduction of habitat, increased flows causing permanent flooding, riparian zone degradation, increased habitat for invasive species and loss or disruption of ecological function. It is recognised that the study area borders a SEPP 14 wetland as well as containing a drainage line which drains towards Moonee Beach to the east. Accordingly, a number of recommendations have been made through the report to ensure that any potential impacts are minimised. In regards to this species, it is considered that the level of threat associated with this 'Key Threatening Process' is low in this instance.

- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera***: Small areas of *Chrysanthemoides monilifera* (Bitou Bush) were identified within the subject site and it may be stated that this 'Key Threatening Process' is already present on site. The level of this threat posed to this species has the potential to be significant and consideration of weed control within any future management plan is recommended to ensure that populations of weed species across the site are managed so as to minimise any impacts on native flora and fauna as well as preventing their spread to areas of neighboring bushland.

- **Predation by the European Red Fox *Vulpes vulpes*:** With the noted presence of at least one Fox during the survey period, it may stated that this 'Key Threatening Process' is already present on site. However, as Foxes do not prey upon this flora species, this 'Key Threatening Process' is not applicable in this instance.

- **Predation by the Feral Cat *Felis catus***: No Feral Cats were observed on site during the survey period although they are believed likely to occur within the locality. The proposal is unlikely to result in an increase in the number of Feral Cats.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: The site showed evidence of a past fire, although it is difficult to ascertain the disruption and structural change, if any, past fires have caused the site. The proposal is unlikely to result in any increase in frequency of fire events across the study area.

- **Competition from feral honeybees *Apis mellifera*:** No honey bees were observed on the site and as this flora species does not rely on either tree hollows or nectar resources it is not considered a 'Key Threatening Process' in this instance.

- **Bushrock Removal**: No bushrock was observed on the site and as this species does not rely on this habitat resource it is not considered a 'Key Threatening Process' in this instance.

- **Predation by *Gambusia holbrooki* (Plague Minnow)**: No Plague Minnows were noted on site during the survey although they may occur within the locality. The proposal is unlikely to result in the introduction of this species within the site nor is it likely to increase the numbers of this species within the locality. As the Plague Minnow does not prey upon this species this 'Key Threatening Process' does not apply.

- **Importation of Red Fire Ants *Solenopsis invicta***: This species is not known to occur on site.

- **Infection of native plants by *Phytophthora cinnamomi***: This infection is not known to occur on site.

- **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations**: No endangered Psittacine species were seen on site.

- **Loss and/or degradation of site used for hill-topping by butterflies**: Given that this species is not a form of butterfly, this ' Key Threatening Process' is not applicable.

- **Anthropogenic Climate Change**: No species living on site are considered likely to be significantly affected by anthropogenic climate change.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** Numerous Rabbits were identified on site during the survey period and it may therefore be stated that this 'Key Threatening Process' is already present on site. The proposal is unlikely to increase the numbers of Rabbits within the locality.

- **Infection of frogs by amphibian chytrid causing disease chytridiomycosis:** No indication of amphibian chytrid was noted on site.

- **Invasion of native plant communities by exotic perennial grasses:** As a small number of exotic perennial grasses were identified on site during the survey, it may be stated that this Key Threatening Process is already present on site. The proposed development may result in the further introduction of perennial grasses to the locality, however it is unlikely to be at a scale which would significantly affect any local population of this threatened species

- **Removal of dead wood and dead trees:** As the site contains an Open Forest assemblage with fallen deris noted, the proposal will result in the removal of dead wood and dead trees. However, with consideration given to the recommended retention of Open Forest habitat within

a habitat corridor, it is unlikely to be at a scale which would significantly affect any local population of threatened species.

h) whether any threatened species, population or ecological community is at the limit of its known distribution.

Neither this species nor any population in the area is at the limit of the species known standard distribution.

Bibliography:

Briggs, J.D. and Leigh, J.H. (1995). *Rare or Threatened Australian Plants*. CSIRO Publishing, Victoria.

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14. *Crinia tinnula* Wallum Froglet

The Wallum Froglet is an inhabitant of shallow acid swamps (temporary / semi-permanent) and associated connecting channels and deeper water holes (permanent). The vegetation type in these areas consists of hard-leafed heaths, shrubs and woodland on coastal plains and dunes and associated sedgelands and swamps in low lying areas collectively known as wallum, hence the common name. *C. tinnula* is a very small frog, and is a most difficult species to directly observe.

C. tinnula has a distribution range from Maryborough in Queensland south to Kurnell near Sydney. *C. tinnula* is a winter breeder with females laying approximately 120 eggs. Males are vocal between May and September making identification of the species at this time easier. Due to the morphological similarities with *C. signifera*, positive identification of *C. tinnula* is usually by call. The call of the male is described as being a bell like tinkling: "tching.....tching". Morphologically, *C. tinnula* is described as having a white or light brown belly with a little mottling or flecking and a mid line of white dots along the throat.

Due to the species preference for coastal swamps and associated areas along the east coast, *C. tinnula* is exposed to large habitat loss as this area has the highest growth rate in human population in Australia. Large populations have been recorded in the Myall Lakes National Park area and Moffats Swamp Nature Reserve near Medowie.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

No sign of this species' presence was noted on site during fieldwork, however it is noted that the fieldwork was undertaken outside of the known calling period. Habitat resources for the Wallum Froglet are available within the low-lying areas in the south eastern corner of the site. Similar areas of potential habitat are common within the region including the adjacent SEPP 14 Wetland and the Munmorah State Recreation Area where populations of this species are known to occur. Given the proposed retention of the drainage line within the south eastern corner of the site, it is considered that the proposal is unlikely to significantly affect the life cycle of this species or place any viable local population of this species at risk of extinction.

b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No population of this species on site has been identified under Schedule 1, Part 2 of the TSC Act 1995.

c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

No regionally significant area of known habitat is to be removed or modified as a result of the proposal, particularly given the recommended wetland buffer area.

d) whether an area of known habitat is likely to be isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No areas of known habitat are likely to be isolated as a result of the proposal.

e) whether critical habitat will be affected.

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act 1995.

f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

Populations of this species are known to exist in the region within the Moffats Swamp Nature Reserve (Roderick pers. comm.), within Botany Bay National Park (Ehmann, 1997) and the Brisbane Water National Park and the adjacent Munmorah State Recreation Area (NPWS Database, 2000). As such, it appears that the species may not be well represented within conservation reserves in the region. The adequacy of representation of the habitat of this species in the region is unable to be accurately ascertained, but areas of suitable habitat (further to the aforementioned reserves) are represented in the Wyrrabalong, Bouddi and Seven Mile Beach National Parks.

g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act have been listed in bold below followed by an assessment of the applicability of the threatened process in regards to the species, the site and the proposed development.

- **Clearing of Native Vegetation**: The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The clearing to accommodate the development may be viewed as contributing to the incremental decline of habitat in the local area, although it is recognised that this Key Threatening Process has already affected much of the site due to past colliery activities.. Accordingly, the development of this site is unlikely to be singularly responsible for the loss of any local population of this species provided that the recommendations regarding buffers and corridors are implemented.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands**: Alteration to the natural flow regime is recognised as a major factor contributing to the loss of biological diversity and ecological function of aquatic ecosystems. The impacts of this 'Key Threatening Process' include the reduction of habitat, increased flows causing permanent flooding, riparian zone degradation, increased habitat for invasive species and loss or disruption of ecological function. It is recognised that the study area borders a SEPP 14 wetland as well as containing a drainage line which drains towards Moonee Beach to the east. Accordingly, a number of recommendations have been made in the report to ensure that any potential impacts are minimised. Accordingly, in regards to the Wallum Froglet, it is considered that the level of threat of this 'Key Threatening Process' is low in this instance, provided that the recommendations are implemented.

- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera***: Small areas of *Chrysanthemoides monilifera* (Bitou Bush) were identified within the subject site and it may be stated that this 'Key Threatening Process' is already present on site. However, the level of this

threat posed to the Wallum Froglet would be negligible.

- **Predation by the European Red Fox *Vulpes vulpes*:** With the noted presence of at least one Fox during the survey period, it may stated that this 'Key Threatening Process' is already present on site and could pose a minimal threat to the native fauna. However, the proposal is unlikely to result in increased numbers of this species within the locality.

- **Predation by the Feral Cat *Felis catus***: No Feral Cats were observed on site during the survey period although they are believed likely to occur within the locality. The proposal is unlikely to result in an increase in the number of Feral Cats.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: The site showed evidence of a past fire, although it is difficult to ascertain the disruption and structural change, if any, past fires have caused the site. The proposal is unlikely to result in any increase in frequency of fire events across the study area.

- **Competition from feral honeybees *Apis mellifera*:** No honey bees were observed on the site and as this species does not rely on either tree hollows or nectar resources it is not considered a 'Key Threatening Process' in this instance.

- **Bushrock Removal**: No bushrock was observed on the site and as this species does not rely on this habitat resource it is not considered a 'Key Threatening Process' in this instance.

- **Predation by *Gambusia holbrooki* (Plague Minnow)**: As the Plague Minnow is known to prey upon frog eggs and tadpoles it may potentially impact upon this species. No Plague Minnows were noted on site during the survey, although they may occur within the locality. The proposed development will not result in the introduction of this species within the site nor is it likely to increase the numbers of this species within the locality.

- **Importation of Red Fire Ants *Solenopsis invicta***: This species is not known to occur on site.

- **Infection of native plants by *Phytophthora cinnamomi***: This infection is not known to occur on site.

- **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations**: No endangered Psittacine species were seen on site.

- **Loss and/or degradation of site used for hill-topping by butterflies**: Given that this frog species is not a form of butterfly, this ' Key Threatening Process' is not applicable.

- **Anthropogenic Climate Change**: No species living on site are considered likely to be significantly affected by anthropogenic climate change.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** Numerous Rabbits were identified on site during the survey period and it may therefore be stated that this 'Key Threatening Process' is already present on site. The proposal is unlikely to increase the numbers of Rabbits within the locality.

- **Infection of frogs by amphibian chytrid causing disease chytridiomycosis:** No indication of amphibian chytrid was noted on site.

- **Invasion of native plant communities by exotic perennial grasses:** As a small number of exotic perennial grasses were identified on site during the survey, it may be stated that this Key

Threatening Process is already present on site. The proposed development may result in the further introduction of perennial grasses to the locality, however it is unlikely to be at a scale which would significantly affect any local population of this threatened species

- **Removal of dead wood and dead trees:** As the site contains an Open Forest assemblage with fallen deris noted, the proposal will result in the removal of dead wood and dead trees. However, with consideration given to the recommended retention of Open Forest habitat within a habitat corridor, it is unlikely to be at a scale which would significantly affect any local population of threatened species.

h) whether any threatened species, population or ecological community is at the limit of its known distribution.

Neither this species nor any population occurring in the local area is at the limit of its known standard distribution.

Bibliography:

Barker, J. , Grigg, G.C. & Tyler, M.J. (1995). *A Field Guide to Australian Frogs*. Surry Beatty & Sons, Norton, NSW.

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15. *Heleioporus australiacus* Giant Burrowing Frog

The Giant Burrowing Frog is the only member of the *Heleioporus* genus found outside of Western Australia. It inhabits the banks of semi-permanent to ephemeral sand or rock based streams and has also been identified in dams, drainage ditches and roadside culverts. The current distribution of *H. australiacus* is from Olney State Forest north of Sydney extending along the coast and ranges into the highlands of Victoria.

The Giant Burrowing Frog is described as having a grey, dark chocolate brown or black back with a white belly. They have a few yellow spots along the side of their body as well as a yellow strip on the upper lip. The skin is rough and warty whilst the belly is granular. Breeding occurs during summer and autumn after rain. The call of the male is described as an owl-like; "oo....oo....oo", hence the alternative common name of Eastern Owl Frog.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

No sign of this species' presence was noted on site during fieldwork, which was undertaken at the beginning of the breeding season when the species is active. Habitat resources for this species are available within the drainage line and the recommended retention of this drainage line would also protect this area of potential habitat on site. Similar areas of potential habitat are common within the region including the adjacent Munmorah State Recreation Area. Accordingly, it is believed that provided that the recommendations regarding sediment and water run-off control are implemented, that the proposal is unlikely to significantly affect the life cycle of this species such that a local extinction would occur.

b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No population of this species on site has been identified under Schedule 1, Part 2 of the TSC Act 1995.

c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

No significant area of known habitat is to be removed or modified as a result of the proposal.

d) whether an area of known habitat is likely to be isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No areas of known habitat are likely to be isolated as a result of the proposal provided that the recommendation regarding the retention of habitat with suitable connections to the north and south is implemented.

e) whether critical habitat will be affected.

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act 1995.

f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

Populations of this species are known to exist in the region within the Wollemi, Royal, Blue Mountains, Brisbane Water, Heathcote, Ku-ring-gai Chase, Marramarra and Morton National Parks and Barren Grounds, Jervis Bay, Muogamarra and Nadgee Nature Reserves (Ehmann, 1997). Additional records exist from Garigal National Park as well as the Parr State Recreation Area (NPWS Database, 2000). As such, it appears that the species is well represented within conservation reserves in the region. The adequacy of representation of the habitat of this species in the region is unable to be accurately ascertained, but areas of suitable habitat (further to the aforementioned reserves) are represented in the Dharug, Yengo, Popran and Kanangra Boyd National Parks as well as the Munmorah State Recreation Area.

g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act have been listed in bold below followed by an assessment of the applicability of the threatened process in regards to the species, the site and the proposed development.

- **Clearing of Native Vegetation**: The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The clearing to accommodate the development may be viewed as contributing to the incremental decline of habitat in the local area, although it is recognised that this Key Threatening Process has already affected much of the site due to past colliery activities.. Accordingly, the development of this site is unlikely to be singularly responsible for the loss of any local population of this species provided that the recommendations regarding buffers and corridors are implemented.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands**: Alteration to the natural flow regime is recognised as a major factor contributing to the loss of biological diversity and ecological function of aquatic ecosystems. The impacts of this 'Key Threatening Process' include the reduction of habitat, increased flows causing permanent flooding, riparian zone degradation, increased habitat for invasive species and loss or disruption of ecological function. It is recognised that the study area borders a SEPP 14 wetland as well as containing a drainage line which drains towards Moonee Beach to the east. Accordingly, a number of recommendations have been made through the report to ensure that any potential impacts are minimised. Accordingly, in regards to the Giant Burrowing Frog, it is considered that the level of threat of this 'Key Threatening Process' is low in this instance, provided that the recommendations are implemented.

- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera***: Small areas of *Chrysanthemoides monilifera* (Bitou Bush) were identified within the subject site and it may be stated that this 'Key Threatening Process' is already present on site. However, the level of this threat posed to the Wallum Froglet would be negligible.

- **Predation by the European Red Fox *Vulpes vulpes*:** With the noted presence of at least one Fox during the survey period, it may stated that this 'Key Threatening Process' is already

present on site and could pose a minimal threat to the native fauna. However, the proposal is unlikely to result in increased numbers of this species within the locality.

- **Predation by the Feral Cat *Felis catus***: No Feral Cats were observed on site during the survey period although they are believed likely to occur within the locality. The proposal is unlikely to result in an increase in the number of Feral Cats.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: The site showed evidence of a past fire, although it is difficult to ascertain the disruption and structural change, if any, past fires have caused the site. The proposal is unlikely to result in any increase in frequency of fire events across the study area.

- **Competition from feral honeybees *Apis mellifera*:** No honey bees were observed on the site and as this species does not rely on either tree hollows or nectar resources it is not considered a 'Key Threatening Process' in this instance.

- **Bushrock Removal**: No bushrock was observed on the site and as this species does not rely on this habitat resource it is not considered a 'Key Threatening Process' in this instance.

- **Predation by *Gambusia holbrooki* (Plague Minnow)**: As the Plague Minnow is known to prey upon frog eggs and tadpoles it may potentially impact upon this species. No Plague Minnows were noted on site during the survey although they may occur within the locality. The proposed development will not result in the introduction of this species within the site nor is it likely to increase the numbers of this species within the locality.

- **Importation of Red Fire Ants *Solenopsis invicta***: This species is not known to occur on site.

- **Infection of native plants by *Phytophthora cinnamomi***: This infection is not known to occur on site.

- **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations**: No endangered Psittacine species were seen on site.

- **Loss and/or degradation of site used for hill-topping by butterflies**: Given that this frog species is not a form of butterfly, this ' Key Threatening Process' is not applicable.

- **Anthropogenic Climate Change**: No species living on site are considered likely to be significantly affected by anthropogenic climate change.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** Numerous Rabbits were identified on site during the survey period and it may therefore be stated that this 'Key Threatening Process' is already present on site. The proposal is unlikely to increase the numbers of Rabbits within the locality.

- **Infection of frogs by amphibian chytrid causing disease chytridiomycosis:** No indication of amphibian chytrid was noted on site.

- **Invasion of native plant communities by exotic perennial grasses:** As a small number of exotic perennial grasses were identified on site during the survey, it may be stated that this Key Threatening Process is already present on site. The proposed development may result in the further introduction of perennial grasses to the locality, however it is unlikely to be at a scale which would significantly affect any local population of this threatened species

- **Removal of dead wood and dead trees:** As the site contains an Open Forest assemblage with fallen deris noted, the proposal will result in the removal of dead wood and dead trees. However, with consideration given to the recommended retention of Open Forest habitat within a habitat corridor, it is unlikely to be at a scale which would significantly affect any local population of threatened species.

h) whether any threatened species, population or ecological community is at the limit of its known

Neither this species nor any population occurring in the local area is at the limit of its known standard distribution.

Bibliography:

Barker, J. , Grigg, G.C. & Tyler, M.J. (1995). *A Field Guide to Australian Frogs*. Surry Beatty & Sons, Norton, NSW.

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16. *Litoria aurea* Green and Golden Bell Frog

Litoria aurea was formerly known to inhabit the eastern seaboard of New South Wales and Victoria from Byron Bay through to the Gippsland Lake Region as well as highland sites (New England District, south-western slopes of N.S.W. and Monaro District). Recent literature indicates that the northern and southern distribution limits have not changed, however, *L. aurea* is no longer found on sites above an altitude of 300m above sea level. This frog species inhabits swamps, lagoons, streams and ponds as well as dams, drains and storm water basins. *L. aurea* is thought to be displaced from more established sites by other frog species thus explaining its existence on disturbed sites.

The Green and Golden Bell Frog is a summer breeder and voraciously cannibalistic. The males call from August through to January using a distinctive four part call: "crawk-awk, crawk, crok, crok". The common name of *L. aurea* is derived from its body colouration described as being dull olive to bright emerald green above with blotches of brown or golden-bronze.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

No sign of this species' presence was noted on site during fieldwork, which was undertaken during the known calling period. Habitat resources for the Green and Golden Bell Frog are available within the numerous constructed ponds as well as the drainage line. The recommended retention of this drainage line would protect some areas of potential habitat on site. Similar areas of potential habitat are common within the region including the adjacent Munmorah State Recreation Area. Accordingly, it is believed that provided that the recommendations regarding sediment and water run-off control are implemented, that the proposal is unlikely to significantly affect the life cycle of this species such that a local extinction would occur.

b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No population of this species on site has been identified under Schedule 1, Part 2 of the TSC Act 1995.

c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

No regionally significant area of known habitat is to be removed or modified as a result of the proposal.

d) whether an area of known habitat is likely to be isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No areas of known habitat are likely to be isolated as a result of the proposal provided that the recommendation regarding the retention of habitat with suitable connections to the north and south is implemented.

e) whether critical habitat will be affected.

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act 1995.

f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

Populations of this species are known to exist in the region within Kooragang Nature Reserve (Roderick pers. comm.), Hexham Swamp Nature Reserve (Winning, in press) as well as within Seven Mile Beach and Botany Bay National Parks (Ehmann, 1997). Additional records exist from the Royal National Park and Munmorah State Recreation Area (NPWS Database, 2000). As such, it appears that the species is moderately well represented within conservation reserves in the region. The adequacy of representation of the habitat of this species in the region is unable to be accurately ascertained, but areas of suitable habitat (further to the aforementioned reserves) are represented in the Brisbane Water, Cattai and Thirlmere Lakes National Parks, Pitt Town, Munmorah and Seaham Swamp Nature Reserves and within the Shortland and Newcastle Wetland Reserves.

g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act have been listed in bold below followed by an assessment of the applicability of the threatened process in regards to the species, the site and the proposed development.

- **Clearing of Native Vegetation**: The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The clearing to accommodate the development may be viewed as contributing to the incremental decline of habitat in the local area, although it is recognised that this Key Threatening Process has already affected much of the site due to past colliery activities.. Accordingly, the development of this site is unlikely to be singularly responsible for the loss of any local population of this species provided that the recommendations regarding buffers and corridors are implemented.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands**: Alteration to the natural flow regime is recognised as a major factor contributing to the loss of biological diversity and ecological function of aquatic ecosystems. The impacts of this 'Key Threatening Process' include the reduction of habitat, increased flows causing permanent flooding, riparian zone degradation, increased habitat for invasive species and loss or disruption of ecological function. It is recognised that the study area borders a SEPP 14 wetland as well as containing a drainage line which drains towards Moonee Beach to the east. Accordingly, a number of recommendations have been made through the report to ensure that any potential impacts are minimised. Accordingly, in regards to the Green and Golden Bell Frog, it is considered that the level of threat of this 'Key Threatening Process' is low in this instance, provided that the recommendations are implemented.

- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera***: Small areas of *Chrysanthemoides monilifera* (Bitou Bush) were identified within the subject site and it may be stated that this 'Key Threatening Process' is already present on site. However, the level of this threat posed to this species would be negligible.

- **Predation by the European Red Fox *Vulpes vulpes*:** With the noted presence of at least one

Fox during the survey period, it may stated that this 'Key Threatening Process' is already present on site and could pose a minimal threat to the native fauna. However, the proposal is unlikely to result in increased numbers of this species within the locality.

- **Predation by the Feral Cat *Felis catus***: No Feral Cats were observed on site during the survey period although they are believed likely to occur within the locality. The proposal is unlikely to result in an increase in the number of Feral Cats.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: The site showed evidence of a past fire, although it is difficult to ascertain the disruption and structural change, if any, past fires have caused the site. The proposal is unlikely to result in any increase in frequency of fire events across the study area.

- **Competition from feral honeybees *Apis mellifera*:** No honey bees were observed on the site and as this flora species does not rely on either tree hollows or nectar resources it is not considered a 'Key Threatening Process' in this instance.

- **Bushrock Removal**: No bushrock was observed on the site and it is not considered a 'Key Threatening Process' in this instance.

- **Predation by *Gambusia holbrooki* (Plague Minnow)**: As the Plague Minnow is known to prey upon frog eggs and tadpoles it may potentially impact upon this species. No Plague Minnows were noted on site during the survey, although they may occur within the locality. The proposed development will not result in the introduction of this species within the site nor is it likely to increase the numbers of this species within the locality.

- **Importation of Red Fire Ants *Solenopsis invicta***: This species is not known to occur on site.

- **Infection of native plants by *Phytophthora cinnamomi***: This infection is not known to occur on site.

- **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations**: No endangered Psittacine species were seen on site.

- **Loss and/or degradation of site used for hill-topping by butterflies**: Given that this frog species is not a form of butterfly, this ' Key Threatening Process' is not applicable.

- **Anthropogenic Climate Change**: No species living on site are considered likely to be significantly affected by anthropogenic climate change.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** Numerous Rabbits were identified on site during the survey period and it may therefore be stated that this 'Key Threatening Process' is already present on site. The proposal is unlikely to increase the numbers of Rabbits within the locality.

- **Infection of frogs by amphibian chytrid causing disease chytridiomycosis:** No indication of amphibian chytrid was noted on site.

- **Invasion of native plant communities by exotic perennial grasses:** As a small number of exotic perennial grasses were identified on site during the survey, it may be stated that this Key Threatening Process is already present on site. The proposed development may result in the further introduction of perennial grasses to the locality, however it is unlikely to be at a scale which would significantly affect any local population of this threatened species

- **Removal of dead wood and dead trees:** As the site contains an Open Forest assemblage with fallen deris noted, the proposal will result in the removal of dead wood and dead trees. However, with consideration given to the recommended retention of Open Forest habitat within a habitat corridor, it is unlikely to be at a scale which would significantly affect any local population of threatened species.

h) whether any threatened species, population or ecological community is at the limit of its known distribution.

Neither this species nor any population occurring in the local area is at the limit of its known standard distribution.

Bibliography:

Barker, J. , Grigg, G.C. & Tyler, M.J. (1995). *A Field Guide to Australian Frogs*. Surry Beatty & Sons, Norton, NSW.

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17. *Litoria littlejohni* Heath Frog

This species has a discontinuous distribution east of the Great Dividing Range in NSW and north-eastern Victoria. The best known populations are present in the Watagan State Forest, and the Barren Ground Nature Reserve possibly due to the well established forests with extensive tree cover and availability of breeding ponds. Habitats include wet and dry sclerophyll forest, coastal woodland and heath. Associated characteristics include rocky streams and sandstone outcrops, semi-permanent dams and slow flowing streams. The water quality required for breeding is usually tannic (pH 6.2) and contains detritus which are used as anchors for egg clusters. The species is identified by it's broad head, rounded snout and white patch beneath the eye. The length is 38-56mm in males, 48-72mm in females. The sides and undersurface of the thigh, tibia, armpit and upper arm are bright red-orange. The toes are half-webbed and fingers free, both have large discs. The advertisement call is a series of 6-14 rapidly repeated low, drawn out whistles.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

No sign of this species' presence was noted on site during fieldwork. Habitat resources for this species are available within the drainage line as well as the constructed ponds. The recommended retention of this drainage line would protect this area of potential habitat on site. Similar areas of potential habitat are common within the region including the adjacent Munmorah State Recreation Area. Accordingly, it is believed that provided that the recommendations regarding sediment and water run-off control are implemented, that the proposal is unlikely to significantly affect the life cycle of this species such that a local extinction would occur.

b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No population of this species on site has been identified under Schedule 1, Part 2 of the TSC Act 1995.

c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

No significant area of known habitat is to be removed or modified as a result of the proposal.

d) whether an area of known habitat is likely to be isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No areas of known habitat are likely to be isolated as a result of the proposal provided that the recommendation regarding the retention of habitat with suitable connections to the north and south is implemented.

e) whether critical habitat will be affected.

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act 1995.

f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

The known populations of this species are mostly within National Parks or State Forest (in the latter, frequently in Flora Reserves), and therefore are as secure as is possible. These include Morton National Park, Blue Mountains National Park, Wadibilliga National Park, Barren Grounds Nature Reserve. Breeding grounds include Wattagan SF, Barren Grounds Nature Reserve, Endrick River near Tianjara Falls, Brogo River, and the Royal National Park in NSW; from Bell Bird, Cann River and Orbost in Victoria. (Ehmann, 1997). It may appear that the species is adequately represented within conservation reserves in the region, however, no attempt to estimate the population size has been made as species are rarely located at the same site each year. The adequacy of representation of the habitat of this species in the region is unable to be accurately ascertained, due to the low number of adult breeding pairs and sites, the species is therefore considered uncommon in NSW.

g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act have been listed in bold below followed by an assessment of the applicability of the threatened process in regards to the species, the site and the proposed development.

- **Clearing of Native Vegetation**: The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The clearing to accommodate the development may be viewed as contributing to the incremental decline of habitat in the local area, although it is recognised that this Key Threatening Process has already affected much of the site due to past colliery activities.. Accordingly, the development of this site is unlikely to be singularly responsible for the loss of any local population of this species provided that the recommendations regarding buffers and corridors are implemented.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands**: Alteration to the natural flow regime is recognised as a major factor contributing to the loss of biological diversity and ecological function of aquatic ecosystems. The impacts of this 'Key Threatening Process' include the reduction of habitat, increased flows causing permanent flooding, riparian zone degradation, increased habitat for invasive species and loss or disruption of ecological function. It is recognised that the study area borders a SEPP 14 wetland as well as containing a drainage line which drains towards Moonee Beach to the east. Accordingly, a number of recommendations have been made through the report to ensure that any potential impacts are minimised. Accordingly, in regards to this species, it is considered that the level of threat of this 'Key Threatening Process' is low in this instance, provided that the recommendations are implemented.

- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera***: Small areas of *Chrysanthemoides monilifera* (Bitou Bush) were identified within the subject site and it may be stated that this 'Key Threatening Process' is already present on site. However, the level of this threat posed to this species would be negligible.

- **Predation by the European Red Fox *Vulpes vulpes*:** With the noted presence of at least one Fox during the survey period, it may stated that this 'Key Threatening Process' is already present on site and could pose a minimal threat to the native fauna. However, the proposal is unlikely to result in increased numbers of this species within the locality.

- **Predation by the Feral Cat *Felis catus***: No Feral Cats were observed on site during the survey period although they are believed likely to occur within the locality. The proposal is unlikely to result in an increase in the number of Feral Cats.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: The site showed evidence of a past fire, although it is difficult to ascertain the disruption and structural change, if any, past fires have caused the site. The proposal is unlikely to result in any increase in frequency of fire events across the study area.

- **Competition from feral honeybees *Apis mellifera*:** No honey bees were observed on the site and as this species does not rely on either tree hollows or nectar resources it is not considered a 'Key Threatening Process' in this instance.

- **Bushrock Removal**: No bushrock was observed on the site and as this species and it is not considered a 'Key Threatening Process' in this instance.

- **Predation by *Gambusia holbrooki* (Plague Minnow)**: As the Plague Minnow is known to prey upon frog eggs and tadpoles it may potentially impact upon this species. No Plague Minnows were noted on site during the survey, although they may occur within the locality. The proposed development will not result in the introduction of this species within the site nor is it likely to increase the numbers of this species within the locality.

- **Importation of Red Fire Ants *Solenopsis invicta***: This species is not known to occur on site.

- **Infection of native plants by *Phytophthora cinnamomi***: This infection is not known to occur on site.

- **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations**: No endangered Psittacine species were seen on site.

- **Loss and/or degradation of site used for hill-topping by butterflies**: Given that this frog species is not a form of butterfly, this ' Key Threatening Process' is not applicable.

- **Anthropogenic Climate Change**: No species living on site are considered likely to be significantly affected by anthropogenic climate change.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** Numerous Rabbits were identified on site during the survey period and it may therefore be stated that this 'Key Threatening Process' is already present on site. The proposal is unlikely to increase the numbers of Rabbits within the locality.

- **Infection of frogs by amphibian chytrid causing disease chytridiomycosis:** No indication of amphibian chytrid was noted on site.

- **Invasion of native plant communities by exotic perennial grasses:** As a small number of exotic perennial grasses were identified on site during the survey, it may be stated that this Key Threatening Process is already present on site. The proposed development may result in the further introduction of perennial grasses to the locality, however it is unlikely to be at a scale which would significantly affect any local population of this threatened species

- **Removal of dead wood and dead trees:** As the site contains an Open Forest assemblage with fallen deris noted, the proposal will result in the removal of dead wood and dead trees. However, with consideration given to the recommended retention of Open Forest habitat within

a habitat corridor, it is unlikely to be at a scale which would significantly affect any local population of threatened species.

h) whether any threatened species, population or ecological community is at the limit of its known distribution.

Neither this species nor any population occurring in the local area is at the limit of its known standard distribution.

Bibliography

Barker, J., Grigg, G.C., and Tyler, M.J., 1995. *A Field Guide to Australian Frogs*. Surrey Beatty & Sons, Australia.

Cogger, H.G. (2000). *Reptiles & Amphibians of Australia* (6th edn). Reed Books, Sydney.

Ehmann, H., 1997 (ed). *Threatened Frogs of New South Wales: Habitats, Status and Conservation*. Published by Frog and Tadpole Study Group of NSW Inc., Australia.

18. *Mixophyes iteratus* Great Barred Frog

Also known as the Gold-eyed Barred Frog, this species has been found from near Narooma on the south coast of NSW northwards along the eastern escarpment of the Great Dividing Range and coastal region to the Conondale Ranges in south-eastern QLD. However, this species has not been detected in the far south of its range in recent times, and has been observed to be in decline over the last 15 years. Some recent records exist for the species near Boarding House Dam, in the Watagan Mountains (Mahony pers. comm.).

Mixophyes iteratus occurs on forest slopes of the Great Dividing Range, generally between 20-800m A.S.L. It appears to prefer riparian vegetation or other moist vegetation communities, generally on rich organic soils. Deep leaf litter and/or thick cover is necessary for this species. It appears tolerant of invasion of suitable habitat by weeds such as Lantana. Water quality must be of a high standard, and the species occurs in 1st to 3rd order streams (i.e. 'young' streams), and is absent from ponds and ephemeral pools. Graded banks with undercuts and steep edges are favourable haunts of this frog.

Mixophyes iteratus is the largest frog in the *Mixophyes* genus, with Males reaching a size of 68-78mm, while females are larger at 91-108mm. The call of this species is described as a 'deep guttural grunt', and calling is typically from leaf litter along the banks of streams. The eggs are also laid there, to be washed into the water later by heavy rains. All known breeding seems to be in late spring and early summer.

Clearing of habitat, declining water quality and introduced predators such as *Gambusia holbrooki* (Plague Minnow) and *Cyprinus carpio* (Carp) are all thought likely to be contributing to the decline of this species. However, the apparent disappearance of this species from 'pristine' areas cannot be accounted for at this point in time.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

No sign of this species' presence was noted on site during fieldwork. Marginal habitat resources for this species are available within the drainage line, which has been recommended for retention. Similar habitat attributes occur within the local area including the Munmorah State Recreation Area. It is therefore believed that the proposal is unlikely to significantly affect the life cycle of this species or place any viable local population of this species at risk of extinction.

b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No population of this species has been listed as 'Endangered' within the TSC Act 1995.

c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

No significant area of known habitat is to be removed or modified as a result of the proposal.

d) whether an area of known habitat is likely to be isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No areas of known habitat are likely to be isolated as a result of the proposal provided that the recommendation regarding the retention of habitat with suitable connections to the north and south is implemented.

e) whether critical habitat will be affected.

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act 1995.

f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

Records exist for this species within the Blue Mountains National Park (Ehmann, 1997), though the presence of this species has not been confirmed there for a long period of time. Recent records exist within the Watagan National Park (Mahony pers. comm.). As such, it appears that the species may not be adequately represented within conservation reserves in the region. Other areas such as several State Forests are known to contain populations, but the level of protection afforded by such areas is uncertain. The adequacy of representation of the habitat of this species in the region is unable to be accurately ascertained, but areas of suitable habitat (further to the aforementioned reserves) may exist within the Wollemi, Yengo, Brisbane Waters and Dharug National Parks as well as Munmorah State Recreation Area.

g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act have been listed in bold below followed by an assessment of the applicability of the threatened process in regards to the species, the site and the proposed development.

- **Clearing of Native Vegetation**: The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The clearing to accommodate the development may be viewed as contributing to the incremental decline of habitat in the local area, although it is recognised that this Key Threatening Process has already affected much of the site due to past colliery activities.. Accordingly, the development of this site is unlikely to be singularly responsible for the loss of any local population of this species provided that the recommendations regarding buffers and corridors are implemented.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands**: Alteration to the natural flow regime is recognised as a major factor contributing to the loss of biological diversity and ecological function of aquatic ecosystems. The impacts of this 'Key Threatening Process' include the reduction of habitat, increased flows causing permanent flooding, riparian zone degradation, increased habitat for invasive species and loss or disruption of ecological function. It is recognised that the study area borders a SEPP 14 wetland as well as containing a drainage line which drains towards Moonee Beach to the east. Accordingly, a number of recommendations have been made through the report to ensure that any potential impacts are minimised. Accordingly, in regards to the Giant Barred Frog, it is considered that the level of threat of this 'Key Threatening Process' is low in this instance, provided that the recommendations are implemented.

- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera***: Small areas of *Chrysanthemoides monilifera* (Bitou Bush) were identified within the subject site and it may be stated that this 'Key Threatening Process' is already present on site. However, the level of this threat posed to the Giant Barred would be negligible.

- **Predation by the European Red Fox *Vulpes vulpes*:** With the noted presence of at least one Fox during the survey period, it may stated that this 'Key Threatening Process' is already present on site and could pose a minimal threat to the native fauna. However, the proposal is unlikely to result in increased numbers of this species within the locality.

- **Predation by the Feral Cat *Felis catus***: No Feral Cats were observed on site during the survey period although they are believed likely to occur within the locality. The proposal is unlikely to result in an increase in the number of Feral Cats.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: The site showed evidence of a past fire, although it is difficult to ascertain the disruption and structural change, if any, past fires have caused the site. The proposal is unlikely to result in any increase in frequency of fire events across the study area.

- **Competition from feral honeybees *Apis mellifera*:** No honey bees were observed on the site and as this species does not rely on either tree hollows or nectar resources it is not considered a 'Key Threatening Process' in this instance.

- **Bushrock Removal**: No bushrock was observed on the site and as this species does not rely on this habitat resource it is not considered a 'Key Threatening Process' in this instance.

- **Predation by *Gambusia holbrooki* (Plague Minnow)**: As the Plague Minnow is known to prey upon frog eggs and tadpoles it may potentially impact upon this species. No Plague Minnows were noted on site during the survey, although they may occur within the locality. The proposed development will not result in the introduction of this species within the site nor is it likely to increase the numbers of this species within the locality.

- **Importation of Red Fire Ants *Solenopsis invicta***: This species is not known to occur on site.

- **Infection of native plants by *Phytophthora cinnamomi***: This infection is not known to occur on site.

- **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations**: No endangered Psittacine species were seen on site.

- **Loss and/or degradation of site used for hill-topping by butterflies**: Given that this frog species is not a form of butterfly, this ' Key Threatening Process' is not applicable.

- **Anthropogenic Climate Change**: No species living on site are considered likely to be significantly affected by anthropogenic climate change.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** Numerous Rabbits were identified on site during the survey period and it may therefore be stated that this 'Key Threatening Process' is already present on site. The proposal is unlikely to increase the numbers of Rabbits within the locality.

- **Infection of frogs by amphibian chytrid causing disease chytridiomycosis:** No indication of amphibian chytrid was noted on site.

- **Invasion of native plant communities by exotic perennial grasses:** As a small number of exotic perennial grasses were identified on site during the survey, it may be stated that this Key Threatening Process is already present on site. The proposed development may result in the further introduction of perennial grasses to the locality, however it is unlikely to be at a scale which would significantly affect any local population of this threatened species

- **Removal of dead wood and dead trees:** As the site contains an Open Forest assemblage with fallen deris noted, the proposal will result in the removal of dead wood and dead trees. However, with consideration given to the recommended retention of Open Forest habitat within a habitat corridor, it is unlikely to be at a scale which would significantly affect any local population of threatened species.

h) whether any threatened species, population or ecological community is at the limit of its known distribution.

Neither this species nor any population occurring in the local area is at the limit of its known standard distribution.

Bibliography:

Barker, J. , Grigg, G.C. & Tyler, M.J. (1995). *A Field Guide to Australian Frogs*. Surry Beatty & Sons, Norton, NSW.

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19. *Lathamus discolor* Swift Parrot

The Swift Parrot is most closely related to Rosellas, though its habits are most closely aligned with those of the Lorikeets, which it also resembles morphologically. The main distinction of the Swift Parrot is the long red tail that is not found in Lorikeets, which generally have dumpier green tails. During winter the Swift Parrot inhabits mainland Australia from Adelaide (S.A.) through Victoria, and up the east coast to south-east Queensland, as well as visiting the south and central western slopes and the Riverina in NSW. The Swift Parrot returns to eastern Tasmania in spring to breed.

The species appears to have declined greatly in the northern and eastern parts of its overwintering range to the extent that the NSW Scientific Committee has upgraded the listing of the Swift Parrot from Schedule 2 (Vulnerable) to Schedule 1 (Endangered) (NSW Scientific Committee, 2000). The Swift Parrot is also listed under the Commonwealth Environment Protection and Biodiversity Act (1999) as 'Endangered'. Recent investigations have indicated that there may only be 1000 breeding pairs throughout its entire range (Garnett and Crowley, 2000; Brereton, 1998; Forshaw, 1993). The continued loss of foraging resources, in particular winter-flowering Eucalypt species, appears to be most serious short term threat to this species in NSW. The most recent records are from the tablelands and western slopes of southern and central NSW. Swift Parrots have also been recorded during the winter months of 2000 utilising areas in the vicinity of Aberdare State Forest (Roderick, pers. comm.) and Millers Forest (Newman, pers. comm.).

The Swift Parrot prefers Dry Sclerophyll Forest in Tasmania and Open Forest to Woodland in the north on the mainland. It has also been recorded utilising street trees and in parks and gardens. Swift Parrots forage on the nectar of Eucalypts, often in mixed flocks with Lorikeets. The preferred winter food species are *Eucalyptus sideroxylon* (Red Ironbark), *E. albens* (White Box), *E. ovata* (Swamp Gum), *E. robusta* (Swamp Mahogany) and *E. melliodora* (Yellow Gum) and have also been observed eating the seeds and flowers of *Xanthorrhoea* spp. (Grass Trees). They also feed on insects and their larvae, fruits, berries, seeds and vegetable matter. While feeding, individuals may be approached and watched from under the feed tree. When there is an abundance of food, large congregations of hundreds of birds may gather in noisy and crowded roosts. Nesting occurs from September to January in a hollow branch of Eucalypts and they return to the mainland during March and April.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

No indication of this species' presence was noted on site during fieldwork, although it is recognised that this species returns to Tasmania during spring, when the fieldwork was undertaken. Potential winter foraging habitat for this species is present within the areas of Open Forest, which is recommended for retention as part of a habitat corridor. Given the high mobility of the Swift Parrot and the occurrence of large areas of similar habitat attributes within the locality including the adjacent Munmorah State Recreation Area, it is considered that the proposal is unlikely to significantly affect the life cycle of this species or place any viable local population of this species at risk of extinction.

b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No population of this species in the area has been identified under Schedule 1, Part 2 of the TSC Act 1995.

c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

No regionally significant area of known habitat is to be removed or modified as a result of the proposal, although the proposal may be view as contributing to the incremental decline of potential habitat within the region.

d) whether an area of known habitat is likely to be isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No areas of known habitat are likely to be isolated as result of the proposal, particularly given the high mobility of the species.

e) whether critical habitat will be affected.

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act 1995.

f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

Records of this species in the region exist within the Lower Hunter National Park (Roderick pers. comm.) as well as within Botany Bay, Ku-ring-gai Chase and Sydney Harbour National Parks (NPWS Database, 2000). As such, populations of this species may not be adequately represented within the reserve system in the region. The adequacy of representation of the habitat of this species in the region is difficult to ascertain, although it appears that any of a number of reserves containing forested areas with flowering Eucalypt species could provide some protected foraging habitat for this species. As such, it could be tentatively stated that the habitat of this species is well represented in conservation reserves in region, although the majority of potential habitat remains 'unprotected'.

g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act have been listed in bold below followed by an assessment of the applicability of the threatened process in regards to the species, the site and the proposed development:

- **Clearing of Native Vegetation**: The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The clearing to accommodate the development may be viewed as contributing to the incremental decline of habitat in the local area, although it is recognised that this Key Threatening Process has already affected much of the site due to past colliery activities.. Accordingly, the development of this site is unlikely to be

singularly responsible for the loss of any local population of this species provided that the recommendations regarding buffers and corridors are implemented.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands**: Alteration to the natural flow regime is recognised as a major factor contributing to the loss of biological diversity and ecological function of aquatic ecosystems. The impacts of this 'Key Threatening Process' include the reduction of habitat, increased flows causing permanent flooding, riparian zone degradation, increased habitat for invasive species and loss or disruption of ecological function. It is recognised that the study area borders a SEPP 14 wetland as well as containing a drainage line which drains towards Moonee Beach to the east. Accordingly, a number of recommendations have been made through the report to ensure that any potential impacts are minimised. In regards to this species, it is considered that the level of threat associated with this 'Key Threatening Process' is low in this instance.

- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera***: Small areas of *Chrysanthemoides monilifera* (Bitou Bush) were identified within the subject site and it may be stated that this 'Key Threatening Process' is already present on site. However, the level of threat posed to the Swift Parrot would be negligible.

- **Predation by the European Red Fox *Vulpes vulpes*:** With the recording of at least one Fox during the survey period, it may stated that this 'Key Threatening Process' is already present on site and could pose a minimal threat to this species. However, the proposal is unlikely to result in increased numbers of this species within the locality.

- **Predation by the Feral Cat *Felis catus***: No Feral Cats were observed on site during the survey period, although they are believed likely to occur within the locality. The proposal is unlikely to result in an increase in the number of Feral Cats although any residential development may result in an increase in the numbers of domestic cats in the locality.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: The site showed evidence of a past fire, although it is difficult to ascertain the disruption and structural change, if any, past fires have caused the site. The proposal is unlikely to result in any increase in frequency of fire events across the study area.

- **Competition from feral honeybees *Apis mellifera*:** No honey bees were observed on the site and it is not considered a 'Key Threatening Process' for this species.

- **Bushrock Removal**: No bushrock was observed on the site and as the Swift Parrot does not rely on this habitat resource it is not considered a 'Key Threatening Process' for this species.

- **Predation by *Gambusia holbrooki* (Plague Minnow)**: No Plague Minnows were noted on site during the survey although they may occur within the locality. The proposed development is unlikely to result in the introduction of this species within the site nor is it likely to increase the numbers of this species within the locality. As Plague Minnows do not prey upon Swift Parrots, this Key Threatening Process does not apply in this instance.

- **Importation of Red Fire Ants *Solenopsis invicta***: This species is not known to occur on site.

- **Infection of native plants by *Phytophthora cinnamomi***: This infection is not known to occur on site.

- **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations**: No endangered Psittacine species were seen on site.

- **Loss and/or degradation of site used for hill-topping by butterflies**: Given that the Swift Parrot is not a form of butterfly, this ' Key Threatening Process' is not applicable.

- **Anthropogenic Climate Change**: No species living on site are considered likely to be significantly affected by anthropogenic climate change.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** Numerous Rabbits were identified on site during the survey period and it may therefore be stated that this 'Key Threatening Process' is already present on site. The proposal is unlikely to increase the numbers of Rabbits within the locality.

- **Infection of frogs by amphibian chytrid causing disease chytridiomycosis:** No indication of amphibian chytrid was noted on site.

- **Invasion of native plant communities by exotic perennial grasses:** As a small number of exotic perennial grasses were identified on site during the survey, it may be stated that this Key Threatening Process is already present on site. The proposed development may result in the further introduction of perennial grasses to the locality, however it is unlikely to be at a scale which would significantly affect any local population of this threatened species

- **Removal of dead wood and dead trees:** As the site contains an Open Forest assemblage with fallen deris noted, the proposal will result in the removal of dead wood and dead trees. However, with consideration given to the recommended retention of Open Forest habitat within a habitat corridor, it is unlikely to be at a scale which would significantly affect any local population of threatened species.

h) whether any threatened species, population or ecological community is at the limit of its known distribution.

Neither this species nor any population occurring in the area is at the limit of its known standard distribution.

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20. *Xanthomyza phrygia* Regent Honeyeater

The Regent Honeyeater is a medium-sized, unique Honeyeater. It is nomadic, although it does seem to return to nesting areas sporadically. Small flocks regularly, sometimes annually, visit the northern tablelands and the north western and central western slopes of NSW in the spring and summer. Individuals also appear on the NSW coast at most times of year but primarily in winter. It occurs in temperate woodlands and open forest, including forest edges. Once commonly observed in flocks of hundreds, it is thought that the current population may not number more than 1000 individuals. Regent Honeyeaters are now seldom seen west of Bendigo, Victoria and are only occasionally observed in southern QLD.

Seasonal movements appear to be dictated by the flowering of various species of Eucalypts that are characteristic of the dry forests and woodlands of south eastern Australia. The Regent Honeyeater prefers to forage on large-flowered Eucalypts (e.g. *Eucalyptus sideroxylon*, *E. melliodora*, *E. albens, E. leucoxylon*), particularly where these trees grow in more productive areas and yield plentiful and predictable nectar flows. They also forage on mistletoe and Banksia flowers, and arthropods. In parts of coastal NSW they are also attracted to stands of *Eucalyptus robusta* (Swamp Mahogany). Recent records (winter 2000) exist of this species foraging in flowering *Corymbia maculata* (Spotted Gum) trees at Aberdare State Forest near Ellalong, NSW (Roderick, pers.comm.).

During winter, Regent Honeyeaters disperse widely in small groups. In spring they concentrate into the main breeding areas around Chiltern and Benalla in Victoria and the Capertee Valley, Bundarra District and the Warrumbungles in NSW. Other recent records suggest that the species may be breeding in the vicinity of Quorrobolong, near Cessnock, NSW (Geering, pers. comm.). Nests are constructed of strips of Eucalypt bark, dried grass and other plant material. They are placed in an upright fork 4 to 25m above ground, and 2-3 eggs are laid. Nesting occurs mainly between November and January, but breeding has been recorded in all months between July and February. Radio-tracking methodologies undertaken during the summer of 2000 found that fledged birds from the Capertee Valley foraged on *Eucalyptus* sp. (Scribbly Gum) blossoms on the Newnes Plateau (Morris, pers. comm.).

The decline of the Regent Honeyeater appears to be due to a steady reduction in the extent and quality of its habitat. Many of the remaining stands of the 'key' Eucalypt species have suffered in the past from harvesting of timber and the very slow growth rates of replacement trees. Lack of regeneration due to grazing by stock and hence a lack of new trees to replace dying trees in farmland is also a serious concern.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

No indication of this species' presence was noted on site during fieldwork. Potential winter foraging habitat for this species is present within the areas of Open Forest, which is recommended for retention as a habitat corridor. Given the high mobility of this species and the occurrence of large areas of similar habitat attributes within the locality including the adjacent Munmorah State Recreation Area, it is considered that the proposal is unlikely to significantly affect the life cycle of this species or place any viable local population of this species at risk of extinction.

b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No population of this species in the area has been identified under Schedule 1, Part 2 of the TSC Act 1995.

c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

No regionally significant area of known habitat is to be removed or modified as a result of the proposal, although the proposal may be view as contributing to the incremental decline of potential habitat within the region.

d) whether an area of known habitat is likely to be isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No areas of known habitat are likely to be isolated as a result of the proposal, particularly given the high mobility of the species.

e) whether critical habitat will be affected.

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act 1995.

f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

Records of this species in the region exist in the Lower Hunter National Park (Roderick, pers. comm.), Goulburn River and Yengo National Parks (Hunter Bird Observers Club, 1999) as well as from the Wollemi, Blue Mountains, Brisbane Water, Royal, Nattai National Parks (NPWS Database, 2000). As such, it appears that this species is adequately represented in conservation reserves in the region. The adequacy of representation of the habitat of this species in the region is difficult to ascertain, although it appears that any of a number of reserves containing forested areas with flowering Eucalypt species could provide some protected habitat for this species. As such, it could be tentatively stated that the habitat of this species is well represented in conservation reserves in this region, although the majority of potential habitat remains 'unprotected'.

g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act have been listed in bold below followed by an assessment of the applicability of the threatened process in regards to the species, the site and the proposed development:

- **Clearing of Native Vegetation**: The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The clearing to accommodate the development may be viewed as contributing to the incremental decline of habitat in the local area, although it is recognised that this Key Threatening Process has already affected much of the

site due to past colliery activities.. Accordingly, the development of this site is unlikely to be singularly responsible for the loss of any local population of this species provided that the recommendations regarding buffers and corridors are implemented.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands**: Alteration to the natural flow regime is recognised as a major factor contributing to the loss of biological diversity and ecological function of aquatic ecosystems. The impacts of this 'Key Threatening Process' include the reduction of habitat, increased flows causing permanent flooding, riparian zone degradation, increased habitat for invasive species and loss or disruption of ecological function. It is recognised that the study area borders a SEPP 14 wetland as well as containing a drainage line which drains towards Moonee Beach to the east. Accordingly, a number of recommendations have been made through the report to ensure that any potential impacts are minimised. In regards to this species, it is considered that the level of threat associated with this 'Key Threatening Process' is low in this instance.

- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera***: Small areas of *Chrysanthemoides monilifera* (Bitou Bush) were identified within the subject site and it may be stated that this 'Key Threatening Process' is already present on site. However, the level of this threat posed to this species would be negligible.

- **Predation by the European Red Fox *Vulpes vulpes*:** With the recording of at least one Fox during the survey period, it may stated that this 'Key Threatening Process' is already present on site and could pose a minimal threat to this species. However, the proposal is unlikely to result in increased numbers of this species within the locality.

- **Predation by the Feral Cat *Felis catus***: No Feral Cats were observed on site during the survey period although they are believed likely to occur within the locality. However, the proposal is unlikely to result in an increase in the number of Feral Cats.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: The site showed evidence of a past fire, although it is difficult to ascertain the disruption and structural change, if any, past fires have caused the site. The proposal is unlikely to result in any increase in frequency of fire events across the study area.

- **Competition from feral honeybees *Apis mellifera*:** No honey bees were observed on the site and it is not considered a 'Key Threatening Process' for this species.

- **Bushrock Removal**: No bushrock was observed on the site and as the Regent Honeyeater does not rely on this habitat resource it is not considered a 'Key Threatening Process' for this species.

- **Predation by *Gambusia holbrooki* (Plague Minnow)**: No Plague Minnows were noted on site during the survey although they may occur within the locality. The proposed development is unlikely to result in the introduction of this species within the site nor is it likely to increase the numbers of this species within the locality. As Plague Minnows do not prey upon Regent Honeyeaters, this Key Threatening Process does not apply in this instance.

- **Importation of Red Fire Ants *Solenopsis invicta***: This species is not known to occur on site.

- **Infection of native plants by *Phytophthora cinnamomi***: This infection is not known to occur on site.

- **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered**

psittacine species and populations: No endangered Psittacine species were seen on site.

- **Loss and/or degradation of site used for hill-topping by butterflies**: Given that the Regent Honeyeater is not a form of butterfly, this ' Key Threatening Process' is not applicable.

- **Anthropogenic Climate Change**: No species living on site are considered likely to be significantly affected by anthropogenic climate change.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** Numerous Rabbits were identified on site during the survey period and it may therefore be stated that this 'Key Threatening Process' is already present on site. The proposal is unlikely to increase the numbers of Rabbits within the locality.

- **Infection of frogs by amphibian chytrid causing disease chytridiomycosis:** No indication of amphibian chytrid was noted on site.

- **Invasion of native plant communities by exotic perennial grasses:** As a small number of exotic perennial grasses were identified on site during the survey, it may be stated that this Key Threatening Process is already present on site. The proposed development may result in the further introduction of perennial grasses to the locality, however it is unlikely to be at a scale which would significantly affect any local population of this threatened species

- **Removal of dead wood and dead trees:** As the site contains an Open Forest assemblage with fallen deris noted, the proposal will result in the removal of dead wood and dead trees. However, with consideration given to the recommended retention of Open Forest habitat within a habitat corridor, it is unlikely to be at a scale which would significantly affect any local population of threatened species.

h) whether any threatened species, population or ecological community is at the limit of its known distribution.

Neither this species nor any population occurring in the area is at the limit of its known standard distribution.

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21. *Ptilinopus regina* Rose-crowned Fruit-Dove

The Rose-crowned Fruit-Dove occurs in Eastern Australia, from Cape York south to the vicinity of Port Stephens. Occasionally it extends into Victoria. The Rose-crowned Fruit Dove generally lives in Rainforest, though it also frequents nearby drier forests as well as Mangroves. It usually feeds on Figs or other fruit and berry-bearing trees. The breeding season is from October to February, with a flimsy nest being constructed of twigs on a scanty platform in a low tree or bush. A seasonal movement of birds from the southern end of the range to the north occurs in winter, whilst others have been found to move seasonally in relation to the availability of fruit, with distance and direction traveled varying from one year to the next.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

No indication of this species' presence was noted on site during fieldwork. Limited foraging and roosting habitat for this species is present within the sheltered slopes in the south eastern portion of the site. Additional foraging habitat is also present within the areas of Open Forest. Given the high mobility of this Fruit-Dove and the occurrence of larger areas of similar habitat attributes within the locality including the adjacent Munmorah State Recreation Area, it is considered that the proposal is unlikely to significantly affect the life cycle of this species or place any viable local population of this species at risk of extinction.

b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No population of this species in the area has been identified under Schedule 1, Part 2 of the TSC Act 1995.

c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

No regionally significant area of known habitat is to be removed or modified as a result of the proposal, although the proposal may be view as contributing to the incremental decline of potential habitat within the region.

d) whether an area of known habitat is likely to be isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No areas of known habitat are likely to be isolated as a result of the proposal, particularly given the high mobility of the species.

e) whether critical habitat will be affected.

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act 1995.

f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

The adequacy of representation of the habitat of this species in the region is unable to be accurately ascertained, but areas of suitable habitat are represented in the Watagan, Bouddi and Dharug National Parks and within Glenrock, Awabakal and Munmorah State Recreation Areas.

g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act have been listed in bold below followed by an assessment of the applicability of the threatened process in regards to the species, the site and the proposed development:

- **Clearing of Native Vegetation**: The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The clearing to accommodate the development may be viewed as contributing to the incremental decline of habitat in the local area, although it is recognised that this Key Threatening Process has already affected much of the site due to past colliery activities.. Accordingly, the development of this site is unlikely to be singularly responsible for the loss of any local population of this species provided that the recommendations regarding buffers and corridors are implemented.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands**: Alteration to the natural flow regime is recognised as a major factor contributing to the loss of biological diversity and ecological function of aquatic ecosystems. The impacts of this 'Key Threatening Process' include the reduction of habitat, increased flows causing permanent flooding, riparian zone degradation, increased habitat for invasive species and loss or disruption of ecological function. It is recognised that the study area borders a SEPP 14 wetland as well as containing a drainage line which drains towards Moonee Beach to the east. Accordingly, a number of recommendations have been made through the report to ensure that any potential impacts are minimised. In regards to this species, it is considered that the level of threat associated with this 'Key Threatening Process' is low in this instance.

- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera***: Small areas of *Chrysanthemoides monilifera* (Bitou Bush) were identified within the subject site and it may be stated that this 'Key Threatening Process' is already present on site. However, the level of this threat posed to this species would be negligible.

- **Predation by the European Red Fox *Vulpes vulpes*:** With the recording of at least one Fox during the survey period, it may stated that this 'Key Threatening Process' is already present on site and could pose a minimal threat to this species. However, the proposal is unlikely to result in increased numbers of this species within the locality.

- **Predation by the Feral Cat *Felis catus***: No Feral Cats were observed on site during the survey period, although they are believed likely to occur within the locality. However, the proposal is unlikely to result in an increase in the number of Feral Cats.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: The site showed evidence of a past fire, although it is difficult to ascertain the disruption and structural change, if any, past fires have caused the site. The proposal is unlikely to result in any increase in frequency of fire events across the study area.

- **Competition from feral honeybees *Apis mellifera*:** No honey bees were observed on the site and it is not considered a 'Key Threatening Process' for this species.

- **Bushrock Removal**: No bushrock was observed on the site and as the Rose-crowned Fruit-Dove does not rely on this habitat resource it is not considered a 'Key Threatening Process' for this species.

- **Predation by *Gambusia holbrooki* (Plague Minnow)**: No Plague Minnows were noted on site during the survey although they may occur within the locality. The proposed development is unlikely to result in the introduction of this species within the site nor is it likely to increase the numbers of this species within the locality. As Plague Minnows do not prey upon Rose-crowned Fruit-Doves, this Key Threatening Process does not apply in this instance.

- **Importation of Red Fire Ants *Solenopsis invicta***: This species is not known to occur on site.

- **Infection of native plants by *Phytophthora cinnamomi***: This infection is not known to occur on site.

- **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations**: No endangered Psittacine species were seen on site.

- **Loss and/or degradation of site used for hill-topping by butterflies**: Given that this species is not a form of butterfly, this ' Key Threatening Process' is not applicable.

- **Anthropogenic Climate Change**: No species living on site are considered likely to be significantly affected by anthropogenic climate change.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** Numerous Rabbits were identified on site during the survey period and it may therefore be stated that this 'Key Threatening Process' is already present on site. The proposal is unlikely to increase the numbers of Rabbits within the locality.

- **Infection of frogs by amphibian chytrid causing disease chytridiomycosis:** No indication of amphibian chytrid was noted on site.

- **Invasion of native plant communities by exotic perennial grasses:** As a small number of exotic perennial grasses were identified on site during the survey, it may be stated that this Key Threatening Process is already present on site. The proposed development may result in the further introduction of perennial grasses to the locality, however it is unlikely to be at a scale which would significantly affect any local population of this threatened species

- **Removal of dead wood and dead trees:** As the site contains an Open Forest assemblage with fallen deris noted, the proposal will result in the removal of dead wood and dead trees. However, with consideration given to the recommended retention of Open Forest habitat within a habitat corridor, it is unlikely to be at a scale which would significantly affect any local population of threatened species.

h) whether any threatened species, population or ecological community is at the limit of its known distribution.

Neither this species nor any population occurring in the area is at the limit of its known standard distribution, although records of the species occurring south of the Hunter River are scarce.

References:

Higgins, P.J. and Davies, S.J.J.F. (1996). Handbook of Australian, New Zealand and Antarctic Birds. Volume 3: Snipe to Pigeons, Oxford University Press, Melbourne.

NPWS Database (2000). Fauna Species Lists for Protected Areas in NSW at 'http://www.npws.nsw.gov.au/wildlife/species.htm'

Pizzey, G. & Knight, F. (1997). Field Guide to the Birds of Australia, Angus and Robertson, Sydney

Reader's Digest (1982). The Complete Book of Australian Birds. Reader's Digest Services Pty. Ltd., Sydney.

Recher, H.F., Date, E.M. and Ford, H.A. (1995). The Biology and Management of Rainforest Pigeons in N.S.W. Species Management Report No. 16. NSW National Parks and Wildlife Service.

22. *Ptilinopus superbus* Superb Fruit-Dove

The Superb Fruit-Dove is quite common north of Cardwell, Qld; becoming uncommon nomads or non-breeding migrants further south to the Hunter River, with rare sightings recorded south to Tasmania. The Superb Fruit-Dove lives mainly in Rainforest but will feed in adjacent Mangroves or Eucalypt forest, venturing into coastal habitats at various times of the year, particularly during winter. Many winter-migrating birds in NSW often perish by flying into windows in residential areas (A. Morris, NSW FOC, pers. comm.). It usually feeds on Figs or other fruit-bearing trees. Breeding season is from October to February. The nest is usually a platform about 10cm in diameter, composed of a few twigs; built in a small tree on a horizontal fork, usually about 3 metres from the ground, and situated in Open Forest at the edge of scrub. The species may have one of the shortest nesting periods of any Pigeon, being perhaps no more than seven days.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

No indication of this species' presence was noted on site during fieldwork. Limited foraging and roosting habitat for this species is present within the sheltered slopes in the southeastern portion of the site. Additional foraging habitat is also present within the areas of Open Forest. Given the high mobility of this Fruit-Dove and the occurrence of larger areas of similar habitat attributes within the locality including the adjacent Munmorah State Recreation Area, it is considered that the proposal is unlikely to significantly affect the life cycle of this species or place any viable local population of this species at risk of extinction.

b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No population of this species in the area has been identified under Schedule 1, Part 2 of the TSC Act 1995.

c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

No regionally significant area of known habitat is to be removed or modified as a result of the proposal, although the proposal may be view as contributing to the incremental decline of potential habitat within the region.

d) whether an area of known habitat is likely to be isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No areas of known habitat are likely to be isolated as a result of the proposal, particularly given the high mobility of the species.

e) whether critical habitat will be affected.

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act 1995.

f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

Records of this species in conservation reserves in the region exist in Brisbane Water, Sydney Harbour and Wyrrabalong National Parks (NPWS Database, 2000). As such, it appears that this species is not well represented in conservation reserves in the region. The adequacy of representation of the habitat of this species in the region is unable to be accurately ascertained, but areas of suitable habitat (further to the aforementioned reserves) are represented in the Watagan, Bouddi and Dharug National Parks and within Glenrock, Awabakal and Munmorah State Recreation Areas.

g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act have been listed in bold below followed by an assessment of the applicability of the threatened process in regards to the species, the site and the proposed development:

- **Clearing of Native Vegetation**: The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The clearing to accommodate the development may be viewed as contributing to the incremental decline of habitat in the local area, although it is recognised that this Key Threatening Process has already affected much of the site due to past colliery activities.. Accordingly, the development of this site is unlikely to be singularly responsible for the loss of any local population of this species provided that the recommendations regarding buffers and corridors are implemented.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands**: Alteration to the natural flow regime is recognised as a major factor contributing to the loss of biological diversity and ecological function of aquatic ecosystems. The impacts of this 'Key Threatening Process' include the reduction of habitat, increased flows causing permanent flooding, riparian zone degradation, increased habitat for invasive species and loss or disruption of ecological function. It is recognised that the study area borders a SEPP 14 wetland as well as containing a drainage line which drains towards Moonee Beach to the east. Accordingly, a number of recommendations have been made through the report to ensure that any potential impacts are minimised. In regards to this species, it is considered that the level of threat associated with this 'Key Threatening Process' is low in this instance.

- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera***: Small areas of *Chrysanthemoides monilifera* (Bitou Bush) were identified within the subject site and it may be stated that this 'Key Threatening Process' is already present on site. However, the level of this threat posed to this species would be negligible.

- **Predation by the European Red Fox *Vulpes vulpes*:** With the recording of at least one Fox during the survey period, it may stated that this 'Key Threatening Process' is already present on site and could pose a minimal threat to this species. However, the proposal is unlikely to result in increased numbers of this species within the locality.

- **Predation by the Feral Cat *Felis catus***: No Feral Cats were observed on site during the survey period, although they are believed likely to occur within the locality. However, the proposal is unlikely to result in an increase in the number of Feral Cats.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: The site showed evidence of a past fire, although it is difficult to ascertain the disruption and structural change, if any, past fires have caused the site. The proposal is unlikely to result in any increase in frequency of fire events across the study area.

- **Competition from feral honeybees *Apis mellifera*:** No honeybees were observed on the site and it is not considered a 'Key Threatening Process' for this species.

- **Bushrock Removal**: No bushrock was observed on the site and as the Superb Fruit-Dove does not rely on this habitat resource it is not considered a 'Key Threatening Process' for this species.

- **Predation by *Gambusia holbrooki* (Plague Minnow)**: No Plague Minnows were noted on site during the survey although they may occur within the locality. The proposed development is unlikely to result in the introduction of this species within the site nor is it likely to increase the numbers of this species within the locality. As Plague Minnows do not prey upon the Superb Fruit-Doves, this Key Threatening Process does not apply in this instance.

- **Importation of Red Fire Ants *Solenopsis invicta***: This species is not known to occur on site.

- **Infection of native plants by *Phytophthora cinnamomi***: This infection is not known to occur on site.

- **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations**: No endangered Psittacine species were seen on site.

- **Loss and/or degradation of site used for hill-topping by butterflies**: Given that this species is not a form of butterfly, this ' Key Threatening Process' is not applicable.

- **Anthropogenic Climate Change**: No species living on site are considered likely to be significantly affected by anthropogenic climate change.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** Numerous Rabbits were identified on site during the survey period and it may therefore be stated that this 'Key Threatening Process' is already present on site. The proposal is unlikely to increase the numbers of Rabbits within the locality.

- **Infection of frogs by amphibian chytrid causing disease chytridiomycosis:** No indication of amphibian chytrid was noted on site.

- **Invasion of native plant communities by exotic perennial grasses:** As a small number of exotic perennial grasses were identified on site during the survey, it may be stated that this Key Threatening Process is already present on site. The proposed development may result in the further introduction of perennial grasses to the locality, however it is unlikely to be at a scale which would significantly affect any local population of this threatened species

- **Removal of dead wood and dead trees:** As the site contains an Open Forest assemblage with fallen deris noted, the proposal will result in the removal of dead wood and dead trees. However, with consideration given to the recommended retention of Open Forest habitat within

a habitat corridor, it is unlikely to be at a scale which would significantly affect any local population of threatened species.

h) whether any threatened species, population or ecological community is at the limit of its known distribution.

Neither this species nor any population occurring in the area is at the limit of its known standard distribution.

References:

Higgins, P.J. and Davies, S.J.J.F. (1996). Handbook of Australian, New Zealand and Antarctic Birds. Volume 3: Snipe to Pigeons, Oxford University Press, Melbourne.

NPWS Database (2000). Fauna Species Lists for Protected Areas in NSW at 'http://www.npws.nsw.gov.au/wildlife/species.htm'

Pizzey, G. & Knight, F. (1997). Field Guide to the Birds of Australia, Angus and Robertson, Sydney

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Recher, H.F., Date, E.M. and Ford, H.A. (1995). The Biology and Management of Rainforest Pigeons in N.S.W. Species Management Report No. 16. NSW National Parks and Wildlife Service.

23. *Climacteris picumnus victoriae* Brown Tree-creeper

The Brown Treecreeper, *Climacteris picumnus* is distributed along the east coast of Australia from Spencer Gulf in South Australia, north to Townsville in Queensland and west to Channel Country. The eastern subspecies, *Climacteris picumnus victoriae,* is distributed through central NSW on the western side of the Great Dividing range and sparsely scattered to the east of the divide in drier areas such as the Cumberland Plain of Western Sydney, and in parts of the Hunter, Clarence, Richmond and Snowy River Valleys.

This species is a medium sized insectivorous bird that occupies Eucalypt woodlands, particularly open woodlands lacking a dense understorey, River Red Gums on watercourses and around lake shores. It is sedentary and nests in tree hollows within permanent territories. They forage on tree trunks and on the ground amongst leaf litter and on fallen logs for ants, beetles and larvae. Breeding occurs from May to December.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

No indication of this species' presence was noted on site during fieldwork. Potential foraging and nesting habitat for this species is present within the areas of Open Forest. The recommended habitat corridor within the western portion of the site would provide habitat resources for this species. Given the high mobility of the treecreeper and the occurrence of large areas of similar habitat attributes within the locality including the adjacent Munmorah State Recreation Area, it is considered that the proposal is unlikely to significantly affect the life cycle of this species or place any viable local population of this species at risk of extinction.

b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No population of this species in the area has been identified under Schedule 1, Part 2 of the TSC Act 1995.

c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

No regionally significant area of known habitat is to be removed or modified as a result of the proposal, although the proposal may be view as contributing to the incremental decline of potential habitat within the region.

d) whether an area of known habitat is likely to be isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No areas of known habitat are likely to be isolated as a result of the proposal, particularly given the high mobility of the species.

e) whether critical habitat will be affected.

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act 1995.

f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

The adequacy of representation of the habitat of this species in the region is difficult to ascertain, although it appears that any of a number of reserves containing forested areas (such as Yengo, Goulburn River, Wollemi, Blue Mountains, Dharug, Brisbane Water and Ku-ring-gai Chase National Parks) could provide some protected habitat for this species. As such, it could be tentatively stated that the habitat of this species is well represented in conservation reserves in this region, although the majority of potential habitat remains 'unprotected'.

g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act have been listed in bold below followed by an assessment of the applicability of the threatened process in regards to the species, the site and the proposed development:

- **Clearing of Native Vegetation**: The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The clearing to accommodate the development may be viewed as contributing to the incremental decline of habitat in the local area, although it is recognised that this Key Threatening Process has already affected much of the site due to past colliery activities.. Accordingly, the development of this site is unlikely to be singularly responsible for the loss of any local population of this species provided that the recommendations regarding buffers and corridors are implemented.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands**: Alteration to the natural flow regime is recognised as a major factor contributing to the loss of biological diversity and ecological function of aquatic ecosystems. The impacts of this 'Key Threatening Process' include the reduction of habitat, increased flows causing permanent flooding, riparian zone degradation, increased habitat for invasive species and loss or disruption of ecological function. It is recognised that the study area borders a SEPP 14 wetland as well as containing a drainage line which drains towards Moonee Beach to the east. Accordingly, a number of recommendations have been made through the report to ensure that any potential impacts are minimised. In regards to this species, it is considered that the level of threat associated with this 'Key Threatening Process' is low in this instance.

- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera***: Small areas of *Chrysanthemoides monilifera* (Bitou Bush) were identified within the subject site and it may be stated that this 'Key Threatening Process' is already present on site. However, the level of this threat posed to this species would be negligible.

- **Predation by the European Red Fox *Vulpes vulpes*:** With the recording of at least one Fox during the survey period, it may stated that this 'Key Threatening Process' is already present on site and could pose a minimal threat to this species. However, the proposal is unlikely to result in increased numbers of this species within the locality.

- **Predation by the Feral Cat *Felis catus***: No Feral Cats were observed on site during the survey period although they are believed likely to occur within the locality. However, the proposal is unlikely to result in an increase in the number of Feral Cats.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: The site showed evidence of a past fire, although it is difficult to ascertain the disruption and structural change, if any, past fires have caused the site. The proposal is unlikely to result in any increase in frequency of fire events across the study area.

- **Competition from feral honeybees *Apis mellifera*:** No honeybees were observed on the site and it is not considered a 'Key Threatening Process' for this species.

- **Bushrock Removal**: No bushrock was observed on the site and as this species does not rely on this habitat resource it is not considered a 'Key Threatening Process' for this species.

- **Predation by *Gambusia holbrooki* (Plague Minnow)**: No Plague Minnows were noted on site during the survey although they may occur within the locality. The proposed development is unlikely to result in the introduction of this species within the site nor is it likely to increase the numbers of this species within the locality.

- **Importation of Red Fire Ants *Solenopsis invicta***: This species is not known to occur on site.

- **Infection of native plants by *Phytophthora cinnamomi***: This infection is not known to occur on site.

- **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations**: No endangered Psittacine species were seen on site.

- **Loss and/or degradation of site used for hill-topping by butterflies**: Given that this species is not a form of butterfly, this ' Key Threatening Process' is not applicable.

- **Anthropogenic Climate Change**: No species living on site are considered likely to be significantly affected by anthropogenic climate change.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** Numerous Rabbits were identified on site during the survey period and it may therefore be stated that this 'Key Threatening Process' is already present on site. The proposal is unlikely to increase the numbers of Rabbits within the locality.

- **Infection of frogs by amphibian chytrid causing disease chytridiomycosis:** No indication of amphibian chytrid was noted on site.

- **Invasion of native plant communities by exotic perennial grasses:** As a small number of exotic perennial grasses were identified on site during the survey, it may be stated that this Key Threatening Process is already present on site. The proposed development may result in the further introduction of perennial grasses to the locality, however it is unlikely to be at a scale which would significantly affect any local population of this threatened species

- **Removal of dead wood and dead trees:** As the site contains an Open Forest assemblage with fallen deris noted, the proposal will result in the removal of dead wood and dead trees. However, with consideration given to the recommended retention of Open Forest habitat within a habitat corridor, it is unlikely to be at a scale which would significantly affect any local population of threatened species.

h) whether any threatened species, population or ecological community is at the limit of its known distribution.

Neither this species nor any population occurring in the area is at the limit of its known standard distribution, although records of this species east of the Great Dividing Range are uncommon.

Bibliography

Pizzey, G., & Knight, F., 1997. *Field Guide to the Birds of Australia*, Angus and Robertson, Sydney.

Slater, P., Slater, P., & Slater, R., 1997. *The Slater Field Guide to Australian Birds*. Lansdowne Publishing, Sydney.

24. *Stagonpleura guttata* Diamond Firetail

The Diamond Firetail is distributed through central and eastern NSW, extending north into southern and central Queensland and south to the Eyre Peninsula, South Australia. In NSW, this species occurs predominantly west of the Great Dividing Range, although populations are known from drier coastal areas such as the Cumberland Plain and the Hunter, Clarence, Richmond and Snowy River Valleys.

The Diamond Firetail is a brightly coloured grass finch that is usually seen foraging for seeds on the ground. This species occupies a variety of habitats with a grassy understorey including eucalypt woodlands, forests, Acacia scrubs and mallee. Firetails build a bulky, bottle shaped nests in trees and bushes and breeding occurs from August to January.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

No indication of this species' presence was noted on site during fieldwork. Potential foraging and nesting habitat for this species is present within the areas of Open Forest. The recommended habitat corridor within the western portion of the site would retain habitat resources for this species. Given the high mobility of this species and the occurrence of large areas of similar habitat attributes within the locality including the adjacent Munmorah State Recreation Area, it is considered that the proposal is unlikely to significantly affect the life cycle of this species or place any viable local population of this species at risk of extinction.

b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No population of this species in the area has been identified under Schedule 1, Part 2 of the TSC Act 1995.

c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

No regionally significant area of known habitat is to be removed or modified as a result of the proposal, although the proposal may be view as contributing to the incremental decline of potential habitat within the region.

d) whether an area of known habitat is likely to be isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No areas of known habitat are likely to be isolated as a result of the proposal, particularly given the high mobility of the species.

e) whether critical habitat will be affected.

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act 1995.

f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

The adequacy of representation of the habitat of this species in the region is difficult to ascertain, although it appears that any of a number of reserves containing forested areas (such as Yengo, Goulburn River, Wollemi, Blue Mountains, Dharug, Brisbane Water and Ku-ring-gai Chase National Parks) could provide some protected habitat for this species. As such, it could be tentatively stated that the habitat of this species is well represented in conservation reserves in this region, although the majority of potential habitat remains 'unprotected'.

g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act have been listed in bold below followed by an assessment of the applicability of the threatened process in regards to the species, the site and the proposed development:

- **Clearing of Native Vegetation**: The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The clearing to accommodate the development may be viewed as contributing to the incremental decline of habitat in the local area, although it is recognised that this Key Threatening Process has already affected much of the site due to past colliery activities.. Accordingly, the development of this site is unlikely to be singularly responsible for the loss of any local population of this species provided that the recommendations regarding buffers and corridors are implemented.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands**: Alteration to the natural flow regime is recognised as a major factor contributing to the loss of biological diversity and ecological function of aquatic ecosystems. The impacts of this 'Key Threatening Process' include the reduction of habitat, increased flows causing permanent flooding, riparian zone degradation, increased habitat for invasive species and loss or disruption of ecological function. It is recognised that the study area borders a SEPP 14 wetland as well as containing a drainage line which drains towards Moonee Beach to the east. Accordingly, a number of recommendations have been made through the report to ensure that any potential impacts are minimised. In regards to this species, it is considered that the level of threat associated with this 'Key Threatening Process' is low in this instance.

- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera***: Small areas of *Chrysanthemoides monilifera* (Bitou Bush) were identified within the subject site and it may be stated that this 'Key Threatening Process' is already present on site. However, the level of this threat posed to this species would be negligible.

- **Predation by the European Red Fox *Vulpes vulpes*:** With the recording of at least one Fox during the survey period, it may stated that this 'Key Threatening Process' is already present on site and could pose a minimal threat to this species. However, the proposal is unlikely to result in increased numbers of this species within the locality.

- **Predation by the Feral Cat *Felis catus***: No Feral Cats were observed on site during the survey period although they are believed likely to occur within the locality. However, the proposal is unlikely to result in an increase in the number of Feral Cats.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: The site showed evidence of a past fire, although it is difficult to ascertain the disruption and structural change, if any, past fires have caused the site. The proposal is unlikely to result in any increase in frequency of fire events across the study area.

- **Competition from feral honeybees *Apis mellifera*:** No honeybees were observed on the site and it is not considered a 'Key Threatening Process' for this species.

- **Bushrock Removal**: No bushrock was observed on the site and as the Diamond Firetail does not rely on this habitat resource it is not considered a 'Key Threatening Process' for this species.

- **Predation by *Gambusia holbrooki* (Plague Minnow)**: No Plague Minnows were noted on site during the survey although they may occur within the locality. The proposed development is unlikely to result in the introduction of this species within the site nor is it likely to increase the numbers of this species within the locality.

- **Importation of Red Fire Ants *Solenopsis invicta***: This species is not known to occur on site.

- **Infection of native plants by *Phytophthora cinnamomi***: This infection is not known to occur on site.

- **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations**: No endangered Psittacine species were seen on site.

- **Loss and/or degradation of site used for hill-topping by butterflies**: Given that this species is not a form of butterfly, this ' Key Threatening Process' is not applicable.

- **Anthropogenic Climate Change**: No species living on site are considered likely to be significantly affected by anthropogenic climate change.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** Numerous Rabbits were identified on site during the survey period and it may therefore be stated that this 'Key Threatening Process' is already present on site. The proposal is unlikely to increase the numbers of Rabbits within the locality.

- **Infection of frogs by amphibian chytrid causing disease chytridiomycosis:** No indication of amphibian chytrid was noted on site.

- **Invasion of native plant communities by exotic perennial grasses:** As a small number of exotic perennial grasses were identified on site during the survey, it may be stated that this Key Threatening Process is already present on site. The proposed development may result in the further introduction of perennial grasses to the locality, however it is unlikely to be at a scale which would significantly affect any local population of this threatened species

- **Removal of dead wood and dead trees:** As the site contains an Open Forest assemblage with fallen deris noted, the proposal will result in the removal of dead wood and dead trees. However, with consideration given to the recommended retention of Open Forest habitat within a habitat corridor, it is unlikely to be at a scale which would significantly affect any local population of threatened species.

h) whether any threatened species, population or ecological community is at the limit of its known distribution.

Neither this species nor any population occurring in the area is at the limit of its known standard distribution, although records of this species east of the Great Dividing Range are uncommon.

Bibliography:

NSW National Parks and Wildlife Service, 2001. *Threatened Species Conservation Act 1995 NSW Scientific Committee Final Determination, Diamond Firetail Stagonopleura guttata*.

Pizzey, G. & Knight, F. (1997). *Field Guide to the Birds of Australia*, Angus and Robertson, Sydney.

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25. *Pandion haliaetus* Osprey

The Osprey is a large fishing raptor with a distinct brown band passing through the eye. The Osprey is a very cosmopolitan species, found in most continents across the Earth. A single subspecies, *P. h. cristatus*, breeds in Australia and New Guinea. Southern and inland records show that the Osprey in Australia is able to travel long distances and have been recorded as far inland as the Finke River in Central Australia. It can be found in open and swamp forest adjacent to the coast or estuaries and fishes in brackish or salt water, seldomly in fresh water bodies. It feeds on live fish, usually 20-40 cm in length. Plunging into the water feet first, from heights up to 50 metres above the water, it will submerge itself to at least 1m when fishing. The talons grasp the prey with a grip that cannot be released, so large prey is generally avoided. The fish is carried away from the water angled head first to reduce drag on the return flight.

Individuals are sometimes seen inland along the larger northern rivers and the Murray River though breeding is usually confined to the coast and islands. It builds a conspicuous stick nest on a dead tree or branch, which it uses for breeding between April and November. Nesting sites are also found on man-made structures such as pylons or tall telegraph poles. The nest is added to by breeding pairs each year until they reach a massive size. In some parts of its range overseas nests are as little as 10 m apart but in Australia most are separated by at least 1 km. A recent record of this species breeding exists from a nest with young found at Cundletown, south of Taree (Hunter Bird Observers Club, 2001).

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

No indication of the presence of this species or it's conspicuous nests was noted on site during fieldwork. Potential roosting/nesting habitat for this species is present within the western portion of the site, with the neighbouring ocean providing a potential hunting resource. Potential roosting/nesting habitat will be retained within the recommended habitat corridor and the drainage line vegetation. Given the high mobility of this species and the occurrence of large areas of similar habitat attributes within the locality including the adjacent Munmorah State Recreation Area, it is considered that the proposal is unlikely to significantly affect the life cycle of this species or place any viable local population of this species at risk of extinction.

b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No population of this species in the area has been identified under Schedule 1, Part 2 of the TSC Act 1995.

c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

No regionally significant area of known habitat is to be removed or modified as a result of the proposal, although the proposal may be view as contributing to the incremental decline of potential habitat within the region.

d) whether an area of known habitat is likely to be isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No areas of known habitat are likely to be isolated as a result of the proposal, particularly given the high mobility of the species.

e) whether critical habitat will be affected.

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act 1995.

f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

This species has been recorded in the region from Kooragang Nature Reserve (Roderick, pers. comm.) and from Brisbane Water, Botany Bay, Ku-ring-gai Chase and Royal National Parks and Munmorah State Recreation Area (NPWS Database, 2000). As such, it appears that this species is moderately well represented in conservation reserves in the region. Whether or not the habitat of this species is well represented within the region is abstruse and difficult to determine, although it appears that any of a number of coastal reserves could provide some protected hunting habitat for this species. The level of protection of known nesting sites (as per Clancy, 1991) indicates that no known nesting sites occur in conservation reserves in the region.

g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act have been listed in bold below followed by an assessment of the applicability of the threatened process in regards to the species, the site and the proposed development:

- **Clearing of Native Vegetation**: The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The clearing to accommodate the development may be viewed as contributing to the incremental decline of habitat in the local area, although it is recognised that this Key Threatening Process has already affected much of the site due to past colliery activities.. Accordingly, the development of this site is unlikely to be singularly responsible for the loss of any local population of this species provided that the recommendations regarding buffers and corridors are implemented.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands**: Alteration to the natural flow regime is recognised as a major factor contributing to the loss of biological diversity and ecological function of aquatic ecosystems. The impacts of this 'Key Threatening Process' include the reduction of habitat, increased flows causing permanent flooding, riparian zone degradation, increased habitat for invasive species and loss or disruption of ecological function. It is recognised that the study area borders a SEPP 14 wetland as well as containing a drainage line which drains towards Moonee Beach to the east. Accordingly, a number of recommendations have been made through the report to ensure that any potential impacts are minimised. In regards to this species, it is considered that the level of threat associated with this 'Key Threatening Process' is low in this instance.

- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera***: Small areas of *Chrysanthemoides monilifera* (Bitou Bush) were identified within the subject site and it may be

stated that this 'Key Threatening Process' is already present on site. However, the level of this threat posed to the Osprey would be negligible.

- **Predation by the European Red Fox *Vulpes vulpes*:** With the recording of at least one Fox during the survey period, it may stated that this 'Key Threatening Process' is already present on site and could pose a minimal threat to this species. However, the proposal is unlikely to result in increased numbers of this species within the locality.

- **Predation by the Feral Cat *Felis catus***: No Feral Cats were observed on site during the survey period although they are believed likely to occur within the locality. However, the proposal is unlikely to result in an increase in the number of Feral Cats.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: The site showed evidence of a past fire, although it is difficult to ascertain the disruption and structural change, if any, past fires have caused the site. The proposal is unlikely to result in any increase in frequency of fire events across the study area.

- **Competition from feral honeybees *Apis mellifera*:** No honey bees were observed on the site and as the Osprey does not rely on either tree hollows or nectar resources it is not considered a 'Key Threatening Process' for this species.

- **Bushrock Removal**: No bushrock was observed on the site and as the Osprey does not rely on this habitat resource it is not considered a 'Key Threatening Process' for this species.

- **Predation by *Gambusia holbrooki* (Plague Minnow)**: No Plague Minnows were noted on site during the survey although they may occur within the locality. The proposed development is unlikely to result in the introduction of this species within the site nor is it likely to increase the numbers of this species within the locality. As Plague Minnows do not prey upon Ospreys, this Key Threatening Process does not apply in this instance.

- **Importation of Red Fire Ants *Solenopsis invicta***: This species is not known to occur on site.

- **Infection of native plants by *Phytophthora cinnamomi***: This infection is not known to occur on site.

- **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations**: No endangered Psittacine species were seen on site.

- **Loss and/or degradation of site used for hill-topping by butterflies**: Given the fact that Ospreys are not a form of butterfly this ' Key Threatening Process' is not applicable.

- **Anthropogenic Climate Change**: No species living on site are considered likely to be significantly affected by anthropogenic climate change.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** Numerous Rabbits were identified on site during the survey period and it may therefore be stated that this 'Key Threatening Process' is already present on site. The proposal is unlikely to increase the numbers of Rabbits within the locality.

- **Infection of frogs by amphibian chytrid causing disease chytridiomycosis:** No indication of amphibian chytrid was noted on site.

- **Invasion of native plant communities by exotic perennial grasses:** As a small number of exotic perennial grasses were identified on site during the survey, it may be stated that this Key Threatening Process is already present on site. The proposed development may result in the further introduction of perennial grasses to the locality, however it is unlikely to be at a scale which would significantly affect any local population of this threatened species

- **Removal of dead wood and dead trees:** As the site contains an Open Forest assemblage with fallen deris noted, the proposal will result in the removal of dead wood and dead trees. However, with consideration given to the recommended retention of Open Forest habitat within a habitat corridor, it is unlikely to be at a scale which would significantly affect any local population of threatened species.

h) whether any threatened species, population or ecological community is at the limit of its known distribution.

Neither this species nor any population occurring in the area is at the limit of its known standard distribution.

References:

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26. *Ninox strenua* Powerful Owl

The Powerful Owl is found in the coastal areas and adjacent ranges of eastern Australia from South Australia to around Rockhampton in Queensland, generally within 200km from the coast. Within NSW, Powerful Owls are distributed throughout the length of the Great Dividing Range, which is their stronghold, and extend from the coast to the western slopes where they occur in much lower numbers. The Powerful Owl inhabits a wide range of vegetation types from wet Eucalypt forests with a Rainforest understorey to Dry Open Forests and Woodlands. The species has been recorded utilising disturbed habitats such as exotic pine plantations and large trees in parks and gardens. A resident pair of Powerful Owls have been recorded in recent years from Blackbutt Reserve, near Newcastle, NSW. It appears that this pair successfully reared two young during the 2001 breeding season (HBOC, pers. comm.).

The Powerful Owl is the largest predator of nocturnal forest-dwelling animals in Australian forests. Major prey species in NSW forests are the Greater Glider, Common Ringtail Possum, Sugar Glider, Grey-headed Fruit Bat, and several species of diurnal birds, including the Pied Currawong, Magpie and Lorikeets. It rests during the day amid thick foliage, often grasping food-remains. The male of the species employs a slow, far-carrying 'whoo-hoo' call, more deliberate than the females call, which is higher pitched with the second note slightly higher than the first.

Powerful Owls nest in a slight depression in the wood-mould on the base of a cavity in a large old tree, sometimes in excess of 25 metres above the ground. These trees are usually found growing on a hillside in heavy forest and may be utilised intermittently for several years. The breeding season of the Powerful Owl is highly synchronised, being strictly winter breeders. One or two young are produced, although some pairs do not breed in every year. Pairs appear to mate for life and occupy exclusive territories which can be greater than 800ha in size (Kavanagh, 2000).

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

No indication of this species' presence was noted on site during fieldwork. Potential roosting/nesting habitat for this species is present within the western portion of the site, with hunting resources present across much of the site. The modification of the habitat present on site, whilst contributing to incremental decline of habitat in the locality, is unlikely to significantly affect any local populations, particularly given the high mobility of this species and recommended habitat corridor. Large areas of similar habitat attributes are common within the region including the adjacent Munmorah State Recreation Area. Accordingly, it is considered that the proposal is unlikely to significantly affect the life cycle of this species or place any viable local population of this species at risk of extinction.

b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No population of this species in the area has been identified under Schedule 1, Part 2 of the TSC Act 1995.

c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

No regionally significant area of known habitat is to be removed or modified as a result of the proposal, although the proposal may be view as contributing to the incremental decline of potential habitat within the region.

d) whether an area of known habitat is likely to be isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No areas of known habitat are likely to be isolated as a result of the proposal, particularly given the high mobility of the species.

e) whether critical habitat will be affected.

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act 1995.

f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

Records of this species in the region are known from many conservation reserve areas. These include the Gardens of Stone National Park (Roderick pers. comm.) as well as Wollemi, Botany Bay, Brisbane Water, Marramarra, Nattai, Blue Mountains, Cattai, Heathcote, Goulburn River, Kanangra Boyd, Ku-ring-gai Chase and Yengo National Parks (NPWS Database, 2000). A resident breeding pair of Powerful Owls has established in Blackbutt Council Reserve, in the suburbs of Newcastle (HBOC, pers. comm.; in press). As such, it can be determined that this species is well represented in conservation reserves in the region. Whether or not the habitat of this species is well represented within the region is abstruse and difficult to determine, although it appears that any of a number of reserves containing forested areas could provide some protected hunting and some potential nesting habitat for this species. As such, it could be tentatively stated that the habitat of this species is well represented in conservation reserves in this region, although the majority of potential habitat remains 'unprotected'.

g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act have been listed in bold below followed by an assessment of the applicability of the threatened process in regards to the species, the site and the proposed development:

- **Clearing of Native Vegetation**: The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The clearing to accommodate the development may be viewed as contributing to the incremental decline of habitat in the local area, although it is recognised that this Key Threatening Process has already affected much of the site due to past colliery activities.. Accordingly, the development of this site is unlikely to be singularly responsible for the loss of any local population of this species provided that the recommendations regarding buffers and corridors are implemented.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and**

wetlands: Alteration to the natural flow regime is recognised as a major factor contributing to the loss of biological diversity and ecological function of aquatic ecosystems. The impacts of this 'Key Threatening Process' include the reduction of habitat, increased flows causing permanent flooding, riparian zone degradation, increased habitat for invasive species and loss or disruption of ecological function. It is recognised that the study area borders a SEPP 14 wetland as well as containing a drainage line which drains towards Moonee Beach to the east. Accordingly, a number of recommendations have been made through the report to ensure that any potential impacts are minimised. In regards to this species, it is considered that the level of threat associated with this 'Key Threatening Process' is low in this instance.

- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera***: Small areas of *Chrysanthemoides monilifera* (Bitou Bush) were identified within the subject site and it may be stated that this 'Key Threatening Process' is already present on site. However, the level of this threat posed to this species would be negligible.

- **Predation by the European Red Fox *Vulpes vulpes*:** With the recording of at least one Fox during the survey period, it may stated that this 'Key Threatening Process' is already present on site and could pose a minimal threat to this species. However, the proposal is unlikely to result in increased numbers of this species within the locality.

- **Predation by the Feral Cat *Felis catus***: No Feral Cats were observed on site during the survey period although they are believed likely to occur within the locality. However, the proposal is unlikely to result in an increase in the number of Feral Cats.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: The site showed evidence of a past fire, although it is difficult to ascertain the disruption and structural change, if any, past fires have caused the site. The proposal is unlikely to result in any increase in frequency of fire events across the study area.

- **Competition from feral honeybees *Apis mellifera*:** No honey bees were observed on the site and it is not considered a 'Key Threatening Process' for this species.

- **Bushrock Removal**: No bushrock was observed on the site and as this species does not rely on this habitat resource it is not considered a 'Key Threatening Process' for this species.

- **Predation by *Gambusia holbrooki* (Plague Minnow)**: No Plague Minnows were noted on site during the survey although they may occur within the locality. The proposed development is unlikely to result in the introduction of this species within the site nor is it likely to increase the numbers of this species within the locality. As Plague Minnows do not prey upon Powerful Owls, this Key Threatening Species does not apply in this instance.

- **Importation of Red Fire Ants *Solenopsis invicta***: This species is not known to occur on site.

- **Infection of native plants by *Phytophthora cinnamomi***: This infection is not known to occur on site.

- **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations**: No endangered Psittacine species were seen on site.

- **Loss and/or degradation of site used for hill-topping by butterflies**: Given the fact that the Powerful Owl is not a species of butterfly, this ' Key Threatening Process' is not applicable.

- **Anthropogenic Climate Change**: No species living on site are considered likely to be significantly affected by anthropogenic climate change.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** Numerous Rabbits were identified on site during the survey period and it may therefore be stated that this 'Key Threatening Process' is already present on site. The proposal is unlikely to increase the numbers of Rabbits within the locality.

- **Infection of frogs by amphibian chytrid causing disease chytridiomycosis:** No indication of amphibian chytrid was noted on site.

- **Invasion of native plant communities by exotic perennial grasses:** As a small number of exotic perennial grasses were identified on site during the survey, it may be stated that this Key Threatening Process is already present on site. The proposed development may result in the further introduction of perennial grasses to the locality, however it is unlikely to be at a scale which would significantly affect any local population of this threatened species

- **Removal of dead wood and dead trees:** As the site contains an Open Forest assemblage with fallen deris noted, the proposal will result in the removal of dead wood and dead trees. However, with consideration given to the recommended retention of Open Forest habitat within a habitat corridor, it is unlikely to be at a scale which would significantly affect any local population of threatened species.

h) whether any threatened species, population or ecological community is at the limit of its known distribution.

Neither this species nor any population occurring in the area is at the limit of its known standard distribution.

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Davey, S.M. (1993). Notes on the Habitat of Four Australian Owl Species, In Olsen, P.D. (ed) (1993). *Australian Raptor Studies*, Australasian Raptor Association, RAOU, Melbourne, pp 126-42.
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Kavanagh, R.P. (1993). *Project 149: Ecology and Management of Large Forest Owls*, Unpublished Progress Report to World Wide Fund for Nature, Sydney.

Kavanagh, R.P. (2000). *Conservation and Management of Large Forest Owls in South-eastern New South Wales*. Proceedings of Owls 2000: Third International Conference on the Biology, Conservation and Cultural Significance of Owls.

Kavanagh, R.P. and Stanton, M. A. (2000). *Response to Habitat Fragmentation by the Powerful Owl, Sooty Owl, Masked Owl and other Nocturnal Fauna in South-eastern New South Wales*. Proceedings of Owls 2000: Third International Conference on the Biology, Conservation and Cultural Significance of Owls.

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27. *Dasyurus maculatus* Tiger Quoll

The Tiger Quoll is widespread in eastern Australia, with its distribution being spread between two subspecies. The nominate subspecies, *D. m. maculatus* occurs from southern QLD to Tasmania whereas *D. m. gracilus* occurs in northern QLD. This species is one of the largest carnivorous marsupials. It is an agile climber but spends most of its time on the floor of sclerophyll forests, rainforests and coastal woodlands. Although largely nocturnal, it may forage and bask in the sun during the day. Nests are made in rock caves and hollow logs or trees, and basking sites are usually found nearby. It is an opportunistic hunter of a variety of prey, including birds and their young, rats and other small terrestrial and arboreal mammals, gliders, small Macropods, reptiles and Arthropods. It also scavenges on the carcasses of domestic stock. Sexual maturity is attained in one year, with mating occurring from April to July. Usually, there are 5 young to a litter and young are fully independent at 18 weeks.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

No indication of this species' presence was noted on site during fieldwork. Potential hunting and shelter habitat for this species is present within the areas of Open Forest where fallen timber and hollow logs were noted on the forest floor. The recommended habitat corridor within the western portion of the site would retain habitat resources for this species as well as providing a connection to similar vegetation to the north and south. Given the occurrence of large areas of similar habitat attributes adjacent to the site and within the region, it is considered that the proposal is unlikely to significantly affect the life cycle of this species or place any viable local population of this species at risk of extinction.

b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No population of this species on site has been identified under Schedule 1, Part 2 of the TSC Act 1995.

c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

No regionally significant area of known habitat is to be removed or modified as a result of the proposal, although the proposal may be view as contributing to the incremental decline of potential habitat within the region.

d) whether an area of known habitat is likely to be isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No areas of known habitat are likely to be isolated as a result of the proposal provided that the recommendations given regarding corridors is implemented.

e) whether critical habitat will be affected.

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act 1995.

f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

Records of this species in the region are known from the Wollemi, Blue Mountains, Dharug, Brisbane Water and Ku-ring-gai Chase National Parks (NPWS Database, 2000). As such, it appears that this species is moderately well represented in conservation reserves in the region. The adequacy of representation of the habitat of this species in the region is difficult to ascertain, although it appears that any of a number of reserves containing forested areas could provide some protected habitat for this species. As such, it could be tentatively stated that the habitat of this species is well represented in conservation reserves in this region, although the majority of potential habitat remains 'unprotected'.

g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act have been listed in bold below followed by an assessment of the applicability of the threatened process in regards to the species, the site and the proposed development:

- **Clearing of Native Vegetation**: The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The clearing to accommodate the development may be viewed as contributing to the incremental decline of habitat in the local area, although it is recognised that this Key Threatening Process has already affected much of the site due to past colliery activities.. Accordingly, the development of this site is unlikely to be singularly responsible for the loss of any local population of this species provided that the recommendations regarding buffers and corridors are implemented.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands**: Alteration to the natural flow regime is recognised as a major factor contributing to the loss of biological diversity and ecological function of aquatic ecosystems. The impacts of this 'Key Threatening Process' include the reduction of habitat, increased flows causing permanent flooding, riparian zone degradation, increased habitat for invasive species and loss or disruption of ecological function. It is recognised that the study area borders a SEPP 14 wetland as well as containing a drainage line which drains towards Moonee Beach to the east. Accordingly, a number of recommendations have been made through the report to ensure that any potential impacts are minimised. In regards to this species, it is considered that the level of threat associated with this 'Key Threatening Process' is low in this instance.

- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera***: Small areas of *Chrysanthemoides monilifera* (Bitou Bush) were identified within the subject site and it may be stated that this 'Key Threatening Process' is already present on site. However, the level of this threat posed to this species would be negligible.

- **Predation by the European Red Fox *Vulpes vulpes*:** With the recording of at least one Fox during the survey period, it may stated that this 'Key Threatening Process' is already present on site and could pose a minimal threat to this species. However, the proposal is unlikely to result in increased numbers of this species within the locality.

- **Predation by the Feral Cat *Felis catus***: No Feral Cats were observed on site during the survey period, although they are believed likely to occur within the locality. However, the proposal is unlikely to result in an increase in the number of Feral Cats.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: The site showed evidence of a past fire, although it is difficult to ascertain the disruption and structural change, if any, past fires have caused the site. The proposal is unlikely to result in any increase in frequency of fire events across the study area.

- **Competition from feral honeybees *Apis mellifera*:** No honey bees were observed on the site and as the Tiger Quoll does not rely on either tree hollows or nectar resources it is not considered a 'Key Threatening Process' for this species.

- **Bushrock Removal**: No bushrock was observed on the site and as the Tiger Quoll does not rely on this habitat resource it is not considered a 'Key Threatening Process' for this species.

- **Predation by *Gambusia holbrooki* (Plague Minnow)**: No Plague Minnows were noted on site during the survey although they may occur within the locality. The proposed development is unlikely to result in the introduction of this species within the site nor is it likely to increase the numbers of this species within the locality. As Plague Minnows do not prey upon Tiger Quolls, this Key Threatening Process doe not apply in this instance.

- **Importation of Red Fire Ants *Solenopsis invicta***: This species is not known to occur on site.

- **Infection of native plants by *Phytophthora cinnamomi***: This infection is not known to occur on site.

- **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations**: No endangered Psittacine species were seen on site.

- **Loss and/or degradation of site used for hill-topping by butterflies**: Given that this species is not a form of butterfly, this ' Key Threatening Process' is not applicable.

- **Anthropogenic Climate Change**: No species living on site are considered likely to be significantly affected by anthropogenic climate change.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** Numerous Rabbits were identified on site during the survey period and it may therefore be stated that this 'Key Threatening Process' is already present on site. The proposal is unlikely to increase the numbers of Rabbits within the locality.

- **Infection of frogs by amphibian chytrid causing disease chytridiomycosis:** No indication of amphibian chytrid was noted on site.

- **Invasion of native plant communities by exotic perennial grasses:** As a small number of exotic perennial grasses were identified on site during the survey, it may be stated that this Key Threatening Process is already present on site. The proposed development may result in the further introduction of perennial grasses to the locality, however it is unlikely to be at a scale which would significantly affect any local population of this threatened species

- **Removal of dead wood and dead trees:** As the site contains an Open Forest assemblage with fallen deris noted, the proposal will result in the removal of dead wood and dead trees.

However, with consideration given to the recommended retention of Open Forest habitat within a habitat corridor, it is unlikely to be at a scale which would significantly affect any local population of threatened species.

h) whether any threatened species, population or ecological community is at the limit of its known distribution.

Neither this species nor any population occurring in the area is at the limit of its known standard distribution.

Bibliography:

Edgar, R. and Belcher, C. (1995). Spotted-tailed Quoll (*Dasyurus maculatus*) in Strahan, R. (ed) *The Mammals of Australia*, pp: 67-68. Strahan, R. (Ed). Reed Books, Australia.

NPWS Database (2000). *Fauna Species List for Protected Areas in NSW* at http://www.npws.gov.au/wildlife/species.htm

28. *Planigale maculata* Common Planigale

The Common Planigale is found throughout eastern Australia. In NSW it is found along the coastal strip, occupying a variety of habitats ranging from rainforest, wet and dry sclerophyll forests to grasslands, marshlands and rocky areas. In these habitats it shelters under logs and rocks and any available burrows. Formerly a part of the Antechinus complex, the Planigales differ mainly in that they possess a backward-facing pouch, typical of a burrowing species. The Common Planigale is the largest of the Planigales, though still small in terms of the prey that it feeds on. It is a ferocious predator of small insects, often tackling prey of its own size. In NSW, the young may be born from late spring to summer and presumably the males die after reproduction, typical of small Dasyurids.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

No indication of this species' presence was noted on site during fieldwork. Potential hunting and shelter habitat for this species is present within the areas of Open Forest where fallen timber and hollow logs were noted on the forest floor. The recommended habitat corridor within the western portion of the site would retain habitat resources for this species. Given the occurrence of large areas of similar habitat attributes adjacent to the site and within the adjacent Munmorah State Recreation Area where this species is known to occur, it is considered that the proposal is unlikely to significantly affect the life cycle of this species or place any viable local population of this species at risk of extinction.

b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No population of this species on site has been identified under Schedule 1, Part 2 of the TSC Act 1995.

c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

No regionally significant area of known habitat is to be removed or modified as a result of the proposal, although the proposal may be view as contributing to the incremental decline of potential habitat within the region.

d) whether an area of known habitat is likely to be isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No areas of known habitat are likely to be isolated as a result of the proposal provided that the recommendations given regarding corridors is implemented.

e) whether critical habitat will be affected.

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act 1995.

f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

Records of this species in the region exist only from Munmorah State Recreation Area (NPWS Database, 2000). As such, it appears that this species is not adequately represented in conservation reserves in the region. The adequacy of representation of the habitat of this species in the region is difficult to ascertain, although it appears that any of a number of reserves containing forested areas could provide some protected habitat for this species. As such, it could be tentatively stated that the habitat of this species is well represented in conservation reserves in this region, although the majority of potential habitat remains 'unprotected'.

g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act have been listed in bold below followed by an assessment of the applicability of the threatened process in regards to the species, the site and the proposed development:

- **Clearing of Native Vegetation**: The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The clearing to accommodate the development may be viewed as contributing to the incremental decline of habitat in the local area, although it is recognised that this Key Threatening Process has already affected much of the site due to past colliery activities.. Accordingly, the development of this site is unlikely to be singularly responsible for the loss of any local population of this species provided that the recommendations regarding buffers and corridors are implemented.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands**: Alteration to the natural flow regime is recognised as a major factor contributing to the loss of biological diversity and ecological function of aquatic ecosystems. The impacts of this 'Key Threatening Process' include the reduction of habitat, increased flows causing permanent flooding, riparian zone degradation, increased habitat for invasive species and loss or disruption of ecological function. It is recognised that the study area borders a SEPP 14 wetland as well as containing a drainage line which drains towards Moonee Beach to the east. Accordingly, a number of recommendations have been made through the report to ensure that any potential impacts are minimised. In regards to this species, it is considered that the level of threat associated with this 'Key Threatening Process' is low in this instance.

- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera***: Small areas of *Chrysanthemoides monilifera* (Bitou Bush) were identified within the subject site and it may be stated that this 'Key Threatening Process' is already present on site. However, the level of this threat posed to this species would be negligible.

- **Predation by the European Red Fox *Vulpes vulpes*:** With the recording of at least one Fox during the survey period, it may stated that this 'Key Threatening Process' is already present on site and could pose a minimal threat to this species. However, the proposal is unlikely to result in increased numbers of this species within the locality.

- **Predation by the Feral Cat *Felis catus***: No Feral Cats were observed on site during the survey period although they are believed likely to occur within the locality. However, the proposal is unlikely to result in an increase in the number of Feral Cats.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: The site showed evidence of a past fire, although it is difficult to ascertain the disruption and structural change, if any, past fires have caused the site. The proposal is unlikely to result in any increase in frequency of fire events across the study area.

- **Competition from feral honeybees *Apis mellifera*:** No honey bees were observed on the site and as the Planigale does not rely on either tree hollows or nectar resources it is not considered a 'Key Threatening Process' for this species.

- **Bushrock Removal**: No bushrock was observed on the site and as the Common Planigale does not rely on this habitat resource it is not considered a 'Key Threatening Process' for this species.

- **Predation by *Gambusia holbrooki* (Plague Minnow)**: No Plague Minnows were noted on site during the survey although they may occur within the locality. The proposed development is unlikely to result in the introduction of this species within the site nor is it likely to increase the numbers of this species within the locality.

- **Importation of Red Fire Ants *Solenopsis invicta***: This species is not known to occur on site.

- **Infection of native plants by *Phytophthora cinnamomi***: This infection is not known to occur on site.

- **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations**: No endangered Psittacine species were seen on site.

- **Loss and/or degradation of site used for hill-topping by butterflies**: Given the fact that this species is not a form of butterfly, this ' Key Threatening Process' is not applicable.

- **Anthropogenic Climate Change**: No species living on site are considered likely to be significantly affected by anthropogenic climate change.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** Numerous Rabbits were identified on site during the survey period and it may therefore be stated that this 'Key Threatening Process' is already present on site. The proposal is unlikely to increase the numbers of Rabbits within the locality.

- **Infection of frogs by amphibian chytrid causing disease chytridiomycosis:** No indication of amphibian chytrid was noted on site.

- **Invasion of native plant communities by exotic perennial grasses:** As a small number of exotic perennial grasses were identified on site during the survey, it may be stated that this Key Threatening Process is already present on site. The proposed development may result in the further introduction of perennial grasses to the locality, however it is unlikely to be at a scale which would significantly affect any local population of this threatened species

- **Removal of dead wood and dead trees:** As the site contains an Open Forest assemblage with fallen deris noted, the proposal will result in the removal of dead wood and dead trees.

However, with consideration given to the recommended retention of Open Forest habitat within a habitat corridor, it is unlikely to be at a scale which would significantly affect any local population of threatened species.

h) whether any threatened species, population or ecological community is at the limit of its known distribution.

Neither this species nor any population occurring in the local area is at the limit of its known standard distribution.

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Cronin, L. (1991). *Key Guide to Australian Mammals*. Imago Productions, Singapore

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29. *Petaurus norfolcensis* Squirrel Glider

The Squirrel Glider is distributed throughout the dry sclerophyll forests and woodlands of eastern Australia from South Australia to Cairns. In Victoria its range was considered to be narrow where it inhabited remnant woodlands and open forests which have mature or mixed-age stands of more than one Eucalypt species, or riparian forests of *Eucalyptus camaldulensis* (River Red Gum). In NSW, the Squirrel Gliders' range has recently been extended to coastal habitats, including Swamp Mahogany Swamp forests on the Central Coast. In Victoria the Squirrel Glider occurs predominantly in dry woodland west of the Great Dividing Range. The full range of habitats in which it is found in NSW have not been fully reported in any literature.

The Squirrel Glider eats a high proportion of invertebrates from the foliage of Eucalypts and *Acacias* supplemented by plant exudates in the form of Eucalypt and *Melaleuca* sap and *Acacia* gum. Insects (Coleoptera) and caterpillars (larval Lepidoptera) were found to be very important in its diet. The plant exudates, honeydew, pollen and nectar were considered to be more important in winter and spring. It is also likely that birds eggs are included in its diet. It is thought that a mixed stand of gum and high nectar producing Eucalypts, (including some which flower in winter) were important to support the Squirrel Glider. In coastal NSW forests a significant component may be mature *Acacia irrorata*, *Melaleuca styphelioides* or *M. nodosa*, providing late winter/early spring carbohydrates.

The breeding biology of the Squirrel Glider is probably similar to that of the Sugar Glider. It nests in a leaf-lined hollow in a tree or stump. Interbreeding between the Squirrel Glider and the Sugar Glider has been evidenced in captivity (Fleay, 1947), and is strongly suspected in the wild. Resultant offspring are noted as having intermediate characteristics between those of the two parent animals.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

No indication of this species' presence was noted on site during fieldwork, however it is recognised that potential foraging and nesting habitat for this species is present across the entire site. The recommended habitat corridor within the western portion of the site would retain habitat resources for this species. With consideration given to the occurrence of large areas of similar habitat attributes adjacent to the site and within the adjacent Munmorah State Recreation Area where this species is known to occur, it is considered that the proposal is unlikely to significantly affect the life cycle of this species or place any viable local population of this species at risk of extinction.

b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No population of this species on site has been identified under Schedule 1, Part 2 of the TSC Act 1995.

c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

No regionally significant area of known habitat is to be removed or modified as a result of the

proposal, although the proposal may be view as contributing to the incremental decline of potential habitat within the region.

d) whether an area of known habitat is likely to be isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No areas of known habitat are likely to be isolated as a result of the proposal provided that the recommendations given regarding corridors is implemented.

e) whether critical habitat will be affected.

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act 1995.

f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

Records of this species in the region exist from the Wollemi, Blue Mountains, Brisbane Water, Ku-ring-gai Chase, Dharug National Parks as well as Munmorah State Recreation Area (NPWS Database, 2000). As such, it appears that this species is moderately well represented in conservation reserves in the region. The adequacy of representation of the habitat of this species in the region is difficult to ascertain, although it appears that any of a number of reserves containing forested areas could provide some protected habitat for this species. As such, it could be tentatively stated that the habitat of this species is well represented in conservation reserves in this region, although the majority of potential habitat remains 'unprotected'.

g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act have been listed in bold below followed by an assessment of the applicability of the threatened process in regards to the species, the site and the proposed development:

- **Clearing of Native Vegetation**: The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The clearing to accommodate the development may be viewed as contributing to the incremental decline of habitat in the local area, although it is recognised that this Key Threatening Process has already affected much of the site due to past colliery activities.. Accordingly, the development of this site is unlikely to be singularly responsible for the loss of any local population of this species provided that the recommendations regarding buffers and corridors are implemented.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands**: Alteration to the natural flow regime is recognised as a major factor contributing to the loss of biological diversity and ecological function of aquatic ecosystems. The impacts of this 'Key Threatening Process' include the reduction of habitat, increased flows causing permanent flooding, riparian zone degradation, increased habitat for invasive species and loss or disruption of ecological function. It is recognised that the study area borders a SEPP 14 wetland as well as containing a drainage line which drains towards Moonee Beach to the east. Accordingly, a number of recommendations have been made through the report to ensure that any potential impacts are minimised. In regards to this species, it is considered that the level of threat associated with this 'Key Threatening Process' is low in this instance.

- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera***: Small areas of *Chrysanthemoides monilifera* (Bitou Bush) were identified within the subject site and it may be stated that this 'Key Threatening Process' is already present on site. However, the level of this threat posed to this species would be negligible.

- **Predation by the European Red Fox *Vulpes vulpes*:** With the recording of at least one Fox during the survey period, it may stated that this 'Key Threatening Process' is already present on site and could pose a minimal threat to this species. However, the proposal is unlikely to result in increased numbers of this species within the locality.

- **Predation by the Feral Cat *Felis catus***: No Feral Cats were observed on site during the survey period although they are believed likely to occur within the locality. However, the proposal is unlikely to result in an increase in the number of Feral Cats.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: The site showed evidence of a past fire, although it is difficult to ascertain the disruption and structural change, if any, past fires have caused the site. The proposal is unlikely to result in any increase in frequency of fire events across the study area.

- **Competition from feral honeybees *Apis mellifera*:** No honey bees were observed on the site and accordingly is not considered a 'Key Threatening Process' in this instance.

- **Bushrock Removal**: No bushrock was observed on the site and as this species does not rely on this habitat resource it is not considered a 'Key Threatening Process' for this species. Although it is recognised that this is an applicable KTP to this species.

- **Predation by *Gambusia holbrooki* (Plague Minnow)**: No Plague Minnows were noted on site during the survey although they may occur within the locality. The proposed development is unlikely to result in the introduction of this species within the site nor is it likely to increase the numbers of this species within the locality. As Plague Minnows do not prey upon Squirrel Gliders, this Key Threatening Process does not apply in this instance.

- **Importation of Red Fire Ants *Solenopsis invicta***: This species is not known to occur on site.

- **Infection of native plants by *Phytophthora cinnamomi***: This infection is not known to occur on site.

- **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations**: No endangered Psittacine species were seen on site.

- **Loss and/or degradation of site used for hill-topping by butterflies**: Given the fact that the Squirrel Glider is not a species of butterfly, this ' Key Threatening Process' is not applicable.

- **Anthropogenic Climate Change**: No species living on site are considered likely to be significantly affected by anthropogenic climate change.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** Numerous Rabbits were identified on site during the survey period and it may therefore be stated that this 'Key Threatening Process' is already present on site. The proposal is unlikely to increase the numbers of Rabbits within the locality.

- **Infection of frogs by amphibian chytrid causing disease chytridiomycosis:** No indication of amphibian chytrid was noted on site.

- **Invasion of native plant communities by exotic perennial grasses:** As a small number of exotic perennial grasses were identified on site during the survey, it may be stated that this Key Threatening Process is already present on site. The proposed development may result in the further introduction of perennial grasses to the locality, however it is unlikely to be at a scale which would significantly affect any local population of this threatened species

- **Removal of dead wood and dead trees:** As the site contains an Open Forest assemblage with fallen deris noted, the proposal will result in the removal of dead wood and dead trees. However, with consideration given to the recommended retention of Open Forest habitat within a habitat corridor, it is unlikely to be at a scale which would significantly affect any local population of threatened species.

h) whether any threatened species, population or ecological community is at the limit of its known distribution.

Neither this species nor any population occurring in the local area is at the limit of its known standard distribution.

Bibliography:

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30. *Potorous tridactylus* Long-nosed Potoroo

The Long-nosed Potoroo has a patchy distribution from Gladstone, QLD to south-west Victoria and Tasmania. They are regarded as uncommon north of the Sydney region. A small occurrence is also known from south-western Western Australia, where it was rediscovered in 1994. It is known from a variety of habitats, including rainforest, Open Forests and Woodlands with dense groundcover, and dense, wet coastal heathlands. Soft (often sandy) substrates are preferred by this species. This squat, rabbit-size, kangaroo-like marsupial has a prehensile tail used for gathering nesting material, well-developed upper canine teeth and upper and lower incisor teeth that bite against each other. The fur is generally grey to brown above and paler below. Long-nosed Potoroos have a long tapering nose with a naked tip, rounded ears and a scaly tail that is furry at the base. Head-body length is generally 340-400mm, tail is 195-265mm. Males are larger than females.

They feed predominantly on fungi, subterranean insects, succulent roots, tubers, seeds and fruits. Many food items are obtained by digging in the soil with their forearms. Conical pits with remnants of the fruiting bodies of an underground fungus nearby are characteristics signs of past feeding by this species. Being predominantly nocturnal, the Long-nosed Potoroo sleeps by day in simple nests of grass and other vegetation placed in scrapes below dense scrub, grass tussocks or grass trees. Nesting material is carried to the chosen site in the prehensile tail. During bushfires they refuge in the burrows of other animals. Solitary and sedentary, they have overlapping home ranges of 5-10ha. They rarely venture far from cover, and sometimes gather in small groups. They move quickly with a bipedal hopping gait assisted occasionally by the forelimbs, especially when changing direction.

Sexually mature at 12 months, they live to 12 years and breed all year with peaks in summer and late winter. A single young is born 38 days after mating and attaches firmly to one of the four teats in the mother's pouch, leaving the pouch by 15 weeks and suckling at foot for 5-6 weeks. Fossil remains indicate that this species was far more common in the past. It is not clear to what extent its decline is the result of human activity but it is obvious that very large areas of suitable habitat along the eastern coast of Australia have been removed by land clearing.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

No indication of this species' presence was noted on site during fieldwork. Potential foraging and shelter habitat for this species is present across most the site, with the sandy substrates present being a preferred habitat attribute. The recommended habitat corridor within the western portion of the site would retain habitat resources for this species. With consideration given to the occurrence of large areas of similar habitat attributes adjacent to the site and within the adjacent Munmorah State Recreation Area, it is considered that the proposal is unlikely to significantly affect the life cycle of this species or place any viable local population of this species at risk of extinction.

b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No population of this species on site has been identified under Schedule 1, Part 2 of the TSC Act 1995.

c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

No regionally significant area of known habitat is to be removed or modified as a result of the proposal, although the proposal may be view as contributing to the incremental decline of potential habitat within the region.

d) whether an area of known habitat is likely to be isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No areas of known habitat are likely to be isolated as a result of the proposal provided that the recommendations given regarding corridors is implemented.

e) whether critical habitat will be affected.

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act 1995.

f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

The adequacy of representation of the habitat of this species in the region is difficult to ascertain, although it appears that any of a number of reserves containing forested areas (such as Yengo, Morton, Budderoo, Goulburn River, Wollemi, Blue Mountains, Dharug, Brisbane Water and Ku-ring-gai Chase National Parks) could provide some protected habitat for this species. As such, it could be tentatively stated that the habitat of this species is well represented in conservation reserves in this region, although the majority of potential habitat remains 'unprotected'.

g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act have been listed in bold below followed by an assessment of the applicability of the threatened process in regards to the species, the site and the proposed development:

- **Clearing of Native Vegetation**: The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The clearing to accommodate the development may be viewed as contributing to the incremental decline of habitat in the local area, although it is recognised that this Key Threatening Process has already affected much of the site due to past colliery activities.. Accordingly, the development of this site is unlikely to be singularly responsible for the loss of any local population of this species provided that the recommendations regarding buffers and corridors are implemented.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands**: Alteration to the natural flow regime is recognised as a major factor contributing to the loss of biological diversity and ecological function of aquatic ecosystems. The impacts of this 'Key Threatening Process' include the reduction of habitat, increased flows causing permanent flooding, riparian zone degradation, increased habitat for invasive species and loss or disruption of ecological function. It is recognised that the study area borders a SEPP 14

wetland as well as containing a drainage line which drains towards Moonee Beach to the east. Accordingly, a number of recommendations have been made through the report to ensure that any potential impacts are minimised. In regards to this species, it is considered that the level of threat associated with this 'Key Threatening Process' is low in this instance.

- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera***: Small areas of *Chrysanthemoides monilifera* (Bitou Bush) were identified within the subject site and it may be stated that this 'Key Threatening Process' is already present on site. However, the level of this threat posed to this species would be negligible.

- **Predation by the European Red Fox *Vulpes vulpes*:** With the recording of at least one Fox during the survey period, it may stated that this 'Key Threatening Process' is already present on site and could pose a minimal threat to this species. However, the proposal is unlikely to result in increased numbers of this species within the locality.

- **Predation by the Feral Cat *Felis catus***: No Feral Cats were observed on site during the survey period although they are believed likely to occur within the locality. However, the proposal is unlikely to result in an increase in the number of Feral Cats.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: The site showed evidence of a past fire, although it is difficult to ascertain the disruption and structural change, if any, past fires have caused the site. The proposal is unlikely to result in any increase in frequency of fire events across the study area.

- **Competition from feral honeybees *Apis mellifera*:** No honey bees were observed on the site and as this species does not rely on either tree hollows or nectar resources it is not considered a 'Key Threatening Process' for this species.

- **Bushrock Removal**: No bushrock was observed on the site and as this species does not rely on this habitat resource it is not considered a 'Key Threatening Process' for this species.

- **Predation by *Gambusia holbrooki* (Plague Minnow)**: No Plague Minnows were noted on site during the survey although they may occur within the locality. The proposed development is unlikely to result in the introduction of this species within the site nor is it likely to increase the numbers of this species within the locality. As Plague Minnows do not prey upon Long-nosed Potoroos, this Key Threatening Process does not apply in this instance.

- **Importation of Red Fire Ants *Solenopsis invicta***: This species is not known to occur on site.

- **Infection of native plants by *Phytophthora cinnamomi***: This infection is not known to occur on site.

- **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations**: No endangered Psittacine species were seen on site.

- **Loss and/or degradation of site used for hill-topping by butterflies**: Given the fact that the Long-nosed Potoroo is not a species of butterfly, this ' Key Threatening Process' is not applicable.

- **Anthropogenic Climate Change**: No species living on site are considered likely to be significantly affected by anthropogenic climate change.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** Numerous

Rabbits were identified on site during the survey period and it may therefore be stated that this 'Key Threatening Process' is already present on site. The proposal is unlikely to increase the numbers of Rabbits within the locality.

- **Infection of frogs by amphibian chytrid causing disease chytridiomycosis:** No indication of amphibian chytrid was noted on site.

- **Invasion of native plant communities by exotic perennial grasses:** As a small number of exotic perennial grasses were identified on site during the survey, it may be stated that this Key Threatening Process is already present on site. The proposed development may result in the further introduction of perennial grasses to the locality, however it is unlikely to be at a scale which would significantly affect any local population of this threatened species

- **Removal of dead wood and dead trees:** As the site contains an Open Forest assemblage with fallen deris noted, the proposal will result in the removal of dead wood and dead trees. However, with consideration given to the recommended retention of Open Forest habitat within a habitat corridor, it is unlikely to be at a scale which would significantly affect any local population of threatened species.

h) whether any threatened species, population or ecological community is at the limit of its known distribution.

Any individuals or populations of this species occurring in the local area would be nearing the northern limit of their known distribution, which occurs patchily in south-eastern Australia.

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31. *Pteropus poliocephalus* Grey-headed Flying-fox

The Grey-headed Flying-fox is distributed predominantly along the sub-tropical east coast, from Rockhampton (Qld) through NSW to SE Victoria. It is a fairly large species, weighing up to a kilogram and having a forearm length of up to 180mm. It is the only Australian Flying-fox to possess a mantle of rusty brown fur that full encircles the neck. The fur on the back is dark grey and as the common name suggests, the head is covered with light grey fur. The grey belly fur is often flecked with white and ginger. The fur extends down the legs to the toes, which contrasts with other *Pteropus* species, which are furred only to the knees.

Grey-headed Flying-foxes are known to occupy a variety of habitats, including wet and dry sclerophyll forests, rainforest, mangroves and paperbark swamps and *Banksia* woodlands. Here they forage on a range of fruits and blossoms. Their diet is so varied that they have been recorded eating the fruit or blossom of more than 80 species of plant. The predominant food source is Eucalypt blossom and fruits from trees such as *Ficus* spp. (Figs). It is likely to act as an important pollinator for many of the trees on which they utilise blossoms. They also inhabit cultivated areas where they feed on introduced trees including commercial food crops, and can become a 'pest' animal in these areas. Ironically, this has led to this species being the most intensively researched bat in Australia.

As with most species of Flying-fox, *P. poliocephalus* roost communally where they form large communal colonies called 'camps'. Camps are mostly in rainforest patches, mangroves, paperbark forests and modified vegetation in urban areas. These camps may contain thousands of individuals, and up to 200 000 individuals have been recorded at one camp. They may move up to 70km from the camp each night to forage. Young are raised in maternity camps after birthing in September to October. The young are able to fly at 3 months of age and puberty is reached at 18 months, although males do not achieve effective fertility until 30 months. Vocal communication is highly sophisticated, with over 20 different situation-specific calls being recorded.

The key threats to Grey-headed Flying-fox include the clearing or modification of native vegetation, in particular roost-camp habitat as well as winter food resources in NE NSW. This species is also threatened by persecution in the form of shooting of animals and the destruction of roost camps. This oppression may be a result of Grey-headed Flying-foxes being a perceived pest in agricultural areas or as presenting a noise problem in more urbanised areas. Recently, it has been identified as being a potential carrier of viral pathogens, such as Lyssa-virus. Another threat is from competition and hybridisation with *P. alecto* (Black Flying-fox).

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

No indication of this species' presence was noted on site during fieldwork. Potential foraging and roosting habitat for this species is present across much of the site. Given the high mobility of this species and the occurrence of large areas of similar habitat attributes adjacent to the site and within conservation reserves in the region, it is considered that the proposal is unlikely to significantly affect the life cycle of this species or place any viable local population of this species at risk of extinction.

b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No population of this species on site has been identified under Schedule 1, Part 2 of the TSC Act 1995.

c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

No regionally significant area of known habitat is to be removed or modified as a result of the proposal, although the proposal may be view as contributing to the incremental decline of potential habitat within the region.

d) whether an area of known habitat is likely to be isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No areas of known habitat are likely to be isolated as a result of the proposal, particularly given the high mobility of the species.

e) whether critical habitat will be affected.

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act 1995.

f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

Records of this species in the region exist from the Blue Mountains, Brisbane Water, Dharug, Kanangra Boyd, Ku-ring-gai Chase, Royal and Wyrrabalong National Parks as well as Munmorah State Recreation Area (NPWS Database, 2000). Further records exist from Kooragang Nature Reserve and Shortland Wetlands Reserve (Roderick, pers. comm.). A well documented roosting camp also currently exists within Blackbutt Council Reserve. As such, it appears that this species may be well represented in conservation reserves in the region. The adequacy of representation of the habitat of this species in the region is difficult to ascertain, although it appears that any of a number of reserves containing forested areas could provide some protected habitat for this species. However, it is believed that less than 15% of suitable forest for this species occurs in conservation reserves in NSW and only 5% of known roost sites occur in the reserve system in the state (Hall and Richards, 2000).

g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act have been listed in bold below followed by an assessment of the applicability of the threatened process in regards to the species, the site and the proposed development:

- **Clearing of Native Vegetation**: The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The clearing to accommodate the development may be viewed as contributing to the incremental decline of habitat in the local area, although it is recognised that this Key Threatening Process has already affected much of the

site due to past colliery activities.. Accordingly, the development of this site is unlikely to be singularly responsible for the loss of any local population of this species provided that the recommendations regarding buffers and corridors are implemented.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands**: Alteration to the natural flow regime is recognised as a major factor contributing to the loss of biological diversity and ecological function of aquatic ecosystems. The impacts of this 'Key Threatening Process' include the reduction of habitat, increased flows causing permanent flooding, riparian zone degradation, increased habitat for invasive species and loss or disruption of ecological function. It is recognised that the study area borders a SEPP 14 wetland as well as containing a drainage line which drains towards Moonee Beach to the east. Accordingly, a number of recommendations have been made through the report to ensure that any potential impacts are minimised. In regards to this species, it is considered that the level of threat associated with this 'Key Threatening Process' is low in this instance.

- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera***: Small areas of *Chrysanthemoides monilifera* (Bitou Bush) were identified within the subject site and it may be stated that this 'Key Threatening Process' is already present on site. However, the current level of this threat posed to this species would be negligible.

- **Predation by the European Red Fox *Vulpes vulpes*:** With the recording of at least one Fox during the survey period, it may stated that this 'Key Threatening Process' is already present on site and could pose a minimal threat to this species. However, the proposal is unlikely to result in increased numbers of this species within the locality.

- **Predation by the Feral Cat *Felis catus***: No Feral Cats were observed on site during the survey period although they are believed likely to occur within the locality. However, the proposal is unlikely to result in an increase in the number of Feral Cats.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: The site showed evidence of a past fire, although it is difficult to ascertain the disruption and structural change, if any, past fires have caused the site. The proposal is unlikely to result in any increase in frequency of fire events across the study area.

- **Competition from feral honeybees *Apis mellifera*:** No honey bees were observed on the site and it is not considered a 'Key Threatening Process' in this instance.

- **Bushrock Removal**: No bushrock was observed on the site and as this species does not rely on this habitat resource it is not considered a 'Key Threatening Process' for this species.

- **Predation by *Gambusia holbrooki* (Plague Minnow)**: No Plague Minnows were noted on site during the survey although they may occur within the locality. The proposed development is unlikely to result in the introduction of this species within the site nor is it likely to increase the numbers of this species within the locality. As Plague Minnows do not prey upon Grey-headed Flying-foxes, this Key Threatening Process does not apply in this instance.

- **Importation of Red Fire Ants *Solenopsis invicta***: This species is not known to occur on site.

- **Infection of native plants by *Phytophthora cinnamomi***: This infection is not known to occur on site.

- **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered**

psittacine species and populations: No endangered Psittacine species were seen on site.

- **Loss and/or degradation of site used for hill-topping by butterflies**: Given the fact that the Grey-headed Flying-fox is not a form of butterfly, this ' Key Threatening Process' is not applicable.

- **Anthropogenic Climate Change**: No species living on site are considered likely to be significantly affected by anthropogenic climate change.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** Numerous Rabbits were identified on site during the survey period and it may therefore be stated that this 'Key Threatening Process' is already present on site. The proposal is unlikely to increase the numbers of Rabbits within the locality.

- **Infection of frogs by amphibian chytrid causing disease chytridiomycosis:** No indication of amphibian chytrid was noted on site.

- **Invasion of native plant communities by exotic perennial grasses:** As a small number of exotic perennial grasses were identified on site during the survey, it may be stated that this Key Threatening Process is already present on site. The proposed development may result in the further introduction of perennial grasses to the locality, however it is unlikely to be at a scale which would significantly affect any local population of this threatened species

- **Removal of dead wood and dead trees:** As the site contains an Open Forest assemblage with fallen deris noted, the proposal will result in the removal of dead wood and dead trees. However, with consideration given to the recommended retention of Open Forest habitat within a habitat corridor, it is unlikely to be at a scale which would significantly affect any local population of threatened species.

h) whether any threatened species, population or ecological community is at the limit of its known distribution.

Neither this species nor any population occurring in the local area is at the limit of its known standard distribution.

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32. *Chalinolobus dwyeri* Large-eared Pied Bat

This species was only identified in the late 1960's and as such very little is known about it's distribution or habitat tolerances. The Large Pied Bat ranges from Rockhampton in central Queensland to Bungonia in southern NSW. This species has been found occupying dry sclerophyll forest and woodland, both to the east and west of the Great Divide. Recordings of this species have also been made in subalpine woodland and at the ecotone of rainforest and wet Eucalypt forest.

The Large-eared Pied Bat roosts in caves, abandoned mud-nests of Fairy Martins and mine tunnels. Colonies recorded have ranged in size from 3 to 37 individuals, and are usually located in the twilight area not far from the cave entrance. The physiology of the bat suggests that it feeds primarily on small insects below the canopy. They fly relatively slowly with rapid but shallow wing beats. During autumn and early winter the males have enlarged testes. At this time, the facial glands on either side of the muzzle become swollen and show a cream colour beneath the skin. They exude a milky secretion when compressed. It is probable that these glands have a secondary sexual function. It is not known whether mating occurs in the autumn or spring; hence the duration of pregnancy is also unknown. The females give birth in November, commonly to twins, and the young are independent by late February. They leave the cave soon after and the females remain another month before abandoning the roost in late March for the winter. It is thought that during the cooler winter months the colony disperses for individual hibernation.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

No indication of this species' presence was noted on site during fieldwork. Potential hunting habitat for this species is present over the entire site. Given the high mobility of this species and the occurrence of similar habitat attributes adjacent to the site and within the region, it is considered that the proposal is unlikely to significantly affect the life cycle of this species or place any viable local population of this species at risk of extinction.

b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No population of this species on site has been identified under Schedule 1, Part 2 of the TSC Act 1995.

c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

No regionally significant area of known habitat is to be removed or modified as a result of the proposal, although the proposal may be view as contributing to the incremental decline of potential habitat within the region.

d) whether an area of known habitat is likely to be isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No areas of known habitat are likely to be isolated as a result of the proposal, particularly given the high mobility of the species.

e) whether critical habitat will be affected.

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act 1995.

f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

Records of this species in the region exist from Wollemi and Yengo National Parks as well as the Parr State Recreation Area (NPWS Database, 2000). As such, it appears that this species may not be well represented in conservation reserves in the region. The adequacy of representation of the habitat of this species in the region is difficult to ascertain, although it appears that any of a number of reserves containing forested areas could provide some protected habitat for this species. As such, it could be tentatively stated that the habitat of this species is well represented in conservation reserves in this region, although the majority of potential habitat remains 'unprotected'.

g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act have been listed in bold below followed by an assessment of the applicability of the threatened process in regards to the species, the site and the proposed development:

- **Clearing of Native Vegetation**: The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The clearing to accommodate the development may be viewed as contributing to the incremental decline of habitat in the local area, although it is recognised that this Key Threatening Process has already affected much of the site due to past colliery activities.. Accordingly, the development of this site is unlikely to be singularly responsible for the loss of any local population of this species provided that the recommendations regarding buffers and corridors are implemented.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands**: Alteration to the natural flow regime is recognised as a major factor contributing to the loss of biological diversity and ecological function of aquatic ecosystems. The impacts of this 'Key Threatening Process' include the reduction of habitat, increased flows causing permanent flooding, riparian zone degradation, increased habitat for invasive species and loss or disruption of ecological function. It is recognised that the study area borders a SEPP 14 wetland as well as containing a drainage line which drains towards Moonee Beach to the east. Accordingly, a number of recommendations have been made through the report to ensure that any potential impacts are minimised. In regards to this species, it is considered that the level of threat associated with this 'Key Threatening Process' is low in this instance.

- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera***: Small areas of

Chrysanthemoides monilifera (Bitou Bush) were identified within the subject site and it may be stated that this 'Key Threatening Process' is already present on site. However, the current level of this threat posed to microchiropteran bats would be negligible.

- **Predation by the European Red Fox *Vulpes vulpes*:** With the recording of at least one Fox during the survey period, it may stated that this 'Key Threatening Process' is already present on site and could pose a minimal threat to this species. However, the proposal is unlikely to result in increased numbers of this species within the locality.

- **Predation by the Feral Cat *Felis catus***: No Feral Cats were observed on site during the survey period although they are believed likely to occur within the locality. However, the proposal is unlikely to result in an increase in the number of Feral Cats.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: The site showed evidence of a past fire, although it is difficult to ascertain the disruption and structural change, if any, past fires have caused the site. The proposal is unlikely to result in any increase in frequency of fire events across the study area.

- **Competition from feral honeybees *Apis mellifera*:** No honey bees were observed on the site and it is not considered a 'Key Threatening Process' in this instance.

- **Bushrock Removal**: No bushrock was observed on the site and as this species does not rely on this habitat resource it is not considered a 'Key Threatening Process' for this species.

- **Predation by *Gambusia holbrooki* (Plague Minnow)**: No Plague Minnows were noted on site during the survey although they may occur within the locality. The proposed development is unlikely to result in the introduction of this species within the site nor is it likely to increase the numbers of this species within the locality. As Plague Minnows do not prey upon microchiropteran bats, this Key Threatening Process does not apply.

- **Importation of Red Fire Ants *Solenopsis invicta***: This species is not known to occur on site.

- **Infection of native plants by *Phytophthora cinnamomi***: This infection is not known to occur on site.

- **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations**: No endangered Psittacine species were seen on site.

- **Loss and/or degradation of site used for hill-topping by butterflies**: Given that this species is not a form of butterfly, this ' Key Threatening Process' is not applicable.

- **Anthropogenic Climate Change**: No species living on site are considered likely to be significantly affected by anthropogenic climate change.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** Numerous Rabbits were identified on site during the survey period and it may therefore be stated that this 'Key Threatening Process' is already present on site. The proposal is unlikely to increase the numbers of Rabbits within the locality.

- **Infection of frogs by amphibian chytrid causing disease chytridiomycosis:** No indication of amphibian chytrid was noted on site.

- **Invasion of native plant communities by exotic perennial grasses:** As a small number of exotic perennial grasses were identified on site during the survey, it may be stated that this Key Threatening Process is already present on site. The proposed development may result in the further introduction of perennial grasses to the locality, however it is unlikely to be at a scale which would significantly affect any local population of this threatened species

- **Removal of dead wood and dead trees:** As the site contains an Open Forest assemblage with fallen deris noted, the proposal will result in the removal of dead wood and dead trees. However, with consideration given to the recommended retention of Open Forest habitat within a habitat corridor, it is unlikely to be at a scale which would significantly affect any local population of threatened species.

h) whether any threatened species, population or ecological community is at the limit of its known distribution.

Neither this species nor any population occurring in the area is at the limit of its known standard distribution.

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33. *Mormopterus norfolkensis* Eastern Freetail-bat

This species is distributed along the east coast of New South Wales from south of Sydney extending north into south-eastern Queensland, near Brisbane. There are no records west of the Great Dividing Range. This species appears to live in Sclerophyll Forests and Woodland. Usually only solitary bats are captured, but one group was caught flying low over a rocky river in Rainforest and Wet Sclerophyll Forest. When hunting insects it flies swiftly above the forest canopy or in clearings at the edge of the forest. Their diet is largely unknown. Small colonies have been found in tree hollows or under loose bark and specimens have been collected from under house roofs and the metal caps on telegraph poles. It commonly roosts with other species of bats, including *Scotorepens orion* (Eastern Broad-nosed Bat) and *Chalinolobus gouldii* (Gould's Wattled Bat).

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

No indication of this species' presence was noted on site during fieldwork. Potential hunting and roosting habitat for this species is present over the entire site. Given the high mobility of this species, the recommended retention of hollow bearing trees and the occurrence of large areas of similar habitat attributes adjacent to the site and within the region, it is considered that the proposal is unlikely to significantly affect the life cycle of this species or place any viable local population of this species at risk of extinction.

b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No population of this species on site has been identified under Schedule 1, Part 2 of the TSC Act 1995.

c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

No regionally significant area of known habitat is to be removed or modified as a result of the proposal, although the proposal may be view as contributing to the incremental decline of potential habitat within the region.

d) whether an area of known habitat is likely to be isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No areas of known habitat are likely to be isolated as a result of the proposal, particularly given the high mobility of the species.

e) whether critical habitat will be affected.

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act 1995.

f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

Records of this species in the region are known only from Yengo National Park (NPWS Database, 2000). As such, it appears that this species is not well represented in conservation reserves in the region. The adequacy of representation of the habitat of this species in the region is difficult to ascertain, although it appears that any of a number of reserves containing forested areas could provide some protected habitat for this species. As such, it could be tentatively stated that the habitat of this species is well represented in conservation reserves in this region, although the majority of potential habitat remains 'unprotected'.

g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act have been listed in bold below followed by an assessment of the applicability of the threatened process in regards to the species, the site and the proposed development:

- **Clearing of Native Vegetation**: The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The clearing to accommodate the development may be viewed as contributing to the incremental decline of habitat in the local area, although it is recognised that this Key Threatening Process has already affected much of the site due to past colliery activities.. Accordingly, the development of this site is unlikely to be singularly responsible for the loss of any local population of this species provided that the recommendations regarding buffers and corridors are implemented.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands**: Alteration to the natural flow regime is recognised as a major factor contributing to the loss of biological diversity and ecological function of aquatic ecosystems. The impacts of this 'Key Threatening Process' include the reduction of habitat, increased flows causing permanent flooding, riparian zone degradation, increased habitat for invasive species and loss or disruption of ecological function. It is recognised that the study area borders a SEPP 14 wetland as well as containing a drainage line which drains towards Moonee Beach to the east. Accordingly, a number of recommendations have been made through the report to ensure that any potential impacts are minimised. In regards to this species, it is considered that the level of threat associated with this 'Key Threatening Process' is low in this instance.

- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera***: Small areas of *Chrysanthemoides monilifera* (Bitou Bush) were identified within the subject site and it may be stated that this 'Key Threatening Process' is already present on site. However, the current level of this threat posed to microchiropteran bats would be negligible.

- **Predation by the European Red Fox *Vulpes vulpes*:** With the recording of at least one Fox during the survey period, it may stated that this 'Key Threatening Process' is already present on site and could pose a minimal threat to this species. However, the proposal is unlikely to result in increased numbers of this species within the locality.

- **Predation by the Feral Cat *Felis catus***: No Feral Cats were observed on site during the survey period although they are believed likely to occur within the locality. However, the proposal is unlikely to result in an increase in the number of Feral Cats.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: The site showed evidence of a past fire, although it is difficult to ascertain the disruption and structural change, if any, past fires have caused the site. The proposal is unlikely to result in any increase in frequency of fire events across the study area.

- **Competition from feral honeybees *Apis mellifera*:** No honey bees were observed on the site and it is not considered a 'Key Threatening Process' in this instance.

- **Bushrock Removal**: No bushrock was observed on the site and as this species does not rely on this habitat resource it is not considered a 'Key Threatening Process' for this species.

- **Predation by *Gambusia holbrooki* (Plague Minnow)**: No Plague Minnows were noted on site during the survey although they may occur within the locality. The proposed development is unlikely to result in the introduction of this species within the site nor is it likely to increase the numbers of this species within the locality. As Plague Minnows do not prey upon microchiropteran bats, this Key Threatening Process does not apply in this instance.

- **Importation of Red Fire Ants *Solenopsis invicta***: This species is not known to occur on site.

- **Infection of native plants by *Phytophthora cinnamomi***: This infection is not known to occur on site.

- **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations**: No endangered Psittacine species were seen on site.

- **Loss and/or degradation of site used for hill-topping by butterflies**: Given that this species is not a form of butterfly, this ' Key Threatening Process' is not applicable.

- **Anthropogenic Climate Change**: No species living on site are considered likely to be significantly affected by anthropogenic climate change.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** Numerous Rabbits were identified on site during the survey period and it may therefore be stated that this 'Key Threatening Process' is already present on site. The proposal is unlikely to increase the numbers of Rabbits within the locality.

- **Infection of frogs by amphibian chytrid causing disease chytridiomycosis:** No indication of amphibian chytrid was noted on site.

- **Invasion of native plant communities by exotic perennial grasses:** As a small number of exotic perennial grasses were identified on site during the survey, it may be stated that this Key Threatening Process is already present on site. The proposed development may result in the further introduction of perennial grasses to the locality, however it is unlikely to be at a scale which would significantly affect any local population of this threatened species

- **Removal of dead wood and dead trees:** As the site contains an Open Forest assemblage with fallen deris noted, the proposal will result in the removal of dead wood and dead trees. However, with consideration given to the recommended retention of Open Forest habitat within

a habitat corridor, it is unlikely to be at a scale which would significantly affect any local population of threatened species.

h) whether any threatened species, population or ecological community is at the limit of its known distribution.

Neither this species nor any population occurring in the local area is at the limit of its known standard distribution.

Bibliography:

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34. *Miniopterus australis* Little Bentwing-bat

This species inhabits tropical rainforest to warm-temperate wet and dry sclerophyll forest occurring along the coastal plains and adjacent ranges from Cape York to north-eastern NSW around the Hunter River. Its distribution within Australia becomes increasingly coastal towards the southern limit of its range in NSW.

It is a sub-canopy hunter with a preference for well-timbered areas but it is also known to hunt in clearings adjacent to forests. Prey items include crane flies, ants, moths and wasps. Flight characteristics include rapid movement with considerable manoeuvrability.

The species is a cave dweller that congregates in the summer months in maternity roost colonies and disperses during winter. In the southern part of their range they hibernate during winter but in the north they remain active throughout the year. Recorded roosts include caves, mines, stormwater drains, disused railway tunnels and houses. Mating, fertilisation and implantation occur in July to August, followed by a period of retarded embryonic development until mid-September. Pregnant females congregate in specified large nursery caves to rear their young. Births occur in December, when single young are born. It is often found to roost with the Large Bentwing-bat (*Miniopterus schreibersii*), and benefits from this larger species' ability to increase the roost temperature using metabolic heat. There is a huge nursery colony of 100,000 adult bats at Mt. Etna caves, in central Queensland.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

No indication of this species' presence was noted on site during fieldwork. Potential hunting habitat for this species is present over the entire site, although suitable roosting habitat is absent. Given the high mobility of this species and the occurrence of similar habitat attributes adjacent to the site and within the region, it is considered that the proposal is unlikely to significantly affect the life cycle of this species or place any viable local population of this species at risk of extinction.

b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No population of this species on site has been identified under Schedule 1, Part 2 of the TSC Act 1995.

c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

No regionally significant area of known habitat is to be removed or modified as a result of the proposal, although the proposal may be view as contributing to the incremental decline of potential habitat within the region.

d) whether an area of known habitat is likely to be isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No areas of known habitat are likely to be isolated as a result of the proposal, particularly given the high mobility of the species.

e) whether critical habitat will be affected.

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act 1995.

f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

The adequacy of representation of the habitat of this species in the region is difficult to ascertain, although it appears that any of a number of reserves containing forested areas (such as Yengo, Goulburn River, Wollemi, Blue Mountains, Dharug, Brisbane Water and Ku-ring-gai Chase National Parks) could provide some protected habitat for this species. As such, it could be tentatively stated that the habitat of this species is well represented in conservation reserves in this region, although the majority of potential habitat remains 'unprotected'. In terms of roosting habitat, as far as is known there are no areas of maternal roosting habitat protected in the region, although no such habitat exists on site.

g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act have been listed in bold below followed by an assessment of the applicability of the threatened process in regards to the species, the site and the proposed development:

- **Clearing of Native Vegetation**: The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The clearing to accommodate the development may be viewed as contributing to the incremental decline of habitat in the local area, although it is recognised that this Key Threatening Process has already affected much of the site due to past colliery activities.. Accordingly, the development of this site is unlikely to be singularly responsible for the loss of any local population of this species provided that the recommendations regarding buffers and corridors are implemented.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands**: Alteration to the natural flow regime is recognised as a major factor contributing to the loss of biological diversity and ecological function of aquatic ecosystems. The impacts of this 'Key Threatening Process' include the reduction of habitat, increased flows causing permanent flooding, riparian zone degradation, increased habitat for invasive species and loss or disruption of ecological function. It is recognised that the study area borders a SEPP 14 wetland as well as containing a drainage line which drains towards Moonee Beach to the east. Accordingly, a number of recommendations have been made through the report to ensure that any potential impacts are minimised. In regards to this species, it is considered that the level of threat associated with this 'Key Threatening Process' is low in this instance.

- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera***: Small areas of *Chrysanthemoides monilifera* (Bitou Bush) were identified within the subject site and it may be

stated that this 'Key Threatening Process' is already present on site. However, the current level of this threat posed to this species would be negligible.

- **Predation by the European Red Fox *Vulpes vulpes*:** With the recording of at least one Fox during the survey period, it may stated that this 'Key Threatening Process' is already present on site and could pose a minimal threat to this species. However, the proposal is unlikely to result in increased numbers of this species within the locality.

- **Predation by the Feral Cat *Felis catus***: No Feral Cats were observed on site during the survey period although they are believed likely to occur within the locality. However, the proposal is unlikely to result in an increase in the number of Feral Cats.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: The site showed evidence of a past fire, although it is difficult to ascertain the disruption and structural change, if any, past fires have caused the site. The proposal is unlikely to result in any increase in frequency of fire events across the study area.

- **Competition from feral honeybees *Apis mellifera*:** No honey bees were observed on the site and as the Little Bentwing-bat does not rely on either tree hollows or nectar resources it is not considered a 'Key Threatening Process' for this species.

- **Bushrock Removal**: No bushrock was observed on the site and as the Little Bentwing-bat does not rely on this habitat resource it is not considered a 'Key Threatening Process' for this species.

- **Predation by *Gambusia holbrooki* (Plague Minnow)**: No Plague Minnows were noted on site during the survey although they may occur within the locality. The proposed development is unlikely to result in the introduction of this species within the site nor is it likely to increase the numbers of this species within the locality. As Plague Minnows do not prey upon microchiropteran bats, this KTP does not apply to *Miniopterus australis.*

- **Importation of Red Fire Ants *Solenopsis invicta***: This species is not known to occur on site.

- **Infection of native plants by *Phytophthora cinnamomi***: This infection is not known to occur on site.

- **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations**: No endangered Psittacine species were seen on site.

- **Loss and/or degradation of site used for hill-topping by butterflies**: Given the fact that the Little Bentwing-bat is not a form of butterfly, this ' Key Threatening Process' is not applicable.

- **Anthropogenic Climate Change**: No species living on site are considered likely to be significantly affected by anthropogenic climate change.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** Numerous Rabbits were identified on site during the survey period and it may therefore be stated that this 'Key Threatening Process' is already present on site. The proposal is unlikely to increase the numbers of Rabbits within the locality.

- **Infection of frogs by amphibian chytrid causing disease chytridiomycosis:** No indication of amphibian chytrid was noted on site.

- **Invasion of native plant communities by exotic perennial grasses:** As a small number of exotic perennial grasses were identified on site during the survey, it may be stated that this Key Threatening Process is already present on site. The proposed development may result in the further introduction of perennial grasses to the locality, however it is unlikely to be at a scale which would significantly affect any local population of this threatened species

- **Removal of dead wood and dead trees:** As the site contains an Open Forest assemblage with fallen deris noted, the proposal will result in the removal of dead wood and dead trees. However, with consideration given to the recommended retention of Open Forest habitat within a habitat corridor, it is unlikely to be at a scale which would significantly affect any local population of threatened species.

h) whether any threatened species, population or ecological community is at the limit of its known distribution.

Neither this species nor any population occurring in the local area is at the limit of its known standard distribution.

Bibliography:

Churchill, S. (1998). *Australian Bats*. Reed New Holland Publishers, Sydney, Australia.
Dwyer, P.D. (1995). Little Bentwing-bat (*Miniopterus australis*) in Strahan, R. (ed) *The Mammals of Australia*, pp: 492-493. Reed Books, Australia.

NPWS Database (2000). *Fauna Species List for Protected Areas in NSW* at http://www.npws.gov.au/wildlife/species.htm

Parnaby, H. (1992). *An Interim Guide to Identification of Insectivorous Bats of South-eastern Australia*. Technical Reports of the Australian Museum, Sydney.

35. *Miniopterus schreibersii oceanensis* Large Bentwing-bat

The Large (or 'Common') Bentwing-bat may occur throughout the world. However, Parnaby (1992) notes that the Australasian populations are unlikely to be the same species that occurs outside this area. Within Australia, it is found across the coastal and near coastal areas of the north of the NT and WA and also down the east coast from Cape York to Adelaide on the coastal plains and adjacent ranges.

It is a cave (and similar man-made structures) roosting species that generally feeds above the forest canopy in wet and dry tall open forest, catching insects on the wing. However, the species has also been recorded utilising rainforest, monsoon forest, open woodland, paperbark forests and open grasslands. Moths are the main prey item. Flight is very fast and typically relatively level with swift shallow dives; the estimated flight speed is 50km per hour.

The species is known to migrate over large distances, apparently utilising different roosts for different seasonal needs. The pattern of movement varies with local climate and the dispersion of suitable roost sites. It hibernates over winter in the southern parts of its range and development of the embryo may be delayed over winter by lowering body temperature using roosts in the cooler areas of a cave. Pregnant females roost in large colonies in nursery caves. Birth generally occurs around December. Females cluster together in a roost that generally possesses a domed roof, which allows for the retention of warm air which may also promote faster growth. The young can fly by 7 weeks and reach adult size and are weaned by 10 weeks. The mothers then leave the cave to disperse to their winter roosts and a few weeks later, usually in March, there is a mass exodus of juveniles. The maternity colony is deserted by April.

The longevity record for an Australian bat is from a pregnant female Large Bentwing-bat that was banded and recaptured 18 years later (she was again pregnant).

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

No indication of this species' presence was noted on site during fieldwork. Potential hunting and roosting habitat for this species is present over the entire site. Given the high mobility of this species, the recommended retention of hollow bearing trees and the occurrence of large areas of similar habitat attributes adjacent to the site and within the region, it is considered that the proposal is unlikely to significantly affect the life cycle of this species or place any viable local population of this species at risk of extinction.

b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No population of this species on site has been identified under Schedule 1, Part 2 of the TSC Act 1995.

c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

No regionally significant area of known habitat is to be removed or modified as a result of the proposal, although the proposal may be view as contributing to the incremental decline of potential habitat within the region.

d) whether an area of known habitat is likely to be isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No areas of known habitat are likely to be isolated as a result of the proposal, particularly given the high mobility of the species.

e) whether critical habitat will be affected.

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act 1995.

f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

Records of this species in the region exist from several reserve areas including the Blue Mountains, Yengo, Wyrrabalong, Botany Bay, Brisbane Water, Dharug, Nattai and Kanangra Boyd National Parks (NPWS Database, 2000). As such, it appears that this species is well represented in conservation reserves in the region. The adequacy of representation of the habitat of this species in the region is difficult to ascertain, although it appears that any of a number of reserves containing forested areas could provide some protected habitat for this species. As such, it could be tentatively stated that the hunting habitat of this species is well represented in conservation reserves in this region, although the majority of potential habitat remains 'unprotected'. In terms of roosting habitat, as far as is known there are no areas of maternal roosting habitat protected in the region, although no such habitat exists on site.

g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act have been listed in bold below followed by an assessment of the applicability of the threatened process in regards to the species, the site and the proposed development:

- **Clearing of Native Vegetation**: The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The clearing to accommodate the development may be viewed as contributing to the incremental decline of habitat in the local area, although it is recognised that this Key Threatening Process has already affected much of the site due to past colliery activities.. Accordingly, the development of this site is unlikely to be singularly responsible for the loss of any local population of this species provided that the recommendations regarding buffers and corridors are implemented.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands**: Alteration to the natural flow regime is recognised as a major factor contributing to

the loss of biological diversity and ecological function of aquatic ecosystems. The impacts of this 'Key Threatening Process' include the reduction of habitat, increased flows causing permanent flooding, riparian zone degradation, increased habitat for invasive species and loss or disruption of ecological function. It is recognised that the study area borders a SEPP 14 wetland as well as containing a drainage line which drains towards Moonee Beach to the east. Accordingly, a number of recommendations have been made through the report to ensure that any potential impacts are minimised. In regards to this species, it is considered that the level of threat associated with this 'Key Threatening Process' is low in this instance.

- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera***: Small areas of *Chrysanthemoides monilifera* (Bitou Bush) were identified within the subject site and it may be stated that this 'Key Threatening Process' is already present on site. However, the current level of this threat posed to microchiropteran bats would be negligible.

- **Predation by the European Red Fox *Vulpes vulpes*:** With the recording of at least one Fox during the survey period, it may stated that this 'Key Threatening Process' is already present on site and could pose a minimal threat to this species. However, the proposal is unlikely to result in increased numbers of this species within the locality.

- **Predation by the Feral Cat *Felis catus***: No Feral Cats were observed on site during the survey period although they are believed likely to occur within the locality. However, the proposal is unlikely to result in an increase in the number of Feral Cats.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: The site showed evidence of a past fire, although it is difficult to ascertain the disruption and structural change, if any, past fires have caused the site. The proposal is unlikely to result in any increase in frequency of fire events across the study area.

- **Competition from feral honeybees *Apis mellifera*:** No honey bees were observed on the site and it is not considered a 'Key Threatening Process' in this instance.

- **Bushrock Removal**: No bushrock was observed on the site and as this species does not rely on this habitat resource it is not considered a 'Key Threatening Process' for this species.

- **Predation by *Gambusia holbrooki* (Plague Minnow)**: No Plague Minnows were noted on site during the survey although they may occur within the locality. The proposed development is unlikely to result in the introduction of this species within the site nor is it likely to increase the numbers of this species within the locality. As Plague Minnows do not prey upon microchiropteran bats, this Key Threatening Process does not apply in this instance.

- **Importation of Red Fire Ants *Solenopsis invicta***: This species is not known to occur on site.

- **Infection of native plants by *Phytophthora cinnamomi***: This infection is not known to occur on site.

- **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations**: No endangered Psittacine species were seen on site.

- **Loss and/or degradation of site used for hill-topping by butterflies**: Given that this species is not a form of butterfly, this ' Key Threatening Process' is not applicable.

- **Anthropogenic Climate Change**: No species living on site are considered likely to be significantly affected by anthropogenic climate change.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** Numerous Rabbits were identified on site during the survey period and it may therefore be stated that this 'Key Threatening Process' is already present on site. The proposal is unlikely to increase the numbers of Rabbits within the locality.

- **Infection of frogs by amphibian chytrid causing disease chytridiomycosis:** No indication of amphibian chytrid was noted on site.

- **Invasion of native plant communities by exotic perennial grasses:** As a small number of exotic perennial grasses were identified on site during the survey, it may be stated that this Key Threatening Process is already present on site. The proposed development may result in the further introduction of perennial grasses to the locality, however it is unlikely to be at a scale which would significantly affect any local population of this threatened species

- **Removal of dead wood and dead trees:** As the site contains an Open Forest assemblage with fallen deris noted, the proposal will result in the removal of dead wood and dead trees. However, with consideration given to the recommended retention of Open Forest habitat within a habitat corridor, it is unlikely to be at a scale which would significantly affect any local population of threatened species.

h) whether any threatened species, population or ecological community is at the limit of its known distribution.

Neither this species nor any population occurring in the local area is at the limit of its known standard distribution.

Bibliography:

Churchill, S (1998). *Australian Bats*. Reed New Holland Publishers, Sydney, Australia.

Dwyer, P.D. (1995). Common Bentwing-bat (*Miniopterus schreibersii*) in Strahan, R. (ed) *The Mammals of Australia*, pp: 494-495. Reed Books, Australia.

NPWS Database (2000). *Fauna Species List for Protected Areas in NSW* at http://www.npws.gov.au/wildlife/species.htm

Parnaby, H. (1992). *An Interim Guide to Identification of Insectivorous Bats of South-eastern Australia*. Technical Reports of the Australian Museum, Sydney.

36. *Myotis adversus* Large-footed Myotis

The Large-footed Myotis has been recorded along much of the coastal strip of Australia occurring from the east of SA, around the Victorian, NSW, Queensland and NT coasts and into WA as far as the Kimberleys (the northern population is likely to be a different subspecies - currently undergoing taxonomic revision).

In NSW, the Large-footed Myotis is found in various habitats of the coast and adjacent ranges. Recently, it has also been found along the Murray River valley well into South Australia. It is a small bat that hunts by raking the surface of the water for aquatic insects and small fish, it seldom occurs far from suitable water bodies which range from rainforest streams to large reservoirs and even brackish water. Some aerial hunting also occurs. Prey items include moths, beetles, crickets, cockroaches, flies and many water insects.

It roosts in small colonies of between 15 and several hundred individuals with recorded roosts including caves, mines and disused railway tunnels as well as dense rainforest foliage in the tropical parts of its range. Some occurrences of roosting in tree hollows are also noted. Males establish territories within the colony and monopolise a cluster of females during the breeding season. Outside the breeding season, males roost separately. The number of pregnancies per year varies with latitude. In NSW and Victoria there is one pregnancy per year, the single young being born in November to December. In southern Queensland they produce two litters of single young in October and January. Males show two peaks of testicular development: in April to June and in September to November. Lactation lasts for about eight weeks and young born in late September suckle until late December. The bond between mother and young extends a further 3 to 4 weeks after weaning; they hunt together and roost together during this period. In northern Queensland they are reported to have three births per year.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

No indication of this species' presence was noted on site during fieldwork. Potential hunting habitat for this species is present within the numerous retention ponds although suitable roosting habitat is absent. Given the high mobility of this species and the occurrence of similar habitat attributes within the region, it is considered that the proposal is unlikely to significantly affect the life cycle of this species or place any viable local population of this species at risk of extinction.

b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No population of this species on site has been identified under Schedule 1, Part 2 of the TSC Act 1995.

c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or

removed.

No regionally significant area of known habitat is to be removed or modified as a result of the proposal, although the proposal may be view as contributing to the incremental decline of potential habitat within the region.

d) whether an area of known habitat is likely to be isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No areas of known habitat are likely to be isolated as a result of the proposal, particularly given the high mobility of the species.

e) whether critical habitat will be affected.

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act 1995.

f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

Records of this species in the region exist from the Dharug, Royal and Wyrrabalong National Parks (NPWS Database, 2000). As such, it appears that this species is not well represented in conservation reserves in the region. The adequacy of representation of the habitat of this species in the region is difficult to ascertain, although it appears that any of a number of reserves containing bodies of water could provide some protected habitat for this species. As such, it could be tentatively stated that the habitat of this species is well represented in conservation reserves in this region, although the majority of potential habitat remains 'unprotected'.

g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act have been listed in bold below followed by an assessment of the applicability of the threatened process in regards to the species, the site and the proposed development:

- **Clearing of Native Vegetation**: The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The clearing to accommodate the development may be viewed as contributing to the incremental decline of habitat in the local area, although it is recognised that this Key Threatening Process has already affected much of the site due to past colliery activities.. Accordingly, the development of this site is unlikely to be singularly responsible for the loss of any local population of this species provided that the recommendations regarding buffers and corridors are implemented.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands**: Alteration to the natural flow regime is recognised as a major factor contributing to the loss of biological diversity and ecological function of aquatic ecosystems. The impacts of this 'Key Threatening Process' include the reduction of habitat, increased flows causing permanent flooding, riparian zone degradation, increased habitat for invasive species and loss or disruption of ecological function. It is recognised that the study area borders a SEPP 14 wetland as well as containing a drainage line which drains towards Moonee Beach to the east. Accordingly, a number of recommendations have been made through the report to ensure that

any potential impacts are minimised. In regards to this species, it is considered that the level of threat associated with this 'Key Threatening Process' is low in this instance.

- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera***: Small areas of *Chrysanthemoides monilifera* (Bitou Bush) were identified within the subject site and it may be stated that this 'Key Threatening Process' is already present on site. However, the level of this threat posed to microchiropteran bats would be negligible.

- **Predation by the European Red Fox *Vulpes vulpes*:** With the recording of at least one Fox during the survey period, it may stated that this 'Key Threatening Process' is already present on site and could pose a minimal threat to this species. However, the proposal is unlikely to result in increased numbers of this species within the locality.

- **Predation by the Feral Cat *Felis catus***: No Feral Cats were observed on site during the survey period although they are believed likely to occur within the locality. However, the proposal is unlikely to result in an increase in the number of Feral Cats.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: The site showed evidence of a past fire, although it is difficult to ascertain the disruption and structural change, if any, past fires have caused the site. The proposal is unlikely to result in any increase in frequency of fire events across the study area.

- **Competition from feral honeybees *Apis mellifera*:** No honey bees were observed on the site and it is not considered a 'Key Threatening Process' in this instance.

- **Bushrock Removal**: No bushrock was observed on the site and as this species does not rely on this habitat resource it is not considered a 'Key Threatening Process' for this species.

- **Predation by *Gambusia holbrooki* (Plague Minnow)**: No Plague Minnows were noted on site during the survey although they may occur within the locality. The proposed development is unlikely to result in the introduction of this species within the site nor is it likely to increase the numbers of this species within the locality. As Plague Minnow does not prey upon microchiropteran bats, this Key Threatening Process does not apply in this instance.

- **Importation of Red Fire Ants *Solenopsis invicta***: This species is not known to occur on site.

- **Infection of native plants by *Phytophthora cinnamomi***: This infection is not known to occur on site.

- **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations**: No endangered Psittacine species were seen on site.

- **Loss and/or degradation of site used for hill-topping by butterflies**: Given that this species is not a form of butterfly, this ' Key Threatening Process' is not applicable.

- **Anthropogenic Climate Change**: No species living on site are considered likely to be significantly affected by anthropogenic climate change.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** Numerous Rabbits were identified on site during the survey period and it may therefore be stated that this 'Key Threatening Process' is already present on site. The proposal is unlikely to increase the numbers of Rabbits within the locality.

- **Infection of frogs by amphibian chytrid causing disease chytridiomycosis:** No indication of amphibian chytrid was noted on site.

- **Invasion of native plant communities by exotic perennial grasses:** As a small number of exotic perennial grasses were identified on site during the survey, it may be stated that this Key Threatening Process is already present on site. The proposed development may result in the further introduction of perennial grasses to the locality, however it is unlikely to be at a scale which would significantly affect any local population of this threatened species

- **Removal of dead wood and dead trees:** As the site contains an Open Forest assemblage with fallen deris noted, the proposal will result in the removal of dead wood and dead trees. However, with consideration given to the recommended retention of Open Forest habitat within a habitat corridor, it is unlikely to be at a scale which would significantly affect any local population of threatened species.

h) whether any threatened species, population or ecological community is at the limit of its known distribution.

Neither this species nor any population occurring in the local area is at the limit of its known standard distribution.

Bibliography:

Churchill, S. (1998). *Australian Bats*. Reed New Holland Publishers, Sydney, Australia.

NPWS Database (2000). *Fauna Species List for Protected Areas in NSW* at http://www.npws.gov.au/wildlife/species.htm

Parnaby, H. (1992). *An Interim Guide to Identification of Insectivorous Bats of South-eastern Australia*. Technical Reports of the Australian Museum, Sydney.

Richards, G.C. (1995). Large-footed Myotis (*Myotis adversus*) in Strahan, R. (ed) *The Mammals of Australia*, pp: 521-523. Reed Books, Australia.

37. *Scoteanax rueppellii* Greater Broad-nosed Bat

The Greater Broad-nosed Bat occurs only along the eastern coastal strip of Queensland and NSW where it is restricted to the coast and adjacent areas of the Great Dividing Range. In NSW it extends as far south as the Bega Plain. They are only found at low altitudes (below 500m).

This species apparently feeds on large moths and beetles, and some small vertebrates, emerging just after sundown, flying slowly and directly at a height of 3-6 metres, deviating only slightly to catch larger insects. It is also predatory on vertebrates including other bats, and is a noted carnivore on other captured bats in bat traps. *S. rueppellii* is known to hunt along tree-lined creeks, the junction of woodland and cleared paddocks, and low along rainforest creeks. It may have a preference for wet gullies in tall timber country.

The species roosts mainly in tree hollows but it has also been found in the roof spaces of old buildings. Little is known of the reproductive cycle, but it is suggested that the species follows the typical Vespertilionid pattern. What is known is that females congregate in maternity colonies and single young are born in January, slightly later than the other Vespertilionid bats that share its range. Males appear to be excluded from the colony during the birthing and rearing of the young.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

a) in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

No indication of this species' presence was noted on site during fieldwork. Potential hunting and roosting habitat for this species is present over the entire site. Given the high mobility of this species, the recommended retention of hollow bearing trees and the occurrence of large areas of similar habitat attributes adjacent to the site and within the region, it is considered that the proposal is unlikely to significantly affect the life cycle of this species or place any viable local population of this species at risk of extinction.

b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No population of this species on site has been identified under Schedule 1, Part 2 of the TSC Act 1995.

c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

No regionally significant area of known habitat is to be removed or modified as a result of the proposal, although the proposal may be view as contributing to the incremental decline of potential habitat within the region.

d) whether an area of known habitat is likely to be isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No areas of known habitat are likely to be isolated as a result of the proposal, particularly given the high mobility of the species.

e) whether critical habitat will be affected.

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act 1995.

f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

Records of this species in the region exist from the Dharug, Wyrrabalong and Yengo National Parks (NPWS Database, 2000). As such, it appears that this species is not adequately represented in conservation reserves in the region. The adequacy of representation of the habitat of this species in the region is difficult to ascertain, although it appears that any of a number of reserves containing forested areas could provide some protected habitat for this species. As such, it could be tentatively stated that the habitat of this species is well represented in conservation reserves in this region, although the majority of potential habitat remains 'unprotected'.

g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act have been listed in bold below followed by an assessment of the applicability of the threatened process in regards to the species, the site and the proposed development:

- **Clearing of Native Vegetation**: The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The clearing to accommodate the development may be viewed as contributing to the incremental decline of habitat in the local area, although it is recognised that this Key Threatening Process has already affected much of the site due to past colliery activities.. Accordingly, the development of this site is unlikely to be singularly responsible for the loss of any local population of this species provided that the recommendations regarding buffers and corridors are implemented.

- **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands**: Alteration to the natural flow regime is recognised as a major factor contributing to the loss of biological diversity and ecological function of aquatic ecosystems. The impacts of this 'Key Threatening Process' include the reduction of habitat, increased flows causing permanent flooding, riparian zone degradation, increased habitat for invasive species and loss or disruption of ecological function. It is recognised that the study area borders a SEPP 14 wetland as well as containing a drainage line which drains towards Moonee Beach to the east. Accordingly, a number of recommendations have been made through the report to ensure that any potential impacts are minimised. In regards to this species, it is considered that the level of threat associated with this 'Key Threatening Process' is low in this instance.

- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera***: Small areas of

Chrysanthemoides monilifera (Bitou Bush) were identified within the subject site and it may be stated that this 'Key Threatening Process' is already present on site. However, the level of this threat posed to microchiropteran bats would be negligible.

- **Predation by the European Red Fox *Vulpes vulpes*:** With the recording of at least one Fox during the survey period, it may stated that this 'Key Threatening Process' is already present on site and could pose a minimal threat to this species. However, the proposal is unlikely to result in increased numbers of this species within the locality.

- **Predation by the Feral Cat *Felis catus***: No Feral Cats were observed on site during the survey period although they are believed likely to occur within the locality. However, the proposal is unlikely to result in an increase in the number of Feral Cats.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: The site showed evidence of a past fire, although it is difficult to ascertain the disruption and structural change, if any, past fires have caused the site. The proposal is unlikely to result in any increase in frequency of fire events across the study area.

- **Competition from feral honeybees *Apis mellifera*:** No honey bees were observed on the site and it is not considered a 'Key Threatening Process' in this instance.

- **Bushrock Removal**: No bushrock was observed on the site and as this species does not rely on this habitat resource it is not considered a 'Key Threatening Process' for this species.

- **Predation by *Gambusia holbrooki* (Plague Minnow)**: No Plague Minnows were noted on site during the survey although they may occur within the locality. The proposed development is unlikely to result in the introduction of this species within the site nor is it likely to increase the numbers of this species within the locality. As the Plague Minnow does not prey upon microchiropteran bats, this Key Threatening Process does not apply in this instance.

- **Importation of Red Fire Ants *Solenopsis invicta***: This species is not known to occur on site.

- **Infection of native plants by *Phytophthora cinnamomi***: This infection is not known to occur on site.

- **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations**: No endangered Psittacine species were seen on site.

- **Loss and/or degradation of site used for hill-topping by butterflies**: Given that this species is not a form of butterfly, this ' Key Threatening Process' is not applicable.

- **Anthropogenic Climate Change**: No species living on site are considered likely to be significantly affected by anthropogenic climate change.

- **Competition and grazing by the feral European Rabbit *Oryctolagus cuniculus*:** Numerous Rabbits were identified on site during the survey period and it may therefore be stated that this 'Key Threatening Process' is already present on site. The proposal is unlikely to increase the numbers of Rabbits within the locality.

- **Infection of frogs by amphibian chytrid causing disease chytridiomycosis:** No indication of amphibian chytrid was noted on site.

- **Invasion of native plant communities by exotic perennial grasses:** As a small number of exotic perennial grasses were identified on site during the survey, it may be stated that this Key Threatening Process is already present on site. The proposed development may result in the further introduction of perennial grasses to the locality, however it is unlikely to be at a scale which would significantly affect any local population of this threatened species

- **Removal of dead wood and dead trees:** As the site contains an Open Forest assemblage with fallen deris noted, the proposal will result in the removal of dead wood and dead trees. However, with consideration given to the recommended retention of Open Forest habitat within a habitat corridor, it is unlikely to be at a scale which would significantly affect any local population of threatened species.

h) whether any threatened species, population or ecological community is at the limit of its known distribution.

Neither this species nor any population occurring in the local area is at the limit of its known standard distribution.

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APPENDIX B

FLORA SPECIES LIST

FLORA SPECIES LIST

The following list includes all species of vascular plants observed on site during fieldwork. It should be noted that such a list cannot be considered comprehensive, but rather indicative of the flora. It can take many years of flora surveys to record all of the plant species occurring within any area, especially plant species that are only apparent in some seasons such as orchids.

A number of species cannot always be accurately identified during a brief survey, generally due to a lack of suitable flowering and/or fruiting material. Any such species are identified as accurately as possible, and are indicated in the list thus:

* Specimens which could only be identified to genus level are indicated by the generic name followed by the abbreviation "sp.", indicating an unidentified species of that genus;

* Specimens for which identification of the genus was uncertain are indicated by a question mark ("?") placed in front of the generic, which is followed by the abbreviation "sp.";

* Specimens which could be accurately identified to genus level , but could be identified to species level with only a degree of certainty are indicated by a ("?") placed in front of the epithet.

Authorities for the scientific names are not provided in the list. These follow Harden (1991, 1992, 1993 and 2000). Names of families and higher taxa follow a modified Cronquist System (1981).

Introduced species are indicated by an asterisk ("*").

The following standard abbreviations are used to indicate subspecific taxa:

ssp. - subspecies
var.- variety
× - hybrid between the two indicated species

FAMILY *Scientific Name*	Common Name
CLASS FILICOPSIDA (FERNS)	
ADIANTACEAE *Adiantum aethiopicum*	Common Maidenhair Fern
DAVALLIACEAE **Nephrolepis cordifolia*	Fishbone Fern
DENNSTAEDTIACEAE *Pteridium esculentum*	Bracken
DICKSONIACEAE *Calochlaena dubia*	False Bracken Fern
GLEICHENIACEAE *Gleichenia deicarpa*	Pouched Coral Fern
LINDSAEACEAE *Lindsaea microphylla*	Lacy Wedge Fern
CLASS CYCADOPSIDA (CYCADS)	
ZAMIACEAE *Macrozamia communis*	Burrawang
CLASS MAGNOLIOPSIDA (FLOWERING PLANTS) SUBCLASS MAGNOLIIDAE (Dicotyledons)	
APIACEAE *Actinotus helianthi*	Flannel Flower
Centella asiatica	
**Hydrocotyle bonariensis*	Kurnell Curse
Xanthosia pilosa	Wooly Xanthosia
APOCYNACEAE *Parsonsia straminea* var.*straminea*	Monkey Rope
ARALIACEAE ?*Polyscias murrayi*	Pencil Cedar
ASCLEPIADACEAE **Gomphocarpus fruticosus*	Narrow-leaf Cotton Bush
ASTERACEAE **Ageratina adenophora*	Crofton Weed
**Bidens pilosa*	Cobbler's Pegs
Cassinia uncata	Bent Cassinia
**Chrysanthemoides monilifera* ssp. *rotundata*	Bitou Bush

**Cirsium vulgare*	Spear Thistle
**Conyza albida*	Tall Fleabane
**Conyza bonariensis*	Flaxleaf Fleabane
Gnaphalium sp.	Cudweed
**Hypochoeris radicata*	Cat's Ear
**Senecio madagascariensis*	Fireweed
**Taraxacum officinale*	Dandelion
BASELLACEAE	
Anredera cordifolia	Madeira Vine
BIGNONIACEAE	
Pandorea pandorana	Wonga Vine
CASSYTHACEAE	
Cassytha glabella	Slender Devil's Twine
CASUARINACEAE	
Allocasuarine distyla	
Allocasuarina littoralis	Black She-oak
Allocasuarina torulosa	Forest Oak
CELASTRACEAE	
Maytenus silvestris	
COMMELINACEAE	
Commelina cyanea	Creeping Christian
CONVOLVULACEAE	
Calystegia marginata	
Dichondra repens	Kidney Weed
Polymeria calycina	Swamp Bindweed
DILLENIACEAE	
Hibbertia sp.	
Hibbertia aspera	Rough Guinea Flower
Hibbertia linearis	Showy Guinea Flower
ELAEOCARPACEAE	
Elaeocarpus reticulatus	Blueberry Ash
EPACRIDACEAE	
Epacris longifolia	Native Fuschia
Leucopogon juniperinus	Bearded Heath
Leucopogon lanceolatus	Lance Beard Heath
Monotoca elliptica	Tree Broom-heath
Styphelia triflora	
Woollsia pungens	Snow Wreath
EUPHORBIACEAE	
Breynia oblongifolia	Breynia
Glochidion ferdinandi	Cheese Tree

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FABACEAE	
Bossiaea rhombifolia	
Bossiaea scolopendria	
Daviesia acicularis	
Daviesia alata	
Daviesia ulicifolia	
Desmodium varians	
Desmodium rhytidophyllum	
Dillwynia retorta ssp. *retorta*	Heathy Parrot Pea
Dillwynia retorta ssp. *trichopoda*	
Glycine clandestina	Love Creeper
Glycine microphylla	Love Creeper
Glycine tabacina	Love Creeper
Hardenbergia violacea	False Sarsaparilla
Hovea purpurea	
Kennedia rubicunda	Dusky Coral Pea
Mirbelia speciosa	Purple Mirbelia
Oxylobium ilicifolium	Native Holly
Phyllota phylicoides	
Platylobium formosum ssp. *formosum*	Handsome Flat Pea
Pultenaea daphnoides	
Pultenaea villosa	
Senna sp.	
GENTIANACEAE	
**Centaurium erythraea*	Common Centaury
GOODENIACEAE	
Goodenia heterophylla	Variable-leaved Goodenia
Dampiera stricta	
Scaevola ramosissima	Snake Flower
GROSSULARIACEAE	
Quintinia seeberi	Rough Possumwood
HALORAGACEAE	
Gonocarpus teucrioides	Germander Raspwort
LOBELIACEAE	
Pratia purpurascens	White Root
LORANTHACEAE	
Muellerina celastroides	
MELIACEAE	
Synoum glandulosum	Scentless Rosewood
MENISPERMACEAE	
Sarcopetalum harveyanum	Pearl Vine
Stephania japonica var. *discolor*	Snake Vine
MIMOSACEAE	

Acacia binervia	
Acacia buxifolia	
Acacia elata	
Acacia elongata	
Acacia falcata	
Acacia falciformis	Broad-leaved Hickory
Acacia linifolia	Flax-leafed Wattle
Acacia longifolia	
Acacia myrtifolia	Myrtle Wattle
Acacia suaveolens	Sweet-scented Wattle
Acacia terminalis	Sunshine Wattle
Acacia ulicifolia	Prickly Moses
MYRSINACEAE	
Rapanea variabilis	Muttonwood
MYRTACEAE	
Angophora costata	Smooth-barked Apple
Callistemon salignus	Willow Bottlebrush
Calytrix tretagona	
Corymbia gummifera	Red Bloodwood
Corymbia maculata	Spotted Gum
Eucalyptus acmenoides	White Mahogany
Eucalyptus botryoides	Bangalay
Eucalyptus capitellata	Brown Stringybark
Eucalyptus fibrosa ssp. *fibrosa*	Broad-leaved Ironbark
Eucalyptus haemastoma	Scribbly Gum
Eucalyptus piperita	Sydney Peppermint
Eucalyptus punctata	Grey Gum
Eucalyptus robusta	Swamp Mahogany
Kunzea ericoides	Tick Bush
Leptospermum laevigatum	Coastal Tea-Tree
Leptospermum polygalifolium	Lemon-scented Tea-Tree
Melaleuca armillaris	Giant Honeymyrtle
Melaleuca lineariifolia	Snow-in-summer
Melaleuca nesophilia	
Melaleuca quinquenervia	Broad-leafed Paperbark
Melaleuca thymifolia	
Syncarpia glomulifera	Turpentine
OLEACEAE	
**Ligustrum sinense*	Privett
Notelaea ovata	Mock Olive
OXALIDACEAE	
Oxalis sp.	
PITTOSPORACEAE	
Billardiera scandens	Apple Berry
Pittosporum undulatum	Sweet Pittosporum
PLANTAGINACEAE	
**Plantago lanceolata*	Ribwort / Lamb's Tongues

POLYGALACEAE	
Comesperma defoliatum	Fairies' Wings
Comesperna ericinum	Matchheads
PRIMULACEAE	
**Anagallis arvensis*	Scarlet Pimpernel
PROTEACEAE	
Banksia aemula	
Banksia ericifolia	
Banksia integrifolia	Coastal Banksia
Banksia marginata	Silver Banksia
Banksia serrata	Old Man Banksia
Banksia spinulosa	Hair-pin Banksia
Grevillea sericea	Pink Spider Flower
Hakea teretifolia	Dagger Hakea
Isopogon anemonifolius	Drumsticks
Lambertia formosa	Mountain Devils
Persoonia levis	Smooth Geebung
Persoonia linearis	Narrow-leaved Geebung
Petrophile pulchella	Cone-sticks
RANUNCULACEAE	
Clematis aristata	Old Man's Beard
RHAMNACEAE	
Pomaderris ferruginea	Rusty Pomaderris
ROSACEAE	
Rubus parvifolius	Native Rasberry
**Rubus ulmifolius*	Blackberry
RUBIACEAE	
Pomax umbellata	Pomax
RUTACEAE	
Boronia polygalifolia	Milkwort Boronia
**Citrus* sp.	
Correa reflexa var. *reflexa*	
SANTALACEAE	
Exocarpus cupressiformis	Cherry Ballart
SAPINDACEAE	
Diploglottis australis	Native Tamarind
Dodonaea triquetra	Common Hop Bush
SOLANACEAE	
Duboisia myoporoides	Corkwood
STERCULIACEAE	
Lasiopetalum ferrugineum var. *ferrugineum*	Rusty Petals
STYLIDIACEAE	
Stylidium graminifolium	Trigger Plant

SYMPLOCACEAE	
Symplocos thwaitesii	Buff Hazelwood
THYMELAEACEAE	
Pimelea linifolia ssp. *linifolia*	Rice Flower
TREMANDRACEAE	
Tetratheca juncea	Black-eyed Susan
VERBENACEAE	
**Lantana camara*	Lantana
**Verbena bonariensis*	Purple Top
VIOLACEAE	
Viola hederacea	Native Violet
SUBCLASS LILIIDAE (Monocotyledons)	
ALISMATACEAE	
Alisma plantago-aquatica	Water Plantain
COMMELINACEAE	
Commelina cyanea	Scurvy Weed
CYPERACEAE	
Cyperus polstachyos	
Gahnia aspera	
Gahnia clarkei	
Gahnia sieberana	
Lepidosperma laterale	
Lepidosperma viscidum	
Ptilothrix deusta	
Schoenus melanostachys	
HAEMODORACEAE	
Haemodorum planifolium	Blood Root
IRIDACEAE	
Patersonia sericea	Silky Purple Flag
Watsonia bulbillifera	Bugle Lily
JUNCACEAE	
**Juncus cognatus*	
Juncus subsecundus	Finger Rush
LILIACEAE	
Dianella caerulea var. *caerulea*	Blue Flax Lily
Thysanotus tuberosus	Fringe Lily
LUZURIAGACEAE	
Geitonoplesium cymosum	Scrambling Lily
ORCHIDACEAE	
Cryptostylis subulata	Large Tongue Orchid
Dipodium variegatum	

POACEAE	
**Andropogon virginicus*	Whisky Grass
Anisopogon avenaceus	Oat Speargrass
Aristida vagans	Three-awn Speargrass
**Briza maxima*	Quaking Grass
**Briza minor*	Shivery Grass
**Chloris gayana*	Rhodes Grass
**Chloris truncata*	Windmill Grass
Cynodon dactylon	Common Couch
Danthonia linkii var. *fulva*	
Danthonia tenuior	
Dichelachne micrantha	Plume Grass
Echinopogon caespitosus var. *caespitosus*	Tufted Hedgehog Grass
Entolasia stricta	
Imperata cylindrica var. *major*	Blady Grass
Microlaena stipoides	Weeping Grass
Panicum simile	Two Colour Panic
**Paspalum dilatatum*	Paspalum
Phragmites australis	Native Reed
Poa sp.	
Stipa sp.	
Themeda triandra	Kangaroo Grass
POTAMOGETONACEAE	
Potamogeton pectinatus	Fennel Pondweed
SMILACACEAE	
Smilax australis	Smilax
Smilax glyciphylla	Native Sarsaparilla
XANTHORRHOEACEAE	
Lomandra longifolia	Spiny Mat Rush
Lomandra multiflora	
Lomandra obliqua	Fish Bones
Xanthorrhoea media	Grass Tree

APPENDIX C

VEGETATION TRANSECT & PLOT DATA

C1.0 TRANSECT METHODOLOGY

Six walking transects were undertaken within the bounds of the site to provide detail on the floral assemblages occurring therein. The location of the transects is shown in Figure C1.

C1.1 TRANSECT 1

*Community – Open Forest

*Length – 200m

*Slope – 5 - 10°

*Species Recorded –

Banksia spinulosa	Hair-pin Banksia
Billardiera scandens	Apple Berry
Themeda triandra	Kangaroo Grass
Patersonia sericea	Silky Purple Flag
Xanthorrhoea media	Grass Tree
Lepidosperma laterale	
Angophora costata	Smooth-barked Apple
Lomandra obliqua	Fish Bones
Pultenaea daphnoides	
Eucalyptus capitellata	Brown Stringybark
Banksia serrata	Old Man Banksia
Corymbia gummifera	Red Bloodwood
Entolasia stricta	
Imperata cylindrica var. *major*	Blady Grass
Cryptostylis subulata	Large Tongue Orchid
**Chrysanthemoides monilifera* ssp. *rotundata*	Bitou Bush
Pimelea linifolia ssp. *linifolia*	Rice Flower
Pultenaea villosa	
Calochlaena dubia	False Bracken Fern
Pratia purpurascens	White Root
Macrozamia communis	Burrawang
Dianella caerulea var. *caerulea*	Blue Flax Lily
Oxylobium ilicifolium	Native Holly
Acacia longifolia	
Breynia oblongifolia	Breynia
Centella asiatica	
Glycine tabacina	Love Creeper
Acacia myrtifolia	Myrtle Wattle
Panicum simile	Two Colour Panic
Pteridium esculentum	Bracken
Lomandra longifolia	Spiny Mat Rush
Eucalyptus piperata	Sydney Peppermint
Kennedia rubicunda	Dusky Coral Pea
Echinopogon caespitosus var. *caespitosus*	Tufted Hedgehog Grass
Gahnia aspera	
Acacia terminalis	Sunshine Wattle
Geitonoplesium cymosum	Scrambling Lily
Cassytha glabella	Slender Devil's Twine
Dodonaea triquetra	Common Hop Bush
Smilax australis	Smilax

WILDTHING
Environmental Consultants
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Vegetation Plots
Vegetation Transects
Site Boundary

N

0 100 200 300 400 500
Scale (m)

Figure C1: Location of Vegetation Plots and Transects

Gahnia clarkei	
Adiantum aethiopicum	Common Maidenhair Fern
Rubus parvifolius	Native Rasberry
Exocarpus cupressiformis	Cherry Ballart
Potamogeton pectinatus	Fennel Pondweed
Phragmites australis	Native Reed
Alisma plantago-aquatica	Water Plantain
Isopogon anemonifolius	Drumsticks
Lepidosperma viscidum	
Synoum glandulosum	Scentless Rosewood
Acacia buxifolia	
Glochidion ferdinandi	Cheese Tree
Rapanea variabilis	Muttonwood
Dichelachne micrantha	Plume Grass
Microlaena stipoides	Weeping Grass
Glycine microphylla	Love Creeper
Lomandra obliqua	Fish Bones
Polymeria calycina	Swamp Bindweed
Woollsia pungens	Snow Wreath
Pimelea linifolia ssp. *linifolia*	Rice Flower
Leptospermum polygalifolium	Lemon-scented Tea-Tree
Dampiera stricta	
Lepidosperma viscidum	
Danthonia linkii var. *fulva*	
Styphelia triflora	
Kunzea ericoides	Tick Bush
Quintinia seeberi	Rough Possumwood
Anredera cordifolia	Madeira Vine
Banksia integrifolia	Coastal Banksia
Dipodium variegatum	

C1.2 TRANSECT 2

*Community – Regenerating Open Forest

*Length – 200m

*Slope – 0 - 5°

*Species Recorded –

**Chrysanthemoides monilifera* ssp. *rotundata*	Bitou Bush
Pteridium esculentum	Bracken
**Briza maxima*	Quaking Grass
**Plantago lanceolata*	Ribwort / Lamb's Tongues
Corymbia maculata	Spotted Gum
Angophora costata	Smooth-barked Apple
**Ageratina adenophora*	Crofton Weed
**Anagallis arvensis*	Scarlet Pimpernel
**Andropogon virginicus*	Whisky Grass
Centella asiatica	
Persoonia levis	Smooth Geebung
**Rubus ulmifolius*	Blackberry
Lomandra longifolia	Spiny Mat Rush
**Lantana camara*	Lantana

Rubus parvifolius	Native Rasberry
**Verbena bonariensis*	Purple Top
**Bidens pilosa*	Cobbler's Pegs
Corymbia gummifera	Red Bloodwood
**Centaurium erythraea*	Common Centaury
**Cirsium vulgare*	Spear Thistle
**Briza minor*	Shivery Grass
Cynodon dactylon	Common Couch
Exocarpus cupressiformis	Cherry Ballart
Cassytha glabella	Slender Devil's Twine
Eucalyptus botryoides	Bangalay
Panicum simile	Two Colour Panic
Themeda triandra	Kangaroo Grass
Acacia elata	
Allocasuarina distyla	
Allocasuarina littoralis	Black She-oak
Cyperus polstachyos	
Juncus subsecundus	Finger Rush
Melaleuca armillaris	Giant Honeymyrtle
Watsonia bulbillifera	Bugle Lily
Gnaphalium sp.	Cudweed
Senna sp.	
Watsonia bulbillifera	Bugle Lily

C1.3 TRANSECT 3

*Community –Open Forest

*Length – 200m

*Slope – <5°

*Species Recorded –

**Chrysanthemoides monilifera* ssp. *rotundata*	Bitou Bush
**Hypochoeris radicata*	Cat's Ear
Allocasuarina littoralis	Black She-oak
Angophora costata	Smooth-barked Apple
Gahnia aspera	
Xanthorrhoea media	Grass Tree
Imperata cylindrica var. *major*	Blady Grass
Dianella caerulea var. *caerulea*	Blue Flax Lily
Gahnia clarkei	
Entolasia stricta	
Smilax australis	Smilax
Pteridium esculentum	Bracken
Themeda triandra	Kangaroo Grass
Clematis aristata	Old Man's Beard
Calochlaena dubia	False Bracken Fern
Lomandra obliqua	Fish Bones
Banksia marginata	Silver Banksia
Lambertia formosa	Mountain Devils
Adiantum aethiopicum	Common Maidenhair Fern
**Lantana camara*	Lantana
Stephania japonica var. *discolor*	Snake Vine
Banksia serrata	Old Man Banksia

Leptospermum polygalifolium	Lemon-scented Tea-Tree
Acacia longifolia	
Thysanotus tuberosus	Fringe Lily
Banksia spinulosa	Hair-pin Banksia
**Verbena bonariensis*	Purple Top
**Plantago lanceolata*	Ribwort / Lamb's Tongues
**Anagallis arvensis*	Scarlet Pimpernel
**Senecio madagascariensis*	Fireweed
Acacia terminalis	Sunshine Wattle
Cynodon dactylon	Common Couch
**Conyza bonariensis*	Flaxleaf Fleabane
**Centaurium erythraea*	Common Centaury
**Andropogon virginicus*	Whisky Grass
Breynia oblongifolia	Breynia
Acacia falciformis	Broad-leaved Hickory
Pultenaea villosa	
Exocarpus cupressiformis	Cherry Ballart
Hibbertia linearis	Showy Guinea Flower
Pimelea linifolia ssp. *linifolia*	Rice Flower
Acacia elongata	
Isopogon anemonifolius	Drumsticks
Woollsia pungens	Snow Wreath
Synoum glandulosum	Scentless Rosewood
Persoonia levis	Smooth Geebung
Allocasuarina distyla	
Lepidosperma viscidum	
Dillwynia retorta ssp. *trichopoda*	
Callistemon salignus	Willow Bottlebrush
Lasiopetalum ferrugineum var. *ferrugineum*	Rusty Petals
Isopogon anemonifolius	Drumsticks
Melaleuca armillaris	Giant Honeymyrtle
Comesperma defoliatum	Fairies' Wings
Eucalyptus robusta	Swamp Mahogany
Glochidion ferdinandi	Cheese Tree
Pandorea pandorana	Wonga Vine
Symplocos thwaitesii	Buff Hazelwood
Leucopogon juniperinus	Bearded Heath
Schoenus melanostachys	
**Ligustrum sinense*	Privett
Dodonaea triquetra	Common Hop Bush
Melaleuca lineariifolia	Snow-in-summer
Stipa sp.	
Phyllota phylicoides	
Anisopogon avenaceus	Oat Speargrass

C1.4 TRANSECT 4

*Community –Open Forest and Heath

*Length – 200m

*Slope – 0 - 10°

*Species Recorded –

Angophora costata	Smooth-barked Apple

Eucalyptus piperata	Sydney Peppermint
Corymbia gummifera	Red Bloodwood
**Chrysanthemoides monilifera* ssp. *rotundata*	Bitou Bush
Themeda triandra	Kangaroo Grass
Imperata cylindrica var. *major*	Blady Grass
Pultenaea villosa	
Entolasia stricta	
Xanthorrhoea media	Grass Tree
Panicum simile	Two Colour Panic
Oxylobium ilicifolium	Native Holly
Pultenaea daphnoides	
Macrozamia communis	Burrawang
Eucalyptus capitellata	Brown Stringybark
Lepidosperma laterale	
Dianella caerulea var. *caerulea*	Blue Flax Lily
Allocasuarina littoralis	Black She-oak
Lomandra obliqua	Fish Bones
Banksia aemula	
Leucopogon lanceolatus	Lance Beard Heath
Centella asiatica	
Eucalyptus fibrosa ssp. *fibrosa*	Broad-leaved Ironbark
Dodonaea triquetra	Common Hop Bush
Pimelea linifolia ssp. *linifolia*	Rice Flower
Pratia purpurascens	White Root
Tetratheca juncea	Black-eyed Susan
Glycine tabacina	Love Creeper
Daviesia ulicifolia	
Hardenbergia violacea	False Sarsaparilla
Cassytha glabella	Slender Devil's Twine
Styphelia triflora	
Breynia oblongifolia	Breynia
Geitonoplesium cymosum	Scrambling Lily
Calochlaena dubia	False Bracken Fern
Echinopogon caespitosus var. *caespitosus*	Tufted Hedgehog Grass
Banksia spinulosa	Hair-pin Banksia
Hibbertia aspera	Rough Guinea Flower
Allocasuarina distyla	
Leptospermum laevigatum	Coastal Tea-Tree
Leptospermum polygalifolium	Lemon-scented Tea-Tree
Eucalyptus haemastoma	Scribbly Gum
Acacia suaveolens	Sweet-scented Wattle
Scaevola ramosissima	Snake Flower
Boronia polygalifolia	Milkwort Boronia
Goodenia heterophylla	Variable-leaved Goodenia
Comesperna ericinum	Matchheads
Haemodorum planifolium	Blood Root
Calystegia marginata	
**Andropogon virginicus*	Whisky Grass
Lambertia formosa	Mountain Devils
Petrophile pulchella	Cone-sticks
Pomaderris ferruginea	Rusty Pomaderris
Dillwynia retorta ssp. *retorta*	Heathy Parrot Pea
Banksia serrata	Old Man Banksia
Dampiera stricta	
Persoonia levis	Smooth Geebung

Acacia longifolia	
Daviesia alata	
Hovea purpurea	
Grevillea sericea	Pink Spider Flower
Gonocarpus teucrioides	Germander Raspwort
Daviesia ulicifolia	
Poa sp.	
Danthonia linkii var. *fulva*	
Lepidosperma laterale	
Hakea teretifolia	Dagger Hakea
Hibbertia aspera	Rough Guinea Flower
Monotoca elliptica	Tree Broom-heath
Lepidosperma laterale	
Acacia linifolia	Flax-leafed Wattle
Calytrix tretagona	

C1.5 TRANSECT 5

*Community – Open Forest

*Length – 200m

*Slope – 5-10°

*Species Recorded –

Xanthorrhoea media	Grass Tree
Dodonaea triquetra	Common Hop Bush
Themeda triandra	Kangaroo Grass
**Chrysanthemoides monilifera* ssp. *rotundata*	Bitou Bush
Corymbia gummifera	Red Bloodwood
Eucalyptus capitellata	Brown Stringybark
Angophora costata	Smooth-barked Apple
Pultenaea villosa	
Macrozamia communis	Burrawang
Geitonoplesium cymosum	Scrambling Lily
Panicum simile	Two Colour Panic
Acacia longifolia	
Entolasia stricta	
Acacia terminalis	Sunshine Wattle
Glycine clandestina	Love Creeper
Dianella caerulea var. *caerulea*	Blue Flax Lily
Pratia purpurascens	White Root
Lomandra longifolia	Spiny Mat Rush
Hardenbergia violacea	False Sarsaparilla
Oxylobium ilicifolium	Native Holly
Eucalyptus punctata	Grey Gum
Pteridium esculentum	Bracken
Calochlaena dubia	False Bracken Fern
Persoonia levis	Smooth Geebung
Cryptostylis subulata	Large Tongue Orchid
Allocasuarina littoralis	Black She-oak
Echinopogon caespitosus var. *caespitosus*	Tufted Hedgehog Grass
Centella asiatica	
Imperata cylindrica var. *major*	Blady Grass
Pultenaea daphnoides	

Goodenia heterophylla	Variable-leaved Goodenia
**Hypochoeris radicata*	Cat's Ear
**Lantana camara*	Lantana
Cassytha glabella	Slender Devil's Twine
Gahnia aspera	
Breynia oblongifolia	Breynia
**Andropogon virginicus*	Whisky Grass
**Ageratina adenophora*	Crofton Weed
Banksia marginata	Silver Banksia
Lomandra obliqua	Fish Bones
Glycine clandestina	Love Creeper
Glycine microphylla	Love Creeper
Melaleuca thymifolia	
Kennedia rubicunda	Dusky Coral Pea
Gahnia sieberana	
Lepidosperma laterale	
Desmodium varians	
Acacia falcata	
Acacia linifolia	Flax-leafed Wattle
Danthonia linkii var. *fulva*	
Dichelachne micrantha	Plume Grass
Desmodium rhytidophyllum	
Eucalyptus acmenoides	White Mahogany
Gonocarpus teucrioides	Germander Raspwort
Persoonia levis	Smooth Geebung
**Conyza albida*	Tall Fleabane
**Chloris truncata*	Windmill Grass
Dipodium variegatum	
Persoonia linearis	Narrow-leaved Geebung

C1.6 TRANSECT 6

*Community – Open Forest

*Length – 200m

*Slope – 0 - 5° SE

*Species Recorded –

Leptospermum laevigatum	Coastal Tea-Tree
**Plantago lanceolata*	Ribwort / Lamb's Tongues
**Centaurium erythraea*	Common Centaury
**Verbena bonariensis*	Purple Top
**Chrysanthemoides monilifera* ssp. *rotundata*	Bitou Bush
Acacia longifolia	
**Andropogon virginicus*	Whisky Grass
**Paspalum dilatatum*	Paspalum
**Lantana camara*	Lantana
Rubus parvifolius	Native Rasberry
Billardiera scandens	Apple Berry
Pratia purpurascens	White Root
Cassytha glabella	Slender Devil's Twine
Entolasia stricta	
**Conyza bonariensis*	Flaxleaf Fleabane
**Taraxacum officinale*	Dandelion
Centella asiatica	

Themeda triandra	Kangaroo Grass
Banksia serrata	Old Man Banksia
Angophora costata	Smooth-barked Apple
Oxylobium ilicifolium	Native Holly
Lambertia formosa	Mountain Devils
Pultenaea villosa	
Dodonaea triquetra	Common Hop Bush
Persoonia levis	Smooth Geebung
Banksia integrifolia	Coastal Banksia
Glochidion ferdinandi	Cheese Tree
Allocasuarina littoralis	Black She-oak
Lomandra longifolia	Spiny Mat Rush
Lindsaea microphylla	Lacy Wedge Fern
**Rubus ulmifolius*	Blackberry
Epacris longifolia	Native Fuschia
Melaleuca nesophilia	
Acacia binervia	
Acacia elongata	
Billardiera scandens	Apple Berry

C2.0 PLOT METHODOLOGY

Six plot-based vegetation surveys were undertaken within the bounds of the site to provide additional detail on the flora assemblages present (Figure C1). These plot were 20 × 20m in area. All species observed within the plot was recorded, with the dominant species in each stratum being duly noted.

C2.1 PLOT 1

*Community – Woodland
*Slope – 10°
*Aspect – South east
*Soil Texture – Sandy

*Structural Components –

Upper Stratum	(to 10m)	%coverage = 60%
Lower Stratum	(N/A)	
Shrub Layer	(to 2m)	%coverage = 10%
Ground Cover	(to 1m)	%coverage = 80%

*Species Recorded –

Upper Stratum Dominants

Angophora costata	Smooth-barked Apple
Corymbia gummifera	Red Bloodwood

Shrub Layer Dominants

Juvenile dominants	
Macrozamia communis	Burrawang
Banksia integrifolia	Coastal Banksia

Ground Cover Dominants

Themeda triandra	Kangaroo Grass
Pimelea linifolia ssp. *linifolia*	Rice Flower
Imperata cylindrica var. *major*	Blady Grass
Lomandra obliqua	Fish Bones

Additional Species	*Pratia purpurascens*	White Root
	Pultenaea daphnoides	
	Lambertia formosa	Mountain Devils
	Xanthorrhoea media	Grass Tree
	**Chrysanthemoides monilifera* ssp. *rotundata*	Bitou Bush
	Kennedia rubicunda	Dusky Coral Pea
	Pteridium esculentum	Bracken
	Panicum simile	Two Colour Panic
	**Juncus cognatus*	
	Leptospermum polygalifolium	Lemon-scented Tea-Tree

2.2 PLOT 2

*Community – Open Forest
*Slope – 0°
*Soil Texture – Sandy /Loam

*Structural Components –

Upper Stratum	(to 20m)	%coverage = 40%
Lower Stratum	(to 8m)	%coverage = 20%
Shrub Layer	(to 2m)	%coverage = 60%
Ground Cover	(to 1m)	%coverage = 80%

* Species Recorded -

Upper Stratum Dominants		
	Eucalyptus robusta	Swamp Mahogany
Lower Stratum Dominants		
	Melaleuca linearifolia	Snow-in-summer
	Diploglottis australis	Native Tamarind
Shrub Layer Dominants		
	**Chrysanthemoides monilifera* ssp. *rotundata*	Bitou Bush
	Gahnia aspera	
	Dodonaea triquetra	Common Hop Bush
Ground Cover Dominants		
	Adiantum aethiopicum	Common Maidenhair Fern
	Imperata cylindrica var. *major*	Blady Grass
	Lomandra longifolia	Spiny Mat Rush
	Centella asiatica	
Additional Species	*Breynia oblongifolia*	Breynia
	Rubus parvifolius	Native Rasberry
	Dianella caerulea var. *caerulea*	Blue Flax Lily
	Commelina cyanea	Creeping Christian
	Geitonoplesium cymosum	Scrambling Lily
	Pteridium esculentum	Bracken
	Pandorea pandorana	Wonga Vine

C2.3 PLOT 3

*Community – Heath
*Slope – 10°
*Aspect - Southerly
*Soil Texture – Sandy / Loam

*Structural Components –

Upper Stratum	(N/A)	
Lower Stratum	(to 8m)	%coverage = 10%

Shrub Layer	(to 2m)	%coverage = 40%
Ground Cover	(to 1m)	%coverage = 90%

*Species Recorded –

Lower Stratum Dominants

Angophora costata	Smooth-barked Apple
Eucalyptus piperata	Sydney Peppermint
Allocasuarina littoralis	Black She-oak

Shrub Layer Dominants

Lambertia formosa	Mountain Devils
Banksia aemula	
Banksia spinulosa	Hair-pin Banksia
Grevillea sericea	Pink Spider Flower
Dodonaea triquetra	Common Hop Bush

Ground Cover Dominants

Tetratheca juncea	Black-eyed Susan
Themeda triandra	Kangaroo Grass
Pimelea linifolia ssp. *linifolia*	Rice Flower
Epacris longifolia	Native Fuschia

Additional Species

Xanthorrhoea media	Grass Tree
Hibbertia aspera	Rough Guinea Flower
Haemodorum planifolium	Blood Root
Mirbelia speciosa	Purple Mirbelia
Acacia myrtifolia	Myrtle Wattle
Woollsia pungens	Snow Wreath
Danthonia linkii var. *fulva*	

C2.4 PLOT 4

*Community – Open Forest
*Slope – 0-5^{o}
*Aspect - Notherly
*Soil Texture – Sandy Loam

*Structural Components –

Upper Stratum	(to 20m)	%coverage = 20%
Lower Stratum	(to 8m)	%coverage = 60%
Shrub Layer	(to 2m)	%coverage = 10%
Ground Cover	(to 1m)	%coverage = 85%

*Species Recorded –

Upper Stratum Dominants

Eucalyptus punctata	Grey Gum
Eucalyptus robusta	Swamp Mahogany

Lower Stratum Dominants

Allocasuarina littoralis	Black She-oak
Glochidion ferdinandi	Cheese Tree

Shrub Layer Dominants

Persoonia levis	Smooth Geebung
Gahnia clarkei	
Dodonaea triquetra	Common Hop Bush

Ground Cover Dominants

Themeda triandra	Kangaroo Grass
Entolasia stricta	
Lomandra longifolia	Spiny Mat Rush
Pratia purpurascens	White Root

Additional Species

Pimelea linifolia ssp. *linifolia*	Rice Flower
Lepidosperma laterale	
Leptospermum polygalifolium	Lemon-scented Tea-Tree
**Chrysanthemoides monilifera* ssp. *rotundata*	Bitou Bush
Pultenaea villosa	
Lomandra multiflora	
Pultenaea daphnoides	

C2.5 PLOT 5

*Community – Open Forest
*Slope – 0 – 5^{o}
*Aspect – Southeast
*Soil Texture – Sandy Loam

*Structural Components –

Upper Stratum	(to 20m)	%coverage = 80%
Lower Stratum	(to 5m)	%coverage = 20%
Shrub Layer	(to 2m)	%coverage = 70%
Ground Cover	(to 1m)	%coverage = 30%

*Species Recorded –

Upper Stratum Dominants

Angophora costata	Smooth-barked Apple

Lower Stratum Dominants

Synoum glandulosum	Scentless Rosewood
Allocasuarina littoralis	Black She-oak

Shrub Layer Dominants

**Chrysanthemoides monilifera* ssp. *rotundata*	Bitou Bush
Pteridium esculentum	Bracken
Calochlaena dubia	False Bracken Fern
Macrozamia communis	Burrawang

Ground Cover Dominants

Imperata cylindrica var. *major*	Blady Grass
Entolasia stricta	
Centella asiatica	
Pratia purpurascens	White Root

Additional Species

**Lantana camara*	Lantana
Lambertia formosa	Mountain Devils
Gahnia clarkei	
Banksia serrata	Old Man Banksia
Banksia integrifolia	Coastal Banksia
Smilax australis	Smilax
Xanthorrhoea media	Grass Tree
Oxylobium ilicifolium	Native Holly
Smilax glyciphylla	Native Sarsaparilla
Sarcopetalum harveyanum	Pearl Vine
Viola hederacea	Native Violet
Gonocarpus teucrioides	Germander Raspwort
Clematis aristata	Old Man's Beard
Macrozamia communis	Burrawang
Notelaea ovata	Mock Olive
Glochidion ferdinandi	Cheese Tree
Correa reflexa var. *reflexa*	
Duboisia myoporoides	Corkwood
?*Polyscias murrayi*	Pencil Cedar

C2.6 PLOT 6

*Community – Open Forest
*Slope – 0 – 5^{o}
*Aspect - South
*Soil Texture – Sandy

*Structural Components –

Upper Stratum	(to 15m)	%coverage = 70%
Lower Stratum	(to 8m)	%coverage = 5%
Shrub Layer	(to 2m)	%coverage = 50%
Ground Cover	(to 1m)	%coverage = 30%

*Species Recorded –

Upper Stratum Dominants

Allocasuarina littoralis	Black She-oak
Leptospermum laevigatum	Coastal Tea-Tree

Lower Stratum Dominants

Juvenile Dominants

Shrub Layer Dominants

**Chrysanthemoides monilifera* ssp. *rotundata*	Bitou Bush

	**Lantana camara*	Lantana
	Isopogon anemonifolius	Drumsticks

Ground Cover Dominants

	Pteridium esculentum	Bracken
	Breynia oblongifolia	Breynia
	Lomandra obliqua	Fish Bones
	Lomandra longifolia	Spiny Mat Rush
	Centella asiatica	

Additional Species	*Calochlaena dubia*	False Bracken Fern
	Imperata cylindrica var. *major*	Blady Grass
	Cassytha glabella	Slender Devil's Twine
	Gonocarpus teucrioides	Germander Raspwort
	Monotoca elliptica	Tree Broom-heath
	Muellerina celastroides	

C2.7 PLOT 7

*Community – Heath
*Slope – 5 - 10
*Aspect - Easterly
*Soil Texture – Sandy

*Structural Components –

Upper Stratum	(N/A)	
Lower Stratum	(to 8m)	%coverage = 5%
Shrub Layer	(to 2m)	%coverage = 80%
Ground Cover	(to 1m)	%coverage = 40%

*Species Recorded –

Lower Stratum Dominants

	Melaleuca armillaris	Giant Honeymyrtle

Shrub Layer Dominants

	Leptospermum laevigatum	Coastal Tea-Tree
	Xanthorrhoea media	Grass Tree
	Lambertia formosa	Mountain Devils
	Isopogon anemonifolius	Drumsticks
	Petrophile pulchella	Cone-sticks
	Banksia serrata	Old Man Banksia

Ground Cover Dominants

	Lomandra multiflora	
	Dampiera stricta	

Additional Species	*Allocasuarina distyla*	
	Goodenia heterophylla	Variable-leaved Goodenia
	Billardiera scandens	Apple Berry
	Calytrix tretagona	

Persoonia levis	Smooth Geebung
Lepidosperma laterale	
Banksia integrifolia	Coastal Banksia
Bossiaea scolopendria	
Corymbia gummifera	Red Bloodwood
Leptospermum polygalifolium	Lemon-scented Tea-Tree
Monotoca elliptica	Tree Broom-heath
Dillwynia retorta ssp. *trichopoda*	
Pomaderris ferruginea	Rusty Pomaderris
Acacia longifolia	
Phyllota phylicoides	
Anisopogon avenaceus	Oat Speargrass

APPENDIX D

EXPECTED FAUNA SPECIES LIST

EXPECTED FAUNA SPECIES LIST

Family sequencing and taxonomy follow for each fauna class:

Birds - Pizzey and Knight (1997).

Herpetofauna - Cogger (1996), Ehmann (Ed) (1997) and Barker, Grigg and Tyler (1995).

Mammals - Strahan (Ed) (1995) and Churchill (1998).

- Species observed or indicated by scats, tracks etc. on site during this investigation or previous surveys.

(?) - Indicates a species identified without certainty or to a Genus level only.

* - Indicates an introduced species.

o - Indicates waterbird species observed flying over the site and not likely to utilise the site

Threatened species addressed within this assessment appear in **bold** font.

BIRDS

Family Phasianidae - True Quails		
	Coturnix ypsilophora	Brown Quail
Family Anatidae - Ducks, Swans and Geese		
	Anas castanea	Grey Teal
	Anas gracilis	Chestnut Teal
	**Anas platyrhynchos*	Mallard
	Anas superciliosa	Pacific Black Duck
#	*Chenonetta jubata*	Australian Wood Duck
	Cygnus atratus	Black Swan
Family Anhingidae - Darter		
	Anhinga melanogaster	Australian Darter
Family Phalacrocoridae - Cormorants		
	Phalacrocorax carbo	Great Cormorant
	Phalacrocorax fuscescens	Pied Cormorant
	Phalacrocorax sulcirostris	Little Black Cormorant
	Phalacrocorax varius	Little Pied Cormorant
Family Pelecanidae- Pelican		
	Pelecanus conspicillatus	Australian Pelican
Family Ardeidae - Herons, Egrets and Bitterns		
	Ardea alba	Great Egret
	Ardea ibis	Cattle Egret
	Ardea intermedia	Intermediate Egret
	Ardea pacifica	White-necked Heron
	Butorides striatus	Striated (Mangrove) Heron
	Egretta garzetta	Little Egret
	Egretta novaehollandiae	White-faced Heron

	Nycticorax caledonicus	Nankeen Night Heron

Family Threskiornithidae - Ibises and Spoonbills

	Platalea flavipes	Yellow-billed Spoonbill
	Platalea regia	Royal Spoonbill
	Threskiornis molucca	Sacred Ibis
	Threskiornis spinicollis	Straw-necked Ibis

Family Accipitridae - Osprey, Hawks, Eagles and Harriers

	Accipiter fasciatus	Brown Goshawk
	Accipiter cirrhocephalus	Collared Sparrowhawk
	Accipiter novaehollandiae	Grey Goshawk
	Aquila audax	Wedge-tailed Eagle
	Aviceda subcristata	Crested Hawk
	Circus approximans	Swamp Harrier
	Elanus notatus	Black-shouldered Kite
	Haliaeetus leucogaster	White-breasted Sea-Eagle
#	*Haliastur sphenurus*	Whistling Kite
	Hieraaetus morphnoides	Little Eagle
	Pandion haliaetus	**Osprey**

Family Falconidae - Falcons

	Falco berigora	Brown Falcon
	Falco cenchroides	Nankeen Kestrel
	Falco longipennis	Australian Hobby
	Falco peregrinus	Peregrine Falcon

Family Charadriidae - Plovers, Dotterels and Lapwings

#	*Vanellus miles*	Masked Lapwing

Family Laridae - Gulls and Terns

	Chlidonias hybrida	Whiskered Tern
	Larus novaehollandiae	Silver Gull
	Sterna bergii	Crested Tern
	Sterna caspia	Caspian Tern
	Sterna nilotica	Gull-billed Tern

Family Columbidae - Pigeons, Doves

	Chalcophaps indica	Emerald Dove
	**Columba livia*	Feral Pigeon
	Geopelia humeralis	Bar-shouldered Dove
	Geopelia striata	Peaceful Dove
#	*Ocyphaps lophotes*	Crested Pigeon
	Phaps chalcoptera	Common Bronzewing
	Ptilinopus regina	**Rose-crowned Fruit-Dove**
	Ptilinopus superbus	**Superb Fruit-Dove**
#	**Streptopelia chinensis*	Spotted Turtle-Dove

Family Cacatuidae - Cockatoos and Corellas

	Cacatua galerita	Sulphur-crested Cockatoo
	Cacatua roseicapilla	Galah
	Cacatua sanguinea	Little Corella
	Cacatua tenuirostris	Long-billed Corella
	Calyptorhyncus funereus	Yellow-tailed Black-Cockatoo
	Calyptorhynchus lathami	**Glossy Black-Cockatoo**

Family Psittacidae - Parrots, Rosellas and Lorikeets		
#	*Alisterus scapularis*	King Parrot
	Glossopsitta pusilla	Little Lorikeet
	Glossopsitta concinna	Musk Lorikeet
	Lathamus discolor	**Swift Parrot**
	Platycercus elegans	Crimson Rosella
#	*Platycercus eximius*	Eastern Rosella
	Trichoglossus chlorolepidotus	Scaly-breasted Lorikeet
	Trichoglossus haematodus	Rainbow Lorikeet
Family Cuculidae - Cuckoos		
	Chrysococcyx basalis	Horsefield's Bronze-Cuckoo
	Chrysococcyx lucidus	Shining Bronze-Cuckoo
	Cuculus pallidus	Pallid Cuckoo
	Cacomantis flabelliformis	Fan-tailed Cuckoo
	Cacomantis variolosus	Brush Cuckoo
#	*Eudynamys scolopacea*	Common Koel
	Scythrops novaehollandiae	Channel-billed Cuckoo
Family Centropodidae - Pheasant Coucal		
	Centropus phasianinus	Pheasant Coucal
Family Tytonidae - Barn Owls		
	Tyto alba	Barn Owl
	Tyto novaehollandiae	**Masked Owl**
Family Strigidae - Hawk-Owls		
	Ninox boobook	Southern Boobook
	Ninox strenua	**Powerful Owl**
Family Podargidae - Frogmouths		
	Podargus strigoides	Tawny Frogmouth
Family Caprimulgidae - Nightjars		
	Eurostopodus mystacalis	White-throated Nightjar
Family Aegothelidae - Owlet Nightjars		
	Aegotheles cristatus	Australian Owlet Nightjar
Family Apodidae - Swifts		
	Apus pacificus	Fork-tailed Swift
	Hirundapus caudacutus	White-throated Needletail
Family Alcedinidae - River Kingfishers		
	Ceyx azurea	Azure Kingfisher
Family Halcyonidae - Tree Kingfishers		
#	*Dacelo novaeguineae*	Laughing Kookaburra
	Todiramphus sancta	Sacred Kingfisher
Family Coraciidae - Rollers		
#	*Eurystomus orientalis*	Dollarbird
Family Climacteridae - Treecreepers		

	Climacteris picumnus victoriae	**Brown Treecreeper**
	Cormobates leucophaea	White-throated Treecreeper

Family Maluridae - Fairy-Wrens and Emu-Wrens

#	*Malurus assimilis*	Variegated Fairy-Wren
#	*Malurus cyaneus*	Superb Fairy-Wren

Family Pardalotidae - Pardalotes, Gerygones, Scrubwrens, Heathwrens and Thornbills

	Acanthiza chrysorrhoa	Yellow-rumped Thornbill
	Acanthiza lineata	Striated Thornbill
	Acanthiza nana	Yellow Thornbill
	Acanthiza pusilla	Brown Thornbill
	Acanthiza reguloides	Buff-rumped Thornbill
	Gerygone levigaster	Mangrove Gerygone
	Gerygone mouki	Brown Gerygone
	Gerygone olivacea	White-throated Gerygone
	Pardalotus punctatus	Spotted Pardalote
	Pardalotus striatus	Striated Pardalote
#	*Sericornis frontalis*	White-browed Scrubwren
#	*Smicrornis brevirostris*	Weebill

Family Meliphagidae - Honeyeaters

#	*Acanthorhynchus tenuirostris*	Eastern Spinebill
	Anthrochaera carunculata	Red Wattlebird
#	*Anthrochaera chrysoptera*	Brush Wattlebird
	Entomyzon cyanotus	Blue-faced Honeyeater
	Lichenostomus chrysops	Yellow-faced Honeyeater
	Lichenostomous leucotis	White-eared Honeyeater
	Lichmera indistincta	Brown Honeyeater
	Manorina melanocephala	Noisy Miner
	Manorina melanophrys	Bell Miner
#	*Meliphaga lewinii*	Lewin's Honeyeater
	Melithreptus brevirostris	Brown-headed Honeyeater
	Melithreptus lunatus	White-naped Honeyeater
	Myzomela sanguinolenta	Scarlet Honeyeater
#	*Philemon corniculatus*	Noisy Friarbird
	Phylidonyris novaehollandiae	New Holland Honeyeater
#	*Phylidonyris nigra*	White-cheeked Honeyeater
	Plectorhyncha lanceolata	Striped Honeyeater
	Xanthomyza phrygia	**Regent Honeyeater**

Family Petroicidae - Robins and Jacky Winter

#	*Eopsaltria australis*	Eastern Yellow Robin
#	*Microeca leucophaea*	Jacky Winter (Brown Flycatcher)
	Petroica rosea	Rose Robin

Family Cinclosomatidae - Whipbird and Quail-thrushes

#	*Psophodes olivaceus*	Eastern Whipbird

Family Neosittidae - Sitellas

	Daphoenositta chrysoptera	Varied Sitella

Family Pachycephalidae - Whistlers, Shrike-tit and Shrike-thrushes

#	*Colluricincla harmonica*	Grey Shrike-thrush
	Falcunculus frontatus	Crested Shrike-tit

	Pachycephala pectoralis	Golden Whistler
	Pachycephala rufiventris	Rufous Whistler

Family Dicruridae - Monarchs, Flycatchers, Fantails, Drongo and Magpie-Lark

	Dicrurus megarhynchus	Spangled Drongo
	Monarcha melanopsis	Black-faced Monarch
	Myiagra cyanpleuca	Satin Flycatcher
	Myiagra inquieta	Restless Flycatcher
	Myiagra rubecula	Leaden Flycatcher
#	*Rhipidura fuliginosa*	Grey Fantail
	Rhipidura leucophrys	Willie Wagtail
	Rhipidura rufifrons	Rufous Fantail
	Grallina cyanoleuca	Magpie-lark

Family Campephagidae - Cuckoo-shrikes and Trillers

#	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike
	Coracina tenuirostris	Cicadabird
	Lalage sueruii	White-winged Triller

Family Oriolidae - Orioles and Figbird

	Oriolus sagittatus	Olive-backed Oriole
	Sphecotheres viridus	Figbird

Family Artamidae - Wood-swallows, Butcherbirds, Magpie and Currawongs

	Artamus cyanopterus	Dusky Woodswallow
	Artamus leucorhynchus	White-breasted Woodswallow
#	*Cracticus nigrogularis*	Pied Butcherbird
	Cracticus torquatus	Grey Butcherbird
#	*Gymnorhina tibicen*	Australian Magpie
#	*Strepera graculina*	Pied Currawong

Family Corvidae - Crows, Raven

#	*Corvus coronoides*	Australian Raven
	Corvus tasmanicus	Forest Raven

Family Corcoracidae - Mudnest-builders

	Corcorax melanorhamphos	White-winged Chough

Family Ptilinorhynchidae - Bowerbirds

	Ailuroedus crassirostris	Green Catbird
	Ptilinorhynchus violaceus	Satin Bowerbird
	Sericulus chrysocephalus	Regent Bowerbird

Family Motacillidae - Pipits and Wagtails

	Anthus novaseelandiae	Richard's Pipit

Family Passeridae - Sparrows, Grassfinches, Mannikins

#	*Neochmia temporalis*	Red-browed Finch
	Lonchura castaneothorax	Chestnut-breasted Mannikin
	**Passer domesticus*	House Sparrow
	Poephila bichenovii	Double-barred Finch
	Poephila guttata	Zebra Finch
	Stagonopleura guttata	**Diamond Firetail**

Family Fringillidae - Other Finches		
	**Carduelis carduelis*	European Goldfinch
Family Dicaeidae - Flowerpeckers		
	Dicaeum hirundinaceum	Mistletoebird
Family Hirundinidae - Swallows and Martins		
	Cecropis ariel	Fairy Martin
	Cecropis nigricans	Tree Martin
#	*Hirundo neoxena*	Welcome Swallow
Family Pycnonotidae - Bulbuls		
	**Pycnonotus jocosus*	Red-whiskered Bulbul
Family Zosteropidae - White-eyes		
	Zosterops lateralis	Silvereye
Family Sturnidae - Starlings and Mynas		
	**Acridotheres tristis*	Common Myna
	**Sturnus vulgaris*	Common Starling

AMPHIBIANS

Family Myobatrachidae - 'Southern' Frogs		
#	*Crinia signifera*	Common Eastern Froglet
	Crinia tinnula	**Wallum Froglet**
	Heleioporus australiacus	**Giant Burrowing Frog**
	Limnodynastes dumerilii	Eastern Banjo Frog
	Limnodynastes ornatus	Ornate Burrowing Frog
#	*Limnodynastes peronii*	Striped Marsh Frog
	Limnodynastes tasmaniensis	Spotted Grass Frog
	Mixophyes iteratus	**Southern Barred Frog**
	Pseudophryne bibronii	Brown Toadlet
	Pseudophryne coriacea	Red-backed Toadlet
	Uperoleia laevigata	Smooth Toadlet
Family Hylidae - Tree Frogs		
	Litoria aurea	**Green and Golden Bell Frog**
	Litoria caerulea	Green Tree Frog
	Litoria caerulea	Green Tree Frog
	Litoria citropa	Blue Mountains Tree Frog
	Litoria dentata	Bleating Tree Frog
#	*Litoria fallax*	Dwarf Tree Frog
	Litoria freycineti	Freycinet's Frog
	Litoria gracilenta	Dainty Tree Frog
	Litoria jervisensis	Jervis Bay Tree Frog
#	*Litoria latopalmata*	Broad-palmed Frog
	Litoria lesueuri	Lesueur's Frog
	Litoria littlejohni	**Littlejohn's Tree Frog**
	Litoria nasuta	Rocket Frog
	Litoria peronii	Peron's Tree Frog
	Litoria phyllochroa	Green Leaf Tree Frog

	Litoria tyleri	Tyler's Tree Frog
	Litoria verreauxii	Verreaux's Tree Frog

REPTILES

Family Chelidae - Tortoises

	Chelodina longicollis	Eastern Snake-necked Tortoise

Family Gekkonidae - Geckoes

	Diplodactylus vittatus	Wood Gecko
	Oedura lesueurii	Lesueur's Velvet Gecko
	Phyllurus platurus	Southern Leaf-tailed Gecko
	Underwoodisaurus milii	Thick-tailed Gecko

Family Pygopodidae - Legless Lizards

	Lialis burtonis	Burton's Snake-lizard
	Pygopus lepidopus	Common Scaly-foot

Family Agamidae - Dragons

#	*Amphibolurus muricatus*	Jacky Lizard
	Physignathus lesuerii	Eastern Water Dragon
	Pogona barbata	Eastern Bearded Dragon
	Tympanocryptis diemensis	Mountain Dragon

Family Varanidae - Monitors

	Varanus gouldii	Gould's Monitor
	Varanus varius	Lace Monitor

Family Scinidae - Skinks

	Anomalopus swansoni	
	Carlia tetradactyla	
	Carlia vivax	Tussock Rainbow Skink
	Cryptoblepharus virgatus	Wall Lizard
	Ctenotus robustus	Striped Skink
	Ctenotus taeniolatus	Copper-tailed Skink
	Egernia cunninghami	Cunningham's Skink
	Egernia major	Land Mullet
	Egernia modesta	
	Egernia saxatilis	Black Rock Skink
	Egernia whitii	White's Skink
	Eulamprus quoyii	Eastern Water Skink
	Eulamprus tenuis	
#	*Lampropholis delicata*	Grass Skink
	Lampropholis guichenoti	Garden Skink
	Lygisaurus foliorum	
	Pseudomoia platynota	Red-throated Skink
	Saiphos equalis	Three-toed Skink
	Saproscincus galli	
	Saproscincus mustelinus	Weasel Skink
	Tiliqua scincoides	Eastern Blue-tongued Lizard

Family Typhlopidae - Blind Snakes

	Ramphotyphlops nigrescens	

	Ramphotyphlops proximus	
	Ramphotyphlops wiedii	
Family Boidae - Pythons		
	Morelia spilota	Carpet (Diamond) Python
Family Colubridae		
	Boiga irregularis	Brown Tree Snake
	Dendralaphis punctulata	Green Tree Snake
Family Elapidae - Venomous Snakes		
	Acanthopis antarcticus	Death Adder
	Cacophis krefftii	Dwarf Crowned Snake
	Cacophis squamulosus	Golden Crowned Snake
	Demansia psammophis	Yellow-faced Whip Snake
	Furina diadema	Red-naped Snake
	Hemiaspis signata	Black-bellied Swamp Snake
	Notechis scutatus	Eastern Tiger Snake
	Pseudechis guttatus	Spotted Black Snake
	Pseudechis porphyriacus	Red-bellied Black Snake
	Pseudonaja textilis	Eastern Brown Snake
	Rhinoplocephalus nigrescens	Eastern Small-eyed Snake
	Vermicella annulata	Bandy Bandy

MAMMALS

Family Tachyglossidae - Echidna		
#	*Tachyglossus aculeatus*	Echidna
Family Dasyuridae - Dasyurids		
	Antechinus swainsonii	Dusky Antechinus
#	*Antechinus stuartii*	Brown Antechinus
	Dasyurus maculatus	**Tiger Quoll**
	Planigale maculata	**Common Planigale**
	Sminthopsis murina	Common Dunnart
Family Peramelidae - Bandicoots		
#	*Isoodon macrourus*	Northern Brown Bandicoot
	Perameles nasuta	Long-nosed Bandicoot
Family Phascolarctidae - Koala		
	Phascolarctos cinereus	**Koala**
Family Vombatidae - Wombats		
	Vombatus ursinus	Common Wombat
Family Petauridae - Gliders		
	Petaurus breviceps	Sugar Glider
	Petaurus norfolcensis	**Squirrel Glider**
Family Pseudocheiridae - Ringtail Possums and Greater Glider		
	Petauroides volans	Greater Glider
#	*Pseudocheirus peregrinus*	Common Ringtail Possum

Family Acrobatidae - Feathertail Glider		
	Acrobates pygamaeus	Feathertail Glider
Family Phalangeridae - Brushtail Possums		
	Trichosurus vulpecula	Common Brushtail Possum
Family Potoroidae - Potoroos and Bettongs		
	Potorous tridactylus	**Long-nosed Potoroo**
Family Macropodidae - Kangaroos, Wallabies		
	Macropus giganteus	Eastern Grey Kangaroo
	Macropus rufogriseus	Red-necked Wallaby
#	*Wallabia bicolor*	Swamp Wallaby
Family Pteropodidae - Fruit Bats		
	Pteropus poliocephalus	**Grey-headed Flying-fox**
	Pteropus scapulatus	Little Red Flying-fox
Family Rhinolophidae - Horseshoe-bats		
	Rhinolophus megaphyllus	Eastern Horseshoe-bat
Family Molossidae - Freetail-bats		
	Mormopterus norfolkensis	**Eastern Freetail-bat**
	Mormopterus sp.	Freetail-bat sp.
	Nyctinomus australis	White-striped Freetail-bat
Family Vespertilionidae - Plain-nosed Bats		
	Chalinolobus dwyeri	**Large-eared Pied Bat**
#	*Chalinolobus gouldi*	Gould's Wattled bat
	Chalinolobus morio	Chocolate Wattled Bat
	Miniopterus australis	**Little Bentwing-bat**
	Miniopterus schreibersii	**Large Bentwing-bat**
	Myotis adversus	**Large-footed Myotis**
	Nycticeius greyii	Little Broad-nosed Bat
	Nyctophilus geoffroyi	Lesser Long-eared Bat
	Nyctophilus gouldii	Gould’s Long-eared Bat
	Scoteanax rueppellii	**Greater Broad-nosed Bat**
	Scotorepens orion	Eastern Broad-nosed Bat
	Vespadelus darlingtoni	Large Forest Bat
	Vespadelus pumilus	Eastern Forest Bat
	Vespadelus regulus	Southern Forest Bat
	Vespaledus vulturnus	Little Cave Bat
#	*Vespadelus* sp.	
Family Muridae - Rodents		
	Hydromys chrysogaster	Water Rat
	Melomys burtoni	Grassland Melomys
	**Mus musculus*	House Mouse
	Rattus fuscipes	Southern Bush Rat
	Rattus lutreolus	Swamp Rat
	**Rattus norvegicus*	Brown Rat
#	**Rattus rattus*	Black Rat
	Pseudomys novaehollandiae	New Holland Mouse

Family Canidae		
#	**Vulpes vulpes*	Red Fox
#	**Canis familiaris*	Dog
	Canis familiaris dingo	Dingo
Family Felidae		
	**Felis catus*	Cat
Family Leporidae		
	**Lepus capensis*	European Hare
#	** Oryctolagus cuniculus*	European Rabbit
Family Equidae		
	**Equus asinus*	Donkey
	**Equus caballus*	Horse
Family Suidae		
	**Sus scrofa*	Feral Pig
Family Bovidae		
	**Bos taurus*	Cow
	**Capra hircus*	Goat

APPENDIX E

SUMMARY OF FLORA AND FAUNA GUIDELINES FOR DEVELOPMENT

Wyong Shire Council
August 1999

SUMMARY OF FLORA AND FAUNA GUIDELINES FOR DEVELOPMENT (Wyong Shire Council, 1999)

Table 2.2: Minimum survey effort for flora and fauna surveys. Table 2.4 contains a summary of the minimum survey effort for fauna per survey plot. Further information regarding walking transects and survey plots is presented on pages 32 and 33. Where Council has undertaken detailed vegetation community mapping less survey plots may be required (seek advice from Council)

Study Area* (hectares)	Activity - Rezoning, Development Application	Minimum Survey Effort
0 - 1 ha	Flora survey	1 - 2 walking transects + 1 plot per vegetation community**
	Fauna survey	1 survey plot per vegetation community**
1 - 10 ha	Flora survey	3 walking transects + plots, as indicated in Figure 2.1
	Fauna survey	1 survey plot per vegetation community** + 1 replicate plot per community > 5 ha in area
11 - 100 ha	Flora survey	4 - 6 walking transects + plots, as indicated in Figure 2.1
	Fauna survey	1 survey plot per vegetation community** + 1 replicate plot per community > 5 ha in area
> 101 ha	Flora survey	4 - 6 walking transects + plots, as indicated in Figure 2.1
	Fauna survey	2 survey plots per vegetation community**

* Study area is the area which is likely to be affected by the proposal, either directly or indirectly.
** Vegetation communities are to be defined after mapping, as indicated in section 2.3.1 of this guideline.

Figure 2.1: Minimum number of vegetation plots per study area. A minimum of 4% of the site should be surveyed

Number of plots = 4% of study area (m^2) ÷ 400*

Example: 5 ha study area

$$\text{Number of plots} = \frac{4\% \times 50{,}000}{400}$$

$$= 5 \text{ plots}$$

* A reduced number of flora survey plots may be undertaken where the study area is in excess of 50 ha, after consultation with Council.

Table 2.4 Summary of minimum survey effort for fauna per survey plot (refer to Figure 2.1 for recommended number of survey plots per area).

Fauna Group	Survey Technique	Survey Season Any time during:	Survey Effort per Vegetation Community
Birds			
Diurnal Birds	Formal Census	Both Summer & Winter	One point or plot census
Nocturnal Birds	Formal Census	Both Summer & Winter	One point census
Mammals			
Small Terrestrial	Small mammal traps	All year	40 trap nights over 4 nights
Optional	Hair Tubes	All year	4 small hair tubes for 10 nights
Medium Terrestrial	Cage/B Elliot traps	All year	6 trap nights over 4 nights
Optional	Hair Tubes	All year	4 large hair tubes for 10 nights
Large Mammals	Opportunistic observations	All year	Walking transects
Arboreal Mammals	B Elliot traps	All year	Density of 6 traps per ha for 4 consecutive nights
	Spotlighting	All year	1 person hour
Optional	Hair tubes	All year	4 small arboreal for 10 nights
Microchiropteran Bats	Harp traps	September - April	2 nights
	Echolocation Call	September - April	45 minute continuous recording or call activated at night
Megachiropteran Bats	Spotlighting and listening	All year, when food is available	Refer to spotlighting for arboreal mammals
Reptiles and Amphibians			
Diurnal Searches	Systematic searches	September - February	One person hour per 0.5 ha on 3 days
Nocturnal Searches	Spotlight searches	September - February	One person hour in appropriate habitat on 3 nights
Optional	Pitfall trapping	All year	Dependent upon soil type
Specific habitats	Diurnal + Nocturnal Searches	September - February	One person hour diurnal + One person hour nocturnal on 3 occasions

Note: Where it is highly likely that a threatened species is inhabiting the study area, as determined by habitat characteristics and previous records of the species, Council may require additional survey work to be undertaken. If time is not available to conduct survey during the appropriate survey season, then a precautionary approach should be taken, ie species should be assumed to be present.

APPENDIX F

QUALIFICATIONS AND EXPERIENCE

BRIEF PROFILE – JOANNE WOODHOUSE BEnv Sci DipIndiArch

Joanne graduated from the University of Newcastle in 1999 with a Bachelor of Environmental Science majoring in Environmental Management. She has also recently completed a Graduate Diploma in Indigenous (Aboriginal) Archaeology at the University of New England (2003)

As part of Joanne's undergraduate studies, she worked with NSW State Forests undertaking an environmental specialist study with relation to post tree harvest compliance auditing, field assessment and biological survey and monitoring techniques.

During Joanne's employment as Senior Ecologist with **Wildthing Environmental Consultants,** she has completed a diverse array of environmental studies including weed and feral pest management plans for developments and the mining industry in the Hunter Valley region. She has also undertaken flora and fauna assessments, bushfire hazard assessment, ecological constraint studies and specialised studies including *Tetratheca juncea* (Black-eyed Susan), Squirrel Gliders, Koalas, etc. over a vast area from northern NSW to south of Sydney.

Joanne has been liaising with clients and Aboriginal communities in the conducting of archaeological projects within the Hunter Valley and undertakes Aboriginal Heritage Assessments as required by NSW National Parks and Wildlife Service legislation.

Joanne was the principal author of this Statement of Effect on Threatened Flora and Fauna. She also undertook the fieldwork components of the study.

BRIEF PROFILE – MELISSA THOMAS BEnvScDipEd

Melissa graduated from Newcastle University, Newcastle in 2001 a Bachelor of Environmental Science (Environmental Management).

Melissa has had a wide range of diverse and biological survey experience with government and private enterprises in a variety of locations and ecosystems within NSW.

Melissa is employed with **Wildthing Environmental Consultants** as an Ecologist where she undertakes flora and fauna surveys, bushfire hazard assessments, ecological constraint studies and specialised studies including *Tetratheca juncea* (Black-eyed Susan).

Melissa assisted during the fieldwork component of this report and report production.

BRIEF PROFILE – GARRY WORTH Bsc DipSci MIAG

Educated at Newcastle Boys High School, and University of NSW where he graduated as a Bachelor of Science, majoring in Zoology.

Garry returned to full time study in 1991 to qualify for a Graduate Diploma in Science with a thesis on Lake Sedimentology which was completed in 1992. He is subsequently completing a Doctorate Degree in Physical Geography.

His organisational and communication abilities have allowed him to find employment in the fields of ecology, biology and education. These have included managing his own oyster farm, working as a Technical Officer for NSW Fisheries, a seasonal National Parks and Wildlife Ranger, an Environmental Teacher with TAFE, and more recently as an Associate Lecturer in

Geography at Newcastle University (included in the curriculum was statistics and map interpretation).

Garry served as a volunteer bushfire fighter with the Salt Ash – Williamtown Brigade from 1975 to 1984. This interest was continued when he served as a Councillor on the Port Stephens Shire Council.from 1983 to 1987. During part of this time he was chairman of the Council committee concerned with bushfire and undertook a course at the Australian Counter Disaster College.

Since October 1992, Garry has been a working director of **Wildthing Environmental Consultants** and **Wildthing Consulting Services**. These consultancies employ a team of graduates undertaking a variety of studies associated with land developments including flora and fauna, archaeology, bushfire hazard, soil and land capability, geomorphology, species impact statements, traffic studies and environmental impact statements. These diverse studies are carried out in a wide area of NSW and Queensland.

Garry has spent many year researching the biology and conservation of threatened and endangered native animals including Koalas. Apart from writing research papers on the loss of Koala habitat on the Tilligerry Peninsula at Port Stephens and analysing the decay rate of Koala scats in the open environment to date Koala movements in a particular area, he has also been involved in many Koala studies. These have included Koala Management Plans conducted in Tea Gardens, Hawks Nest, Medowie, Salt Ash, Tanilba Bay, Boat Harbour, Williamtown, O'Donnelltown, West Wallsend and Koala Monitoring in Port Macquarie.

Garry contributed technical advice to the project.

BRIEF PROFILE – MUNGO WORTH (MABS)

Mungo is studying Physical Geography and Arts at the University of Newcastle, and is a member of the Australian Bat Society and the Australian Frog and Tadpole Society.

Mungo has specialised in the analysis of recorded frog and bat calls by auditory and computer-assisted means since joining **Wildthing Environmental Consultants** in October 1995. Since this time he has amassed considerable field experience and management skills, and has conducted numerous flora and fauna surveys, as well as vegetation management plans and specialised ecological studies in both NSW and Queensland. Mungo is fully immunised against Bat Lyssavirus, and his capabilities also extend to equipment, vehicle and computer maintenance both in the field and in the office.

Mungo undertook the bat call analysis for this survey.