ANNEX H

Matters of National Environmental Significance

Addendum

The approved Master Plan MP 20-4-2005 for Fern Bay Seaside Village was signed by the Minister on 8 August 2006. A number of technical assessments supported the Master Plan, including the attached Matters of National Environmental Significance.

As the Matters of National Environmental Significance report is a supporting document to the approved Master Plan, it has not been updated. The EA report in support of the Project Plan has however been prepared in accordance with the approved Master Plan (as detailed in Section 2.4 of the EA). The Project Plan application is essentially consistent with the items listed in Schedule 2 of the Master Plan, with minor amendments to the project plan to account of the requirements of government agencies and site constraints, including lot layout and configuration changes. These changes do not impact the assessment and outcomes of the attached Matters of National Environmental Significance assessment. The updated project plan is detailed in the EA.

FERNBAY
seaside village

Fern Bay Estate

Master Plan Study

WINTEN PROPERTY GROUP

CVC Limited

Fern Bay Estate

Assessment of Matters of National Environmental Significance

Winten Property Group & Continental Venture Capital Limited

April 2005

0012720 Final

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Delivering sustainable solutions in a more competitive world

Project Manager:	*Sally Crews*
	
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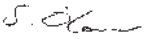
Signed:	

Environmental Resources Management Australia Pty Ltd Quality System

Fern Bay Estate

Assessment of Matters of National Environmental Significance

Winten Property Group & Continental Venture Capital Limited

April 2005

0012720 Final

This report has been prepared in accordance with the scope of services described in the contract or agreement between Environmental Resources Management Australia Pty Ltd ABN 12 002 773 248 (ERM) and the Client. The report relies upon data, surveys, measurements and results taken at or under the particular times and conditions specified herein. Any findings, conclusions or recommendations only apply to the aforementioned circumstances and no greater reliance should be assumed or drawn by the Client. Furthermore, the report has been prepared solely for use by the Client and ERM accepts no responsibility for its use by other parties.

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1 INTRODUCTION

1.1 BACKGROUND

Environmental Resources Management Australia Pty Ltd (ERM) has been commissioned by the Winten Property Group (WPG) and Continental Venture Capital Limited (CVC) to undertake an ecological assessment within Lot 16, DP 258848, No. 85 Nelson Bay Road, Fern Bay (the 'study area') and is illustrated in *Figure 1.1*. This ecological investigation follows a series of previous ecological studies undertaken in the study area.

This assessment addresses the impact of a proposed residential estate at Fern Bay, known as Fern Bay Estate on matters of national environmental significance as listed in the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The Fern Bay Estate is proposed to comprise:

- approximately 950 residential lots in total (some of which have development approval);
- open space lots, which will include formal parks and an Aboriginal heritage reserve within 2(a) zoned land and conservation reserves within 1(a), 2(a) and 7(a) zoned land. These areas of open space are designed to provide opportunities for passive and active recreation, stormwater management and the protection of sites of Aboriginal heritage significance and ecological corridors;
- a community nursery which will be used for the propagation of plants for use in the landscape areas of the estate;
- community, recreational and commercial facilities;
- new public roads, fire trails and pedestrian trails; and
- bushfire buffers (asset protection zones).

The concept plan for development of the estate is illustrated in *Figure 1.2*.

There is already an approval to subdivide part of the site into 208 residential lots and a school site (refer to *Figure 1.3* for the approved subdivision). Clearing and earthworks have already commenced for part of this subdivision. The approved lots form part of the proposed Fern Bay Estate however, those approved lots and roads within 200 metres of the northern boundary of the site are not proposed to be constructed. Instead this area is proposed to form part of a minimum 200 metre wide ecological corridor that will connect the site with the vegetated areas to the north and south. The school site is also now proposed to be developed for residential purposes

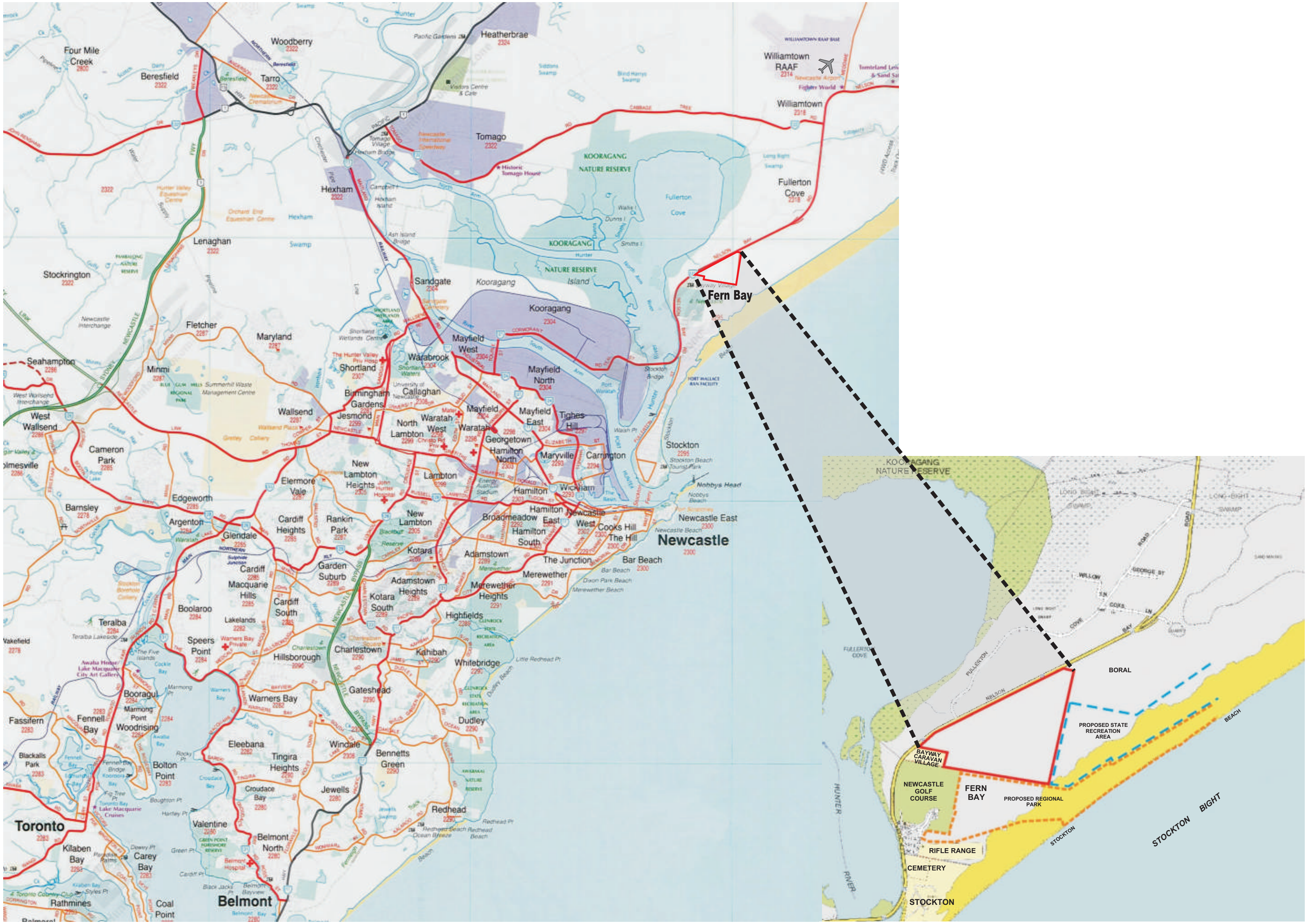


Figure 1.1

Locality Plan

Winten Property Group - CVC Limited - Fern Bay Estate

LEGEND

- Residential Integrated Housing
- Residential Villas 340m² to 399m²
- Residential Premium Villas 400m² to 449m²
- Residential Courtyard 450m² to 589m²
- Residential Conventional lots 590m² +
- Residential Duplex 750m² +
- Part of Existing DA
- Part of Approved Development Footprint
- Recreational Facilities/Community Centre
- Active Recreational Facility
- Open Space - conservation areas
- Open Space - Landscaped areas, playground
- Community Nursery
- Aboriginal Heritage Reserve
- Fern Bay Study Area
- Fire Trail
- Major Walking trail
- Asset Protection Zone
- 1(a) Rural Agriculture 1(a) Zone
- 2(a) Residential 2(a) Zone
- 7(a) Environment Protection 7(a) Zone

ALLOTMENT TYPES AND NUMBERS

Residential Integrated Housing 3.78ha x 25/ha	94 units
Residential Villas	123 lots
Residential Premium Villas	120 lots
Residential Courtyard	255 lots
Residential Conventional Lots	186 lots
Residential Duplex	20 units
Existing DA	149 lots
Total	**947**

Source: Robertsday, Town Planning Design

ERM

0 100m
Approximate only

Figure 1.2 **Concept Plan of Proposed Subdivision**

Winten Property Group - CVC Limited - Fern Bay Estate

Jobs\2003\0012720\Master Plan Studies - EPBC-Fg1.2 Concept Plan.cdr March 2005 SP Environmental Resources Management Australia Pty Ltd

Figure 1.3 **Approved Subdivision**

Winten Property Group - CVC Limited - Fern Bay Estate

given the Department of Education and Training has confirmed that it is no longer required for educational purposes.

An assessment of the impact of the proposal on the habitat of threatened species, populations or ecological communities listed under the State *Threatened Species Conservation Act, 1995* (TSC Act) has been prepared by ERM as part of a Species Impact Statement for the site (ERM, 2005). This report has been prepared to fully explore all the issues associated with matters of national environmental significance within the study area.

Chapter 1 of this report provides background information about the proposed development, a list of previous ecological surveys that have been carried out in the study area, the aims of this assessment, and a discussion of the requirements of the EPBC Act. *Chapter 2* details the methodology adopted for this and previous ecological assessments on site, including details of the survey effort. *Chapter 3* provides a description of flora and fauna in the study area, including threatened species and migratory birds listed under the EPBC Act. The impacts of the proposed development on matters of national environmental significance are addressed in *Chapter 4*. Finally *Chapter 5* draws conclusions on the proposal having regard to matters of national environmental significance.

1.2 PREVIOUS ECOLOGICAL SURVEYS

Previous flora and fauna surveys of the study area have been undertaken by:

- Clements A. M., Rodd A. N., Lim I., Clulow J and Hoye G. (1992) *Flora and Fauna Report: part of the Environment Assessment of Fern Bay, New South Wales*. Prepared for Port Stephens Shire Council. Anne Clements & Associates Pty Ltd, North Sydney;

- SWC Wetlands and Ecological Management Consultancy (Shortland Wetlands Centre) (1993) *Fern Bay Rezoning Proposal Assessment of Impact on Endangered Fauna*;

- Ecological Management Consultancy (Shortland Wetlands Centre) (1994) *Fern Bay Rezoning Proposal Assessment of Impact on Migratory Birds*;

- Gunninah Consultants (1996 and revised in 1997) *Fauna and Flora Assessment, Proposed Residential Development, Nelson Bay Road, Fern Bay (including Section 5A and SEPP 44 Assessments)*;

- ERM Mitchell McCotter (1998) *Fern Bay Rezoning Application* prepared for Howship Holdings Pty Ltd; and

- Gunninah Consultants (2002) *Preliminary Draft Flora and Fauna Assessment, Lot 16 DP 258848, No. 85 Nelson Bay Road, Fern Bay*.

The flora and fauna of the study area is assessed in the Species Impact Statement (ERM 2005) prepared for the estate.

1.3 AIMS

The aims of this assessment were to:

- review Department of Environment and Conservation (DEC) and Department of Environment and Heritage (DEH) databases to identify any threatened species, populations or ecological communities listed on Commonwealth legislation that may occur in the study area;
- collate and summarise all previous flora and fauna investigations illustrating survey effort, survey coverage and results; and
- conduct an assessment of potential impacts of the proposed residential development on threatened and migratory species listed in the EPBC Act.

The locality is defined as the area within 10 kilometres of the study area.

1.4 LEGISLATIVE REQUIREMENTS

1.4.1 Environment Protection and Biodiversity Conservation Act, 1999

The *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) requires approval of the Commonwealth Minister for the Environment for actions that may have a significant impact on matters of national environmental significance. The EPBC Act also requires Commonwealth approval for certain actions on Commonwealth land. Matters of national environmental significance under the Act include the following:

- World Heritage properties;
- Ramsar wetlands of international importance;
- threatened species or ecological communities listed in the EPBC Act;
- migratory species listed in the EPBC Act;
- Commonwealth marine environment; and
- nuclear actions.

An assessment of whether the development will have or is likely to have a significant impact on a matter of national environmental significance is provided in *Section 4.3*.

2 METHODOLOGY

2.1 INTRODUCTION

This chapter summarises the methods used for flora and fauna surveys, mapping and data interpretation in providing information for the assessment of impacts on matters of national environmental significance.

Field surveys were undertaken within the study area by ERM in 2002, 2004 and 2005. These were designed to map and describe the vegetation communities and habitat, and target threatened flora and fauna that may be directly or indirectly affected by the proposal, so that potential impacts on flora and fauna could be assessed. Several other environmental consultants have conducted surveys throughout the study area since 1992. Details of all surveys undertaken in the study area, including survey methods and survey effort, are included in this chapter.

2.2 LITERATURE REVIEW AND DATABASE SEARCHES

A literature review was undertaken of relevant studies and published information for the study area. Vegetation mapped by the Lower Hunter and Central Coast Regional Environmental Management Strategy (LHCCREMS) vegetation mapping (CRA Unit NPWS 2003) for the study area and locality was reviewed.

A search of the DEC Wildlife Atlas database was conducted for all recent records of threatened flora and fauna within the locality. This search revealed the presence of several threatened species within a 10 kilometre radius of the site. A search of the on-line database maintained by the Commonwealth Department of the Environment and Heritage (DEH) was completed for a 10 kilometre radius of the study area, to identify the presence of nationally listed threatened and migratory species in the locality. A search was also conducted of the Birds Australia New Atlas database (2004) for records of threatened and migratory birds in the locality.

All flora and fauna database records were plotted using a geographic information system and were analysed to determine the likelihood that threatened flora and fauna could occur within habitats in the study area. The analysis entailed assessment of dates, source reliability and numbers of records to assess the accuracy and current relevance to the study area. It should be noted that the DEH search is based on habitat requirements rather than actual records, and the assessment is based on those listed species considered likely to be in the study area.

2.3 OBTAINING INFORMATION ON GENERAL FLORA

The methodology of previous flora surveys is summarised in *Table 2.1* and the survey effort is illustrated in *Figures 2.1*, *2.2* and *2.3*. Vegetation communities in the study area were identified from these sources to verify vegetation mapping by LHCCREMS (CRA Unit NPWS 2003) and to provide a consistent and transferable mapping approach.

Table 2.1 Compilation of Previous Flora Survey Effort and Methodology in the Study Area

Source	Survey Dates	Survey Aims	Survey Methodology	Data Analysis
Clements et al. (1992)	March – April 1992	Description of floristics and vegetation communities	Quadrat-based transects	TWINSPAN ordination
Fanning and Clark (1993)	June, July 1993	Description of floristics and vegetation communities	Transects	Subjective description
Gunninah Consultants (1996 revised 1997)	25 and 26 September 1996	Description of floristics and vegetation communities; threatened species searches, impact assessment	No details	Subjective description
Gunninah Consultants (2002)	31 January and 1 February 2001	Description of floristics and vegetation communities; threatened species searches, impact assessment	York *et al*. (1991) and random meander technique (Cropper 1993), aerial photography	Subjective description
ERM (2002 to 2005)	13 and 14 January 2005	Flora surveys	quadrats	
	19 November 2002	Targeted leafless tongue orchid	random meander transect	
	July 2002, 25 August 2004	*Diuris praecox*	random meander transect	
	18 January 2005	*Eucalyptus parramattensis* subsp. *decadens* / netted bottlebrush	random meander transect	
	13 and 14 January 2005	*Rulingia prostrata*	quadrats	

2.4 DETERMINING THE PRESENCE OF THREATENED OR SIGNIFICANT FLORA SPECIES

The likelihood of threatened or significant flora occurring in the study area was determined by considering the type and condition of vegetation and habitats, and analysis of database records. The results of searches dedicated to surveying for threatened species were used in determining the likelihood of their occurrence in the study area (eg Gunninah Consultants 2002).

2.5 *GENERAL FAUNA AND FAUNA HABITAT ASSESSMENT*

Several fauna studies have been conducted in the study area and wider Fern Bay area (Croft and Associates 1980; Corkery and Co. 1988; Clements et al. 1992; Fanning and Clarke 1993; ERM Resource Planning 1994; Ecotone Ecological Consultants 1994; Gunninah Consultants 1995, 1996 revised 1997, 2002). The methodology of each is summarised in *Table 2.2* and the survey effort is illustrated in *Figures 2.1, 2.2* and *2.3*.

Legend

- Spotlight Transect - Anne Clements & Associates (1992)
- Vegetation Transect - Anne Clements & Associates (1992)
- Trap Lines - Gunninah Environmental Consultants (1996)
- Spotlight Transect - Gunninah Environmental Consultants (1996)
- H Harp Trap - Gunninah Environmental Consultants (1996)
- P Pitfall Trap - Gunninah Environmental Consultants (1996)
- T Hair Tubes - Gunninah Environmental Consultants (1996)
- M Mist Nets - Gunninah Environmental Consultants (1996)
- A Anabat Recorders - Gunninah Environmental Consultants (1996)

Nelson Bay Road

Fullerton Cove Road

Nelson Bay Road

Tilligerry Creek

Tilligerry Catchment

Figure 2.1 **Survey Effort - Previous Studies**

Winten Property Group - CVC Limited - Fern Bay Estate

Legend

- Orchid Survey Location (ERM 2002)
- Orchid Survey Location (ERM 2004)
- Threatened Flora Transect (ERM 2005
- Flora Survey Quadrats
- Cleared Vegetation
- Swamp Mahogany - Paperbark Forest
- Coastal Sand Apple Blackbutt Forest
- Wet Heath - Tomago Sand Swamp Woodland
- Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-East Corner Bioregion

Nelson Bay Road

Fullerton Cove Road

Nelson Bay Road

1 2 3 4 5 6 7 8 9

ERM

Figure 2.2 **Flora Survey Effort in the Study Area**

Winten Property Group - CVC Limited - Fern Bay Estate

Legend

- 6 ● Koala Habitat Assessment and Faecal Pellet Search
- 2 ● Nocturnal Call Playback
- T1 Spotlighting and Anabat Detection Transects
- Wallum Froglet Survey Site
- Swift Parrot/Regent Honeyeater Survey Site
- 3 ✖ Frog Survey Site (ERM 2005)
- Owl Call Playback Location (ERM 2005)
- Cage Trap Location (ERM 2005)
- Powerful Owl Observed (ERM 2005)
- Hairfunnel and Elliot Trapping Transect (ERM 2005)
- Fauna Survey Locations (ERM 2005)
- Harp3 Harp Trap Survey Location (Forest Fauna 2005)
- Ana3 Ana Bat Survey Location (Forest Fauna 2005)
- Site 5 Squirrel Glider Survey Location (Forest Fauna 2005)
- FB3 Bird Survey Records (Ekerlogic 2005)
- Approved Subdivision

- Cleared Vegetation
- Swamp Mahogany - Paperbark Forest
- Coastal Sand Apple Blackbutt Forest
- Wet Heath - Tomago Sand Swamp Woodland
- Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-East Corner Bioregion

Nelson Bay Road
Fullerton Cove Road
Nelson Bay Road
Powerline Easement
Powerline Easement
Harp 1
Site 3
Ana 1
FB7G
FB6B
FB7F
Site 2
T3
1
FB7E
3
T1
Site 5
4
2
Harp 4
Ana 4
6
5
Site 4
Harp 5
FB7A
Ana 3
FB6A
FB7D
2
T2
FB3
2
1
4
FB3B
FB6
FB7B
FB3A
FD2
3
Harp 2
FB7C
1
7
Harp 3
Site 1
Ana 2
FB8

Figure 2.3 **Fauna Survey Effort in the Study Area**

Table 2.2 Compilation of Previous Fauna Survey Effort and Methodology

Source	Survey Dates	Survey Method	Survey Effort
Croft and Associates (1980)	No formal surveys	Observations from local residents, literature review	None provided
Corkery and Co. (1988)	July 1987	Observations from local residents, literature review, opportunistic observations, bird census	3 days
Clements et al. (1992)	13 – 17 March, 3 – 7 April 1992	Elliott A type traps, cage traps, harp traps, mistnets, Anabat detection, spotlighting, bird census, pitfall traps, opportunistic observations	1,284 Elliott A trap nights, 15 hours spotlighting, no other details
Fanning and Clarke (1993)	June 1993	Harp traps, Anabat detection, Elliott A traps, hair tubes, spotlighting, owl call playback, habitat searches	4 days
ERM Resource Planning (1994)*	May and September 1994	Anabat detection, Elliott A and B traps, spotlighting, owl call playback, habitat searches	8 days
Ecotone Ecological Consultants (1994)*	March 1993, October 1994	Harp traps, Anabat detection	5 nights
Gunninah Consultants (1995)*	unknown	Spotlighting, pitfall traps, hair tubes, Elliott A and B type traps, bird and reptile census, searches for indirect evidence of fauna, targeted search for the little tern and sooty tern on sand dunes	6 days
Gunninah Consultants (1996 revised 1997)	25 September – 3 October 1996	Elliott A type traps, cage traps, harp traps, mistnets, Anabat detection, spotlighting, pitfall traps, bird and reptile census, opportunistic observations and searches for indirect evidence of fauna	None provided
Gunninah Consultants (2002)	29 January – 1 February 2001	Diurnal herpetofauna census (all reptiles and amphibians)	16 person hours
		Nocturnal call playback (owls, arboreal mammals, amphibians)	3 hours
		Anabat detection	72 hours
		Diurnal bird census	15 person hours
		Spotlighting (owls, arboreal mammals, amphibians)	20 person hours
		Elliott trapping (small mammals)	240 trap nights
		Cage trapping (medium-sized mammals)	60 trap nights
		Harp trapping (microchiropteran bats)	8 trap nights

Source	Survey Dates	Survey Method	Survey Effort
		Pitfall trapping (small and medium-sized mammals)	12 trap nights
		Hair tubes (small and medium-sized mammals)	128 tube nights
ERM (2002-2005)	11 – 15 February 2002	Elliott B type trapping (squirrel glider, brush-tailed phascogale)	
	3–5 September 2002; 24 and 31 January; 15 February 2005; 14 and 16 February 2005.	Spotlighting (all nocturnal fauna)[2]	585 trap nights
	3–5 September 2002, 24 January 2005, 14–17 February 2005	Anabat detection (microchiropteran bats) hand-held unit	24.5 person hours
	14–17 February 2005	Harp trapping (microchiropteran bats)	5 sites/ 10 harp nights
	14 and 16 February 2005	Stagwatching (arboreal fauna)	2 nights/ 2 hours
	21 February 2005	Habitat and tadpole searches (green and golden bell frog)	4 sites / 2.2 hrs
	9, 10 and 23 June 2004	Point call census (nectivorous birds)	5 sites/5.0 hours
	1, 2, 3 and 5 February 2005	Call playback/point call census (frugivorous birds)	4 sites/4.2 hours
	1, 2, 3, 5, 6 and 7 February 2005	Point call census/nest search (raptors)	34 sites/14.2 hours
	24–28 January 2005	Elliott A type trapping (small ground mammals)	4 transects/320 trap nights
	24–28 January 2005	Hair tubes (spotted-tailed quoll, brush-tailed phascogale, small ground mammals)	4 transects/400 funnel nights

1. * surveys conducted outside the study area

3 FLORA AND FAUNA OF THE STUDY AREA

3.1 SOIL LANDSCAPES

The study area comprises four soil landscapes as mapped and defined by Matthei (1995).

3.1.1 Lower Pindimar

This swamp landscape occurs as a small area in the south-west corner of the study area. It is characterised by poorly-drained Holocene sandsheets, small isolated permanently wet areas, with cleared to uncleared closed forest swamp with small areas of open forest. Soils are deep (> 300 centimetres) imperfectly drained humus podzols on sandy rises with poorly drained siliceous sands on low-lying, poorly-drained areas.

3.1.2 Blind Harry's Swamp

This swamp landscape occurs in a small area in the centre southern portion of the study area, which corresponds to the area mapped as swamp mahogany – paperbark forest by CRA Unit NPWS (2003). It is characterised by waterlogged swales and deflation areas on sands of the Tomago Coastal Plain, with uncleared swamp forest. Soils are deep (> 150 centimetres) poorly-drained acid peats – siliceous sands.

3.1.3 Boyce's Track

This aeolian landscape is widely distributed over the study area. It is characterised by steep Quaternary Holocene sand dunes on the Tomago Coastal Plain, with uncleared tall open forest. Soils are deep (>300 centimetres) well-drained, weakly developed podzols.

3.1.4 Hawks Nest

This aeolian landscape is widely distributed over the study area. It is characterised by low Holocene sandsheets and low transgressive dunes on the Tomago Coastal Plain, with dry scrubland, woodland and tall open forest. Soils are deep (> 300 centimetres) well-drained podzols and siliceous sands and podzols on dunes.

3.2 VEGETATION COMMUNITIES

Broad vegetation communities in the locality have been mapped in the Lower Hunter and Central Coast Regional Environmental Management Strategy (LHCCREMS) (House 2003). The study area includes three vegetation communities: coastal sand apple – blackbutt forest, swamp oak rushland forest and swamp mahogany – paperbark forest (see *Figures 3.1* and *3.2*).

Refinement of the LHCCREMS mapping by ERM (2005a), based on the vegetation mapping of Clements et al. (1992), delineated these vegetation communities into dry sclerophyll forest (coastal sand apple – blackbutt forest) and swamp forest (swamp oak rushland forest and swamp mahogany – paperbark forest) (see *Figure 3.3*). The 'wet heath' community described by Clements et al. (1992) was determined by ERM to correspond to the LHCCREMS mapping unit of 'Tomago sand swamp woodland'.

With regards to endangered ecological communities (EECs), it was determined by ERM that the EEC 'swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and south east corner bioregions' is present in the swamp forest on site where it adjoins Nelson Bay Road (refer to *Figure 2.1*).

Dry Sclerophyll Open Forest (Coastal Sand Apple – Blackbutt Forest)

The dry sclerophyll open forest community occupies the greatest area and is dominated by smooth-barked apple (*Angophora costata*), blackbutt (*Eucalyptus pilularis*) and old man banksia (*Banksia serrata*), with occasional red bloodwood (*Corymbia gummifera*) and black she-oak (*Allocasuarina littoralis*). The canopy density ranges from 30 to 70 percent and the mid-storey is sparse, reflecting the likely fire history of the study area. There is a well-developed understorey, mainly of shrubs, although some herbaceous species are also present. Some bitou bush occurs in this community. This community corresponds to the LHCCREMS mapping unit of coastal sand apple – blackbutt forest.

Swamp Forest (Swamp Mahogany – Paperbark Forest)

The swamp forest is dominated by broad-leaved paperbark, swamp mahogany (*Eucalyptus robusta*), swamp oak (*Casuarina glauca)* and cabbage tree palm (*Livistona australis*). The community mainly occurs along the Nelson Bay Road boundary of the study area, with an extensive patch in the western corner of the study area. The canopy density is 70 percent or greater and there is a sparse mid-storey of occasional broad-leaved paperbark. The ground cover is sparse and is dominated by swamp water fern (*Blechnum indicum*), jointed twigrush (*Baumea articulata*) and saw sedge (*Gahnia clarkei*). Weeds such as pennywort (*Hydrocotyle bonariensis*) are present, due to the favourable moisture conditions.

This community corresponds to the LHCCREMS mapping unit swamp mahogany – paperbark forest. Although the western half of the study area has been mapped by LHCCREMS as swamp oak - rushland forest, swamp forest in the study area is more characteristic of swamp mahogany – paperbark forest due to the dominant plant species present in the canopy, mid- and ground strata.

Coastal Scrub (Wet Heath)

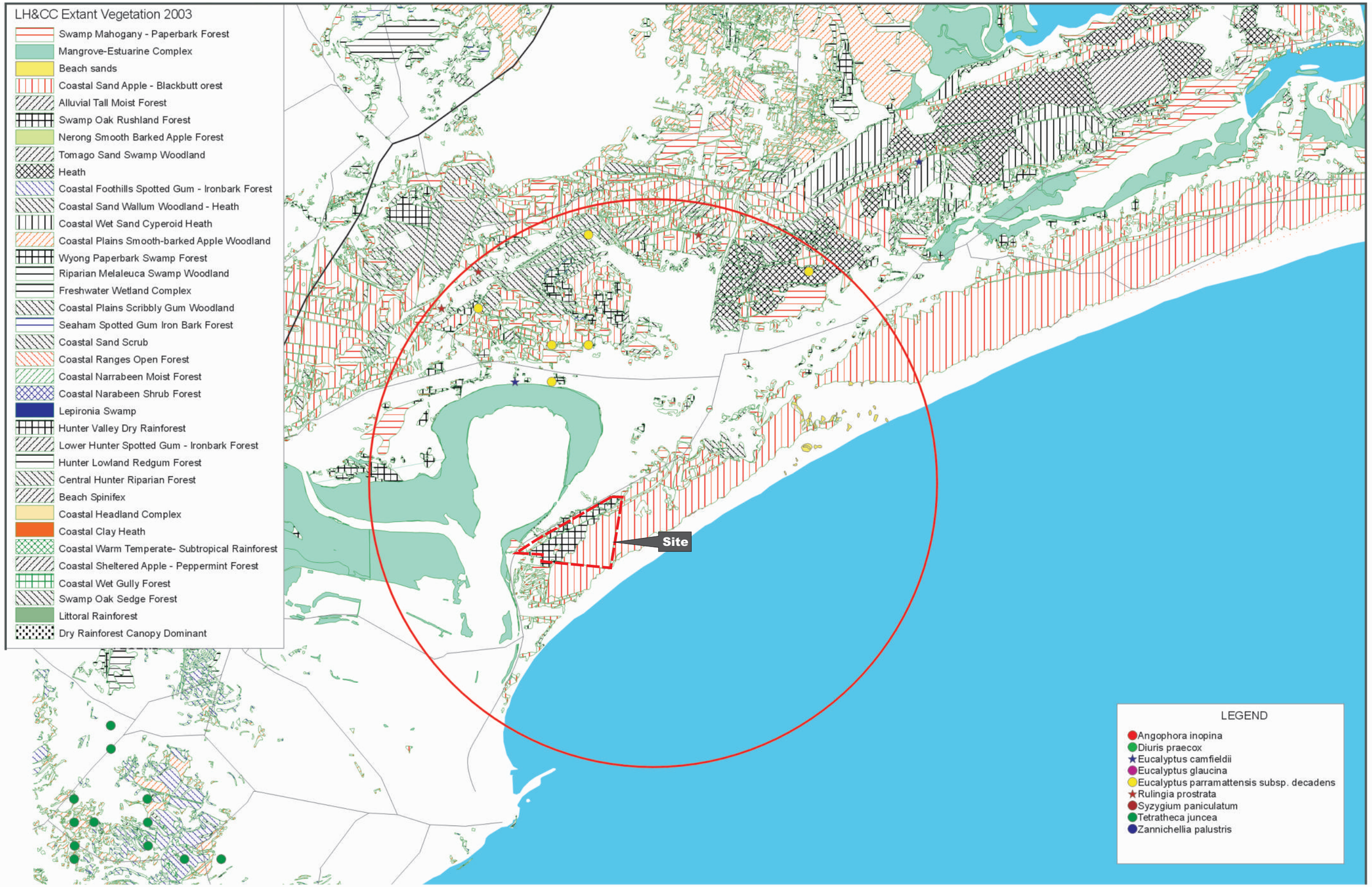
The coastal scrub community is dominated by swamp mahogany, red bloodwood and old man banksia as occasional emergent trees, although the community is generally less than three metres in height. This community corresponds to the wet heath community identified by Clements *et al*. (1992), and can be delineated into heath occurring on a 2000 year BP sand transgression, dominated by red bloodwood, and a 4000 year BP sand mass dominated by swamp mahogany that occurs further inland. Wet heath species such as *Melaleuca nodosa* and *Restio tetraphyllus* dominate the community. This community corresponds to the LHCCREMS mapping unit of Tomago sand swamp woodland on the 4000 year BP sand transgression.

3.3 TERRESTRIAL FAUNA HABITAT

The dry sclerophyll open forest community provides fauna habitat in the form of tree hollows, logs and ground cover such as grasses and bracken. Logs and ground cover provide shelter and foraging habitat for reptiles and small ground-dwelling mammals. The sandy substrate enables small to medium-sized mammals to create burrows for shelter. It is likely that tree hollows of this community provide suitable roosting habitat for microchiropteran bats. No habitat in the form of bush rock or rock platform was identified in the study area. The presence of Banksia in the mid-strata provides foraging resources for nectivorous birds and arboreal mammals.

The coastal scrub community has little to no habitat in the form of tree hollows, however, the dense grass cover and presence of *Acacia*, *Banksia* and *Leptospermum* provides extensive foraging habitat for granivorous and nectivorous birds, and some sheltering habitat for reptiles and small ground-dwelling mammals.

The swamp forest community provides potential foraging habitat to the grey-headed flying-fox and a suite of nectivorous birds such as the swift parrot. Swamp mahogany comprises the primary winter foraging resource in this community, although *Melaleuca* also provides a flowering resource. Some hollow-bearing trees are also present in this community, providing potential roost sites for microchiropteran bats. This vegetation community also supports a wetland that provides suitable habitat for frog species. This vegetation community is located within the 7(a) Environment Protection zone and the 2(a) Residential zoned land.



Jobs/2003/0012720/Master Plan Studies -EPBC - Fg3.1 Threatened Flora.cdr March 2005 SP Environmental Resources Management Australia Pty Ltd

Figure 3.1 **Threatened Flora Records and Vegetation Communities**

Winten Property Group - CVC Limited - Fern Bay Estate

3.4 THREATENED OR SIGNIFICANT FAUNA SPECIES

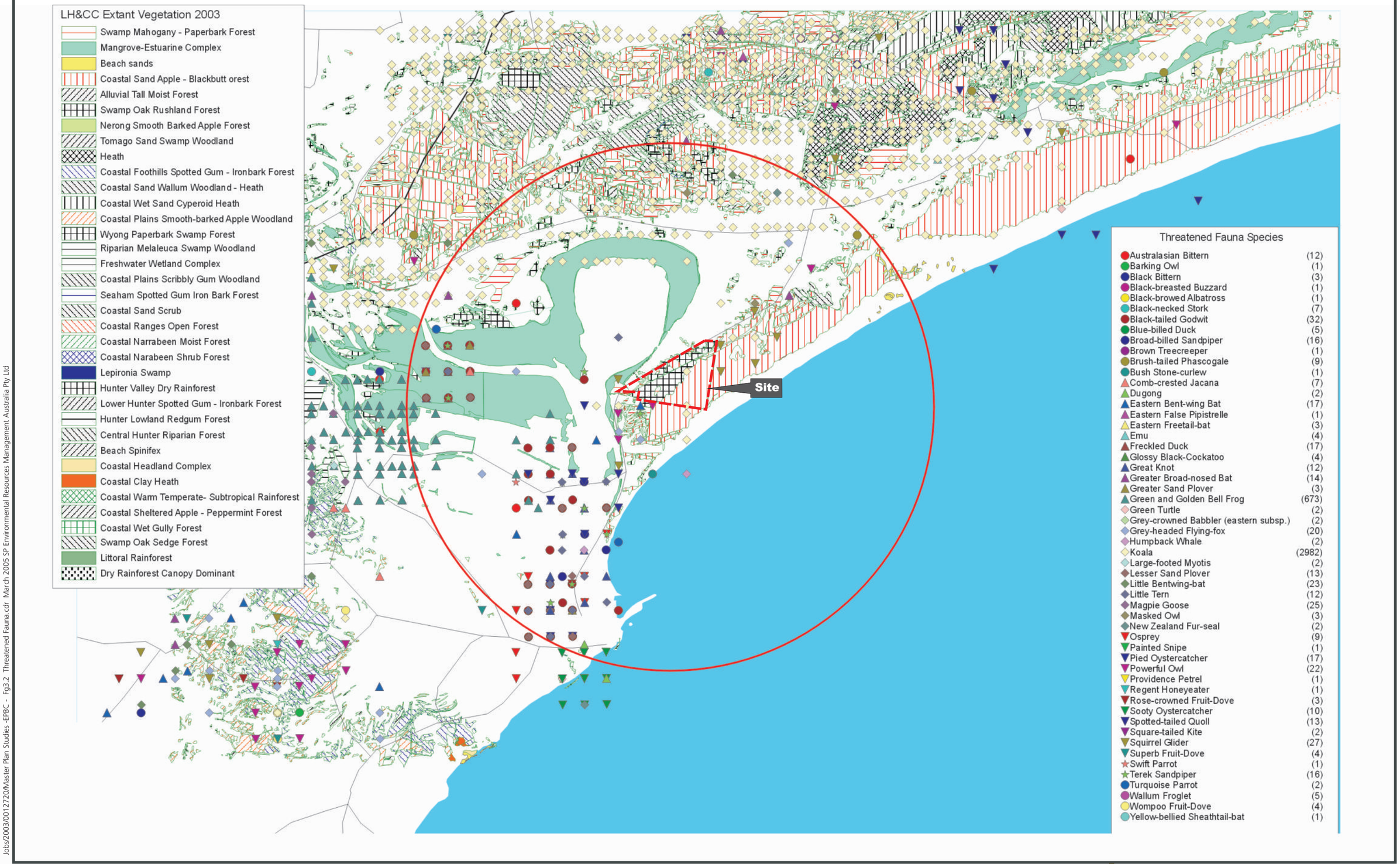
A number of species currently listed as threatened on the EPBC Act are known or likely to occur in the locality, ie. within a 10 kilometre radius of the study area, based on DEC, DEH and Birds Australia database records (see *Figure 3.2* and *Figure 3.4*).

Species listed as threatened and/or migratory species in the EPBC Act that have been recorded and that have the potential to occur in the study area are identified in *Table 3.1*. A number of species have not been included in this assessment as they are largely marine mammals (eg whales and other cetaceans), birds (eg albatross, petrels), reptiles (eg sea turtles, sea snakes) and fishes (eg pipefishes, sharks). It is reasonable to assume that these species are not present or depend on habitats within the study area. Migratory wader birds that depend on estuarine mudflats and saltmarsh were also excluded from the assessment, due to the absence of these habitats in the study area, although the following species have been recorded in the locality and are included on the DEH database:

- ruddy turnstone (*Arenaria interpres*);
- curlew sandpiper (*Calidris ferruginea*);
- lesser sand-plover (*Charadrius mongolus*);
- broad-billed sandpiper (*Limicola falcinellus*);
- bar-tailed godwit (*Limosa lapponica*);
- black-tailed godwit (*Limosa limosa*);
- eastern curlew (*Numenius madagascariensis*);
- whimbrel (*Numenius phaeopus*);
- Pacific golden plover (*Pluvialis fulva*);
- common greenshank (*Tringa nebularia*);
- marsh sandpiper (*Tringa glareola*); and
- Terek Sandpiper (*Xenus Cinereus*).

3.5 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

The flora and fauna species listed as threatened in the EPBC Act and the bird species listed in the migratory provisions of the EPBC Act that have the potential to occur on site are listed in *Table 3.1*. Only two of these species,



Jobs/2003/0012720/Master Plan Studies -EPBC - Fg3.2 Threatened Fauna.cdr March 2005 SP Environmental Resources Management Australia Pty Ltd

ERM

Figure 3.2 **Threatened Fauna Records and Vegetation Communities**

Winten Property Group - CVC Limited - Fern Bay Estate

Diuris praecox and the grey-headed flying-fox, have been recorded in the study area (refer to *Figure 3.3*).

Table 3.1 Matters of National Environmental Significance as Listed under Environmental Protection and Biodiversity Conservation Act 1999

Species	Status	Likelihood of Occurrence
FLORA		
leafless tongue-orchid (*Cryptostylis hunteriana*)	V	Low to moderate likelihood. Terrestrial orchid grows in coastal swamp heath on sandy soil, eucalypt woodland, swamp fringes to bare hillsides in tall forest, with *Blandfordia nobilis*, *Cryptostylis erecta* and *Cryptostylis subulata.* Prefers volcanic hills in Port Stephens area. Not recorded in previous surveys in study area.
Diuris praecox	V	High likelihood recorded in north east corner of study area. Prefers sclerophyll forest on sand hills.
Camfield's stringybark (*Eucalyptus camfieldii*)	V	Low likelihood occurs on coastal shrub heath on sandy soils on sandstone, often of restricted drainage.
Parramatta red gum (*Eucalyptus parramattensis* subsp. *decadens*)	V	Moderate likelihood. Prefers dry woodland on sandy soils in low, often wet sites. Locally records appear to be restricted to pleistocene dune systems. Study area contains preferred Tomago sand swamp woodland habitat but no individuals have been recorded. Hybrids of this species have been identified in the study area.
knotweed (*Persicaria elatior*)	V	Not expected to occur. Prefers sandy alluvial soil. No records in locality.
dwarf kerrawang (*Rulingia prostrata*)	E	Moderate likelihood. Prefers ecotone of sedgeland and paperbark forest.
Tetratheca juncea	V	Not expected. Dry sclerophyll open forest on the upper part of ridges with a southerly aspect, west through to east, with the most commonly associated tree species being *Angophora costata*, *Eucalyptus globoidea* and *E. gummifera*. Not recorded on site.
FAUNA		
swift parrot (*Lathamus discolor*)	E, M	Moderate likelihood. Foraging resources (winter flowering swamp mahogany) present and local records. Not recorded during targeted surveys.
regent honeyeater (*Xanthomyza phrygia*)	E, M	Moderate likelihood. Foraging resources (winter flowering swamp mahogany) present. Local records, although not recorded during targeted surveys.
Australian painted snipe (*Rostratula australis*)	V	Not expected to occur. No foraging and nesting habitat present.
green and golden bell frog (*Litoria aurea*)	V	Low to moderate likelihood. Prefers permanent freshwater wetlands including dams and ponds with tall emergent vegetation such as *Typha* sp. and *Eleocharis* sp.
southern barred frog (*Mixophyes iteratus*)	E	Low to moderate likelihood. Species prefers rivers and creeks in rainforest, wet sclerophyll and eucalypt forests. Unlikely to occur.
large-eared pied bat (*Chalinolobus dwyeri*)	V	Low to moderate likelihood of foraging. Cave roosting species that forages in dry sclerophyll forests and woodland.
spotted-tailed quoll (*Dasyurus maculatus*)	E	Moderate to high likelihood. Requires caves, rock crevices and hollow logs in a wide range of habitats.
long-nosed potoroo (SE mainland) (*Potorous*	V	Low likelihood. Prefers rainforest, wet sclerophyll forest and coastal heath.

Species	Status	Likelihood of Occurrence
tridactylus tridactylus)		
grey-headed flying-fox (*Pteropus poliocephalus*)	V	High likelihood recorded in area. Potential foraging habitat in the study area. Roosts at Fullerton Cove.
white-throated needletail (*Hirundapus caudacutus*)	M	May forage aerially over the study area. Potential to occur.
black-faced monarch (*Monarcha melanopsis*)	M	Species prefers rainforest, wet sclerophyll and denser eucalypt forests, damp gullies, and mangroves. Potential to occur.
satin flycatcher (*Myiagra cyanoleuca*)	M	Species prefers forest, particularly thick gullies. Potential to occur.
rufous fantail (*Rhipidura rufifrons*)	M	Species prefers rainforest. Unlikely to occur.
white-bellied sea-eagle (*Haliaeetus leucogaster*)	M	Potential foraging habitat present. No nests recorded in the study area. Potential to occur.
Latham's snipe (*Gallinago hardwickii)*	M	No foraging and nesting habitat present. Unlikely to occur.
Status EPBC Act: E = endangered; V = vulnerable; M = migratory		

Other matters of national environmental significance that occur within the locality include:

- the Hunter Estuary Wetlands, which is a Ramsar wetland site that covers part of the Kooragang Nature Reserve and the Shortland Wetlands Centre.; and

- Commonwealth land at Williamtown RAAF Base.

The south west boundary of the study area is approximately 400 metres from the boundary of the Hunter Estuary Wetlands. The study area does not drain into this Ramsar wetland and is separated by Nelson Bay Road and cleared agricultural land. This wetland is not likely to be adversely impacted by the proposed residential development.

Given the Williamtown RAAF Base is approximately six kilometres from the study area, the proposal will not impact Commonwealth land.

There are no threatened ecological communities, World Heritage properties or Commonwealth marine areas or nuclear actions on or near the study area.

Legend

Threatened Species

	Easting	Northing
Grey-headed Flying-fox	389000	6364110
	389820	6364300
	388300	6363570
Diuris praecox	389765	6364485
	389800	6364430

1(a) 1(a) Rural Agriculture Zone

2(a) 2(a) Residential Zone

7(a) 7(a) Environment Protection Zone

Approved Subdivision

Cleared VegetationCleared Vegetation

Swamp Mahogany - Paperbark Forest

Coastal Sand Apple Blackbutt Forest

Wet Heath - Tomago Sand Swamp Woodland

Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-East Corner Bioregion

Nelson Bay Road

Fullerton Cove Road

Nelson Bay Road

Powerline Easement

7a

2a

1a

Figure 3.3 **Vegetation Communities and Threatened Species Listed in the EPBC Act in the Study Area**

Winten Property Group - CVC Limited - Fern Bay Estate

ERM

Jobs\2003\0012720\Master Plan Studies -EPBC - Fg3.4 Birds Australia Records.cdr March 2005 SP Environmental Resources Management Australia Pty Ltd

ERM

Figure 3.4 **Birds Australia Records**

Winten Property Group - CVC Limited - Fern Bay Estate - SIS

4 IMPACT ASSESSMENT

4.1 HABITAT LOSS

The proposed residential estate (including the asset protection zone) will involve the direct loss of approximately 70.2 hectares of vegetation comprising swamp forest, wet heath and dry sclerophyll open forest. A total of 30 hectares of vegetation has already been approved to be cleared under the existing development consent that applies over part of the study area. However, 7.2 hectares is not now proposed to be cleared and will be retained in a vegetated fauna movement corridor. Therefore the net area of vegetation to be cleared as a result of the proposal (ie excluding the approved 22.8 hectares that can be cleared) is 70.2 hectares (see *Table 4.1*). It should be noted that a conservative approach has been adopted in calculating the extent of vegetation clearance required for the proposed estate. In reality the amount of clearing will be less than the estimate provided as some vegetation will be retained in the open space and residential areas of the estate as well as within the asset protection zone. No vegetation will be disturbed with the Aboriginal heritage reserve.

Table 4.1 Clearance and Conservation of Vegetation in the Study Area (approximate hectares)

Vegetation community	Total hectares of native vegetation in study area	Hectares to be removed by approved subdivision	Hectares removed by this subdivision proposal	Hectares conserved in study area
swamp forest	43.5	3.3	9.7	30.5
wet heath	26.0	4.0	15.0	7.0
dry sclerophyll open forest	130.5	15.5	45.5	69.5
TOTAL	**200.0**	**22.8**	**70.2**	**107.0**

Note: Five hectares of the study area is cleared land.

Most of the vegetation that will be cleared is dry sclerophyll open forest. Relative to the area that will be conserved, the greatest loss of habitat in the study area will be wet heath, with only 26 percent of the total area being conserved. Approximately 70 percent of the swamp forest will be conserved, mostly within the minimum 200 metre wide ecological corridor. Over half of the dry sclerophyll forest in the study area will also be conserved.

The loss of approximately 70.2 hectares of vegetation will remove habitat for a number of threatened species, although within a regional context, a significant area of known habitat will not be removed or modified.

4.2 *HABITAT FRAGMENTATION*

The proposed residential subdivision will remove approximately 35 percent of the native vegetation in the study area, and vegetation communities are likely to be fragmented. This vegetation forms part of the existing vegetation corridor along the sand dunes of Stockton Bight. However, given that a minimum 200 metre wide ecological corridor will be retained along the northern boundary of the site, the proposal will ensure that connectivity of swamp forest is maintained in the Fern Bay area. The ingress of two roads into the development area will fragment this corridor somewhat, although it is currently fragmented by a powerline easement. Two areas of wet heath will be cleared, leaving a smaller area isolated in the northern portion of the study area. Although an area of wet heath occurs on Boral's land holdings to the north, it is discontinuous with wet heath in the study area.

Dry sclerophyll open forest will be fragmented throughout the study area, leaving the only intact corridor of this vegetation around the eastern boundary of the study area. The design facilitates the retention of approximately 300 metres of existing bushland between the proposed residential allotments and the cleared areas of Stockton Bight dune system, providing a movement corridor for fauna through dry sclerophyll open forest. This corridor is within the 100 year dune hazard zone, and therefore the corridor width may decrease over time. However, in order to maintain this corridor and protect the residential areas of the estate from sand dune encroachment, periodic removal of sand will be considered as a future option for managing dune migration. WPG are in the process of developing a strategy to address this issue.

The corridors of swamp forest and dry sclerophyll open forest will facilitate the movement of fauna so that species, populations and ecological communities will not become isolated from the currently interconnecting areas of habitat to the south and north. Fauna movement west of the study area is presently disrupted by Nelson Bay Road, although some fauna such as the squirrel glider may be able to glide across the canopy above the road. Cleared agricultural land west of Nelson Bay Road also presents a barrier to the movement of terrestrial fauna.

4.3 *INDIRECT IMPACTS*

Edge effects in swamp forest will be minimised in areas where it is proposed for conservation by the application of a 50 metre wide buffer around the boundary of the community. Most edge effects disappear over the first 50 metres into a remnant of native vegetation (Murcia 1995). Edge effects are likely to be greatest in the dry sclerophyll open forest due to the large interface area between this community and the development footprint.

The absence of streams and drainage lines in the study area reduces the potential issue of erosion and sedimentation as a result of the proposed development. However, the implementation of erosion and sedimentation

control plan, and stormwater management protocols, will restrict the movement of sediment within the study area and offsite.

The construction of roads within the study area increases the risk of traffic strike to fauna, particularly where roads traverse corridors. Low speed zones (40km/hr) will be established where the two roads provide ingress to the proposed subdivision, in the minimum 200 metre wide ecological corridor.

Weed invasion into low nutrient environments such as dry sclerophyll open forest is a potential issue, given that this vegetation community will be fragmented by the proposed development. The implementation of a weed management plan for the construction and post-construction phases of the development will assist in controlling weeds on site.

The subdivision of Fern Bay Estate will be carried out under Community Title. This means that a Community Association will be established to implement a Community Management Plan (CMP) that will be prepared for the estate. The CMP will not only contain design guidelines for future urban development but will also identify how the open space areas and the recreational and community facilities will be managed by the Community Association. Therefore it is the Community Association (established via Community Title) that will be responsible for ensuring that appropriate action is taken to minimise edge effects and the spread of weeds, and for maintaining the public areas of the estate.

4.4 LOCAL AND REGIONAL WILDLIFE CORRIDORS

The study area forms part of a local corridor of native vegetation that extends along the coast north to the Tomago sandbeds, Stockton Bight and the Tomaree Peninsula. The study area also forms part of a regional corridor from the coastal forests of Stockton Bight to estuarine habitats in Fullerton Cove, and further west to wetland habitats on Kooragang Island and in Hexham Swamp, to the forested foothills of Mount Sugarloaf. This corridor has been mapped as a regional corridor in the National Parks and Wildlife Service's "Key Habitats and Corridors – a Landscape Framework for Regional Conservation Programs in North East New South Wales" (NPWS 2002). This project is designed to provide an indicative representation of potential high conservation value areas for priority forest fauna, and habitats that link across the landscape. The fragment of vegetation that the study area is situated within has also been mapped as a key habitat. Key habitats define areas identified as centres of high native species diversity for a range of fauna assemblages (NPWS 2002).

The proposal will remove key habitat from the regional corridor. However, the retention of a minimum 200 metre wide ecological corridor and other local corridors in the study area are designed to maintain the integrity of this corridor.

4.5 ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

4.5.1 Threatened Species, Populations and Ecological Communities

As discussed in *Section 3.5*, there are no threatened ecological communities or World Heritage properties listed under the EPBC Act within 10 kilometres of the site. The nearest Commonwealth land to the site is the Williamtown RAAF base. The proposed subdivision will not impact upon these sites. The proposal is not expected to impact on the hydrology or ecology of the Hunter Estuary Wetlands.

The threatened species recorded, or with a moderate to high likelihood of occurring in the study area, based on the availability of suitable habitat, include *Diuris praecox*, *Rulingia prostrata*, and *E. parramattensis* subsp. *decadens*, swift parrot, regent honeyeater, large-eared pied bat, spotted-tailed quoll and grey-headed flying-fox (see *Table 3.1*). The nature and extent of a likely impact to these species from the proposed development has been assessed below in accordance with criteria described by Environment Australia (2000).

An action has, will have, or is likely to have a significant impact on a threatened species if it does, will, or is likely to:

a) lead to a long-term decrease in the size of an important population of a species

It has been assumed that these species, which have the potential to occur on the site, do not represent important populations (ie. if they were to occur they would not be necessary for the species' long-term survival and recovery).

Diuris praecox

Two individual plants of *Diuris praecox* were found in the north eastern portion of the study area, which will not be developed. No other individual plants were found in the dry sclerophyll forest elsewhere in the study area, despite targeted searches. As the local population of *Diuris praecox* in the study area appears to be restricted to the north eastern boundary, outside the development footprint, the proposed development is unlikely to lead to a decrease in the size of an important population.

Eucalyptus parramattensis subsp. *decadens*

Eucalyptus parramattensis subsp. *decadens* was not recorded in the study area during previous vegetation surveys and by ERM during koala habitat assessments. It is expected that these surveys would have detected such a conspicuous tree within the wet heath community. Therefore, a local population is not likely to be present in the study area.

Hybrids of this species with *Eucalyptus robusta* have been identified in the study area. Hybrids of *Eucalyptus parramattensis* with *Eucalyptus resinifera* and *Eucalyptus punctata* have also been identified. It is proposed to collect seed from these hybrids and establish a population within similar habitat in land

zoned 1(a) in the eastern part of study area. The potential for the establishment of these hybrid species at new locations, providing they are within similar habitat, appears to be high given that *Eucalyptus parramattensis* subsp. *decadens* has been successfully used as a canopy species in the rehabilitation of sand mined areas in the Tomago sandbeds (see URS 2003).

Rulingia prostrata

Rulingia prostrata was not recorded in the study area during previous investigations, although it has the potential to occur in the ecotone between swamp forest and dry sclerophyll open forest. As large areas of the swamp forest and a 50 metre buffer around swamp forest will be retained in the study area, a population that may be present is unlikely to be reduced in size as a result of the proposed development.

Swift Parrot and Regent Honeyeater

Potential foraging habitat for the swift parrot and regent honeyeater is proposed to be conserved, as swamp mahogany in swamp forest will be retained in the study area. Local populations are unlikely to exist in the locality as the species are migratory. No swift parrots or regent honeyeaters were recorded during targeted surveys. Individual groups in the migrating population are unlikely to be affected by the proposed development, as foraging resources will be conserved in the study area.

Large-eared Pied Bat

The large-eared pied bat roosts in caves and tunnels, and forages over dry sclerophyll forests and woodland. As there is no roosting habitat present in the study area, the proposed development is unlikely to disrupt the breeding and hibernation cycles of this species. The study area provides potential foraging habitat, although similar habitats occur in the vicinity of the study area, and areas of dry sclerophyll open forest will be conserved in the study area. Therefore, the proposed development is unlikely to lead to the long-term decrease in the size of an important population.

Spotted-tailed Quoll

Potential habitat for the spotted-tailed quoll is provided by dry sclerophyll open forest. However, no individuals have been recorded during the extensive survey effort in the study area, and it is unlikely that the study area comprises the home range of any individuals. The proposed development will only result in a marginal reduction in the potential foraging habitat for the species, which has a large home range (Mansergh 1983). Therefore, the proposed development is unlikely to lead to a reduction in the size of a population that may occur in the locality.

Grey-headed Flying-fox

The study area does not provide roosting habitat for the grey-headed flying-fox as this species roosts in specific camps, the nearest being Fullerton Cove.

The study area provides seasonal foraging resources for this species, in the form of eucalypt, paperbark and *Banksia serrata* blossoms and nectar. Given the absence of roosting habitat, the extent of alternative foraging habitat in the vicinity of the study area, and the mobile nature of the species, the proposal is unlikely to lead to the long-term decrease in the size of a population of grey-headed flying-fox.

b) reduce the area of occupancy of an important population

No known habitat for an important population is to be removed. The proposed residential subdivision development requires the loss of vegetation that has the potential to support foraging habitat for the swift parrot, spotted-tailed quoll, large-eared pied bat and grey-headed flying-fox. The removal of this vegetation, however, is unlikely to reduce the area of occupancy of an important population. The proposed development is not likely to reduce the area of an important population of threatened flora in the study area, due to the proposed layout and retention of habitat in corridors and buffers.

c) fragment an existing important population into two or more populations

Populations of threatened species that may exist in the study area are unlikely to be fragmented due to the retention of movement corridors on the eastern and western boundaries of the study area, as well as an open space corridor through the centre of the proposed subdivision. Populations of *Diuris praecox* will not be fragmented, as no development will occur in the northern corner of the study area. Mobile fauna such as the large-eared pied bat and grey-headed flying-fox will be able to traverse the study area regardless of the proposed development.

d) adversely affect habitat critical to the survival of the species

Potential habitat for the threatened species in the study area is not regarded as critical to the survival of the species.

e) disrupt the breeding cycle of an important population

The breeding cycle of an important population of *Diuris praecox* or *Rulingia prostrata* will not be disrupted as a result of the proposed development, as habitat for both species will be retained in the study area. This measure will enable the future propagation of both species within the study area.

A population of hybrid *Eucalyptus parramattensis* subsp. *decadens* x *Eucalyptus robusta*, *Eucalyptus parramattensis* x *Eucalyptus resinifera* and *Eucalyptus parramattensis* x *Eucalyptus punctata* will be established in a conservation reserve in the study area.

Roost sites for the large-eared pied bat and den sites for the spotted-tailed quoll will not be disturbed as a result of the proposal. The swift parrot breeds only in Tasmania and the regent honeyeater breeds west of the Hunter Valley. No camp sites of the grey-headed flying-fox are present in the study area.

f) modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The degree of clearing in potential habitat areas for these species is not significant in terms of the abundance of adjoining and nearby habitat areas. Of the habitat types that occur in the study area, providing potential habitat for these species, approximately 70 percent of the existing swamp forest, 27 percent of the wet heath and approximately 53 percent of the dry sclerophyll open forest in the study area will be conserved. Movement corridors will be maintained around these habitats and through the centre of the proposed subdivision. The implementation of erosion and sediment control plans, a weed management plan and other mitigation measures will reduce the potential impacts to these species so their populations are unlikely to decline in the study area.

g) result in invasive species that are harmful to a threatened species becoming established in the threatened species habitat

The proposed subdivision is likely to introduce new animals such as household pets into the study area, however, with the promotion of responsible pet ownership these impacts may be minimised. A weed management plan would aim to control exotic perennial grasses and weeds such as bitou bush, particularly in areas susceptible to weed invasion, such as road edges and asset protection zones. Community education programs may also be beneficial in educating home-owners on responsible garden waste management.

h) interfere substantially with the recovery of the species

The proposed subdivision will not interfere with the recovery of any of the threatened species.

As a local population of threatened species would not be significantly impacted by the proposed subdivision, no further assessment under the EPBC Act is warranted.

4.5.2 Migratory Species

Migratory species with a moderate to high likelihood of occurring in the study area or in its vicinity, based on the availability of suitable habitat, include the swift parrot, regent honeyeater, white-throated needletail, black-faced monarch, satin flycatcher and white-bellied sea-eagle (see *Table 3.1*). The nature and extent of a likely impact to these species from the proposed development has been assessed below in accordance with criteria described by Environment Australia (2000).

An action has, will have, or is likely to have a significant impact on a migratory species if it does, will, or is likely to:

a) substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat of the migratory species

Swift Parrot and Regent Honeyeater

Swift parrots and regent honeyeaters follow the flowering of trees such as eucalyptus and banksias. Potential foraging habitat for both species is proposed to be conserved, as swamp mahogany in swamp forest will be retained in the study area. Local populations are unlikely to exist in the locality as the species are migratory. No swift parrots or regent honeyeaters were recorded in the study area during targeted surveys. Individual groups in the migrating population are unlikely to be affected by the proposed development, as foraging resources will be conserved in the study area.

White-throated Needletail

The white-throated needletail rests and feeds at high altitudes, and roosts in trees in forested hill country. They breed in the northern hemisphere prior to migrating to Australia in late October from Asia. Foraging and roosting habitat does not occur within the study area, and the loss of habitat in the study area is not considered to be important habitat for the species.

Black-faced Monarch and Satin Flycatcher

The black-faced monarch and satin flycatcher breed in moist forest types communities. The swamp forest in the study area provides potential breeding habitat. This removal of this vegetation community will be minimised and approximately 70% of the existing amount will be conserved in the study area. Therefore, impacts to the breeding cycle of these species will be minimised.

White-bellied Sea-eagle

The white-bellied sea-eagle inhabits coastal areas and beside large lowland rivers and lakes (Schodde and Tidemann 1993). Its nest is a huge structure of sticks, 30 metres or more above the ground in a tall tree (Schodde and Tidemann 1993). Potential foraging and roosting habitat for the white-bellied sea-eagle occurs in the study area, however nesting habitat has not been recorded during current or previous ecological investigations. Therefore, the white-bellied sea-eagle is unlikely to be nesting in the study area.

b) result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat of the migratory species

The proposed subdivision is likely to introduce new animals such as household pets into the study area, however, with the promotion of responsible pet ownership these impacts may be minimised. A weed management plan would aim to control exotic perennial grasses and weeds such as bitou bush. Community education programs may also be beneficial in educating home-owners on responsible garden waste management.

c) *seriously disrupt the life cycle (breeding, feeding, migration or nesting behaviour) of an ecologically significant proportion of the population of the species*

Only minor, seasonal or temporary breeding, feeding, migration and/or nesting sites for migratory species potentially occur in the study area and will not be significantly disturbed. Mitigation measures would ensure that no indirect impacts to important migratory species habitat occur. Therefore, disruptions to the life cycle of an ecologically significant proportion of the population of these species are unlikely to occur.

As a local population of migratory species would not be significantly impacted by the proposed subdivision, no further assessment under the EPBC Act is warranted.

5 CONCLUSIONS

The proposed residential subdivision at Fern Bay will involve clearance of approximately 70.2 hectares of habitat for protected and threatened species. The potential for a significant impact arises given that roosting and foraging habitat for these species in the dry sclerophyll open forest and some areas of swamp forest will be removed. Regional corridors and connectivity will be maintained along the minimum 200 metre wide ecological corridor along Nelson Bay Road.

A number of measures are proposed to minimise impacts on flora and fauna such as:

- retaining ecological corridors on site;
- retaining koala habitat trees in bushfire asset protection zones where possible;
- conducting pre-clearance surveys of hollow-bearing trees;
- introducing a 40 kph low speed zone for vehicles along the two ingress roads that traverse the minimum 200 metre wide ecological corridor;
- implementing an erosion and sediment control plan and a vegetation management plan to reduce the impacts of development on flora and fauna and off-site;
- collecting seed from the *Eucalyptus parramattensis* subsp. *decadens* x *Eucalyptus robusta, Eucalyptus parramattensis* x *Eucalyptus resinifera* and *Eucalyptus parramattensis* x *Eucalyptus punctata* hybrid species and establishing populations in land zoned 1(a) Rural Agriculture that is outside the proposed development footprint; and
- promoting responsible dog and cat ownership.

A local population of threatened or migratory species listed in the EPBC Act is not likely to be significantly impacted by the proposed subdivision. Implementation of erosion and sedimentation controls will reduce the risk of sediment movement off-site, including into the Hunter Estuary Wetlands. The proposal will not impact on Commonwealth land, Commonwealth marine areas or World Heritage properties. Given the proposal will not impact on matters of national environmental significance approval from the Commonwealth Minister for the Environment is not required.

REFERENCES

Bell, S.A.J. (1997) **Tomaree National Park Vegetation survey.** A fire management document. Prepared for NSW National Parks and Wildlife Service

Briggs, J.H., and Leigh, J.D. (1996) **Rare and Threatened Australian Plants**. Australian National Parks and Wildlife Service, Canberra

Clements, A.M., Rodd, A.N., Lim, I, Clulow, J., and Hoye, G. (1992) **Flora and Fauna Report for the Environment Assessment of Fern Bay, New South Wales**. Prepared for Port Stephens Shire Council. Anne Clements & Associates Pty Ltd, North Sydney

Corkery & Co. (1988) **An Environmental Impact Statement for an Industrial Sand Extraction Operation North of Stockton, New South Wales**. Prepared for Hooker Resources

Croft & Associates (1980) **Newcastle Bight Study**. Prepared for NSW Department of Planning and Environment

Cropper, S. (1993) **Management of Endangered Plants**. CSIRO Publishing, Melbourne

CRA Unit, National Parks and Wildlife Service (2000) **Vegetation Survey, Classification and Mapping. Lower Hunter and Central Coast Region**. Version 1.2. For the Lower Hunter and Central Coast Regional Environment Management Strategy. April 2000

Ecological Management Consultancy (Shortland Wetlands Centre) (1994) **Fern Bay Rezoning Proposal Assessment of Impact on Migratory Birds**

Ecotone Ecological Consultants (2001) **Flora and Fauna Survey and Threatened Species Assessment. Proposed Subtransmission Line Upgrade to Tomaree Peninsula. Southern Section Lavis Lane to Nelson Bay Road, Salt Ash**. Prepared for Enerserve

ERM Resource Planning (1994) **Sand Extraction operations on Boral Resources freehold property at Fern Bay, Newcastle Bight. Fauna Impact Statement**. Prepared for Boral Resources Pty Ltd

ERM (2005) **Fern Bay Estate Species Impact Statement**. Prepared for Winten Property Group and Continental Venture Capital Limited

ERM Mitchell McCotter (1998) **Fern Bay Rezoning Application.** Prepared for Howship Holdings Pty Ltd

Fanning, F.D., and Clarke, S. (1993) **Fauna and Flora Assessment for a proposed sewage treatment plant at Fern Bay, Port Stephens Shire**. Prepared for the Hunter Water Corporation

Gunninah Consultants (1996 revised 1997) **Fauna and Flora Assessment, Proposed Residential Development, Nelson Bay Road, Fern Bay**

Gunninah Consultants (2002) **Preliminary Draft Flora and Fauna Assessment, Lot 16 DP 258848, No. 85 Nelson Bay Road, Fern Bay**

Hager, T.C., and Benson, J.S. (1994) **Review of the conservation status of vegetation communities in New South Wales. Part 3: Assessment of the conservation status of forest plant communities in north eastern New South Wales**. Report to the Australian Heritage Commission

House, S. (2003) **Lower Hunter and Central Coast Regional Biodiversity Conservation Strategy, Technical Report, Digital Aerial Photo Interpretation and Updated Extant Vegetation Community Map, May 2003**. Lower Hunter and Central Coast Regional Environmental Management Strategy (LHCCREMS)

Matthei, L.E. (1995) **Soil Landscapes of the Newcastle 1:100 000 Sheet Report**. Department of Land and Water Conservation, Sydney

Murcia, C. (1995) **Edge effects in fragmented forests: implications for conservation**. *Trends in Ecology and Evolution* 10: 58-62

Murray, M., Bell, S.A.J., and Hoye, G. (2002) **Flora and fauna survey guidelines: lower Hunter Central Coast region 2002**. Lower Hunter & Central Coast Regional Environmental Management Strategy, Callaghan

NPWS (2002) **Lower Hunter Conservation – Draft Issues Paper**. NSW National Parks and Wildlife Service, Northern Directorate

Myerscough, P., and Carolin, R. (1986) **The vegetation of the Eurunderee sand mass, headlands and previous islands of the Myall Lakes area, New South Wales**. *Cunninghamia* 1: 399-466

Schodde, R. and Tidemann, S.C. (Eds) (1993) **Readers Digest Complete Book of Australian Birds**. Readers Digest Australia Pty Ltd

SWC Wetlands and Ecological Management Consultancy (Shortland Wetlands Centre) (1993**) Fern Bay Rezoning Proposal Assessment of Impact on Endangered Fauna**

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