Appendix 8
Flora and Fauna Assessment

Conacher Environmental Group

June 2008

Warner Industrial Park Concept Plan and Project Application

Precinct 14 WEZ

Sparks Rd and Hue Hue Rd
Warnervale
June 2008

80 TERRACE TOWER GROUP

Warner Business Park Pty Ltd
Part of the Terrace Tower Group

Peter Andrews + Associates Pty Ltd
architecture planning urban design

FLORA AND FAUNA ASSESSMENT REPORT

PROPOSED INDUSTRIAL DEVELOPMENT

PRECINCT 14
WYONG EMPLOYMENT ZONE
WARNERVALE

JUNE 2008
(REF: 8035F)

www.cegconsult.com

Central Coast Office
4/369 Mann Street, Gosford NSW 2250
PO Box 360 Gosford NSW 2250

•Ph (02) 4324 7888 • Fax (02) 4324 7899

•Email cegconsult@bigpond.com

ABN 62 274 841 042

FLORA AND FAUNA ASSESSMENT REPORT

PROPOSED INDUSTRIAL DEVELOPMENT

PRECINCT 14
WYONG EMPLOYMENT ZONE
WARNERVALE

JUNE 2008

Conacher Environmental Group

Environmental and Land Management Consultants

369 Mann Street, Gosford NSW
PO Box 360, Gosford NSW
Phone: 02 4324 7888 Fax: 02 43247899
23 Coleman Street, Lismore NSW
PO Box 92, Lismore NSW
Ph: 02 6622 7522 Fax: 02 6622 7533

PREFACE

This Flora and Fauna Assessment Report has been prepared by *Conacher Environmental Group* to identify the flora and fauna characteristics of the proposed Warner Industrial Park and the adjoining lands in Lot 5 DP 259531 and Lot 9 DP 239704 within Precinct 14 of the Wyong Employment Zone, Jilliby.

This Report provides an assessment of existing habitats and the potential for the proposed development to significantly impact on threatened species according to Section 5(A) of *the Environmental Planning and Assessment (EP&A) Act* 1979 and the *Threatened Species Conservation Act* (1995).

PROJECT TEAM

PHILLIP ANTHONY CONACHER B.Sc.(Hons), Dip.Urb Reg Planning, M.Nat.Res.
NPWS Scientific Licence Number: S10359
Director
Conacher Environmental Group

PAUL GERARD SHELLEY Grad. Cert. Appl. Sc
NPWS Scientific Licence Number: S10359 Fauna Technician
Conacher Environmental Group

ROBERT CLIFFORD SANSOM B.Sc.(Hons.)
NPWS Scientific Licence Number: S10359
Botanist / Ecologist
Conacher Environmental Group

JACOB MANNERS B.Sc.
Ecological Consultant
Conacher Environmental Group

JASMINE ROWE B.EnScMgt.
Ecological Consultant
Conacher Environmental Group

TABLE OF CONTENTS

SECTION 1
INTRODUCTION AND BACKGROUND

SECTION 2
VEGETATION CHARACTERISTICS

SECTION 3
FAUNA AND FAUNA HABITATS

SECTION 4
IMPROVE OR MAINTAIN ASSESSMENT

SECTION 1

INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

Conacher Environmental Group has been engaged to prepare a Flora and Fauna Assessment Report for the proposed development of Precinct 14, Warner Industrial Park, Warnervale. This Precinct is part of the Wyong Employment Zone (WEZ).

This Flora and Fauna Assessment Report has been prepared to identify the flora and fauna characteristics of the site and to determine whether or not a Species Impact Statement should be prepared for the proposed development according to the provisions of the *Threatened Species Conservation Act (TSC)* (1995) and Section 5(A) of the *Environmental Planning & Assessment (EP&A) Act* (1979).

This report relies on the detailed surveys and reports completed for the Wyong Employment Zone and extracts relevant results pertaining to Precinct 14 from those reports. These results have been updated where necessary due to new listings of threatened species or threatening processes within the *Threatened Species Conservation Act* (1995). The main document utilised for compilation of this report was the Ecological Investigations Report – Wyong Employment Zone (Bell and Murray 2007), which has been accepted by Council and placed on exhibition. All reports utilised in the compilation of this report are listed within the References section of this report.

The figures used in this report have been extracted from Bell and Murray (2007) and have been included in an unaltered format so that there are no contradictions in map and figure presentation.

1.2 SITE CHARACTERISTICS

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

TABLE 1.1
SITE DETAILS

Location	The proposed development is within the Warner Industrial Park and the adjoining lands in Lot 5 DP 259531 and Lot 9 DP 239704 within Precinct 14 of the Wyong Employment Zone, Jilliby. Precinct 14 is bounded by Sparks Road in the south-west, Hue Hue Road to the north-west, Kiar Ridge Road to the north-east and the F3 freeway to the south-east.
Area	Precinct 14 = 129.92 ha (Approximately 130ha) Proposed Development Area = 80 ha
Topographic Maps	Dooralong 1:25000
Grid Reference	353500E 6323200N
Local Government Area	Wyong
Existing Land Use	Rural – Residential

TABLE 1.1 (Cont.) SITE DETAILS	
Current Zoning	10 (a) – Investigation Precinct, 7 (g) – Wetlands Management, 6 (a) – Open Space and Recreation
Proposed Development	Industrial development as part of the Wyong Employment Zone – Precinct 14 and conservation of retained vegetation.

TABLE 1.2 SITE CHARACTERISTICS	
Elevation	Approximately 17 - 50m AHD
Topography	Undulating low hills and rises, broad crests and ridges with long gentle slopes associated with Buttonderry Creek
Aspect	Various – from south-westerly, south, south-easterly and easterly
Soil Type	Yellow-brown clayey sand, yellow-brown pedal clay and grey massive clays of the Gorokan Soil Landscape, and Deep (>200cm) Yellow Podzolic Soils, Brown Podzolic Soils, Soloths with some Humus Podzols associated with the Wyong Soil Landscape (Murphy, 1992).
Catchment	Tuggerah Lake
Drainage	Overland flow into Buttonderry Creek which flows into Porters Wetland which discharges into Wyong River then into Tuggerah Lake.
Vegetation	- Alluvial Floodplain Shrub Swamp Forest - Narrabeen Buttonderry Footslopes Forest - Narrabeen Dooralong Spotted Gum-Ironbark Forest - Alluvial Riparian Blackbutt Forest

1.3 PROPOSED DEVELOPMENT

The proposed development is for an industrial complex being the Warner Industrial Park, which is part of the Wyong Employment Zone (WEZ). The Minister for Planning has agreed to consider the WEZ site as a potential State Significant Site (SSS) following a request and a draft LEP from Wyong Shire Council due to the need to resolve a number of outstanding issues such as potential impacts on threatened species. Subsequently the WEZ project has been declared a State Significant Site under the provisions of the *State Environmental Planning Policy (Major Projects)* 2005.

This development will include associated infrastructure such as access, bushfire asset protection zones and services.

The subject site is known as Precinct 14 which occupies 130 hectares within the Wyong Employment Zone. A riparian corridor along Buttonderry Creek and other areas of land is to be included and maintained within the proposed Drainage / Environmental / Open Space Lands which total approximately 48.94ha or 37.6% of the site. These Drainage / Environmental / Open Space areas will be dedicated to and managed by Wyong Shire Council. A separate document has been prepared for the management of these Drainage / Environmental / Open Space Lands (WSC, 2008) which are outside of the management areas of this plan. The 80.98ha proposed development area is situated within the proposed industrial areas designated in the draft LEP proposed by council within Precinct 14 as shown in Figure 2.

A detailed Ecological Plan of Management (draft) is in the process of preparation of these areas under the direction of Wyong Shire Council. This Ecological Plan of Management is being prepared to address the conservation and management issues identified through the detailed

ecological assessments completed and the Biodiversity Certification Process between Wyong Council, Department of Environment and Climate Change and Department of Planning.

1.4 PREVIOUS SURVEYS AND DOCUMENTATION

The key reports used in the compilation of this report were:

Bell, S. and Murray, M. (2007) *Ecological Investigations (Version 2), Wyong Employment Zone, Warnervale Business Park, Warnervale Airport Lands, Precincts 11 & 13 and Precinct 14.* Report to Wyong Shire Council May 2007.

This report describes in detail the survey methods undertaken and the results of investigations on-site and in the surrounding areas of the Wyong Employment Zone. The report also contains an assessment of threatened species, populations and ecological communities according to the *Threatened Species Conservation Act (TSC)* (1995) and Section 5(A) of the *Environmental Planning & Assessment (EP&A) Act* (1979).

Bell, S. and Murray, M. (2004) *Flora and Fauna Investigations, Proposed Warnervale Town Centre, Wyong Shire.* Report to Wyong Shire Council, July 2004.

This report describes in detail the survey methods undertaken and the results of investigations within the proposed Warnervale Town Centre. This report also contains an assessment of threatened species, populations and ecological communities according to the *Threatened Species Conservation Act (TSC)* (1995) and Section 5(A) of the *Environmental Planning & Assessment (EP&A) Act* (1979).

Forest Fauna Surveys/East Coast Flora Survey (2005) *Flora and Fauna Assessment Rezoning of Land off Louisiana Road, Hamlyn Terrace, Wyong Shire.*

This document describes in detail the survey methods undertaken and the results of investigations within the proposed rezoning of land at Louisiana Road Hamlyn Terrace. This report also contains an assessment of threatened species, populations and ecological communities according to the *Threatened Species Conservation Act (TSC)* (1995) and Section 5(A) of the *Environmental Planning & Assessment (EP&A) Act* (1979).

Forest Fauna Surveys (2008) *Wyong Employment Zone Ecological Plan of Management*

This document provides objectives and plans for the management of the Wyong Employment Zone are; the protection of the environmental and ecological values of conservation areas; the establishment, protection and restoration of wildlife corridor linkages; the maintenance of biodiversity and protection of native flora and fauna species; minimisation of the impact of the proposed development upon designated conservation areas during and post construction; and to implement long-term monitoring of designated conservation lands to determine changes (if any) to vegetation communities, flora and fauna populations, particularly threatened species.

Forest Fauna Surveys (2008) *Wyong Employment Zone Ecological Plan of Management*

This document outlines the planning and conservation proposals for the LEP for the Wyong Employment Zone and demonstrate how they “maintain and improve” biodiversity values and confirms the outcomes of the assessments under Section 126G of the *Threatened Species Conservation Act, 1995* so that biodiversity certification may be granted to the WEZ rezoning by the Minister of the Environment

1.5 COMPLIANCE WITH THE DIRECTOR GENERAL'S REQUIREMENTS FOR SECTION 75F OF THE EP&A ACT (1979)

This report has been completed in compliance with the Director General's Requirements, including the draft Part 3A Guidelines for Threatened Species Assessment. A Biocertification Report (WSC, 2007) has also been prepared for this project which measures the various levels of compliance with benchmarks required under the DG's requirements, the draft Part 3A Guidelines for Threatened Species Assessment as well as other state and federal legislation.

SECTION 2

VEGETATION CHARACTERISTICS

2.1 VEGETATION SURVEY METHODOLOGY

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

Literature Review

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

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

Aerial Photograph Interpretation

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

Field Survey

Field surveys were undertaken within Precinct 14 by Bell and Murray (2007). The survey methods included targeted terrestrial orchid surveys, vegetation survey quadrats and vegetation community mapping. The survey dates and methods (Table 2.1) were extracted from the Ecological Investigations report for the Wyong Employment Zone (Bell and Murray, 2007). The locations of the flora survey quadrats within Precinct 14 are shown in Figure 3.

TABLE 2.1
DATES OF TARGETED ORCHID SURVEY WITHIN PRECINCT 14
(adapted from Bell & Murray 2007)

Month of Survey	Dates of Survey
December 2004	8, 17 December 2004
January 2005	12 January 2005
February 2005	12, 14, 28, February 2005
March 2005	8 March 2005
August 2005	18 August 2005
September 2005	7 September 2005
October 2005	7 & 25 October 2005
November 2005	9 November 2005

In addition, opportunistic survey of orchid species was undertaken while surveying and mapping the remaining vegetation in the study area.

The general floristic surveys by Bell and Murray (2007) consisted of a total of eleven (11) floristic survey quadrats (0.04ha, or 20 x 20m) which were undertaken within Precinct 14.

The flora surveys of Precinct 14 were undertaken in December 2004 to March 2005 and from September 2005 to November 2005 (no dates supplied).

Additional Survey
Two staff members of *Conacher Environmental Group* undertook a site inspection of the subject site on Friday 4 April 2007. This site inspection was undertaken to determine the current condition of the vegetation on site and concentrated on the Buttonderry Creek Riparian Corridor, the area where placement of large amounts of fill has occurred and the northern parts of the proposed development area.

2.2 VEGETATION DESCRIPTION

According to Bell and Murray (2007) the vegetation communities present within Precinct 14 consist of the following Communities as mapped by Bell (2002):

MU 20aXr - Alluvial Floodplain Shrub Swamp Forest (Canopy Only) 2.10ha;
MU 20f - Alluvial Floodplain Shrub Swamp Forest (sedge scrub variant) 2.91ha;
MU 20Xs - Alluvial Floodplain Shrub Swamp Forest (regrowth) 0.35 ha;
MU 28 - Narrabeen Buttonderry Footslopes Forest 14.63ha;
MU 28Xr - Narrabeen Buttonderry Footslopes Forest (Canopy Only) 6.52ha;
MU 28Xs - Narrabeen Buttonderry Footslopes Forest (Regrowth) 1.08ha;
MU 30 - Narrabeen Dooralong Spotted Gum / Ironbark Forest 18.22ha;
MU 30Xr - Narrabeen Dooralong Spotted Gum / Ironbark Forest (Regrowth) 6.61ha;
MU 43a - Alluvial Riparian Blackbutt Forest (Type Variant) 5.78ha;
MU 43aXr - Alluvial Riparian Blackbutt Forest (Canopy Only) 0.22ha;
Xr - Unspecified Canopy Only 18.88ha;
Xs - Unspecified Regrowth Only 0.71ha;
\- - Cleared Land 53ha.

Vegetation community descriptions are provided below while a detailed species list is provided in Table 2.2.

MU 20: Alluvial Floodplain Shrub Swamp Forest (MU20 in Bell and Murray, 2007)
This vegetation community was sporadically recorded in southern and south-eastern parts of the subject site. The Alluvial Floodplain Shrub Swamp Forest, as described in Bell and Murray (2007), is highly variable depending on depth to water table, soil type and other factors. Dominant species commonly associated with this vegetation community type include *Eucalyptus amplifolia* subsp. *amplifolia, Eucalyptus robusta*, *Angophora floribunda, Melaleuca linariifolia* and *Melaleuca decora*. The understorey is often characterised by a dense layer of sedges and grasses, and a scattered shrub layer of *Leptospermum juniperinum, Gahnia clarkei*, and juvenile *Melaleuca linariifolia* and *Eucalyptus* species. Two threatened species (*Melaleuca biconvexa* and *Angophora inopina*) were recorded within this vegetation community on the subject site. Alluvial Floodplain Shrub Swamp Forest can be considered as part of the Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-East Corner bioregions Endangered Ecological Community (SSFCF). Within the regional classification of NPWS (2000), this community falls into either the Swamp Mahogany – Paperbark Swamp Forest (MU37) or the Wyong Paperbark Swamp Forest (MU43).

MU 28: Narrabeen Buttonderry Footslopes Forest (MU28 in Bell and Murray, 2007)
Narrabeen Buttonderry Footslopes Forest was recoded mostly in the north-eastern parts of the subject site. Dominant canopy species and regrowth was recorded in the south-western corners of the site. Dominant species characteristic of this vegetation community type include *Angophora costata, Syncarpia glomulifera* subsp. *glomulifera, Eucalyptus umbra, Melaleuca decora, Eucalyptus fibrosa, Banksia spinulosa, Melaleuca nodosa, Bossiaea*

obcordata, Epacris pulchella, Leptospermum trinervium, Goodenia heterophylla and Lomandra oblique. Two threatened species (*Angophora inopina* and *Tetratheca juncea*) were recorded within this vegetation community on the subject site.

MU 30: Narrabeen Dooralong Spotted Gum – Ironbark Forest (MU30 in Bell and Murray, 2007)
Narrabeen Dooralong Spotted Gum – Ironbark Forest was recorded in the north-east of the subject site, and towards the centre of the subject site in a patchy distribution, for example along fenceline corridors. In some areas, sections of MU30 have been partially cleared for grazing purposes, and support a disturbed forest of variable density and canopy retention. This was evident in the north-eastern corner and centre of Precinct 14 north-west of the F3 Freeway. Dominant species commonly associated with this vegetation community type include *Corymbia maculata*, *Eucalyptus fibrosa*, *Daviesia ulicifolia* and *Podolobium ilicifolium.* Two threatened species *(Grevillea parviflora* subsp. *parviflora* and *Melaleuca biconvexa*) were recorded within this vegetation community type on the subject site.

Regionally, this vegetation type is equivalent to Coastal Foothills Spotted Gum – Ironbark Forest (MU15) in NPWS (2003).

MU 43a: Alluvial Riparian Blackbutt Forest (MU43a in Bell and Murray, 2007)
Much of Buttonderry Creek supports Alluvial Riparian Blackbutt Forest as it flows through the study area. This vegetation community was only found in association with the creekline. Alluvial Riparian Blackbutt Forest equates to the Alluvial Tall Moist Forest of NPWS (2000). Dominant species commonly associated with this vegetation community type include *Eucalyptus pilularis, Corymbia maculata* and *Gahnia clarkei.* Two threatened species (*Tetratheca juncae* and *Melaleuca biconvexa*) were found within this vegetation community type on the subject site. Alluvial Riparian Blackbutt Forest was also found to contain two Endangered Ecological Communities; River Flat Eucalypt Forest and remnants of Freshwater Wetlands on Coastal Fllodplains.

MU Xr: Canopy-only vegetation (includes, for example, units such as "30Xr") (MUXr in Bell and Murray, 2007)
Several locations within the study area support vegetation where understorey structure has been completely or partially removed or modified, such that only emergent canopy trees remain. In such cases, these areas have been mapped with the MU 'Xr' appended to the main vegetation map unit. For example, MU 28Xr refers to canopy-only vegetation of MU28. In areas where it has been difficult to assign remnant trees to a particular vegetation community, the tag "Xr" only has been applied, representing unspecified canopy-only vegetation.

MU Xs: Regrowth vegetation (MU Xs in Bell and Murray, 2007)
One area within the subject site was recorded to support regrowth vegetation that does not align well with any specific vegetation type. In such cases, these areas have been mapped with the MU 'Xs" to indicate opportunist regrowth. In certain areas, the floristic composition present in regrowth areas allows alignment with the established vegetation communities, and these are included within the general mapping for those communities, but with the suffix 'Xs". For example, MU 28Xs refers to regrowth vegetation of MU28.

2.3 FLORA SPECIES PRESENT, WYONG EMPLOYMENT ZONE

All species recorded within the whole of the Wyong Employment Zone by Eastcoast Flora Survey and Sinclair Knight Mertz during plot sampling, targeted seasonal and miscellaneous surveys have been included in Table 2.2.

Precinct 14 may not contain all of the flora species listed within Table 2.2. This species list is for the whole of the Wyong Employment Zone (WEZ) and data which differentiates the location of each species within the WEZ was unavailable. Due to the way in which the flora species were recorded in Bell and Murray (2007) it is not possible to separate the species identified in Precinct 14.

Threatened species that do not occur within Precinct 14 (Bell and Murray, 2007), have been omitted from this flora list to avoid confusion or misunderstandings regarding the presence or absence of other threatened flora known to occur within the greater area of the Wyong Employment Zone.

TABLE 2.2
FLORA SPECIES OBSERVED WITHIN THE WHOLE OF THE WYONG EMPLOYMENT ZONE
(Extracted from Bell and Murray 2007)

Family	Scientific Name	Common Name
TREES		
Arecaceae	*Livistona australis*	Cabbage Tree Palm
Casuarinaceae	*Allocasuarina littoralis*	Black She-oak
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak
Casuarinaceae	*Casuarina glauca*	Swamp Oak
Euphorbiaceae	*Glochidion ferdinandii*	Cheese Tree
Fabaceae	*Erythrina sykesii**	Coral Tree
Lauraceae	*Cinnamomum camphora**	Camphor Laurel
Mimosaceae	*Acacia irrorata* subsp. *irrorata*	Green Wattle
Mimosaceae	*Acacia terminalis* subsp. *longiaxialis*	Sunshine Wattle
Myrsinaceae	*Myrsine variabilis*	Muttonwood
Myrtaceae	*Acmena smithii*	Lillypilly
Myrtaceae	*Angophora costata*	Smooth-barked Apple
Myrtaceae	*Angophora floribunda*	Rough-barked Apple
Myrtaceae	*Angophora inopina*[TS]	-
Myrtaceae	*Backhousia myrtifolia*	Grey Myrtle
Myrtaceae	*Corymbia gummifera*	Red Bloodwood
Myrtaceae	*Corymbia maculata*	Spotted Gum
Myrtaceae	*Eucalyptus agglomerata*	Blue-leaved Stringybark
Myrtaceae	*Eucalyptus amplifolia*	Cabbage Gum
Myrtaceae	*Eucalyptus capitellata*	Brown Stringybark
Myrtaceae	*Eucalyptus crebra*	Narrow-leaved Ironbark
Myrtaceae	*Eucalyptus fibrosa*	Broad Leaved Ironbark
Myrtaceae	*Eucalyptus globoidea*	White Stringybark
Myrtaceae	*Eucalyptus haemastoma*	Scribbly Gum
Myrtaceae	*Eucalyptus longifolia*	Woollybutt
Myrtaceae	*Eucalyptus paniculata* subsp. *paniculata*	Grey Ironbark
Myrtaceae	*Eucalyptus pilularis*	Blackbutt
Myrtaceae	*Eucalyptus punctata*	Grey Gum
Myrtaceae	*Eucalyptus racemosa*	Narrow-leaved Scribbly Gum
Myrtaceae	*Eucalyptus racemosa X piperita?*	-
Myrtaceae	*Eucalyptus resinifera* subsp. *resinifera*	Red Mahogany
Myrtaceae	*Eucalyptus robusta*	Swamp Mahogany
Myrtaceae	*Eucalyptus saligna*	Sydney Blue Gum
Myrtaceae	*Eucalyptus siderophloia*	Northern Grey Ironbark
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum
Myrtaceae	*Eucalyptus umbra* subsp. *umbra*	Broad-leaved White Mahogany
Myrtaceae	*Melaleuca biconvexa*[TS]	-
Myrtaceae	*Melaleuca decora*	-

TABLE 2.2 (Cont.)
FLORA SPECIES OBSERVED WITHIN THE WHOLE OF THE WYONG EMPLOYMENT ZONE
(Extracted from Bell and Murray 2007)

Myrtaceae	*Melaleuca linariifolia*	Snow in Summer
Myrtaceae	*Melaleuca stypheloides*	Prickly-leaved Tea Tree
Myrtaceae	*Syncarpia glomulifera*	Turpentine
Myrtaceae	*Syzygium oleosum*	Blue lillypilly
Oleaceae	*Notelaea longifolia* forma *intermedia*	Mock Olive
Oleaceae	*Notelaea longifolia* forma *longifolia*	Mock Olive
Pinaceae	*Pinus radiata**	Radiata or Monterey Pine
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum
Proteaceae	*Banksia serrata*	Old Man Banksia
Rhamnaceae	*Alphitonia excelsa*	Red Ash
Rutaceae	*Citrus limon**	Lemon Tree
Salicaceae	*Salix babylonica**	Weeping Willow
Santalaceae	*Exocarpos cupressiformis*	Native Cherry
SHRUBS		
Apiaceae	*Platysace ericoides*	Heathy Platysace
Apiaceae	*Platysace lanceolata*	Lance-leaf Platysace
Araliaceae	*Polyscias sambucifolia*	Elderberry Panax
Asteraceae	*Cassinia aculeata*	Dolly Bush
Asteraceae	*Cassinia arcuata*	Sifton Bush
Cannabiaceae	*Cannabis sativa**	Cannabis
Cesalpinioideae	*Senna pendula* var. *glabrata**	-
Dilleniaceae	*Hibbertia vestita*	-
Epacridaceae	*Epacris microphylla*	Coral Heath
Epacridaceae	*Epacris pulchella*	NSW Coral Heath
Epacridaceae	*Leucopogon juniperinus*	Prickly Beard-heath
Epacridaceae	*Melichrus urceolatus*	-
Epacridaceae	*Monotoca scoparia*	Prickly Broom-heath
Euphorbiaceae	*Amperea xiphoclada*	Broom Spurge
Euphorbiaceae	*Breynia oblongifolia*	Coffee Bush
Fabaceae	*Bossiaea obcordata*	Spiny Bossiaea
Fabaceae	*Bossiaea prostrata*	-
Fabaceae	*Bossiaea rhombifolia*	-
Fabaceae	*Daviesia squarrosa*	-
Fabaceae	*Daviesia ulicifolia*	Gorse Bitter Pea
Fabaceae	*Dillwynia retorta* var. *retorta*	Eggs and Bacon
Fabaceae	*Gompholobium latifolium*	Broad-leaf Wedge-pea
Fabaceae	*Gompholobium pinnatum*	-
Fabaceae	*Hovea linearis*	-
Fabaceae	*Mirbelia rubiifolia*	-
Fabaceae	*Platylobium formosum* subsp. *parviflorum*	Handsome Flat-pea

TABLE 2.2 (Cont.)
FLORA SPECIES OBSERVED WITHIN THE WHOLE OF THE WYONG EMPLOYMENT ZONE
(Extracted from Bell and Murray 2007)

Fabaceae	*Podolobium scandens*	Netted Shaggy Pea
Fabaceae	*Pultenaea ferruginea*	-
Fabaceae	*Pultenaea retusa*	-
Fabaceae	*Pultenaea tuberculata*	-
Fabaceae	*Pultenaea villosa*	-
Fabaceae	*Sphaerolobium minus*	-
Fabaceae	*Sphaerolobium vimineum*	-
Faboideae	*Pultenaea paleacea* var. *paleacea*	-
Lamiaceae	*Clerodendrum tomentosum*	Hairy Clerodendrum
Loganiaceae	*Logania pusilla*	-
Mimosaceae	*Acacia falcata*	Sickle Wattle
Mimosaceae	*Acacia longifolia* var. *longifolia*	Sydney Golden Wattle
Mimosaceae	*Acacia longifolia* var. *sophorae*	-
Mimosaceae	*Acacia myrtifolia*	Red Stem Wattle
Mimosaceae	*Acacia suaveolens*	Sweet Scented Wattle
Mimosaceae	*Acacia ulicifolia*	Prickly Moses
Myrtaceae	*Callistemon citrinus*	Crimson Bottlebrush
Myrtaceae	*Callistemon linearis*	Narrow-leaved Bottlebrush
Myrtaceae	*Callistemon rigidus*	Stiff Bottlebrush
Myrtaceae	*Callistemon salignus*	Willow Bottlebrush
Myrtaceae	*Kunzea ambigua*	Tick Bush
Myrtaceae	*Leptospermum juniperinum*	Prickly Tea-tree
Myrtaceae	*Leptospermum polygalifolium* subsp. *cismontanum*	Lemon Scented Tea-tree
Myrtaceae	*Leptospermum polygalifolium* subsp. *montanum?*	Lemon Scented Tea-tree
Myrtaceae	*Leptospermum polygalifolium* subsp. *polygalifolium*	Lemon Scented Tea-tree
Myrtaceae	*Leptospermum trinervium*	Flaky-barked Tea-tree
Myrtaceae	*Melaleuca ericifolia*	Swamp Paperbark
Myrtaceae	*Melaleuca nodosa*	Ball Honey Myrtle
Myrtaceae	*Melaleuca sieberi*	-
Myrtaceae	*Melaleuca thymifolia*	Thyme Honey Myrtle
Ochnaceae	*Ochna serrulata**	Mickey Mouse Plant
Oleaceae	*Ligustrum lucidum**	Large-leaved Privet
Phytolaccaceae	*Phytolacca octandra**	Inkweed
Pittosporaceae	*Bursaria spinosa* var. *spinosa*	Blackthorn
Pittosporaceae	*Pittosporum revolutum*	Yellow Pittosporum
Polygalaceae	*Comesperma ericinum*	Matchheads
Proteaceae	*Banksia oblongifolia*	-
Proteaceae	*Banksia spinulosa* var. *collina*	Hairpin Banksia
Proteaceae	*Grevillea humilis* subsp. *humilis*	-
Proteaceae	*Grevillea parviflora* subsp. *parviflora*^{TS}	-

TABLE 2.2 (Cont.)
FLORA SPECIES OBSERVED WITHIN THE WHOLE OF THE WYONG EMPLOYMENT ZONE
(Extracted from Bell and Murray 2007)

Proteaceae	*Grevillea sericea*	Pink Spider Flower
Proteaceae	*Hakea laevipes* subsp. *laevipes*	-
Proteaceae	*Hakea salicifolia*	Willow Hakea
Proteaceae	*Hakea teretifolia*	Dagger Hakea
Proteaceae	*Isopogon anemonifolius*	Flat-leaved Drumsticks
Proteaceae	*Lambertia formosa*	Mountain Devil
Proteaceae	*Persoonia laurina*	Laurel Geebung
Proteaceae	*Persoonia levis*	Broad-leaved Geebung
Proteaceae	*Persoonia linearis*	Narrow-leaved Geebung
Rosaceae	*Rubus anglocandicans**	Blackberry
Rubiaceae	*Opercularia diphylla*	-
Rutaceae	*Boronia parviflora*	Swamp Boronia
Rutaceae	*Boronia polygalifolia*	Milkwort Boronia
Rutaceae	*Zieria smithii*	Sandfly Zieria
Solanaceae	*Solanum mauritianum**	Wild Tobacco
Verbenaceae	*Lantana camara**	Lantana
Zamiaceae	*Macrozamia flexuosa*	-
GROUNDCOVERS		
Acanthaceae	*Brunoniella australis*	Blue Trumpet
Acanthaceae	*Brunoniella pumilio*	Dwarf Blue Trumpet
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower
Adiantaceae	*Adiantum aethiopicum*	Common Maidenhair
Amaranthaceae	*Alternanthera denticulata*	Lesser Joyweed
Anthericaceae	*Arthropodium minus*	Small Vanilla Lily
Anthericaceae	*Caesia parviflora* var. *parviflora*	Pale Grass Lily
Anthericaceae	*Caesia parviflora* var. *vittata*	-
Anthericaceae	*Laxmannia gracilis*	Slender Wire Lily
Anthericaceae	*Thysanotus juncifolius*	Fringed Lily
Anthericaceae	*Thysanotus tuberosus*	Fringed Lily
Anthericaceae	*Tricoryne elatior*	Yellow Rush Lily
Anthericaceae	*Tricoryne simplex*	Yellow Rush-lily
Apiaceae	*Centella asiatica*	Swamp Pennywort
Apiaceae	*Centella cordifolia*	
Apiaceae	*Hydrocotyle peduncularis*	Pennywort
Apiaceae	*Hydrocotyle tripartita*	Pennywort
Apiaceae	*Trachymene incisa* subsp. *incisa*	Native Parsnip
Aspleniaceae	*Asplenium flabellifolium*	Necklace Fern
Asteraceae	*Ageratina adenophorum**	Crofton Weed
Asteraceae	*Aster subulatus**	Wild Aster
Asteraceae	*Bidens pilosa**	Cobbler's Pegs
Asteraceae	*Brachyscome angustifolia* var. *angustifolia*	-

TABLE 2.2 (Cont.)
FLORA SPECIES OBSERVED WITHIN THE WHOLE OF THE WYONG EMPLOYMENT ZONE
(Extracted from Bell and Murray 2007)

Asteraceae	*Conyza bonariensis**	Flax-leaf Fleabane
Asteraceae	*Conyza sp**	Fleabane
Asteraceae	*Eclipta platyglossa*	-
Asteraceae	*Euchiton sphaericus*	Cudweed
Asteraceae	*Gamochaeta spicata**	Cudweed
Asteraceae	*Hypochaeris microcephala* var. *albiflora**	-
Asteraceae	*Hypochaeris radicata**	Flatweed
Asteraceae	*Lagenifera gracilis?*	-
Asteraceae	*Lagenifera stipitata*	-
Asteraceae	*Senecio linearifolius*	Fireweed
Asteraceae	*Senecio madagascariensis**	Fireweed
Asteraceae	*Soliva sessilis**	Jojo
Asteraceae	*Sonchus asper**	Sow-thistle
Asteraceae	*Sonchus oleraceus**	Common Sow-thistle
Asteraceae	*Taraxacum officinale**	Dandelion
Asteraceae	*Vernonia cinerea* var. *cinerea*	-
Blandfordiaceae	*Blandfordia grandiflora*	Christmas Bell
Blechnaceae	*Blechnum cartilagineum*	Gristle Fern
Blechnaceae	*Doodia aspera*	Rasp Fern
Campanulaceae	*Wahlenbergia gracilis*	Australian Bluebell
Carophyllaceae	*Cerastium glomeratum**	Mouse-ear Chickweed
Clusiaceae	*Hypericum gramineum*	Small St Johns Wort
Colchicaceae	*Burchardia umbellata*	Milkmaids
Colcicaceae	*Wurmbea dioica* subsp. *dioica*	Early Nancy
Commelinaceae	*Commelina cyanea*	Scurvy Weed
Convolvulaceae	*Cuscuta australis*	Australian Dodder
Convolvulaceae	*Dichondra repens*	Kidney Weed
Cyperaceae	*Carex appressa*	Tall Sedge
Cyperaceae	*Carex inversa*	Knob Sedge
Cyperaceae	*Carex longebrachiata*	Bergalia Tussock
Cyperaceae	*Carex polyantha*	-
Cyperaceae	*Caustis recurvata* var. *recurvata*	-
Cyperaceae	*Cyathochaeta diandra*	-
Cyperaceae	*Cyperus eragrostis**	Umbrella Sedge
Cyperaceae	*Fimbristylis dichotoma*	Common Fringe-rush
Cyperaceae	*Gahnia aspera*	Saw Sedge
Cyperaceae	*Gahnia clarkei*	Tall Saw-sedge
Cyperaceae	*Gahnia radula*	-
Cyperaceae	*Gahnia sieberiana*	Red-fruited Saw-sedge
Cyperaceae	*Lepidosperma laterale*	Variable Sword-sedge
Cyperaceae	*Lepidosperma quadrangulatum*	-
Cyperaceae	*Ptilothrix deusta*	-

TABLE 2.2 (Cont.)
FLORA SPECIES OBSERVED WITHIN THE WHOLE OF THE WYONG EMPLOYMENT ZONE
(Extracted from Bell and Murray 2007)

Cyperaceae	*Schoenus brevifolius*	Bog-rush
Cyperaceae	*Schoenus melanostachys*	Black Bog Rush
Cyperaceae	*Tetraria capillaris*	-
Cyperaceae	*Tricostularia pauciflora*	-
Dennstaedtiaceae	*Histiopteris incisa*	Bat's Wing Fern
Dennstaedtiaceae	*Pteridium esculentum*	Bracken
Dicksoniaceae	*Calochlaena dubia*	False Bracken
Dilleniaceae	*Hibbertia aspera*	Rough Guinea Flower
Dilleniaceae	*Hibbertia empetrifolia* subsp. *uncinata*	-
Dilleniaceae	*Hibbertia obtusifolia*	Grey Guinea Flower
Droseraceae	*Drosera auriculata*	Sundew
Droseraceae	*Drosera peltata*	Sundew
Droseraceae	*Drosera spathulata*	Common Sundew
Elaeocarpaceae	*Tetratheca juncea*^{TS}	Black-eyed Susan
Euphorbiaceae	*Poranthera microphylla*	
Fabaceae	*Melilotus indicus**	-
Fabaceae	*Trifolium repens**	White Clover
Gentianaceae	*Centaurium spicatum*	-
Gleicheniaceae	*Gleichenia dicarpa*	Pouched Coral Fern
Goodeniaceae	*Dampiera stricta*	Blue Dampiera
Goodeniaceae	*Goodenia bellidifolia*	Daisy-leaved Goodenia
Goodeniaceae	*Goodenia hederacea* subsp. *hederacea*	Ivy-leaved Goodenia
Goodeniaceae	*Goodenia heterophylla* subsp. *heterophylla*	Variable Leaved Goodenia
Goodeniaceae	*Goodenia ovata*	-
Goodeniaceae	*Goodenia stelligera*	-
Goodeniaceae	*Scaevola ramosissima*	Purple Fan Flower
Goodeniaceae	*Velleia spathulata*	-
Haemodoraceae	*Haemodorum corymbosum*	Bloodroot
Haemodoraceae	*Haemodorum planifolium*	Bloodroot
Haloragaceae	*Gonocarpus micranthus* subsp. *ramosissimus*	-
Haloragaceae	*Gonocarpus tetragynus*	Poverty Raspwort
Haloragaceae	*Gonocarpus teucroides*	Raspwort
Hypoxidaceae	*Hypoxis hygrometrica*	Golden Star
Iridaceae	*Patersonia glabrata*	Leafy Purple-flag
Iridaceae	*Patersonia sericea*	Wild Iris
Juncaceae	*Juncus bufonius*	Toad Rush
Juncaceae	*Juncus cognatus**	-
Juncaceae	*Juncus continuus*	-
Juncaceae	*Juncus usitatus*	Common Rush
Lindsaeaceae	*Lindsaea linearis*	Screw Fern

TABLE 2.2 (Cont.)
FLORA SPECIES OBSERVED WITHIN THE WHOLE OF THE WYONG EMPLOYMENT ZONE
(Extracted from Bell and Murray 2007)

Lindsaeaceae	*Lindsaea microphylla*	Lacy Wedge-fern
Lobeliaceae	*Lobelia anceps*	-
Lobeliaceae	*Pratia purpurascens*	Whiteroot
Loganiaceae	*Mitrasacme polymorpha*	Mitrewort
Lomandraceae	*Lomandra confertifolia* subsp. *rubiginosa*	-
Lomandraceae	*Lomandra confertifolia var. pallida*	-
Lomandraceae	*Lomandra cylindrica*	-
Lomandraceae	*Lomandra filiformis* subsp. *coriacea*	Wattle Mat-rush
Lomandraceae	*Lomandra filiformis* subsp. *filiformis*	Wattle Mat-rush
Lomandraceae	*Lomandra glauca* subsp. *glauca*	-
Lomandraceae	*Lomandra longifolia*	Spiky-headed Mat-rush
Lomandraceae	*Lomandra multiflora*	Many-flowered Mat-rush
Lomandraceae	*Lomandra obliqua*	Twisted Mat-rush
Malvaceae	*Sida rhombifolia**	Paddy's Lucerne
Menyanthaceae	*Villarsia exaltata*	Yellow Marsh Flower
Orchidaceae	*Arthrochilus prolixus*	Elbow Orchid
Orchidaceae	*Caladenia carnea*	Pink Finger Orchid
Orchidaceae	*Caladenia catenata*	White Finger Orchid
Orchidaceae	*Caladenia picta*	-
Orchidaceae	*Calochilus campestris*	Copper Beard Orchid
Orchidaceae	*Calochilus robertsonii*	Purplish Beard Orchid
Orchidaceae	*Cryptostylis erecta*	Bonnet Orchid
Orchidaceae	*Cryptostylis subulata*	Large Tongue Orchid
Orchidaceae	*Dipodium punctatum*	Hyacinth Orchid
Orchidaceae	*Microtis parviflora*	Slender Onion Orchid
Orchidaceae	*Microtis unifolia*	Common Onion Orchid
Orchidaceae	*Orthoceras strictum*	Birds-mouth Orchid
Orchidaceae	*Pterostylis nutans*	Nodding Greenhood
Orchidaceae	*Thelymitra pauciflora*	Slender Sun Orchid
Oxalidaceae	*Oxalis perrenans*	-
Phormiaceae	*Dianella caerulea* var. *assera*	Flax Lily
Phormiaceae	*Dianella caerulea* var. *caerulea*	Flax Lily
Phormiaceae	*Dianella caerulea* var. *producta*	Blue Flax Lily
Phormiaceae	*Dianella longifolia*	-
Phormiaceae	*Dianella revoluta* var. *revoluta*	Spreading Flax Lily
Plantaginaceae	*Plantago lanceolata**	Ribwort
Plantaginaceae	*Veronica plebeia*	Creeping Speedwell
Poaceae	*Andropogon virginicus**	Whisky Grass
Poaceae	*Anisopogon avenaceus*	Oat Speargrass
Poaceae	*Aristida ramosa*	Wire Grass

TABLE 2.2 (Cont.)
FLORA SPECIES OBSERVED WITHIN THE WHOLE OF THE WYONG EMPLOYMENT ZONE
(Extracted from Bell and Murray 2007)

Poaceae	*Aristida vagans*	Three-awn Speargrass
Poaceae	*Aristida warburgii*	Wire Grass
Poaceae	*Austrodanthonia linkii* var. *fulva*	Wallaby Grass
Poaceae	*Austrodanthonia tenuior*	Wallaby Grass
Poaceae	*Austrostipa pubescens*	Tall Speargrass
Poaceae	*Austrostipa scabra* subsp. *scabra*	Speargrass
Poaceae	*Axonopus fissifolius**	Narrow-leaf Carpet Grass
Poaceae	*Bothriochloa macra*	-
Poaceae	*Briza maxima**	Quaking Grass
Poaceae	*Briza minor**	Shivery Grass
Poaceae	*Chloris gayana**	Rhodes Grass
Poaceae	*Cortaderia selloana**	Pampas Grass
Poaceae	*Cymbopogon refractus*	Barbwire Grass
Poaceae	*Cynodon dactylon*	Common Couch
Poaceae	*Deyeuxia quadriseta*	Reed Bent Grass
Poaceae	*Dichelachne micrantha*	Short-hair Plume Grass
Poaceae	*Digitaria ramularis*	-
Poaceae	*Echinopogon caespitosus* var. *caespitosus*	Tufted Hedgehog Grass
Poaceae	*Echinopogon ovatus*	Forest Hedgehog Grass
Poaceae	*Entolasia marginata*	Bordered Panic
Poaceae	*Entolasia stricta*	Wiry Panic
Poaceae	*Eragrostis brownii*	Brown's Lovegrass
Poaceae	*Hemarthria uncinata var. uncinata*	Matgrass
Poaceae	*Imperata cylindrica* var. *major*	Blady Grass
Poaceae	*Joycea pallida*	Red Anther Wallaby Grass
Poaceae	*Lachnagrostis aemula*	Blown Grass
Poaceae	*Microlaena stipoides* var. *stipoides*	Weeping Rice Grass
Poaceae	*Notodanthonia longifolia*	Long-leaved Danthonia
Poaceae	*Oplismenus aemulus*	Basket Grass
Poaceae	*Oplismenus imbecillis*	-
Poaceae	*Panicum simile*	Two Colour Panic
Poaceae	*Paspalidium distans*	-
Poaceae	*Paspalum dilatatum**	Paspalum
Poaceae	*Paspalum orbiculare*	Ditch Millet
Poaceae	*Paspalum urvillei**	Vasey Grass
Poaceae	*Pennisetum clandestinum**	Kikuyu
Poaceae	*Phragmites australis*	Common Reed
Poaceae	*Plinthanthesis paradoxa*	
Poaceae	*Poa affinis*	-
Poaceae	*Poa labillardieri* var. *labillardieri*	Tussock Grass
Poaceae	*Poa seiberiana*	Tussock Grass

TABLE 2.2 (Cont.)
FLORA SPECIES OBSERVED WITHIN THE WHOLE OF THE WYONG EMPLOYMENT ZONE
(Extracted from Bell and Murray 2007)

Poaceae	*Setaria gracilis**	Slender Pigeon Grass
Poaceae	*Sporobolus elongatus*	Slender Rat's Tail Grass
Poaceae	*Stenotaphrum secundatum**	Buffalo Grass
Poaceae	*Themeda australis*	Kangaroo Grass
Polygalaceae	*Comesperma sphaerocarpum*	-
Polygonaceae	*Persicaria decipiens*	Slender Knotweed
Polygonaceae	*Rumex crispus**	Curled Dock
Ranunculaceae	*Ranunculus lappaceus* var. *lappaceus*	Glossy Buttercup
Ranunculaceae	*Ranunculus plebeius*	Hairy Buttercup
Ranunculaceae	*Ranunculus repens**	Creeping Buttercup
Restionaceae	*Leptocarpus tenax*	Slender Twine-rush
Restionaceae	*Lepyrodia muelleri*	-
Restionaceae	*Lepyrodia scariosa*	Scale Rush
Rubiaceae	*Galium proquinquum*	Bedstraw
Rubiaceae	*Opercularia varia*	Variable Stinkweed
Sinopteridaceae	*Cheilanthes sieberi* subsp. *sieberi*	Poison Rock Fern
Solanaceae	*Solanum nigrum**	Black Nightshade
Stylidiaceae	*Stylidium graminifolium*	Trigger Plant
Stylidiaceae	*Stylidium lineare*	Trigger Plant
Thymelaeaceae	*Pimelea linifolia* subsp. *linifolia*	Slender Rice Flower
Verbenaceae	*Verbena bonariensis**	Purpletop
Violaceae	*Hybanthus monopetalus*	Slender Violet
Violaceae	*Viola betonicifolia*	-
Violaceae	*Viola hederacea*	Ivy-leaved Violet
Xanthorrhoaceae	*Xanthorrhoea fulva*	-
Xanthorrhoaceae	*Xanthorrhoea latifolia* subsp. *latifolia*	-
Xanthorrhoaceae	*Xanthorrhoea macronema*	-
Xanthorrhoaceae	*Xanthorrhoea resinosa* subsp. *resinosa*	-
EPIPHYTES		
Loranthaceae	*Amyema sp.*	Mistletoe
Loranthaceae	*Dendrophthoe vitellina*	Mistletoe
Loranthaceae	*Muellerina eucalyptoides*	Mistletoe
Orchidaceae	*Cymbidium suave*	Native Cymbidium
Orchidaceae	*Dendrobium aemulum*	White Feather Orchid
Polypodiaceae	*Pyrrosia rupestris*	Rock Felt Fern
WATERPLANTS		
Asteraceae	*Epaltes australis*	-
Cyperaceae	*Baumea articulata*	Jointed Twig-Rush

TABLE 2.2 (Cont.)
FLORA SPECIES OBSERVED WITHIN THE WHOLE OF THE WYONG EMPLOYMENT ZONE
(Extracted from Bell and Murray 2007)

Cyperaceae	*Baumea juncea*	-
Cyperaceae	*Gahnia melanocarpa*	Black-fruit Saw-sedge
Cyperaceae	*Isolepis inundata*	Swamp Club-rush
Cyperaceae	*Isolepis nodosa*	-
Cyperaceae	*Lepidosperma neesii*	-
Cyperaceae	*Schoenus apogon*	Fluke Bog-rush
Goodeniaceae	*Goodenia paniculata*	Swamp Goodenia
Poaceae	*Pseudoraphis paradoxa*	Slender Mudgrass
Selaginallaceae	*Selaginella uliginosa*	Swamp Selaginella
Cyperaceae	*Baumea rubignosa*	Twig Rush
Cyperaceae	*Baumea teretifolia*	Wrinkle-nut Twig Rush
Cyperaceae	*Chorizandra cymbaria*	Heron Bristle Rush
Cyperaceae	*Chorizandra sphaerocephala*	Round-headed Bristle Rush
Cyperaceae	*Eleocharis sphacelata*	Tall Spike-rush
Cyperaceae	*Schoenoplectus mucronatus*	River Clubrush
Juncaginaceae	*Triglochin microtuberosum*	Water Ribbons
Phylydraceae	*Phylidrum lanuginosum*	Woolly Frogsmouth
Poaceae	*Paspalum distichum*	Water Couch
Restionaceae	*Empodisma minus*	-
Salviniaceae	*Salvinia molesta**	Salvinia
Typhaceae	*Typha orientalis*	Cumbungi
CLIMBERS		
Apocnyaceae	*Araujia sericifolia**	Mothvine
Apocynaceae	*Parsonsia straminea*	Common Silkpod
Bignoniaceae	*Pandorea pandorana*	Wonga Vine
Caprifoliaceae	*Lonicera japonica**	Japanese Honeysuckle
Convolvulaceae	*Polymeria calycina*	Bindweed
Dilleniaceae	*Hibbertia scandens*	Climbing Guinea-flower
Dioscoreaceae	*Dioscorea transversa*	Native Yam
Fabaceae	*Desmodium rhytidophyllum*	-
Fabaceae	*Glycine clandestina*	Twining Glycine
Fabaceae	*Glycine microphylla*	-
Fabaceae	*Glycine tabacina*	Twining Glycine
Fabaceae	*Hardenbergia violacea*	False Sarsparilla
Fabaceae	*Kennedia rubicunda*	Dusky Coral Pea
Lauraceae	*Cassytha glabella* forma *glabella*	Slender Devil's Twine
Lauraceae	*Cassytha pubescens*	Common Devil's Twine
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry
Luzuriagaceae	*Geitonoplesium cymosum*	Scrambling Lily
Menispermiaceae	*Stephania japonica* var. *discolor*	Snake Vine
Pittosporaceae	*Billardiera scandens* var. *scandens*	Apple Dumplings

TABLE 2.2 (Cont.) FLORA SPECIES OBSERVED WITHIN THE WHOLE OF THE WYONG EMPLOYMENT ZONE (Extracted from Bell and Murray 2007)		
Ranunculaceae	*Clematis glycinoides* var. *glycinoides*	Clematis
Rubiaceae	*Morinda jasminoides*	-
Smilacaceae	*Smilax australis*	Lawyer Vine
Smilacaceae	*Smilax glyciphylla*	Sarsaparilla
Vitaceae	*Cissus hypoglauca*	Water Vine

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

2.4 THREATENED FLORA SPECIES

A search of the Atlas of NSW Wildlife (NPWS, 2008) was undertaken to identify records of threatened flora species located within 10km of the site. This allowed for a specific search for threatened flora and their habitats to be undertaken to determine if any threatened flora species were present within the study area. Details on threatened flora species, as listed in Schedules 1 and 2 of the *Threatened Species Conservation Act* (1995), with a known or likely occurrence within the local area, are provided in Table 2.3.

TABLE 2.3
THREATENED FLORA SPECIES OF THE AREA

Species	TSC Act	EPBC Act	Growth Form and Habitat Requirements	Comments
Acacia bynoeana	E1	V	Erect or spreading shrub to 0.3 m high growing in heath and dry sclerophyll open forest on sandy soils. Often associated with disturbed areas such as roadsides. Distribution limits N-Newcastle S- Berrima.	Suitable habitat is present. Not observed during flora survey.
Angophora inopina	V	V	Erect or low spreading shrub 0.2-1m tall. Grows on sandy soils in heath, woodland and open forests from Morisset to Warnervale	Suitable habitat is present. Observed during flora survey.
Callistemon linearifolius	V	-	Shrub to 4m high. Grows in Sclerophyll Forest in moist gullies on coast and adjacent ranges, Nelson Bay to Georges River.	Suitable habitat is present. Not observed during flora survey.
Caladenia tessellata	E1	V	Terrestrial orchid. Clay-loam or sandy soils. Distribution limits N-Swansea S-south of Eden.	Suitable habitat is present. Not observed during flora survey.

TABLE 2.3 (Cont.) THREATENED FLORA SPECIES OF THE AREA				
Species	**TSC Act**	**EPBC Act**	**Growth Form and Habitat Requirements**	**Comments**
Cryptostylis hunteriana	V	V	Saprophytic orchid. Grows in swamp heath on sandy soils. Distribution limits N-Gibraltar Range S- south of Eden.	No suitable habitat is present. Not observed during flora survey.
Eucalyptus camfieldii	V	V	Stringybark to 10 m high. Grows on coastal shrub heath and woodlands on sandy soils derived from alluviums and Hawkesbury sandstone. Distribution limits N - Norah Head S - Royal NP.	No suitable habitat is present. Not observed during flora survey.
Eucalyptus pumila	V	V	Mallee species only known from Pokolbin State Forest	No suitable habitat is present. Not observed during flora survey.
Grevillea parviflora subsp *parviflora*	V	V	Open to erect shrub to 1 metre. Grows in woodland on light clayey soils Distribution limits N – Cessnock S - Appin	Suitable habitat is present. Observed during flora survey.
Melaleuca biconvexa	V	V	Tall shrub. Grows in wetlands adjoining perennial streams and on the banks of those streams, generally within the geological series known as the Terrigal Formation. Distribution limits N – Port Macquarie S – Jervis Bay.	Suitable habitat is present. Observed during flora survey.
Syzygium paniculatum	V	V	Small tree. Subtropical and littoral rainforest on sandy soil. Distribution limits N - Forster S - Jervis Bay.	Suitable habitat is present. Not observed during flora survey.
Rhizanthella slateri (Underground Orchid)	V	E	A terrestrial saprophytic underground orchid with a fleshy underground stem with overlapping bracts. Known from SE Qld to NSW South Coast in eucalypt forest. Flowers from Oct to Nov.	Suitable habitat is present. Not observed during flora survey.
Rutidosis heterogama	V	V	Small perennial herb to 30cm tall. Grows in heaths in clay soils and has been recorded along disturbed roadsides. Distribution limits N – Yuraygir NP S - Wyong.	Suitable habitat is present. Not observed during flora survey.

TABLE 2.3 (Cont.) THREATENED FLORA SPECIES OF THE AREA				
Species	**TSC Act**	**EPBC Act**	**Growth Form and Habitat Requirements**	**Comments**
Tetratheca juncea	V	V	Prostrate shrub to 1 m high. Dry sclerophyll forest and heath. Distribution limits N - Bulahdelah S - Port Jackson.	Suitable habitat is present. Observed during flora survey.
E = Endangered Species			V = Vulnerable Species	

It is considered that there is suitable habitat for *Acacia bynoeana, Angophora inopina, Callistemon linearifolius, Caladenia tessellata, Grevillea parviflora* subsp *parviflora, Melaleuca biconvexa, Syzygium paniculatum, Rhizanthella slateri, Rutidosis heterogama* and *Tetratheca juncea* within the subject site.

Four threatened species (*Angophora inopina, Grevillea parviflora, Melaleuca biconvexa* and *Tetratheca juncea*) as listed in the *Threatened Species Conservation Act* (1995) and the *Environmental Protection and Biodiversity Conservation Act* (1999) were observed within the subject site by Bell and Murray (2007).

Angophora inopina were observed at ten locations within the 20f – Alluvial Floodplain Shrub Swamp Forest in the eastern parts of the subject site (Bell and Murray, 2007).

Grevillea parviflora subsp. *parviflora* were observed at three locations near the central / southern parts of the site and at four other locations in the northern parts of the subject site (Bell and Murray, 2007).

Specimens of *Melaleuca biconvexa* were observed at various locations within the Map Unit 43a – Alluvial Riparian Blackbutt Forest associated with the drainage line of Buttonderry Creek in the southern parts of the subject site (Bell and Murray, 2007). The presence of *Melaleuca biconvexa* specimens at various locations along Buttonderry Creek was confirmed during a site inspection by R. Sansom of *Conacher Environmental Group.*

Tetratheca juncea was observed at two locations in the eastern parts of the subject site within the Map Unit 28 – Narrabeen Buttonderry Footslopes Forest (Bell and Murray, 2007).

The locations of these threatened species are shown in Figure 11 (Bell and Murray, 2007).

2.5 LOCAL AND REGIONAL DISTRIBUTION OF VEGETATION

The vegetation within the subject site forms part of a mosaic of disturbed and near natural vegetation distributed throughout the local area. The disturbed vegetation within the local area is associated with rural residential land uses such as grazing and the construction of rural dwellings and infrastructure such as dams, tanks, access roads and sheds. The amount of disturbance within the subject site ranges from areas of natural bushland that is lightly grazed to scattered trees in improved pasture.

Interspersed within the disturbed land are areas of near natural vegetation. These patches of vegetation form some corridor connectivity throughout the subject site, notably along the Buttonderry Creek riparian zone.

The vegetation communities observed and described in Section 2.2 of this document were based on site-specific surveys (Bell and Murray, 2007).

The vegetation communities present within the subject site and described in Section 2.2 are common throughout the local area. These vegetation communities are widespread to the north, south, east and west of the subject site where large tracts of similar forest extend for a minimum distance of 3km in all directions.

An inspection of the 1:25,000 aerial photograph of the local area indicates that the site is surrounded by large areas of almost undisturbed native vegetation to the north-west, north-east and to the south-east (separated by the F3 Freeway).

2.6 ENDANGERED ECOLOGICAL POPULATIONS / COMMUNITIES

2.6.1 Endangered Populations

One species (*Eucalyptus parramattensis* subsp. *parramattensis*) has been listed as an endangered population in the Wyong and Lake Macquarie Local Government Areas on Part 2 of Schedule 1 of the *TSC Act* (1995). This species has not been recorded within the subject site (NPWS, 2008; Bell and Murray, 2007). It is therefore considered that no specimens constituting part of this endangered population are present within the subject site.

2.6.2 Endangered Ecological Communities

There are six (6) Endangered Ecological Communities (EECs) listed in the *Threatened Species Conservation Act* (1995) present in the local area. Details regarding the habitat attributes and indicative species for these communities are provided in Table 2.4.

TABLE 2.4
ENDANGERED ECOLOGICAL COMMUNITIES OF THE AREA

Name	Habitat Requirements	Comments
Freshwater Wetlands on Coastal Floodplains (FWCF)	**Geology / Soils:** Silts, muds or humic loams. **Topography:** in depressions, flats, drainage lines, backswamps, lagoons and lakes associated with coastal floodplains with a recurring flood interval of less than 1 in 100 years. **Characteristic Species:** *Carex appressa, Paspalum distichum, Baumea articulata, Phylidrum lanuginosum, Ludwigia peploides ssp. montevidensis and Myriophyllum spp.*	Suitable habitat is present. Observed on site, within the River Flat and Swamp Sclerophyll Forest EEC.
Low Woodland with Heathland on indurated sand	**Geology / Soils:** Indurated (hardsetting) sands with a range of local variation in drainage conditions. **Topography:** low rolling sandy hills – restricted to Norah Head east of Wilfred Barrett Drive. **Characteristic Species**: *Eucalyptus camfieldii, Melaleuca quinquenervia, Melaleuca thymifolia, Lambertia formosa, Corymbia gummifera, Acacia longifolia, Banksia oblongifolia, Allocasuarina distyla* and *Melaleuca sieberi.*	No suitable habitat present. Not observed on site.

TABLE 2.4 ENDANGERED ECOLOGICAL COMMUNITIES OF THE AREA		
Name	**Habitat Requirements**	**Comments**
River-flat Eucalypt Forest on Coastal Floodplains	**Geology / Soils:** Silts, clay-loams and sandy loams. **Topography:** Periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains with a recurring flood interval of less than 1 in 100 years. **Characteristic Species:** *Eucalyptus tereticornis, E. amplifolia, E. botryoides, E. grandis, E. benthamii, Angophora floribunda, A. subvelutina, Melaleuca decora, M. stypheloides, Backhousia myrtifolia, Casuarina cunninghamiana* and *Casuarina glauca.*	Suitable habitat present. Observed on site.
Swamp Oak Floodplain Forest (SOFF)	**Geology / Soils:** Alluvial soils of fluvial or estuarine origin, with significant salinity. **Topography:** Flood plains in areas with saline soils and flats adjoining estuaries. **Characteristic Species:** *Casuarina glauca.*	No suitable habitat present. Not observed on site.
Swamp Sclerophyll Forest on Coastal Floodplains (SSFCF)	**Geology / Soils:** Waterlogged or periodically inundated humic clay loams and sandy loams. **Topography:** Alluvial flats and drainage lines of coastal floodplains with a recurring flood interval of less than 1 in 100 years. **Characteristic Species:** includes species such as *Eucalyptus robusta, Melaleuca quinquenervia and eucalyptus botryoides.*	Suitable habitat present. Observed on site.
Sydney Freshwater Wetlands (SFW)	**Geology / Soils:** Generally on the Warriewood and Tuggerah Soil Landscapes (Chapman and Murphy 1989). **Topography:** Swales and depressions on sand dunes and sandplain sites. **Characteristic Species:** *Eleocharis sphacelata*, *Baumea juncea*, *B. rubignosa*, *B. articulata*, *Gahnia sieberiana*, *Ludwigia peploides* and *Persicaria sp*	No suitable habitat present. Not observed on site.

Due to the presence of suitable habitat and indicator species it is considered that two of these Endangered Ecological Communities (EECs) known as, Swamp Sclerophyll Forest on Coastal Floodplains (SSFCF) and River Flat Eucalypt Forest on Coastal Floodplains (RFEFCF) are present on the subject site (See Figures 13 and 19).

The SSFCF EEC corresponds to Map Unit 20 - Alluvial Floodplain Shrub Swamp Forest (and all its variants) while the RFEFCF EEC corresponds to Map Unit 43 – Alluvial Riparian Blackbutt Forest (and its variants). These vegetation communities were described in detail in Section 2.2 and are shown in Figure 8 (Bell and Murray, 2007).

SECTION 3

FAUNA AND FAUNA HABITATS

3.1 FAUNA SURVEY METHODOLOGY

In order to detect the possible occurrence of threatened fauna species specific methods targeting these species were employed in addition to the standard fauna survey methods of nocturnal spotlighting and habitat searches. No additional fauna survey was undertaken by *Conacher Environmental Group*. The survey methods and results of the previous survey by Bell and Murray (2007) have been relied on for this assessment.

Literature Review:

- Review of local resource documents (listed in Table 1.3);
- A search of the Atlas of NSW Wildlife (NPWS, 2008) was undertaken to identify records of threatened fauna species located within 10km of the site. This enabled the preparation of a predictive list of threatened fauna species that could possibly occur within the habitats found on the site.

Fauna Survey:

Survey for fauna species in the study area was undertaken by Bell and Murray (2007) and included surveys targeting the following fauna groups; birds, mammals (including microchiropteran and megachiropteran bats), reptiles and amphibians. Survey sites were established to sample each fauna habitat type. The locations of the three fauna survey sites are shown in Figures 4 and 5 while detailed descriptions of the methods utilised for fauna surveys are provided in Sections 2.4.1 to 2.4.5 in Bell and Murray (2007).

A summary of total survey effort for mammals is indicated in Table 3.1.

Table 3.1.
Mammal Trapping Survey Effort, Precinct 14, Wyong Employment Zone.
(adapted from Bell and Murray, 2007)

Trap Type	Trapping Effort per Site	Precinct 14	Total
Elliott A	20 or 25 traps per site / night	225	225
Cage Trap	One cage trap for three nights	15	15
Elliott B arboreal	10 traps per site for three nights	90	90
Hair Tubes	2 large + 2 small for 4 nights	48	48
Micro Bats	Anabat Detector	60 hours	
Micro Bats	Harp Traps	6	

The fauna survey dates for Precinct 14 are provided in Table 3.2.

TABLE 3.2
FAUNA SURVEY DATES
(adapted from FFS, 2007)

General Fauna (Birds, Mammals, Reptiles, Amphibians)

Site No.	Habitat	Easting	Northing	Jan-05	Mar-05	Oct-05	Nov-05
16	Open Forest	354008	6323563	26-27	3 – 4th		
17	Open Forest	353228	6322963	26-27	3 – 4th		
18	Riparian Tall Forest	352984	6322720		3 – 4th	23rd	29th

Microchiropteran Bats (HT refers to Harp Trap location + Anabat Recording Site)

Site No.	Habitat	Easting	Northing	Jan-05	Mar-05	Oct-05	Nov-05
HT17	Open Forest	354432	6323426	26-27	3 – 4th		
HT18	Swamp Woodland	354244	6323220				
HT19	Open Forest	353304	6323054	26-27	3 – 4th		
HT20	Riparian Tall Forest	353061	6322726		5th		
HT21	Riparian Tall Forest	353094	6322660		5th		

Note: HT in this Table refers to Harp Trap for Microchiropteran Bats.

3.2 FAUNA HABITATS

The subject site consists of a mosaic of near natural and disturbed vegetation types associated with the past and current land uses within the rural residential allotments. The subject site is connected to similar areas of vegetation and habitat to the north, south, west and east (separated by the F3 Freeway). The local area provides large tracts of good quality fauna habitats associated with privately and publicly owned lands and Jilliby State Conservation Area located approximately 5km to the west.

A range of fauna habitats are present throughout the site and include:

- Vegetated areas comprising a variety of vegetation communities with varying levels of disturbance;
- 202 hollow bearing trees and stags;
- Nectar producing tree and shrub species;
- Sparse to dense patchy shrub layer and understorey;
- Grassy ground cover;
- Fallen timber and hollow logs;
- Leaf litter;
- Human refuse and building materials;
- Aquatic drainage line habitats.

Bell and Murray (2007) have identified that the fauna habitats relating to the vegetation types present include:

- Open forest;
- Open forest Woodland;
- Canopy-only Forest Woodland;
- Regrowth Forest Woodland;
- Riparian Forest;
- Swamp Forest;
- Water;
- Wet Heath.

The hollows present within the hollow bearing trees and stags across the site range from small branch hollows suitable for small mammals, (such as microbats), and reptiles, to large trunk and branch hollows providing suitable roosting and nesting sites for larger arboreal mammals and bird species such as cockatoos and owls. A total of 203 hollow bearing trees were identified within the subject site (Bell and Murray, 2007). A list of these hollow bearing trees and their attributes is provided in the Appendices of this Reportl. It is likely that other hollow bearing trees are present within the subject site that were not observed or surveyed.

The flower and nectar producing species within the vegetation communities on-site provide foraging resources for bird and arboreal mammal species. The sparse to dense understorey, grassy ground layer and leaf litter provide foraging and shelter habitat for a number of bird, small mammal and reptile species.

The drainage line flowing through the central-southern section of site provides shelter, breeding and foraging habitat for amphibians and reptiles and water nourishment for mammals and birds. The riparian vegetation surrounding the drainage line provides foraging, refuge and roosting sites for mammals, bird and reptile species.

The fallen timber and hollow logs present across the site provide foraging and shelter for small mammal and reptile species. Human refuse dumped on the site has created habitat for small mammals and reptiles and amphibians.

Bell and Murray (2007) have provided a breakdown of the fauna habitats of Precinct 14 in relation to the vegetation communities present and hollow bearing trees identified within the site. These details are provided in Tables 3.3, 3.4, 3.5.

TABLE 3.3
Open Forest Attributes, Precinct 14
(extracted from Bell and Murray 2007)

	% Canopy Cover	**Tree Size Class (DBH in cm)**			
Tree Species (to 25 metres in Height)		0 - 20	21 - 40	41 - 80	>80cm
Spotted Gum (*Corymbia maculata*)	46.7%	20	37	0	0
Forest Oak (*Allocasuarina torulosa*)	35.2%	27	16	0	0
Brown Stringybark (*E. capitellata*)	4.1%	0	5	0	0
Smooth-barked Apple (*A. costata*)	13.9%	17	0	0	0
Understorey Species (to 5m)					
Melaleuca nodosa		22	-	-	-
Forest Oak (*Allocasuarina torulosa*)		5	-	-	-
Ground Layer Vegetation (to 1m)					
Blady Grass	90.0%				
Trees with Lge Hollows (>10cm /ha)	2				
Trees with Sml Hollows (<10cm /ha)	4				
No. Flowering Trees	None during fieldwork				
Disturbance	Habitat in good condition with few weeds and limited dumping, infrequent fire, habitat dissected by vehicle tracks				

TABLE 3.4 Abundance of Tree Species and Size Class of Hollow Bearing Trees - Precinct 14							
	Size Class (DBH in Cms)						
Tree Species	**0 - 50**	**51 - 100**	**101 - 150**	**151 - 200**	**>200**	**Total**	**% of Total**
Angophora costata	1	53	21	1	0	**76**	37.6%
Dead Stag	4	38	11	2	0	**55**	27.2%
Corymbia maculata	0	34	4	3	0	**41**	20.3%
Eucalyptus capitellata	0	8	1	0	0	**9**	4.4%
Eucalyptus resinifera	0	7	0	0	0	**7**	3.4%
Eucalyptus pilularis	1	0	1	1	1	**4**	2.0%
Angophora floribunda	0	3	0	0	0	**3**	1.5%
Eucalyptus tereticornis	0	2	1	0	0	**3**	1.5%
Eucalyptus robusta	0	1	1	0	0	**2**	1.0%
Corymbia gummifera	0	1	0	0	0	**1**	0.5%
Ironbark	0	1	0	0	0	**1**	0.5%
Total	**6**	**148**	**40**	**7**	**1**	**202**	

TABLE 3.5 Proportion of Potential Hollow Bearing Trees for each Fauna Group					
		Proportion of Total Habitat Trees as Potential Roost / Den / Nests for each fauna Group			
	No. Trees	**Micro Bats**	**Gliders**	**Possum**	**Owls**
Precinct 14	202	66.3%	49.5%	82.6%	15.3%

3.3 THREATENED FAUNA SPECIES

A search of the Atlas of NSW Wildlife (NPWS, 2008) was conducted for threatened fauna recorded within 10km of the subject site. This revealed a number of threatened species that may be present in the area. Details on threatened fauna species (Schedule 1 or 2) which are known to occur within the area are provided in Table 3.6.

TABLE 3.6 RECORDED THREATENED FAUNA OF THE AREA				
Common Name ***Scientific Name***	**TSC Act**	**EPBC Act**	**Preferred Habitat**	**Comments**
Green and Golden Bell Frog *Litoria aurea*	E	V	Prefers the edges of permanent water, streams, swamps, creeks, lagoons, farm dams and ornamental ponds. Often found under debris. Distribution Limit - N-Byron Bay. S-South of Eden	Suitable habitat present. Not observed during survey.
Green Thighed Frog *Litoria brevipalmata*	V	-	Found in rainforests and open forests within or at the edge of streams, swamps, lagoons, dams and ponds. Distribution Limit - N-Border Ranges National Park. S-Near Gosford	Suitable habitat present. Not observed during survey.
Littlejohn's Tree Frog *Litoria littlejohnii*	V	V	Found in wet and dry sclerophyll forest associated with sandstone outcrops at altitudes 280-1000m on eastern slopes of Great Dividing Range. Prefers flowing rocky streams. Distribution Limit – N-Hunter River. S-Eden	No suitable habitat present. Observed in Precinct 14 lands
Wallum Froglet *Crinia tinnula*	V	-	Found in acidic paperbark swamps and Wallum country with dense groundcover. Breeds in temporary and permanent pools and ponds of high acidity. Distribution Limit - N-Tweed Heads S-Tumbi Umbi.	Suitable habitat present.
Giant Burrowing Frog *Heleioporus australiacus*	V	V	Inhabits open forests and riparian forests along non-perennial streams, digging burrows into sandy creek banks. Distribution Limit- N-Near Singleton. S-South of Eden	Sub - optimal habitat present. Not observed during survey.
Stuttering Frog *Mixophyes balbus*	E	V	Terrestrial inhabitant of rainforest and wet sclerophyll forests. Distribution Limit - N-Near Tenterfield. S-South of Bombala.	Sub - optimal habitat present. Not observed during survey.
Giant Barred Frog *Mixophyes iteratus*	E	E	Terrestrial inhabitant of rainforest and open forests. Distribution Limit- N-Border Ranges National Park. S-Narooma.	Sub - optimal habitat present. Not observed during survey.
Red-crowned Toadlet *Pseudophryne australis*	V	-	Prefers sandstone areas, breeds in grass and debris beside non-perennial creeks or gutters. Individuals can also be found under logs and rocks in non breeding periods. Distribution Limit- N-Pokolbin S-Near Wollongong	No suitable habitat present.
Speckled Warbler *Chthonicola sagittata*	V	-	Found in temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts. Distribution Limit - N-Urbanville. S-Eden	Suitable foraging and roosting habitat present. Not observed during survey.
Australasian Bittern *Botaurus poiciloptilus*	V	-	Inhabits shallow freshwater or brackish wetlands with tall dense beds of reeds, sedges or rush species and swamp edges. Distribution Limit - N-North of Lismore. S-Eden.	No suitable habitat present.

TABLE 3.6 (Cont.) RECORDED THREATENED FAUNA OF THE AREA				
Common Name ***Scientific Name***	**TSC Act**	**EPBC Act**	**Preferred Habitat**	**Comments**
Black Bittern *Dupetor flavicollis*	V	-	Forages in freshwater & brackish streams & ponds. Distribution Limit - N-Tweed Heads. S-South of Eden.	Foraging habitat present. Not observed during survey.
Bush Stone-curlew *Burhinus grallarius*	E	-	Utilises open forests and savanna woodlands, sometimes dune scrub, savannah and mangrove fringes. Distribution Limit- N-Border Ranges National Park S-Near Nowra	Sub – optimal foraging habitat present. Not observed during survey.
Gang-gang Cockatoo *Callocephalon fimbriatum*	V	-	Prefers wetter forests and woodlands from sea level to > 2000m on Divide, timbered foothills and valleys, timbered watercourses, coastal scrubs, farmlands and suburban gardens. Distribution Limit –mid north coast of NSW to western Victoria	Suitable foraging and roosting habitat present. Not observed during survey.
Glossy Black-Cockatoo *Calyptorhynchus lathami*	V	-	Open forest with Allocasuarina species and hollows for nesting. Distribution Limit- N-Tweed Heads S-Sth of Eden.	Suitable foraging and roosting habitat present. Observed during survey.
Black-necked Stork *Ephippiorhynchus asiaticus*	E	-	Occurs in tropical to warm temperate terrestrial wetlands, estuarine and littoral habitats. Distribution Limit - N-Tweed Heads. S-Nowra.	Sub – optimal foraging habitat present. Not observed during survey.
Superb Fruit-dove *Ptilinopus superbus*	V	-	Rainforests, adjacent mangroves, eucalypt forests, scrubland with native fruits. Distribution Limit - N-Border Ranges National Park. S-Bateman's Bay.	No suitable habitat present.
Pied Oystercatcher *Haematopus longirostris*	V	-	Inhabits coastal beaches and estuarine flats. Distribution Limit N-Tweed Heads S-South of Eden.	No suitable habitat present.
Comb-crested Jacana *Irediparra gallinacea*	V	-	Deep and permanent vegetation-choked tropical and warm temperate wetlands. Distribution Limit - N-Tweed Heads. S - Ku-ring-gai Chase National Park.	No suitable habitat present.
Painted Honeyeater *Grantiella picta*	V	-	Found in open forest, woodland and scrubland feeding on mistletoe fruits. Distribution Limit- N-Boggabilla S-Albury.	Suitable foraging and roosting habitat present. Not observed during survey.
Regent Honeyeater *Xanthomyza phrygia*	E	E	Found in temperate Eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature Eucalypts. Distribution Limit - N-Urbanville. S-Eden.	Suitable foraging and roosting habitat present. Not observed during survey.

TABLE 3.6 (Cont.) RECORDED THREATENED FAUNA OF THE AREA				
Common Name ***Scientific Name***	**TSC Act**	**EPBC Act**	**Preferred Habitat**	**Comments**
Swift Parrot *Lathamus discolor*	E	E	Inhabits Eucalypt forests and woodlands with winter flowering Eucalypts. Distribution Limit - N-Border Ranges National Park. S-South of Eden.	Suitable foraging habitat present. Not observed during survey.
Turquoise Parrot *Neophema pulchella*	V	-	Inhabits coastal scrubland, open forest and timbered grassland, especially ecotones between dry hardwood forests and grasslands. Distribution Limit - N-Near Tenterfield. S-South of Eden.	Suitable foraging and roosting habitat present. Not observed during survey.
Barking Owl *Ninox connivens*	V	-	Inhabits principally woodlands but also open forests and partially cleared land and utilises hollows for nesting. Distribution Limits- N-Border Ranges National Park S-Eden	Suitable foraging and roosting habitat present. Not observed during surveys.
Powerful Owl *Ninox strenua*	V	-	Forests containing mature trees for shelter or breeding and densely vegetated gullies for roosting. Distribution Limits - N-Border Ranges National Park. S-South of Eden.	Suitable foraging and roosting habitat present. Not observed during surveys.
Masked Owl Tyto novaehollandiae	V	-	Open forest and woodlands with cleared areas for hunting and hollow trees for roosting. Distribution Limit - N-Border Ranges National Park S-Eden.	Suitable foraging and roosting habitat present. Not observed during survey.
Sooty Owl *Tyto tenebricosa*	V	-	Tall, dense, wet forests containing trees with very large hollows. Distribution Limit - N-Border Ranges National Park. S-South of Eden	Sub - optimal foraging and roosting habitat present. Not observed during survey.
Spotted-tailed Quoll *Dasyurus maculatus*	V	V	Dry and moist open forests containing rock caves, hollow logs or trees. Distribution Limit- N-Mt Warning National Park S-South of Eden.	Suitable foraging and roosting habitat present. Not observed during survey.
Parma Wallaby *Macropus parma*	V	-	Inhabits rainforests and wet and dry sclerophyll forests with a dense understorey and associated grassy patches. Distribution Limit - N-Border Ranges National Park. S-Morton National Park.	Sub-optimal habitat present. Not observed during survey.
Southern Brown Bandicoot *Isoodon obesulus*	E	E	Utilises a range of habitats containing thick ground cover - open forest, woodland, heath, cleared land, urbanised areas and regenerating bushland. Distribution Limit - N-Kempsey. S-South of Eden.	No suitable habitat present.

TABLE 3.6 (Cont.) RECORDED THREATENED FAUNA OF THE AREA				
Common Name ***Scientific Name***	**TSC Act**	**EPBC Act**	**Preferred Habitat**	**Comments**
Yellow-bellied Glider *Petaurus australis*	V	-	Tall mature eucalypt forests with high nectar producing species and hollow bearing trees. Distribution Limit- N-Border Ranges National Park. S-South of Eden.	Sub-optimal foraging and den habitat present. Not observed during survey.
Squirrel Glider *Petaurus norfolcensis*	V	-	Mixed aged stands of Eucalypt forest and woodlands including gum barked, high nectar producing species and hollow bearing trees. Distribution Limit - N-Lismore. S-Albury.	Suitable foraging and den habitat present. Observed during survey.
Koala *Phascolarctos cinereus*	V	-	Inhabits both wet & dry Eucalypt forest on high nutrient soils containing preferred feed trees. Distribution Limit- N-Tweed Heads S-South of Eden.	Sub-optimal foraging habitat present. Not observed / detected during survey.
Grey-headed Flying-fox Pteropus poliocephalus	V	V	Found in a variety of habitats including rainforest, mangroves, paperbark swamp, wet and dry open forest and cultivated areas. Forms camps commonly found in gullies and in vegetation with a dense canopy. Distribution Limit – N – Tweed Heads S - Eden	Suitable foraging habitat present. Not observed during survey.
Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris*	V	-	Rainforests, sclerophyll forests and woodlands. Distribution Limit - N-North of Walgett. S-Sydney.	Suitable foraging and shelter habitat present. Not detected during survey.
Eastern Freetail-bat *Mormopterus norfolkensis*	V	-	Inhabits open forests and woodlands foraging above the canopy and along the edge of forests. Roosts in tree hollows, under bark and buildings. Distribution Limit - N-Woodenbong. S-Pambula.	Suitable foraging and shelter habitat present. Detected on adjoining land..
Large-eared Pied Bat *Chalinolobus dwyeri*	V	V	Warm-temperate to subtropical dry sclerophyll forest and woodland. Roosts in caves, tunnels and tree hollows in colonies of up to 30 animals. Distribution Limit - N-Border Ranges Nation Park. S-Wollongong.	Suitable foraging and shelter habitat present. Not detected during survey.
Eastern False Pipistrelle *Falsistrellus tasmaniensis*	V	-	Recorded roosting in caves, old buildings and tree hollows. Distribution Limit- N-Border Ranges National Park S-Pambula	Suitable foraging and shelter habitat present. Not detected during survey.
Little Bentwing-bat *Miniopterus australis*	V	-	Roosts in caves, old buildings and tree hollows in the higher rainfall forests along the south coast of Australia. Distribution Limit - N-Border Ranges National Park. S-Sydney.	Suitable foraging habitat present. Detected during survey.
Eastern Bentwing-bat *Miniopterus schreibersii oceanensis*	V	-	Prefers areas where there are caves, old mines, old buildings, stormwater drains & well timbered areas. Distribution Limit - N-Border Ranges National Park. S-South of Eden.	Suitable foraging habitat present. Detected during survey.

TABLE 3.6 (Cont.) RECORDED THREATENED FAUNA OF THE AREA				
Common Name ***Scientific Name***	**TSC Act**	**EPBC Act**	**Preferred Habitat**	
Large-footed Myotis *Myotis adversus*	V	-	Rainforests and sclerophyll forests near creeks and lakes over which it feeds. Roosts in tree hollows, caves, mines and tunnels. Distribution Limit - N-Border Ranges Nation Park. S-South of Eden.	Suitable foraging and shelter habitat present. Not detected during survey.
Greater Broad-nosed Bat *Scoteanax rueppellii*	V	-	Inhabits areas containing moist river & creek systems especially tree lined creeks. Distribution Limit - N-Border Ranges National Park. S-Pambula.	Suitable foraging and shelter habitat present. Detected during survey.

The locations of threatened fauna species observed within the subject site are shown in Figure 12.

3.4 KOALA HABITAT ASSESSMENT

Potential Koala habitat is defined as at least 15% koala feed tree species (as listed in Schedule 2 of the SEPP 14 – Koala Habitat Protection) in the upper or lower strata.

Core koala habitat is defined as an area of land with a resident population of koalas as evidenced by attributes such as breeding females, recent sightings of and historical records of a population.

The list of tree species in Schedule 2 of SEPP 44 is provided in Table 3.7.

TABLE 3.7 SEPP 14 - KOALA HABITAT PROTECTION - SCHEDULE 2 TREE SPECIES (adapted from FFS, 2007)		
Scientific Name	**Common Name**	**Tree Species in Study Area**
Eucalyptus albens	White Box	No
Eucalyptus camaldulensis	River Red Gum	No
Eucalyptus haemastoma	Broad-leaved Scribbly Gum	YES
Eucalyptus microcorys	Tallowwood	No
Eucalyptus populnea	Bimble Box	No
Eucalyptus punctata	Large-fruited Grey Gum	YES
Eucalyptus robusta	Swamp Mahogany	YES
Eucalyptus signata	Scribbly Gum	No
Eucalyptus tereticornis	Forest Red Gum	YES
Eucalyptus viminalis	Ribbon Gum	No

There were four (4) species of Koala feed trees listed in Schedule 2 of SEPP N^0 44 – Koala Habitat Protection identified within the subject site.

No evidence of a Koala population was recorded in the Wyong Employment Zone by any of the previous fauna investigation surveys. A review of all records of the species on the Wildlife Atlas (NPWS, 2008) and Wyong Fauna Database indicate a number of observations in the locality. There is no record of Koala in the Wyong Employment Zone study area, but several records occur within a five kilometre radius of the site. Historical records of Koala in the locality include:

- Near the Porter's Creek Wetland in the 1970's (immediately south of the study area)(Andrews Neil, 1996a);

- In proximity to the Warnervale Town Centre in 1994 (approximately 2 kilometres to the east)(DEC Wildlife Atlas, 2005); and

- In proximity to the township of Warnervale in 2003 (Scott Duncan, Wyong Shire Council, personal communications – in Bell and Murray 2007).

Potential Koala habitat as defined in SEPP 44 (>15% of Schedule 2 trees in the upper and lower strata) occurs within small pockets within the study area.

No evidence of core habitat was recorded in the study area. No evidence of individual Koalas was detected by spotlight and scat searches in the study area. No fresh or old scats were evident to suggest a resident population of Koala utilise feed trees in study area.

3.5 FAUNA OBSERVED

The fauna species recorded by Bell and Murray (2007) within and adjacent to the subject site land are listed in Table 3.8.

TABLE 3.8
FAUNA OBSERVED AND RECORDED IN THE LOCAL AREA
(adapted from Bell and Murray, 2007)

	Scientific Name
Birds	
Brown Quail	*Coturnix ypsilophora*
Black Swan	*Cygnus atratus*
Australian Wood Duck	*Chenonetta jubata*
Pacific Black Duck	*Anas superciliosa*
Australasian Grebe	*Tachybaptus novaehollandiae*
Little Pied Cormorant	*Phalacrocorax melanoleucos*
Australian Pelican	*Pelecanus conspicillatus*
White-faced Heron	*Egretta novaehollandiae*
White-necked Heron	*Ardea pacifica*
Great Egret	*Ardea alba*
Intermediate Egret	*Ardea intermedia*
Nankeen Night Heron	*Nycticorax caledonicus*
Australian White Ibis	*Threskiornis molucca*
Straw-necked Ibis	*Threskiornis spinicollis*
Black-shouldered Kite	*Elanus axillaris*
Whistling Kite	*Haliastur sphenurus*
White-bellied Sea-Eagle	*Haliaeetus leucogaster*
Swamp Harrier	*Circus approximans*
Brown Goshawk	*Accipiter fasciatus*
Wedge-tailed Eagle	*Aquila audax*
Brown Falcon	*Falco berigora*
Nankeen Kestrel	*Falco cenchroides*
Purple Swamphen	*Porphyrio porphyrio*
Dusky Moorhen	*Gallinula tenebrosa*
Masked Lapwing	*Vanellus miles*
Rock Dove	*Columba livia*
Spotted Turtle-Dove	*Streptopelia chinensis*
Crested Pigeon	*Ocyphaps lophotes*
Glossy Black-Cockatoo[TS]	*Calyptorhynchus lathami*
Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*
Galah	*Cacatua roseicapilla*
Long-billed Corella	*Cacatua tenuirostris*
Little Corella	*Cacatua sanguinea*
Sulphur-crested Cockatoo	*Cacatua galerita*
Rainbow Lorikeet	*Trichoglossus haematodus*
Little Lorikeet	*Glossopsitta pusilla*
Australian King-Parrot	*Alisterus scapularis*
Eastern Rosella	*Platycercus eximius*
Pallid Cuckoo	*Cuculus pallidus*
Fan-tailed Cuckoo	*Cacomantis flabelliformis*
Horsfield's Bronze-Cuckoo	*Chrysococcyx basalis*
Shining Bronze-Cuckoo	*Chrysococcyx lucidus*
Common Koel	*Eudynamys scolopacea*

TABLE 3.8 (Cont.)
FAUNA OBSERVED AND RECORDED IN THE LOCAL AREA
(adapted from Bell and Murray, 2007)

Channel-billed Cuckoo	*Scythrops novaehollandiae*
Pheasant Coucal	*Centropus phasianinus*
Tawny Frogmouth	*Podargus strigoides*
Australian Owlet-nightjar	*Aegotheles cristatus*
White-throated Needletail	*Hirundapus caudacutus*
Laughing Kookaburra	*Dacelo novaeguineae*
Sacred Kingfisher	*Todiramphus sanctus*
Dollarbird	*Eurystomus orientalis*
White-throated Treecreeper	*Cormobates leucophaeus*
Superb Fairy-wren	*Malurus cyaneus*
Southern Emu-wren	*Stipiturus malachurus*
Spotted Pardalote	*Pardalotus punctatus*
Striated Pardalote	*Pardalotus striatus*
White-browed Scrubwren	*Sericornis frontalis*
White-throated Gerygone	*Gerygone olivacea*
Brown Thornbill	*Acanthiza pusilla*
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*
Yellow Thornbill	*Acanthiza nana*
Striated Thornbill	*Acanthiza lineata*
Red Wattlebird	*Anthochaera carunculata*
Noisy Friarbird	*Philemon corniculatus*
Bell Miner	*Manorina melanophrys*
Noisy Miner	*Manorina melanocephala*
Lewin's Honeyeater	*Meliphaga lewinii*
Yellow-faced Honeyeater	*Lichenostomus chrysops*
White-eared Honeyeater	*Lichenostomus leucotis*
Brown-headed Honeyeater	*Melithreptus brevirostris*
White-naped Honeyeater	*Melithreptus lunatus*
White-cheeked Honeyeater	*Phylidonyris nigra*
Eastern Spinebill	*Acanthorhynchus tenuirostris*
Eastern Yellow Robin	*Eopsaltria australis*
Eastern Whipbird	*Psophodes olivaceus*
Golden Whistler	*Pachycephala pectoralis*
Rufous Whistler	*Pachycephala rufiventris*
Grey Shrike-thrush	*Colluricincla harmonica*
Magpie-lark	*Grallina cyanoleuca*
Grey Fantail	*Rhipidura fuliginosa*
Willie Wagtail	*Rhipidura leucophrys*
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*
Cicadabird	*Coracina tenuirostris*
Olive-backed Oriole	*Oriolus sagittatus*
White-breasted Woodswallow	*Artamus leucorynchus*
Grey Butcherbird	*Cracticus torquatus*
Pied Butcherbird	*Cracticus nigrogularis*
Australian Magpie	*Gymnorhina tibicen*
Pied Currawong	*Strepera graculina*
Australian Raven	*Corvus coronoides*
Red-browed Finch	*Neochmia temporalis*
Welcome Swallow	*Hirundo neoxena*
Silvereye	*Zosterops lateralis*

TABLE 3.8 (Cont.)
FAUNA OBSERVED AND RECORDED IN THE LOCAL AREA
(adapted from Bell and Murray, 2007)

Common Starling	*Sturnus vulgaris*
Common Myna	*Acridotheres tristis*
Mammals	
Brown Antechinus	*Antechinus stuartii*
Sugar Glider	*Petaurus breviceps*
Squirrel Glider [TS]	*Petaurus norfolcensis*
Common Ringtail Possum	*Pseudocheirus peregrinus*
Common Brushtail Possum	*Trichosurus vulpecula*
Eastern Grey Kangaroo	*Macropus giganteus*
Red-necked Wallaby	*Macropus rufogriseus*
Swamp Wallaby	*Wallabia bicolor*
Southern Freetail-bat	*Mormopterus planiceps*
White-striped Freetail-bat	*Nyctinomus australis*
Little Bentwing-bat [TS]	*Miniopterus australis*
Eastern Bentwing-bat [TS]	*Miniopterus schreibersii oceanensis*
Lesser Long-eared Bat	*Nyctophilus geoffroyi*
Gould's Long-eared Bat	*Nyctophilus gouldii*
Gould's Wattled Bat	*Chalinolobus gouldii*
Chocolate Wattled Bat	*Chalinolobus morio*
Greater Broad-nosed Bat [TS]	*Scoteanax rueppellii*
Eastern Broad-nosed Bat	*Scotorepens orion*
Large Forest Bat	*Vespadelus darlingtoni*
Eastern Forest Bat	*Vespadelus pumilus*
Little Forest Bat	*Vespadelus vulturnus*
House Mouse *	*Mus musculus*
Bush Rat	*Rattus fuscipes*
Swamp Rat	*Rattus lutreolus*
Black Rat *	*Rattus rattus*
Dog *	*Canis familiaris*
European Red Fox *	*Vulpes vulpes*
Rabbit*	*Oryctolagus cuniculus*
Brown Hare *	*Lepus lepus*
Amphibians	
Wallum Froglet	*Crinia tinnula*
Common Eastern Froglet	*Crinia signifera*
Striped Marsh Frog	*Limnodynastes peronii*
Brown Toadlet	*Pseudophryne bibronii*
Smooth Toadlet	*Uperoleia laevigata*
Bleating Tree Frog	*Litoria dentata*
Eastern Dwarf Tree Frog	*Litoria fallax*
Broad-palmed Frog	*Litoria latopalmata*
Reptiles	
Jacky Lizard	*Amphibolurus muricatus*
Eastern Water Dragon	*Physignathus lesueurii*
Eastern Bearded Dragon	*Pogona barbata*
Lace Monitor	*Varanus varius*
Robust Striped Skink	*Ctenotus robustus*
She-oak Skink	*Cyclodomorphus casuarinae*
Eastern Water Skink	*Eulamprus quoyii*

TABLE 3.8 (Cont.) FAUNA OBSERVED AND RECORDED IN THE LOCAL AREA (adapted from Bell and Murray, 2007)	
Dark-flecked Garden Sunskink	*Lampropholis delicata*
Eastern Blue-tounged Lizard	*Tiliqua scincoides*
Green Tree Snake	*Dendrelaphis punctulatus*
Black-bellied Swamp Snake	*Hemiapis signata*
Red-bellied Black Snake	*Pseudechis porphyriacus*

Six threatened species were observed or detected within the subject site. These species were:

- *Crinia tinnula* (Wallum Froglet);
- *Calyptorhynchus lathami* (Glossy Black Cockatoo),
- *Petaurus norfolcensis* (Squirrel Glider),
- *Miniopterus australis* (Little Bentwing-bat)
- *Miniopterus schreibersii oceanensis* (Eastern Bentwing-bat)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat)

Additionally two threatened fauna species have been detected on nearby or adjoining land during fauna surveys. These species are:

- *Pteropus poliocephalus* (Grey-headed Flying Fox);
- *Mormopterus norfolkensis* (Eastern Freetail Bat).

SECTION 4

MAINTAIN OR IMPROVE ASSESSMENT

4.1 OVERVIEW

In relation to Precinct 14 a range ecological attributes were assessed for retention or removal. The following criteria identified in the 'maintain or improve' assessment.

Precinct 14 occupies a total of approximately 130 hectares within the Wyong Employment Zone. A riparian corridor along Buttonderry Creek and other areas of land is to be included and maintained within the proposed Drainage / Environmental / Open Space Lands which total approximately 50ha or 38% of the site. Proposed development area (approximately 80 hectares) is situated within areas designated in the draft LEP an Industrial Zone.

A Biocertification Report for the whole of the Wyong Employment Zone was prepared by Wyong Shire Council (WSC, 2007). The Biocertification Report (WSC, 2007) identifies that:

The primary test for biodiversity certification is whether the proposal "improves or maintains biodiversity values". This was undertaken for the Wyong Employment Zone. A large amount of data was available to undertake this exercise from comprehensive vegetation, flora and fauna surveys which have been undertaken by Murray and Bell (2007).

Information relevant to Precinct 14 has been extracted from the Biocertification Report (WSC 2007) and the Ecological Investigations Report (Bell and Murray 2007) and is provided in the following sections of this report. The order in which the various criteria are assessed follows the order provided by Wyong Shire Council (2007). As Precinct 14 is part of the larger WEZ lands the consideration of 'maintain or improve' criteria also needs to be balanced against the overall WEZ assessment.

4.2 VEGETATION COMMUNITIES

Details on the vegetation communities present in Precinct 14 are provided in Table 4.1

TABLE 4.1
VEGETATION COMMUNITIES PRESENT IN PRECINCT 14

Biodiversity Value	Total Area (ha)		Area Lost to Development (ha)		Area Maintained or Improved (ha)		Environmental Outcome % Conserved	
	WEZ	P14	WEZ	P14	WEZ	P14	WEZ	P14
Remnant Vegetation (Good Condition)	354.8	43	93.3	11	261.5	32	73.7%	74.4%
Disturbed Vegetation [Xr]	71.4	35	48.6	22	22.8	13	31.9%	37.1%
Cleared Land (Low Condition)	285.4	52	225.3	47	60.1	5	21.0%	9.6%
TOTAL AREA (ha)	**711**	**130**	**367.2**	**80**	**344.4**	**50**	**48.3%**	**38.5%**

Outcome: Impact of vegetation losses offset through introduction of new conservation zonings, acquisition of environmentally significant areas, secure tenure and regeneration of disturbed vegetation (WSC, 2007).

4.3 FAUNA HABITATS

Based on fauna habitat assessment and vegetation mapping of the study area, 10 fauna habitats are described for the whole of the WEZ study area (Bell and Murray 2007);

- Open Forest,
- Open Forest / Woodland,
- Regrowth Forest / Woodland,
- Swamp Forest,
- Riparian Forest,
- Wet Heath,
- Water and
- Cleared / Open Space.

Table 4.2 identifies the loss of fauna habitats in Precinct 14 in relation to total habitats present.

TABLE 4.2
FAUNA HABITATS PRESENT IN PRECINCT 14

Biodiversity Value	Total Area (ha)		Habitat Lost to Development (ha)		Habitat Maintained or Improved (ha)		Environmental Outcome % Conserved	
	WEZ	P14	WEZ	P14	WEZ	P14	WEZ	P14
Fauna Habitats (all pooled except cleared)	432.0	78	141.9	33	284.3	45	67.1%	57.7%
Cleared Land (Low Value)	278.9	52	225.3	47	60.1	5	31.9%	9.6%
TOTAL AREA (ha)	**711**	**130**	**367.2**	**80**	**344.4**	**50**		

Outcome: *Impacts of fauna habitat losses offset through introduction of new conservation zonings, acquisition of environmentally significant areas, secure tenure and habitat enhancement strategies (these are outlined in the report by Murray and Bell, 2007 and will be discussed in detail in the WEZ plan of management). Despite some localised habitat the losses proposal still maintains biodiversity values through the substantial conservation outcomes which are achieved* (WSC, 2007).

4.4 THREATENED FLORA

Four threatened species (*Angophora inopina, Grevillea parviflora, Melaleuca biconvexa* and *Tetratheca juncea*) as listed in the *Threatened Species Conservation Act* (1995) were observed within the subject site.

Angophora inopina were observed at ten locations within the 20f – Alluvial Floodplain Shrub Swamp Forest in the eastern parts of the subject site (Bell and Murray, 2007).

Grevillea parviflora subsp. *parviflora* were observed at three locations near the central / southern parts of the site within an area to be zoned for development and at three other locations in the northern parts of the subject site to be zoned for conservation (Bell and Murray, 2007).

Specimens of *Melaleuca biconvexa* were observed at 14 locations within the Map Unit 43a – Alluvial Riparian Blackbutt Forest associated with the drainage line of Buttonderry Creek in the southern parts of the subject site (Bell and Murray, 2007).

Tetratheca juncea was observed at two locations in the eastern parts of the subject site within the Map Unit 28 – Narrabeen Buttonderry Footslopes Forest (Bell and Murray, 2007). This area of vegetation is planned to be retained, therefore these specimens will be retained within the proposed conservation / open space areas within Precinct 14.

TABLE 4.4
THREATENED FLORA SPECIES – PRECINCT 14

Threatened Plant Species	Total Plants	Plants lost to development	Plants retained in Reserve areas
Angophora inopina	≈120	<20	50-100
Grevillea parviflora subsp. parviflora	6	3	3
Melaleuca biconvexa	50-100	0	50-100
Tetratheca juncea	12	0	12

Outcome: *Minor overall impact on some threatened plant species in terms of size and significance. The draft EPI adequately conserves sufficient numbers of each threatened plant species within the WEZ to offset any potential loss of individuals and small populations. It, therefore, maintains biodiversity values.*

4.5 THREATENED FAUNA SPECIES

Threatened fauna species recorded within Precinct 14 or considered likely to occur based on locality records is summarised in Table 4.5. A total of 37 threatened fauna species have the potential to occur in the Precinct 14 study area. Table 4.5 has used fauna habitat groupings to provide a method to segregate broad groups of potential threatened species into different fauna habitat types.

TABLE 4.5
THREATENED FAUNA SPECIES, HABITAT RETENTION, PRECINCT 14
(extracted from WSC, 2007)

Biodiversity Value/ Threatened Species	Recorded In WEZ	Recorded In Locality	Recorded In Precinct 14	Habitat Lost to Development (ha)	Habitat Maintained or Improved (ha)	Environ-mental Outcome
Open Forest / Open Forest Woodland / Swamp Forest / Riparian Forest / Regrowth Forest Woodland						
Glossy Black-Cockatoo	+	+	+	33.54ha	37.13ha	+3.59
Powerful Owl	+	+		"	"	"
Masked Owl	+	+		"	"	"
Swift Parrot		+		"	"	"
Superb Fruit Dove		+		"	"	"
Barking Owl		+		"	"	"
Regent Honeyeater		+		"	"	"
Painted Honeyeater		+		"	"	"
Squirrel Glider	+	+		"	"	"
Yellow-bellied Glider	Tentative ID	Tentative ID		"	"	"

TABLE 4.5
THREATENED FAUNA SPECIES, HABITAT RETENTION, PRECINCT 14
(extracted from WSC, 2007)

Biodiversity Value/ Threatened Species	Recorded In WEZ	Recorded In Locality	Recorded In Precinct 14	Habitat Lost to Development (ha)	Habitat Maintained Or Improved (ha)	Environ-mental Outcome
Open Forest / Open Forest Woodland / Swamp Forest / Riparian Forest / Regrowth Forest Woodland						
Spotted-tail Quoll		+		"	"	"
Koala		+		"	"	"
Grey-headed Flying-fox	+	+		"	"	"
Eastern Freetail Bat	+	+		"	"	"
Little Bent-wing Bat	+	+		"	"	"
Eastern Bent-wing Bat	+	+		"	"	"
Large-footed Myotis	+	+		"	"	"
Greater Broad-nosed Bat	+	+		"	"	"
Eastern False Pipistrelle	Tentative ID	+		"	"	"
Yellow-bellied Sheathtail Bat		+		"	"	"
Giant Barred Frog		+		"	"	"
Wet Heath						
Eastern Chestnut Mouse	Tentative ID			3.19ha	3.19ha	+3.19ha
Wallum Froglet	+	+	+	"	"	"
Wetland / Water (Note: does not include areas for Integrated Water Cycle Management Structures)						
Black Bittern		+		0.44ha	0.14ha	-0.30ha
Australasian Bittern		+		"	"	"
Black-necked Stork		+		"	"	"
Giant Barred Frog		+		"	"	"
Green-thighed Frog	Tentative ID	+		"	"	"
Green and Golden Bell Frog		+		"	"	"
Cleared (comprised open grassland +/- scattered paddock trees and aerial space)						
Grey-headed Flying-fox	+	+		43.37ha	7.05ha	-36.32ha
Eastern Freetail Bat	+	+		"	"	"
Little Bent-wing Bat	+	+	+	"	"	"
Eastern Bent-wing Bat	+	+	+	"	"	"
Large-footed Myotis	+	+		"	"	"
Greater Broad-nosed Bat	+	+	+	"	"	"

TABLE 4.5 THREATENED FAUNA SPECIES, HABITAT RETENTION, PRECINCT 14 (extracted from WSC, 2007)						
Biodiversity Value/ Threatened Species	**Recorded In WEZ**	**Recorded In Locality**	**Recorded In Precinct 14**	**Habitat Lost to Development (ha)**	**Habitat Maintained Or Improved (ha)**	**Environ-mental Outcome**
Eastern False Pipistrelle	Tentative ID	+		"	"	"
Yellow-bellied Sheathtail Bat		+		"	"	"

Outcome: The overall impact on threatened fauna species in terms of habitat removal and retention is that large areas of relatively undisturbed or better quality habitat will be retained. While the areas of poorer quality habitat within previously disturbed areas will be removed for the proposed development.

4.6 WILDLIFE CORRIDORS

WSC (2007) states in the Biocertification Report that:

It is necessary to ensure that effective wildlife corridor planning outcomes are provided to link Porters Creek Wetland to the extensive natural areas which exist in the Wallarah Creek catchment (to the north of the WEZ) as part of any development proposal. This wildlife corridor is extremely important for maintaining the Shire's biodiversity and threatened species as it forms the only major north-south wildlife corridor which is located to the east of the F3 – Freeway.

In terms of routing options two main options for locating this corridor were evaluated where it crosses Sparks Road.

> • *Option 1 is located to the east of the existing Warnervale Airport. Ecological investigations by Murray & Bell (2007) have indicated this to be the preferred corridor route at it provides high quality habitat for a suite of fauna species, riparian dispersal routes and habitat. It also contains extensive areas supporting endangered ecological communities and can take advantage of existing culvert crossings beneath Sparks Road to facilitate the dispersal of ground fauna.*
>
> • *Option 2 is located between the Warnervale Business Park and Warnervale Airport (not preferred). At present, this area supports a regrowth open forest / woodland habitat with limited essential habitat attributes for several fauna groups. In particular, obligate hollow dependent fauna have very limited roost and nesting sites. Further, this resource will not develop naturally for many decades. Whilst functioning as a conduit corridor for fauna, it will not provide habitat attributes for resident fauna species. Proximity to existing and proposed developments in this general area will result in a likely degradation of habitat quality over time. These likely impacts will require very high maintenance over time.*

To supplement this corridor WSC also states that:

The creation of a system of secondary corridors of at least 100 metres width along Buttonderry Creek and other locations of different widths is advocated in the report by Murray and Bell (2007).

A Riparian Corridor along the section of Buttonderry Creek within Precinct 14 will be retained, rehabilitated, consolidated and managed with a view to supplement the vegetated connectivity within the local area. This Riparian Corridor will provide creekline connectivity from the south to the central-north of Precinct 14. This Riparian Corridor will cover approximately 13.5ha with a length of approximately 720m and widths ranging from approximately 150m to approximately 425m.

In addition, a vegetated corridor is proposed along the south-eastern boundary of Precinct 14. This corridor will provide connectivity from the Riparian Corridor to the retained bushland in the north-east of the precinct. This Riparian Corridor will cover approximately 3 ha with an approximate width of 60m and approximate length of 850m.

Outcome: *Impacts of fauna habitat losses offset through introduction of new conservation zonings, acquisition of environmentally significant areas, securing regional wildlife corridors and funding of habitat enhancement strategies will maintain biodiversity values.*

4.7 ENDANGERED ECOLOGICAL COMMUNITIES

Two Endangered Ecological Communities (EECs) are present within Precinct 14. These two EECs are Swamp Sclerophyll Forest on Coastal Floodplains (SSFCF) and River Flat Eucalypt Forest on Coastal Floodplains (RFEFCF).

Swamp Sclerophyll Forest on Coastal Floodplains (SSFCF)
The SSFCF EEC corresponds to Map Unit 20 - Alluvial Floodplain Shrub Swamp Forest (and all its variants) (Bell and Murray, 2007). This community is located within small areas in the south-eastern parts of the subject site.

A small patch of Swamp Sclerophyll forest on Coastal Floodplain (SSFCF) could potentially be cleared by development under the draft LEP. This small patch occupies 1.07 hectares and is located on land zoned 4(c) under the draft LEP. The extent of this EEC in the Wyong Employment Zone is 117.27 hectares. The loss of 1.07 hectares of Swamp Sclerophyll Forest on Coastal Floodplain is offset by conservation of 111.71 hectares in the Wyong Employment Zone (Bell and Murray, 2007).

River Flat Eucalypt Forest on Coastal Floodplains (RFEFCF)
The RFEFCF EEC corresponds to Map Unit 43 – Alluvial Riparian Blackbutt Forest (and its variants) (Bell and Murray, 2007). This community is located along the drainage line associated with Buttonderry Creek.

The extent of River Flat Eucalypt Forest on Coastal Floodplain in Precinct 14 is 5.86 hectares (Bell and Murray, 2007). The draft LEP encompasses all the riparian corridor of Buttonderry Creek containing the RFEFCF EEC. Therefore the proposed development will retain all of this vegetation type within the Riparian Corridor which will be managed according to the Management Plan for this area. The amounts of EECs to be retained and removed are shown in Table 4.6.

TABLE 4.6 ENDANGERED ECOLOGICAL COMMUNITY "MAINTAIN OR IMPROVE" PRESENT IN PRECINCT 14								
Biodiversity Value	**Total Area (ha)**		**Area Lost to Development (ha)**		**Area Maintained or Improved (ha)**		**Environmental Outcome % Conserved**	
	WEZ	**P14**	**WEZ**	**P14**	**WEZ**	**P14**	**WEZ**	**P14**
River Flat Eucalypt Forest on Coastal Floodplains (RFEFCF)	64.1	5.7	1.0	0.1	63.1	5.6	98.4	98
Cleared Land (Low Value)	117.3	5.3	5.56	1.1	111.71	4.2	95.2	79
TOTAL AREA (ha)	**181.4**	**11**	**6.56**	**1.2**	**174.81**	**9.8**	**96.3**	**89**

The extent of River Flat Eucalypt Forest on Coastal Floodplain in Precinct 14 is 5.73 hectares. The draft LEP encompasses all the riparian corridor of Buttonderry Creek containing the River Flat EEC.

Outcome: *The proposed development will retain the creekline vegetation, therefore, it is considered that all of the River Flat Eucalypt Forest on Coastal Floodplain in Precinct 14 (5.86 hectares) will be retained. The loss of 1.12 hectares of Swamp Sclerophyll Forest on Coastal Floodplain within Precinct 14 is offset by conservation of 111.71 hectares in the whole of the Wyong Employment Zone (WSC 2007). Some areas of disturbed EEC will be improved to good condition under the draft EPI as these areas would be specifically zoned for conservation and actively managed to improve conservation values under Council ownership (conservation in perpetuity outcome). The proposed development achieves a 96.3% conservation outcome for Endangered Ecological Communities within the whole of the WEZ.*

4.8 HABITAT TREES

The number of habitat trees to be removed or retained is shown in Table 4.7.

TABLE 4.7 Habitat Tree "Improve or Maintain" Test - Precinct 14				
Biodiversity Value	**Actual Count**	**Habitat Trees Cleared**	**Habitat Trees Conserved**	**Environmental Outcome %**
Habitat Trees	203	139	63	31%

The loss of hollow bearing trees will be offset by the use of artificial nest boxes to provide refuge and breeding habitat for hollow dependant fauna.

Outcome: Habitat trees will be retained within the Drainage/Environmental/Open Space Lands. Habitat trees are not suitable, or ecologically viable, for retention in industrial lands. The plan of management will require the erection of more hollows than will be removed through the use of nest boxes in areas where there is a low density of natural hollows or where revegetation is required. A variety of roost boxes will need to be installed for tree hollow dependent fauna.

4.9 CONCLUDING COMMENTS

The Proposed development within Precinct 14 has been designed to retain the principal areas of vegetation and biodiversity values. Approximately 50 hectares of good quality vegetation and fauna habitat is proposed to be retained while the proposed industrial estate (80 hectares) will mostly be located in cleared areas (approximately 50 hectares) and fragmented or disturbed vegetation (approximately 30 hectares). The 'maintain or improve' criteria for Precinct 14, as a part of the WEZ proposal, have identified that the proposal will result in an acceptable level of improvement or maintenance of biodiversity values for the site.

REFERENCES

Andrews Neil (1996a) Fauna Impact Statement, Proposed Extractive Industry and Industrial Subdivision, Warnervale Airport. Report to Wyong Shire Council by Andrews Neil Consultants.

Andrews Neil (1996b) Integrated Planning Assessment, Warnervale Development Area. Prepared for Wyong Shire Council.

Aquatic Ecological Investigations (1999). Porters Creek Wetland Monitoring Program. Report to Wyong Shire Council.

Bell, S.A.J. (2002a) *The natural vegetation of Wyong Local Government Area, Central Coast, New South Wales. Technical Report & Community Profiles*. Report to Wyong Shire Council by Eastcoast Flora Survey.

Bell, S.A.J. (2003) Vegetation and Terrestrial Orchid Survey of the Warnervale Industrial Lands, Warnervale, Wyong Shire. Report to Wyong Shire Council.

Bell, S.A.J. (2004a) *Porters Creek vegetation monitoring program: Collection of baseline vegetation data*. Unpublished Report to Wyong Shire Council. Eastcoast Flora Survey. April 2004.

Bell, S.A.J. and Driscoll, C. (2004) *Population count and habitat assessment of* Rutidosis heterogama *(Asteraceae), Lower Hunter and Central Coast*. Unpublished Report to Wyong Shire Council. Eastcoast Flora Survey.

Bell, S.A.J. and Murray, M. (2004a) Species Impact Statement: Stage 1 Warnervale Business Park, Sparks Road, Warnervale. Part Lot 3 DP1007500, Wyong LGA. 21 December 2004. Unpublished Report to Wyong Shire Council.

Bell, S.A.J. and Murray, M. (2004b) *Flora and fauna survey and assessment of the Warnervale Industrial Lands, Warnervale*. Unpublished Draft Report to Wyong Shire Council. July 2004.

Bell, S.A.J. and Murray, M. (2004c) *Flora and Fauna Investigations, Proposed Warnervale Town Centre, Wyong Shire*. Report to Wyong Shire Council, July 2004.

Bell, S.A.J. and Murray, M. (2007) Ecological Investigations – Version 2, Wyong Employment Zone. Warnervale Business Park, Warnervale Airport Lands, Precincts 11 & 13 and Precinct 14. Report to Wyong Shire Council by Forest Fauna surveys Pty Ltd / Eastcoast Flora Survey, 25 May 2007.

Conacher Travers (1999) Flora and Fauna Assessment Report Proposed Subdivision Portion 2 and 3 DP 228750 Hue Hue Road, Jilliby.

Conacher Travers (2003a) Flora and Fauna Assessment Report. Lot 5 DP 239691 Jack Grant Drive, Warnervale.

Conacher Travers (2003b) Flora and Fauna Assessment Report. Proposed Subdivision, Warnervale Business Park, Lot 2 in DP 1007500, Lots 198 & 199 in DP 1030020, Burnet Road, Warnervale.

Connell Wagner (1997) Wyong Shire Council Flora and Fauna Report for Precincts 11 and 13, north of Sparks Road Warnervale.

Cropper, S.C. (1993) *Management of Endangered Plants*. CSIRO Publications, East Melbourne.

Ecotone Ecological Consultants (2001) Report on Stage 3 of the Nest Box Program for Warnervale Business Park.

Ecotone Ecological Consultants (2002) Report on results of the May 2002 Nest Box inspection at the Warnervale Business Park.

Ecotone Ecological Consultants (2003) Targeted Threatened Fauna & Fauna Habitat Survey at Warnervale Industrial Park and Porters Creek Wetland. Prepared for Wyong Shire Council, April 2003.

Environmental Planning and Assessment Act (1979) New South Wales Government.

Environmental Protection and Biodiversity Conservation Act (1999) Commonwealth Government

Forest Fauna Surveys/East Coast Flora Survey (2005) Flora and Fauna Assessment Rezoning of Land off Louisiana Road Hamlyn Terrace Wyong Shire.

Forest Fauna Surveys/East Coast Flora Survey (2007) Ecological Investigations – Version 2, Wyong Employment Zone. Warnervale Business Park, Warnervale Airport Lands, Precincts 11 & 13 and Precinct 14. Report to Wyong Shire Council by Bell, S.A.J. and Murray, M., 25 May 2007.

Forest Fauna Surveys (2008) *Wyong Employment Zone Ecological Plan of Management.*

Gunninah Environmental Consultants (2003) Wyong ground orchid survey, Wyong Shire. Report to Wyong Shire Council. January 2003.

Harden, G.J. (1994) *Flora of New South Wales Vols 1-4.* Royal Botanic Gardens. New South Wales University Press, Kensington NSW.

HWR (2005) Ecological Constraints Report, Part Lots 62 and 64 DP 755245 Sparks Road, Warnervale. Prepared for Johnson Partners Pty Ltd.

HWR (2006). Ecological Assessment, Water Pipeline Morisset to WArnervale. Report to Patterson Britton and Partners Pty Ltd.

Jones, D.L. (1996) *Microtis angusii*, a new species of Orchidaceae from Australia. *The Orchadian* 12(1): 10-12.

Jones, D.L., Clements, M.A., Sharma, I.K., and Mackenzie, A.M. (2001) A new classification of Caladenia R.Br. (Orchidaceae). The Orchadian 13(9): 389-417.

Jones, D.L., Clements, M., Sharma, I., Mackenzie, A., and Molloy, B. (2002) Nomenclatural notes arising from studies into the tribe Diurideae. The Orchadian 13(10): 437-468.

Lesryk Environmental Consultants (1997) Flora and fauna assessment of proposed quarrying and land filling of PGH/CSR quarry, Lot 67, Mountain Road, Warnervale. July 1997.

Lesryk Environmental Consultants (1999) Flora and Fauna Assessment within and adjacent to Warnervale Farm.

Marchant, S. and Higgins P.J. (Eds) (1993) *Handbook of Australian, New Zealand and Antarctic Birds. Volume 2: Raptors to Lapwings.* Oxford University Press, Melbourne.

Mitchell McCotter (1993) Fauna Impact Statement for Warnervale Airport Upgrading. Prepared for Wyong City Council.

Murphy C.L. (1992) *Soil Landscapes of the Gosford - Lake Macquarie 1:100,000 map sheet*. Report, Dept. CaLM.

Murray, M. (2003) Fauna Investigations, Warnervale Business Park. Report to Wyong Shire Council. May 2003.

National Parks and Wildlife Service (2003) Lower Hunter and Central Coast Regional Environment Management Strategy Vegetation Survey, Classification and Mapping: Lower Hunter and Central Coast Region. CRA Unit, National Parks and Wildlife Service, Hurstville.

National Parks and Wildlife Service (2008) Atlas of NSW Wildlife website: http://wildlifeatlas.nationalparks.nsw.gov.au/wildlifeatlas/watlas.jsp

NSW Scientific Committee (2005) Final Determination to list the Gang-gang Cockatoo *(Callocephalon fimbriatum)* as a vulnerable species in NSW. NSW NPWS.

Parry-Jones, K.A. and Augee, M.L. (1991) *The diet of Flying-foxes in the Sydney and Gosford areas of NSW, based on sighting reports 1986-1990* in "Australian Zoologists." Vol.27(3&4) pgs 49-54. Lunney, D. (ed)

Payne, R. (2001) Threatened Species Management Strategy: Educational development site at Warnervale. Unpublished Report to Wyong Shire Council. May 2001.

Payne, R. (2004) Species Impact Statement for Proposed Water Main and Arterial Road, Sparks Road Warnervale to Mardi Pumping Station. Prepared by Robert Payne Ecological Surveys and Management for Wyong Shire Council. October 2004.

Payne, R. and Murray, M. (2001) Reconnaissance Flora, Fauna and Habitat Assessment, Warnervale District. Report to Wyong Shire Council.

Payne, R., Stevenson, D., and Wellington, R. (2002) A Standardised Method for Counting Black-eyed Susan Populations, Technical Note, NPWS.

Poore M.E.D. (1977) The use of phyto-sociological methods in ecological investigations. The Braun-Blanquet System. Botany School, University of Cambridge, UK.

Riley, J.J. and Banks, D.P. (2002) Orchids of Australia. University of NSW Press: Sydney.

Sainty & Associates and Wyong Shire Council (2002) Porters Creek Wetland Management Plan.

Sharpe, D. (2004) Habitat Connectivity for the Squirrel Glider at Jack Grant Drive, Warnervale. Prepared for Conacher Travers by D & D Environmental Consultants.

Sinclair Knight Merz (2004) Precinct 11&13 Flora and Fauna Assessment and Conservation Mapping Analysis. Report to Wyong Shire Council.

Smith (2000) Wyong Sub-regional Squirrel Glider Study. Report to Wyong Shire Council by Austeco Environmental Consultants.

Threatened Species Conservation Act (1995), New South Wales Government

Wyong Shire Council (2007) *Biocertification Report: Wyong Employment Zone (WEZ) Rezoning.*

Wyong Shire Council (2008) *Wyong Employment Zone Ecological Plan of Management*.

LIST OF FIGURES

These figures were extracted from Forest Fauna Surveys / Eastcoast Flora Survey (Bell and Murray, 2007).


KIAR RIDGE ROAD
HUE HUE ROAD
HUE HUE ROAD
SPARKS ROAD
F3 EXPRESSWAY SYDNEY TO NEWCASTLE
Buttonderry Creek
PUBLIC RESERVE
PROPOSED TYPE C T-JUNCTION
PROPOSED ROUNDABOUT OR SEAGULL INTERSECTION SUBJECT TO NEGOTIATIONS WITH RTA
PROPOSED MAINTENANCE TRACK
PROPOSED BUS STOP
PROPOSED BUS SHELTER
EXISTING WIDE S.M.P.
LEGEND
STORMWATER STORAGE (WITH 4m MAINTENANCE BANK)
WETLAND AREA
SCALE 1 : 3000
0 60 120 180 240 METRES
30 90 150 210
N

Figure 2

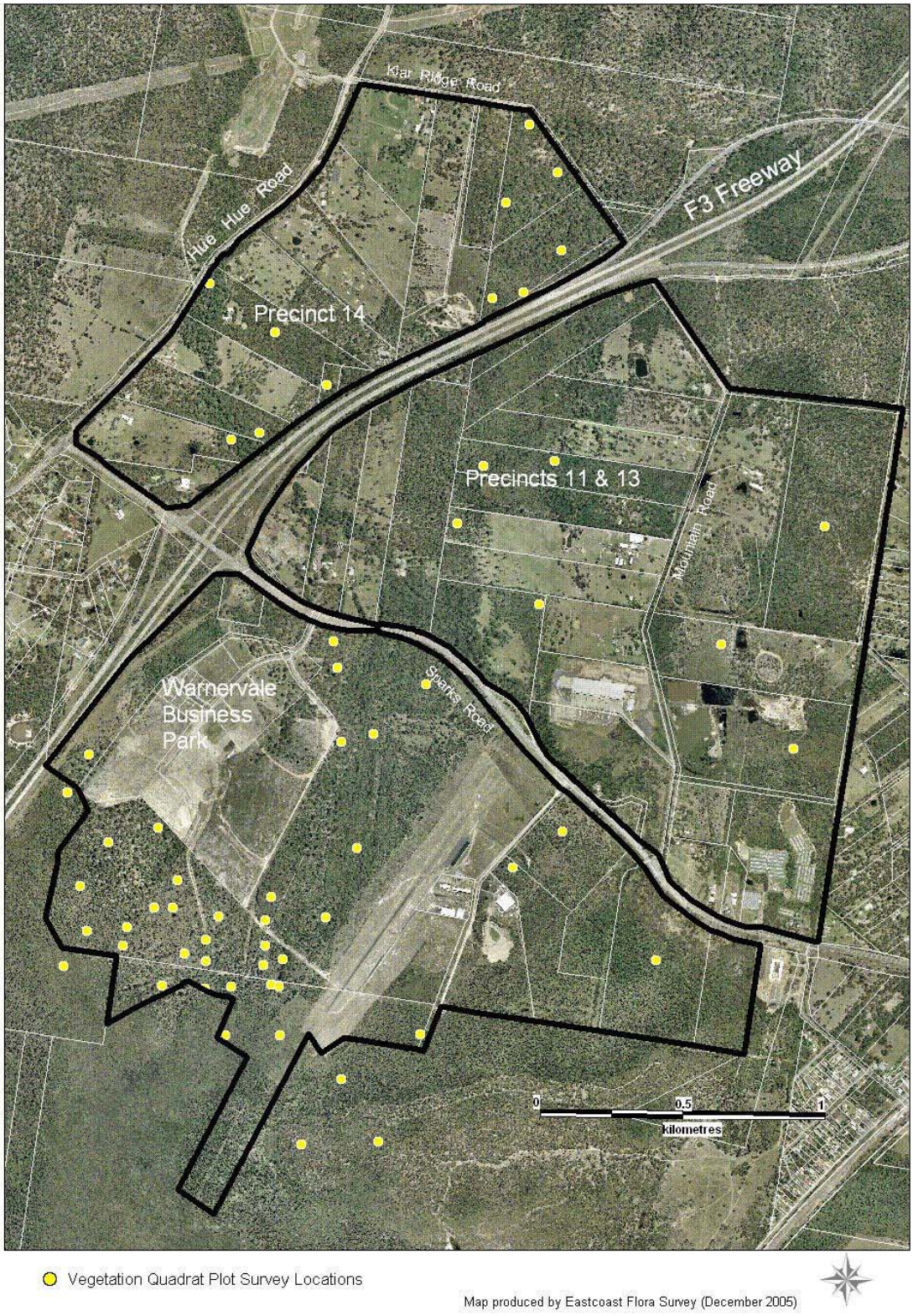


Figure 3. Location of Flora Survey Quadrats, Wyong Employment Zone.

Figure 4 Location of Fauna Survey Sites, Wyong Employment Zone.

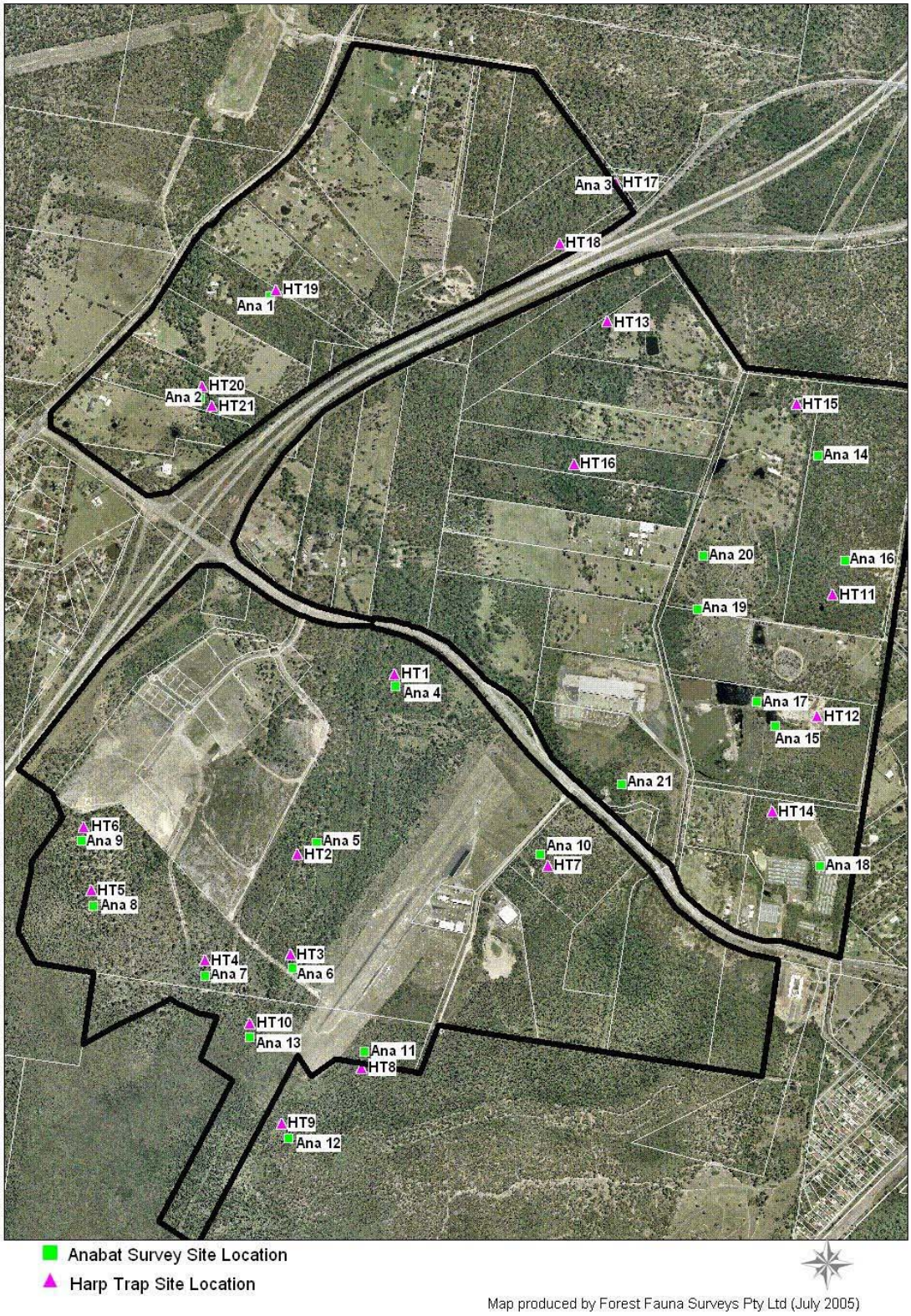


Figure 5. Locations of Microchiropteran Bat Survey Sites, Wyong Employment Zone.

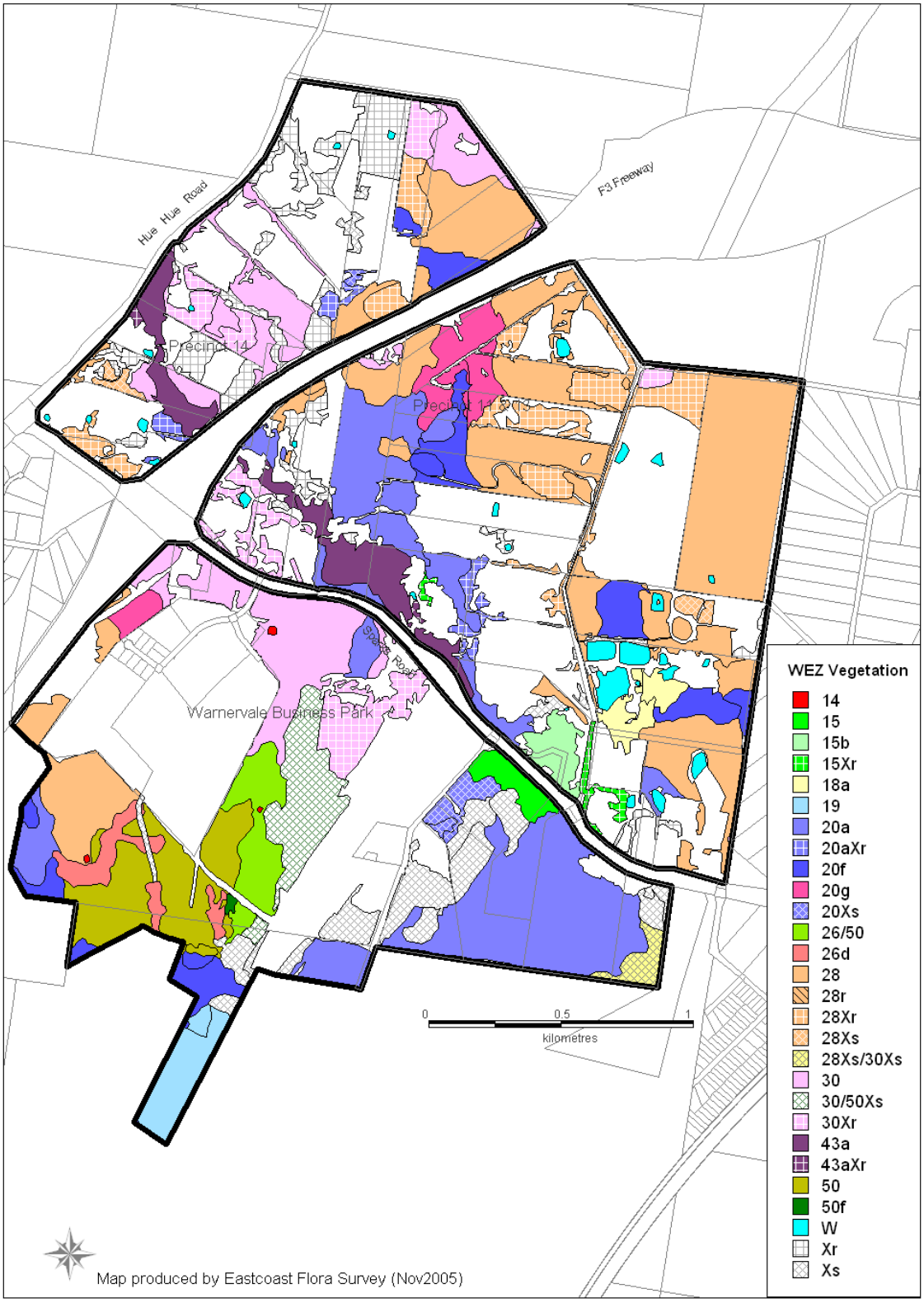
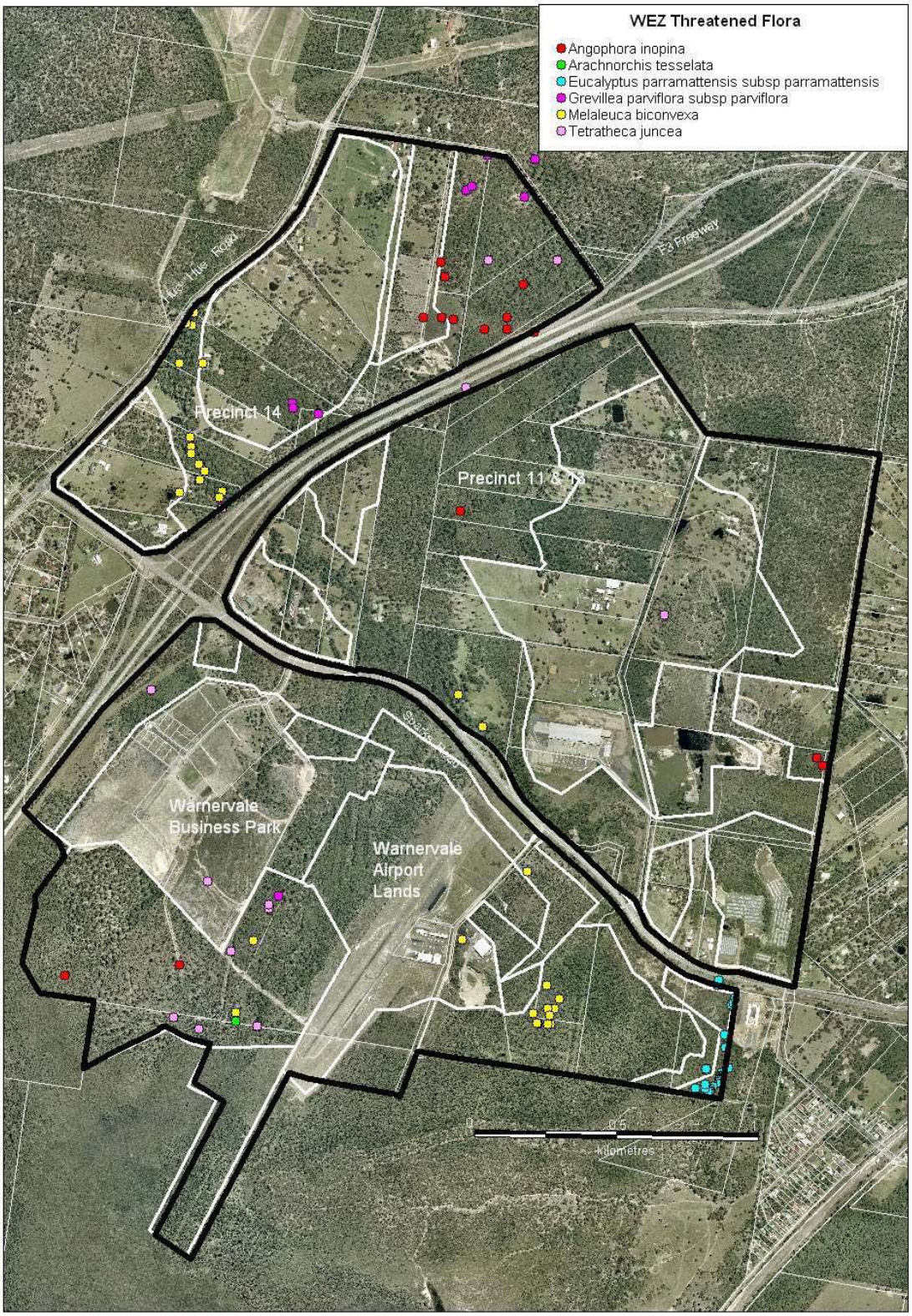


Figure 8. Vegetation Map, Wyong Employment Zone.



(Map extracted from Forest Fauna Surveys 2007)

Figure 11. Location of Threatened Flora, Wyong Employment Zone.

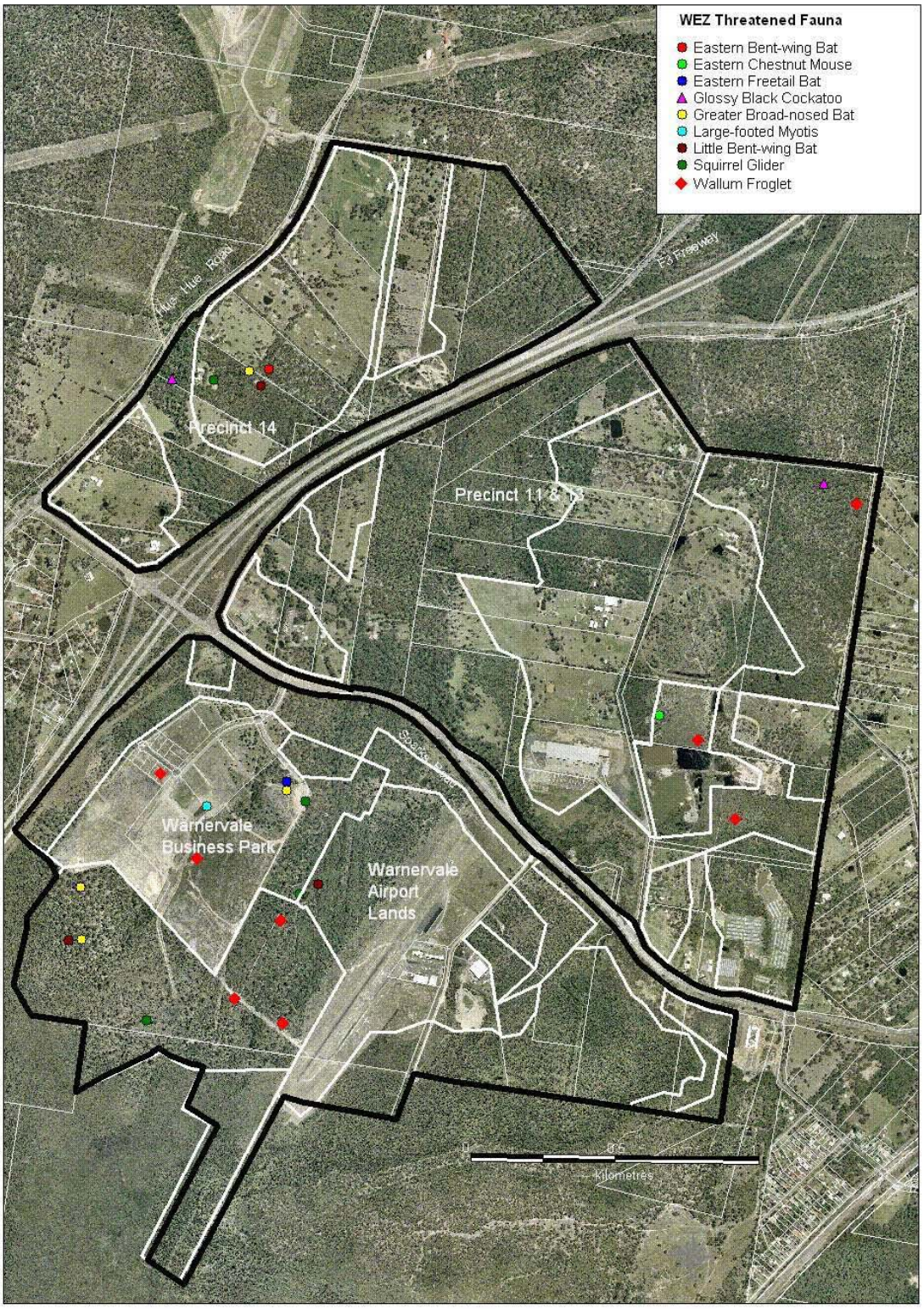
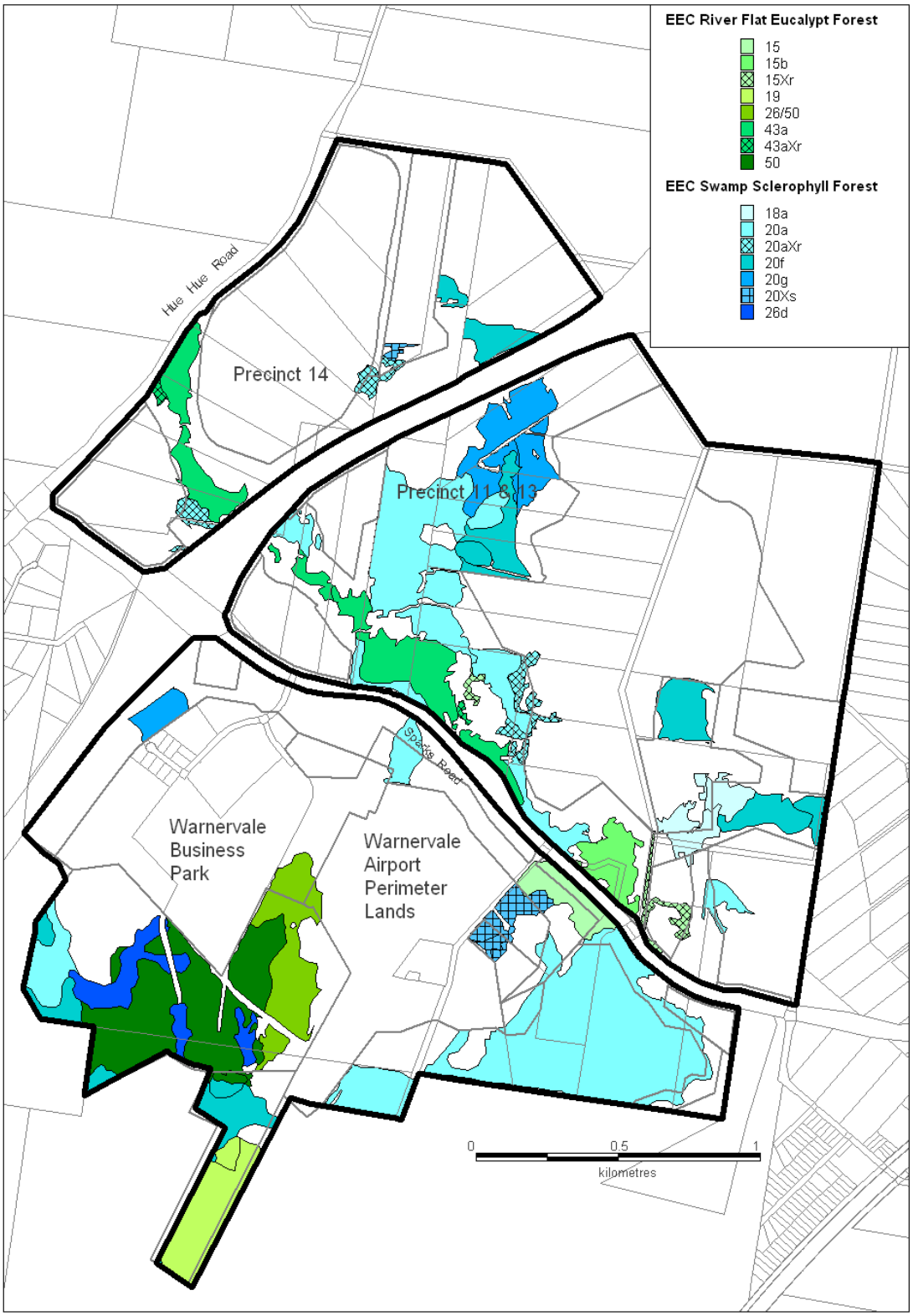
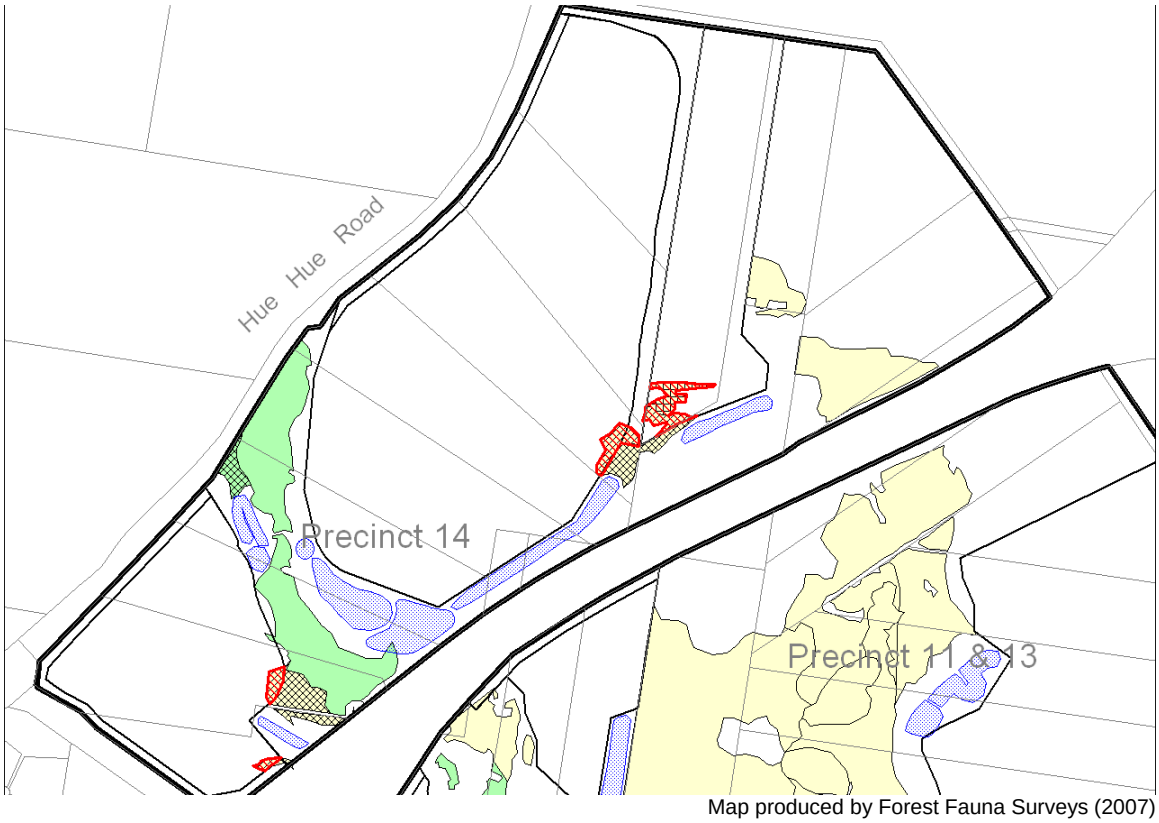


Figure 12. Location of Threatened Fauna, Wyong Employment Zone.



(Map extracted from Forest Fauna Surveys 2007)

Figure 13. Distribution of Endangered Ecological Communities - WEZ.



Map produced by Forest Fauna Surveys (2007)

Figure 19. Distribution of EECs in Precinct 14, Wyong Employment Zone.

Key to Figure 19.
Red hatched areas indicated extent of endangered ecological community on 4(c) land.
Green areas – River Flat Eucalypt Forest on Coastal Floodplain (RFEFCF)
Pale Yellow – Swamp Sclerophyll Forest on Coastal Floodplain (SSFCF)

- Diamond Hatching – Xr Disturbance (regrowth)
- Blue Polygons – WSUD structures

APPENDIX I

SQUIRREL GLIDER HABITAT ASSESSMENT

SQUIRREL GLIDER HABITAT ASSESSMENT

Location: Warner Industrial Park & Lot 5 DP 259531, Lot 9 DP239704, Precinct 14, Wyong Employment Zone **Job No:** 8035

Date: 26/03/08 **Assessor:** RS

Veg Commty

1 - Stringybark w Mel/Acacia/Grass U-storey	
2 - Spotted Gum / Ironbark / Gum	√
3 - Stringybark w Banksia U-storey	
4 - Syd Red Gum / Scribbly w Wet Heath (Allocas/Mel) U-storey	
5 - Scribbly/Syd Red Gum/ w Dry Heath (Banksia U-storey)	
6 - Other: Blackbutt forest w Mel understorey	√

Trees - Age Structure	**No per 20x 20m**
Juv <10cm DBH	1
Adolesc 10 - 30cm	1
Mature >30cm	3
Senescent >30cm	0.3

Hollow Trees / ha	1.6 (average)

Understorey

Ht (m)	To 5m	
Density (%)	10 - 80%	
Dominant species	*Banksia spinulosa*	0.5/ 20 x 20m
	Acacia irrorata	0.1 / 20 x 20m
	Melaleuca spp	10 / 20 x 20m
	Banksia oblongifolia	0.5 / 20 x 20m
	Xanthorrhoea spp	0.1 / 20 x 20m
	Allocasuarina spp	0.2 / 20 x 20m
	Other *Acacia spp*	0.2 / 20 x 20m

Smith (2002) Veg Unit

19b - Alluvial Woollybutt-Melaleuca Sedge Forest (*E. longifolia, E. robusta, Mel lin, Mel sieb, Ac. irrorat, Pitto und*) **YES**

15 - Alluvial Redgum Footslopes Forest (*E. amplif, Ang florib, Allo torul, Alphitona exc*)

20a - Alluvial Floodplain Shrub Swamp Forest (*E. rob, Ang florib, Ang cost, E. resin, E. pil, E. teret, Mel lin, Gloch*)

26 - Narrabeen Alluvial Drainage Line Complex (*E. rob, A. cost, E. resinif, Ang inopina, E. parra ssp parra*)

28 - Narrabeen Buttonderry Footslopes Forest (A. *cost, E. umbra, Syn glom, E. resin, C. mac, A. toru, E. cap*) **YES**

30 - Narrabeen Dooralong Spotted Gum-Ironbark Forest (*C. maculata, E. sidero, E. fibrosa*) **YES**

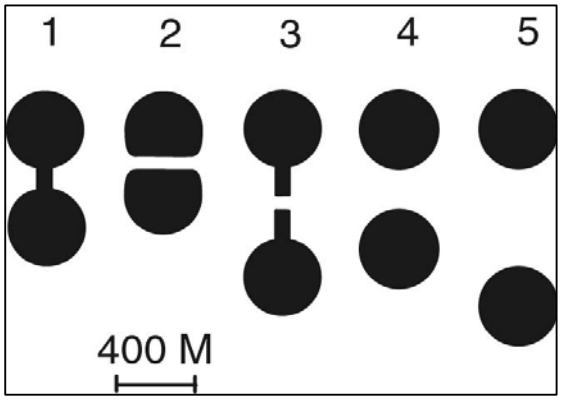
Seasonal Food

C. gummifera (Red Bloodwood)	√
E. capitellata (Brown Stringybark)	√
E. siderophloia (Northern Grey Ironbark)	√
E. umbra (Broad-leaved White Mahogany)	√
E. longifolia (Woollybutt)	√
A. costata (Smooth-barked Apple)	√
A. floribunda (Rough-barked Apple)	√

Remnant Isolation Class
Class 1 = a narrow corridor (single tree to 250 m wide);

Class 2 = a cleared gap (eg road or utility line) up to 75 m wide, but with a wide area of contact including native vegetation on both sides of the gap for a distance of at least 250m;
Class 3 = as in 2 (above) but the width of vegetation on either side of the gap is narrow (less than 250 m wide);
Class 4 = cleared areas of 75 – 400m in rural (pasture) environments or 75-200 m in urban environments;

Class 5 = more than 200m of urban habitat or 400m of cleared habitat, and class 2, 3 or 4 remnants separated by impassable barriers (eg rivers, or expressways with barrier fencing).



Isolation of Subject site remnant = Class 1 or 2 within and external to the subject site

Notes

- Large areas within the subject site have been grazed or otherwise disturbed by agricultural uses for a long period.
- Groundcover and shrub layers are sparse within the Disturbed areas.
- Squirrel Glider food resources are sparse in the shrub layer of the Disturbed areas with the main understorey species being *Melaleuca spp*.

APPENDIX II

HOLLOW BEARING TREE DATA

(adapted from Bell and Murray, 2007)

HOLLOW BEARING TREES WITHIN PRECINCT 14

A total of 203 hollow bearing trees were observed and assessed within Precinct 14 as shown in Table A2.4 (Bell and Murray, 2007). Of the 203 hollow bearing trees assessed within Precinct 14 the proposed development is expected to remove 79 (or 39%) of these hollow bearing trees.

A summary of the size classes of the hollow bearing trees is provided in Table A2.1

TABLE A2.1 ABUNDANCE OF TREE SPECIES AND SIZE CLASSES OF HABITAT TREES (adapted from Bell and Murray, 2007)

	Size Class (DBH in cm)						
Tree Species	**0-50**	**51-100**	**101-150**	**150-200**	**>200**	**Total**	**% of total**
Angophora costata	1	53	21	1	0	77	37.6%
Dead Stag	4	38	11	2	0	55	27.2%
Corymbia maculata	0	34	4	3	0	41	20.3%
Eucalyptus capitellata	0	8	1	0	0	9	4.4%
Eucalyptus resinifera	0	7	0	0	0	7	3.4%
Eucalyptus pilularis	1	0	1	1	1	4	2.0%
Angophora floribunda	0	3	0	0	0	3	1.5%
Eucalyptus tereticornis	0	2	1	0	0	3	1.5%
Eucalyptus robusta	0	1	1	0	0	2	1.0%
Corymbia gummifera	0	1	0	0	0	1	0.5%
Ironbark	0	1	0	0	0	1	0.5%
TOTAL	6	148	40	7	1	203	99.90%

Below in Table A2.2 is a summary of the percentage of potential habitat trees for the four main fauna groups. Data is presented in percentages rather than raw counts of habitat trees due to potential for a particular habitat tree to have several hollows for all fauna groups.

TABLE A2.2 PROPORTION OF TOTAL HABITAT TREES AS POTENTIAL ROOST / DEN / NESTS FOR EACH FAUNA GROUP (adapted from Bell and Murray, 2007)

Planning Precinct	No. Trees	Micro Bats	Gliders	Possums	Owls
Precinct 14	203	66.3%	49.5%	82.6%	15.3%

It must be noted that this proportional estimate of potential roost / den / nests is derived from counts of habitat trees at ground level, and that the suitability and occupancy of these hollows for each fauna group is likely to be an overestimate. For example, a ground based inspection of habitat trees for owls in a 70ha parcel of forest in the City of Lake Macquarie identified 14 potential owl trees. However, upon inspection of the hollow in each of the 14 trees, only 1 tree was deemed suitable and demonstrated evidence of use by owls (Bell and Murray, 2007).

The relative proportions of habitat trees within Precinct 14 varied between fauna groups, with estimates of microbat and owl potential comparable to densities found in the Airport Perimeter Lands and Precincts 11 and 13 within other areas of the Wyong Employment Zone. The proportion of habitat trees as potential owl trees in Warnervale Business Park / Airport Perimeter Lands is significantly lower than Precinct 11 & 13 and Precinct 14 (Bell and Murray, 2007).

A summary of the location (by zoning) of hollows (based on Fauna Groups) is shown in Table A2.3

TABLE A2.3 PROPORTION OF HABITAT TREES FOR FAUNA GROUPS IN LAND USE ZONES WITHIN PRECINCT 14				
Land Use Zone (Draft LEP March 2007)	**Micro Bats**	**Gliders**	**Possums**	**Owls**
Total Number of Potential Habitat Trees per Fauna Group	**134**	**100**	**168**	**31**
4c	41.8%	29.0%	35.1%	45.2%
4e	1.5%	1.0%	2.4%	0.0%
5a	0.7%	0.0%	1.2%	0.0%
7a	56.0%	70.0%	61.3%	54.8%
	100.0%	100.0%	100.0%	100.0%

Within Table A2.3, the conservation land use zone (7a) is likely to conserve a higher proportion of the potential habitat for all fauna groups.

TABLE A2.4 HOLLOW BEARING TREES = Hollow Bearing Trees in Industrial Zones (likely to be Removed)

Tree_id	Tree_species	Easting gda	Northing gda	% dead	DBH cm	Height m	Major_spout	Minor_spout	Trunk hollow	Bat	Glider	Possum	Owl	Notes	Prop zone
1	Dead stag	353559	6322854	100	60	18	0	0	fissure	0	0	0	0		7(a)
2	Dead stag	353556	6322886	100	40	12	0	0	fissure	0	0	0	0		7(a)
3	Corymbia gummifera	353556	6322896	10	80	20	0	2	0	0	0	0	0		4(c)
4	Angophora floribunda	353484	6322926	80	80	20	1	7	0	+	+	+	0		4(c)
5	Angophora floribunda	353483	6322926	20	60	20	0	2	0	0	+	+	0		4(c)
6	Eucalyptus pilularis	353232	6323062	20	204	25	1	10	0	+	+	+	0		4(c)
7	Eucalyptus robusta	353141	6323057	40	80	20	2	0	0	+	+	+	0		4(c)
9	Eucalyptus pilularis	352992	6323088	60	20	25	2	6	0	+	+	+	0		7(a)
10	Eucalyptus pilularis	353043	6323059	10	200	25	4	0	0	+	+	+	0		7(a)
11	Corymbia maculata	353227	6322954	50	160	25	4	2	0	+	+	+	+	bees+	4(c)
12	Corymbia maculata	353245	6322992	10	160	25	4	0	0	+	+	+	+		4(c)
13	Corymbia maculata	353254	6322998	20	200	25	3	4	0	+	+	+	+		4(c)
14	Dead stag	353249	6322943	90	160	20	3	6	0	+	+	+	0		4(c)
15	Eucalyptus resinifera	353267	6322913	60	100	20	2	3	0	+	+	+	0		4(c)
16	Dead stag	353427	6322791	100	60	20	1	2	0	+	+	+	0		7(a)
17	Dead stag	353471	6322871	100	40	15	0	3	0	0	+	+	0		4(c)
18	Eucalyptus resinifera	353412	6322887	60	80	20	1	0	1 large	+	+	+	0		4(c)
19	Eucalyptus resinifera	353418	6322908	40	100	20	2	3	1 medium	+	+	+	0		4(c)
20	Eucalyptus resinifera	353424	6322904	60	60	20	0	0	1 medium	+	0	0	0		4(c)
21	Dead stag	353577	6322971	100	60	20	0	0	1 large	+	0	0	+	potential owl tree	4(c)
22	Angophora floribunda	353593	6323001	30	80	20	2	0	0	+	0	0	0	bees+	4(c)
23	Corymbia maculata	353503	6323038	30	100	25	2	3	0	+	+	+	+		4(c)
24	Dead stag	353371	6323187	100	80	10	0	0	1	+	+	0	0		4(c)
25	Dead stag	353372	6323186	100	60	20	1	0	0	+	0	0	0		4(c)
26	Corymbia maculata	353369	6323116	40	100	25	2	0	0	+	+	+	0		4(c)
27	Corymbia maculata	353350	6323096	20	80	25	0	1	0	0	0	+	0		4(c)
28	Dead stag	353439	6323006	100	120	25	2	2	1 large	+	+	+	+		4(c)
29	Stringybark	353419	6322853	10	80	20	0	0	1 large	+	0	0	0		4(c)
30	Dead stag	353271	6322621	100	80	20	0	2	0	0	0	+	0		7(a)
32	Dead stag	353190	6322631	100	80	20	2	0	0	+	+	+	0		7(a)

TABLE A2.4 (Cont.) HOLLOW BEARING TREES = Hollow Bearing Trees in Industrial Zones (likely to be Removed)

Tree_id	Tree_species	Easting gda	Northinggda	% dead	Dbh cm	Height m	Major_spout	Minor_spout	Trunk hollow	Bat	Glider	Possum	Owl	Notes	Prop zone
33	Dead stag	353201	6322637	100	60	20	0	1	0	0	0	+	0		7(a)
34	Dead stag	353143	6322670	100	60	15	0	0	fissure	0	0	+	0		7(a)
35	Eucalyptus resinifera	353156	6322693	30	60	20	2	0	0	+	+	0	0		7(a)
36	Eucalyptus tereticorn	353108	6322754	10	100	25	3	0	0	+	+	+	0		7(a)
37	Dead stag	353042	6322795	100	150	20	2	0	0	0	+	+	0		7(a)
38	Dead stag	353165	6322622	100	200	25	7	5	0	+	+	+	0		7(a)
39	Dead stag	353047	6322606	100	150	25	4	6	0	+	+	+	0	bees+	7(a)
40	Dead stag	353102	6322543	100	60	20	0	3	fissure	+	0	+	0		7(a)
41	Eucalyptus robusta	353075	6322545	50	150	20	0	3	0	+	+	+	0		7(a)
42	Angophora costata	352955	6322718	20	100	20	3	3	0	+	+	+	0		4(c)
43	Angophora costata	352862	6322764	20	100	20	0	3	0	0	0	+	0		4(c)
44	Angophora costata	352858	6322767	20	100	20	2	2	0	+	+	+	0		4(c)
45	Angophora costata	352855	6322723	10	100	20	1	0	0	+	0	0	0		4(c)
46	Angophora costata	352769	6322801	30	100	15	0	0	1 large	+	0	0	+		4(c)
53	Angophora costata	352797	6322871	40	100	15	0	5	0	0	0	+	0		4(c)
54	Angophora costata	352873	6322816	50	150	20	2	3	1 large	+	0	+	+		4(c)
55	Stringybark	352961	6322785	10	100	20	0	2	0	0	0	+	0		4(c)
56	Stringybark	353731	6323845	80	1	20	0	0	1 medium	0	0	+	0		5(a)
57	Corymbia maculata	354200	6323704	20	83	20	2	1	0	0	+	+	0		7(a)
58	Corymbia maculata	354202	6323694	40	60	20	2	0	0	0	+	+	0		7(a)
59	Stringybark	354198	6323682	40	60	18	2	6	fissure	0	+	+	0		7(a)
60	Dead stag	354185	6323674	100	60	15	0	0	1 medium	+	0	0	0		7(a)
61	Corymbia maculata	354178	6323735	10	60	20	0	0	1 medium	+	0	0	0		7(a)
62	Dead stag	354164	6323756	100	60	15	0	0	fissure	0	0	+	0		7(a)
63	Corymbia maculata	354136	6323757	40	80	20	2	0	1 medium	+	+	+	0		7(a)
64	Corymbia maculata	354128	6323779	10	80	20	0	1	fissure	0	0	+	0		7(a)
66	Corymbia maculata	354054	6323791	60	100	15	4	5	0	+	+	+	+		7(a)
67	Corymbia maculata	354038	6323810	20	80	20	0	3	0	0	+	+	0		7(a)
68	Corymbia maculata	354016	6323811	10	60	20	0	2	0	0	0	+	0		7(a)

TABLE A2.4 (Cont.) HOLLOW BEARING TREES = Hollow Bearing Trees in Industrial Zones (likely to be Removed)

Tree_id	Tree_species	Easting gda	Northing gda	% dead	Dbh cm	Height m	Major spout	Minor spout	Trunk hollow	Bat	Glider	Possum	Owl	Notes	Prop zone
69	Corymbia maculata	353985	6323804	10	80	20	0	0	1 medium	+	0	0	0		7(a)
70	Corymbia maculata	354009	6323742	30	106	25	1	3	0	+	+	+	0		7(a)
71	Corymbia maculata	354011	6323735	10	80	25	0	2	0	0	0	+	0		7(a)
72	Corymbia maculata	354034	6323746	70	100	25	4	7	0	+	+	+	0		7(a)
73	Corymbia maculata	354052	6323757	70	80	20	1	4	0	0	0	+	0		7(a)
74	Corymbia maculata	354044	6323737	60	80	20	0	0	1 large	+	0	0	+		7(a)
75	Corymbia maculata	354046	6323696	40	80	20	0	4	0	0	0	+	0		7(a)
76	Corymbia maculata	354071	6323734	10	60	20	0	2	0	0	0	+	0		7(a)
77	Corymbia maculata	354077	6323761	40	80	20	0	0	1 vert. holl	+	0	0	+		7(a)
78	Corymbia maculata	354084	6323755	20	60	20	0	0	1 small	0	+	+	0		7(a)
79	Stringybark	354162	6323698	30	60	20	0	0	2 medium	+	+	+	0		7(a)
80	Angophora costata	354186	6323637	20	80	20	0	3	0	0	0	+	0		7(a)
81	Corymbia maculata	354184	6323623	30	80	20	0	0	1 v. large	+	0	0	+		7(a)
82	Corymbia maculata	354208	6323596	40	80	20	1	2	fissure	+	+	+	0		7(a)
83	Dead stag	354251	6323647	100	60	20	0	0	fissure	0	0	+	0		7(a)
84	Corymbia maculata	354277	6323594	30	80	20	1	0	3 medium	+	+	+	0		7(a)
85	Angophora costata	354304	6323544	10	120	25	0	2	0	0	+	+	0		7(a)
86	Angophora costata	354321	6323451	60	120	20	2	4	1 medium	+	+	+	0		7(a)
87	Angophora costata	354377	6323430	40	120	20	2	3	0	0	+	+	0		7(a)
88	Angophora costata	354384	6323379	70	140	20	3	0	1 v. large	+	+	+	+		7(a)
89	Angophora costata	354410	6323366	20	120	20	2	5	0	+	+	+	0		7(a)
90	Angophora costata	354429	6323340	40	120	20	0	3	0	0	+	+	0		7(a)
91	Angophora costata	354442	6323334	70	80	20	3	2	0	+	+	+	0		7(a)
92	Angophora costata	354385	6323323	30	120	20	2	10	0	0	+	+	0		7(a)
93	Angophora costata	354376	6323299	90	60	15	2	0	fissure	0	0	+	0		7(a)
94	Dead stag	354364	6323283	100	60	15	1	2	0	0	0	+	0		7(a)
95	Dead stag	354352	6323287	100	109	8	0	0	1 v. large	0	0	0	+	Good Masked Owl tree	7(a)
96	Corymbia maculata	354342	6323387	30	60	20	1	2	0	+	0	+	0		7(a)
97	Dead stag	354310	6323416	100	80	20	3	3	1 medium	+	+	+	0		7(a)

TABLE A2.4 (Cont.) HOLLOW BEARING TREES = Hollow Bearing Trees in Industrial Zones (likely to be Removed)

Tree_id	Tree_species	Easting gda	Northing gda	% dead	Dbh cm	Height m	Major spout	Minor spout	Trunk hollow	Bat	Glider	Possum	Owl	Notes	Prop zone
98	Angophora costata	354272	6323467	20	80	20	0	3	0	0	0	+	0		7(a)
99	Angophora costata	354272	6323474	20	60	20	0	3	0	0	0	+	0		7(a)
100	Angophora costata	354256	6323484	30	80	20	4	4	fissure	+	+	+	+		7(a)
101	Angophora costata	354227	6323501	20	80	20		4	1 v. large	0	0	0	+		7(a)
102	Dead stag	354192	6323538	100	60	8	0	0	1 medium	+	0	0	0		7(a)
103	Dead stag	354271	6323549	100	80	7	0	0	1 v. large	+	0	0	+	Good Masked Owl tree	7(a)
104	Dead stag	354211	6323585	90	40	15	0	2	0	0	0	+	0		7(a)
105	Corymbia maculata	354146	6323554	20	80	20	0	2	0	0	0	+	0		7(a)
106	Angophora costata	354104	6323544	40	80	20	0	4	0	+	+	+	0		7(a)
107	Corymbia maculata	354102	6323560	20	80	20	1	0	1 v. large	+	+	+	+		7(a)
108	Stringybark	354146	6323580	30	80	20	2	0	0	+	+	+	0		7(a)
109	Angophora costata	354116	6323631	20	80	20	2	1	0	+	+	+	0		7(a)
110	Angophora costata	354101	6323669	40	60	20	0	3	0	0	0	+	0		7(a)
111	Dead stag	354081	6323663	100	60	20	0	0	fissure	0	0	+	0		7(a)
112	Corymbia maculata	354070	6323653	30	100	20	6	6	1 v. large	+	+	+	+		7(a)
113	Corymbia maculata	354018	6323695	40	100	20	3	3	1 v. large	+	+	+	+		7(a)
114	Dead stag	354064	6323607	100	80	15	1	2	0	+	+	+	0		7(a)
115	Ironbark	354089	6323614	20	100	20	0	2	0	0	0	+	0		7(a)
116	Angophora costata	354059	6323561	30	60	20	2	1	1 medium	+	+	+	0		7(a)
117	Angophora costata	354058	6323560	30	60	20	3	0	0	+	+	+	0		7(a)
118	Angophora costata	354085	6323479	20	80	20	2	2	0	+	+	+	0		7(a)
119	Angophora costata	354119	6323485	20	80	20	0	2	0	0	0	+	0		7(a)
120	Dead stag	354119	6323482	100	60	10	0	0	1 medium	+	0	0	0		7(a)
121	Dead stag	354163	6323423	100	60	8	0	0	1 medium	+	0	0	0		7(a)
122	Angophora costata	354204	6323421	40	80	20	5	0	0	+	+	+	0		7(a)
123	Angophora costata	354199	6323456	20	100	20	4	4	0	+	+	+	0		7(a)
124	Angophora costata	354247	6323416	40	100	20	2	2	fissure	+	+	+	0		7(a)
125	Angophora costata	354277	6323389	20	80	20	1	2	0	+	+	+	0		7(a)
126	Stringybark	354280	6323368	50	80	20	1	2	0	+	+	+	0		7(a)
127	Dead stag	354287	6323365	100	80	20	4	0	0	+	+	+	0		7(a)

TABLE A2.4 (Cont.) HOLLOW BEARING TREES = Hollow Bearing Trees in Industrial Zones (likely to be Removed)

Tree_id	Tree_species	Easting gda	Northing gda	% dead	Dbh cm	Height m	Major spout	Minor spout	Trunk hollow	Bat	Glider	Possum	Owl	Notes	Prop zone
128	Angophora costata	354301	6323297	40	80	20	4	4	0	0	0	+	0		7(a)
129	Angophora costata	354311	6323237	40	80	20	3	0	0	0	0	+	0		7(a)
130	Angophora costata	354242	6323256	10	80	20	0	3	0	0	0	+	0		7(a)
131	Angophora costata	354177	6323306	70	60	15	2	1	0	+	0	+	0		7(a)
132	Dead stag	354163	6323301	100	40	10	2	0	0	+	0	+	0		7(a)
133	Dead stag	354160	6323304	100	60	15	4	0	1 large	+	+	+	+		7(a)
134	Dead stag	354148	6323300	100	125	10	0	0	1 v. large	0	0	0	+	very significant tree	7(a)
135	Angophora costata	354125	6323384	60	60	20		0	0	+	0	0	0		7(a)
136	Angophora costata	354105	6323370	40	100	20	2	0	1 large	+	0	0	+		7(a)
137	Angophora costata	354036	6323442	10	80	20	1	0	0	+	0	+	0		7(a)
138	Angophora costata	354025	6323438	30	80	20	0	9	0	0	+	+	0		7(a)
139	Angophora costata	354032	6323465	20	60	20	0	6	0	0	+	+	0		7(a)
140	Dead stag	354031	6323389	100	80	12	8	0	0	+	+	+	+		7(a)
141	Dead stag	354067	6323398	100	100	25	4	5	0	+	+	+	0		7(a)
142	Dead stag	354054	6323405	100	80	20	3	0	0	+	+	+	0		7(a)
143	Angophora costata	354082	6323320	70	60	20	4	0	0	+	+	+	0		7(a)
144	Angophora costata	354091	6323291	30	100	20	3	4	0	+	+	+	0		7(a)
145	Angophora costata	354018	6323346	30	80	20	1	1	0	+	+	0	0		7(a)
146	Dead stag	354059	6323535	100	80	6	0	0	1 large	0	0	+	0		7(a)
147	Dead stag	354054	6323543	100	60	10	0	0	1 medium	+	0	0	0		7(a)
404	Dead Stag	353588	6322923	100	80	15	0	0	1 large	+	0	+	0		7(a)
405	Corymbia maculata	353595	6322934	10	80	20	2	0	0	+	+	+	0		7(a)
406	Corymbia maculata	353558	6322929	10	60	20	0	2	0	0	0	+	0		4(c)
407	Dead Stag	353580	6322963	100	60	12	0	0	1	+	0	+	0		4(c)
408	Dead Stag	353022	6323173	100	60	10	0	3	0	0	+	+	0		7(a)
412	Dead Stag	353744	6323114	100	150	25	3	2	0	+	+	+	0		4(e)
413	Eucalytptus resinifer	353617	6323033	20	60	20	0	0	1 large	+	0	0	0		4(c)
414	Corymbia maculata	353460	6323280	20	80	25	2	1	0	+	+	+	0		4(c)
415	Angophora costata	353558	6323344	20	100	25	0	6	0	0	+	+	0		4(c)
416	Angophora costata	353536	6323254	60	60	20	1	0	0	+	0	+	0		4(c)
417	Eucalyptus resinifera	353357	6323222	20	80	20	2	0	1	+	+	+	0		4(c)

TABLE A2.4 (Cont.) HOLLOW BEARING TREES = Hollow Bearing Trees in Industrial Zones (likely to be Removed)

Tree_id	Tree_species	Easting gda	Northing gda	% dead	Dbh cm	Height m	Major spout	Minor spout	Trunk hollow	Bat	Glider	Possum	Owl	Notes	Prop zone
418	Dead Stag	353301	6323236	100	60	20	6	0	0	+	0	+	0		4(c)
419	Eucalyptus pilularis	353156	6322578	20	150	25	6	0	0	+	+	+	0		7(a)
420	Corymbia maculata	353130	6322567	50	150	20	0	0	2	+	+	+	+		7(a)
421	Corymbia maculata	353147	6322551	50	120	20	2	0	1	+	+	+	0		7(a)
422	Corymbia maculata	353053	6322697	50	150	20	3	0	1	+	+	+	0		7(a)
423	Angophora costata	352886	6322660	80	100	20	2	0	0	+	+	+	0		4(c)
424	Angophora costata	352884	6322605	60	100	20	4	2	0	+	0	+	0		4(c)
425	Angophora costata	352873	6322621	40	80	20	2	0	0	+	0	+	0		4(c)
426	Angophora costata	352876	6322606	40	80	10	2	0	0	+	0	+	0		4(c)
427	Dead Stag	352879	6322582	100	150	25	3	0	0	+	0	+	0		4(c)
428	Angophora costata	352866	6322613	50	150	25	3	4	0	+	0	+	0		4(c)
429	Angophora costata	352874	6322548	90	150	20	2	6	0	+	0	+	0		4(c)
430	Angophora costata	352866	6322575	80	150	20	2	2	0	+	0	+	0		4(c)
431	Dead Stag	352859	6322569	100	100	15	3	2	0	+	0	+	0		4(c)
432	Angophora costata	352843	6322546	80	150	15	5	2	0	+	0	+	0		4(c)
433	Stringybark	352814	6322529	20	150	25	5	4	0	+	+	+	0		4(c)
434	Angophora costata	352810	6322514	30	150	20	1	1	0	+	0	+	0		4(c)
435	Dead Stag	352802	6322535	100	80	10	1	0	0	+	0	0	0		4(c)
436	Angophora costata	352788	6322535	20	150	20	3	0	0	+	+	+	0		4(c)
437	Angophora costata	352797	6322574	10	100	20	0	3	0	+	+	+	0		4(c)
438	Angophora costata	352800	6322602	40	200	25	2	6	0	+	+	+	+		4(c)
439	Angophora costata	352796	6322593	30	100	20	2	3	0	+	+	+	0		4(c)
440	Angophora costata	352790	6322597	50	100	15	0	2	0	0	0	+	0		4(c)
441	Angophora costata	352802	6322631	40	100	20	4	4	0	+	0	+	0		4(c)
442	Angophora costata	352786	6322627	80	100	10	0	0	1	+	0	0	+		4(c)
443	Angophora costata	352790	6322607	80	150	10	0	0	1 v.large	0	0	0	+		4(c)
444	Angophora costata	352762	6322623	40	150	20	1	4	0	+	0	+	0		4(c)
445	Angophora costata	352762	6322637	80	150	15	2	3	1 large	+	0	+	+		4(c)
446	Angophora costata	352727	6322654	80	150	20	2	2	0	+	0	+	+		4(c)
447	Dead Stag	353641	6323864	100	150	20	3	1	0	+	0	+	0		5(a)
448	Angophora costata	353696	6323786	90	150	20	2	3	0	0	0	+	0		4(c)
449	Dead Stag	353702	6323771	100	150	10	0	0	1 large	0	0	0	+		4(c)

TABLE A2.4 (Cont.) HOLLOW BEARING TREES = Hollow Bearing Trees in Industrial Zones (likely to be Removed)

Tree_id	Tree_species	Easting gda	Northing gda	% dead	Dbh cm	Height m	Major spout	Minor spout	Trunk hollow	Bat	Glider	Possum	Owl	Notes	Prop zone
450	Dead Stag	353704	6323719	100	150	20	0	8	0	0	0	+	0		4(c)
451	Dead Stag	353707	6323693	100	100	20	0	3	0	0	0	+	0	nesting galahs	4(c)
452	Angophora costata	353635	6323639	60	100	20	2	0	0	+	0	+	0		4(c)
453	Dead Stag	353672	6323489	100	150	20	4	4	0	+	0	+	0		4(c)
454	Eucalyptus tereticorn	353658	6323436	10	100	20	0	1	0	0	0	+	0		4(c)
455	Eucalyptus tereticorn	353682	6323372	10	150	20	0	3	0	0	0	+	0		4(c)
456	Dead Stag	353841	6323079	100	100	15	0	2	1 old	0	0	+	0		7(a)
457	Dead Stag	353746	6323118	100	100	15	5	0	0	0	0	+	0		4(e)
458	Angophora costata	353556	6323347	20	150	20	0	3	0	+	+	+	0		4(c)
459	Angophora costata	353474	6323298	20	150	20	3	2	0	+	+	+	0		4(c)
460	Angophora costata	353979	6323115	20	80	20	3	4	0	+	+	+	0		7(a)
461	Angophora costata	354008	6323119	60	20	20	2	2	0	+	+	+	0		7(a)
462	Dead Stag	354004	6323104	100	60	15	0	3	0	0	0	+	0		7(a)
463	Angophora costata	353976	6323070	60	60	15	2	3	0	+	+	+	0		7(a)
464	Corymbia maculata	354225	6323674	10	80	20	1	3	0	+	+	+	0		7(a)
465	Corymbia maculata	354229	6323656	20	80	20	0	2	1 large	+	+	+	0		7(a)
466	Angophora costata	353966	6323810	10	100	20	2	0	0	+	0	0	0		4(e)
467	Angophora costata	353945	6323821	10	80	20	1	3	0	0	0	+	0		4(e)
468	Angophora costata	353966	6323820	10	60	20	0	2	0	0	0	+	0		4(e)
469	Stringybark	354376	6323463	50	60	20	0	1	0	0	0	+	0		7(a)
470	Dead Stag	354368	6323449	100	60	20	0	5	0	0	+	+	0		7(a)
471	Corymbia maculata	354352	6323431	50	80	20	0	0	1 medium	+	+	+	0		7(a)

Total No of Hollow Bearing Trees on-site = 203
Total no of Hollow Bearing Trees within 4c, 4e and 5a Zones (likely to be removed) = 79

% Hollow Bearing Trees to be removed = 39%

APPENDIX III

ENVIRONMENTAL PROTECTON AND BIODIVERSITY CONSERVATION ACT ASSESSMENT

ENVIRONMENTAL PROTECTON AND BIODIVERSITY CONSERVATION ACT ASSESSMENT

PROPOSED INDUSTRIAL DEVELOPMENT

PRECINCT 14
WYONG EMPLOYMENT ZONE
WARNERVALE

JUNE 2008
(REF: 8035 AIII)

www.cegconsult.com

Central Coast Office
4/369 Mann Street, Gosford NSW 2250
PO Box 360 Gosford NSW 2250

•Ph (02) 4324 7888 • Fax (02) 4324 7899

•Email cegconsult@bigpond.com

ABN 62 274 841 042

TABLE OF CONTENTS

1. INTRODUCTION

The *Environment Protection and Biodiversity Conservation Act (1999)* requires that Commonwealth approval be obtained for certain actions that have a significant impact on matters of national environment significance (NES). These may include:-

- Wetlands protected by international treaty (the Ramsar Convention);
- Nationally listed threatened species and ecological communities;
- Nationally listed migratory species.

Actions are projects, developments, undertakings, activities, and series of activities or alteration of any of these. An action that needs Commonwealth approval is known as a controlled action. A controlled action needs approval where the Commonwealth decides the action would have a significant effect on a NES matter.

Where a proposed activity is located in an area identified to be of NES, or such that it is likely to significantly affect threatened species, ecological communities, migratory species or their habitats, the matter needs to be referred to Department of Environment, Water, Heritage and Arts (DEWHA) Resources.

A protected matters search was undertaken using the DEWHA website, using a 10km search area centred on the subject site.

Four (4) threatened species (*Angophora inopina, Grevillea parviflora* subsp *parviflora, Melaleuca biconvexa* and *Tetratheca juncea*) listed as Vulnerable in the EPBC Act (1999) were identified on the subject site. With regard to these species present on the subject site several criteria must be assessed to satisfy the requirements of the EPBC Act (1999). Criteria identified within the *EPBC Act Administrative Guidelines on Significance July* (2000) are addressed below in order to determine the significance of the impact upon these species and whether the development is subsequently classed as a controlled action. If in the event the activity (proposed development) is a controlled action, it must be referred to the DEWHA.

An assessment of the matters identified by the 10km Protected Matters Report is provided in the following sections of this report. Following the completion of this assessment report correspondence was forwarded to the Department of Environmental, Water, Heritage and Arts (DEWHA) which identified that the assessment was completed and forwarded to the Environment Assessment Branch of DEWHA. No formal referral of the project was sent to DEWHA as it was concluded that the proposed development was not likely to result in a significant effect on a matter of National Environmental Significance.

2. WETLANDS OF INTERNATIONAL SIGNIFICANCE (RAMSAR SITES)

No Wetlands of International Significance (Ramsar Sites) listed in the EPBC Act (1999) were identified on or within 10km of the subject site.

3. THREATENED SPECIES

The 10km search results list 3 threatened bird species, 5 threatened frog species, 5 threatened mammal species, 1 threatened reptile species and 11 threatened plant species as occurring within 10km of the subject site. Details of these species are provided in Table 3.1. Additionally *Rutidosis heterogama* (vulnerable species), known to have a population of more than 100 individuals, is located approximately 3km to the east of the subject site. Species that are wholly marine are not assessed as there is no suitable habitat within the subject site.

TABLE 3.1 RECORDED THREATENED FAUNA OF THE AREA				
Common Name ***Scientific Name***	**TSC Act**	**EPBC Act**	**Preferred Habitat**	**Comments**
Swift Parrot *Lathamus discolor*	E	E	Inhabits Eucalypt forests and woodlands with winter flowering Eucalypts. Distribution Limit - N-Border Ranges National Park. S-South of Eden.	Suitable foraging habitat present. Not observed during survey.
Australian Painted Snipe *Rostratula australis*	E	V	Most numerous within the Murray-Darling basin and inland Australia within marshes and freshwater wetlands with swampy vegetation. Distribution Limit- N-Tweed Heads S-South of Eden	Sub - optimal habitat present. Not observed during survey.
Regent Honeyeater *Xanthomyza phrygia*	E	E	Found in temperate Eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature Eucalypts. Distribution Limit - N-Urbanville. S-Eden.	Suitable foraging and roosting habitat present. Not observed during survey.
Giant Burrowing Frog *Heleioporus australiacus*	V	V	Inhabits open forests and riparian forests along non-perrenial streams, digging burrows into sandy creek banks. Distribution Limit- N-Near Singleton. S-South of Eden	No suitable habitat present. Not observed during survey.
Green and Golden Bell Frog *Litoria aurea*	E	V	Prefers the edges of permanent water, streams, swamps, creeks, lagoons, farm dams and ornamental ponds. Often found under debris. Distribution Limit - N-Byron Bay. S-South of Eden	Sub - optimal habitat present. Not observed during survey.
Littlejohn's Tree Frog *Litoria littlejohnii*	V	V	Found in wet and dry sclerophyll forest associated with sandstone outcrops at altitudes 280-1000m on eastern slopes of Great Dividing Range. Prefers flowing rocky streams. Distribution Limit – N-Hunter River. S-Eden	No suitable habitat present. Not observed during survey.
Stuttering Frog *Mixophyes balbus*	E	V	Terrestrial inhabitant of rainforest and wet sclerophyll forests. Distribution Limit - N-Near Tenterfield. S-South of Bombala.	No suitable habitat present. Not observed during survey.
Giant Barred Frog *Mixophyes iteratus*	E	E	Terrestrial inhabitant of rainforest and open forests. Distribution Limit- N-Border Ranges National Park. S-Narooma.	No suitable habitat present. Not observed during survey.
Spotted-tailed Quoll *Dasyurus maculatus*	V	E	Dry and moist open forests containing rock caves, hollow logs or trees. Distribution Limit- N-Mt Warning National Park S-South of Eden.	Suitable foraging and roosting habitat present. Not observed during survey.

TABLE 3.1 cont. RECORDED THREATENED FAUNA OF THE AREA				
Common Name ***Scientific Name***	**TSC Act**	**EPBC Act**	**Preferred Habitat**	**Comments**
Brush-tailed Rock-wallaby *Petrogale penicillata*	E	V	Found in rocky gorges with a vegetation of rainforest or open forests to isolated rocky outcrops in semi-arid woodland country. Distribution Limit - N-North of Tenterfield. S-Bombala.	No suitable habitat present. Not observed during survey.
Long-nosed Potoroo *Potorous tridactylus tridactylus*	V	V	Coastal heath and dry and wet sclerophyll forests with a dense understorey. Distribution Limit - N-Mt Warning National Park. S-South of Eden.	Sub - optimal habitat present. Not observed during survey.
Grey-headed Flying-fox *Pteropus poliocephalus*	V	V	Found in a variety of habitats including rainforest, mangroves, paperbark swamp, wet and dry open forest and cultivated areas. Forms camps commonly found in gullies and in vegetation with a dense canopy. Distribution Limit – N – Tweed Heads S - Eden	Suitable foraging habitat present. Not observed during survey.
Large-eared Pied Bat *Chalinolobus dwyeri*	V	V	Warm-temperate to subtropical dry sclerophyll forest and woodland. Roosts in caves, tunnels and tree hollows in colonies of up to 30 animals. Distribution Limit - N-Border Ranges Nation Park. S-Wollongong.	Suitable foraging and shelter habitat present. Not detected during survey.
Broad-headed Snake *Hoplocephalus bungaroides*	E	V	Habitat requirements include north-facing sandstone escarpments that have dry sclerophyll forest or woodland on the top of the escarpment. Confined to sandstone ranges within 200-250 km of Sydney.	No suitable habitat present. Not detected during survey.
Acacia bynoeana	E	V	Erect or spreading shrub to 0.3 m high growing in heath and dry sclerophyll open forest on sandy soils. Often associated with disturbed areas such as roadsides. Distribution limits N-Newcastle S- Berrima.	Suitable habitat is present. Not observed during flora survey.
Angophora inopina	V	V	Erect or low spreading shrub 0.2-1m tall. Grows on sandy soils in heath, woodland and open forests from Morisset to Warnervale	Suitable habitat is present. Observed during flora survey.
Caladenia tessellata	E	V	Terrestrial orchid. Clay-loam or sandy soils. Distribution limits N-Swansea S-south of Eden.	Suitable habitat is present. Not observed during flora survey.
Cryptostylis hunteriana	V	V	Saprophytic orchid. Grows in swamp heath on sandy soils. Distribution limits N-Gibraltar Range S- south of Eden.	No suitable habitat is present. Not observed during flora survey.

TABLE 3.1 cont. RECORDED THREATENED FAUNA OF THE AREA				
Common Name ***Scientific Name***	**TSC Act**	**EPBC Act**	**Preferred Habitat**	**Comments**
Eucalyptus camfieldii	V	V	Stringybark to 10 m high. Grows on coastal shrub heath and woodlands on sandy soils derived from alluviums and Hawkesbury sandstone. Distribution limits N - Norah Head S - Royal NP.	Suitable habitat is present. Not observed during flora survey.
Grevillea parviflora subsp *parviflora*	V	V	Open to erect shrub to 1 metre. Grows in woodland on light clayey soils Distribution limits N – Cessnock S - Appin	Suitable habitat is present. Observed during flora survey.
Melaleuca biconvexa	V	V	Tall shrub. Grows in wetlands adjoining perennial streams and on the banks of those streams, generally within the geological series known as the Terrigal Formation. Distribution limits N – Port Macquarie S – Jervis Bay.	Suitable habitat is present. Observed during flora survey.
Rutidosis heterogama	V	V	Small perennial herb to 30cm tall. Grows in heaths in clay soils and has been recorded along disturbed roadsides. Distribution limits N –Yuraygir NP S - Wyong.	Suitable habitat is present. Not observed during flora survey.
Prostanthera junosis	E	E	Restricted to areas around Somersby (Central Coast). Generally occurs along drainage lines or in seepage areas. Open woodland with an understorey dominated by a more or less dense cover of rushes, sedges and shrubs.	No suitable habitat is present. Not observed during flora survey.
Rhizanthella slateri (Underground Orchid)	V	E	A terrestrial saprophytic underground orchid with a fleshy underground stem with overlapping bracts. Known from SE Qld to NSW South Coast in eucalypt forest. Flowers from Oct to Nov.	Suitable habitat is present. Not observed during flora survey.
Syzygium paniculatum	V	V	Small tree. Subtropical and littoral rainforest on sandy soil. Distribution limits N - Forster S - Jervis Bay.	Suitable habitat is present. Not observed during flora survey.
Tetratheca juncea	V	V	Prostrate shrub to 1 m high. Dry sclerophyll forest and heath. Distribution limits N - Bulahdelah S - Port Jackson.	Suitable habitat is present. Observed during flora survey.

Four threatened flora species as listed under the EPBC Act (1999) were observed on the subject site. These species were: *Angophora inopina, Grevillea parviflora* subsp*. parviflora, Melaleuca biconvexa and Tetratheca juncea.*

No threatened fauna species as listed under the EPBC Act (1999) were directly observed on the subject site, however the Grey-headed Flying-fox has been observed foraging in nearby areas.

3.1 ASSESSMENT OF SIGNIFICANT IMPACT ON A VULNERABLE SPECIES

3.1.1 Grey-headed Flying-fox

This species is listed as Vulnerable within the EPBC Act (1999).

Determining an important population

For the purposes of assessment of a vulnerable species under the EPBC Act (1999) an assessment as to whether the species comprises an important population is required.

An *"important population"* is one that is necessary for a species' long-term survival and recovery. Questions (in bold) to determine whether a population is an *"important population"* are as follows:

Whether the population constitutes a key source population for breeding or dispersal:

The Grey-headed Flying-fox is common throughout its distribution, occurring within 200km of the east coast of Australia between Bundaberg and Melbourne in the Sydney Basin Bioregion (DEC, 2005a). They are a mobile species, flying long distances to forage (up to 50 km) and roost (DEC, 2005a). The subject site contains foraging habitat for the species, however is not critical to the species' survival. It is therefore considered that any Grey-headed Flying-fox population that may use the subject site does not constitute a key source population for breeding and dispersal for the species.

Whether the population constitutes a population necessary for maintaining genetic diversity:

The Grey-headed Flying-fox is common throughout its distribution along the southern east coast of Australia, and fly long distances to forage and roost (DEC, 2005a). The subject site is suitable foraging grounds for the species, however is not critical to the species' survival. It is therefore considered that any Grey-headed Flying-fox population that may use the subject site does not constitute a population necessary for maintaining genetic diversity.

Whether the population is at the limit of its known distribution:

The Grey-headed Flying-fox has a geographical distribution within 200 km of the east coast of Australia between Bundaberg and Melbourne (DEC, 2005a). Therefore, it is considered that any Grey-headed Flying-fox population that may use the subject site is not at the limit of the species' known distribution.

The criteria set by the EPBC Act (1999) states that an action has, will have, or is likely to have a significant impact on an *"important population"* of a vulnerable species if it does, will, or is likely to:

- ***Lead to a long-term decrease in the size of an important population of a species;***

No important populations of the Grey-headed Flying-fox has been found within the subject site. It is therefore considered unlikely the proposed action will lead to a long-term decrease in the size of an important population of a species

- ***Reduce the area of occupancy of an important population;***

No important populations of the Grey-headed Flying-fox has been found within the subject site. It is therefore considered unlikely the proposed action will reduce the area of occupancy of an important population

- ***Fragment an existing important population into two or more populations;***

No important populations of the Grey-headed Flying-fox has been found within the subject site. The proposal is not expected to fragment any populations of the species.

It is therefore considered unlikely the proposed action will fragment an existing important population into two or more populations.

- ***Adversely affect habitat critical to the survival of a species;***

The study area is not considered to constitute habitat critical to the survival of the species. Similar vegetation communities and habitat types are represented in adjoining bushland within the locality. It is therefore considered unlikely the proposed action will adversely affect habitat critical to the survival of a species.

- **Disrupt the breeding cycle of an important population;**

No important populations of the Grey-headed Flying-fox have been found within the subject site. No breeding camps occur in the study area, and no known camps are known in the immediate vicinity. It is therefore considered unlikely the proposed action will disrupt the breeding cycle of an important population.

- ***Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that a species is likely to decline;***

The Grey-headed Flying-fox was not observed or detected within the subject site (Bell and Murray, 2007). The loss of habitat associated with any future development is unlikely to contribute towards a decline in the local population of the species. Since there is a large availability of quality habitat located off-site, it is considered unlikely the proposed action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

- ***Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;***

The Grey-headed Flying-fox was not observed or detected within the subject site (Bell and Murray, 2007). The study area is relatively free of invasive species and none that would potentially impact upon the species. It is therefore considered unlikely the proposed action will result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat.

- ***Introduce disease that may cause the species to decline; or***

The Grey-headed Flying-fox was not observed or detected within the subject site (Bell and Murray, 2007). The subject site is relatively free of disease and none that would potentially impact upon the species. It is therefore considered unlikely the proposed action will introduce disease that may cause the species to decline.

- ***Interferes substantially with recovery of the species.***

The Grey-headed Flying-fox was not observed or detected with the subject site (Bell and Murray, 2007). Factors contributing to the recovery of the species are not associated within the subject site; therefore it is considered unlikely the proposed action will interfere substantially with the recovery of the species.

3.1.2 Angophora inopina

This species is listed as Vulnerable within the EPBC Act (1999).

Determining an important population

For the purposes of assessment of a vulnerable species under the EPBC Act (1999) an assessment as to whether the species comprises an important population is required.

An *"important population"* is one that is necessary for a species' long-term survival and recovery. Questions (in bold) to determine whether a population is an *"important population"* are as follows:

Whether the population constitutes a key source population for breeding or dispersal:
A number of *Angophora inopina* individuals were found in the north-eastern corner of the subject site (Bell and Murray, 2007). *Angophora inopina* is common throughout its range of approximately 120km, occurring between Buladelah and Warnervale. The species is more commonly found between Charmhaven and Morisset (DEC, 2005b). It is considered that the population found on-site does not constitute a key source population for breeding or dispersal.

Whether the population constitutes a population necessary for maintaining genetic diversity:
Angophora inopina is common throughout its range of approximately 120km, particularly between Charmhaven and Morisset (DEC, 2005b). It is therefore considered that the population found on-site does not constitute a population necessary for maintaining genetic diversity.

Whether the population is at the limit of its known distribution:
Angophora inopina is common throughout its range of approximately 120km, occurring between Buladelah and Warnervale. One population has been recorded at Gorokan, and another on the southern side of Hue Hue Road (NSW Government, 2005). The population recorded on the subject site is therefore considered not to be at the limit of its known distribution.

The criteria set by the EP&BC Act (1999) states that an action has, will have, or is likely to have a significant impact on an *"important population"* of a vulnerable species if it does, will, or is likely to:

- ***Lead to a long-term decrease in the size of an important population of a species;***

No important populations of *Angophora* inopina has been detected within the subject site.
It is therefore considered unlikely the proposed action will lead to a long-term decrease in the size of an important population of a species.

- ***Reduce the area of occupancy of an important population;***

No important populations of *Angophora inopina* has been detected within the subject site.
It is therefore considered unlikely the proposed action will reduce the area of occupancy of an important population

- ***Fragment an existing important population into two or more populations;***

No important populations of *Angophora inopina* has been detected within the subject site.
The *Angophora inopina* population is already highly fragmented on the subject site and any land rezoning or future development based on the draft land use zones is unlikely to further fragment the local population.

It is therefore considered unlikely the proposed action will fragment an existing important population into two or more populations.

- ***Adversely affect habitat critical to the survival of a species;***

There has currently been no critical habitat for *Angophora inopina* declared under the EPBC Act (1999). As the species occupies an extensive range to Buladelah in the north, it is considered unlikely the proposed action will adversely affect habitat critical to the survival of a species.

- ***Disrupt the breeding cycle of an important population;***

No important populations of *Angophora inopina* has been detected within the subject site. It is therefore considered unlikely the proposed action will disrupt the breeding cycle of an important population.

- ***Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that a species is likely to decline;***

Although there are many different habitat types that support *Angophora inopina* (Bell, 2004) these are poorly represented on the subject site.

It is therefore considered unlikely the proposed action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

- ***Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;***

Any future development on the subject site has potential to result in the establishment of invasive species that may increase competition with *Angophora inopina*, however there is a low risk of this occurring within habitat of *Angophora inopina* as this land is proposed not to be developed. A Vegetation Management Plan will be implemented to reduce the risk of invasive species establishment in *Angophora inopina* habitat.

It is therefore considered unlikely the proposed action will result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.

- ***Introduce disease that may cause the species to decline; or***

The subject site is relatively free of disease and none that would potentially impact upon the species. It is therefore considered unlikely the proposed action will introduce disease that may cause the species to decline.

- ***Interferes substantially with recovery of the species.***

Factors contributing to the recovery of the species are not associated with the subject site; therefore it is considered unlikely the proposed action will interfere substantially with the recovery of the species.

3.1.3 Grevillea parviflora subsp. *parviflora*

This species is listed as Vulnerable within the EPBC Act (1999).

Determining an important population

For the purposes of assessment of a vulnerable species under the EPBC Act (1999) an assessment as to whether the species comprises an important population is required.

An *"important population"* is one that is necessary for a species' long-term survival and recovery. Questions (in bold) to determine whether a population is an *"important population"* are as follows:

Whether the population constitutes a key source population for breeding or dispersal:

Two clumps of *Grevillea parviflora* subsp. *parviflora* was found within the subject site; one in the north of the site and the other clump near the freeway towards the south.

Grevillea parviflora subsp. *parviflora* is widespread within the Sydney Basin Bioregion (NPWS, 2002). Due to its distribution, it is considered the population found within the subject site is not a key source breeding population for breeding or dispersal.

Whether the population constitutes a population necessary for maintaining genetic diversity:

Grevillea parviflora subsp. *parviflora* is widespread within the Sydney Basin Bioregion, occurring between Wallaroo in the Lower Hunter (in the north) and Bargo (in the south) (NPWS, 2002). There are two major occurrences of the species within its distribution; one is

centred near Picton south of Sydney, and the other centred around Cessnock in the Hunter Valley (NSW Government, 2005).

The population found on-site is located in the northern cluster of *Grevillea parviflora* subsp. *parviflora* populations where the species is common.

It is therefore considered that the population found within the subject site does not constitute a population necessary for maintaining diversity.

Whether the population is at the limit of its known distribution:
Grevillea parviflora subsp. *parviflora* is widespread within the Sydney Basin Bioregion (NPWS, 2002). Its northern distribution limit is near Wallaroo in the Lower Hunter Valley, and its southern distribution limit is near Bargo south of Sydney (NSW Government, 2005). The western distribution limit is near Dooralong in the north and Buxton in the south. The population found on-site is a rather central location within this distribution.

It is therefore considered that the population found within the subject site is not at the limit of its known distribution.

The criteria set by the EP&BC Act (1999) states that an action has, will have, or is likely to have a significant impact on an *"important population"* of a vulnerable species if it does, will, or is likely to:

- ***Lead to a long-term decrease in the size of an important population of a species;***

Grevillea parviflora subsp. *parviflora* is widespread throughout the Sydney Basin Bioregion (NPWS, 2002). Due to its distribution, it is not considered necessary to the species long-term survival and recovery as it is not a key source breeding population for breeding or dispersal, not necessary for maintaining genetic diversity, and it is not near the limit of the species range.

Therefore, it is considered unlikely the proposed action will lead to a long-term decrease in the size of an important population of a species.

- ***Reduce the area of occupancy of an important population;***

No important populations of *Grevillea parviflora* subsp. *parviflora* have been found within the subject site. Within the Wyong Employment Zone, habitat supporting a local significant population of *Grevillea parviflora* subsp. *parviflora* has been identified for conservation. This strategy will prevent a reduction in the area of occupancy of an important population by any future development within the study area. The other known population occurs outside of the study and will not be impacted by future development within the Wyong Employment Zone.

It is therefore considered unlikely the proposed action will reduce the area of occupancy of an important population.

- ***Fragment an existing important population into two or more populations;***

No important populations of *Grevillea parviflora* subsp. *parviflora* have been found within the subject site. It is therefore considered unlikely the proposed action it will fragment an existing important population into two or more populations.

- ***Adversely affect habitat critical to the survival of a species;***

No critical habitat for *Grevillea parviflora* subsp. *parviflora* has been declared under the EPBC Act (1999). It is therefore considered unlikely the proposed action will adversely affect habitat critical to the survival of a species.

- **Disrupt the breeding cycle of an important population;**

No important populations of *Grevillea parviflora* subsp. *parviflora* have been found within the subject site. It is therefore considered unlikely the proposed action will disrupt the breeding cycle of an important population.

- ***Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that a species is likely to decline;***

The habitat of the *Grevillea parviflora* subsp. *parviflora* population located within the Warnervale Business Park is to be conserved under the draft LEP. Consequently, further development of the WBP and the Wyong Employment Zone in general is unlikely to destroy, remove, isolate or decrease the availability or quality of habitat such that the species is likely to decline.

It is therefore considered unlikely the proposed action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

- ***Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;***

Any future development on the subject site has potential to result in the establishment of invasive species, however there is a low risk of this occurring within habitat of *Grevillea parviflora* subsp. *parviflora*. A Vegetation Management Plan will be implemented to reduce the risk of invasive species establishment in *Grevillea parviflora* subsp. *parviflora* habitat.

It is therefore considered unlikely the proposed action will result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat.

- ***Introduce disease that may cause the species to decline; or***

The subject site is relatively free of disease and none that would potentially impact upon the species. It is therefore considered unlikely the proposed action will introduce disease that may cause the species to decline.

- ***Interferes substantially with recovery of the species.***

Factors contributing to the recovery of the species are not associated with the subject site; therefore it is considered unlikely the proposed action will interfere substantially with the recovery of the species.

3.1.4 Melaleuca biconvexa

This species is listed as Vulnerable within the EPBC Act (1999).

Determining an important population

For the purposes of assessment of a vulnerable species under the EPBC Act (1999) an assessment as to whether the species comprises an important population is required.

An *"important population"* is one that is necessary for a species' long-term survival and recovery. Questions (in bold) to determine whether a population is an *"important population"* are as follows:

Whether the population constitutes a key source population for breeding or dispersal:
Melaleuca biconvexa was recorded in the riparian zone along Buttonderry Creek within the subject site (Bell and Murray, 2007).

The geographical distribution of *Melaleuca biconvexa* is known to be between Port Macquarie in the north and Jervis Bay in the south (NSW Government, 2005). It is considered that the

population found within the subject site does not constitute a key source population for breeding or dispersal.

Whether the population constitutes a population necessary for maintaining genetic diversity:
Melaleuca biconvexa is commonly found within its distribution on the Central Coast (NSW Government, 2005). Its geographical range extends much further than this along the east coast of Australia between Port Macquarie and Jervis Bay.

It is therefore considered that the population found within the subject site does not constitute a population necessary for maintaining genetic diversity.

Whether the population is at the limit of its known distribution:
The geographical distribution of *Melaleuca biconvexa* is known to be between Port Macquarie in the north, Jervis Bay in the south and near Camden in the west (NSW Government, 2005).

The population found within the subject site is central in this distribution, therefore it is considered this population is not at the limit of its known distribution.

The criteria set by the EPBC Act (1999) states that an action has, will have, or is likely to have a significant impact on an *"important population"* of a vulnerable species if it does, will, or is likely to:

- ***Lead to a long-term decrease in the size of an important population of a species;***

Melaleuca biconvexa was recorded in large numbers along Buttonderry Creek, from Hue Hue road in the west to the Jack Grant Avenue area in the east.

The Warnervale location occurs within the middle of the regional distribution of this species (Cooranbong to Gosford).

It is therefore considered unlikely the proposed action will lead to a long-term decrease in the size of an important population of a species.

- ***Reduce the area of occupancy of an important population;***

No important population of *Melaleuca biconvexa* was found within the subject site. It is therefore considered unlikely the proposed action will reduce the area of occupancy of an important population.

- ***Fragment an existing important population into two or more populations;***

No important population of *Melaleuca biconvexa* was found within the subject site. Future development of Precinct 14 is unlikely to fragment habitat and populations of *Melaleuca biconvexa* along Buttonderry Creek due to restrictive land use zones and legislation.

It is therefore considered unlikely the proposed action will fragment an existing important population into two or more populations.

- ***Adversely affect habitat critical to the survival of a species;***

No critical habitat for *Melaleuca biconvexa* has been declared under the EPBC Act (1999). It is therefore considered unlikely the proposed action will adversely affect habitat critical to the survival of a species.

- **Disrupt the breeding cycle of an important population;**

No important population of *Melaleuca biconvexa* was found within the subject site. It is therefore considered unlikely the proposed action will disrupt the breeding cycle of an important population.

- ***Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that a species is likely to decline;***

A total of over 2,000 ha of habitat of *Melaleuca biconvexa* has been mapped in Wyong Shire (Bell, 2002). The majority of habitat and populations occur along major creek lines and water courses. Development actions within this zone are unlikely due to restrictive land uses and legislative protection.

It is therefore considered unlikely the proposed action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

- ***Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;***

Any future development on the subject site has potential to result in the establishment of invasive species, however there is a low risk of this occurring within habitat of *Melaleuca biconvexa*. A Vegetation Management Plan will be implemented to reduce the risk of invasive species establishment in *Melaleuca biconvexa* habitat.

It is therefore considered unlikely the proposed action will result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.

- ***Introduce disease that may cause the species to decline; or***

The subject site is relatively free of disease and none that would potentially impact upon the species. It is therefore considered unlikely the proposed action will introduce disease that may cause the species to decline.

- ***Interferes substantially with recovery of the species.***

Melaleuca biconvexa is relatively widespread within the Wyong-Gosford region. Factors contributing to the recovery of the species are not associated with the subject site; therefore it is considered unlikely the proposed action will interfere substantially with the recovery of the species.

3.1.5 Tetratheca juncea

This species is listed as Vulnerable within the EPBC Act (1999).

Determining an important population

For the purposes of assessment of a vulnerable species under the EPBC Act (1999) an assessment as to whether the species comprises an important population is required.

An *"important population"* is one that is necessary for a species' long-term survival and recovery. Questions (in bold) to determine whether a population is an *"important population"* are as follows:

Whether the population constitutes a key source population for breeding or dispersal:

There are only a few individuals of *Tetratheca juncea* recorded within the subject site (Bell and Murray, 2007).

Tetratheca juncea has a known distribution between Buladelah (in the north) and Wyong (in the south) (NSW Government 2005). It is most commonly distributed between Wyong and Kurri Kurri on the Central Coast.

It is therefore considered that the population found within the subject site does not constitute a key source population for breeding and dispersal.

Whether the population constitutes a population necessary for maintaining genetic diversity:
The geographic distribution of *Tetratheca juncea* is known to currently occur between the northern portion of the Sydney Basin Bioregion and the southern portion of the North Coast Bioregion (DEC, 2005c). The species is common between Wyong and Newcastle. It is therefore considered that the population found within the subject site does not constitute a population necessary for maintaining genetic diversity.

Whether the population is at the limit of its known distribution:
Tetratheca juncea occurs between Buladelah and Wyong (DEC, 2 2005c). The population found within the subject site is closest to the southern extent of its distribution, however is not considered to be at the limit of its known distribution.

The criteria set by the EPBC Act (1999) states that an action has, will have, or is likely to have a significant impact on an *"important population"* of a vulnerable species if it does, will, or is likely to:

- ***Lead to a long-term decrease in the size of an important population of a species;***

It is considered that this population of *Tetratheca juncea* is not an important population as it is not listed as an important population and not considered necessary for the species' long-term survival and recovery. It is therefore considered unlikely the proposed action will lead to a long-term decrease in the size of an important population of a species.

- ***Reduce the area of occupancy of an important population;***

No important population of *Tetratheca juncea* was found within the subject site. It is therefore considered unlikely the proposed action will reduce the area of occupancy of an important population.

- ***Fragment an existing important population into two or more populations;***

No important population of *Tetratheca juncea* was found within the subject site. It is therefore considered unlikely the proposed action will fragment an existing important population into two or more populations.

- ***Adversely affect habitat critical to the survival of a species;***

No critical habitat for *Tetratheca juncea* has been declared under the EPBC Act (1999). It is therefore considered unlikely the proposed action will adversely affect habitat critical to the survival of a species.

- **Disrupt the breeding cycle of an important population;**

Driscoll (2003) has documented the pollination process of *Tetratheca juncea* and identified several species of native bees responsible. Such pollinators are highly mobile and are not restricted solely to *Tetratheca* for their nourishment. Several species include *Tetratheca juncea* as a minor component of their diet. The few small plant clumps located within the study area are likely to form part of the diet of these bees should they be present in the area, along with several other native shrubs.

No important population of *Tetratheca juncea* was found within the subject site. It is therefore considered unlikely the proposed action will disrupt the breeding cycle of an important population.

- ***Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that a species is likely to decline;***

Any development of the Wyong Employment Zone, based on the draft LEP, is unlikely to destroy, remove or isolate the availability or quality of habitat such that the species is likely to decline.

It is therefore considered unlikely the proposed action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

- ***Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;***

Any future development on the subject site has potential to result in the establishment of invasive species, however there is a low risk of this occurring within habitat of *Tetratheca juncea.* A Vegetation Management Plan will be implemented to reduce the risk of invasive species establishment in *Tetratheca juncea* habitat.

It is therefore considered unlikely the proposed action will result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat.

- ***Introduce disease that may cause the species to decline; or***

The subject site is relatively free of disease and none that would potentially impact upon the species. It is therefore considered unlikely the proposed action will introduce disease that may cause the species to decline.

- ***Interferes substantially with recovery of the species.***

Factors contributing to the recovery of the species are not associated with the subject site; therefore it is considered unlikely the proposed action will interfere substantially with the recovery of the species.

3.2 ASSESSMENT OF SIGNIFICANT IMPACT ON AN ENDANGERED SPECIES

3.2.1 Swift Parrot

This species is listed as Endangered within the EPBC Act (1999).

The criteria set by the EPBC Act (1999) states that an action has, will have, or is likely to have a significant impact on a critically endangered or endangered species if it does, will, or is likely to:

- ***Lead to a long-term decrease in the size of a population;***

The Swift Parrot is a migratory species that breeds in Tasmania and its offshore islands in summer. In late March almost the entire population migrates to mainland Australia spreading from Victoria through to central and coastal NSW and south east Queensland (Schodde & Tidemann, 1986).

No population of Swift Parrot was observed or detected within the subject site (Bell and Murray 2007).

The Swift Parrot's highly mobile migration patterns suggest it would not use the subject site exclusively, given the occurrence of suitable habitat in surrounding areas.

It is therefore considered unlikely the proposed action will lead to a long-term decrease in the size of a population.

- ***Reduce the area of occupancy of the species;***

The proposed action will remove a small area of disturbed foraging habitat for this species. Due to its much larger distribution throughout its migratory path it is considered unlikely the proposed action will reduce the area of occupancy of the species.

- ***Fragment an existing population into two or more populations;***

The Swift Parrot is a nomadic, migratory species and therefore is not restricted to any particular area (except perhaps specific breeding habitat in Tasmania). It is therefore considered unlikely the proposed action will fragment an existing population into two or more populations.

- ***Adversely affect habitat critical to the survival of a species;***

The subject site has not been identified as being critical habitat for the survival of the Swift Parrot. It is therefore considered unlikely the proposed action will adversely affect habitat critical to the survival of the species.

- ***Disrupt the breeding cycle of a population;***

The Swift Parrot breeds in Tasmania, not on the mainland. The proposed action is unlikely to significantly decrease the size of the population of Swift Parrots that may forage in the subject site and/or its surrounding lands. It is therefore considered unlikely the proposed action will disrupt the breeding cycle of a population.

- ***Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;***

Any development of the Wyong Employment Zone, based on the draft LEP, is unlikely to destroy, remove or isolate the availability or quality of habitat such that the species is likely to decline. A number of offsets are proposed for the subject site where the protection and conservation of several high quality fauna habitats (for example Riparian Forest, Wet Heath and Swamp Forest) would be implemented.

It is therefore considered unlikely the proposed action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

- ***Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species' habitat;***

Much of the subject site is free of invasive species and none that would potentially impact upon the species. It is therefore considered unlikely the proposed action will result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species' habitat.

- ***Introduce disease that may cause the species to decline, or***

There subject site is free of disease, and there is little chance disease that is harmful to the Swift Parrot will be introduced into the subject site. It is therefore considered unlikely the proposed action will introduce disease that may cause the species to decline.

- ***Interfere with the recovery of the species.***

Factors contributing to the recovery of the species are not associated with the subject site; therefore it is considered unlikely the proposed action will interfere with the recovery of the species.

3.2.2 Regent Honeyeater

This species is listed as Endangered within the EPBC Act (1999).

The criteria set by the EPBC Act (1999) states that an action has, will have, or is likely to have a significant impact on a critically endangered or endangered species if it does, will, or is likely to:

- ***Lead to a long-term decrease in the size of a population;***

The Regent Honeyeater is a semi-nomadic species which occurs in temperate eucalypt woodlands and open forest between north-eastern Victoria and south-eastern Queensland. There are a few known breeding sites in NSW, the most important of which are: Warrumbungles NP, Pilliga NR, Barraba district, Central Coast around Gosford, Hunter Valley, and Capertee Valley (NPWS, 1999).

No population of Regent Honeyeater was observed or detected within the subject site (Bell and Murray 2007).

The Regent Honeyeater is a highly mobile species, suggesting it would not use the subject site exclusively, given the occurrence of suitable habitat in surrounding areas.

It is therefore considered unlikely the proposed action will lead to a long-term decrease in the size of a population.

- ***Reduce the area of occupancy of the species;***

The proposed action will remove a small area of disturbed habitat for this species. Due to its larger distribution, suitable habitat off-site and lack of records within the subject area, it is considered unlikely the proposed action will reduce the area of occupancy of the species.

- ***Fragment an existing population into two or more populations;***

The Regent Honeyeater is a partly-nomadic species and therefore is not restricted to any particular area. It is therefore considered unlikely the proposed action will fragment an existing population into two or more populations.

- ***Adversely affect habitat critical to the survival of a species;***

The subject site has not been identified as being critical habitat for the survival of the Regent Honeyeater. It is therefore considered unlikely the proposed action will disrupt the breeding cycle of a population.

- ***Disrupt the breeding cycle of a population;***

The closest known breeding habitat of the Regent Honeyeater is located around Gosford (NPWS 1999). There are five important breeding habitats identified in NSW which are: Warrumbungles NP, Pilliga NR, Barraba district, Hunter Valley, and Capertee Valley (NPWS 1999).

It is therefore considered unlikely the proposed action will disrupt the breeding cycle of a population.

- ***Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;***

Any development of the Wyong Employment Zone, based on the draft LEP, is unlikely to destroy, remove or isolate the availability or quality of habitat such that the species is likely to decline. A number of offsets are proposed for the subject site where the protection and conservation of several high quality fauna habitats (for example Riparian Forest, Wet Heath and Swamp Forest) would be implemented.

It is therefore considered unlikely the proposed action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

- ***Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species' habitat;***

Much of the subject site is free of invasive species and none that would potentially impact upon the species. It is therefore considered unlikely the proposed action will result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species' habitat.

- ***Introduce disease that may cause the species to decline, or***

There subject site is free of disease, and there is little chance disease that is harmful to the Regent Honeyeater will be introduced into the subject site. It is therefore considered unlikely the proposed action will introduce disease that may cause the species to decline.

- ***Interfere with the recovery of the species.***

Factors contributing to the recovery of the species are not associated with the subject site; therefore it is unlikely the proposed action will interfere with the recovery of the species.

4. THREATENED ECOLOGICAL COMMUNITIES

No Threatened Ecological Communities as listed in the EPBC Act (1999) were identified on or within 10km of the subject site.

5. ASSESSMENT OF SIGNIFICANCE- MIGRATORY SPECIES

The 10km search results lists 7 threatened migratory terrestrial bird species, 6 threatened migratory wetland bird species and 14 migratory marine birds which may potentially use the site for roosting, foraging or overflying.

Species that are wholly marine are not assessed as there is no suitable habitat within the subject site.

Of the 7 threatened migratory terrestrial bird species listed in the 10km search, none of the species were recorded on-site, and three species (White-bellied Sea-eagle, White-throated Needletail and the Regent Honeyeater) were observed in the local area.

The criteria set by the EPBC Act (1999) states that 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:

- ***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.***

There is no proposal for disturbance or modification of important habitat. It is therefore considered unlikely the proposed action will 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.

- ***Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat of the migratory species.***

There is a small chance of weed invasion on the subject site, however since there are similar or larger areas of important habitat near to the subject site it is considered that an impact resulting in invasive species that is harmful to migratory species becoming established in an area of important habitat is not significant.

It is therefore considered unlikely the proposed action will result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat of the migratory species.

- ***Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species.***

The lifecycles of listed migratory species occurring on or near the subject site would not be impacted upon by disturbance and or clearing of vegetation communities and fauna habitat on the subject site. Few species are expected to breed on the subject site, therefore any impact on the subject site is not considered to significantly disrupt the lifecycle of an ecologically significant proportion of the population of the species.

It is therefore considered unlikely the proposed action will seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species.

6. COMMONWEALTH LANDS

There are three (3) Commonwealth Lands listed within the 10km search. These are:

1. Communications, Information Technology and the Arts - Australian Postal Corporation;
2. Communications, Information Technology and the Arts - Telstra Corporation Limited; and
3. Defence – Defence Housing Authority.

The subject site does not contain or adjoin any of these three Commonwealth Lands. It is expected that the proposed development will not have any effect on these Commonwealth Lands.

7. PLACES ON THE REGISTER OF NATIONAL ESTATE

There are two (2) places listed on the Register of National Estate. These are:

1 - Alison Homestead NSW;
2 - Old Maitland Road Section NSW.

The subject site does not contain or adjoin any of these two places listed on the Register of National Estate, therefore it is expected that the proposed development will not have any effect on these places.

8. CONCLUSION

It is considered that a referral of this project to Department of Environment, Water Heritage and the Arts is not required as it is not likely to impact on a significant population of nationally listed threatened species, any nationally listed endangered ecological community or on any nationally listed migratory or marine species.

REFERENCES

Bell, S.A.J. (2002) *The natural vegetation of Wyong Local Government Area, Central Coast, New South Wales. Technical Report & Community Profiles*. Report to Wyong Shire Council by Eastcoast Flora Survey.

Bell, S.A.J. (2004). Distribution and habitat of the vulnerable tree species, *Angophora inopina* (Myrtaceae), on the Central Coast of New South Wales. *Cunninghamia* 8(4): 477-484.

Bell, S.A.J. and Murray, M. (2007) *Ecological Investigations Version 2: Wyong Employment Zone.*Warnervale Business Park, Warnervale Airport Lands, Precincts 11 & 13 and Precinct 14. Report to Wyong Shire Council, 25 May 2007.

Department of Environment and Conservation (2005_b) Threatened Species Information- *Angophora inopina* profile. Available at: http://threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10053

Department of Environment and Conservation (2005_a) Threatened Species Information- Grey-headed Flying-fox profile. Available at : http://threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10697

Department of Environment and Conservation (2005_c) Threatened Species Information- *Tetratheca juncea* profile. Available at: http://threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10799

Driscoll, C. (2003) Pollination ecology of *Tetratheca juncea* (Tremandraceae): finding the pollinators. *Cunninghamia* 8(1): 133-140.

NPWS (1999) Threatened Species Information- Regent Honeyeater. September 1999. NSW National Parks and Wildlife Service

NPWS (2002) Threatened Species Information- *Grevillea parviflora* subsp. *Parviflora. August 2002.* NSW National Parks and Wildlife Service

NSW Government (2005) Bionet. NSW Government. Available at: http://www.bionet.nsw.gov.au/BioNet.cfm?is_ie5up

Schodde, R. and Tidemann, S. (Eds) (1986). Readers Digest complete book of Australian Birds. Second Edition. Reader's Digest Services Pty Ltd, Sydney.

Shine, R. and Fitzgerald, M. (1989) *"Conservation and reproduction of an endangered species: the Broadheaded Snake, Hoplocephalus bungaroides (Elapidae)"*, in Australian Zoologist Vol 25(3), pp 65-67

ATTACHMENT 1

EPBC PROTECTED MATTERS SEARCH RESULTS

-

Department of the Environment, Water, Heritage and the Arts home page

Skip navigation links About us | Contact us | Publications | What's new

header imagesheader imagesheader images

Protected Matters Search Tool

You are here: Environment Home > EPBC Act > Search

3 March 2008 13:07

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

You may wish to print this report for reference before moving to other pages or websites.

The Australian Natural Resources Atlas at http://www.environment.gov.au/atlas may provide further environmental information relevant to your selected area. Information about the EPBC Act including significance guidelines, forms and application process details can be found at http://www.environment.gov.au/epbc/assessmentsapprovals/index.html

---

Map of Search Region including any Buffer

Search Type:	Point
Buffer:	10 km
Coordinates:	-33.22018,151.4286
	Thumbnail Map of Search Region

Report Contents:

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance - see http://www.environment.gov.au/epbc/assessmentsapprovals/guidelines/index.html.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Significance: (Ramsar Sites)	None
Commonwealth Marine Areas:	None
Threatened Ecological Communities:	None
Threatened Species:	25
Migratory Species:	16

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage/index.html.

Please note that the current dataset on Commonwealth land is not complete. Further information on Commonwealth land would need to be obtained from relevant sources including Commonwealth agencies, local agencies, and land tenure maps.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species. Information on EPBC Act permit requirements and application forms can be found at http://www.environment.gov.au/epbc/permits/index.html.

Commonwealth Lands:	3
Commonwealth Heritage Places:	None
Places on the RNE:	2
Listed Marine Species:	14
Whales and Other Cetaceans:	None
Critical Habitats:	None

Commonwealth Reserves:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Other Commonwealth Reserves:	None
Regional Forest Agreements:	1

Details

Matters of National Environmental Significance

Threatened Species [Dataset Information]	Status	Type of Presence
Birds		
Lathamus discolor * Swift Parrot	Endangered	Species or species habitat may occur within area
Rostratula australis * Australian Painted Snipe	Vulnerable	Species or species habitat may occur within area
Xanthomyza phrygia * Regent Honeyeater	Endangered	Species or species habitat likely to occur within area
Frogs		
Heleioporus australiacus * Giant Burrowing Frog	Vulnerable	Species or species habitat likely to occur within area
Litoria aurea * Green and Golden Bell Frog	Vulnerable	Species or species habitat may occur within area
Litoria littlejohni * Littlejohn's Tree Frog, Heath Frog	Vulnerable	Species or species habitat may occur within area
Mixophyes balbus * Stuttering Frog, Southern Barred Frog (in Victoria)	Vulnerable	Species or species habitat likely to occur within area
Mixophyes iteratus * Southern Barred Frog, Giant Barred Frog	Endangered	Species or species habitat likely to occur within area
Mammals		
Chalinolobus dwyeri * Large-eared Pied Bat, Large Pied Bat	Vulnerable	Species or species habitat may occur within area
*Dasyurus maculatus maculatus (SE mainland population)** Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population)	Endangered	Species or species habitat may occur within area
Petrogale penicillata * Brush-tailed Rock-wallaby	Vulnerable	Species or species habitat may occur within area

Potorous tridactylus tridactylus * Long-nosed Potoroo (SE mainland)	Vulnerable	Species or species habitat may occur within area
Pteropus poliocephalus * Grey-headed Flying-fox	Vulnerable	Roosting known to occur within area
Reptiles		
Hoplocephalus bungaroides * Broad-headed Snake	Vulnerable	Species or species habitat likely to occur within area
Plants		
Acacia bynoeana * Bynoe's Wattle, Tiny Wattle	Vulnerable	Species or species habitat likely to occur within area
Angophora inopina *	Vulnerable	Species or species habitat likely to occur within area
Caladenia tessellata * Thick-lipped Spider-orchid, Daddy Long-legs	Vulnerable	Species or species habitat likely to occur within area
Cryptostylis hunteriana * Leafless Tongue-orchid	Vulnerable	Species or species habitat may occur within area
Eucalyptus camfieldii * Camfield's Stringybark	Vulnerable	Species or species habitat likely to occur within area
*Grevillea parviflora subsp. parviflora**	Vulnerable	Species or species habitat likely to occur within area
Melaleuca biconvexa * Biconvex Paperbark	Vulnerable	Species or species habitat likely to occur within area
Prostanthera junonis * Somersby Mintbush	Endangered	Species or species habitat likely to occur within area
Rhizanthella slateri * Eastern Underground Orchid	Endangered	Species or species habitat may occur within area
Syzygium paniculatum * Magenta Lilly Pilly, Magenta Cherry, Pocket-less Brush Cherry, Scrub Cherry, Creek Lilly Pilly, Brush Cherry	Vulnerable	Species or species habitat likely to occur within area
Tetratheca juncea *	Vulnerable	Species or species habitat likely to occur within area
Migratory Species [Dataset Information]	Status	Type of Presence
Migratory Terrestrial Species		
Birds		
Haliaeetus leucogaster White-bellied Sea-Eagle	Migratory	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail	Migratory	Species or species habitat may occur within area
Merops ornatus * Rainbow Bee-eater	Migratory	Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch	Migratory	Breeding may occur within area

Myiagra cyanoleuca Satin Flycatcher	Migratory	Breeding likely to occur within area
Rhipidura rufifrons Rufous Fantail	Migratory	Breeding may occur within area
Xanthomyza phrygia Regent Honeyeater	Migratory	Species or species habitat likely to occur within area

Migratory Wetland Species

Birds

Ardea alba Great Egret, White Egret	Migratory	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Migratory	Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper	Migratory	Species or species habitat likely to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover	Migratory	Species or species habitat likely to occur within area
Gallinago hardwickii ***** Latham's Snipe, Japanese Snipe	Migratory	Species or species habitat may occur within area
Rostratula benghalensis s. lat. Painted Snipe	Migratory	Species or species habitat may occur within area

Migratory Marine Birds

Apus pacificus Fork-tailed Swift	Migratory	Species or species habitat may occur within area
Ardea alba Great Egret, White Egret	Migratory	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Migratory	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Dataset Information]	Status	Type of Presence

Birds

Apus pacificus Fork-tailed Swift	Listed - overfly marine area	Species or species habitat may occur within area
Ardea alba Great Egret, White Egret	Listed - overfly marine area	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Listed - overfly marine area	Species or species habitat may occur within area

Calidris acuminata Sharp-tailed Sandpiper	Listed	Species or species habitat likely to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover	Listed	Species or species habitat likely to occur within area
Gallinago hardwickii ***** Latham's Snipe, Japanese Snipe	Listed - overfly marine area	Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle	Listed	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail	Listed - overfly marine area	Species or species habitat may occur within area
Lathamus discolor ***** Swift Parrot	Listed - overfly marine area	Species or species habitat may occur within area
Merops ornatus ***** Rainbow Bee-eater	Listed - overfly marine area	Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch	Listed - overfly marine area	Breeding may occur within area
Myiagra cyanoleuca Satin Flycatcher	Listed - overfly marine area	Breeding likely to occur within area
Rhipidura rufifrons Rufous Fantail	Listed - overfly marine area	Breeding may occur within area
Rostratula benghalensis s. lat. Painted Snipe	Listed - overfly marine area	Species or species habitat may occur within area

Commonwealth Lands [Dataset Information]

Communications, Information Technology and the Arts - Australian Postal Corporation

Communications, Information Technology and the Arts - Telstra Corporation Limited

Defence - Defence Housing Authority

Places on the RNE [Dataset Information]
Note that not all Indigenous sites may be listed.

Historic

Alison Homestead NSW

Old Maitland Road Section NSW

Extra Information

Regional Forest Agreements [Dataset Information]
Note that all RFA areas including those still under consideration have been included.

Lower North East NSW RFA, New South Wales

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the *Environment Protection and Biodiversity Conservation Act 1999*. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under "type of presence". For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the migratory and marine provisions of the Act have been mapped.

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites;

- seals which have only been mapped for breeding sites near the Australian continent.

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Acknowledgments

This database has been compiled from a range of data sources. The Department acknowledges the following custodians who have contributed valuable data and advice:

- New South Wales National Parks and Wildlife Service
- Department of Sustainability and Environment, Victoria
- Department of Primary Industries, Water and Environment, Tasmania
- Department of Environment and Heritage, South Australia Planning SA
- Parks and Wildlife Commission of the Northern Territory
- Environmental Protection Agency, Queensland
- Birds Australia
- Australian Bird and Bat Banding Scheme
- Australian National Wildlife Collection
- Natural history museums of Australia
- Queensland Herbarium
- National Herbarium of NSW
- Royal Botanic Gardens and National Herbarium of Victoria
- Tasmanian Herbarium
- State Herbarium of South Australia
- Northern Territory Herbarium
- Western Australian Herbarium
- Australian National Herbarium, Atherton and Canberra
- University of New England
- Other groups and individuals

ANUCliM Version 1.8, Centre for Resource and Environmental Studies, Australian National University was used extensively for the production of draft maps of species distribution. Environment Australia is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Last updated:

Department of the Environment, Water, Heritage and the Arts
GPO Box 787 Canberra ACT 2601 Australia
Telephone: +61 (0)2 6274 1111

ATTACHMENT 2

LETTER OF CONSULTATION WITH DEWHA

Our Ref: 8035
24 April 2008

Ms Marina Walkington
Director
EIA Governance Section, Environment Assessment Branch
Dept of Environment, Water, Heritage and the Arts
GPO Box 787
Canberra ACT 2601

Dear Marina

RE: Warner Industrial Park, Wyong Employment Zone (Precinct 14)

The Warner Industrial Park is proposed within Precinct 14 of the Wyong Employment Zone situated between Hue Hue Road and the main northern rail line at Warnervale. An application to develop the areas of Precinct 14 has been made to the Department of Planning under Part 3A of the Environmental Planning and Assessment Act (1979) (Application No. MP070162), and is considered a State significant site by the Minister for the Department of Planning.

Conacher Environmental Group has been engaged by Warner Industrial Park Pty Ltd to undertake the Biodiversity Assessment component of the Part 3A Application.

The requirements issued by the Director General of the Department of Planning have identified that the applicants are required to consult with the Department of Environment, Water, Heritage and the Arts.

Under Part 3A of the EP&A Act (1979) the project must be referred to the Department of Environment, Water, Heritage and the Arts (DEWHA) if it will have or is likely to have a significant impact on a matter of national environmental significance. It is considered by *Conacher Environmental Group* that the proposed action is not likely to have a significant impact on any matter of national environmental significance. It is therefore considered that a referral is not required. However, we have been requested to obtain your conformation that a formal referral of this project to DEWHA is not required in this instance.

Please find enclosed a copy of the Environmental Protection and Biodiversity Conservation Act (1999) Assessment and a copy of the Flora and Fauna Assessment for your consideration.

We look forward to your confirmation that a referral for the proposed action is not required.

Yours faithfully

P A CONACHER
Director
CONACHER ENVIRONMENTAL GROUP

ww.cegconsult.com

Central Coast Office
4/369 Mann Street, Gosford NSW 2250
PO Box 360 Gosford NSW 2250

•Ph (02) 4324 7888 • Fax (02) 4324 7899

•Email cegconsult@bigpond.com

ABN 62 274 841 042

APPENDIX IV

STORMWATER PIPELINE ASSESSMENT REPORT

STORMWATER PIPELINE ASSESSMENT REPORT

PROPOSED INDUSTRIAL DEVELOPMENT

PRECINCT 14
WYONG EMPLOYMENT ZONE

JUNE 2008
(REF: 8035)

www.cegconsult.com

Central Coast Office
4/369 Mann Street, Gosford NSW 2250
PO Box 360 Gosford NSW 2250

•Ph (02) 4324 7888 • Fax (02) 4324 7899

•Email cegconsult@bigpond.com

ABN 62 274 841 042

STORMWATER PIPELINE ASSESSMENT REPORT

PROPOSED INDUSTRIAL DEVELOPMENT

PRECINCT 14
WYONG EMPLOYMENT ZONE

JUNE 2008

Conacher Environmental Group

Environmental and Land Management Consultants

369 Mann Street, Gosford NSW
PO Box 360, Gosford NSW
Phone: 02 4324 7888 Fax: 02 43247899
23 Coleman Street, Lismore NSW
PO Box 92, Lismore NSW
Ph: 02 6622 7522 Fax: 02 6622 7533

PREFACE

This Stormwater Pipeline Assessment Report has been prepared by *Conacher Environmental Group* to identify the flora and fauna characteristics of the proposed stormwater pipeline emanating from the proposed Warner Industrial Park and the adjoining lands in Lot 5 DP 259531 and Lot 9 DP 239704 within Precinct 14 of the Wyong Employment Zone, and discharging into Wyong River.

This Report provides an assessment of existing habitats and the potential for the proposed pipeline to significantly impact on threatened species according to Section 5(A) of *the Environmental Planning and Assessment (EP&A) Act* 1979 and the *Threatened Species Conservation Act* (1995).

PROJECT TEAM

PHILLIP ANTHONY CONACHER B.Sc.(Hons), Dip.Urb Reg Planning, M.Nat.Res.
NPWS Scientific Licence Number: S10359
Director
Conacher Environmental Group

ROBERT CLIFFORD SANSOM B.Sc.(Hons.)
NPWS Scientific Licence Number: S10359
Botanist / Ecologist
Conacher Environmental Group

TABLE OF CONTENTS

1. INTRODUCTION

Conacher Environmental Group has been engaged to prepare a Flora and Fauna Assessment Report for the proposed pipeline from Precinct 14, Warnervale Business Park, Warnervale. This Precinct is part of the Wyong Employment Zone (WEZ).

This Flora and Fauna Assessment Report has been prepared to identify the flora and fauna characteristics of the proposed pipeline route and to determine whether or not a Species Impact Statement should be prepared for the proposed development according to the provisions of the *Threatened Species Conservation Act (TSC)* (1995) and Section 5(A) of the *Environmental Planning & Assessment (EP&A) Act* (1979).

2. SITE CHARACTERISTICS

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

TABLE 1.1 SITE DETAILS	
Location	The proposed development is within the Hue Hue Road reserve from Precinct 14 of the Wyong Employment Zone to: (Option 1) From the corner of Hue Hue and Sparks Roads via Hue Hue Road and Yarramalong Road reserves to the Wyong River at Alison, or (Option 2) From the corner of Hue Hue and Sparks Roads via Hue Hue Road and Jilliby Road Reserves to Jilliby Jilliby Creek at Flacks Bridge.
Area	Option 1 = approx 3m wide x 7900m long = 23,700m^2 = 2.37ha Option 2 = approx 3m wide x 5600m long = 16,800m^2 = 1.68ha
Topographic Maps	Dooralong and Wyong 1:25000
Local Government Area	Wyong
Existing Land Use	Road Reserve
Proposed Development	Industrial development as part of the Wyong Employment Zone – Precinct 14 and conservation of retained vegetation.

TABLE 1.2 SITE CHARACTERISTICS	
Elevation	Approximately 6 - 50m AHD
Topography	Undulating low hills and rises, broad crests and ridges with long gentle slopes.
Aspect	Various
Soil Type	Yellow-brown clayey sand, yellow-brown pedal clay and grey massive clays of the Gorokan Soil Landscape, and Deep (>200cm) Yellow Podzolic Soils, Brown Podzolic Soils, Soloths with some Humus Podzols associated with the Wyong Soil Landscape (Murphy, 1992).
Catchment	Wyong River into Tuggerah Lake
Vegetation	- Disturbed roadside vegetation

3. PROPOSED DEVELOPMENT

The proposed development is for a stormwater pipeline from the proposed Precinct 14 industrial development (Warnervale Business Park), which is part of the Wyong Employment Zone (WEZ).

There are two options being considered for the proposed stormwater pipeline.

Option 1 (Preferred)
The proposed pipeline will run from the Hue Hue and Sparks Road intersection southwards along the Hue Hue Road reserve and then along Yarramalong Road reserve to the Wyong River at Alison (total distance approximately 7.9km).

Option 2
The proposed pipeline will run from the Hue Hue and Sparks Road intersection southwards along the Hue Hue Road reserve and then along Jilliby Road reserve to Jilliby Jilliby Creek at Flacks Bridge (total distance approximately 5.6km).

4. SURVEY METHODS

The entire route of both pipeline options were traversed and inspected with regard to vegetation types and fauna habitat value. These surveys were carried out in vehicles and on foot on 4 April 2008. Aspects of the survey included vegetation types, disturbance levels, hollow bearing trees, weed levels and habitat values of the roadside vegetation.

5. VEGETATION

The vegetation types observed along the roadsides of the proposed routes were assessed according to The Natural Vegetation of the Wyong Local Government Area (Bell 2002).

Vegetation communities (according to Bell 2002) observed along the roadsides were:

MU 19	- Alluvial Woollybutt-Melaleuca Sedge Forest;
MU 30	- Narrabeen Dooralong Spotted Gum / Ironbark Forest;
MU 30Xr	- Narrabeen Dooralong Spotted Gum / Ironbark Forest (Regrowth);
MU 40	- Riverine Alluvial Gallery Rainforest-Moist Forest;
Xr	- Unspecified Canopy Only;
Xs	- Unspecified Regrowth Only.

The vegetation types within the road reserves were mostly disturbed remnants of the adjoining vegetation. Disturbances such as weed invasion, partial or complete removal of the tree, shrub and/or ground layers, dumping of rubbish, driveways and soil or vegetation disturbances due to installation of services such as water, electricity, telecommunications and others.

6. THREATENED FLORA SPECIES

A search of the Atlas of NSW Wildlife (NPWS, 2008) was undertaken to identify records of threatened flora species located within 10km of the site. Details on threatened flora species, as listed in Schedules 1 and 2 of the *Threatened Species Conservation Act* (1995), with a known or likely occurrence within the local area, are provided in Table 2.2.

TABLE 2.2 THREATENED FLORA SPECIES OF THE AREA				
Species	**TSC Act**	**EPBC Act**	**Growth Form and Habitat Requirements**	**Comments**
Acacia bynoeana	E1	V	Erect or spreading shrub to 0.3 m high growing in heath and dry sclerophyll open forest on sandy soils. Often associated with disturbed areas such as roadsides. Distribution limits N- Newcastle S- Berrima.	Suitable habitat is present. Not observed during flora survey.
Angophora inopina	V	V	Erect or low spreading shrub 0.2-1m tall. Grows on sandy soils in heath, woodland and open forests from Morisset to Warnervale	Suitable habitat is present. Not observed during flora survey.
Callistemon linearifolius	V	-	Shrub to 4m high. Grows in Sclerophyll Forest in moist gullies on coast and adjacent ranges, Nelson Bay to Georges River.	Suitable habitat is present. Not observed during flora survey.
Caladenia tessellata	E1	V	Terrestrial orchid. Clay-loam or sandy soils. Distribution limits N-Swansea S- south of Eden.	Suitable habitat is present. Not observed during flora survey.
Cryptostylis hunteriana	V	V	Saprophytic orchid. Grows in swamp heath on sandy soils. Distribution limits N-Gibraltar Range S- south of Eden.	No suitable habitat is present. Not observed during flora survey.
Eucalyptus camfieldii	V	V	Stringybark to 10 m high. Grows on coastal shrub heath and woodlands on sandy soils derived from alluviums and Hawkesbury sandstone. Distribution limits N - Norah Head S - Royal NP.	No suitable habitat is present. Not observed during flora survey.
Eucalyptus pumila	V	V	Mallee species only known from Pokolbin State Forest	No suitable habitat is present. Not observed during flora survey.
Grevillea parviflora subsp *parviflora*	V	V	Open to erect shrub to 1 metre. Grows in woodland on light clayey soils Distribution limits N – Cessnock S - Appin	Suitable habitat is present. Not observed during flora survey.
Melaleuca biconvexa	V	V	Tall shrub. Grows in wetlands adjoining perennial streams and on the banks of those streams, generally within the geological series known as the Terrigal Formation. Distribution limits N – Port Macquarie S – Jervis Bay.	Suitable habitat is present. Not observed during flora survey.

TABLE 2.2 (Cont.) THREATENED FLORA SPECIES OF THE AREA				
Species	**TSC Act**	**EPBC Act**	**Growth Form and Habitat Requirements**	**Comments**
Syzygium paniculatum	V	V	Small tree. Subtropical and littoral rainforest on sandy soil. Distribution limits N - Forster S - Jervis Bay.	Suitable habitat is present. Not observed during flora survey.
Rhizanthella slateri (Underground Orchid)	V	E	A terrestrial saprophytic underground orchid with a fleshy underground stem with overlapping bracts. Known from SE Qld to NSW South Coast in eucalypt forest. Flowers from Oct to Nov.	Suitable habitat is present. Not observed during flora survey.
Rutidosis heterogama	V	V	Small perennial herb to 30cm tall. Grows in heaths in clay soils and has been recorded along disturbed roadsides. Distribution limits N – Yuraygir NP S - Wyong.	Suitable habitat is present. Not observed during flora survey.
Tetratheca juncea	V	V	Prostrate shrub to 1 m high. Dry sclerophyll forest and heath. Distribution limits N - Bulahdelah S - Port Jackson.	Suitable habitat is present. Not observed during flora survey.
E = Endangered Species			V = Vulnerable Species	

It is considered that there is suitable habitat for *Acacia bynoeana, Angophora inopina, Callistemon linearifolius, Caladenia tessellata, Grevillea parviflora* subsp *parviflora, Melaleuca biconvexa, Syzygium paniculatum, Rhizanthella slateri, Rutidosis heterogama* and *Tetratheca juncea* within the subject site.

No threatened flora species as listed in the *Threatened Species Conservation Act* (1995) and the *Environmental Protection and Biodiversity Conservation Act* (1999) were observed within the subject site.

7. THREATENED FAUNA SPECIES

A search of the Atlas of NSW Wildlife (NPWS, 2008) was conducted for threatened fauna recorded within 10km of the subject site. This revealed a number of threatened species that may be present in the area. Details on threatened fauna species (Schedule 1 or 2) which are known to occur within the area are provided in Table 3.3. Only those species identified with suitable habitat present on site will be further assessed in the seven part test in Section 4 of this document.

TABLE 3.3 RECORDED THREATENED FAUNA OF THE AREA				
Common Name ***Scientific Name***	**TSC Act**	**EPBC Act**	**Preferred Habitat**	**Comments**
Green and Golden Bell Frog *Litoria aurea*	E	V	Prefers the edges of permanent water, streams, swamps, creeks, lagoons, farm dams and ornamental ponds. Often found under debris. Distribution Limit - N-Byron Bay. S-South of Eden	Suitable habitat present. Not observed during survey.

TABLE 3.3 (Cont.) RECORDED THREATENED FAUNA OF THE AREA				
Common Name ***Scientific Name***	**TSC Act**	**EPBC Act**	**Preferred Habitat**	**Comments**
Green Thighed Frog *Litoria brevipalmata*	V	-	Found in rainforests and open forests within or at the edge of streams, swamps, lagoons, dams and ponds. Distribution Limit - N-Border Ranges National Park. S-Near Gosford	Suitable habitat present. Not observed during survey.
Littlejohn's Tree Frog *Litoria littlejohnii*	V	V	Found in wet and dry sclerophyll forest associated with sandstone outcrops at altitudes 280-1000m on eastern slopes of Great Dividing Range. Prefers flowing rocky streams. Distribution Limit – N-Hunter River. S-Eden	No suitable habitat present.
Wallum Froglet *Crinia tinnula*	V	-	Found in acidic paperbark swamps and Wallum country with dense groundcover. Breeds in temporary and permanent pools and ponds of high acidity. Distribution Limit - N-Tweed Heads S-Tumbi Umbi.	No suitable habitat present.
Giant Burrowing Frog *Heleioporus australiacus*	V	V	Inhabits open forests and riparian forests along non-perennial streams, digging burrows into sandy creek banks. Distribution Limit- N-Near Singleton. S-South of Eden	Sub - optimal habitat present. Not observed during survey.
Stuttering Frog *Mixophyes balbus*	E	V	Terrestrial inhabitant of rainforest and wet sclerophyll forests. Distribution Limit - N-Near Tenterfield. S-South of Bombala.	Sub - optimal habitat present. Not observed during survey.
Giant Barred Frog *Mixophyes iteratus*	E	E	Terrestrial inhabitant of rainforest and open forests. Distribution Limit- N-Border Ranges National Park. S-Narooma.	Sub - optimal habitat present. Not observed during survey.
Red-crowned Toadlet *Pseudophryne australis*	V	-	Prefers sandstone areas, breeds in grass and debris beside non-perennial creeks or gutters. Individuals can also be found under logs and rocks in non breeding periods. Distribution Limit- N-Pokolbin S-Near Wollongong	No suitable habitat present.
Speckled Warbler *Chthonicola sagittata*	V	-	Found in temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts. Distribution Limit - N-Urbanville. S-Eden	Suitable foraging and roosting habitat present. Not observed during survey.
Australasian Bittern *Botaurus poiciloptilus*	V	-	Inhabits shallow freshwater or brackish wetlands with tall dense beds of reeds, sedges or rush species and swamp edges. Distribution Limit - N-North of Lismore. S- Eden.	No suitable habitat present.
Black Bittern *Dupetor flavicollis*	V	-	Forages in freshwater & brackish streams & ponds. Distribution Limit - N-Tweed Heads. S-South of Eden.	Foraging habitat present. Not observed during survey.

TABLE 3.3 (Cont.) RECORDED THREATENED FAUNA OF THE AREA				
Common Name ***Scientific Name***	**TSC Act**	**EPBC Act**	**Preferred Habitat**	**Comments**
Bush Stone-curlew *Burhinus grallarius*	E	-	Utilises open forests and savanna woodlands, sometimes dune scrub, savannah and mangrove fringes. Distribution Limit- N-Border Ranges National Park S-Near Nowra	Sub – optimal foraging habitat present. Not observed during survey.
Gang-gang Cockatoo *Callocephalon fimbriatum*	V	-	Prefers wetter forests and woodlands from sea level to > 2000m on Divide, timbered foothills and valleys, timbered watercourses, coastal scrubs, farmlands and suburban gardens. Distribution Limit –mid north coast of NSW to western Victoria	Suitable foraging and roosting habitat present. Not observed during survey.
Glossy Black-Cockatoo *Calyptorhynchus lathami*	V	-	Open forest with Allocasuarina species and hollows for nesting. Distribution Limit- N-Tweed Heads S-Sth of Eden.	Suitable foraging and roosting habitat present. Not observed during survey.
Black-necked Stork *Ephippiorhynchus asiaticus*	E	-	Occurs in tropical to warm temperate terrestrial wetlands, estuarine and littoral habitats. Distribution Limit - N-Tweed Heads. S-Nowra.	Sub – optimal foraging habitat present. Not observed during survey.
Superb Fruit-dove *Ptilinopus superbus*	V	-	Rainforests, adjacent mangroves, eucalypt forests, scrubland with native fruits. Distribution Limit - N-Border Ranges National Park. S-Bateman's Bay.	No suitable habitat present.
Pied Oystercatcher *Haematopus longirostris*	V	-	Inhabits coastal beaches and estuarine flats. Distribution Limit N-Tweed Heads S-South of Eden.	No suitable habitat present.
Comb-crested Jacana *Irediparra gallinacea*	V	-	Deep and permanent vegetation-choked tropical and warm temperate wetlands. Distribution Limit - N-Tweed Heads. S - Ku-ring-gai Chase National Park.	No suitable habitat present.
Painted Honeyeater *Grantiella picta*	V	-	Found in open forest, woodland and scrubland feeding on mistletoe fruits. Distribution Limit- N-Boggabilla S-Albury.	Suitable foraging and roosting habitat present. Not observed during survey.
Regent Honeyeater *Xanthomyza phrygia*	E	E	Found in temperate Eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature Eucalypts. Distribution Limit - N-Urbanville. S-Eden.	Suitable foraging and roosting habitat present. Not observed during survey.
Swift Parrot *Lathamus discolor*	E	E	Inhabits Eucalypt forests and woodlands with winter flowering Eucalypts. Distribution Limit - N-Border Ranges National Park. S-South of Eden.	Suitable foraging habitat present. Not observed during survey.

TABLE 3.3 (Cont.) RECORDED THREATENED FAUNA OF THE AREA				
Common Name ***Scientific Name***	**TSC Act**	**EPBC Act**	**Preferred Habitat**	**Comments**
Turquoise Parrot *Neophema pulchella*	V	-	Inhabits coastal scrubland, open forest and timbered grassland, especially ecotones between dry hardwood forests and grasslands. Distribution Limit - N-Near Tenterfield. S-South of Eden.	Suitable foraging and roosting habitat present. Not observed during survey.
Barking Owl *Ninox connivens*	V	-	Inhabits principally woodlands but also open forests and partially cleared land and utilises hollows for nesting. Distribution Limits- N-Border Ranges National Park S-Eden	Suitable foraging and roosting habitat present. Not observed during surveys.
Powerful Owl *Ninox strenua*	V	-	Forests containing mature trees for shelter or breeding and densely vegetated gullies for roosting. Distribution Limits - N-Border Ranges National Park. S-South of Eden.	Suitable foraging and roosting habitat present. Not observed during surveys.
Masked Owl Tyto novaehollandiae	V	-	Open forest and woodlands with cleared areas for hunting and hollow trees for roosting. Distribution Limit - N-Border Ranges National Park S-Eden.	Suitable foraging and roosting habitat present. Not observed during survey.
Sooty Owl *Tyto tenebricosa*	V	-	Tall, dense, wet forests containing trees with very large hollows. Distribution Limit - N-Border Ranges National Park. S-South of Eden	Sub - optimal foraging and roosting habitat present. Not observed during survey.
Spotted-tailed Quoll *Dasyurus maculatus*	V	V	Dry and moist open forests containing rock caves, hollow logs or trees. Distribution Limit- N-Mt Warning National Park S-South of Eden.	Suitable foraging and roosting habitat present. Not observed during survey.
Parma Wallaby *Macropus parma*	V	-	Inhabits rainforests and wet and dry sclerophyll forests with a dense understorey and associated grassy patches. Distribution Limit - N-Border Ranges National Park. S-Morton National Park.	Sub-optimal habitat present. Not observed during survey.
Southern Brown Bandicoot *Isoodon obesulus*	E	E	Utilises a range of habitats containing thick ground cover - open forest, woodland, heath, cleared land, urbanised areas and regenerating bushland. Distribution Limit - N-Kempsey. S-South of Eden.	No suitable habitat present.
Yellow-bellied Glider *Petaurus australis*	V		Tall mature eucalypt forests with high nectar producing species and hollow bearing trees. Distribution Limit- N-Border Ranges National Park. S-South of Eden.	Sub-optimal foraging and den habitat present. Not observed during survey.

TABLE 3.3 (Cont.) RECORDED THREATENED FAUNA OF THE AREA				
Common Name *Scientific Name*	TSC Act	EPBC Act	Preferred Habitat	Comments
Squirrel Glider *Petaurus norfolcensis*	V	-	Mixed aged stands of Eucalypt forest and woodlands including gum barked, high nectar producing species and hollow bearing trees. Distribution Limit - N-Lismore. S-Albury	Suitable foraging and den habitat present. Not observed during survey.
Koala *Phascolarctos cinereus*	V	-	Inhabits both wet & dry Eucalypt forest on high nutrient soils containing preferred feed trees. Distribution Limit- N-Tweed Heads S-South of Eden.	Sub-optimal foraging habitat present. Not observed / detected during survey.
Grey-headed Flying-fox Pteropus poliocephalus	V	V	Found in a variety of habitats including rainforest, mangroves, paperbark swamp, wet and dry open forest and cultivated areas. Forms camps commonly found in gullies and in vegetation with a dense canopy. Distribution Limit – N – Tweed Heads S - Eden	Suitable foraging habitat present. Not observed during survey.
Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris*	V	-	Rainforests, sclerophyll forests and woodlands. Distribution Limit - N-North of Walgett. S-Sydney.	Suitable foraging and shelter habitat present. Not detected during survey.
Eastern Freetail-bat *Mormopterus norfolkensis*	V	-	Inhabits open forests and woodlands foraging above the canopy and along the edge of forests. Roosts in tree hollows, under bark and buildings. Distribution Limit - N-Woodenbong. S-Pambula.	Suitable foraging and shelter habitat present. Not detected during survey.
Large-eared Pied Bat *Chalinolobus dwyeri*	V	V	Warm-temperate to subtropical dry sclerophyll forest and woodland. Roosts in caves, tunnels and tree hollows in colonies of up to 30 animals. Distribution Limit - N-Border Ranges Nation Park. S-Wollongong.	Suitable foraging and shelter habitat present. Not detected during survey.
Eastern False Pipistrelle *Falsistrellus tasmaniensis*	V	-	Recorded roosting in caves, old buildings and tree hollows. Distribution Limit- N-Border Ranges National Park S-Pambula	Suitable foraging and shelter habitat present. Not detected during survey.
Little Bentwing-bat *Miniopterus australis*	V	-	Roosts in caves, old buildings and tree hollows in the higher rainfall forests along the south coast of Australia. Distribution Limit - N-Border Ranges National Park. S-Sydney.	Suitable foraging habitat present. Not detected during survey.
Eastern Bentwing-bat *Miniopterus schreibersii oceanensis*	V	-	Prefers areas where there are caves, old mines, old buildings, stormwater drains & well timbered areas. Distribution Limit - N-Border Ranges National Park. S-South of Eden.	Suitable foraging habitat present. Not detected during survey.

TABLE 3.3 (Cont.) RECORDED THREATENED FAUNA OF THE AREA				
Common Name ***Scientific Name***	**TSC Act**	**EPBC Act**	**Preferred Habitat**	**Comments**
Large-footed Myotis *Myotis adversus*	V	-	Rainforests and sclerophyll forests near creeks and lakes over which it feeds. Roosts in tree hollows, caves, mines and tunnels. Distribution Limit - N-Border Ranges Nation Park. S-South of Eden.	Suitable foraging and shelter habitat present. Not detected during survey.
Greater Broad-nosed Bat *Scoteanax rueppellii*	V	-	Inhabits areas containing moist river & creek systems especially tree lined creeks. Distribution Limit - N-Border Ranges National Park. S-Pambula.	Suitable foraging and shelter habitat present. Not detected during survey.

No threatened fauna species as listed in the *Threatened Species Conservation Act* (1995) and the *Environmental Protection and Biodiversity Conservation Act* (1999) were observed within the subject site.

8 ENDANGERED POPULATIONS / ECOLOGICAL COMMUNITIES

8.1 Endangered Populations

One species (*Eucalyptus parramattensis* subsp. *parramattensis*) has been listed as an endangered population in the Wyong and Lake Macquarie Local Government Areas on Part 2 of Schedule 1 of the *TSC Act* (1995). This species has not been recorded within the subject site (NPWS, 2008; Bell and Murray, 2007). It is therefore considered that no specimens constituting part of this endangered population are present within the subject site.

8.2 Endangered Ecological Communities

There are six (6) Endangered Ecological Communities (EECs) listed in the *Threatened Species Conservation Act* (1995) present in the local area. Details regarding the habitat attributes and indicative species for these communities are provided in Table 2.3.

TABLE 2.3 ENDANGERED ECOLOGICAL COMMUNITIES OF THE AREA		
Name	**Habitat Requirements**	***Comments***
Freshwater Wetlands on Coastal Floodplains (FWCF)	**Geology / Soils:** Silts, muds or humic loams. **Topography:** in depressions, flats, drainage lines, backswamps, lagoons and lakes associated with coastal floodplains with a recurring flood interval of less than 1 in 100 years. **Characteristic Species:** *Carex appressa, Paspalum distichum, Baumea articulata, Phylidrum lanuginosum, Ludwigia peploides ssp. montevidensis and Myriophyllum spp.*	No suitable habitat present. Not observed on site.

TABLE 2.3 (Cont.) ENDANGERED ECOLOGICAL COMMUNITIES OF THE AREA		
Name	**Habitat Requirements**	***Comments***
Low Woodland with Heathland on indurated sand	**Geology / Soils:** Indurated (hardsetting) sands with a range of local variation in drainage conditions. **Topography:** low rolling sandy hills – restricted to Norah Head east of Wilfred Barrett Drive. **Characteristic Species**: *Eucalyptus camfieldii, Melaleuca quinquenervia, Melaleuca thymifolia, Lambertia formosa, Corymbia gummifera, Acacia longifolia, Banksia oblongifolia, Allocasuarina distyla* and *Melaleuca sieberi.*	No suitable habitat present. Not observed on site.
River-flat Eucalypt Forest on Coastal Floodplains	**Geology / Soils:** Silts, clay-loams and sandy loams. **Topography:** Periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains with a recurring flood interval of less than 1 in 100 years. **Characteristic Species:** *Eucalyptus tereticornis, E. amplifolia, E. botryoides, E. grandis, E. benthamii, Angophora floribunda, A. subvelutina, Melaleuca decora, M. stypheloides, Backhousia myrtifolia, Casuarina cunninghamiana* and *Casuarina glauca.*	Suitable habitat present. Observed on site. Corresponds to Map Unit 19 – Alluvial Woollybutt-Melaleuca Sedge Forest and Map Unit 40 – Riverine Alluvial Gallery Rainforest-Moist Forest (Bell 2002)
Swamp Oak Floodplain Forest (SOFF)	**Geology / Soils:** Alluvial soils of fluvial or estuarine origin, with significant salinity. **Topography:** Flood plains in areas with saline soils and flats adjoining estuaries. **Characteristic Species:** *Casuarina glauca.*	No suitable habitat present. Not observed on site.
Swamp Sclerophyll Forest on Coastal Floodplains (SSFCF)	**Geology / Soils:** Waterlogged or periodically inundated humic clay loams and sandy loams. **Topography:** Alluvial flats and drainage lines of coastal floodplains with a recurring flood interval of less than 1 in 100 years. **Characteristic Species:** includes species such as *Eucalyptus robusta, Melaleuca quinquenervia and Eucalyptus botryoides.*	No suitable habitat present. Not observed on site.
Sydney Freshwater Wetlands (SFW)	**Geology / Soils:** Generally on the Warriewood and Tuggerah Soil Landscapes (Chapman and Murphy 1989). **Topography:** Swales and depressions on sand dunes and sandplain sites. **Characteristic Species:** *Eleocharis sphacelata*, *Baumea juncea*, *B. rubignosa*, *B. articulata*, *Gahnia sieberiana*, *Ludwigia peploides* and *Persicaria sp*	No suitable habitat present. Not observed on site.

Due to the presence of suitable habitat and indicator species it is considered that one of these Endangered Ecological Communities (EECs) known as River Flat Eucalypt Forest on Coastal Floodplains (RFEFCF) is present on the subject site.

The RFEFCF EEC corresponds to Map Unit 19 – Alluvial Woollybutt-Melaleuca Sedge Forest and Map Unit 40 – Riverine Alluvial Gallery Rainforest-Moist Forest (Bell 2002). These vegetation communities were described in detail in Bell (2002).

9. KOALA HABITAT ASSESSMENT

Potential Koala habitat is defined as at least 15% koala feed tree species (as listed in Schedule 2 of the SEPP 14 – Koala Habitat Protection) in the upper or lower strata.

Core koala habitat is defined as an area of land with a resident population of koalas as evidenced by attributes such as breeding females, recent sightings of and historical records of a population.

The list of tree species in Schedule 2 of SEPP 44 is listed in Table 3.4.

TABLE 3.4
SEPP 14 - KOALA HABITAT PROTECTION - SCHEDULE 2 TREE SPECIES
(adapted from FFS, 2007)

Scientific Name	Common Name	Tree Species in Study Area
Eucalyptus albens	White Box	No
Eucalyptus camaldulensis	River Red Gum	No
Eucalyptus haemastoma	Broad-leaved Scribbly Gum	No
Eucalyptus microcorys	Tallowwood	No
Eucalyptus populnea	Bimble Box	No
Eucalyptus punctata	Large-fruited Grey Gum	YES
Eucalyptus robusta	Swamp Mahogany	YES
Eucalyptus signata	Scribbly Gum	No
Eucalyptus tereticornis	Forest Red Gum	YES
Eucalyptus viminalis	Ribbon Gum	No

There were three (3) species of Koala feed trees listed in Schedule 2 of SEPP N^0 44 – Koala Habitat Protection identified within the subject site.

No evidence of a Koala population was recorded in the proposed route by any of the previous fauna investigation surveys. A review of all records of the species on the Wildlife Atlas (NPWS, 2008) show several records occur within a five kilometres of the site. Historical records of Koala in the locality include:

- Near the Porter's Creek Wetland in the 1970's (immediately east of the study area)(Andrews Neil, 1996a);
- In proximity to the Warnervale Town Centre in 1994 (approximately 2 kilometres to the north-east)(DEC Wildlife Atlas, 2005); and
- In proximity to the township of Warnervale in 2003 (Scott Duncan, Wyong Shire Council, personal communications – in Bell and Murray 2007).

Potential Koala habitat as defined in SEPP 44 (>15% of Schedule 2 trees in the upper and lower strata) occurs within small pockets within the study area.

No evidence of core habitat was recorded in the study area. No fresh or old scats were evident to suggest a resident population of Koala utilise feed trees in study area.

10. IMPACT ON THREATENED SPECIES (7-part Test)

As identified in Section 5(A) of the *EP&A Act* 1979 the following matters need to be addressed to determine whether or not a significant effect on threatened species, populations or ecological communities or their habitats is likely to result from the proposed development.

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

FLORA

It is considered that there is either sub-optimal or suitable habitat for *Acacia bynoeana, Angophora inopina, Caladenia tessellata, Callistemon linearifolius, Grevillea parviflora* subsp. *parviflora, Melaleuca biconvexa, Rhizanthella slateri, Rutidosis heterogama, Syzygium paniculatum* and *Tetratheca juncea,* within the subject site. No threatened species as listed in the *Threatened Species Conservation Act* (1995) were observed on the subject site.

Acacia bynoeana

Occurs mainly in heath and dry open forests or woodlands on sandy soils and loamy clay soils (Harden, 1994; Tame, 1992), often with ironstone gravels (Benson & McDougall, 1996). The drier parts of the subject site such as the higher areas on slopes provide suitable habitat for this species.

This species was not observed during detailed surveys of the subject site. It is considered that the proposed action is not likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Angophora inopina

This species is a small tree which is easily identifiable. The known distribution of *Angophora inopina* is from the Great Lakes to the Gosford LGAs. It was observed during detailed surveys of the subject site. Between 50 and 100 plants were observed within the 20f – Alluvial Floodplain Shrub Swamp Forest (sedge-scrub variant) in the north-eastern part of Precinct 14.

This species was not observed during detailed surveys of the subject site. Due to the presence of other specimens of this species within the local area within a Public Reserve it is considered that the proposed action is not likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

***Caladenia tessellata* (Thick-lip Spider Orchid)**

The flowering period for *Caladenia tessellata* is between September and October. The flora surveys of the subject site took place on 7th September, 7 & 25 October 2005 during the flowering period for this species. This species was detected within the Warnervale Airport Lands. In the Gosford/Lake Macquarie District *Caladenia tessellata* has been recorded in open forest in soils of the Woodbury's Bridge or Wyong Soil Landscapes at Wyong and from Munmorah State Recreation Area. This species favours low open forest with a heathy or sometimes grassy understorey (Bishop, 2000). This orchid often grows in dense shrubbery in coastal areas and is often only evident after fire (Bishop, 2000).

The subject site contains areas of the Wyong Soil Landscape which is favoured by this species. The current and past land uses such as clearing, continuing underscrubbing, soil disturbance and introduction of exotic plants indicate that the presence of this species is unlikely within disturbed areas. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Callistemon linearifolius
This species grows in woodland or dry sclerophyll forest on the coast and adjacent ranges. It grows in damp places such as gullies on sandstone. This species is easily identifiable when not in flower. Despite detailed searches this species was not observed on the subject site, which indicates that the presence of this species is unlikely. It is considered that the action proposed is not likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Grevillea parviflora* subsp. *parviflora
This species favours light clay soils in woodlands. Flowers appear mainly in spring but also sporadically throughout the year. This species is easily identifiable when not in flower. The distribution of this species is from West of Prospect (where now it is almost certainly extinct), Kemps Ck and lower Georges River, South to Camden, Appin and Cordeaux Dam, with disjunct northern populations South of Putty and near Cessnock and Cooranbong, possibly also South of Moss Vale.

This species was not observed during detailed surveys of the subject site. Additional specimens of this species have been observed within the Warnervale Business Park land. Further specimens of this species were observed approximately 300 metres to the south-east and 2.5km to the south-east of Precinct 14 of the Wyong Employment Zone (Bell and Murray, 2007).

The majority of occurrences of this species will be retained within the Public Reserve to the north-east of Precinct 14 within Lots 10 and 11 DP 23906. Due to the absence of this species within the proposed pipeline route and the retention of the majority of this species within a Public Reserve it is considered that the proposed action is not likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Melaleuca biconvexa
This species is a paperbark shrub or small tree which prefers poorly drained habitats near swamps and along drainage lines. The geographical distribution of this species is predominantly the Central Coast in the Gosford / Wyong area with disjunct populations near Jervis Bay and Port Macquarie (NSW Scientific Committee, 1998). A population of this species is considered to be all individuals within the same catchment (NPWS, 1996).

This species was not observed on the subject site. Large numbers of this species have been recorded within a 10km radius of the subject site (NPWS, 2008). It is therefore considered that the action proposed is not likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

***Rhizanthella slateri* (an Underground Orchid)**
This species is a terrestrial saprophytic orchid. Flowers mature below the soil surface (Oct – Nov) and rarely extend to 2cm high above the soil surface. This species grows

in eucalypt forest but no informative assessment of the likely preferred habitat for this species is available (NSW Scientific Committee, 2002). The distribution of this species is from southern Queensland to the south coast of NSW. This species has been recorded from Buladelah, Watagan Mountains, Blue Mountains, Wisemans Ferry, Agnes Banks and near Nowra (NSW Scientific Committee, 2002).

This species has not been recorded within 10km of the site (NPWS, 2008). This species was not observed within the subject site. Due to the lack of local records (NPWS, 2008) and the presence of other areas of similar vegetation within the local area, it is considered that the action proposed is not likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Rutidosis heterogama

This species grows in heath in clay soils and has been recorded along disturbed roadsides. Distribution is from Minnie Water in Yuraygir National Park to Wyong. The flowering period for this species is from November to January (Harden, 1994) with spot flowers occurring at other times of the year.

No occurrences of this species were observed within the subject site. However, due to the presence of other large areas of similar vegetation within the local area, and the known occurrence of populations of this species at two locations within 3km east of Precinct 14 (Conacher Travers, 2007; Murray and Bell, 2004), it is considered that the action proposed is not likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Syzygium paniculatum

Syzygium paniculatum is found predominantly along the coast on headlands and ranges. It is usually found growing in or near subtropical and littoral rainforests on sandy soils, stabilised dunes near the sea or sheltered gullies, especially near watercourses (Fairly & Moore, 1989; Harden, 1994).

This species was not observed within the subject site during detailed surveys of the subject site. It is considered that the proposed action is not likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Tetratheca juncea

Tetratheca juncea occurs chiefly in coastal districts on sandy, and occasionally swampy, heath and open forest (Fairly & Moore, 1989; Harden, 1994). A review of the distribution of *T. juncea* suggests that it is concentrated around Lake Macquarie with small populations occurring as far north as Bulahdelah and south to the Wyong area (SWC Consultancy, 1992; Ecological Surveys and Management, 1998). *Tetratheca juncea* has been recorded at a number of localities within the Wyong Local Government Area. The preferred habitat for this species is described as being on a southerly aspect (161° - 240°) on ridges and upper slopes with good drainage with dry understorey (Ecological Surveys and Management, 1998). The preferred soil types in descending order are Awaba, Warners Bay, Gateshead, Norah Head, Doyalson and Killingworth soil landscapes (Ecological Surveys and Management, 1998). *Tetratheca juncea* is known to occur within four (4) conservation reserves throughout the Sydney Basin Bio-region including: Glenrock SRA, Awabakal NR, Munmorah SRA and Lake Macquarie SRA (NPWS, 2008). It is considered that suitable soil landscapes and other habitat attributes exist on the subject site for this species.

This species was not observed on-site. Several specimens are to be retained within the proposed Public Reserve in the north-eastern parts of Precinct 14. Additional occurrences of this species were found approximately 1.2km to the south-east of Precinct 14 within Precincts 11 and 13 of the Wyong Employment Zone. Further populations are located within the southern sections of Warnervale Business Park approximately 2km south of the Precinct 14 and also within the Wyong Employment Zone. Due to the retention of this species within a public reserve, it is considered that the action proposed is not likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

FAUNA

In relation to threatened fauna species with suitable habitat present on-site the following assessments are provided.

Green and Golden Bell Frog (*Litorea aurea*)

The Green and Golden Bell Frog utilises vegetation along the edge of streams, swamps, farm dams, lagoons and ponds for breeding, foraging and shelter (Cogger, 1992). The creek, and associated drainage line present on the subject site provides habitat for this species based on the habitat requirements identified by Pyke and White (1996) and Cogger (1992).

Although the subject site provides some suitable habitat for this species, the Green and Golden Bell Frog was not detected within the subject site. The proposed development will retain the creeklines and its associated riparian vegetation. This species would use all of the potential habitat within the local area and not the subject site exclusively. Therefore, the action proposed is not likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Green Thighed Frog *(Litoria breviplamata)*

The preferred habitats of the Green-thighed Frog are largely unknown. The Green-thighed Frog has been found in mostly terrestrial habitats including along the grassy margins of semi-permanent and permanent ponds in late spring and summer (Cogger 2000), rainforests, moist open forest (Robinson, 1993), drier open forest and woodland (McDonald, 1974, Nattrass & Ingram, 1993), coastal swamp forest (SFNSW 1995) and along the perimeter of flooded paddocks (Barker *et al*, 1995).

This species was not observed within the subject site during detailed searches. This species is widespread and occurs at numerous locations within the bioregion. Therefore, the action proposed is not likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Giant Burrowing Frog *(Heleioporus australiacus)*

This species is most common on the Hawkesbury Sandstone in the Sydney region. It occurs south to Victoria. (Barker *et al*, 1995). Males call from beside smaller semi permanent to permanent streams or dams or from burrows within the bank of streams or dams. (Anstis, 2002). They call mainly in spring and late autumn, but also after rain in late summer. A foamy egg mass is laid in a burrow such as an old crayfish hole in a stream bank, or concealed under dense vegetation. (Anstis, 2002).

This species was not observed within the subject site during detailed searches. The proposed development will retain the creeklines and associated riparian vegetation. This species would use the potential habitat within the local area and not the subject

site exclusively. Therefore, the action proposed is not likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Stuttering Frog (*Mixophyes balbus)*
This species is a terrestrial inhabitant of rainforest, Antarctic Beech and moist hardwood forest. They feed principally on insects and small frogs (Cogger, 2000). Males call during spring and summer from beside streams, often well camouflaged on leaf litter, under banks, or on dry parts of the stream floor or logs just above flowing water midstream (Anstis, 2002).

Although the subject site provides sub-optimal habitat, this species was not observed during surveys. The proposed development will retain the creeklines and associated riparian vegetation. It is likely that this species will utilise the extensive areas of vegetation present within the local area such as the Jilliby State Conservation Area, Watagan National Park, Wallarah National park, Awaba State Forest, Heaton State Forest, Glenrock State Conservation Area and Munmorah State Conservation Area as habitat and not the subject site exclusively. It is considered that the proposed development is unlikely to disrupt the life cycle or habitats of this species within the local area to the extent that a viable local population would be placed at risk of extinction.

Giant Barred Frog *(Mixophyes iteratus)*
This large frog inhabits the coast and ranges from south-eastern Qld to mid northern NSW. It is associated with flowing streams in wet sclerophyll forest or rainforest. Males call during spring and summer from the ground, often on leaf litter, near streams or ponds (Anstis, 2002).

Although the subject site provides sub-optimal habitat, this species was not observed during surveys. The proposed development will retain the creeklines and associated riparian vegetation. It is likely that this species will utilise the extensive areas of vegetation present within the local area such as the Jilliby State Conservation Area, Watagans National Park, Wallarah National park, Awaba State Forest, Heaton State Forest, Glenrock State Conservation Area and Munmorah State Conservation Area as habitat and not the subject site exclusively. It is considered that the proposed development is unlikely to disrupt the life cycle or habitats of this species within the local area to the extent that a viable local population would be placed at risk of extinction.

Speckled Warbler *(Pyrrholaemus saggitata)*
Speckled Warblers inhabit mainly grassy ground layer of dry sclerophyll forests and woodlands, often with scattered shrubs in the understorey. This species is mainly insectivorous but will also take seeds and other plant material. (Higgins & Peters, 2002). They are sedentary with no migratory or seasonal movements known. They nest solitary with large exclusive breeding territories, the boundaries of which change little over successive years. They breed most of the year round with a peak from September to November (Higgins & Peters, 2002).

Although the subject site provides suitable foraging and roosting habitat, this species was not observed during surveys. It is likely that this species will utilise the extensive areas of vegetation present within the local area such as the Jilliby State Conservation Area, Watagans National Park, Wallarah National park, Awaba State Forest, Heaton State Forest, Glenrock State Conservation Area and Munmorah State Conservation Area as habitat and not the subject site exclusively. It is considered that the proposed development is unlikely to disrupt the life cycle or

habitats of this species within the local area to the extent that a viable local population would be placed at risk of extinction.

Black Bittern *(Ixobrychus flavicollis)*
The Black Bittern inhabits freshwater and brackish wetlands, ponds and streams with tall dense reed beds (Lindsey, 1992). They usually forage at the edge of running or still water, usually in permanent wetlands fringed by dense vegetation (Marchant & Higgins (Eds), 1998).

Although the subject site provides sub-optimal foraging habitat within the creeklines, this species was not observed during surveys. It is likely that this species will utilise the extensive areas of vegetation present within the local area such as the Jilliby State Conservation Area, Watagans National Park, Wallarah National park, Awaba State Forest, Heaton State Forest, Glenrock State Conservation Area and Munmorah State Conservation Area as habitat and not the subject site exclusively. It is considered that the proposed development is unlikely to disrupt the life cycle or habitats of this species within the local area to the extent that a viable local population would be placed at risk of extinction.

Bush Stone-curlew *(Burhinus grallarius)*
The Bush Stone Curlew occurs in open woodland with fallen branches, leaf-litter, sparse grass, timber along dry watercourses, sand plains with spinifex and mallee, sandy scrub near beaches, mangrove-fringes, country golf courses, timber remnants on roadsides, plantations and also urban areas.

The subject site provides sub-optimal habitat for this species. This species was not observed within the subject site during detailed searches. This species would use all of the potential habitat within the local area and not the subject site exclusively. Therefore, the action proposed is not likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Gang-gang Cockatoo (*Callocephalon fimbriatum*)
A relatively small, dark grey Cockatoo that is associated with a variety of woodland and forest habitats, and occasionally more open areas in south–eastern New South Wales and Victoria. (NSW Scientific Committee, 2001). This species has been observed in eucalypt forests and exotic trees (Morris, 1997), and is known to feed on the seeds of native shrubs and trees, in addition to some exotic species such as the Hawthorn and Cupressus species (Schodde & Tideman, 1986). The Gang-gang Cockatoo nests in hollows in large, dead trees (NSW Scientific Committee, 2001).

This species was not observed within the site during surveys, however, the site provides suitable habitat within the eucalypts. It is expected that this species would use all of the available habitat resources throughout the local area and not the subject site exclusively. Therefore, it is considered that the action proposed is not likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Glossy Black-Cockatoo (*Calyptorhynchus lathami*)
The Glossy Black-Cockatoo inhabits mountain forests, coastal woodland, open forest and trees bordering watercourses where there are substantial stands of casuarinas. Foraging within Casuarinas tends to be concentrated on trees with greater crops of cones. This species nests in large trees with large hollows (dead and alive). The Glossy Black-Cockatoo usually forages close to the nest but is capable of travelling up to 20km away (Clout, 1989).

The subject site provides suitable foraging and roosting habitat, this species was not observed during surveys. It is likely that this species will utilise the extensive areas of vegetation present within the local area such as the Jilliby State Conservation Area, Watagans National Park, Wallarah National park, Awaba State Forest, Heaton State Forest, Glenrock State Conservation Area and Munmorah State Conservation Area as habitat and not the subject site exclusively. It is considered that the proposed development is unlikely to disrupt the life cycle or habitats of this species within the local area to the extent that a viable local population would be placed at risk of extinction.

Black-necked Stork *(Ephippiorhynchus asiaticus)*
The Black-necked Stork usually forages singly but also forages in large family groups in fresh or saline waters up to 0.5 metres deep (Marchant & Higgins, 1990). This species feeds mainly on fish but will also eat reptiles, frog's crabs, insects, rodents and carrion (Schodde & Tiedemann, 1986). The Black-necked Stork occurs throughout tropical and warm temperate terrestrial wetlands, estuarine and littoral habitats and occasionally in grassland and wooded lands (Marchant & Higgins, 1990).

Although the subject site provides sub-optimal foraging habitat, this species was not observed during surveys. It is likely that this species will utilise the extensive areas of vegetation present within the local area such as the Jilliby State Conservation Area, Watagans National Park, Wallarah National park, Awaba State Forest, Heaton State Forest, Glenrock State Conservation Area and Munmorah State Conservation Area as habitat and not the subject site exclusively. It is considered that the proposed development is unlikely to disrupt the life cycle or habitats of this species within the local area to the extent that a viable local population would be placed at risk of extinction.

Painted Honeyeater *(Grantiella picta)*
The Painted Honeyeater inhabits dry forests and woodlands. Its primary food is the fruit of the mistletoes in the genus *Amyema* though it will also take nectar and insects (Garnett & Crowley, 2000). The Painted Honeyeater is nomadic moving north in the winter and south in the summer over eastern Australia, usually travelling in pairs, families or small flocks. Breeding takes place between October and March.

Although the subject site provides suitable foraging and roosting habitat, this species was not observed during surveys. It is likely that this species will utilise the extensive areas of vegetation present within the local area such as the Jilliby State Conservation Area, Watagans National Park, Wallarah National park, Awaba State Forest, Heaton State Forest, Glenrock State Conservation Area and Munmorah State Conservation Area as habitat and not the subject site exclusively. It is considered that the proposed development is unlikely to disrupt the life cycle or habitats of this species within the local area to the extent that a viable local population would be placed at risk of extinction.

Regent Honeyeater *(Xanthomyza phrygia)*
The Regent Honeyeater inhabits mostly dry eucalypt woodlands and forests dominated by box ironbark eucalypts; on inland slopes of Great Divide, especially associations in moister more fertile sites, along creeks, broad river valleys and on lower slopes of foothills. (Higgins *et al*, 2001). Nectar is the principal food but sugary exudates from insects are also used (Oliver 1998, 2000). The Regent Honeyeater is known to breed along the western Slopes of the Great Dividing Range in New South Wales (Bundarra-Barraba district, Capertee Valley).

Although the subject site provides suitable foraging and roosting habitat, this species was not observed during surveys. It is likely that this species will utilise the extensive areas of vegetation present within the local area such as the Jilliby State Conservation Area, Watagans National Park, Wallarah National park, Awaba State Forest, Heaton State Forest, Glenrock State Conservation Area and Munmorah State Conservation Area as habitat and not the subject site exclusively. It is considered that the proposed development is unlikely to disrupt the life cycle or habitats of this species within the local area to the extent that a viable local population would be placed at risk of extinction.

Swift Parrot (*Lathamus discolor*)
This species feeds mainly on nectar and lerp from eucalypt flowers, particularly Blue Gum (*Eucalyptus globulus*). On the mainland, the Swift Parrot congregates where winter flowering species such as Red Ironbark (*Eucalyptus sideroxylon*), White Box (*Eucalyptus albens*), Yellow Gum (*Eucalyptus leucoxylon*) and Swamp Gum (*Eucalyptus ovata*) (Brown, 1989). The Swift Parrot is a migratory species that breeds in Tasmania and its offshore islands in summer (Shepherd, 1994). In late March almost the entire population migrates to mainland Australia (Schodde and Tidemann, 1986).

Although the subject site provides suitable foraging habitat, this species was not observed during surveys. It is likely that this species will utilise the extensive areas of vegetation present within the local area such as the Jilliby State Conservation Area, Watagans National Park, Wallarah National park, Awaba State Forest, Heaton State Forest, Glenrock State Conservation Area and Munmorah State Conservation Area as habitat and not the subject site exclusively. It is considered that the proposed development is unlikely to disrupt the life cycle or habitats of this species within the local area to the extent that a viable local population would be placed at risk of extinction.

Turquoise Parrot (*Neophema pulchella*)
This species is associated with the edges of woodlands and dry sclerophyll forest, including grassy clearings within forests, with a high proportion of native grasses and forbs. The NSW Scientific Committee (1999a) describes this species as being associated with woodlands and open forests with a ground cover of grasses and low understorey of shrubs. The NSW Scientific Committee (1999a) also describe this species as feeding on the seeds of grasses, herbs and shrubs and requiring a reliable source of drinking water.

Although the subject site provides sub-optimal foraging and roosting habitat, this species was not observed during surveys. It is likely that this species will utilise the extensive areas of vegetation present within the local area such as the Jilliby State Conservation Area, Watagans National Park, Wallarah National park, Awaba State Forest, Heaton State Forest, Glenrock State Conservation Area and Munmorah State Conservation Area as habitat and not the subject site exclusively. It is considered that the proposed development is unlikely to disrupt the life cycle or habitats of this species within the local area to the extent that a viable local population would be placed at risk of extinction.

Barking Owl *(Ninox connivens)*
The Barking Owl utilises Dry sclerophyll forests and woodlands of tropical, temperate and semi-arid zones, often dominated by *Eucalyptus,* and containing many large trees suitable for roosting or breeding. This species is both carnivorous and insectivorous, taking mainly insects outside breeding season and more birds and mammals when breeding (Higgins,1999).

Although the subject site provides suitable foraging and roosting habitat, this species was not observed during surveys. It is likely that this species will utilise the extensive areas of vegetation present within the local area such as the Jilliby State Conservation Area, Watagans National Park, Wallarah National park, Awaba State Forest, Heaton State Forest, Glenrock State Conservation Area and Munmorah State Conservation Area as habitat and not the subject site exclusively. It is considered that the proposed development is unlikely to disrupt the life cycle or habitats of this species within the local area to the extent that a viable local population would be placed at risk of extinction.

Powerful Owl *(Ninox strenua)*
The Powerful Owl breeds in open or closed sclerophyll forests and woodlands, including wet sclerophyll forest and dry sclerophyll forest and woodlands. Nest in hollows in large old trees; usually living Eucalyptus, within or below canopy – rarely in dead stags, stumps or broken-off trunks (Higgins, 1999). Powerful Owls are sedentary within home ranges of about 1,000 hectares within open eucalypt, casuarina or *Callitris* pine forest and woodlands, though they often roost in denser vegetation, including rainforest or exotic pine plantations (Garnett & Crowley, 2000). Powerful Owls feed mainly on those medium-sized species of arboreal marsupials that are most readily available at any given locality (Lavazanian *et al,* (1994).

Although the subject site provides suitable foraging and roosting habitat, this species was not observed during surveys. It is likely that this species will utilise the extensive areas of vegetation present within the local area such as the Jilliby State Conservation Area, Watagans National Park, Wallarah National park, Awaba State Forest, Heaton State Forest, Glenrock State Conservation Area and Munmorah State Conservation Area as habitat and not the subject site exclusively. It is considered that the proposed development is unlikely to disrupt the life cycle or habitats of this species within the local area to the extent that a viable local population would be placed at risk of extinction.

Masked Owl (*Tyto novaehollandiae*)
The Masked Owl is widespread through forests and woodlands, utilising caves for shelter in treeless country. The Masked Owl is known to utilise forest margins and isolated stands of trees within agricultural land (Hollands, 1991; Hyem, 1979). This species is often found in heavily disturbed forest where its prey of small and medium sized mammals can be readily obtained (Kavanagh & Peake, 1993). The Masked Owl requires old mature trees with large hollows for breeding and as diurnal roosting sites, being dependent upon hollow bearing trees all year round rather than only during the breeding season (Hyem, 1979).

Although the subject site provides suitable foraging and roosting habitat, this species was not observed during surveys. It is likely that this species will utilise the extensive areas of vegetation present within the local area such as the Jilliby State Conservation Area, Watagans National Park, Wallarah National park, Awaba State Forest, Heaton State Forest, Glenrock State Conservation Area and Munmorah State Conservation Area as habitat and not the subject site exclusively. It is considered that the proposed development is unlikely to disrupt the life cycle or habitats of this species within the local area to the extent that a viable local population would be placed at risk of extinction.

Sooty Owl *(Tyto tenebricosa)*
The Sooty Owls habitat is often but not restricted to, tall old-growth montane forests, including temperate and subtropical rainforest. Mostly occurring in uplands in gullies and on slopes of valleys; rarely on ridges. (Higgins, 1999). Optimal habitat contains

tall eucalypts with large hollows suitable for nesting and roosting, but also a range of hollows that provide shelter for prey. The same nest is used repeatedly, and the owls also roost and occasionally nest in caves. (Garnett & Crowley, 2000).

Although the subject site provides sub-optimal foraging and roosting habitat, this species was not observed during surveys. It is likely that this species will utilise the extensive areas of vegetation present within the local area such as the Jilliby State Conservation Area, Watagans National Park, Wallarah National park, Awaba State Forest, Heaton State Forest, Glenrock State Conservation Area and Munmorah State Conservation Area as habitat and not the subject site exclusively. It is considered that the proposed development is unlikely to disrupt the life cycle or habitats of this species within the local area to the extent that a viable local population would be placed at risk of extinction.

Spotted-tailed Quoll (*Dasyurus maculatus*)
The Spotted-tailed Quoll inhabits a range of forest communities including wet and dry open forest and rainforest. It appears to prefer moist forest types and riparian habitat. It has been recorded from dry sclerophyll forest, open woodland and coastal heathland, and despite its occurrence in inland riparian areas, it also ranges over dry ridges (NSW Scientific Committee, 1999b).

Although the subject site provides suitable habitat, this species was not observed during surveys. It is likely that this species will utilise the extensive areas of vegetation present within the local area such as the Jilliby State Conservation Area, Watagans National Park, Wallarah National park, Awaba State Forest, Heaton State Forest, Glenrock State Conservation Area and Munmorah State Conservation Area as habitat and not the subject site exclusively. It is considered that the proposed development is unlikely to disrupt the life cycle or habitats of this species within the local area to the extent that a viable local population would be placed at risk of extinction.

Parma Wallaby *(Macropus parma)*
The Parma Wallaby's optimum habitat appears to be wet sclerophyll forest with a thick, shrubby understorey associated with grassy patches. Primarily nocturnal, taking cover among shrubs during the day. It feeds on grasses and herbs.

Although the subject site provides sub-optimal habitat, this species was not detected during surveys. It is likely that this species will utilise the extensive areas of vegetation present within the local area such as the Jilliby State Conservation Area, Watagans National Park, Wallarah National Park, Awaba State Forest, Heaton State Forest, Glenrock State Conservation Area and Munmorah State Conservation Area as habitat and not the subject site exclusively. It is considered that the proposed development is unlikely to disrupt the life cycle or habitats of this species within the local area to the extent that a viable local population would be placed at risk of extinction.

Yellow-bellied Glider *(Petaurus australis)*
The Yellow-bellied Glider is an arboreal tree-dwelling mammal. The Yellow-bellied Glider is restricted to tall mature eucalypt forests found within high rainfall regions of temperate through to sub-tropical eastern Australia (Russell, 1988). The bulk of the diet of the Yellow-bellied Glider consists of plant and insect exudates including sap, nectar, honeydew and manna while arthropods and pollen are also eaten (Goldingay & Kavanagh, 1991). Yellow-bellied Gliders occupy large exclusive home ranges between 30 and 65 hectares in size (Goldingay & Kavanagh, 1991).

Although the subject site provides sub-optimal foraging and den habitat, this species was not observed during surveys. It is likely that this species will utilise the extensive areas of vegetation present within the local area such as the Jilliby State Conservation Area, Watagans National Park, Wallarah National Park, Awaba State Forest, Heaton State Forest, Glenrock State Conservation Area and Munmorah State Conservation Area as habitat and not the subject site exclusively. It is considered that the proposed development is unlikely to disrupt the life cycle or habitats of this species within the local area to the extent that a viable local population would be placed at risk of extinction.

Squirrel Glider *(Petaurus norfolcensis)*

The Squirrel Glider is an arboreal, tree dwelling mammal that feeds on nectar, pollen, eucalypt sap, *Acacia* gum, honeydew and arthropods (Quin, 1993). The Squirrel Glider feeds on sugary exudates to obtain its energy requirements and arthropods for protein (Smith, 2002). The Squirrel Glider feeds on nectar of flowering tree species, honeydew and by gleaning arthropods from vegetation. This species also feeds on sap flows by incising the bark of trees. The Squirrel Glider uses tree hollows for den sites either alone or communally.

The subject site provides suitable foraging and den habitat. This species was not observed in the subject site during surveys. It is likely that this species will utilise the extensive areas of vegetation present within the local area such as the Jilliby State Conservation Area, Watagans National Park, Wallarah National Park, Awaba State Forest, Heaton State Forest, Glenrock State Conservation Area and Munmorah State Conservation Area as habitat and not the subject site exclusively. It is considered that the proposed development is unlikely to disrupt the life cycle or habitats of this species within the local area to the extent that a viable local population would be placed at risk of extinction.

Koala *(Phascolarctos cinereus)*

Koalas inhabit forested areas with acceptable Eucalypt food trees, also utilising some other non-Eucalypt species as a food source. Koalas inhabit both wet and dry Eucalypt forest that contain a canopy cover of between 10 and 70% as well as suitable feed trees. (Reed *et al,* 1990).

There are some patches of vegetation containing food trees within the subject site. Although the subject site provides sub-optimal habitat for this species, the Koala was not detected within the subject site by either direct observation, scratches on tree trunks, or by Koala scats. Although a viable population may exist in the locality, it is not expected to occur or likely to be present on the subject site. It is considered that the proposed development is unlikely to disrupt the life cycle or habitats of this species within the local area to the extent that a viable local population would be placed at risk of extinction.

Grey-headed Flying-fox (*Pteropus poliocephalus*)

The Grey-headed Flying-fox inhabits a wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests and cultivated areas. The subject site contains a number of species identified in the diet of the Grey-headed Flying-fox (Parry-Jones & Augee, 2001; Eby, 1998; Parry-Jones & Augee, 1991). These are *Angophora* sp.*, Banksia* sp.*, Cinnamomum camphora, Corymbia* sp.*, Eucalyptus* sp.

Although the subject site provides suitable foraging habitat, this species was not observed during surveys. It is likely that this species will utilise the extensive areas of vegetation present within the local area such as the Jilliby State Conservation Area,

Watagans National Park, Wallarah National Park, Awaba State Forest, Heaton State Forest, Glenrock State Conservation Area and Munmorah State Conservation Area as habitat and not the subject site exclusively. It is considered that the proposed development is unlikely to disrupt the life cycle or habitats of this species within the local area to the extent that a viable local population would be placed at risk of extinction.

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

Although the subject site provides suitable foraging and shelter habitat, this species was not detected during surveys. It is likely that this species will utilise the extensive areas of vegetation present within the local area such as the Jilliby State Conservation Area, Watagans National Park, Wallarah National Park, Awaba State Forest, Heaton State Forest, Glenrock State Conservation Area and Munmorah State Conservation Area as habitat and not the subject site exclusively. It is considered that the proposed development is unlikely to disrupt the life cycle or habitats of this species within the local area to the extent that a viable local population would be placed at risk of extinction.

Yellow-bellied Sheathtail-bat *(Saccolaimus flaviventris)*
The Yellow-bellied Sheathtail-bat inhabits a wide variety of Eucalypt forests, foraging above the canopy in fast flight movements. This species roosts in tree hollows and occasionally in old buildings (Hoye & Richards, 1995a).

Although the subject site provides suitable foraging and shelter habitat, this species was not detected during surveys. It is likely that this species will utilise the extensive areas of vegetation present within the local area such as the Jilliby State Conservation Area, Watagans National Park, Wallarah National Park, Awaba State Forest, Heaton State Forest, Glenrock State Conservation Area and Munmorah State Conservation Area as habitat and not the subject site exclusively. It is considered that the proposed development is unlikely to disrupt the life cycle or habitats of this species within the local area to the extent that a viable local population would be placed at risk of extinction.

Large-eared Pied Bat (*Chalinolobus dwyeri*)
The Large-eared Pied Bat forages for insects below the forest canopy. During the day these bats may roost in caves, mine tunnels and the abandoned nests of Fairy Martins (Dwyer, 1991). The Large-eared Pied Bat may also utilise tree hollows (Schultz *et al,* 1994). The Large-eared Pied Bat is mainly found in drier habitat including dry sclerophyll and woodland, east and west of the Great Dividing Ranges. However Hoye and Dwyer (1995) suggest that from records of the species in subalpine woodland, moist eucalypt forest and near rainforest, it may tolerate a greater range of habitats. The distribution of this bat ranges from inland and south-eastern Queensland to central-eastern and north-eastern NSW (Parnaby, 1992).

Although the subject site provides suitable foraging and shelter habitat, this species was not detected during surveys. It is likely that this species will utilise the extensive areas of vegetation present within the local area such as the Jilliby State Conservation Area, Watagans National Park, Wallarah National park, Awaba State Forest, Heaton State Forest, Glenrock State Conservation Area and Munmorah State Conservation Area as habitat and not the subject site exclusively. It is

considered that the proposed development is unlikely to disrupt the life cycle or habitats of this species within the local area to the extent that a viable local population would be placed at risk of extinction.

Eastern False Pipistrelle *(Falsistrellus tasmaniensis)*
The Eastern False Pipistrelle inhabits warm to cool temperate moist and dry open forests (Strahan, 1995). The Eastern False Pipistrelle roosts mainly in tree hollows, occasionally utilising caves and abandoned buildings (Parnaby, 1992; Phillips, *et al.* 1985).

Although the subject site provides suitable foraging and shelter habitat, this species was not detected during surveys. It is likely that this species will utilise the extensive areas of vegetation present within the local area such as the Jilliby State Conservation Area, Watagans National Park, Wallarah National park, Awaba State Forest, Heaton State Forest, Glenrock State Conservation Area and Munmorah State Conservation Area as habitat and not the subject site exclusively. It is considered that the proposed development is unlikely to disrupt the life cycle or habitats of this species within the local area to the extent that a viable local population would be placed at risk of extinction.

Little Bentwing-bat *(Miniopterus australis)*
The Little Bentwing-bat forages below the canopy within open forests and woodlands, feeding on small insects (Dwyer, 1995a). This species roosts in caves, tunnels, tree hollows and occasionally old buildings (Dwyer, 1995a).

The subject site provides suitable foraging and shelter habitat for this species. The Little Bentwing-bat was not detected within the subject site. It is likely that this species will utilise the extensive areas of vegetation present within the local area such as the Jilliby State Conservation Area, Watagans National Park, Wallarah National park, Awaba State Forest, Heaton State Forest, Glenrock State Conservation Area and Munmorah State Conservation Area as habitat and not the subject site exclusively. It is considered that the proposed development is unlikely to disrupt the life cycle or habitats of this species within the local area to the extent that a viable local population would be placed at risk of extinction.

Eastern Bentwing-bat *(Miniopterus schreibersii oceanensis)*
The Eastern Bentwing-bat forages above and below the canopy within open forests and woodlands, feeding on small insects (Dwyer, 1995b). The Eastern Bentwing-bat is known to roost in a range of habitats including stormwater channels, under bridges, occasionally in buildings, old mines and, in particular, caves (Dwyer, 1995b). Caves are an important resource for this species, particularly for breeding where maternity caves must have suitable temperature, humidity and physical dimensions to permit breeding (Dwyer, 1995b).

The subject site provides suitable foraging habitat for this species. The Eastern Bentwing-bat was detected was not detected within the subject site during surveys. It is likely that this species will utilise the extensive areas of vegetation present within the local area such as the Jilliby State Conservation Area, Watagans National Park, Wallarah National park, Awaba State Forest, Heaton State Forest, Glenrock State Conservation Area and Munmorah State Conservation Area as habitat and not the subject site exclusively. It is considered that the proposed development is unlikely to disrupt the life cycle or habitats of this species within the local area to the extent that a viable local population would be placed at risk of extinction.

Large-footed Myotis *(Myotis adversus)*
The Large-footed Myotis inhabits rainforests and open forests containing creeks and lakes over which it feeds and roosts in tree hollows, caves, mines, under bridges, in tunnels and occasionally buildings (Richards, 1995). The Large-footed Myotis predominantly forages along creeklines and over waterbodies where it takes insects and small fish from on and just below the water surface (Richards, 1995).

Although the subject site provides suitable foraging and shelter habitat, this species was not detected during surveys. It is likely that this species will utilise the extensive areas of vegetation present within the local area such as the Jilliby State Conservation Area, Watagans National Park, Wallarah National park, Awaba State Forest, Heaton State Forest, Glenrock State Conservation Area and Munmorah State Conservation Area as habitat and not the subject site exclusively. It is considered that the proposed development is unlikely to disrupt the life cycle or habitats of this species within the local area to the extent that a viable local population would be placed at risk of extinction.

Greater Broad-nosed bat *(Scoteanax rueppellii)*
The Greater Broad-nosed Bat inhabits open forests and woodlands, foraging throughout these forest types and also along creeks and small river systems (Hoye and Richards, 1995b). This species roost in tree hollows and occasional old buildings (Hoye and Richards, 1995b).

The subject site provides suitable foraging and shelter habitat for this species. The Greater Broad-nosed Bat was not detected within the subject site during surveys. It is likely that this species will utilise the extensive areas of vegetation present within the local area such as the Jilliby State Conservation Area, Watagans National Park, Wallarah National park, Awaba State Forest, Heaton State Forest, Glenrock State Conservation Area and Munmorah State Conservation Area as habitat and not the subject site exclusively. It is considered that the proposed development is unlikely to disrupt the life cycle or habitats of this species within the local area to the extent that a viable local population would be placed at risk of extinction.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

One species (*Eucalyptus parramattensis* subsp. *parramattensis*) has been listed as an endangered population in the Wyong and Lake Macquarie Local Government Areas on Part 2 of Schedule 1 of the *TSC Act* (1995). This species occurs at Warnervale within 10km of the subject site (NPWS, 2008). It is considered that there is no suitable habitat for this species within the subject site. No specimens of this species were observed within the subject site. It is therefore considered that the action proposed is not likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

c) In the case of a critically endangered or endangered ecological community, whether the action proposed:

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

There are no critically endangered ecological communities present within the subject site. Therefore the proposed action is not likely to have an adverse effect on the extent of any critically endangered ecological community such that its local occurrence is likely to be placed at risk of extinction.

Due to the presence of suitable habitat and indicator species it is considered that one Endangered Ecological Communities (EEC) is present on-site. This EEC is River Flat Eucalypt Forest on Coastal Floodplains (RFEFCF).

River Flat Eucalypt Forest on Coastal Floodplains (RFEFCF)
The RFEFCF EEC corresponds to Map Unit 19 – Alluvial Woollybutt-Melaleuca Sedge Forest and Map Unit 40 – Riverine Alluvial Gallery Rainforest-Moist Forest (Bell 2002). This community is located along some of the the drainage lines crossing the proposed route and on the river flats associated with Wyong River and Jilliby Jilliby Creek.

The extent of River Flat Eucalypt Forest on Coastal Floodplain within the proposed pipeline route is less than 400m^2 (0.04hectares) whichever option is used.

The proposed development will remove or disturb a very small proportion of this EEC within the drainage line and riverflat vegetation, therefore, it is considered that the proposed action is not likely to have an adverse effect on the extent of the RFEFCF ecological community such that its local occurrence is likely to be placed at risk of extinction.

ii. Is likely to substantially and adversely modify the composition such that its local occurrence is likely to be placed at risk of extinction,

There are no critically endangered ecological communities present within the subject site. Therefore the proposed action is not likely to substantially and adversely modify the composition of any critically endangered ecological community such that its local occurrence is likely to be placed at risk of extinction.

The River Flat Eucalypt Forest on Coastal Floodplain (RFEFCF) endangered ecological community present within the subject site is to be disturbed or modified within a very small area (approximately 400m^2 or 0.04ha). Therefore it is considered that the proposed development is not likely to substantially and adversely modify the composition of this EEC such that its local occurrence is likely to be placed at risk of extinction.

d) In relation to the habitat of threatened species, populations or ecological community:

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

It is considered that the habitat attributes of the subject site provide known or potential habitat for a number of threatened flora and fauna species and ecological communities as assessed in Parts (a) and (c) of this 7-part test.

The proposed development area is 2.37ha for Option 1 or 1.68ha for Option 2.

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

The subject site is covered by a mosaic of natural bushland and disturbed rural land. The site is bound to the north, south, east and west by similar mosaic vegetation types for a distance of at least 3km in all directions.

The proposed development will be located primarily within existing disturbed land within the road reserves and will retain the majority of the more natural vegetation within the road reserves.

The retention of the majority of the existing bushland areas within the road reserve will maintain the current connectivity within the subject site and the wider area. It is considered that known habitat for a threatened species, population or ecological community within the local area and region is unlikely to become isolated or fragmented as a result of the proposal.

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

The proposed development is likely to remove or modify but not fragment approximately 2.37ha for Option 1 or 1.68ha for Option 2. This disturbance is located within previously disturbed vegetation within the road reserves. Given the retention of the majority of the vegetation within the subject site, and the occurrence of large areas of similar adjoining vegetation it is considered that the habitat to be removed is unlikely to be important to the long-term survival of the species, populations or ecological communities within the locality.

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

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

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

There are no Recovery Plans or Threat Abatement Plans for any of the threatened flora species *Acacia bynoeana, Angophora inopina, Callistemon linearifolius, Caladenia tessellata, Eucalyptus camfieldii, Grevillea parviflora* subsp *parviflora, Melaleuca biconvexa, Syzygium paniculatum, Rhizanthella slateri, Rutidosis heterogama* and *Tetratheca juncea* that have potential habitat within the site.

There are no recovery plans for the River Flat Eucalypt Forest on Coastal Floodplain (RFEFCF) endangered ecological communities.

There are recovery plans for the following threatened fauna species with potential habitat within the subject site: Barking Owl and the Large Forest Owls (Powerful Owl, Masked Owl, Sooty Owl) and the Yellow-bellied Glider. The proposed development is considered generally consistent with the objectives or actions of these Recovery Plans. However these plans emphasise the need for protection of suitable habitat for these species. In this regard the removal of vegetation and habitats as a result of the proposed development does not correspond with the objectives of the Recovery Plans.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The "Clearing of native vegetation" has been listed within Schedule 3 of the *Threatened Species Conservation Act* (1995) as a Key Threatening Process. Removal of native vegetation will occur in association with future development and is therefore classified as a threatening process. The removal of native vegetation on the subject site is not likely to significantly affect the biodiversity of the local area due to the extent of equal or better quality natural vegetation within the local area and the small area of undisturbed native vegetation to be removed.

"Removal of Dead Wood and Dead Trees" has been listed within Schedule 3 of the *Threatened Species Conservation Act* (1995) as a Key Threatening Process, and as such the proposal is of a class of development recognised as a threatening process.

"Loss of Hollow-bearing Trees" has been listed within Schedule 3 of the *Threatened Species Conservation Act* (1995) as a Key Threatening Process. The proposed development is likely to remove 79 (or 39%) of the 203 hollow bearing trees within Precinct 14. As such the proposal is of a class of development recognised as a threatening process. However the remaining 124 hollow bearing trees will be retained within vegetated riparian corridors and Public reserves.

"Invasion of native plant communities by exotic perennial grasses" has been listed within Schedule 3 of the *Threatened Species Conservation Act* (1995) as a Key Threatening Process. The proposal is of a class of development recognised as a threatening process due to possible incursions of grasses such as *Pennisetum clandestinum* (Kikuyu). The proposed development has the potential to increase the number of exotic grass species but will also provide an opportunity to manage the area with regard to weed invasion.

11. COMMONWEALTH LEGISLATION

The *Environment Protection and Biodiversity Conservation Act,* (1999) requires that Commonwealth approval be obtained for certain actions. The Act provides an assessment and approvals systems for actions that have a significant impact on matters of national environment significance (NES). These may include:-

- Wetlands protected by international treaty (the Ramsar Convention);
- Nationally listed threatened species and ecological communities;
- Nationally listed migratory species.

Actions are projects, developments, undertakings, activities, series of activities or alteration of any of these. An action that needs Commonwealth approval is known as a controlled action. A controlled action needs approval where the Commonwealth decides the action would have a significant effect on a NES matter.

Where a proposed activity is located in an area identified to be of NES, or such that it is likely to significantly affect threatened species, ecological communities, migratory species or their habitats, the matter needs to be referred to the Department of the Environment, Water, Heritage and Arts (DEWHA).

No threatened species or ecological communities listed in the EPBC Act (1999) were identified within the subject site.

It is considered that the proposed action does not constitute an NES matter and a referral of this project to the Department of the Environment, Water, Heritage and Arts is not required as the proposed action is not likely to impact on a significant population of nationally listed threatened species or on any nationally listed endangered ecological community.

12. CONCLUSIONS

Based on the detailed field survey and information provided in this report it is concluded that:

i. No threatened flora or fauna species or endangered populations were observed within the subject site.

ii. One endangered ecological community (River Flat Eucalypt Forest on Coastal Floodplains) was observed within the subject site. The proposed development is likely to disturb a very small proportion (approximately 400m^2 or 0.04ha) of this community.

iii. The proposed development is not likely to have a significant effect on threatened species, populations or ecological communities or their habitats.

iv. A Species Impact Statement is not required for the proposed development.

v. A referral to the Department of the Environment, Water, Heritage and Arts (DEWHA) is not considered necessary.

13. REFERENCES

Bell, S.A.J. (2002a) *The natural vegetation of Wyong Local Government Area, Central Coast, New South Wales. Technical Report & Community Profiles*. Report to Wyong Shire Council by Eastcoast Flora Survey.

Environmental Planning and Assessment Act (1979) New South Wales Government.

Environmental Protection and Biodiversity Conservation Act (1999) Commonwealth Government

National Parks and Wildlife Service (2008) Atlas of NSW Wildlife website: http://wildlifeatlas.nationalparks.nsw.gov.au/wildlifeatlas/watlas.jsp

Threatened Species Conservation Act (1995), New South Wales Government

APPENDIX V

BIODIVERSITY MATTERS FOR CONSIDERATION AMENDMENT TO PROPOSED REZONING

BIODIVERSITY MATTERS FOR CONSIDERATION
AMENDMENT TO PROPOSED REZONING

PART LOT 5

WYONG EMPLOYMENT ZONE

JUNE 2008
(REF: 8057)

www.cegconsult.com

Central Coast Office
4/369 Mann Street, Gosford NSW 2250
PO Box 360 Gosford NSW 2250

•Ph (02) 4324 7888 • Fax (02) 4324 7899

•Email cegconsult@bigpond.com

ABN 62 274 841 042

BIODIVERSITY MATTERS FOR CONSIDERATION
AMENDMENT TO PROPOSED REZONING

PART LOT 5

WYONG EMPLOYMENT ZONE

JUNE 2008

Conacher Environmental Group

Environmental and Land Management Consultants

369 Mann Street, Gosford NSW
PO Box 360, Gosford NSW
Phone: 02 4324 7888 Fax: 02 43247899
23 Coleman Street, Lismore NSW
PO Box 92, Lismore NSW
Ph: 02 6622 7522 Fax: 02 6622 7533

TABLE OF CONTENTS

1. BACKGROUND

This report has been prepared to address biodiversity related issues relevant to a proposal to increase the area of proposed industrial zoning into the areas of Lot 5 currently proposed for 7(a) Conservation (excluding the area of proposed wildlife dispersal corridor).

The exhibited proposal in relation to Lot 5 identifies part of the site as future industrial land (estimated to cover 7650m^2) with the remainder of the site included in either a Conservation Zone or wildlife movement corridor.

The land within lot 5 to the north of the proposed 50 metre wide wildlife corridor which was initially proposed as a Conservation Zone has been assessed in relation to including this parcel of land within the industrial zone. The area of land subject to this investigation covers approximately 2.36 hectares and contains the cleared land containing stock grazing paddocks, workshop/sheds and soil stockpile site.

An aerial photograph of the land subject to this investigation is provided in Figure 1.

2. SITE INVESTIGATIONS

The principal matters investigated for this parcel of land included:

- Extent of site clearing for development;
- Extent of disturbed areas with soil stockpiles and motor bike tracks;
- Extent of vegetation clearing;
- Condition of remaining vegetation;
- Presence of threatened flora species and threatened fauna habitat;
- Any other matters relevant to the previous ecological investigations of the site.

The site was inspected to determine the following characteristics:

- Extent of vegetation clearing;
- Condition of vegetation;
- Presence of threatened flora species and threatened fauna habitat characteristics;
- Extent and types of ground disturbances.

Recent aerial photographs of the site were also used for assessment and mapping purposes. Previous surveys of the site and assessments prepared by Murray and Bell (2006) were reviewed for any relevant information. These reports were completed for Wyong Shire Council and formed the basis for the Biocertification Report for the Wyong Employment Zone – Rezoning Proposals.

3. SITE CHARACTERISTICS

SITE ANALYSIS FROM MURRAY AND BELL (2006)

The site was included within Precinct 14 maps and assessments prepared by Murray and Bell (2006). Relevant details are provided below.

Flora and Vegetation Communities

Most of the site is mapped as cleared land with a small area of Narrabeen Buttonderry Footslopes Forest. Much of this vegetation is mapped with canopy only vegetation present (Refer to Figure 8 of Murray and Bell, 2006).
No endangered ecological communities were identified on the subject site (Refer to Figure 13 of Murray and Bell, 2006).

No endangered populations were identified on the site. Two specimens of the threatened plant species *Angophora inopina* were identified on the subject site (Refer to Figure 11 of Murray and Bell, 2006).

Flora and Fauna Habitats

No threatened fauna species were detected on the subject site (Refer to Figure 12 of Murray and Bell, 2006). No endangered fauna populations were identified on the subject site. Two hollow bearing habitat trees were located on the subject site in the southern corner (Refer to Figure 9 of Murray and Bell, 2006). These trees are to be retained within the 50 metre wide wildlife corridor.

The cleared areas of the site are not identified as containing any fauna habitat. The open forest with removed understorey in the south of the site is identified as lower quality habitat (Refer to Figures 10 and 16 of Murray and Bell, 2006).

Wildlife Corridors

A secondary wildlife movement corridor (50 metre wide) is identified along the southern part of the site connecting Buttonderry Creek vegetation to the Kiar Ridge Road Conservation Area (Refer to Figures 20 and 22 of Murray and Bell, 2006).

Management Actions

The area of land within the subject site exhibited as Conservation Zone is proposed for Habitat Revegetation / Repair (Refer to Figure 23 of Murray and Bell, 2006). The measures proposed for habitat revegetation and repair would be outlined in the Ecological Management Plan to be proposed for the site.

4. SITE DETAILS

The results of an inspection of the subject site in relation to the biophysical characteristics are outlined below.

Site Disturbance

The northern part of the subject site has been cleared of vegetation and a large machinery/storage shed erected within a fenced compound area. Vegetation has been removed from an area of approximately 4000m^2. The southern parts of the subject site contain areas with stockpiles of excavated soil material much of which has been regraded to provide a trail bike track with curves, batters and jumps constructed from soil material.

Large remnant eucalypts provide a patchy canopy cover over parts of this disturbed landscape. This disturbed area covers approximately 2 hectares of land of which approximately 5000m^2 is present within the subject site.

Vegetation Condition

Most of the tree canopy, shrub understorey and groundlayer vegetation within the site has been removed or modified. Some remnant eucalypts and patches of melaleucas are present along the northern and eastern boundaries of the site. The native shrub and groundlayers have been removed and replaced by introduced pasture species.
The vegetation is considered to be low condition vegetation dominated by introduced pasture species.

Fauna Habitat

The main fauna habitats present on the subject site are the larger eucalypts along the north and eastern boundaries and the canopy eucalypts growing in the disturbed areas in the south of the site. No aquatic habitats are present. The natural groundlayer and shrub vegetation has been removed and replaced with grasses and pasture with low fauna habitat values. Ground litter, logs and branches are sparse in this area. Several hollow bearing trees and the canopy trees in the south of the site are the main fauna habitat features proposed for retention within the 50 metre wide wildlife movement corridor.

Threatened Biodiversity

Two specimens of *Angophora inopina* have been identified within the subject site. One of these was proposed to be removed by the proposed development while the second specimen was to be conserved in the Conservation Zone. Future development following the revised rezoning would require the removal of both of these specimens.

No threatened fauna species, endangered populations or endangered ecological communities have been recorded on the subject site.

5. CONSIDERATION OF REZONING ISSUES ON BIODIVERSITY

Rezoning of the identified part of the subject site to industrial land rather than a Conservation Zone is not likely to lead to a significant effect on threatened biodiversity of the site or precinct. The area of the proposed rezoning is highly degraded land with native vegetation in a low condition.

Two specimens of *A. inopina* are present in the subject site and one of these specimens is proposed to be removed for the proposed development as exhibited. The loss of one additional specimen of *A. inopina* is not likely to result in a significant effect on the population of *A. inopina* present.

If this land is developed for industrial purposes significant cost savings for the habitat revegetation and repair of the site will result. No justification has been provided in the Ecological Investigations Report or Bioceritification Report as to why this area of land was proposed to be incorporated into the Conservation Zone. The economic costs associated with the restoration/repair of this area of land to replenish the biodiversity characteristics have not been accounted for or justified within the assessment reports prepared for the site.

It would be a more appropriate action to direct the restoration efforts and budgets to reinstalling habitat values into the proposed corridor along the southern part of the site rather than reinstate the vegetation and fauna habitat values within the subject site.

6. CONCLUDING COMMENTS

The proposal to revise the boundary line of the industrial zone and Conservation Zone and include the subject site within the industrial zone will not result in significant changes to the loss of threatened biodiversity. One additional *Angophora inopina* tree will be removed if the industrial zone is expanded in area.

The land proposed for industrial zoning is highly disturbed and would require extensive and costly restoration to repair the degraded habitats to the condition of the adjoining areas of conservation to the north and east. This restoration effort would be more appropriately directed to restoring the degraded land within the proposed wildlife movement corridor in the southern parts of the site.

In relation to the overall 'maintain or improve' test for biodiversity certification the proposal will remove approximately 2.36 hectares of cleared land from the 344.4 hectares of land proposed to be maintained or improved. This represents 0.7% of the land proposed to be incorporated into Conservation Zones. This small percentage would be less than the degree of accuracy of area measurements for the total area of the Wyong Employment Zone.

6. SEVEN PART TEST FOR *Angophora inopina*

As identified in Section 5(A) of the *EP&A Act* (1979) the following matters need to be addressed to determine whether or not a significant effect on threatened species, populations or ecological communities or their habitats is likely to result from the proposed development.

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Angophora inopina has a highly visible growth form being a small tree, often multi-stemmed, to 8 metres high, with opposite leaves. The bark is characteristically flaky with long strings also present. The currently known distribution of *Angophora inopina* is from Buladelah to Warnervale (Murray and Bell, 2006). Two specimens of *A inopina* were observed within Lot 5. The proposed rezoning provides for the removal of one specimen from the site. The revised rezoning and subsequent industrial development will require the removal of an additional specimen which is currently located within the proposed 7(a) zone within Lot 5. The population within the Environmental / Open Space areas is a healthy and viable population as evidenced by good fruit production and seed set and the presence of many juvenile or seedling specimens. Murray and Bell (2006) estimate the size of the *A. inopina* population to be greater than 100 specimens in the Conservation Zone adjoining the site. Due to the retention of a large number of *A. inopina* within dedicated reserves and open space, it is considered that the action proposed is not likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

Angophora inopina is not listed as an endangered population and therefore does not require assessment under part (b) of the 7-part test.

c) In the case of a critically endangered or endangered ecological community, whether the action proposed:

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

Angophora inopina is not listed as a critically endangered or an endangered species within the TSC Act (1995) and therefore does not require assessment under part (c - i) of the 7-part test.

ii. Is likely to substantially and adversely modify the composition such that its local occurrence is likely to be placed at risk of extinction,

Angophora inopina is not listed as a critically endangered or an endangered species within the TSC Act (1995) and therefore does not require assessment under part (c - ii) of the 7-part test.

d) In relation to the habitat of threatened species, populations or ecological community:

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

Approximately 2.36 hectares of land is proposed to be rezoned to an industrial zone development following the proposed rezoning. This proposed rezoning is likely to allow the removal of an additional 1 specimen of *A. inopina* from Lot 5. This habitat area consists of highly disturbed vegetation in the form of Pasture with scattered trees and is subject to ongoing land management activities such as grazing, slashing and weed invasion.

The proposed rezoning and subsequent development are expected to require the removal of 1 additional specimen of *Angophora inopina*, but will retain in excess of 850 specimens within the adjacent Environmental / Open Space areas.

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

The proposed rezoning and development area currently consists of highly disturbed Pasture with scattered remnant trees. One of the remnant trees is *A. inopina* while others are common species known throughout the local area. The *Angophora inopina* population is already fragmented within the local area by existing development, current land management practices and ongoing land uses. The areas adjacent to the proposed development area (Lot 11 DP 23908 and Lot 2 DP 240205) are to be retained as

Environmental / Open Space areas. These Environmental / Open Space areas contain a large population of *A. inopina* estimated to be in excess of 100 individuals.

Due to the location and extent of the proposed rezoning and development, the small number of additional *A. inopina* to be removed (1), and the large number (in excess of 100 specimens) of *A. inopina* to be retained within the adjoining Environmental / Open Space areas it is considered that the proposed rezoning and subsequent development will not fragment or isolate areas of habitat for *A. inopina.*

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

The proposed development will require the removal of the highly disturbed Pasture with scattered trees vegetation within Lot 5. Given the occurrence of a large area of adjoining vegetation designated as Environmental / Open Space containing in excess of 100 specimens, it is considered that the habitat to be removed is of very low quality and is unlikely to be significant to the long-term survival of the species, populations or ecological communities within the locality.

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

The site has not been identified as critical habitat for *Angophora inopina* within the provisions of the *Threatened Species Conservation Act* (1995). Therefore, this matter does not require further consideration at this time.

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

There is no Recovery Plan for *Angophora inopina* at this time.

The proposed development would be considered generally consistent with the objectives or actions of a recovery plan due to the retention of a very high proportion of the locally occurring specimens of *A. inopina* within a dedicated Environmental / Open Space area.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The proposal is likely to include clearing of native vegetation. “Clearing of native vegetation” is a Key Threatening Process. The proposal is therefore a class of development recognised as a threatening process.

It is expected however that the proposed development and subsequent retention and management of the *Angophora inopina* within the adjoining Environmental / Open Space areas will provide an opportunity to ensure the long-term survival of this species within the local area.

COMMONWEALTH LEGISLATION

The *Environment Protection and Biodiversity Conservation Act* (1999) requires that Commonwealth approval be obtained for certain actions. The Act provides an assessment and approvals systems for actions that have a significant impact on matters of National Environment Significance (NES). These may include:-

- Wetlands protected by international treaty (the Ramsar Convention);
- Nationally listed threatened species and ecological communities;
- Nationally listed migratory species.

Actions are projects, developments, undertakings, activities, series of activities or alteration of any of these. An action that needs Commonwealth approval is known as a controlled action. A controlled action needs approval where the Commonwealth decides the action would have a significant effect on a NES matter.

Where a proposed activity is located in an area identified to be of NES, or such that it is likely to significantly affect threatened species, ecological communities, migratory species or their habitats, the matter needs to be referred to the Department of Environment, Water, Heritage and Arts (DEWHA).

One threatened species (*Angophora inopina*) listed as Vulnerable within the *EPBC Act* (1999) was identified on and adjacent to the subject site.

Determining an important population
For the purposes of assessment of a vulnerable species under the *EPBC Act* (1999) an assessment as to whether the species comprises an important population is required.

An *"important population"* is one that is necessary for a species' long-term survival and recovery. Questions (in bold) to determine whether a population is an *"important population"* are as follows:

Whether the population constitutes a key source population for breeding or dispersal:
A number of *Angophora inopina* individuals were found within Lot 5 in the north-eastern corner of the Precinct 14 (Murray and Bell, 2006). *Angophora inopina* is common throughout its range of approximately 120km, occurring between Buladelah and Warnervale. The species is more commonly found between Charmhaven and Morisset (DEC, 2005b). It is considered that the population found on-site does not constitute a key source population for breeding or dispersal.

Whether the population constitutes a population necessary for maintaining genetic diversity:
Angophora inopina is common throughout its range of approximately 120km, particularly between Charmhaven and Morisset (DEC, 2005b). It is therefore considered that the population found on-site does not constitute a population necessary for maintaining genetic diversity.

Whether the population is at the limit of its known distribution:
Angophora inopina is common throughout its range of approximately 120km, occurring between Buladelah and Warnervale. One population has been recorded at Gorokan, and another on the southern side of Hue Hue Road (NSW Government, 2005). The population recorded on the subject site is therefore considered to be well within the limit of its known distribution.

As determined by the above criteria it is considered that the population of *Angophora inopina* within the proposed development area and within the local area is not an "important population".

The criteria set by the EP&BC Act (1999) states that an action has, will have, or is likely to have a significant impact on an *"important population"* of a vulnerable species if it does, will, or is likely to:

- ***Lead to a long-term decrease in the size of an important population of a species;***

No important populations of *Angophora* inopina have been detected within the subject site.

The proposed rezoning and subsequent development will require the removal of one additional specimen of *A. inopina*. In excess of 100 specimens are to be retained within adjoining Environmental / Open Space areas. It is therefore considered unlikely the proposed action will lead to a long-term decrease in the size of an important population of a species.

- ***Reduce the area of occupancy of an important population;***

No important populations of *Angophora inopina* have been detected within the subject site.

The proposed rezoning and subsequent industrial development will allow the removal of an additional 1 specimen of *A. inopina*. This additional specimen is located within an area of highly disturbed vegetation best described as Pasture with scattered trees. The proposed rezoning and development will retain adjoining Environmental / Open Space areas which contain in excess of 100 specimens of *A. inopina*. It is therefore considered unlikely the proposed action will reduce the area of occupancy of an important population.

- ***Fragment an existing important population into two or more populations;***

No important populations of *Angophora inopina* have been detected within the subject site.

The *Angophora inopina* population is already fragmented within the local area by existing development, current land management practices and ongoing land uses. The proposed land rezoning and future industrial development is unlikely to further fragment the local population.

It is therefore considered unlikely the proposed action will further fragment an existing important population into two or more populations.

- ***Adversely affect habitat critical to the survival of a species;***

There has currently been no critical habitat for *Angophora inopina* declared under the EPBC Act (1999). As the species occupies an extensive range from Warnervale to Buladelah in the north, and has a large healthy population of more than 100 specimens within adjoining reserves, it is considered unlikely the proposed action will adversely affect habitat critical to the survival of this species.

- ***Disrupt the breeding cycle of an important population;***

No important populations of *Angophora inopina* have been detected within the subject site. It is considered that the proposed action will be unlikely to disrupt the breeding cycle of an important population of *Angophora inopina*.

- ***Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that a species is likely to decline;***

There are many different habitat types that support *Angophora inopina* (Bell, 2004). It is therefore considered unlikely that the proposed action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

- ***Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;***

Any future development on the subject site has potential to result in the establishment of invasive species that may increase competition with *Angophora inopina*. There is a low risk of this occurring within the existing habitat of *Angophora inopina* to be retained within Environmental / Open Space areas. It is expected that the Environmental / Open Space areas will be managed in accordance with a Bushland Management Plan which will incorporate weed management strategies. It is recommended that a Bushland Management Plan be formulated and implemented to reduce the risk of invasive species establishing within the retained *Angophora inopina* habitat.

It is therefore considered unlikely the proposed action will result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.

- ***Introduce disease that may cause the species to decline; or***

It is considered unlikely the proposed action will introduce disease that may cause this species to decline.

- ***Interferes substantially with recovery of the species.***

Factors contributing to the recovery of the species such as designating the best habitat areas and the majority of the existing population (100 individuals) as Environmental / Open Space areas are associated with the proposed development of the subject site, therefore it is considered unlikely the proposed action will interfere substantially with the recovery of *Angophora inopina* within the local area.

It is considered that the proposed action does not constitute an NES matter and a referral of this project to the Department of the Environment, Water, Heritage and Arts is not required as the proposed action is not likely to impact on a significant population of nationally listed threatened species or on any nationally listed endangered ecological community.

7. CONCLUSION

i. The proposed rezoning of this part of Lot 5 will result in one additional specimen of *Angophora inopina* being included within an industrial zone and therefore not likely to be conserved with future development.

ii. The proposed development is not likely to have a significant effect on *Angophora inopina* or its habitat.

iii. The proposed development is still commensurate with the previous "Maintain or Improve" assessment undertaken within the Flora and Fauna Assessment.

iv. A referral to the Department of the Environment, Water, Heritage and Arts (DEWHA) is not considered necessary.

v. A Species Impact Statement is not required for the proposed development.

7. REFERENCES

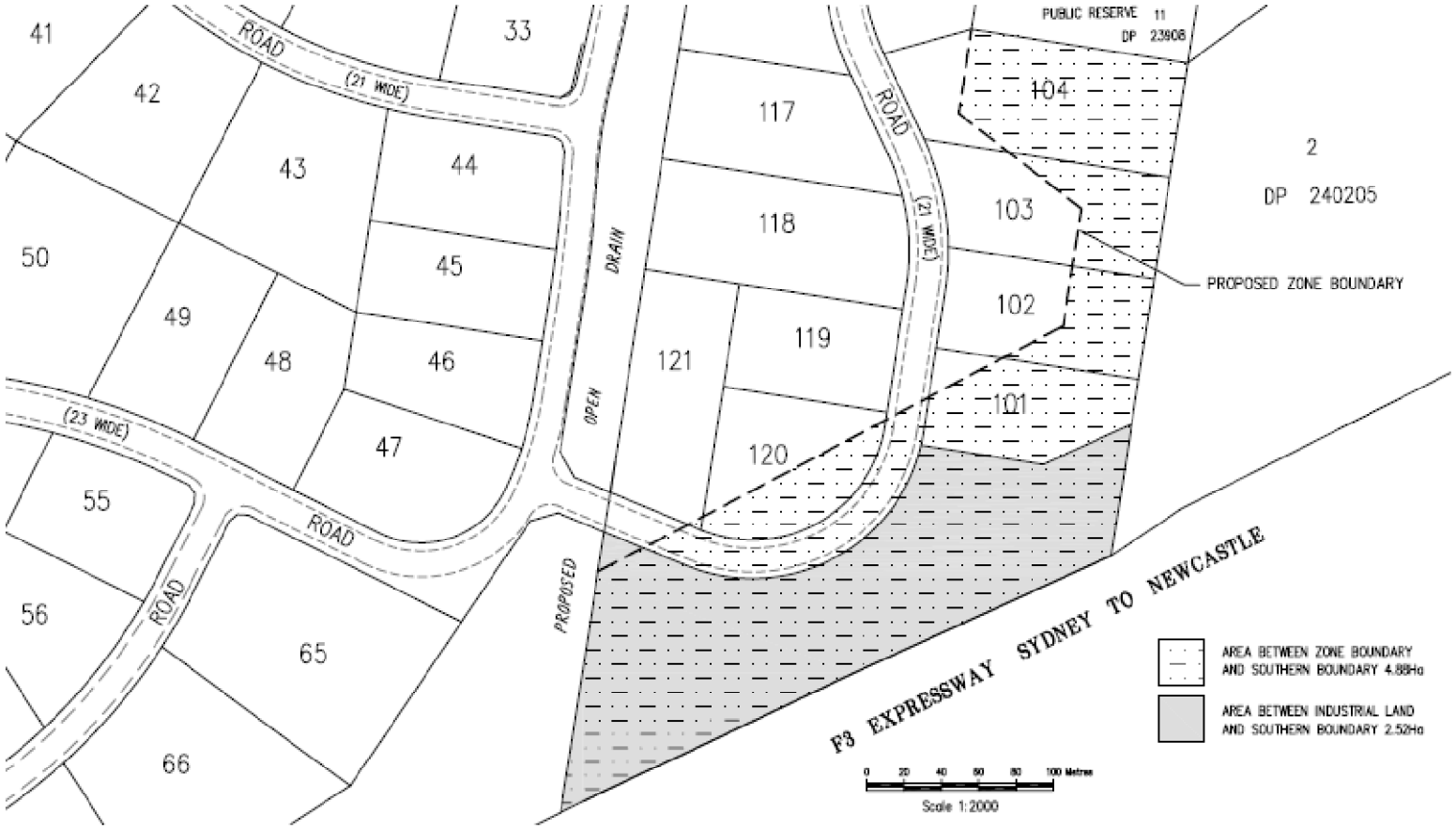
Bell, S.A.J. (2004). Distribution and habitat of the vulnerable tree species, *Angophora inopina* (Myrtaceae), on the Central Coast of New South Wales. *Cunninghamia* 8(4): 477-484.

Murray, M and Bell, S.A.J., (2006), *Ecological Investigations Version 2: Wyong Employment Zone.* Warnervale Business Park, Warnervale Airport Lands, Precincts 11 & 13 and Precinct 14. Report to Wyong Shire Council, 25 May 2007.

Department of Environment and Conservation (2005_b) Threatened Species Information- *Angophora inopina* profile. Available at: http://threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10053

NSW Government (2005) Bionet. NSW Government. Available at: http://www.bionet.nsw.gov.au/BioNet.cfm?is_ie5up

Wyong Shire Council (2007) Biocertification Report Wyong Employment Zone. Wyong Shire Council Future Planning, December 2007.



Plan for indicative purposes only. Not for detailed measurement. Subject site boundary subject to final survey.

conacher environmental group
ABN: 62 274 841 042
PO Box 360
369 Mann Street
Gosford NSW 2250
Ph: (02) 4324 7888
Fax: (02) 4324 7899
cegconsult@bigpond.com

Drawing No.	8057	Date
Drawn By	JM	19/06/08
Amendment		Date
A		
B		
C		

Figure 1

Zonings of the Subject Site

Kiar Rd, Jilliby

Source: Trehy, Ingold and Neate