The Sussex Inlet Golf Course Re-development
Badgee Lagoon, Sussex Inlet

Rezoning for Residential Development and Golf Course

Ecological Issues & Constraints Report

25th February 2011

Whelans InSites Pty Ltd
Level 12/80 Clarence Street Sydney NSW 2000
ph: 02 – 8234 8300 fax: 02 – 9262 6511
email: dfanning@insites.com.au

The Sussex Inlet Golf Course Re-development
Badgee Lagoon, Sussex Inlet

Rezoning for Residential Development and Golf Course

Ecological Issues & Constraints Report

25th February 2011

Principal Author: F Dominic Fanning	Version: 3.0	Date: 25th February 2011

THE SUSSEX INLET GOLF COURSE RE-DEVELOPMENT
BADGEE LAGOON, SUSSEX INLET

REZONING for RESIDENTIAL DEVELOPMENT and GOLF COURSE

ECOLOGICAL ISSUES & CONSTRAINTS REPORT

25th February 2011

TABLE of CONTENTS

APPENDICES

FIGURES

THE SUSSEX INLET GOLF COURSE RE-DEVELOPMENT
BADGEE LAGOON, SUSSEX INLET

REZONING for RESIDENTIAL DEVELOPMENT and GOLF COURSE

ECOLOGICAL ISSUES & CONSTRAINTS REPORT

25th February 2011

PART A	**INTRODUCTION & INFORMATION BASE**

1 INTRODUCTION

1.1 The Subject Site

The "*subject site*", known as the Sussex Inlet Golf Course Site is located to the immediate west of the township of Sussex Inlet (Figure 1), on the south coast of NSW. The subject site has a total area of approximately 240.6 hectares, and contains the existing 9-hole Sussex Inlet Golf Course.

The Sussex Inlet Golf Course Site is:

- bound to the east by the existing residential part of Badgee (at north Sussex Inlet) and by the St Georges Basin (to the northeast);
- bound to the south by Jacobs Drive and/or existing rural-residential developments;
- bound to the west by existing rural-residential lands, which have been substantially cleared for a variety of purposes, and then Sussex Inlet Road; and
- adjoined to its north by undeveloped lands containing a variety of contiguous forest types similar or identical to those on the subject site.

The site is currently zoned variously (Figure 2) pursuant to the *Shoalhaven Local Environmental Plan 1985* (SLEP 1985) and the Shoalhaven *Interim Development Order No.1* (IDO 1985):

- *1(a) – Non Urban Zone* (IDO 1985)*;*
- *1(b) - Non Urban Zone* (IDO 1985)*;*
- *1(b) - Rural "B" (Arterial and Main Road Protection) Zone;*
- *1(d) - Rural "D" (General Rural) Zone;*
- *1(g) - Rural "G" (Flood Liable) Zone;*
- *2(c) - Residential "C" (Living Area);*
- *6(a) - Open Space—Recreation "A" (Existing) Zone;*
- *7(b) – Environmental Protection B; and*
- *7(d2) - Environment Protection "D2" (Special Scenic) Zone*.

1.2 Background to This Report

The subject site currently contains a nine hole golf course in the southwestern portion of the site, with a clubhouse and associated infrastructure (Figure 3). Most of the remainder of the site retains a cover of native forest or wetland vegetation, although there are various areas of disturbance and a number of vehicle tracks through the site. Two small and highly modified creeklines traverse the golf course in the southwestern part of the site, draining into Badgee Lagoon and then into the St Georges Basin to the east (Figure 3). There is also a small mostly unmodified (except for its lower reaches) ephemeral drainage line in the northeast of the site.

The proposed development for the subject site involves two elements:

1 rezoning of the whole of the subject site for various purposes, pursuant to Part 3 of the *Environmental Planning & Assessment Act 1979* (EP&A Act); and

2 subsequent development of the site in accordance with that rezoning and the detailed *Concept Plan*, which is being prepared pursuant to Part 3A of the Act.

This *Ecological Issues & Constraints Report* (EICR) has been prepared by Environmental InSites to address the relevant ecological issues for the rezoning process, pursuant to Part 3 of the EP&A Act.

As noted above, a detailed *Concept Plan* is also being prepared pursuant to Part 3A of the EP&A Act for the proposed future development of the subject site at Sussex Inlet. The rezoning of the land and the *Concept Plan* are the outcomes of a comprehensive constraints analysis process which has involved an array of experts. That process has considered *inter alia* the potential for adverse environmental (in the case of this *Report*, ecological) impacts and the opportunities for environmentally beneficial outcomes.

This EICR has been prepared specifically to contribute to the *Local Environmental Study* (LES) currently being prepared by or on behalf of Shoalhaven City Council, and to assist in the process of determining appropriate zonings for parts of the subject site at Sussex Inlet for the preparation of a new *Local Environmental Plan* (LEP). This *Report* has been prepared:

- on the basis of an array of field investigations undertaken on the subject site specifically in order to determine appropriate areas for development activities and the design of future development on the site;
- in response to *Section 62 Letters of Advice* from various government agencies to SCC in respect of the rezoning, intended to guide preparation of the LES and LEP; and
- on the basis of a number of meetings and negotiations between the proponent, SCC and the relevant government agencies.

1.3 Definitions

For the purposes of this *Ecological Issues & Constraints Report*, the following definitions of relevant areas apply:

- *subject site* the land which is the subject of the current rezoning application and the Part 3A *Project Application* – Lots 123-125 in DP 528699, Lot 5 in DP 56283, Lot 144 and Lot 145 in DP 755937, Lot 156 in DP 40207, Lot 2442 in DP 1074478 and Lot 51 in DP 1033684.

- *study area* the catchment of Badgee Lagoon and the western shores of the St Georges Basin.
- *locality* an area of 10 kilometres around the *subject site*.

Other definitions for terms used in this *Report* are as provided in the attached *Glossary of Terms* (page 98), and in the relevant statutes and legislation (as documented below).

1.4 Future Development Concept

Development of the subject site at Sussex Inlet *inter alia* for residential purposes, an expanded (18 hole) golf course and the provision of a flood-free access road for Badgee, is anticipated by the *Sussex Inlet Settlement Strategy* and the *South Coast Regional Strategy* (see Chapters 9 and 10 of this *Report* for a detailed discussion).

The future development of the site is expected to include:

- the creation of two new residential areas, in the approximate location of the existing golf course and to the immediate west and north of the existing Badgee residential area of north Sussex Inlet;
- a patch of development to the southwest of Badgee Lagoon;
- an eighteen hole golf course and clubhouse, adjacent to and/or through the residential areas on the land;
- an array of relevant stormwater management and water quality control facilities;
- appropriate *Asset Protection Zones* surrounding all residential development (in many areas, to be provided by golf course elements);
- maintenance of a broad (minimum 250m wide) north/south vegetated linkage or 'corridor' through the land and on east-west vegetated link through Badgee Lagoon; and
- the dedication of substantial areas of native vegetation for conservation purposes.

This *Ecological Issues & Constraints Report* does not address the details of any specific development concept or the requirements of Part 3A of the EP&A Act. A draft *Concept Plan* had previously been prepared for the site, but an amended *Concept Plan* (prepared pursuant to *Part 3A of the EP&A Act* and the DGRs which have already been issued by the DoP) will be prepared once some certainty regarding the likely rezoning of the subject site is obtained by the proponent from Shoalhaven City Council and the DoP. That *Concept Plan* would include both design elements and environmental management features designed specifically to protect retained habitats and features.

Thus, details of the anticipated impact amelioration measures and design features of the future development of the subject site are not incorporated into this *Report*. Nevertheless, in determining the appropriate land to be rezoned for residential and/or golf course development purposes, the likely or expected clearing of vegetation and implementation of appropriate 'best practice' environmental management and impact amelioration measures have been taken into account. It is a necessary requirement of determining an appropriate zoning for various portions of land that the potential for impacts from urban (including golf course) development on adjoining land to be zoned for conservation purposes be taken into consideration.

1.5 Scope and Aims of this Report

As noted above, this *Ecological Issues & Constraints Report* provides the relevant data and analysis to inform the rezoning process, both for Shoalhaven City Council (SCC) and the Department of Planning (DoP), in consultation with the DECCW[1].

This *Ecological Issues & Constraints Report*:

- collates the information obtained during previous and current flora and fauna investigations on the subject site and on adjoining lands;
- provides a comprehensive and detailed description of the vegetation and native biota of the subject site;
- identifies the extent of relevant threatened biota and/or their habitats on the subject site and in its immediate vicinity;
- addresses the likely impacts of future development of the site in accordance with the proposed rezoning, taking into consideration likely effectiveness of the impact amelioration and environmental management measures which would be anticipated; and
- considers the relevant statutory requirements of relevance to the assessment of the project by the DoP pursuant to Part 3 of the EP&A Act, in respect of:
  - the *Environmental Planning & Assessment Act 1979* (EP&A Act);
  - the *Threatened Species Conservation Act 1995* (TSC Act);
  - the *Fisheries Management Act 1994*;
  - *State Environmental Planning Policy No. 14 – Coastal Wetlands* (SEPP 14);
  - *State Environmental Planning Policy No. 44 – Koala Habitat Protection* (SEPP 44);
  - relevant Council environmental planning instruments;
  - the *Sussex Inlet Settlement Strategy 2007*;
  - the *South Coast Regional Strategy 2007*;
  - the *St Georges Basin Estuary Management Plan 1985*; and
  - the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999* (EPBC Act).

The specific aims of this *Report* are:

- to identify and describe the native biota, and particularly the threatened biota and/or their habitats, on the subject site and on adjoining lands (as far as it is possible to do so);
- to address issues identified in relevant planning instruments and policies (including the *Sussex Inlet Settlement Strategy* and the *South Coast Regional Strategy*) with respect to the appropriate balance between development opportunities and biodiversity outcomes;
- to address relevant issues with respect to *High Conservation Value* areas (as described in the *South Coast Regional Strategy*) and/or other biodiversity or riparian and wetland

[1] DECCW – the Department of Environment, Climate Change & Water - formerly the Department of Environment & Climate Change (DECC) and prior to that the Department of Environment & Conservation (DEC). The DECCW incorporates the NSW National Parks & Wildlife Service.

constraints which may apply to portions of the subject site, and thus determine the appropriate footprints for development and conservation purposes in the rezoning process;

- to consider in detail the '*Verification Rules*' prepared by the DECCW with respect to determining the appropriate balance between development and biodiversity conservation outcomes; and
- to present an appropriate rezoning footprint for the subject site which will facilitate the goals and requirements of the *Sussex Inlet Settlement Strategy* and the *South Coast Regional Strategy*, as well as the *South Coast Regional Conservation Plan* and the "*objects*" of the EP&A Act.

2 INFORMATION BASE

2.1 Introduction

This *Ecological Issues & Constraints Report* (EICR) is based on an array of sources of information, as documented below. The *Report* collates and synthesizes:

- all of the data collected during investigations of the subject site and nearby lands; and
- information obtained during the supplementary surveys conducted specifically for this *Report* in response to discussions with SCC, the DECCW and the DoP.

Note that this Chapter of the *Report* provides only a summary of the recent field investigations undertaken (by BES/ELA and Environmental InSites). It MUST be read in conjunction with (and does not replace) a review of Appendix A, which provides the full details of those investigations.

2.2 Previous Investigations of the Site and Adjoining Lands

Previous investigations on the subject site and/or on adjoining lands have included:

- an investigation by K Mills of wetland boundaries around Badgee Lagoon (in 2003);
- a previous *Local Environmental Study in respect of lands in the Badgee Lagoon Area, Sussex Inlet, owned by the Lucas and Tait Group* (Travers Morgan 1994);
- an investigation (in June 1988) by Travers Morgan of the environmental attributes of the western foreshore areas of St Georges Basin, including parts of the subject site;
- detailed investigations of flora and fauna on the subject site by BES between December 2007 and December 2008 (see Chapter 2.3); and
- complementary surveys undertaken by Environmental InSites in 2009 (see Chapter 2.3).

Kevin Mills produced several *Reports* in support of a *Development Application* (DA) for a nine-lot subdivision by Lucas Property Group to the immediate north of Badgee Lagoon, and south of the existing Badgee residential area. Of particular relevance to this *Report* is the Kevin Mills (2003) *Response to Council* which *inter alia* defines the wetland boundaries around Badgee Lagoon. The nine-lot subdivision has since been developed as proposed, and as approved by Council.

Travers Morgan produced two *Reports* for Shoalhaven City Council which involved consideration of the ecological values of the subject site:

- a *Local Environmental Study in Respect of Lands in the Badgee Lagoon Area, Sussex Inlet* (1994); and
- the *Sussex Inlet Environmental Studies* (1988).

The *Local Environmental Study* was prepared for a proposed residential and golf course development which encompassed the majority of the subject site, with the exception of the area immediately around Badgee Lagoon. The Travers Morgan 1994 *Report* determined that no "*rare or significant terrestrial or arboreal mammal fauna were observed*" and "*that the land located between the existing Badgee residential area and Sussex Inlet Drive in the vicinity of the existing golf course is suitable for future*

residential development". A north-south "*fauna linkage*" was also identified through the central portion of the site, in a similar location to that proposed in this *Report* (see Chapters 5 and 13).

Subsequently, the *Sussex Inlet Settlement Strategy* (SISS) was prepared by SCC, in consultation with relevant government agencies. The SISS identifies an array of "*constraints and opportunities*" including *inter alia* the approximate (indicative) location of wildlife corridors through the subject site, a small riparian zone in the southwest and the purported locations of potential "*endangered ecological communities*". The recommendations of the SISS with respect to the subject site (the *Badgee Urban Investigation Area*) are considered in detail in Chapter 8 of this *Ecological Issues & Constraints Report*.

2.3 Recent Investigations for the Concept Plan

2.3.1 BES 2007 and 2008 Surveys

More recent ecological investigations of the site have been conducted by BES (between December 2007 and December 2008) and by Whelans InSites (in 2009), as part of the documentation required *inter* alia for the rezoning of the site and for the Part 3A application.

Bushfire & Environmental Services (BES)[2] performed extensive investigations across the subject site between 2007 and late 2008 (Appendix A). The purpose of those surveys was to identify the species, communities and habitats present, and to determine the ecological constraints to any future development of the land. The BES survey techniques and efforts undertaken on the site summarised in Tables 1 and 2 below, and are detailed in Appendix A.

Table 1 Flora survey dates, methods and effort undertaken by BES at Badgee Lagoon in 2007 and 2008

FLORA SURVEYS		
Date	**Method**	**Effort (person-hrs)**
Dec 07	Community Identification/verification	10
Dec 07	EEC boundary mapping	7
Dec 07 Jan 08	Targeted surveys - *Cryptostylis hunteriana*	89.75
Mar 08	Targeted surveys - *Genoplesium baueri*	72.5
May / June 08	Targeted surveys - *Speculantha ventricosa*	36
June 08	Old Growth Forest ID	27
Sept / Oct 08	Targeted surveys - *Caladenia tessellata*	75
Oct / Nov 08	Targeted surveys - *Rhizanthella slateri* & *Calochilus pulchellus*	45.25
Nov 08	Targeted surveys - *Galium australe* & *Genoplesium vernale*	63
Dec 08	Community verification	4
Total Flora Survey Effort		**455.5**

[2] Now part of EcoLogical Australia.

Table 2 Fauna survey dates, methods and effort undertaken by BES at Badgee Lagoon

FAUNA SURVEYS		
Date	**Survey**	**Effort (person-hrs)**
March-April and June 08	Call playback for Yellow-bellied and Squirrel Glider, Koala, Masked, Barn, Powerful and Sooty Owls	5
March 08	Call playback and spotlighting for Green & Golden Bell Frog	2.41
	Call playback, spotlighting, listening and vehicle transects for Giant Burrowing Frog	3.5
April - July 08	Nesting Assessment for the Glossy Black Cockatoo	22.74
April – June and Nov 08	Stag-watching for nocturnal birds and mammals	9.84
April - May 08	Echo-location recording for microchiropteran bats	2 detectors (4nights) + 3 hours
April - June 08	Spotlighting for nocturnal birds and mammals	3.33 person-hrs
April - May 08	Elliott (A) trapping for Eastern Pygmy Possum and White-footed Dunnart	400 trap-nights
April - May 08	Small cage trapping for Southern Brown Bandicoot and Long-nosed Potoroo	400 trap-nights
April - May 08	Large cage trapping for Tiger Quoll and Rosenberg's Monitor	80 trap-nights
April -May and Oct 08	Pitfall trapping for Eastern Pygmy Possum and White-footed Dunnart	240 trap-nights
April - May 08	Stag-watching and dusk listening for nocturnal birds and mammals	6 person-hrs
April - May 08	Call playback for nocturnal birds and mammals	1 person-hrs
June 08	Area search for Swift Parrot and Regent Honeyeater	6 person-hrs
June and Sept 08	Nesting assessment for Powerful Owl	11.75 person-hrs
Oct 08	Arboreal Elliott (B) trapping for Squirrel Gliders	200 trap-nights
Nov 08	Nesting Assessment for the Gang Gang Cockatoo	15.25 person-hrs
Nov 08	Call playback for Yellow-bellied and Squirrel Glider, Koala and Masked Owl	0.75 person-hrs
Total Fauna Survey Effort #	97.32 person-hours of general surveys, 400 Elliott (type A) trap nights, 200 Elliott (type B) trap nights, 400 small cage trap nights, 80 large cage trap nights, 240 pitfall trap nights and 8.5 nights of bat echolocation recording.	

This accounts ONLY for the dedicated and intensive survey methods cited (as discussed below), and does not include general and/or opportunistic surveys.

The BES field surveys for native fauna (Table 2; Appendix A) included an array of detailed and dedicated field investigations which involved *inter alia*:

- arboreal and terrestrial mammal trapping;
- Anabat surveys for microchiropteran bats;

- diurnal bird surveys;
- spotlighting and call playback for large forest owls and gliders; and
- fauna habitat assessment.

It should be noted that the total survey effort for native fauna undertaken by BES on the Sussex Inlet site involved diurnal survey activities over a total of 25 days between April 2008 and November 2008, and nocturnal surveys and investigations over a total of 11 days during the same period. The total survey effort by BES alone, including opportunistic observation periods and other broad surveys, thus encompasses the equivalent of approximately one month of full time investigations on the site by at least two investigators, spread over nearly a twelve month period.

The BES surveys identified 254 flora species, 126 fauna species and 8 plant communities, including 3 "*endangered ecological communities*" listed in the TSC Act, 12 threatened fauna species listed as "*Vulnerable"* in the TSC Act, and one threatened flora species listed as "*Vulnerable"* in the TSC Act (see Chapter 3), as well as one plant species in December 2010 with a *Preliminary Determination* for listing as "*Endangered*" (Chapter 3).

2.3.2 Environmental InSites 2009 Surveys

A review of the BES data and a subsequent site inspection were undertaken by Environmental InSites in late 2008. As a consequence of that review (as detailed in this *Report*), supplementary field surveys were undertaken by Environmental InSites (Table 3A; Appendix A) for this *Report* in 2009.

Those supplementary surveys included:

- ground-truthing of previously mapped plant communities;
- supplementary targeted surveys for the Leafless Tongue Orchid;
- the collection of a updated and comprehensive flora species list using the 'Random Meander' technique (Cropper 1993) and quadrat surveys;
- the conduct of an Eastern Pygmy Possum habitat assessment;
- the conduct of a hollow-bearing tree density assessment;
- call playback for the Yellow-bellied Glider and large forest owls;
- arboreal mammal trapping, particularly targeting the Squirrel Glider; and
- additional diurnal bird surveys.

Botanical surveys were undertaken on the 21st and 22nd of January and the 18th, 19th and 20th February 2009 (Table 3A) by a qualified botanist, and have been completed in accordance with the *Draft Guidelines* of the Department of Environment & Climate Change (DECC 2004). Systematic surveys were undertaken in seven 20 x 20 metre quadrats, sampling each vegetation type (Appendix A). Cover abundance for each plant species recorded within the quadrats was allocated on a modified Braun-Blanquet scale. The 'Random Meander' technique, *sensu* Cropper (1993), was also utilised to target plant species in general and threatened species in particular.

Table 3A Summary of survey effort for specific intensive survey activities in the supplementary InSites investigations in 2009 on the subject site.

Date	Survey Type	Survey Effort #
17th-20th Feb 09	Arboreal pipe trapping	120 trap-nights
17th-20th Feb 09	Owl call playback	3 hours
17th-20th Feb 09	Eastern Pygmy Possum habitat assessment	12 hours
8th, 20th-21st Jan 09 17th-20th Feb 09	Anabat recording	60 hours
17th-20th Feb 09	Flora community composition analysis	12 hours
8th, 20th-21st Jan 09 17th-20th Feb 09	Diurnal bird surveys	7 hours
21st Jan 09	Hollow-bearing tree survey	12 hours

This accounts ONLY for the dedicated and intensive survey methods cited (as discussed below), and does not include the substantial additional general and 'opportunistic' surveys over the 7 days of field investigations.

As is the case with the BES investigations, the total survey effort for native fauna on the subject site in 2009 is considerably greater than indicated in Table 3A, which identifies only the specific and particular survey efforts for individual threatened biota or groups of animals. The total effort involved at least two field biologists on the subject site over a total of 7 days, and involved both the dedicated surveys indicated in Table 3A and a broad, continuous and extensive array of general and opportunistic recording of biota, habitats and resources.

Botanical nomenclature was applied according to Harden (1992-2002), and cross-referenced against updated changes per www.plantnet.com.au or the National Herbarium of New South Wales. Where varieties or subspecies were not able to be accurately determined, specimens were listed at the base species level.

Collected threatened plant species, rare or threatened taxa or regionally significant species were determined against recognised herbarium specimens and/or were sent to the National Herbarium of New South Wales for positive verification.

2.3.3 Supplementary Surveys - 2010

Following a series of meetings with the DECCW, SCC and DoP in late 2010, and two review *Reports* regarding the previous Environmental InSites *Reports* for the subject site at Sussex Inlet, agreement was reached with the DECCW and SCC with respect to:

- additional information which was required to satisfy Council and the agencies with respect to ecological matters on the subject site at Sussex Inlet;
- the conduct of a supplementary site inspection involving officers of the DECCW and SCC along with staff of Environmental InSites; and

- a supplementary field survey for native fauna and fauna habitats of potential relevance at relevant locations within the subject site.

On the basis of the site inspection (on the 26th of October 2010) by DECCW, SCC and Environmental InSites, it was agreed that:

- the vegetation mapping of Environmental InSites is indeed accurate, and is the preferred vegetation mapping for the subject site; and
- a supplementary set of field surveys for threatened fauna should be undertaken with particular attention paid to areas that were identified as potentially 'contentious'. These areas were the northeastern development area, and the two northern extensions of proposed residential development located to the north of the existing 9-hole golf course (Appendix A; Figure 4).

The array of supplementary investigations undertaken by BES/ELA in November 2010, on the instructions of Environmental InSites (Table 3B; Appendix A), included:

- supplementary deployment of Anabat detectors at new locations within the areas in contention and adjoining areas proposed for conservation purposes;
- the conduct of six 200m x 50m survey quadrats for hollow-bearing trees, including the recording of the numbers and sizes of tree-hollows, and sizes of the hollow-bearing trees;
- further surveys for feeding evidence of the Glossy Black Cockatoo and dedicated searches for areas of high density *Allocasuarina*;
- supplementary spotlighting surveys within the designated areas and the use of call-play-back; and
- dedicated searches for additional Yellow-bellied Glider feed trees within the areas of contention and adjoining areas within the proposed conservation corridors through the site;

Details of the additional investigations undertaken and the results obtained are contained in Appendix A to this *Report*.

Table 3B Summary of supplementary survey effort by BES/ELA in Novemebr 2010 on the subject site (in accordance with an agreement with the DECCW and SCC).

Date	**Survey Type**	**Survey Effort #**
10th-13th and 16th Nov	Tree surveys – hollow-bearing tree counts, Yellow-bellied Glider and Glossy Black Cockatoo feed trees	31 person-hours
10th-12th and 15th Nov	Spotlighting – nocturnal mammals and birds	8 person-hours
10th-12th and 15th Nov	Call playback – Yellow-bellied Glider Squirrel Glider, Masked Owl	4 person-hours
12th and 15th Nov	Anabat recording – microchiropteran bats	4 nights
10th Nov	Roost search – Powerful Owl	2 person-hours

This accounts ONLY for the dedicated and intensive survey methods cited, and does not include general and/or opportunistic observations over the 6 survey days.

2.4 Additional Information Sources

Additional information has also been obtained from a range of other sources including:

- published scientific information regarding relevant threatened biota;
- vegetation mapping of the locality (courtesy of the DECCW – see Chapter 5);
- the *Wildlife Atlas* of the NSW National Parks & Wildlife Service (NPWS)[3], updated in November 2010 (Appendix B);
- the records of *Matters of National Environmental Significance* on the EPBC Act website (Appendix C);
- other investigations of various sites undertaken by a range of environmental consultants in the locality (including those identified above);
- several *Reports* prepared by Gunninah Environmental Consultants (which merged with Whelans InSites in 2006) on land in the immediate vicinity and general locality (see *Bibliography*); and
- information gleaned from the *Preliminary Assessment* for the One Tree Bay Part 3A proposal (*Preliminary Assessment*) to the immediate north.

A recommendation had been made (on behalf of Shoalhaven City Council) that additional databases be reviewed for information regarding (in particular) potential threatened biota. The flora or fauna databases of the Australian Museum, Birds Australia and the National Herbarium at the Royal Botanic Gardens in Sydney were identified as relevant databases worthy of interrogation. Those databases were reviewed by the DECCW, and no additional relevant threatened biota, not already identified as of relevance, were recorded (Mr M Boak DECCW *pers comm*).

2.5 Adequacy of Investigations and Data

The fieldwork which has been conducted by BES and Environmental InSites (between 2007 and November 2010) has been undertaken in cognisance of the *Threatened Biodiversity Survey and Assessment Guidelines for Development and Activities – Working Draft* (DEC & DPI 2005). These *Draft Guidelines* had been prepared by the DECCW (the then DEC) to provide a basis for the conduct of field investigations for threatened biota.

As discussed above, the array of field investigations undertaken by BES/ELA (in 2007 and 2008) and those undertaken by Environmental InSites (in 2009) were the subject of review by consultants employed by SCC for the LES and LEP process. On the basis of those reviews, further discussions were held between Environmental InSites, DECCW and SCC, which resulted *inter alia* in agreement as to the final additional field investigations and surveys which were necessary to satisfy their requirements for the purposes of determining appropriate zonings for the subject land (pursuant to *Part 3 of the EP&A Act*).

[3] The NPWS is now part of the DECCW (Department of the Environment, Climate Change & Water) which was previously the Department of Environment & Conservation (DEC), and prior to that the Department of Environment & Climate Change (DECC).

Further, at a meeting in the DECCW office in Queanbeyan on the 24th of November 2010, it was stated by the DECCW that the investigations and field studies undertaken had satisfied the requirements of the Department, and that the data on which this *Report* is based is adequate and sufficient.

On the basis of those considerations, it can reasonably be stated that the investigations and surveys of the subject site at Sussex Inlet are regarded by all involved as satisfactory and appropriate for the purposes for which they were undertaken.

PART B THE EXISTING ENVIRONMENT

3 DESCRIPTION of the SUBJECT SITE

The subject site at Sussex Inlet (see Chapter 1) is approximately 240.6ha in area (Figures 1 and 2).

The land is generally low-lying to slightly elevated and gently undulating, with gradual slopes to the south and east (towards Badgee Lagoon) and to the northeast towards St Georges Basin (in the northeastern part of the site). The highest point of the subject site is approximately 24m AHD in the central and northwestern portions of the site (Figure 2), and the lowest elevations (at sea level) are around Badgee Lagoon (in the southeast) and the St Georges Basin (in the northeast).

The southwestern portion of the site is currently managed as a nine-hole golf course, with mown fairways and greens, tees, tracks, artificial ponds and drainage lines and maintenance areas (Figure 3). A range of tracks are located through parts of the site, particularly through the northern areas of the site.

The subject site is located to the west and north of the existing Sussex Inlet settlement (Figures 1 and 2) on the mid-south coast of NSW (Figure 1), with substantial existing residential development located to the east and southeast of the subject site (Figure 3). The St Georges Basin adjoins the site along its northeastern boundary (Figure 2) and Badgee Lagoon is located within the southeastern portion of the site and further to the southeast (Figure 1). Existing rural-residential lands adjoin the site to the west, with vegetated areas to the north (Figure 3).

The subject site is located on the southern shores of the St Georges Basin, which is a large tidal lake located to the southwest of Jervis Bay on the mid-south coast of NSW (Figures 1 and 3). The surrounding landscape is characterised by:

- the existing township of Sussex Inlet, the urban areas of which are located to the south and east of the subject site, along Sussex Inlet which joins the St Georges Basin to the ocean;
- existing largely cleared rural/residential allotments to the west, which extend for approximately 8km almost to the Princess Highway;
- naturally vegetated lands to the north, around the southwestern and western parts of the St Georges Basin; and
- extensive areas of vegetated land to the southwest and east, which are separated from the subject site by the existing rural development of Sussex Inlet and the rural/ residential lands to the west of the site.

As a result of the extent and location of existing residential and rural/residential lands, the subject site does not constitute a functional "*wildlife corridor*" (see detailed discussion in Chapters 5.1.3 and 13.6), although parts of the site do provide a 'vegetated linkage' (or "*wildlife connection*" in the terms used in the SISS) through this part of the landscape. The subject site is located at the southeastern extremity of a broad band of contiguous vegetated lands along the southern and western shores of the St Georges Basin.

In this respect, there is little or no native vegetation or natural habitat for native biota to the east, south or west of the subject site at Sussex Inlet. The only notable connectivity to natural habitats is to the north and northwest (for a detailed consideration of this issue, see Chapter 13.6).

As noted elsewhere in this *Report*, much of the subject site contains native forest and woodland vegetation, with the southern part of the site (which forms part of the Badgee Lagoons wetlands) consisting of an array of wetland habitat types. Although much of the open forest and woodland vegetation is in moderately good condition, there are a number of historical and current disturbance factors, including *inter alia*:

- the impacts of the adjoining urban development of Badgee, to the immediate east of the subject site north of Badgee Lagoon;
- the nine-hole golf course in the southwestern part of the subject site, which has involved substantial removal of native vegetation, re-contouring, earthworks, the construction of dams and artificial creek channels, and the incorporation of infrastructure;
- long-term timber harvesting and logging activities, as indicated by the presence of tree stumps and by the relatively low density of large or over-mature and senescent trees in places;
- the creation of vehicular tracks, and the use thereof, particularly north of the existing 9-hole golf course; and
- the indirect impacts of adjoining land uses to the northwest.

Nevertheless, much of the remaining native vegetation on the subject site (particularly through the central parts of the site, in the northeast and in the south) is in moderate to good condition. Indeed, many of the wetland vegetation types around Badgee Lagoon in the southern parts of the subject site are in very good to excellent condition, notwithstanding the impacts of some urban runoff and likely historical increases in sediment and nutrient discharges from the golf course and/or adjoining rural and/or rural-residential activities.

The dedicated investigations undertaken to date by BES/ELA and Environmental InSites (between 2007 and 2010 inclusive), have revealed the presence of an array of threatened biota (Table 4; Chapters 4.3, 4.4 and 5.3), including:

- two "*threatened*" plant species (Chapter 4.4), of which one (*Speculantha ventricosa*) has only recently been described in a *Preliminary Determination* for listing in the TSC Act;
- three "*endangered ecological communities*" (Chapter 4.5); and
- fifteen "*threatened*" fauna species (Chapter 5.3), including five *Vulnerable* bird species, seven *Vulnerable* microchiropteran bat species and three other *Vulnerable* mammal species.

These, and other potentially relevant threatened biota which are known from the locality and which could theoretically or potentially occur on the subject site, are addressed in the ensuing chapters of this *Report.*

Table 4 Endangered ecological communities and threatened species recorded on the subject site at Sussex Inlet

Endangered Ecological Communities	
Swamp Sclerophyll Forest on Coastal Floodplains Swamp Oak Floodplain Forest Coastal Saltmarsh	
Threatened Fauna Species	
East Coast Freetail Bat	*Micronomus norfolkensis*
Common (Eastern) Bent-wing Bat	*Miniopterus (schreibersii) orianae oceansis*
Little Bent-wing Bat	*Miniopterus australis*
Greater Broad-nosed Bat	*Scoteanax rueppellii*
Yellow-bellied Sheath-tail Bat	*Saccolaimus flaviventris*
Large-eared Pied Bat	Chalinolobus dwyeri
Eastern Falsistrelle	*Falsistrellus tasmaniensis*
Southern Myotis	*Myotis macropus*
Grey-headed Flying-fox	*Pteropus poliocephalus*
Gang Gang Cockatoo	*Callocephalon fimbriatum*
Glossy Black Cockatoo	*Calyptorhynchus lathami*
Powerful Owl	*Ninox strenua*
Masked Owl	*Tyto novaehollandiae*
Square-tailed Kite	*Lophoictinia isura*
Eastern Pygmy Possum	*Cercartetus nanus*
Yellow-bellied Glider	*Petaurus australis*
Threatened Flora Species	
Leafless Tongue Orchid	*Cryptostylis hunteriana*
Threatened Orchid[4]	*Speculantha ventricosa*

[4] This species has only a *Preliminary Determination* for listing as a threatened ("*endangered*") species at the time of this *R*

4 FLORA and VEGETATION

4.1 Vegetation Mapping – Prior Documentation

Field surveys of vegetation in the general vicinity, including of the "*subject site*", were undertaken by Travers Morgan (1994). However, those surveys are now considered out-of-date, and the subsequent surveys (as documented within this *Report*) are considered the most relevant given their currency, level of detail and use of GPS technology.

A more recent study (Kevin Mills 2003) of land proposed for the Lucas Property Group (a nine-lot subdivision), to the immediate northeast of Badgee Lagoon adjacent to existing residential development, detailed the wetland communities around Badgee Lagoon (Table 5).

Table 5 Wetlands defined by Mills (2003) in and around Badgee Lagoon

Location	Wetland Type	Salinity
Estuary Edge	Mangrove Woodland/Forest	Saline
	Lower Saltmarsh	Saline
	Upper Saltmarsh	Saline/Fresh
	Swamp Oak Forest/Woodland	Saline/Fresh
Low-lying Inland Flats	Paperbark Shrubland	Fresh/Saline
Adjacent to Upland	Swamp Forest	Fresh

BES (2009) provides a more recent description of the plant communities over the whole of the "*subject site*", and identified eight vegetation communities on the subject site:

- Currambene Lowlands Forest
- Coastal Sand Swamp Forest
- Coastal Sand Forest
- Shoalhaven Sandstone Forest
- Estuarine Fringe Forest
- Estuarine Creek-flat Scrub
- Estuarine Mangrove Forest
- Estuarine Saltmarsh

As noted above, these communities were subsequently 'ground-truthed' by Environmental InSites (in early 2009) using GPS technology. The vegetation mapping provided in this *Report* (Figure 5) is the preferred final mapping, given its higher degree of differentiation of plant communities and its greater accuracy by virtue of the use of GPS technology. This mapping has been 'verified' by the DECCW and SCC as the most accurate and appropriate for use in the rezoning (and subsequent Part 3A application) process.

4.2 Plant Communities

On the basis of the extensive and detailed flora investigations which have been conducted (BES 2009; this *Report*), a total of eight distinct plant (vegetation) community types have been identified on the subject site (Figure 5; Table 6).

Table 6 Vegetation Types on the subject site at Sussex Inlet

MU	Vegetation Community	Area (ha) #	Proportion of the Site	EEC
1	Currambene Lowlands Forest	87.10	36.20%	No
2	Coastal Sand Swamp Forest	27.24	11.32%	SSFCF/BSF
3	Coastal Sand Forest	21.89	9.10%	No
4	Shoalhaven Sandstone Forest	35.65	14.82%	No
5	Estuarine Fringe Forest	6.53	2.71%	SOFF
6	Estuarine Creek-flat Scrub	33.39	13.88%	SSFCF
7	Estuarine Mangrove Forest	0.21	0.09%	No
8	Estuarine Saltmarsh	2.11	0.88%	CSM
	Cleared	21.66	9.00%	No
	Water	4.83	2.01%	No

EEC An "*endangered ecological community*" listed on the TSC Act
SSFCF Swamp Sclerophyll Forest on Coastal Floodplains
SOFF Swamp Oak Floodplain Forest
CSM Coastal Saltmarsh
Note that the areas provided are approximate only

It is to be noted that none of the vegetation types present on the subject site at Sussex Inlet are listed as "*threatened ecological communities*" on the *Environmental Protection & Biodiversity Conservation Act 1999* (EPBC Act).

It should also be noted that the depiction and mapping of vegetation types is open to interpretation, and that different approaches are adopted by various agencies and individuals. The mapping of vegetation types depicted in this *Report,* therefore, is but one of several equally valid approaches to the mapping of native vegetation on the subject site.

Further, vegetation types and plant communities generally (or at least often) intergrade across sometimes broad ecotones. The depiction of plant communities by a line on a map, therefore, is mostly an approximation rather than a 'survey accurate' identification of precise vegetation boundaries. Also, given the scale of the mapping (over an area of approximately 350ha), the vegetation boundaries are not likely in all instances to be precise. Nevertheless, field verification of the EEC boundaries by the DECCW, SCC and Environmental InSites (in October 2010) has determined that the InSites mapping is accurate (even 'conservative').

The consideration of *"endangered ecological communities"* listed in the TSC Act is subject to the detailed descriptions and definitions provided in the *Final Determinations* for those listed communities.

The majority of the subject site, as described elsewhere in this *Report*, contains native vegetation ranging from moderately tall forest (the Currambene Lowlands Forest) to Estuarine Saltmarsh (<1m high), which is confined to narrow strips around Badgee Lagoon south of the subject site (Figures 5 and 6). Of the 240.6ha (approximately) of the subject site, all but 18.54ha is covered by various native vegetation types (Table 6). The later is occupied by the existing 9-hole golf course, although it should be noted that other cleared and/or highly disturbed areas are present (associated with tracks and clearings resulting from local residents).

The most extensive native vegetation type on the subject site is the Currambene Lowlands Forest community, which occupies 87.10ha (or 36.2%) of the site (Figure 5; Table 6). This vegetation type extends for a significant distance to the north and northwest, and is also located widely around the St Georges Basin. The Shoalhaven Sandstone Forest, also xeric community, is the second most abundant vegetation type on the subject site (35.65ha or 14.82%).

Regional mapping of vegetation by the DECCW (Figure 7) includes the xeric communities on the subject site (the Currambene Lowlands Forest and Shoalhaven Sandstone Forest) in a broad Currambene Batemans Lowlands Forest vegetation type. This vegetation is, as indicated by the DECCW (Figure 7) well distributed in the locality.

Other plant communities which occupy significant portions of the subject site (and which are also widely distributed in the Shoalhaven LGA) include:

- Coastal Sand Swamp Forest (which occupies approximately 27.24ha or 11.32% of the site);
- Shoalhaven Sandstone Forest (which occupies approximately 35.65ha or 14.82% of the site); and
- Estuarine Creek Flat Scrub (which occupies 33.39ha or 13.88% of the subject site).

Cleared land (which is predominantly occupied by the existing 9-hole golf course) occupies approximately 21.66ha (or 9.0% of the subject site), and water (in the canals in the south of the site) occupy approximately 4.83ha (or approximately 2.01% of the site).

As discussed in further detail below, four "*endangered ecological communities*" (Figures 5 and 6; Table 6) have been recorded on the subject site (BES 2009; this *Report*):

- Swamp Sclerophyll Forest on Coastal Floodplains (SSFCF) and Bangalay Sand Forest (BSF) - Vegetation Types 2 and 6;
- Swamp Oak Floodplain Forest (SOFF) - Vegetation Type 5; and
- Coastal Saltmarsh (CSM) - Vegetation Type 8.

Vegetation Type 1 Currambene Lowlands Forest

The Currambene Lowlands Forest community is located in the central and eastern portions of the site (Figure 5). This community occupies the more elevated parts of the subject site, and is the vegetation type most affected by the existing 9-hole golf course. Nevertheless, and notwithstanding the presence of tracks and 'edge effects', much of this vegetation is in good to very good condition.

The upper stratum of this vegetation type is dominated by Red Bloodwood, Sydney Peppermint, White Stringybark, Thin-leaved Stringybark, Blackbutt and Turpentine (Appendix E). The mid-stratum (where present) is characterised by Black She-oak *Allocasuarina littoralis* and Turpentine, and sometimes by Saw Banksia *Banksia Serrata* and Cherry Ballart *Exocarpos cupressiformis*.

The understorey is dominated by Sydney Golden Wattle, Sunshine Wattle, Yellow Tea-tree, Hairpin Banksia, Large-leaf Hop-bush, Narrow-leaf Geebung, Handsome Flat-pea, Bearded Heath, *Gompholobium glabratum,* Halo Bush-pea, Stalked Conesticks, Spiny Bossiaea, Prickly Moses and Needle-bush.

The ground layer is dominated by Wiry Panic, Common Bracken, Two Colour Panic, Golden Weather-grass, Love Creeper, Rough Guinea Flower, Three-awn Speargrass, Oat Spear Grass, Twining Pea, Dwarf Blue Trumpet, Thatch Saw-sedge, Spiny-headed Mat-rush, Hairy Apple Berry, Kangaroo Grass, *Xanthorrhoea concave*, Variable Sword-sedge, Wallum Heath, Screw Fern, Paroo Lily and Blady Grass.

This vegetation type has been sampled in quadrats Q1, Q2 & Q3 (Figure 5; Appendix E).

Two threatened orchid species have been recorded in this community, at 5 locations (BES 2009).

This vegetation type is not part of any "*endangered ecological community*".

Photo 1 Currambene Lowlands Forest

Vegetation Type 2 Coastal Sand Swamp Forest

The Coastal Sand Swamp Forest community adjoins both the Badgee Lagoon and St Georges Basin, at the southeastern and northeastern extremities of the site (Figure 5). This vegetation is located on low-lying parts of the site along or adjacent to drainage lines and wetlands, on alluvial or fluvial sandy soils. Again, notwithstanding some disturbance, much of this vegetation is in very good condition.

This vegetation type is dominated by the Bangalay and Swamp Oak in the upper stratum, with a mid-stratum comprised of scattered patches of the Green Wattle and Snow-in-Summer, and an understorey dominated by Tall Saw-sedge.

The groundcover layer is dominated by Braken, Harsh Ground Fern, Common Maidenhair Fern, Asian Pennywort, False Bracken, Native Violet, Pennywort, Basket Grass, Gristle Fern, Common Bracken, Bordered Panic, Lilac Lily, Pastel Flower, Rasp Fern, Mat-grass and White-root. Climbers include Morinda Jasmine, Trailing Guinea-flower, Common Milk Vine, and Common Silkpod.

This vegetation type has been sampled in quadrats Q10 and Q11 (Figure 5; Appendix E).

Despite extensive survey efforts, no threatened flora species were recorded from this community during the recent survey period.

This vegetation type conforms to the "*endangered ecological community*" listed as Swamp Scleroplyll Forest on Coastal Floodplains (SSFCF) and/or Bangalay Sand Forest (BSF), as discussed in Chapter 4.3 of this *Report*.

Photo 2 Coastal Sand Swamp Forest

Vegetation Type 3 Coastal Sand Forest

The Coastal Sand Forest community is located in the northeastern and southern portions of the site (Figure 5), on mid-slopes between the Coastal Sand Swamp Forest and the more xeric forest communities, upslope of Badgee Lagoon and upslope of the swamp communities along the St Georges Basin in the north of the site. This vegetation type is also in generally very good condition

The upper stratum of this community consists predominantly of Blackbutt with scattered individuals of Bangalay, White Stringybark, Thin-leaved Stringybark and Red Bloodwood. The mid-stratum is dominated by Sydney Golden Wattle but also includes Yellow Tea-tree, Coffee Bush, Native Indigo, Everlasting, Turpentine, Mock Olive, *Hibbertia linearis* and Straight Wattle.

The ground layer consists of Common Bracken, Spiny-headed Mat-rush, Variable Sword-sedge, Bordered Panic, Slender Rice-flower, Blady Grass, Paroo Lily, Weeping Meadow Grass, Tussock Grass, Kidney Weed, Rasp Fern, Common Maidenhair Fern, Basket Grass, Trailing Guinea-flower, Lawyer Vine, *Oxalis perennans*, Common Milk Vine, Dusky Coral-pea and Wombat Berry.

This vegetation type has been sampled in Q7 and Q8 (Figure 5; Appendix E).

Despite extensive surveys, no threatened flora species were recorded from this community during the most recent field surveys.

This community does not form part of any listed "*endangered ecological community*".

Photo 3 Coastal Sand Forest

Vegetation Type 4 Shoalhaven Sandstone Forest

This vegetation type is located on more elevated land, and is generally in good condition, although there are areas which have been affected by adjoining land uses (roads and rural-residential) and/or the existing 9-hole golf course.

The Shoalhaven Sandstone Forest community is located within the northwestern and southwestern corners of the site (Figure 5). This community is associated with shallow sandy soils over a sandstone substrate, although no major sandstone outcropping is present on the subject site.

The upper stratum of this variant is dominated by the Hard-leaved Scribbly Gum and Red Bloodwood. The mid-stratum is comprises Hairpin Banksia, Mountain Devil, Curl Wig, Myrtles Wattle, Needle-bush, Yellow Tea-tree, Handsome Flat-pea, Broad Leaf Geebung, Golden Glory Pea, Stalked Conesticks, Spiny Bossiaea, Sweet Wattle and Wallum Heath.

The lower stratum is dominated by Wiry Panic, Heathy Mirbelia, Lesser Flannel Flower, Rock Xanthosia, Drumsticks, Slender Stackhousia, *Sphaerolobium vimineum, Xanthorrhoea concave,* Halo Bush-pea, Variable Bossiaea, Holly Lomatia, Germander Raspwort, *Dampiera stricta*, Oat Spear Grass, Screw Fern, *Poranthera ericifolia*, Variable Sword-sedge, Fishbones, Pale Mat-rush, Blue Flax-lily, Silky Purple Flag, Threeawn Speargrass, Wallaby Grass, Twining Pea, *Cyathochaeta diandra, Baumea acuta* and *Ptilothrix deusta.*

This vegetation type has been sampled in quadrats Q3, Q4 and Q5 (Figure 5; Appendix E).

Despite extensive surveys, no threatened flora species were recorded from this community, although suitable habitat occurs for the threatened Leafless Tongue Orchid.

This community does not form part of any listed "*endangered ecological community*".

Photo 4 Shoalhaven Sandstone Forest

Vegetation Type 5 Estuarine Fringe Forest

On the subject site, the Estuarine Fringe Forest community is located along the St Georges Basin foreshore and the southern side of Badgee Lagoon (Figure 5). The Estuarine Fringe Forest is generally not tolerant of saline conditions, and is located where fresh water dominates the hydrologic regime. Given its nature and its location, this vegetation type is generally little disturbed and remains in good to very good condition in those places.

The upper stratum of this vegetation type is a patchy canopy dominated by Swamp Oak and a patchy sub-canopy of Boobialla (Appendix E).

The understorey is dominated by Sea Rush, Swamp Paperbark, Tall Saw-sedge, Common Reed and *Baumea juncea.* A patchy groundcover includes *Lobelia alata,* Sea Celery and Native Spinach.

Despite extensive survey efforts, no threatened flora species have been recorded from this community. However, the edges of this community that adjoin both Estuarine Saltmash and Estuarine Mangrove Forest provide suitable habitat for the threatened Narrow-leafed Wilsonia. This species was allegedly previously recorded at the interface of these vegetation types along the northern edge of Badgee Lagoon (Travers Morgan 1988).

This community conforms to the "*endangered ecological community*" listed as Swamp Oak Floodplain Forest (SOFF), as discussed in detail in Chapter 4.3 of this *Report*.

Photo 5 Estuarine Fringe Forest (right and background), with Estuarine Saltmarsh in the left.

Vegetation Type 6 Estuarine Creekflat Scrub

The Estuarine Creek-flat Scrub community occupies most of Badgee Lagoon, other than those areas of open water and/or Estuarine Mangrove Forest (Figure 5) in the southeastern parts. Most of this vegetation is in good to excellent condition, as it is not particularly conducive to human incursions.

The community is characterised by a dense shrubland of Swamp Paperbark.

The understorey and groundcover (Appendix E) is dominated by Sea Rush, *Baumea juncea,* Common Reed, *Lobelia alata,* Creeping Brookweed and Swamp Weed.

Despite extensive survey efforts, no threatened flora species were recorded from this community during the most recent field surveys. The previously recorded Narrow-leafed Wilsonia *Wilsonia backhousei* has not been located in this vegetation type, although it does provide sub-optimal habitat. The dense almost closed shrubland structure, however, limits the suitability of this habitat for the Narrow-leaved Wilsonia.

This vegetation conforms to the "*endangered ecological community*" listed as Swamp Scleroplyll Forest on Coastal Floodplains (SSFCF), as discussed in detail in Chapter 4.3 of this *Report*.

Photo 6 Estuarine Creek-flat Scrub in the upper reaches of Badgee Lagoon

Vegetation Type 7 Estuarine Mangrove Forest

The Estuarine Mangrove Forest community fringes both Badgee Lagoon (in the southeastern corner of the site, and the St Georges Basin foreshore in the northeastern corner of the site (Figure 5). This community is generally restricted to a narrow fringing foreshore area that is subject to tidal influences.

The Mangrove Forest community is generally in good to excellent condition, other than the effects of urban debris and rubbish washed down during runoff events. General human access into the Mangrove Forest is limited.

The community is characterised by a dense scrub consisting almost exclusively of the Grey Mangrove *Avicennia marina.* A patchy groundcover of *Sarcocornia quinqueflora, Suaeda australis,* Creeping Brookweed, Native Spinach and *Rhagodia candolleana* subsp. *candolleana* is also present (Appendix E).

Despite extensive surveys, no threatened flora species were recorded from this community. Whilst a previous flora survey recorded the threatened Narrow-leafed Wilsonia from the periphery of this vegetation type along the northern foreshore of Badgee Lagoon (Travers Morgan 1994), that species does not tolerate the saline circumstances of the mangrove forest community.

This community does not form part of any listed "*endangered ecological community*".

Photo 7 Estuarine Mangrove Forest fringing Badgee Lagoon, with Estuarine Saltmarsh in the foreground

Vegetation Type 8 Estuarine Saltmarsh

This vegetation type is present only around Badgee Lagoon in the southeastern portion of the subject site (Figure 5). The Saltmarsh community is present in isolated patches between the Fringing Mangrove Forest and the Estuarine Fringe Forest, and generally occurs only in a very narrow range of elevations, whaich area subject to tidal inundations only during very high tides.

This vegetation type consists of a 'grassland' or 'herbland' dominated by Sea Rush, *Baumea juncea, Sarcocornia quinqueflora, Suaeda australis,*Creeping Brookweed, Sand Couch and Swamp Weed (Appendix E).

This vegetation community was not survey by vegetation quadrats (due to its homogenous nature and its location outside of all proposed development activities).

No threatened flora species are present in the Estuarine Saltmarsh Community.

This vegetation type clearly conforms to the "*endangered ecological community*" listed as Coastal Saltmarsh, as discussed in detail in Chapter 4.3 of this *Report*.

Photo 8 Estuarine Saltmarsh, with Estuarine Fringe Forest in the background

4.3 Native and Introduced Plant Species

A total of 254 plant species have been recorded on the subject site at Sussex Inlet (Appendix D), including 223 native plant species and 31 species (12% of the total) which are non-native introduced or exotic species.

A number of the introduced species present on the site are classified or recognized as invasive or pernicious weeds, including the Blackberry, Cobblers Pegs, Whisky Grass, Paspalum, Spear Thistle, Paddy's Lucerne, Quaking Grass and Fireweed.

Three of the species recorded on the subject site during investigations by BES (2009) and Travers Morgan (1994) are either listed as "*threatened species*" in the TSC Act (the Leafless Tongue Orchid *Cryptostylis hunteriana* and the Narrow-leaved Wilsonia *Wilsonia backhousei*) or were proposed for listing at the time of this *Report* (the orchid *Speculantha ventricosa*).

4.4 Threatened Plant Species

As noted above (Chapter 2), the field surveys to date have been comprehensive, have extended over a total period of 17 years, and have identified 254 flora species on the subject site (Appendix E).

Despite that survey intensity and extent, only three threatened plant species have been recorded during any field surveys (Travers Morgan 1988,1994; Mills 2003; BES 2009; this study). An additional eleven threatened flora species were recorded in a 10km search of the DECCW Wildlife Atlas (dated October 2010) around the subject site (Appendix B). However, the subject site does not contain suitable habitat for any of these species (Table 7), as discussed in detail in Appendix I.

Table 7 Threatened flora species from the DECCW Wildlife Atlas

Common Name	Scientific Name	Recorded on Site	Suitable Habitat
Narrow-leaf Wilsonia	*Wilsonia backhousei*	Yes	Yes
Albatross Mallee	*Eucalyptus langleyi*	No	No
Ettrema Mallee	*Eucalyptus sturgissiana*	No	No
Biconvex Paperbark	*Melaleuca biconvexa*	No	Limited
Magenta Lilly Pilly	*Syzygium paniculatum*	No	No
Thick Lip Spider Orchid	*Caladenia tessellata*	No	No
Leafless Tongue Orchid	*Cryptostylis hunteriana*	Yes	Yes
Bauer's Midge Orchid	*Genoplesium baueri*	No	No
Jervis Bay Leek Orchid	*Prasophyllum affine*	No	No
Eastern Australian Underground Orchid	*Rhizanthella slateri*	No	Unknown
Tangled Bedstraw	*Galium australe*	No	No

The Leafless Tongue Orchid *Cryptostylis hunteriana* was recorded in the central portion of the site by BES in 2008 (Figure 8), with a sub-population in the central part of the proposed north-south 'corridor' and another next to a track north of the golf course. The surveys undertaken by Environmental InSites during January and February of 2009 did not identify any specimens of the Leafless Tongue Orchid, despite intensive searches of the site for that species.

The Narrow-leafed Wilsonia *Wilsonia backhousei* was also allegedly recorded on the northern boundary of Badgee Lagoon by Travers Morgan (1994), but no details were provided of its precise location. Recent extensive surveys by BES (2008) and Environmental InSites (this *Report*) failed to locate this species, although it may still be present in restricted areas. It should be noted that no development activities are proposed in areas likely to be of relevance for the Narrow-leaved Wilsonia.

An additional threatened orchid *Speculantha ventricosa* (*Preliminary Determination*) was tentatively recorded by BES in 2008 at two locations:

- in the centre of the site, east of the existing golf course, in the centre of the proposed north-south 'corridor'. These specimens consisted of a few withered flowers and rosettes (D Coombes *pers comm*); and
- in the north of the site near the property boundary, in an area proposed in this *Report* as an extension of the proposed golf course to be managed specifically for the orchid. Those specimens consisted solely of a few withered rosettes, without flowers (D Coombes *pers comm*).

4.5 Endangered Ecological Communities

Four of the vegetation types on the subject site at Sussex Inlet (Figures 5 and 6) clearly do or appear to conform to one of three *Final Determinations* by the Scientific Committee of an "*endangered ecological community"* pursuant to the TSC Act (Table 8).

Table 8 Endangered Ecological Communities (EECs) on the subject site at Sussex Inlet

MU	Vegetation Community	EEC	Area (ha)	% of Site
2	Coastal Sand Swamp Forest	SSFCF/BSF	27.24	11.32
5	Estuarine Fringe Forest	SOFF	6.53	2.71
6	Estuarine Creekflat Scrub	SSFCF	33.39	13.88
8	Estuarine Saltmarsh	CSM	2.11	0.88

SSFCF Swamp Sclerophyll Forest on Coastal Floodplains
BSF Bangalay Sand Forest
SOFF Swamp Oak Floodplain Forest
CSM Coastal Saltmarsh

4.5.1 Swamp Sclerophyll Forest on Coastal Floodplains

Two of the vegetation types on the subject site (the Coastal Sand Swamp Forest and the Estuarine Creek-flat Scrub) conform to the *Final Determination* of the "*endangered ecological community*" (EEC) known as *Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions* (SSFCF). Patches of the Coastal Sand Swamp Forest, however, appear to more closely resemble the EEC known as the *Bangalay Sand Forest of the Sydney Basin and South East Corner Bioregions* (BSF) "*endangered ecological community*" (see Chapter 4.5.2 – below).

Vegetation Type 2 (the Coastal Sand Swamp Forest community) is located along the fringes of Badgee Lagoon in the southeastern part of the site, and adjacent to the St Georges Basin in the northeastern portion of the site (Figures 5 and 6). That vegetation is of a swampy character, and includes stands and scattered specimens of the Bangalay and Swamp Oak which are characteristic of the SSFCF community. Similarly, the groundcover stratum is predominantly of the Tall Saw-sedge *Gahnia clarkei*, which is also characteristic of swamp habitats and of the SSFCF community.

Vegetation Type 6 (the Estuarine Creek-flat Scrub community) is a low dense forest predominantly of Swamp Paperbark within the shallows around Badgee Lagoon (Figures 5 and 6). The Swamp Paperbark and understorey species recorded in this vegetation type are characteristic of the SSFCF community.

4.5.2 Bangalay Sand Forest

As noted above, Vegetation Type 2 (the Coastal Sand Swamp Forest community) is located along the fringes of Badgee Lagoon in the southeastern part of the site, and adjacent to the St Georges Basin in the northeastern portion of the site (Figures 4 and 5). This vegetation type is of a swampy nature, and is dominated by the Bangalay (which is characteristic of the BSF community) along with the Swamp Oak.

The Coastal Sand Swamp Forest community in places appears more representative of the SSFCF community, and also has patches that more closely resemble the SOFF community (see below). In any case, all of Vegetation Type 2 (the Coastal Sand Swamp Forest community) is classified in this *Report* as an example of one of those three "*endangered ecological communities*" and/or an ecotone (in places) between those three communities (SSFCF, BSF and SOFF).

4.5.3 Swamp Oak Floodplain Forest

Vegetation Type 5 (Estuarine Fringe Forest community) is located around the fringes of the Badgee Lagoon, inland of the Estuarine Creek-flat Scrub community, as well as in a small patch to the immediate north of the existing residential area of Sussex Inlet, on the edge of the St Georges Basin (Figures 5 and 6).

This community conforms to the *Final Determination* of the "*endangered ecological community"* known as *Swamp Oak Floodplain Forest on the NSW North Coast, Sydney Basin and South East Corner Bioregions* (SOFF). Domination of the canopy by the Swamp Oak is a characteristic of the SOFF community.

4.5.4 Coastal Saltmarsh

The final *"endangered ecological community"* present on the site is the Estuarine Saltmarsh community (Vegetation Type 8) which conforms to the *Final Determination* of the *"endangered ecological community"* known as *Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions*.

This community is located in scattered patches around Badgee Lagoon, between the Estuarine Mangrove Forest and the Estuarine Fringe Forest (Figures 5 and 6).

5 FAUNA and FAUNA HABITATS

5.1 Fauna Habitats

5.1.1 General Features

The subject site and surrounding lands at Sussex Inlet support a range of fauna habitats and resources typically associated with open forest, swamp forest and estuarine vegetation (Figure 5). The subject site forms the southernmost extremity of a relatively continuous tract of vegetation which extends from Badgee Lagoon in the south, north to the St Georges Basin and then northwest along the foreshores of St Georges Basin towards the Princess Highway (see Chapters 5.3 and 13.6).

As discussed above (in Chapters 3 and 4), most of the subject site is covered by generally dry forest communities, apart from the foreshores of the St Georges Basin and vegetation in and around Badgee Lagoon, which include a number of swamp and open wetland or saltmarsh communities (Figure 5). As also noted above, most of the vegetation on the subject site is in relatively good condition, other than:

- those areas which have been affected by the 9-hole golf course in the southwestern corner;
- parts of the site affected by tracks and/or access from adjoining rural-residential and residential areas; and
- occasional patches of weeds in areas of previous disturbance.

It should also be noted, however, that most of the forest communities on the subject site have been either partially cleared in the past or have been subjected to previous timber harvesting and logging activities. There are substantial numbers of cut stumps present throughout the subject site, and large over-mature or senescent trees are not abundant.

Taken as a whole, the vegetated parts of the subject site exhibit a moderate structural and floristic diversity, and provide a mosaic of forested, shrubland, wetland and open water resources for native biota. These elements of the site provide an array of particular habitats and resources for a variety of native fauna species at this location. As indicated above, there is good connectivity between the subject site and other forested areas to the north, and the site is readily accessible for moderately mobile forest-dependent fauna species (such as possums and gliders), at least from the north.

As discussed in some detail below, tree-hollows (which provide specific roosting or denning habitat a variety of for hollow-obligate species) are present throughout the forested sections of the site, predominantly within the areas dominated by the Red Bloodwood, Blackbutt, Sydney Peppermint and Scribbly Gum. These tree species (particularly the Blackbutt and Scribbly Gum) are known to readily form hollows.

There are no rock outcrops or other similar features present on the site, and no natural pools or ponds present in the small watercourses or drainage lines. There are, however, a number of artificial dams associated with the golf course in the southwestern section of the subject site which would provide habitat for a variety of amphibian and avian species which can utilise disturbed or artificial environments (see detailed discussion in Chapter 6). Common waterbirds (such as the Pacific Black Duck, Australian Wood Duck and Dusky Moorhen) were observed frequently within these dams.

5.1.2 Hollow-bearing Trees

Original (2008) Surveys

The density of hollow-bearing trees within the subject site was initially estimated in twelve 50m x 50m plots, with a minimum of two per relevant vegetation type, and undertaking direct counts of hollows within each plot (Figure 9; Table 9). For obvious reasons, no hollow-bearing tree surveys were conducted in the Estuarine Mangrove Forest, Estuarine Saltmarsh, Estuarine Creekflat Scrub or Estuarine Fringe Forest communities.

Table 9 Number of hollow-bearing trees and tree-hollows of various sizes in the relevant vegetation types on the subject site at Sussex Inlet

Vegetation Community	No. of Plots	No. of Trees Surveyed	Total number of hollows per size per veg unit				
			L	M	S	O	Total
Shoalhaven Sandstone Forest	4	34 (8.5)	25 (6.25)	22 (5.5)	21 (5.25)	1 (0.25)	69
Currambene Lowland Forest	3	23 (7.7)	23 (7.7)	11 (3.7)	23 (7.7)	0	80
Coastal Sand Swamp Forest	3	10 (3.3)	3 (1)	3 (1)	6 (2)	0	22
Coastal Sand Forest	2	12 (6)	10 (5)	0	10 (5)	0	32

Key to Visible Hollows:

O = Owl	hollow suitable for large forest owls such as the Powerful Owl
L = Large	hollow large enough for a large arboreal mammals such as the Yellow-bellied Glider
M = Medium	hollow large enough for a medium sized arboreal mammal such as the Squirrel Glider
S = Small	hollow large enough for a small arboreal mammal up to the size of a Sugar Glider

The vegetation types in which the greatest densities of hollow-bearing trees and of tree-hollows were recorded are the more xeric forest communities (Currambene Lowlands Forest and Shoalhaven Sandstone Forest) in which the trees which most readily form hollows are present in greatest densities (Table 9; Appendix G).

The swamp forest types had much lower densities of hollow-bearing trees, and are consequently of less importance for hollow-dependent species. There are lower densities of tree-hollows in the Coastal Sand Forest and in the Coastal Sand Swamp Forest (Table 9), despite the presence of some species which usually readily form hollows (such as the Blackbutt). The trees in these communities, however, are generally somewhat smaller than in the more xeric communities, and are less numerous.

As indicated in Table 10, very large tree-hollows (suitable for forest owls including the Powerful Owl) are relatively rare on the subject site. This observation accords with the extent of previous disturbance to the forests of the site and/or logging and timber harvesting which has occurred on the subject site (as indicated by the many cut tree stumps).

Nevertheless, there are moderate numbers of hollow-bearing trees scattered through the subject site, particularly in the taller and more xeric forest communities. Tree species which regularly form hollows and which provide a moderately significant resource in this regard on the subject site include the Hard-

leaved Scribbly Gum, Red Bloodwood and Blackbutt (Table 10), all of which are known to form hollows on a regular and ready basis. The subject site supports a reasonable array of small, medium and large tree-hollows suitable for a variety of hollow-dependent species ranging from microchiropteran bats to the Yellow-bellied Glider and Glossy Black Cockatoo.

Table 10 Number of tree-hollows of different sizes in different tree species on the subject site (2008)

Species	**Number**	**Visible Hollows**			
		L	**M**	**S**	**O**
Hard-leaved Scribbly Gum	19	10	14	18	1
Red Bloodwood	24	17	17	21	0
Silvertop Ash	1	1	0	0	0
Sydney Peppermint	7	11	1	6	0
Bangalay	2	0	1	1	0
White Stringybark	2	4	0	1	0
Blackbutt	13	6	1	10	0
Stag	11	12	2	3	0

Key to Visible Hollows:

O = Owl	hollow suitable for large forest owls such as the Powerful Owl
L = Large	hollow large enough for a large arboreal mammals such as the Yellow-bellied Glider
M = Medium	hollow large enough for a medium sized arboreal mammal such as the Squirrel Glider
S = Small	hollow large enough for a small arboreal mammal up to the size of a Sugar Glider

Supplementary 2010 Surveys

Subsequent investigations undertaken in November 2010, pursuant to discussions with the DECCW, involved the conduct of six 200x50m quadrats to survey for the numbers of hollow-bearing trees and the numbers and sizes of tree-hollows in the 'Contentious Areas' identified by the DECCW and in adjoining areas proposed for conservation purposes (Figure 9). That supplementary investigation provided additional data and information with which to refine the mapping and identification of 'Old Growth Forest' and important habitat for hollow-dependent fauna (see detailed discussion in Chapter 13).

The previous analysis of 'Old Growth Forest' and tree-hollow resources (discussed above) relied on a number of smaller transects (Appendix A; Figure 9) which were used to determine an average hollow-bearing tree density for each of the plant communities present on the subject site.

However, it was subsequently determined that the original approach by BES was not suitable for application broadly across the landscape (in part because of the small size of the transects). It was concluded that there were likely differences in hollow-bearing tree densities within each of the different vegetation types (particularly the Currambene Lowland Forest and Shoalhaven Sandstone Forest communities) that warranted a more detailed and substantial survey approach.

That approach was adopted for the November 2010 surveys by BES/ELA, at the behest of Environmental InSites, with respect to hollow-bearing tree densities in the identified 'Contentious Areas' and nearby

(Figure 4). Those surveys, based on 200x50m quadrats (*ie* 1ha quadrats), provided a far greater level of detail, and have enabled a differentiation between areas that are of high or particularly tree-hollow habitat value and areas that are of relatively lower significance.

As indicated in Table 11, the survey area identified below as Area 1A (the proposed Northeast Development Area) has a significantly lower density of hollow-bearing trees than the other areas surveyed in November 2010 (Figure 9). In terms of the *'Verification Rules'* of the DECCW, therefore, Area 1A is of lesser value or significance with respect both to issues of 'Old Growth Forest' and in terms of resources of particular relevance for threatened biota (*ie* tree-hollows).

Table 11 Hollow-bearing trees recorded in the six supplementary survey quadrats in 2010

Survey Area	**No. of HBTs**
Area 1A	15
Area 1B	29
Area 2A	41
Area 2B	45
Area 3A	39
Area 3B	42

5.1.3 Wildlife Corridors

The subject site is claimed in various documents (including the *Sussex Inlet Settlement Strategy*) to contain "*wildlife corridors*" (or "*wildlife connections*") which traverse the site in an east-west direction and a north-south direction. These "*wildlife connections*" are identified as of significance for native biota at this location, and, indeed, habitat con activity and "*wildlife connections*" or "*wildlife corridors*" are generally regarded as of significance on at least a local basis for native biota and biodiversity.

The issue of "*wildlife corridors*" or "*wildlife connections*" through the subject site is addressed in detail in Chapters 8.3.3 and 13.6 of this *Report*. In brief, the presence of broad bands of native vegetation through the subject site is recognised in this *Report* including both:

- a north-south connection between Badgee Lagoon, through the forested lands and the centre and northern central and northern parts of the subject site, to the one tree bay land to the north;
- an east-west vegetated linkage through the wetlands and Swamp Forest communities of and around Badgee Lagoon.

However, as discussed in further detail in Chapters 8.3.3 and 13.6 with respect to the consolation significance of the subject site, connectivity to the west and to the south is marginal at best. Those lands are characterised by existing residential or rural-residential development, as well as existing roads and other infrastructure. Other than for highly mobile and adaptable species, there is no real connectivity between the subject site and vegetation further to the south or west.

5.2 Fauna Assemblage

Targeted and opportunistic fauna surveys undertaken by BES (in 2007 and 2008), Environmental InSites (2009 and 2010) and BES/ELA (in 2010) have recorded 135 native fauna species within the subject site, including 32 mammals, 85 birds, 9 amphibians and 9 reptiles (Appendix F). In addition, 7 introduced species have been recorded on the site.

As noted in Chapter 2 of this *Report*, the cumulative survey effort for fauna over a period of more than 3 years (by BES and Environmental InSites), in addition to information included from the previous investigations and studies on other sites in the vicinity, more than satisfies the *Draft Guidelines* of the DECC (DEC 2004) for threatened biota.

The array of native fauna which have been recorded on the subject site (involving 135 native vertebrate species as noted above) is not surprising given the substantial size of the subject site and the considerable array of fauna habitats and vegetation types present, Because there is a mosaic of xeric and mesic forest types, as well as shrublands, mangroves, saltmarsh and open water habitats, the suite of fauna species present encompasses a considerable variety of animals which use a wide variety of habitat types.

Surveys of the subject site have identified 16 threatened fauna species listed on the TSC Act (see Chapter 5.3) including the Eastern Pygmy Possum, Yellow-bellied Glider, Grey-headed Flying Fox, Powerful Owl, Gang Gang Cockatoo, Glossy Black Cockatoo and eight microchiropteran bats (Figure 6). Most of the threatened fauna species identified within the subject site are forest-dependent and highly mobile. These threatened species are not considered likely be affected to any significant extent by the future development of the site because a large proportion of the forested sections of the subject site are to be retained within the proposed *Conservation Area*.

5.2.1 Birds

The avifauna recorded on the subject site consists of a mixture of species generally recorded in areas of coastal forest and riparian habitats in the region (Appendix F). The species recorded also reflect the variety of foraging resources (such as insects, seeds, fruit, nectar, sap, lerps, manna and small vertebrates) and nesting habitats (such as hollow-bearing trees) present within the subject site and on adjoining lands, as well as the presence of areas of dense shrub and understorey plants.

Five broad guilds of birds were identified during the survey, including:

- a few waterbirds utilising the dams within the golf course and a suite of additional (mostly estuarine) species in Badgee Lagoon (*eg* the Darter, Black Swan, Little Pied Cormorant, Australian Pelican, ducks and teals);
- large and aggressive species which prey on vertebrates and large invertebrates, and which cover large distances while foraging (*eg* the White-bellied Sea Eagle, Powerful Owl, Masked Owl *etc*). These birds generally have large home ranges;
- an array of moderate forest avifauna ranging from honeyeaters to the Kookaburra;
- granivorous and nectarivorous species which utilise grasslands, forests and heathlands (*eg* the Rainbow Lorikeet and the wattlebirds); and

- smaller and more cryptic terrestrial birds which utilise dense heath or shrub layers for shelter (*eg* the Superb Fairy Wren, thornbills and gerygones, Eastern Spinebill and other smaller honeyeaters).

Surveys over several seasons by a number of investigators from BES, ELA and Environmental InSites have recorded five bird species listed as "*threatened species*" on the TSC Act on the subject site (Appendix F). The conservation significance of the subject site and its relevance for these threatened bird species is discussed in further detail in Chapter 5.3 of this *Report*.

5.2.2 Reptiles

The nine reptile species recorded within the subject site during the survey period are widespread and abundant within the locality. The reptile species recorded are generally common to abundant and widespread in eastern Australia, and include species typical of the region such as the Jacky Lizard, Copper-tailed Skink, Garden and Grass Sun-skinks, Blue-Tongue Lizard, Lace Monitor and the Red-Bellied Black Snake, Common Brown Snake and Eastern Small-eyed Snake (Appendix F).

As is the case for other native vertebrate fauna, the substantial array of habitat types and vegetation communities within the subject site provide opportunities for an array of other native reptile species, including those typically recorded around wetlands.

It is not considered likely that any threatened reptile species would occur on the subject site, given the habitats and resources present. Relevantly, the Heath Monitor *Varasus rosenbergei* has not been recorded in the vicinity, and there is no suitable habitat for this species on the subject site.

5.2.3 Amphibians

During the field investigations by BES (2008) and Environmental InSites (this *Report*), nine amphibian species were recorded on the subject site (Appendix F). All of the amphibian species recorded on the subject site are common to abundant and widespread, and all are recorded in the habitat types and wetlands present on the subject site (including artificial farm dams).

Despite targeted surveys for the Green & Golden-Bell Frog by both BES and Environmental InSites, this species has not been recorded in recent times on the subject site at Sussex Inlet. There is a previous alleged 'sighting' of this species from the 9-hole golf course in the southwestern part of the site, by a green-keeper on the golf course. That record, however, is of some age, and has not been verified or repeated despite an array of investigations in this locality, including further dedicated surveys inclusive of those undertaken by Gunninah Environmental Consultants for development to the south of Badgee Lagoon (Gunninah Environmental Consultants 2001, 2004; InSites 2008).

It is not considered likely that the Green & Golden-Bell Frog, even if previously present on the subject site, is currently resident thereon. In any case, features associated with the proposed development (such as the proposed detention basins and stormwater treatment ponds) and water features associated with the golf course can readily be designed, constructed and maintained in a manner which is ideal for the Green & Golden Bell Frog.

Similarly, no evidence of the Giant Burrowing Frog has been obtained from the subject site, despite dedicated surveys.

No other threatened amphibian species is considered of relevance to the proposed development on the subject site at Sussex Inlet.

5.2.4 Mammals

The habitats and resources within the subject site support a variety of mammal species, with a total of 36 species recorded during the recent field investigations, including 32 native and 4 introduced species (Appendix F).

The open forest communities provide habitats and resources for arboreal mammal species such as the Common Brushtail Possum, Sugar Glider and Yellow-bellied Glider. These arboreal marsupials are all frequently recorded throughout the forested areas in the region. All utilise tree-hollows as dens, but exhibit varying levels of tolerance to disturbance, with Yellow-bellied Gliders appearing less tolerant than the other species.

The Eastern Pygmy Possum was recorded within the Shoalhaven Sandstone Forest on the subject site, although it is likely to utilise a variety of forest habitats that contain abundant foraging resources, particularly plant species from the *Proteacea* family (*eg* Banksias, Grevilleas and Mountain Devils). A detailed habitat analysis was undertaken for this species, and is presented in Appendix H of this *Report*.

Large macropods, including the Eastern Grey Kangaroo, Red-necked Wallaby and Swamp Wallaby, were recorded during the field investigations on the subject site. These species graze on the grasses and understorey plants of the forests and woodlands of southeastern Australia, as well as on improved pastures and on golf courses. Small terrestrial mammals (the Brown and Agile Antechinus, the Bush Rat and Swamp Rat) were also recorded on the site. Such species are also common residents of bushland in the locality, and are relatively disturbance-tolerant, utilising resources in the vicinity of residential development.

Flying-foxes and microchiropteran bats are highly mobile and wide-ranging species, and are not likely to be dependent on a single area of bushland for their foraging requirements. Whilst a variety of such species (Appendix F) utilise or are likely to utilise the site for foraging purposes:

- critical roosting resources for many species (caves, mine shafts or other similar artificial structures) are not present on the site; and/or
- tree-hollows suitable for roosting purposes, whilst common on the subject site, are also abundant widely through the locality and region. Further, a significant proportion of those resources present on the site will be retailed in the extensive tracts of forest to be conserved through the centre of the subject land.

Three introduced mammal species were recorded on the subject site – the European Fox, Cat and Dog (Appendix F).

As indicated in Tables 12 and 13, fourteen microchiropteran bat species have been positively identified within the subject site (BES 2009; this *Report*), and a further seven species were recorded to a lesser degree of certainty. Eight of the species are threatened bats, although there is only a low level of

certainty in respect of the Eastern Falsistrelle, the Large-footed Myotis and the Greater Broad-nosed Bat. Calls of the Eastern Falsistrelle and the Greater Broad-nosed Bat are difficult to differentiate (Pennay *et al* 2004), and the Large Footed Myotis is hard to differentiate from calls of *Nyctophilus* species (Pennay *et al* 2004). Of the 6 calls attributed to a *Nyctophilus* species, only one sequence displayed possible characteristics of the Large-footed Myotis (being the much longer duration of the call sequence relative to the other calls recorded). This species, and the other threatened microchiropteran bat species, are discussed further in Chapter 5.3.1 of this *Report*.

Notwithstanding the uncertainties regarding the presence or otherwise of some microchiropteran bat species, for the purposes of this *Report* it has been assumed that individuals of all of those species (even tentatively recorded) are, or are likely to be, present on the subject site at times at least. Further, it is assumed that other threatened microchiropteran bats could possibly occur on the subject site. The subdivision design has taken into account the possible presence and the habitat and resource requirements of such species (see Chapter 13).

Table 12 Results of ultrasonic bat detection surveys conducted within the subject site on the 8th of January and the 18th, 19th and 20th of February 2009

Scientific Name	Common Name	Status	No.	Def	Pro	Pos
***Molossidae* (Freetail Bats)**						
Mormopterus ridei	Eastern Freetail Bat	P	5	4		1
Micronomus norfolkensis	East-coast Freetail Bat	V	18	11	4	3
Austronomus australis	White-striped Freetail Bat	P	14	13		1
***Rhinolophidae* (Horseshoe Bats)**						
Rhinolophus megaphyllus	Eastern Horseshoe Bat	P	1	1		
***Vespertilionidae* (Evening Bats)**						
Chalinolobus gouldii	Gould's Wattled Bat	P	12	10		2
Chalinolobus morio	Chocolate Wattled Bat	P	13	4	3	6
Falsistrellus tasmaniensis	Eastern Falsistrelle	V	8			8
Myotis macropus	Large-footed Myotis	V	1			1
Nyctophilus geoffroyi	Lesser Long-eared Bat	P	6			6
Nyctophilus gouldi	Gould's Long-eared Bat	P	6			6
Scoteanax rueppellii	Greater Broad-nosed Bat	V	5			5
Scotorepens orion	Eastern Broad-nosed Bat	P	8			8
Vespadelus darlingtoni	Large Forest Bat	P	48	4	11	33
Vespadelus regulus	Southern Forest Bat	P	41			41
Vespadelus vulturnus	Little Forest Bat	P	7	1		6
***Miniopteridae* (Bent-wing Bats)**						
Miniopterus orianae oceanensis	Eastern (Common) Bent-wing Bat	V	28	4	2	22
Key to Accuracy						
Def	absolutely no doubt about identification of bat making call					
Pro	most likely the species named, but there is low probability of confusion with species with similar calls					
Pos	call is comparable with the listed species, but there is moderate to high probability of confusion with species that emit similar calls					
Key to Legal Status						
P	'Protected pursuant to the *National Parks & Wildlife Act 1974*					
V	'Vulnerable' pursuant to the *Threatened Species Conservation Act 1995*					

Table 13 Results of ultrasonic bat detection surveys conducted by BES/ELA in the 'Areas of Contention' in November 2010

Survey Area	Common Name	Scientific Name
Area 1A	Yellow-bellied Sheath-tail Bat	*Saccolaimus flaviventris*
	Large-eared Pied Bat	*Chalinolobus dwyeri*
	Little Bent-wing Bat	*Miniopterus australis*
	Common (Eastern) Bent-wing Bat	*Miniopterus (schreibersii) orianae oceansis*
	East-coast Freetail Bat	*Micronomus norfolkensis*
	Eastern Falsistrelle	*Falsistrellus tasmaniensis*
Area 2A	Yellow-bellied Sheath-tail Bat	*Saccolaimus flaviventris*
	Common (Eastern) Bent-wing Bat	*Miniopterus (schreibersii) orianae oceansis*
	Eastern Falsistrelle	*Falsistrellus tasmaniensis*
Area 3A	Yellow-bellied Sheath-tail Bat	*Saccolaimus flaviventris*
	Common (Eastern) Bent-wing Bat	*Miniopterus (schreibersii) orianae oceansis*
	East-coast Freetail Bat	*Micronomus norfolkensis*
	Eastern Falsistrelle	*Falsistrellus tasmaniensis*

5.3 Threatened Species

5.3.1 Threatened Species Recorded on the site

Sixteen threatened fauna species have been recorded on the subject site during the field surveys between December 2007 and November 2010 (Appendix F; Table 14). Threatened fauna are predominantly located within the northern and central portions of the site, relatively distant from the effects of the existing residential development of Badgee and the effects of clearing to the west and north, and of the golf course to the southeast.

All of the "*threatened species*" which have been recorded are listed as "*Vulnerable*" on Schedule 2 of the TSC Act (Table 14), and most are widely and frequently recorded in the Shoalhaven LGA.

Many of these species are common to abundant on at least a local and/or sub-regional basis, notwithstanding their alleged "*Vulnerable*" status. Further, suitable habitats and resources for most of these species are extremely well conserved in the extensive reserves in the LGA (approximately 60% of the Shoalhaven LGA is protected in conservation reserves, not including the substantial Commonwealth areas). Additionally, there are substantial areas of State Forest and privately owned forested land, much of which is unlikely ever to be developed (*eg* much of the One Tree Bay land to the immediate north).

The consideration of the local and regional distribution of threatened biota, and of suitable or relevant habitat, is reliant substantially on:

- the substantial personal experience of the principal author of this *Report* in the Jervis Bay area, particularly including investigations over large tracts of land for threatened biota (including the Yellow-Bellied Glider, Glossy Black Cockatoo and other relevant species); and
- the regional vegetation mapping provided by the DECCW (Figure 7).

In that latter regard, the broad-scale of mapping of vegetation and habitats provided by the DECCW (Figure 7) should appropriately be used as a means of determining the likely extent of threatened biota through the landscape. In this regard, it should be noted that it is a fundamental precept, as documented in an array of publications provided by the DECCW regarding the assessment and analysis of threatened biota and their habitats, that where there is suitable or appropriate habitat for a threatened species, it must assumed that the species is present.

On that basis, and given the DECCW mapping of native vegetation through the general locality and sub-region (Figure 7), it must be assumed (by the approach identified by the DECCW) that the threatened biota which rely upon those habitat or vegetation types are distributed throughout those communities within the general locality.

Table 14 Threatened fauna recorded on the subject site or on immediately adjoining land

Species	BES 2009	InSites 2009	BES 2010	Habitat in the Subject Site	Habitat significance[5]	
					Local	Sub-Regional
Grey-headed Flying Fox	✓	✓		Forest canopy (foraging)	Low to Moderate	Low
East-coast Freetail Bat	✓	✓	✓	Forest canopy (foraging and roosting)	Moderate	Low
Common Bent-wing Bat	✓	✓	✓	Forest canopy (foraging)	Moderate	Low
Little Bent-wing Bat	✓	✓	✓	Forest canopy (foraging)	Moderate	Low
Large-footed Myotis	✓	✓		Badgee Lagoon and ponds (foraging)	Low to Moderate	Low to Moderate
Greater Broad-nosed Bat	✓	✓		Forest canopy (foraging and roosting)	Moderate	Low to Moderate
Yellow-bellied Sheath-tail Bat	✓	✓	✓	Forest canopy (foraging and roosting)	Moderate	Low to Moderate
Eastern Falsistrelle	✓		✓	Forest canopy (foraging and roosting)	Moderate	Low to Moderate
Large-eared Pied Bat			✓	Forest canopy (foraging and roosting)	Moderate	Low to Moderate
Eastern Pygmy Possum	✓			Shoalhaven Sandstone and Currambene Lowland Forest	High	Moderate to High
Yellow-bellied Glider	✓	✓	✓	Forest canopy (foraging and denning)	Moderate	Moderate
Square-tailed Kite	✓			Forest canopy (foraging)	Low	Low
Glossy Black Cockatoo	✓	✓	✓	Forest canopy - Shoalhaven Sandstone and Currambene Lowland Forest	Moderate	Low to Moderate
Gang Gang Cockatoo	✓			Forest canopy (foraging and nesting)	Low	Low
Powerful Owl	✓		✓	Forest canopy - Currambene Lowland Forest	Low to Moderate	Low to Moderate
Masked Owl	✓			Forest canopy and golf course	Low to Moderate	Low to Moderate

[5] Detailed consideration of the importance of the subject site for each threatened species is provided below and in Appendix I.

Grey-headed Flying Fox

This species occurs in or utilises subtropical and temperate rainforests, tall sclerophyll forests and woodlands, and some heaths and swamps, as well as urban gardens and cultivated fruit crops.

Roosting camps are generally within 20km of a regular food source, and are commonly located in large trees in gullies, close to water, in forest vegetation with a dense canopy. Individual camps may have tens of thousands of animals, and are used for mating, birth and the rearing of young. Site fidelity to roost camps is high, with some camps having been used for over a century. Conversely, at least in the southern parts of its range, the Grey-headed Flying Fox can be migratory.

Grey-headed Flying Foxes travel up to 50km in an evening to forage, feeding on the nectar and pollen of native trees, in particular eucalypts, paperbarks and banksias, and the fruits of rainforest trees (including many figs) and vines. They may also forage in cultivated gardens and fruit crops, and can inflict severe crop damage.

This species is frequently recorded throughout coastal NSW, including in the Sussex Inlet locality. However, the subject site does not constitute a significant portion of the habitat for a local population of this species, given that:

- there are no camps of this species present on the site;
- the site represents only a very small area of potentially suitable habitat, and
- the extensive distribution of potential suitable habitat in the locality and region (Figure 7).

The Grey-headed Flying Fox can be expected to forage widely throughout the subject site during periods when there is extensive flowering in the upper and middle strata, and particularly in winter where there are winter-flowering tree species. A large area of potential foraging habitat for the Grey-headed Flying Fox will be retained as part of the proposed rezoning, however, and in the vicinity, and no restrictions on the movement of this wide-ranging and highly mobile species would be anticipated. Further, no existing camps of the Grey-headed Flying Fox will be affected.

East-coast Freetail Bat

The East-coast Freetail Bat *Micronomus norfolkensis* is a tree-dwelling insectivorous bat which is often located in dry eucalypt forest and coastal woodlands, although individuals have also been captured within riparian zones, wet sclerophyll forest and rainforest (Allison & Hoye 1995). This species forages above the canopy or in unobstructed corridors in open areas (Strahan 1995), on either winged or wingless ants (Allison 1989). Small colonies of the East-coast Freetail Bat roost in tree-hollows or under loose bark on large trees (Churchill 2008).

This species was recorded by ultrasonic detection within the subject site at Sussex Inlet, and is likely to utilise all forested areas of the site, as well as surrounding lands. There is substantial potential roosting habitat for this species (hollow-bearing and large trees), much of which will be retained as part of the proposed rezoning of the subject site.

Given the high mobility of this species and the extent of large areas of habitat within the subject site and in the vicinity (Figure 7), the proposed rezoning and subsequent development of the site at Sussex Inlet

would not be likely to impose any significant adverse effects on the local population of the East-coast Freetail Bat.

Common (Eastern) Bent-wing Bat

The Common (Eastern) Bent-wing Bat forages above dry and moist forest, and can be found in forested as well as urban areas. This species preferentially roosts in caves, although man-made structures (such as old mines, tunnels, bridges, and other similar structures) are also used. Specific maternity caves are used by females during summer to give birth.

The Common Bent-wing Bat was positively recorded via ultrasonic detection within the subject site, and individuals can be expected to utilise all of the forested areas of the site and surrounding lands for foraging purposes. However, no significant roosting habitat has been identified within the subject site, although this species does utilise tree-hollows for roosting on occasions.

Given the high mobility of this species and the retention of large areas of suitable foraging habitat within the subject site and in the vicinity (Figure 7), the proposed development is unlikely to have any significant adverse impacts upon any local population of the Common (Eastern) Bent-wing Bat.

Little Bent-wing Bat

The Little Bent-wing Bat forages "*between the shrub and canopy layers of densely wooded areas*" (Churchill 2008). This species almost exclusively roosts in caves, although man-made structures (such as old mines, tunnels, stormwater drains and occasionally buildings) are also used. Specific maternity caves are used by females during summer to give birth.

The Little Bent-wing Bat was positively recorded via ultrasonic detection in the northeastern part of the subject site, and individuals can be expected to utilise all of the forested areas of the site and surrounding lands for foraging purposes. No relevant roosting habitat has been identified within the subject site, although this species has been recorded once using tree-hollows for roosting.

Given the high mobility of this species and the retention of large areas of suitable foraging habitat within the subject site and in the vicinity (Figure 7), the proposed development is unlikely to have any significant adverse impacts upon any local population of the Little Bent-wing Bat.

Large-footed Myotis

The Large-footed Myotis is distributed through eastern and northern Australia and roosts in caves, tunnels and under bridges, and sometimes in hollow-bearing trees. This species has very large hind feet to catch insects and small fish from the water, and narrow wings for fast flight. Individuals of the Large-footed Myotis fly over creeks and ponds, raking their clawed hind feet through the water to catch fish and insects.

This species was recorded to a low degree of accuracy within the subject site via ultrasonic detection (Chapter 5.2.4 of this *Report*). Badgee Lagoon and the small dams or ponds associated with the golf course represent potential foraging habitat for this species, but no potential roosting habitat was located.

Future development of the subject site in accordance with the proposed rezoning would require the removal of only artificial dams, and replacements for such features could readily be incorporated into the new golf course design and open space areas. The proposal is not likely to have any relevant adverse impacts upon any local population of the Large-footed Myotis.

Greater Broad-nosed Bat

The Greater Broad-nosed Bat is found in a variety of habitats, ranging from woodlands to moist and dry eucalypt forest and rainforest (Hoye & Richards 1995; Churchill 2008). This species prefers open habitats in which individuals can fly straight and direct, and the species is known to utilise artificial openings in forests, with favoured habitats being river and creek corridors (Hoye & Richards 1995). Individuals have been recorded roosting in tree-hollows, cracks and fissures in the trunk and boughs of stags, and under exfoliating bark. A recent study on the north coast of NSW by Campbell (2001) found roosting habitat in a Melaleuca swamp woodland habitat (Wallum) in areas of low relief.

This species was recorded to a low degree of accuracy via ultrasonic detection within the subject site at Sussex Inlet, and would be expected to utilise all of the forested areas of the site and surrounding lands, as well as the Estuarine Scrub Community around Badgee Lagoon. There is an abundance of potential roosting habitat for this species, much of which will be retained as part of the proposed rezoning and any future development of the subject site.

Given the high mobility of this species and the retention of large areas of habitat containing suitable roosting resources within the subject site and in the vicinity (Figure 7), the proposed rezoning and future development of the site is unlikely to impose any significant adverse impacts upon the local population of the Greater Broad-nosed Bat.

Yellow-bellied Sheath-tail Bat

The Yellow-bellied Sheath-tail Bat is found in a variety of habitats, ranging from grasslands and desert to woodlands, moist and dry eucalypt forest and rainforest (Churchill 2008). This species fly "*fast and straight usually above the canopy, but lower over open spaces and at the forest edge*" (Churchill 2008), and roosts in large tree-hollows.

The Yellow-bellied Sheath-tail Bat was recorded throughout the subject site at Sussex Inlet, and would be expected to utilise all of the forested areas of the site and surrounding lands, as well as the Estuarine Scrub Community around Badgee Lagoon. There is an abundance of potential roosting habitat for this species, much of which will be retained as part of the proposed rezoning and any future development of the subject site.

Given the high mobility of this species and the retention of large areas of habitat containing suitable roosting resources within the subject site and in the vicinity (Figure 7), the proposed rezoning and future development of the site is unlikely to impose any significant adverse impacts upon the local population of the Yellow-bellied Sheath-tail Bat.

Large-eared Pied Bat

The Large-eared Pied Bat has been recorded from dry woodlands and eucalypt forest to moist forest and the edges of rainforest (Churchill 2008). This species fly "*relatively slowly*" (Churchill 2008) and roosts in caves and mines.

The Large-eared Pied Bat was recorded in the northeastern part of the subject site at Sussex Inlet, but would be expected to utilise most or all of the forested areas of the site and surrounding lands. There is no potential roosting habitat for this species on the site, and it is assumed that the record is either of a vagrant or of animals that roost elsewhere and travelled to the site to forage.

Given the high mobility of this species and the retention of large areas of habitat containing suitable foraging resources within the subject site and in the vicinity (Figure 7), and given the lack of roosting habitat, the proposed rezoning and future development of the site is unlikely to impose any significant adverse impacts upon the local population of the Large-eared Pied Bat.

Eastern Pygmy Possum

The Eastern Pygmy Possum is found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath vegetation. In most areas, however, woodlands and heath appear to be the preferred habitat types, except in northeastern NSW (where the species is most frequently encountered in rainforest).

The Eastern Pygmy Possum feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes, and is an important pollinator of heathland plants (such as banksias). In addition, soft fruits are eaten when flowers are unavailable. This species also feeds on insects throughout the year, and this food resource may be more important in habitats where flowers are less abundant (such as in wet forest types).

Eastern Pygmy Possums shelter in tree-hollows, rotten stumps, holes in the ground, abandoned bird-nests, Common Ringtail Possum dreys or thickets of vegetation (*eg* grass-tree skirts). Nest-building appears to be restricted to breeding females, and tree-hollows are favoured, although spherical nests have been found under the bark of eucalypts and in shredded bark in tree forks.

A single Eastern Pygmy Possum was trapped by BES (2008) within the Shoalhaven Sandstone Forest in the northwestern part of the site. Subsequently, a detailed habitat assessment was undertaken by Environmental InSites to determine which areas of the subject site were likely to be of greatest potential value to this species (refer to Appendix H). This habitat assessment focused on the distribution of preferred foraging resources, specifically plants within the *Proteacea* family such as banksias, grevilleas and *Lambertia* species.

The habitat assessment indicates that the Shoalhaven Sandstone Forest generally represents preferred habitat for the Eastern Pygmy Possum, and the Currambene Lowland Forest is of secondary value. Suitable vegetation and habitat for this species is characteristic of much of the areas proposed for conservation zoning on the subject site, as well as on the One Tree Bay land to the north. Indeed, the single record of this species on the subject site is at the southern extremity of preferred habitat.

The proposed rezoning of the subject site has been designed to ensure that the majority of Shoalhaven Sandstone Forest is retained, thereby avoiding the potential to impose a significant impact upon this species. In addition, there is extensive contiguous preferred habitat to the immediate north (Figures 3 and 8), which would be reserved as part of the One Tree Bay development.

Yellow-bellied Glider

The Yellow-bellied Glider occurs in tall mature eucalypt forest, generally in areas with a high rainfall and nutrient-rich soils. Forest type preferences vary with latitude and elevation, and range from mixed coastal forests to dry escarpment forests in the north, and moist coastal gullies and creek flats to tall montane forests in the south.

This species could potentially utilise all forested parts of the subject site (excluding the estuarine habitats), although most records are from the Currambene Lowland Forest. As noted elsewhere in this *Report*, hollow-bearing trees are common through the more xeric forest types, although tree-hollows of sufficient size for the Yellow-bellied Glider represent only a relatively small proportion of those present.

The Yellow-bellied Glider lives in family groups of up to 6 individuals, which occupy home ranges of between 30 and 65 hectares (NPWS 1998). This suggests that potentially as many as 8 families could reside within the subject site, although the frequency and distribution of records indicate a smaller population size.

All Yellow-bellied Glider records on the site (including indirect evidence) have been in the Currambene Lowlands Forest and Shoalhaven Sandstone Forest vegetation types, which represent a total of 122.75ha (or 51% of the site). Substantial areas of those communities are to be retained in the proposed rezoning (see Chapter 15), and the site is contiguous with substantial areas of potentially suitable forest habitat to the north (Figures 3 and 7; Chapter 13).

The proposed rezoning of the subject site has been designed such that a significant proportion of the habitat for the Yellow-bellied Glider would be retained on the site, and that connectivity to adjoining land (Figure 3) to the north would not be affected. As a consequence, and given the extent of suitable habitat in the locality (Figure 7) it is not considered likely that the proposed future development of the site would impose significant adverse impacts on the Yellow-bellied Glider.

Green & Golden Bell Frog

There is one historical record of the Green & Golden Bell Frog on the subject site. That record was a sighting and report by a greenkeeper at the golf course in the early 1990s, and there have been no further records of the Green & Golden-Bell Frog on the subject site.

Other investigations have been conducted on the site and in the vicinity over a number of years, including surveys by G Daly and investigations by Gunninah Environmental Consultants for land to the south of Badgee Lagoon (south of Jacobs Drive). No further records of this species on the subject site have been obtained during that period.

However, Green & Golden Bell Frogs are known to survive and breed in ponds adjacent to the Sussex Inlet Sewerage Treatment Plant (STP), approximately 3km to the south. Recent investigations by

Environmental InSites on a portion of land immediately south of Jacobs Drive (at Sussex Inlet Road) failed to locate any specimens of the Green & Golden-Bell Frog at that location, despite intensive investigations at a period when Green & Golden-Bell Frogs were calling at the STP site (InSites 2008).

The Green & Golden-Bell Frog is a highly mobile terrestrial amphibian species, which has been recorded moving over distances of some kilometres. It is therefore theoretically possible at least that Green & Golden-Bell Frogs could occur on the subject site under appropriate circumstances. It is noted that stormwater detention basins and ponds associated with the new golf course proposed on the subject site could readily be designed, constructed, and managed to provide suitable habitat for the Green & Golden-Bell Frog at this location.

Square-tailed Kite

The Square-tailed Kite is found in a variety of timbered habitats through eastern Australia (including dry woodlands and open forests), and displays a particular preference for timbered watercourses. This species appears to occupy very large hunting ranges of more than 100km^2. It is a specialist hunter of passerines (especially honeyeaters) and most particularly nestlings, as well as insects in the tree canopy, picking most prey items from the outer foliage. Breeding is from July to February, with nest sites generally located along or near watercourses, in a fork or on large horizontal limbs.

A review of the New Atlas of Australian Birds (Birds Australia 2003) indicates that this species is relatively sedentary within the Shoalhaven locality, being recorded at all times of year other than winter, albeit in low numbers.

This species was observed over the subject site by BES (2008), although no nesting activity has been recorded on the site or in the vicinity. The subject site would provide only an extremely small area of habitat within a very large home range for individuals of this species.

The proposed rezoning and subsequent development of the subject site is unlikely to impose any significant impact upon this species, given:

- the retention of a large proportion of the forested land within the subject site; and
- the extent of suitable forest vegetation and habitat in the locality (Figure 7).

Gang Gang Cockatoo

In summer, the Gang Gang Cockatoo is generally found in tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, however, this species is present at lower altitudes (in drier more open eucalypt forests and woodlands), and is often found in urban areas. Individuals may also occur in sub-alpine Snow Gum woodland and occasionally in temperate rainforests.

A review of the New Atlas of Australian Birds (Birds Australia 2003) indicates that this species is relatively sedentary within the Shoalhaven locality, being recorded at all times of year albeit in low numbers.

This species was observed on three occasions on the subject site by BES (2008), although no nesting activity was observed. Given the large area of the forest to be retained on the site, coupled with the

extensive area of suitable habitat within the locality (Figure 7), this species is not likely to be affected by the proposed rezoning or future development of the subject site in accordance with that rezoning to any relevant extent.

Glossy Black Cockatoo

The Glossy Black Cockatoo inhabits woodlands and open forests on low nutrient soils, with a middle stratum containing abundant *Allocasuarina* species (particularly the Black She-oak *Allocasuarina littoralis* and the Forest Oak *Allocasuarina torulosa*) upon which they are dependent for food. The Glossy Black Cockatoo is a common inhabitant of coastal forests within the Shoalhaven LGA and in the region.

This species breeds in either dead or live large vertical tree-hollows within woodlands or remnant woodlands. Roosts are usually in the canopy of leafy eucalypts within 30 metres of the nesting tree (Higgins 1999).

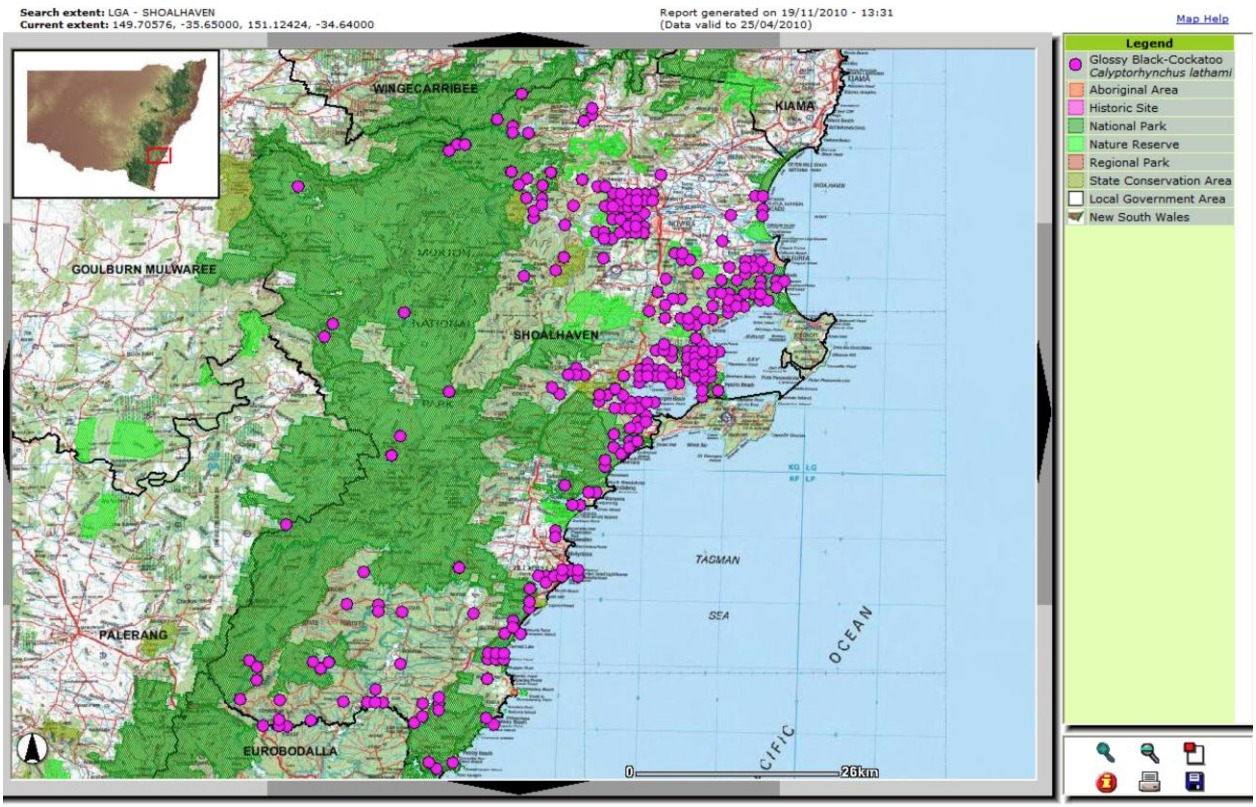
A review of the New Atlas of Australian Birds (Birds Australia 2003) indicates that this species is relatively sedentary within the Shoalhaven locality, being recorded at all times of year, albeit generally in relatively low numbers. Conversely, the DECCW Wildlife Atlas indicates a significant number of records (see map below). Further, the experience of the principal author of this *Report* over 20 years in the Shoalhaven is that Glossy Black Cockatoos are widely distributed and common in suitable forest in the LGA.

It had been suggested that the subject site may contain dense or significant stands of mature she-oaks (*Allocasuarina* spp) that may be important for the survival of a local sub-population of the Glossy Black Cockatoo. There had been observations of a flock of up to eighteen Glossy Black Cockatoos flying in a southeasterly direction from the One Tree Bay site to the immediate north, onto the subject site (M Boak and D Young DECCW *pers comm*).

However, whilst there is clear evidence of Glossy Black Cockatoo feeding sites within the subject site (Figure 8), dedicated searches undertaken in November 2010 for dense or significant stands of mature she-oaks failed to identify any such stands within the northern half of the subject site (Appendix A). It would appear, therefore, either that the Glossy Black Cockatoo sub-population is utilising a more dispersed array of she-oaks for feeding on the subject site or that this sub-population is travelling further to the southeast (into Commonwealth land to the east of Sussex Inlet) to obtain sufficient food resources.

Foraging signs of this species have been recorded throughout the subject site, predominantly within the Currambene Lowland Forest. Further, this species is widely distributed throughout the Jervis Bay area (as noted above), and was sighted throughout the subject site on a variety of occasions. However, no nesting sites or any evidence of nesting activities have been recorded on the subject site.

Given that a large proportion of suitable forested lands are to be retained on the subject site by the proposed rezoning, and given the extensive area of suitable habitat within the locality, as well as the substantial population of this species in the LGA and in the region (Figure 7), the Glossy Black Cockatoo is not likely to be affected by the proposed rezoning or future development of the subject site to any relevant or significant extent.



Glossy Black Cockatoo records on the DECCW Wildlife Atlas in the Shoalhaven LGA

Powerful Owl

Powerful Owls inhabit a range of wet or dry sclerophyll forest communities with mature trees, large tree-hollows and abundant aboreal mammals for food. This species roosts and breeds in trees (usually in densely vegetated gullies), and pairs occupy large home ranges (800-1000ha). The Powerful Owl is the largest of Australia's owls (Debus & Chafer 1994). It feeds on large arboreal mammals, megachiropteran bats, and other fauna captured in trees, and forages mostly in open forests, typically roosting in tall trees in moist gullies. It nests in very large tree-hollows, typically in large tree in a moist gully.

A review of the New Atlas of Australian Birds (Birds Australia 2003) indicates that this species is relatively sedentary within the Shoalhaven locality, being recorded at all times of year. Not surprisingly for a peak predator, the Powerful Owl is present in only low numbers, although it is widespread and relatively common in the LGA (F D Fanning *pers obs*).

The subject site provides an area of foraging habitat for this species amounting to about one-quarter of a normal pairs' home range, and there is extensive suitable contiguous habitat to the immediate north. Suitable tree-hollows for this species are scattered throughout the site in low numbers, although there is no evidence to suggest that this species is currently nesting on the site, or has done so in recent times.

Given the extent of the forest habitats to be retained, and the extensive area of habitat within the locality (Figure 7), as well as the size of the home range and the mobility of this species, the Powerful Owl is not likely to be affected by the proposed rezoning or future development of the subject site to any significant extent.

Masked Owl

The Masked Owl inhabits a diverse range of dry eucalypt forest and woodland communities, especially adjacent to grassland or clearings. This species requires a large home range (up to 1000ha). Key roosting and nesting habitat must contain tall or dense mature trees with suitable hollows, and the favoured nesting hollows are near-vertical spouts or large hollows in the trunks of large eucalypts (Higgins 1999). This owl species forages mainly upon terrestrial prey in adjoining open habitat, occasionally preying upon arboreal or scansorial mammals (Higgins 1999). Rats form a large part of their diet (DEC 2005).

A review of the New Atlas of Australian Birds (Birds Australia 2003) indicates that there are only incidental records of the Masked Owl in the Shoalhaven locality, being recorded mostly during summer and in very low numbers.

The subject site provides a relatively small area of suitable potential foraging habitat for this species relative to the locality, and could be utilised by an individual or a pair of Masked Owls at least on a transitory basis given the existence of potential prey species. Suitable hollows for this species are scattered throughout the site in low numbers, but there is no evidence to suggest that any Masked Owls are resident on or actually use the site for nesting purposes.

Given that a large proportion of potential habitat on the site is to be retained, and given the extent of suitable habitat within the locality (Figure 7), the Masked Owl is not likely to be affected by the proposed rezoning or future development of the subject site to any relevant extent.

5.3.2 Other Threatened Fauna Species

Other threatened fauna species known to occur in the general vicinity (*eg* the Osprey, Black Bittern and other microchiropteran bats) could also potentially utilise the subject site, particularly given its connectivity with larger tracts of vegetation to the north. However, given the large area of vegetation being conserved as part of the proposed rezoning of the site, as well as the extensive areas of contiguous vegetation to the immediate north, it is considered unlikely that any of these species would be adversely affected to any significant extent.

The potential or likelihood of an array of additional threatened fauna species utilising the subject site or being dependent upon it has been considered by reference to the complete list of threatened fauna species recorded on the DECCW Wildlife Atlas (Appendix B). Of the additional threatened fauna species identified as occurring in the locality, less than half are considered moderately likely to occur on the subject site (as individuals at least) whilst a considerable number of species are not considered of any relevance to the subject site or the proposal (Appendix I).

The proposed rezoning of the subject site has taken into account the potential for a range of additional threatened species to occur on the subject site, and has sought to retain examples of all of the vegetation types present. Further, significant resources (such as hollow-bearing trees) have been selectively addressed in the rezoning proposal, with the area proposed for conservation zoning through the central and northwestern parts of the subject site containing the greatest proportions of and densities of hollow-bearing trees present (see Chapter 13). In addition, features such as the proposed golf course would ultimately be designed to ensure the retention of significant or relevant resources (such as hollow-bearing trees).

The areas proposed for conservation zoning on the subject site, and the extensive areas of habitats and resources on adjoining lands, as well as in the St Georges Basin and Badgee Lagoon, provide a considerable and highly varied array of suitable habitats for the additional threatened species which could potentially occur on the site. Given the extent of land to be protected from future development, and the extent of contiguous habitat (particularly to the immediate north) and in the general locality and region (Figure 7), the long-term prognosis for any such additional threatened biota which might occur in the immediate locality is high.

6 AQUATIC ECOSYSTEMS and BIOTA

6.1 Aquatic Ecosystems

There are four aquatic ecosystems and habitat areas located either on or associated with the Sussex Inlet Golf Course site at Sussex Inlet (Figures 3 and 5):

- Badgee Lagoon itself - *State Environmental Planning Policy No.14* (SEPP 14) Wetland No. 306 and its associated wetlands, located in and adjacent to the southern parts of the subject site;
- the St Georges Basin and its associated wetlands (including SEPP 14 Wetland No. 312), located in and to the northeast of the subject site;
- a small predominantly natural watercourse in the northeastern part of the subject site; and
- two small highly modified, degraded and substantially artificial watercourses in the southwestern part of the site, associated with the existing golf course.

6.2 Badgee Lagoon and Wetlands

Badgee Lagoon is a small tidal lagoon off Sussex Inlet, immediately south of the interface between Sussex Inlet and the St Georges Basin (Figures 3 and 5). The open water of Badgee Lagoon occupies only the eastern part of the mapped SEPP 14 Wetland (No. 306) at this location, and is (narrowly) bordered by areas of Mangrove Forest and patches of Coastal Saltmarsh.

Beyond those estuarine plant communities, particularly to the west, there are substantial areas of estuarine and freshwater wetland vegetation types (Figure 5). All of those areas of vegetation are listed as "*endangered ecological communities*" (EECs) in the TSC Act (Figure 6), and all are to be retained in the proposed conservation zoned land on the site (see Chapters 8 and 13).

Badgee Lagoon itself and its associated estuarine vegetation (particularly the Mangrove Forest) provide important habitat and resources for a range of native biota, including native fish. These ecosystems also provide an array of important habitat and resources for wading and wetland birds, including both foraging and roosting habitats.

The freshwater ecosystems on the landward side of the estuarine ecosystems (which include an array of creek-flat scrub and swamp forest communities – see Figure 5) also provide important habitat and resources for an array of wetland bird species. However, there are no significant permanent freshwater bodies or pools in these areas for aquatic fauna. Importantly, all relevant habitats and vegetation are contained within the lands proposed to be zoned for conservation purposes (see Chapter 15), and any future development would be anticipated to protect all downstream ecosystems.

6.3 St Georges Basin

Wetlands and Aquatic Ecosystems

The aquatic habitats and environments associated with the St Georges Basin are confined substantially to the estuarine and lacustrine parts of that substantial waterbody, abutting the northeastern part of the subject site. The aquatic environment of the St Georges Basin and its associated beaches and littoral

environments are not part of the subject site, however, and would not be adversely affected directly by future development, although there may be a demand for access to the St Georges Basin for recreational purposes.

There is an SEPP 14 wetland on and adjacent to the northeastern boundary of the subject site (SEPP 14 Wetland No. 312), with several swamp and wetland vegetation types (all being EECs) present. There are no substantial open bodies of water in that part of the site, however, and there are no strictly aquatic ecosystems present within that part of the subject site.

As discussed in further detail in Part C of this *Ecological Issues & Constraints Report*, the approach being adopted by the DECCW and SCC (and apparently also by the DoP) with respect to the rezoning of the subject site at Sussex Inlet, is that all "*endangered ecological communities*" (EECs) and all SEPP 14 Wetlands constitute '*High Conservation Value'* areas, and are regarded by Council and the agencies as '*No Go Areas'*. These features are to be zoned solely for conservation purposes.

On that basis, both of the SEPP 14 Wetlands present on the subject site (adjacent to the St Georges Basin in the northeast and including Badgee Lagoon in the south) are to be zoned purely for conservation purposes. In addition, areas of the EECs which are contained within and adjoining those SEPP 14 Wetlands will be zoned solely for conservation purposes (see Chapter 15). Further, any future development in this part of the subject site would be anticipated to protect all ecosystems downstream, including those along the St Georges Basin.

6.4 Small Northeastern Watercourse

The small watercourse located in the northeastern part of the subject site, draining into the St Georges Basin, is an ephemeral natural watercourse surrounded by predominantly native riparian vegetation and native forest. This watercourse has not been subjected to significant disturbance or modification, other than in its lower reaches adjacent to the existing Badgee residential area, and consists of a small ephemeral drainage line with occasional (generally) small ponds.

The lower parts of the northeastern watercourse have been somewhat modified as a result of earthworks associated with the existing Badgee residential settlement and general uncontrolled access by residents and visitors. Nevertheless, much of the small northeastern watercourse is bordered by Swamp Sclerophyll Forest (an EEC), and will therefore be excluded from rezoning for any development purposes (see discussion above).

6.5 Southwestern Watercourses

There are two small ephemeral drainage lines in the southwest of the subject site at Sussex Inlet, largely contained within the existing golf course (Figure 10). These watercourses have long been subjected to significant modification and disturbance (see photographs in Appendix D), and currently include:

- a number of artificial farm or golf course dams;
- areas of cleared and grassed drainage swales within the golf course fairways; and
- small stretches of modified but partly natural native riparian vegetation.

There are no natural aquatic ecosystems of significance located along these small watercourses. It is not likely that the artificial farm/golf course dams on the subject site along the southwestern watercourses would constitute significant aquatic habitat, ecosystems or resources for any native biota. In any case, such features are readily re-created, and it is anticipated that the future 18-hole golf course and the residential development areas would provide similar resources.

Whilst the farm dams do provide some aquatic habitat for an array of native plant and animal species, they are also home to the Plague Minnow *Gambusia affinis*. This species is a known predator of native amphibian and fish eggs and hatchlings, and its presence is likely to preclude any native fish species which may once have occupied similar features (*ie* natural ponds) in the landscape.

The lower reaches of the small southwestern watercourses on the subject site support areas of impeded drainage which contain stands of the Swamp Sclerophyll Forest on Coastal Floodplains (SSFCF) community, which is one of the EECs identified on the subject site. Those relevant areas (Figure 6) are identified by DECCW and SCC as being '*No Go Areas'*, and would therefore be rezoned for biodiversity conservation purposes, precluding any development activities.

6.6 Aquatic Fauna

Whilst an array of native aquatic fauna may be expected within both the natural aquatic features (parts of the northeastern watercourse and Badgee Lagoon), and within the highly artificial and modified watercourses (the lower reaches of the northeastern watercourse and the two southwestern watercourses), no threatened aquatic fauna have been recorded from the immediate vicinity.

In any case, neither the northeastern watercourse nor Badgee Lagoon, nor any parts of the St Georges Basin, are to be zoned for development purposes, and any future development adjacent to these features will need to implement appropriate impact amelioration and environmental management measures to ensure the avoidance of any adverse impacts upon those waterbodies and any associated biota.

Neither of the small southwestern watercourses are likely to support any threatened or significant native biota. Both watercourses are highly modified, and consist predominantly of ponds and dams and artificial vegetated or grassed swales within the existing golf course. Whilst these features doubtless provide habitat for an array of native biota, they are not regarded as of any relevance or potential significance for any aquatic fauna or significance or concern.

None of the threatened aquatic biota listed in the TSC Act or the *Fisheries Management Act* are known to or are likely to occur within the watercourses on the subject site, particularly those which would be included within any future rezoning for residential or other purposes.

6.7 Conclusions

Whilst there are some notable aquatic ecosystems and habitats associated with the subject site at Sussex Inlet (particularly the St Georges Basin and Badgee Lagoon), the site itself does not support aquatic ecosystems or habitats of particular conservation significance or relevance. Badgeee Lagoon itself is not located on the subject site but adjacent to it, and is to be retained and protected in any case. Similarly, no direct impacts upon the St Georges Basin will be imposed as a result of the proposal.

There are three small ephemeral watercourses on the subject site at Sussex Inlet, but none of these contain aquatic habitat or resources of any particular conservation value or significance. Further, none of those watercourses represents or supports habitat or resources considered of any relevance to significant aquatic biota, including *inter alia* threatened species listed in either the *Fisheries Management Act 2000* or the *Threatened Species Conservation Act 1995.*

As indicated above, and as discussed in further detail in Part C of this *Report*, the full extent of both "*endangered ecological communities*" (EECs) and SEPP 14 Wetlands within the subject site at Sussex Inlet are identified by the DECCW (in the '*Verification Rules*' for *High Conservation Value Areas*) as '*No Go Areas*' (*ie* areas of land which are not regarded by the DECCW as acceptable for development purposes).

These areas are proposed by the DECCW to be zoned wholly and purely for biodiversity conservation purposes, and no use (including even for vehicular access) is considered acceptable by the DECCW pursuant to that zoning. As discussed elsewhere in this *Ecological Issues & Constraints Report*, that is not the statutory arrangement pursuant to the EP&A Act, the TSC Act or SEPP 14. Nevertheless, for the purposes of this *Report* and for the proposed rezoning of the subject site, it is assumed that all of the EECs and SEPP 14 Wetlands within the subject site at Sussex Inlet are to be zoned for conservation purposes, and are to be excluded from lands to be zoned for residential development or golf course purposes (except where existing).

PART C PART 3 – REZONING CONSIDERATIONS

7 RATIONALE for REZONING

7.1 Introduction

As discussed above (in Chapter 1), this *Ecological Issues & Constraints Report* provides the information base and relevant analyses required to determine, on an ecological basis, the appropriate zoning of the relevant parts of the subject site at Sussex Inlet. It is to be noted in this regard that determination of the appropriate zoning of various parts of the subject site (for development, golf course and/or residential purposes) is reliant in part on the consideration of ecological matters (as documented in Part B of this *Report*) but also in part on social and economic considerations in respect of relevant planning instruments and, *inter alia*, the "*objects*" of the *Environmental Planning & Assessment Act 1979* (EP&A Act).

Determination of the appropriate zoning of various parts of the subject site is reliant on two layers of consideration or constraint:

- the relevant planning instruments and policies, development strategies and statutory considerations (including the "*objects*" of the EP&A Act); and
- the identification of *High Conservation Value Areas* (HCVs), pursuant to the *Verification Rules* of the DECCW.

Consideration of the relevant matters contained in the various planning instruments, policies and statutes with respect to the subject site at Sussex Inlet (detailed in subsequent chapters of this *Report*), and of the HCVs identified pursuant to the DECCW *Verification Rules*, will necessitate an integrated approach in order to generate an appropriate and reasonable balance between biodiversity goals and appropriate and reasonable development outcomes.

7.2 Existing Planning Instruments and Policies

In order to determine the appropriate zoning of various parts of the subject site at Sussex Inlet, it is necessary to take into consideration matters raised in an array of planning instruments, policies and statutes (as indicated above). It is noted that those documents invoke a requirement to consider matters relating both to ecological and other statutory (*eg* riparian or coastal protection) issues, as well as to responsible and appropriate urban development requirements (including social and economic factors).

In the case of the subject site at Sussex Inlet, those planning instruments (see below) anticipate both:

- a conservation outcome, particularly with respect to lands considered of *High Conservation Value*; and
- expansion of the urban footprint of Sussex Inlet (including the provision of a flood-free access road) and the provision of an 18-hole golf course for Sussex Inlet.

Relevant planning instruments, policies and statutes have been taken into account and which are considered in further detail in subsequent chapters of this *Report* include:

- the *Sussex Inlet Settlement Strategy 2007* (Chapter 8);
- the *South Coast Regional Strategy 2009* (Chapter 9);

- the *St Georges Basin's Estuary Management Plan 1985* (Chapter 10);
- *State Environmental Planning Policy No. 14 – Coastal Wetlands* (Chapter 11);
- *State Environmental Planning Policy No. 44 – Koala Habitat Protection* (Chapter 12);
- the *Verification Rules* of the DECCW (Chapter 13); and
- the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999* (Chapter 14).

7.3 DECCW High Conservation Value Areas

As part of the process of determining which portions of the subject site are or may be constrained from an ecological perspective, the DECCW has provided a set of *Guidelines* entitled "*Verification of High Conservation Value Areas from South Coast Regional Strategy of the Sussex Inlet Area for the LEP Preparation Process*" (Appendix J). The '*Verification Rules*' provided by the DECCW indicate that the "*key conservation values mapped as occurring in the Sussex Inlet area are Endangered Ecological Communities, threatened fauna habitat, threatened flora habitat, wildlife corridors, old growth forest, wetlands and wader habitat*".

The *Verification Rules* of the DECCW have been prepared to identify land of "*high conservation value*". The *South Coast Regional Strategy* states (page 13) that "*New urban development is to be prohibited by environmental plans on land assessed as being of high conservation value*".

The specific verification requirements identified in the *Verification Rules* (Appendix J; Chapter 13) include:

- endangered ecological communities;
- old growth forest;
- threatened species of both flora and fauna, and their habitats;
- wildlife corridors (including *inter alia* a wildlife corridor mapped by the DECCW); and
- SEPP 14 and other wetlands.

The *Verification Rules* of the DECCW have been addressed by:

- the extensive field investigations undertaken on the subject site (see Chapter 2 of this *Report*), including those conducted in November 2010 in response to consultation between Environmental InSites, the DECCW, Shoalhaven City Council and the DoP; and
- detailed consideration of the results of those investigations and application of the *Verification Rules* (Chapter 13).

The detailed consideration of the *Verification Rules* (in Chapter 13), as well as consideration of the objectives of the SISS and *South Coast Regional Strategy*, form the basis for the rezoning of the subject site at Sussex Inlet. The current rezoning proposal by Lucas Property Group P/L (detailed in Chapter 15) represents an appropriate balance between development opportunities and requirements (including for residential development, a golf course and a flood-free access road) and reasonable biodiversity conservation goals and aspirations.

8 SUSSEX INLET SETTLEMENT STRATEGY

8.1 Introduction

The *Sussex Inlet Settlement Strategy* (the SISS) was prepared by Shoalhaven City Council in collaboration with the DoP and other NSW state government agencies, and was endorsed by the Department of Planning (DoP) on the 14th of August 2007. The SISS was adopted by Shoalhaven City Council on the 25th of August 2007.

The SISS "*provides options for future urban development in the Sussex Inlet area, taking into consideration the significant natural values of the area*". Further, the SISS "*establishes a clear vision for the areas* [sic] *future settlement*", and "*contains a series of objectives and actions designed to achieve quality, well managed development and sustainable natural resource management outcomes*".

It is also noted in the SISS that "*development of the Settlement Strategy represents a positive collaborative effort between Shoalhaven City Council and NSW Government and supports the State Government's South Coast Regional Strategy*".

8.2 The Badgee Investigation Area

The SISS identifies the landholdings which comprise the subject site for this *Report* as the *Badgee Investigation Area*, and notes a range of "*potential social/economic benefits arising from the development of this land*" including *inter alia*:

- the "*provision of additional housing stock in a flood free location ... with associated efficiencies*";
- the "*ability to co-ordinate planning and environmental management*";
- "*sufficient land to provide for an extension of the existing golf course from nine to eighteen holes*"; and
- "*provision of a flood free access road from the existing residential area to the north of Badgee Lagoon through to Sussex Inlet Road*".

The SISS also states that "*Potential environmental offsets/mitigation measures*" which could be derived from the mosaic of development and conservation outcomes on the subject site at Sussex Inlet would include:

- "*the opportunity to incorporate the habitat corridors through the site in a north-south direction*" which would involve an "*opportunity to link Badgee riparian areas to the south of Sussex Inlet Road to the bushland fronting St Georges Basin*";
- the potential "*dedication of Badgee Lagoon (with appropriate buffer) to the community at no cost, thereby protecting the SEPP 14 wetland and rezoning this land to appropriate environmental protection zone*"; and
- "*public dedication of St Georges Basin foreshore*".

All of these conservation opportunities are realised with the rezoning proposed in this *Report* (Chapter 15; Figures 14-16), as well as achieving the desired development outcomes enunciated in the SISS and in the *South Coast Regional Strategy*.

With respect to the Badgee Lagoon area, the SISS:

- notes that Badgee Lagoon and Badgee Inlet are in good condition with respect to water quality, and that any development which drains into the Lagoon and/or the St Georges Basin would need to demonstrate the avoidance of adverse impacts on water quality;
- notes the presence of the SEPP 14 wetlands within Badgee Inlet and Lagoon and along the foreshore of the St Georges Basin, both of which impinge upon the subject site;
- indicates the potential presence of potential "*endangered ecological communities*" including *inter alia* the SSFCF community (see Figure 11 of this *Report*);
- identifies a number of threatened fauna and flora species which are known to occur in the Sussex Inlet area;
- identifies (indicative) "*potential wildlife connections*" in a north-south direction and in an east-west direction through the site (Figure 11); and
- identifies a riparian buffer along the small watercourse in the southwestern part of the site.

The SISS also states that:

- "*further detailed flora and fauna analysis* [is required] *to establish the appropriate location, width and linkages of the potential habitat corridors, including through the proposed expansion of the golf course*" (emphasis added).

As noted above, the SISS identifies a number of "*constraints and opportunities*" associated with the *Badgee Investigation Area* (Figure 11), and indicates that a detailed "*environmental study is necessary to consider its potential high conservation value (defined by The South Coast Regional Strategy)*". The SISS also notes, however, that the nature of the landholding and the large portions of land involved provides an excellent opportunity for a balanced outcome.

8.3 Investigation Outcomes

8.3.1 General Considerations

The ecological values and biodiversity conservation significance and relevance of the subject site at Sussex Inlet have been the subject of intense and extensive investigations (as discussed in detail in Part B of this *Report*).

This *Ecological Issues & Constraints Report* (EICR) provides the basis for proceeding with an appropriate rezoning of the subject site at Sussex Inlet, which will provide for both high quality residential development on the subject site (with flood-free access and an expanded golf course) and a substantial tract of land to be dedicated for biodiversity conservation purposes. In addition, the proposed 18-hole golf course (envisaged in the SISS) is to be designed specifically with the maintenance and management of threatened species resources as a key outcome.

As indicated in the SISS, a range of constraints to development opportunities in the *Badgee Investigation Area* have been identified, associated with the location (or alleged locations) of "*endangered ecological communities*", riparian areas and "*potential wildlife connections*" (Figure 11), as well as the presence of threatened biota and/or their habitats.

8.3.2 Constraints and Opportunities

With respect to the "*constraints and opportunities*" identified on the *Badgee Investigation Area* in the SISS (Figure 11):

- the correct and accurate mapping of "*endangered ecological communities*" (EECs) is that which is provided in this *Report* by Environmental InSites (Figures 5 and 6), not that contained in the SISS[6];
- the 'riparian corridor' mapped in the SISS relates to a highly modified and degraded drainage line, predominantly through the existing golf course, in the southwest of the site. This drainage line does not warrant separate zoning for conservation purposes, but would be appropriately addressed in the *Concept Plan* approval process pursuant to Part 3A of the EP&A Act; and
- the subject site does in fact provide two "*wildlife connections*":
  - a north-south vegetated "*connection*" through the centre (approximately) of the site between Badgee Lagoon and the forested lands of the One Tree Bay site to the immediate north; and
  - an east-west "*connection*" through Badgee Lagoon, to the southwest through the rural-residential lands adjoining Sussex Inlet Road (see discussion in Chapters 8.3.3 and 13.6).

This *Ecological Issues & Constraints Report* (EICR) for the rezoning of the Sussex Inlet Golf Course site provides:

- accurate mapping of the areas of Swamp Sclerophyll Forest and other EECs, as detailed and identified in Figures 5 and 6 of this *Report*;
- protection of all of the EECs in the substantial parts of the subject site proposed for conservation zoning (see Chapter 15; Figure 16); and
- identification of all SEPP 14 Wetlands within the land to be zoned for biodiversity conservation purposes (in the northeast and in the south of the subject site);
- a broad north-south corridor of vegetation through the centre of the subject site (at least 250m in width) in order to facilitate wildlife movements and connectivity (see Chapter 15; Figure 16);
- identification of *High Conservation Value* lands (containing high densities of threatened species records and of hollow-bearing trees) through the central parts of the subject site (Chapter 13), which are to be zoned for biodiversity conservation purposes (see Chapter 15; Figure 16); and
- justification of the lands identified for residential and golf course purposes (in the northeastern, eastern and southwestern parts of the subject site) and provides consideration of their relative ecological values and of the appropriate subsequent development measures which would be required to protect the ecological attributes of the lands zoned for conservation purposes (Chapter 13).

[6] As agreed by DECCW (Miles Boak and Dimitri Young) and SCC (Elizabeth Dixon) during a site inspection on the 26th of October 2010.

The *Sussex Inlet Settlement Strategy* identifies two features of the subject site which are regarded by the DECCW and SCC as of significance in establishing the biodiversity conservation values of the site (Figure 11). Those elements (identified in the "*Constraints and Opportunities*" map of the Badgee *Investigation Area* (Figure 22 of the SISS) are:

- indicative "*potential wildlife connections*" (located approximately north-south through the centre of the site, east-west through Badgee Lagoon, and to the south from Badgee Lagoon); and
- approximate areas of Swamp Sclerophyll Forest which had been mapped (Figure 11) by DECCW and SCC (M Boak DECCW and E Dixon SCC *pers comm*).

8.3.3 Potential Wildlife Connections

With respect to the "*potential wildlife connections*" (or "*wildlife corridors*") through the subject site, the detailed vegetation mapping and analysis undertaken for this *Ecological Issues & Constraints Report* (see Chapter 4) has concluded that:

- the indicative "*wildlife connection*" north-south through the centre of the site identified in the SISS is located slightly to the west of the appropriate location for that "*connection*". That shown on Figure 22 of the SISS (Figure 11 of this *Ecological Issues & Constraints Report*) in fact includes the northeastern part of the existing golf course, whereas the proposed rezoning of the subject site identifies a vegetated "*wildlife connection*" of at least 250m in width in a north-south direction through the subject site to the east of the existing golf course (see Chapter 15; Figure 16);
- the "*potential wildlife connection*" running east-west through Badgee Lagoon will be retained (Figures 6 and 12) in any case in a biodiversity conservation zoning by virtue of the presence of the SEPP 14 Wetland and associated EECs; and
- there is, in fact, no actual "*wildlife connection*" to the south from Badgee Lagoon (Figure 3). The subject site at Sussex Inlet is bound to its immediate south by:
  - Jacobs Drive;
  - existing well-established residential development; and
  - recently approved residential development (to the immediate south of Jacobs Drive), which has removed any direct vegetated link to the south.

Whilst a number of highly mobile native biota (particularly birds, bats and insects) can doubtless move between the subject site and vegetated land further to the south, only species either tolerant of intervening urban environments or capable of traversing such environments safely (*ie* aerial species) can reasonably be expected to utilise this area as a "*corridor*".

Importantly, the proposed rezoning of the subject site (Chapter 15; Figure 16) will:

- maintain the main north-south "*wildlife connection*" through the subject site from the Badgee Lagoon habitats, in a northwesterly direction;
- maintain the east-west "*wildlife connection*" from Badgee Lagoon in a southwesterly direction (noting that both rural-residential development and clearing, and Sussex Inlet Road, traverse that "*connection*"); and

- will have no impact upon any purported southerly "*wildlife connection*" from Badgee Lagoon through the residential areas to the south of the subject site.

8.3.4 Endangered Ecological Communities

With respect to the Swamp Sclerophyll Forest mapped by DECCW and SCC in Figure 22 of the SISS (Figure 11 of this *Ecological Issues & Constraints Report*), it has been agreed by representatives of the DECCW (Miles Boak and Dimitri Young) and of SCC (Elizabeth Dixon) that the mapping of EEC and of native vegetation provided in this *Report* by Environmental InSites (Figures 5 and 6) represents the actual extent both of the EECs and of other vegetation types on the subject site at Sussex Inlet.

That agreement was reached during a site inspection on the 26th of October 2010 by the DECCW and SCC, with Environmental InSites, using an accurate GPS unit to identify the precise boundaries of the vegetation types present in relevant parts of the subject site (particularly in the southwest and northeast).

Indeed, it is accepted by the DECCW that the mapping of EECs provided by Environmental InSites is 'conservative', and in many instances includes buffers of vegetation which do not constitute the EECs themselves. Thus, for example, in the southwestern part of the subject site (in the southern part of the existing golf course land), the mapping of EECs includes xeric vegetation types 10m-25m in width upslope of the EECs which would constitute a satisfactory buffer to the EECs. Similarly, in the northwest of the subject site, the mapping of EECs by Environment InSites (Figures 5 and 6) includes xeric forest vegetation as a buffer to the actual swamp communities.

Thus, for the purposes of identifying appropriate land for zoning either for residential and golf course purposes or for biodiversity conservation purposes, the vegetation mapping provided by Environmental InSites on the subject site at Sussex Inlet is considered to be the most appropriate and accurate.

8.4 Conclusions

The *Sussex Inlet Settlement Strategy* (SISS) identifies a range of "*constraints and opportunities*" on the subject site at Sussex Inlet, although the precise locations of those constraints is not as illustrated in the SISS. Rather, the accurate and correct locations of the relevant constraints (particularly EECs and "*corridors*") is provided in this *Ecological Issues & Constraints Report*.

Importantly, the SISS determines that the subject land is appropriate for both development and biodiversity conservation purposes. The SISS considers that (*inter alia* given its size and tenure) the subject site provides an excellent opportunity for the achievement of both necessary and appropriate urban development (including the provision of a flood-free access road for the settlement of Badgee to its immediate east) and the achievement of satisfactory biodiversity conservation outcomes.

The detailed investigations of the subject site undertaken by BES/ELA and Environmental InSites (between 2007 and November 2010) provide a substantive information base, and the accurate mapping of vegetation and features, necessary to facilitate the identification of:

- appropriate lands for biodiversity conservation within the subject site (the '*High Conservation Value*' areas); and
- those areas with lesser conservation values which are appropriate for residential and urban development features (see Chapter 13).

The "*constraints and opportunities*" identified in the SISS for the subject site at Sussex Inlet have been considered in detail in this *Report*, and the proposed rezoning of the subject site (Chapter 15; Figures 14-16) reflects an appropriate and reasonable balance between development opportunities and biodiversity conservation goals. The investigations and mapping contained in this *Report* provide a more accurate depiction of the true "*constraints and opportunities*" of the subject site at Sussex Inlet than the SISS, and provide a sound basis for the proposed rezoning contained in this *Ecological Issues & Constraints Report*.

It is an important outcome of this *Ecological Issues & Constraints Report*, and of the proposed rezoning of the subject site (Chapter 5), that all of the conservation opportunities identified in the SISS are realised. In addition, the rezoning proposed in this *Ecological Issues & Constraints Report* achieves the desired development outcomes enunciated in the SISS and in the *South Coast Regional Strategy* (including an 18-hole golf course, a flood-free access road for Badgee and additional residential areas for Sussex Inlet).

9 SOUTH COAST REGIONAL STRATEGY

9.1 Introduction

The *South Coast Regional Strategy* (dated January 2009) was prepared by the NSW Department of Planning (DoP), in consultation with all relevant government agencies. The *Strategy* "*sets out a clear certain land use plan for the South Coast, which balances the demand for future growth with the need to protect and enhance environmental values*".

As stated in the introduction to the *Regional Strategy*:

> "*the Regional Strategy represents an agreed NSW government position on the future of the South Coast. It is the pre-eminent planning document for the South Coast Region and has been prepared to complement and inform other relevant State planning instruments*".

9.2 The Sussex Inlet Golf Course Site

The *South Coast Regional Strategy* considered *inter alia* the recommendations of the *South Coast Sensitive Urban Lands Review* regarding the potential for development of part of the site at Badgee Lagoon.

Both the *Review* and the *Strategy* state that "*the majority of the Badgee Lagoon site is unsuitable for urban development on the grounds of its potential negative impacts on water quality on Badgee Lagoon*". The *South Coast Regional Strategy* also states, however, that "*two areas of the site in the north-western and south-western corners are suitable for residential development in accordance with the proposal put forward by the owner, subject to best practice WSUD and water quality management*" (see map below from the *South Coast Sensitive Urban Lands Review*).

However, reference to the *South Coast Sensitive Urban Lands Review* reveals that the 'Badgee Lagoon site' addressed both in that *Review* and in the *South Coast Regional Strategy* constitutes only a very small proportion of the subject site (*ie* the land which is addressed in this *Report* and in the current rezoning proposal). The 'Badgee Lagoon site' identified both in the *South Coast Regional Strategy* and in the *South Coast Sensitive Urban Lands Review* is confined to the southeastern corner of the current proposal. The *Sensitive Urban Lands Review* recommended development only in the northwestern and southwestern corners of that portion of the land, in areas which are also proposed for development in the current zoning of the land.

The land which is the subject of this *Ecological Issues & Constraints Report* includes that which was identified in the *South Coast Regional Strategy* (SCRS), but extends substantially to the west and north. The total area of the subject site at Sussex Inlet (Figure 2) has been considered with respect to the *South Coast Regional Strategy*, as well as the *Sussex Inlet Settlement Strategy* (SISS) and the *South Coast Sensitive Urban Lands Review Report* in assessing the areas which are most appropriate for rezoning for residential and/or golf course purposes and land appropriate for rezoning for biodiversity conservation purposes (see Chapter 8 of this *Report* for detailed discussion).

In addition, the *South Coast Regional Conservation Plan* (SCRCP), which has been prepared by the DECCW, has been taken into account (Chapter 9.4).

Subsequent development of the subject site pursuant to the proposed rezoning will undoubtedly require the removal of some native vegetation, including resources and habitats for threatened biota. That requirement, however, is an inevitable outcome of defining an appropriate balance on the subject site between development opportunities and biodiversity conservation goals.

9.3 Consideration of Relevant Issues for Rezoning

As discussed above, virtually any development of the subject site at Sussex Inlet will inevitably require the removal of some native vegetation, including resources and features of relevance for threatened biota (*eg* hollow-bearing trees, feed trees for some species). Conversely, both the SISS and the SCRS identify the subject site as appropriate and suitable for expansion of the Sussex Inlet residential area and for the provision of both new residential allotments and a flood-free access road, as well as for expansion of the existing golf course to an 18-hole golf course.

Resolution of those inherent conflicts requires an assessment of the relative conservation values of various parts of the subject site (in accordance *inter alia* with respect to the '*Verification Rules*' of the DECCW, established in respect of the *Regional Strategy*) and a determination as to the most appropriate locations for both urban development and biodiversity conservation. An more detailed consideration of the matters raised in the DECCW '*Verification Rules*' is contained in Chapter 13 of this *Report*.

The concerns regarding the protection of water quality within Badgee Lagoon (contained in the *South Coast Regional Strategy* and in the *South Coast Sensitive Urban Lands Review Report*) have been taken into account in establishing the proposed rezoning boundaries on the subject site, including for the protection of wetlands. It is anticipated that water quality protection would be a key element in any future development on the subject site at Sussex Inlet.

Maintenance of high water quality conditions and measures to mimic existing stormwater flows are considered to be crucial elements of the future development of the subject site. Considerable effort has already been expended in designing appropriate stormwater quality and flow control measures intended specifically to avoid the discharge of contaminants or pollutants into Badgee Lagoon or the St Georges Basin, as part of the process of preparing an indicative *Concept Plan* for the site.

Further, detailed investigations have been undertaken with respect to biodiversity on and around the subject site. A subsequent iterative design process has also been undertaken already (and will be further implemented in finalisation of the ultimate *Concept Plan* pursuant to the proposed rezoning of the site) to provide an appropriate and highly sensitive urban design for the site. Both the proposed rezoning of the site and the subsequent *Concept Plan* have been (or will be) prepared in full cognisance of the issues and concerns raised in the *Regional Strategy* and the *South Coast Sensitive Urban Lands Review*.

In this regard, the current rezoning proposal (Chapter 15) is designed *inter alia*:

- to ensure the protection of water quality and stormwater flows;
- to protect retained vegetation, habitats and ecosystems;
- to provide a substantial biodiversity conservation resource and wildlife corridors through the centre of the subject site; and
- to satisfy the concerns and requirements of the *South Coast Regional Strategy* and the *South Coast Sensitive Urban Lands Review* documents.

9.4 Draft South Coast Regional Conservation Plan

The draft *South Coast Regional Conservation Plan* (SCRCP) has been prepared by the DECCW to guide "*natural heritage conservation on non-government lands on the South Coast*" of NSW. The SCRCP "*provides direction to local government on planning and development decision-making, so that the biodiversity of the South Coast can be maintained or improved into the future. It seeks to align restoration activities on the South Coast and to ensure that such activities complement future development that will be guided by the Government's South Coast Planning Strategy*".

The draft SCRCP is intended *inter alia* to guide "*implementation of the conservation objectives of the South Coast Regional Strategy*", and is intended to:

- "*identify areas of high conservation value that would be protected as the Strategy directs new residential, rural residential, industrial and commercial zonings away from those areas*";
- "*verify important wildlife corridors across the region*"; and
- "*identify coastal lakes and estuaries that Strategy will protect by ensuring further residential rural residential zonings are allowed only if neutral beneficial effect and water quality can be demonstrated*".

The draft SCRCP indicates that a "*key consideration* [of the SCRCP] *is to deliver the aim of the South Coast Regional Strategy* (*SCRS*)" to:

- "*protect high value environments including pristine coastal lakes, estuaries, aquifers, threatened species, vegetation communities and habitat corridors by ensuring that new urban development avoids these important areas and their catchments*".

The draft SCRCP identifies the subject site as containing *inter alia* some features of *High Conservation Value*, including:

- areas of a number of EECs (noting that the areas of EECs identified in the SISS are incorrect, and have been accurately mapped in this *Report*);
- habitat for threatened flora and fauna (as detailed in this *Report*);
- aquatic habitats and native wetlands (including SEPP 14 Wetlands); and
- habitat and wildlife connections (although the site is not identified as contributing to any regional wildlife corridors).

The detailed consideration of *High Conservation Value* (HCV) areas within the subject site at Sussex Inlet, pursuant to the '*Verification Rules'* of the DECCW, is provided in Chapter 13 of this *Report*. Those considerations *inter alia*:

- identify areas of the subject site regarded as of HCV;
- determine the distribution of land which should appropriately be zoned for biodiversity conservation purposes;
- address the '*Verification Rules'*, which *inter alia* address the issues of relevance contained in the draft SCRCP; and
- determine the appropriate balance between development and conservation aspirations on the subject site and in its immediate vicinity.

9.5 Outcomes and Conclusions

The current rezoning proposal (detailed in Chapter 15 of this *Report*) is the culmination of a substantial array of investigations, discussions and negotiations, and input from an array of organisations and individuals (including several state government agencies, Shoalhaven City Council, expert groups and consultants) associated with the subject site and the general locality.

The current rezoning proposal (Chapter 15) has been refined, amended and adjusted to take into account a variety of issues and environmental constraints and considerations, including *inter alia*:

- threatened biota and their habitats;
- areas identified potentially as *High Conservation Value* lands;
- the identification of both constraints and opportunities in relevant planning documents such as the *Sussex Inlet Settlement Strategy* (SISS) and the *South Coast Regional Strategy* (SCRS); and
- documentation and matters raised with respect to biodiversity conservation, including *inter alia* the *Verification Rules* of the DECCW and the draft *South Coast Regional Conservation Plan* (SCRCP), prepared by the DECCW.

The considerable effort that has been dedicated by the proponent to the determination of an appropriate rezoning plan for the subject site at Sussex Inlet (Chapter 15) has involved a comprehensive and iterative approach to determine the appropriate balance between development aspirations and biodiversity conservation goals. That iterative process has involved a substantial array of field investigations and data analysis, as well as consideration of the goals and aspirations enunciated in the planning documents identified above.

Extract from the *South Coast Regional Strategy* regarding part of the subject site (the southeastern corner – see Figure below). This is not the site which is the subject of the current proposal, and represents only a very small part of the larger site (see Figures 2 and 3).

BADGEE LAGOON

TERMS OF REFERENCE		ASSESSMENT AND RECOMMENDATION
1a	**Suitability of site**	The majority of the Badgee Lagoon site is unsuitable for urban development on the grounds of its potential negative impacts on water quality in Badgee Lagoon. Two areas of the site in the north-western and south-western corners are suitable for residential development in accordance with the proposals put forward by the owner, subject to best practice WSUD and water quality management. It should be noted that the site considered by the Panel includes a subdivided and developed strip of land along Suncrest Avenue on the northern side of the lagoon. The Panel has excluded this area from its recommendations so that development can proceed in line with existing approvals.
1b	**Scale and type of land release**	Development should provide for a mix of housing, at yields that exceed traditional residential yields in the locality.
2	**Priority and timing**	According to market demand.
3	**Alternate land uses**	The land that is unsuitable for development should be zoned for conservation purposes. The most appropriate zone under the new standard instrument for LEPs is either Zone E2 Environmental Conservation or Zone E1 National Parks and Nature Reserves. Negotiations should be commenced with the owner to secure dedication of the land for conservation purposes in return for development of the two areas identified above.

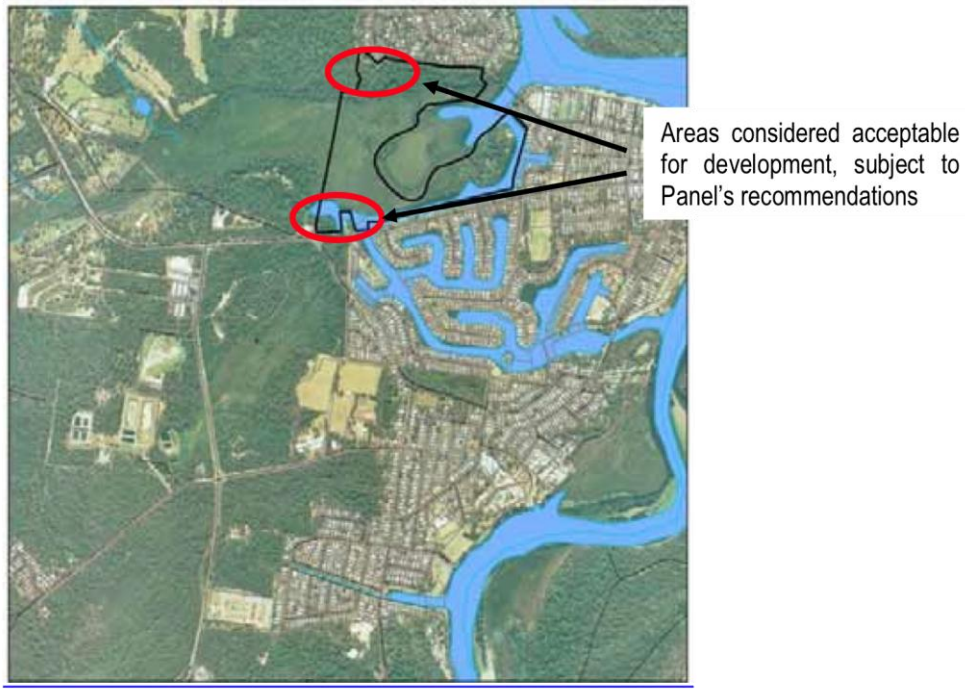


Figure 16 Panel's recommendations for development at Badgee Lagoon

10 ST GEORGES BASIN ESTUARY MANAGEMENT PLAN

The *St Georges Basin Estuary Management Plan* was adopted by Shoalhaven City Council (SCC) in July 1998, and is "*currently under comprehensive review*". The *Estuary Management Plan* was prepared on the basis of a number of issues and concerns raised by the local community and government agencies, and recognised a need to protect the ecological and biodiversity values of the St Georges Basin as well as to accommodate development and recreational usage of the Basin.

The *St Georges Basin Estuary Management Plan* (the EMP) provides an array of strategies to deal with perceived and possible threats to the ecological values of the St Georges Basin, and to assist in the management of various land use activities around the St Georges Basin and/or within it. Strategies identified in the EMP include *inter alia*:

- environmental protection zoning of "*land adjacent to foreshores, watercourses or draining into sensitive aquatic habitat*";
- the provision of "*buffer zones*" and the retention of "*natural vegetation corridors along streams or watercourses*";
- measures to provide physical protection to areas of natural habitat, seagrass beds and "*important wildlife habitat areas*"; and
- the application of 'best practice' water management measures to minimise or prevent the discharge of sediments, contaminants, rubbish or other inappropriate materials into the St Georges Basin and its associated wetlands.

All of these matters have been considered in the process of preparing the proposed rezoning of the site at Sussex Inlet. The proposed rezoning (Chapter 15) satisfies the relevant considerations of the EMP. They have also been considered in detail in development of the *Concept Plan* for the subject site.

The proposal has been specifically designed *inter alia* to avoid the imposition of those threats to or impacts on the St Georges Basin, and Sussex Inlet itself (including Badgee Lagoon), which are identified in the *Estuary Management Plan*. In particular, the proposed rezoning of the subject site identifies the lands most appropriate for development purposes, and any future development proposal (including the *Concept Plan* currently being prepared) would prevent the discharge of additional sediments, nutrients or pollutants into the St Georges Basin or Sussex Inlet, and would incorporate measures to protect, enhance and maintain the natural features of significance in the landscape.

The proposed development of the subject site at Sussex Inlet (which is being prepared as a *Concept Plan* pursuant to Part 3A DGRs in accordance with the proposed rezoning of the site) has specifically incorporated an array of stormwater quality and quantity control measures which are intended *inter alia* to protect all ecosystems and habitats associated with the St Georges Basin and Badgee Lagoon. In particular, the stormwater management system for the *Concept Plan* would be designed specifically:

- to provide for the capture and re-use of stormwater;
- to protect adjoining habitats and wetlands by the treatment of stormwater prior to discharge, and the maintenance of existing flow regimes;
- to incorporate current 'best practice' *Water Sensitive Urban Design* (WSUD) principles and practices to ensure the highest quality in water management; and

- to prevent inappropriate discharges into sensitive habitats (*eg* to avoid excessive fresh water discharges into the Coastal Saltmarsh community).

11 STATE ENVIRONMENTAL PLANNING POLICY No. 14 – COASTAL WETLANDS

Two wetlands on the subject site have been identified and mapped as a Coastal Wetland (Figures 5 and 6) *State Environmental Planning Policy No. 14 – Coastal Wetlands* (SEPP 14), being:

- SEPP 14 Wetland No. 312, which is located along the southwestern side of the St Georges Basin, partly within the Sussex Inlet Golf Course site and partly on adjoining Crown land which fringes the St Georges Basin itself; and
- SEPP 14 Wetland No. 306 in the south of the subject land, which includes the Badgee Lagoon (or Badgee Inlet) in the southeastern corner of the site and the adjoining freshwater wetlands to its west.

A third SEPP 14 Wetland (No. 309) is located further to the north of the subject site, at least 240m from the northern boundary (Figure 5).

On advice from the DECCW and SCC, and on the basis of the '*Verification Rules*' of the DECCW for *High Conservation Value* Areas, the presence of the SEPP 14 Wetland has been identified as a total constraint to development opportunities. The proposed rezoning of the subject site has therefore excluded all SEPP 14 Wetland areas (Chapter 15; Figure 14). Furthermore, any future development design would avoid the imposition of direct (or indirect) impacts upon those SEPP 14 wetlands.

It is anticipated that a comprehensive stormwater management regime and program would be prepared (as part of the *Part 3A Application* process) for any *Concept Plan* for future development of the subject land at Sussex Inlet. The relevant stormwater quality control and volume discharge measures *inter alia* would prevent the discharge of contaminants or pollutants into the SEPP 14 wetlands, and would maintain existing hydrological regimes.

On that basis, it anticipated that no significant adverse impacts would be imposed upon either Badgee Lagoon and its adjoining wetlands (including the designated SEPP 14 wetland) or upon the St Georges Basin and any of its associated wetlands (including the SEPP 14 wetland) as a result of future development of the subject site.

Future development of the subject site in accordance with the proposed rezoning (Chapter 15) would involve requirements *inter alia* for:

- the establishment and maintenance of buffers of various sizes (depending on circumstances) between development and the SEPP 14 Wetlands. In this regard, however, the 'requirement' of SCC (Elizabeth Dixon *pers comm*) that a 100m buffer be provided is regarded as unjustified; and
- the management of all urban and golf course stormwater run-off to ensure the maintenance of high water quality for inputs into the SEPP 14 Wetlands (as discussed above).

12 SEPP No. 44 – KOALA HABITAT PROTECTION

State Environmental Planning Policy No. 44 - Koala Habitat Protection (SEPP 44) aims to protect the Koala and its habitat throughout NSW by identifying matters for consent authorities to consider during the assessment of relevant *Development Applications* (DAs) or proposals. In particular, SEPP 44 contains definitions of "*potential koala habitat*" and "*core koala habitat*" to be applied in the consideration of developments within Local Government Areas (LGAs) listed on Schedule 1 of the *Policy*.

The Shoalhaven LGA is listed on Schedule 1 of SEPP 44 as an area to which the *Policy* applies, and the subject site is greater than 1 hectare in area. Consequently, SEPP 44 applies (at least theoretically) to the subject land.

Potential Koala Habitat

Clause 4 of SEPP 44 defines "*potential koala habitat*" as "*areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component*".

None of the tree species listed in Schedule 2 of SEPP 44 were recorded on the subject site, and the site cannot therefore constitute "*potential koala habitat*" as defined in SEPP 44.

Core Koala Habitat

Clause 4 of SEPP 44 defines "*core koala habitat*" as "*an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population*".

As the land does not constitute "*potential koala habitat*", it cannot constitute "*core koala habitat*" by definition. In any case, no evidence of a "*resident population of koalas"* (such as individual Koalas, scats or scratches on trees) was recorded during the field surveys. The subject site could not be defined as "*core koala habitat*" pursuant to Clause 4 of SEPP 44, even if it were "*potential koala habitat*".

Conclusions

Koalas and their habitat are not an issue with respect to the proposed rezoning and subsequent development of the subject site at Sussex Inlet, because:

- the subject site does not constitute "*potential koala habitat*", given that none of the Koala food tree species designated in Schedule 2 of SEPP 44 are present on the subject site;
- the site does not represent "*core koala habitat*" pursuant to SEPP 44 given the absence of a "*resident population of koalas*"; and
- there is no evidence of any Koalas occupying the subject site, despite the substantial investigations that have been undertaken by a number of ecological consultants over a number of years.

13 HIGH CONSERVATION VALUE AREAS

13.1 Introduction

The *South Coast Regional Strategy* (see Chapter 9) states *inter alia* that "*New urban development is to be prohibited by \local environmental plans on land assessed as being of high conservation value*". The *Strategy*, however, does not define "*land .. of high conservation value*".

To assist in identifying areas regarded (by the DECCW at least) as of *"High Conservation Value*", the Department of Environment, Climate Change & Water (DECCW) has prepared a set of "*broad verification rules for high conservation value areas*" (Appendix J). The DECCW *Verification Rules* are detailed in two DECCW (undated) documents (Appendix J) entitled:

- "*Verification of High Conservation Value Areas from South Coast Regional Strategy of the Sussex Inlet Area for the LEP Preparation Process*"; and
- "*Verification and Rules for Identification of High Conservation Value*".

The *Verification Rules* were prepared by the DECCW in response to an *Action* identified in the *South Coast Regional Strategy* in respect of (alleged or perceived) "*High Conservation Value Areas*". As noted in the DECCW *Verification Rules*, that *Action* (page 13 of the *Strategy*) states that "*In identifying potential new urban areas, the location and conservation significance of areas shown as 'Biodiversity Assets Outside Conservation Areas' on Map 2* [of the Strategy] will *be verified by councils in consultation with the Department of Planning and Department of Environment and Conservation*".

It is important to note (as discussed below) that the DECCW *Verification Rules* are, in some instances (*eg* with respect to a total prohibition on development in EECs and SEPP 14 Wetlands), far more proscriptive and onerous than:

- *State Environmental Planning Policy No. 14 – Coastal Wetlands* (SEPP 14) itself; or
- the EP&A Act (in respect of the requirements of Section 5A); or
- the TSC Act (with respect to the protection of threatened biota, particularly EECs, in general).

It is also critical to note that whilst some of the HCV constraints are clearly defined and readily quantifiable (*eg* the locations of EECs and SEPP 14 Wetlands), and are not subject to any condition or quality analysis, others (*eg* the presence of "*old growth forest*" and the presence of "*important habitat*" for threatened species) are not clearly defined or definite. As noted by the DECCW, "*Some of these values are well documented, while others will require verification*". This *Report*, *inter alia*, provides that "*verification*".

Whilst the *Verification Rules* identify "*threatened flora* habitat" and "*threatened fauna* habitat" as "*key conservation* values", it would be neither reasonable nor appropriate to determine that all habitat and resources for threatened flora and fauna is *High Conservation Value* (HCV). If that were the case, essentially all native vegetation throughout the South Coast would be HCV.

In this regard:

- some "*threatened*" biota are more threatened than others (*eg "endangered*" versus "*vulnerable*"), and their habitat and resource requirements are therefore of higher conservation value;

- some habitat types or resources are less abundant and more significant than others, and are therefore of higher conservation value; and
- there are now so many threatened biota, that essentially all native (and much non-native) vegetation is habitat for at least one threatened species.

Second, there are clearly qualitative (and therefore 'Conservation Value') differences between patches of vegetation. In this regard, some portions of the subject site at Sussex Inlet display a high concentration of threatened biota and a high density hollow-bearing trees, whereas others appear to support fewer species often at lower densities. This is likely in part to be a consequence of 'edge effects' and/or previous or adjoining disturbance, which doubtless in part explains the concentration of threatened species in the central parts of the subject site (Figure 8).

On the basis of those considerations, the DECCW (Miles Boak and Dimitri Young *pers comm*) has stated that the relevant consideration is the identification of "*important*" or *"essential"* habitat for threatened biota, not all habitat for such species. On that basis, an assessment of the relative values of vegetation on the subject site is required (see Chapters 13.5 and 13.6).

Conversely, as discussed below (Chapter 13.5), the *Verification Rules* (inappropriately in the opinion of the author of this *Report*) state that "*no feed, den or nesting tree*[s]" (emphasis added) for the Glossy Black Cockatoo or the Yellow-bellied Glider should be cleared. That requirement is excessive and unreasonable, and is not mandated by any statute or planning instrument.

In this regard, it should be noted that:

- both the Glossy Black Cockatoo and Yellow-Bellied Glider are widely distributed both on the subject site and on forest lands throughout the locality;
- potentially suitable forest and resources for these species are widely distributed in the Shoalhaven LGA (*eg* Figure 7), and feed trees for both species are widely distributed and abundant;
- application of that proscriptive requirement in an uncritical or 'broad brush' approach would unreasonably and inappropriately prevent the development of much of the subject site at Sussex Inlet.

The philosophical approach which underpins the assessment and analysis contained in this *Report* (particularly that contained in this Chapter and Chapter 15) is one of achieving an appropriate and reasonable balance between responsible urban development outcomes and desirable biodiversity consolation goals. That philosophical approach is the basis of the *Sussex Inlet Settlement Strategy* (SISS) and the *South Coast Regional Strategy* (SCRS), and of the "*objects*" of the EP&A Act.

13.2 Scope and Approach

The detailed information and data collected by BES/ELA and Environmental InSites between December 2007 and November 2010 has been used as the basis for the assessment of vegetation, habitats and resources on the Badgee Lagoon Project site.

It is important (indeed critical) to note that the delineation and determination of vegetation identified as "*High Conservation Value*" (in respect of the importance of habitat for threatened biota) is an imprecise

analysis, and is affected *inter alia* by the nature and condition of adjoining lands and the types of adjoining land uses, as well as by the nature, condition and/or density of the vegetation and the resources present.

It is also the case that the boundaries between vegetation or habitats which might be considered of high conservation value and those of lesser conservation value are usually broad and/or ill-defined, with usually a broad gradation between vegetation or habitats with those two assigned values. It is not common that an exact or accurate line can be drawn which identifies the precise boundary of vegetation or habitats which may be regarded as of '*High Conservation Value'* as compared with those of somewhat lower Conservation Value.

The following chapters of this *Report* consider the five issues raised by the DECCW (above) in the *Verification Rules* with respect to the assessment and treatment of *High Conservation Value Areas*:

- "*endangered ecological communities*" (EECs) – Chapter 13.3;
- "*old growth forest*" – Chapter 13.4;
- threatened flora and fauna species, and their habitats – Chapter 13.5;
- wildlife corridors (including *inter alia* a wildlife corridor mapped by the DECCW) – Chapter 13.6; and
- SEPP 14 and other wetlands – Chapter 13.7.

As indicated above, and as discussed elsewhere in this *Report*, some of the elements identified as *High Conservation Value* (HCV) areas in the DECCW *Verification Rules* (albeit not with any specificity in the *South Coast Regional Strategy*) are readily easily identified and/or mapped. In this regard, for example, areas of vegetation which constitute an EEC and land which is an SEPP 14 Wetland can readily be mapped and identified as 'No Go Areas', pursuant to the attitude adopted by the DECCW with respect to the rezoning of the subject site at Sussex Inlet.

Conversely, as discussed elsewhere, areas of land which contain some HCV features (*eg* hollow-bearing trees or food trees for the Glossy Black Cockatoo and Yellow-Bellied Glider) may, or may not, be assessed as HCV areas. Other than SEPP 14 Wetlands and EECs, the remaining areas of vegetation which may (or may not) be identified as HCV areas can only be determined by a qualitative analysis or assessment. That analysis is the subject of this *Ecologist Issues & Constraints Report*, and is based on the approach and philosophy identified above (in Chapter 13.1).

13.3 Endangered Ecological Communities

13.3.1 Constraints and Issues

As noted above, the DECCW '*Verification Rules*' require that "*Urban development must be prohibited from occurring on EEC*" (emphasis added).

Whilst that is not the statutory requirement of either the EP&A Act or the TSC Act in New South Wales, it has been stated by the DECCW (Miles Boak and Dimitri Young *pers comm*) and SCC (Elizabeth Dixon *pers comm*) that all "*endangered ecological communities*" (EECs) are to be regarded as 'No Go Areas', and are to be excluded from anything other than strict conservation zoning.

Future development on the subject site at Sussex Inlet would need to ensure that all of the mapped EECs on the site are to be retained and protected, assuming that the prohibition of any development in any areas of EEC (as identified in the *Verification Rules*) is applied. Further, it is anticipated that a detailed *Vegetation Management Plan* (VMP) would be implemented as part of any future development of the subject site for the golf course, for residential areas and for the conservation-zoned lands on the site.

13.3.2 Endangered Ecological Communities Present

The EECs present on the subject site or in its immediate vicinity include four of the vegetation types identified on the subject site at Sussex Inlet which clearly do or appear to conform to one of three *Final Determinations* by the Scientific Committee of an "*endangered ecological community"* pursuant to the TSC Act (Table 15). As noted above, all of these areas of vegetation are zoned for conservation purposes.

Table 15 Endangered Ecological Communities on the subject site at Sussex Inlet

MU	Vegetation Community	Area (ha)	Proportion of the Site	TSC
2	Coastal Sand Swamp Forest	27.24	11.32%	SSFCF/BSF
5	Estuarine Fringe Forest	6.53	2.71%	SOFF
6	Estuarine Creek-flat Scrub	33.39	13.88%	SSFCF
8	Estuarine Saltmarsh	2.11	0.88%	CSM

TSC "*endangered ecological community*" listed on the TSC Act
SSFCF Swamp Sclerophyll Forest on Coastal Floodplains
BSF Bangalay Sand Forest
SOFF Swamp Oak Floodplain Forest
CSM Coastal Saltmarsh

Swamp Sclerophyll Forest on Coastal Floodplains - SSFCF

Two of the vegetation types on the subject site (the Coastal Sand Swamp Forest and the Estuarine Creekflat Scrub) conform to the *Final Determination* of the "*endangered ecological community*" (EEC) known as *Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions* (SSFCF).

Vegetation Type 2 (the Coastal Sand Swamp Forest community) is located along the fringes of Badgee Lagoon in the southeastern portion of the site and of St Georges Basin in the northeastern portion of the site (Figures 5 and 6). That vegetation is of a swampy character, and includes stands and scattered specimens of the Bangalay and Swamp Oak which are characteristic of the SSFCF community. Similarly, the groundcover stratum is dominated by the Tall Saw-sedge *Gahnia clarkei*, which is also characteristic of swamp habitats and of the SSFCF community. This vegetation type, however, also has affinities with the Bangalay Sand Forest (BSF) EEC (see below).

Vegetation Type 6 (the Estuarine Creek-flat Scrub community) is a low dense forest predominantly of Swamp Paperbark *Melaleuca ericifolia* within the shallows around Badgee Lagoon (Figures 5 and 6). The Swamp Paperbark and several of the understorey species in this vegetation are characteristic of the SSFCF community (Figure 5).

Bangalay Sand Forest - BSF

As noted above, Vegetation Type 2 (the Coastal Sand Swamp Forest community) is located along the fringes of Badgee Lagoon in the southeastern part of the site, and adjacent to the St Georges Basin in the northeastern portion of the site (Figure 5). This vegetation type is of a swampy nature, and in parts is dominated by the Bangalay (which is characteristic of the BSF community) along with the Swamp Oak.

The Coastal Sand Swamp Forest community in places appears more representative of the SSFCF community, and also has patches that more closely resemble the SOFF community (see below). In any case, all of Vegetation Type 2 (the Coastal Sand Swamp Forest community) is classified in this *Report* as an example of one of those three "*endangered ecological communities*" and/or an ecotone (in places) between those three communities (SSFCF, BSF and SOFF).

Swamp Oak Floodplain Forest - SOFF

Vegetation Type 5 (Estuarine Fringe Forest community) is located around the fringes of the Badgee Lagoon, inland of the Estuarine Creekflat Scrub community.

This community conforms to the *Final Determination* of the "*endangered ecological community"* known as *Swamp Oak Floodplain Forest on the NSW North Coast, Sydney Basin and South East Corner Bioregions* (SOFF). The domination of the Swamp Oak *Casuarina glauca* is a characteristic of the SOFF community.

Coastal Saltmarsh - CSM

The final *"endangered ecological community"* present on the site is the Estuarine Saltmarsh community (Vegetation Type 8) which conforms to the *Final Determination* of the *"endangered ecological community"* known as *Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions*.

This community is located in scattered patches around Badgee Lagoon, between the Estuarine Mangrove Forest and the Estuarine Fringe Forest (Figures 5 and 6). It is not located close to any areas proposed to be rezoned for development purposes.

13.3.3 EEC Buffers and Management

The DECCW (Miles Boak and Dimitri Young *pers comm*) and SCC (Elizabeth Dixon *pers comm*) have advised that both organisations 'require' a 50m buffer to (or setback from) all areas of EEC.

As with other 'constraints' identified DECCW and SCC, this 'requirement' has no statutory basis, and represents the desires of those organisations (or at least their representatives) rather than any legal

requirement. That approach also ignores the individual circumstances (*eg* there are areas on the subject site where existing golf course and/or residential development is located immediately adjacent to EECs without any noticeable or significant adverse impacts).

Nevertheless, it is anticipated that any future development of the subject site would require:

- the provision of some (generally small or limited) buffers to EECs, noting that many EECs are already located immediately adjacent to areas of disturbance (such as the existing golf course and the Badgee village);
- management of all interface areas to ensure that adverse impacts (direct and/or indirect) are not imposed on adjoining or nearby areas of EEC; and
- rehabilitation of existing areas of disturbed EECs.

13.3.4 EEC Outcomes

The DECCW (Miles Boak and Dimitri Young *pers comm*) and SCC (Elizabeth Dixon *pers comm*) have advised that both organisations 'require' that all "*endangered ecological communities*" (EECs) are to be regarded as 'No Go Areas', and are to be excluded from anything other than strict conservation zoning. Further, those officers have advised that both organisations 'require' a 50m buffer to (or setback from) all areas of EEC.

Whilst that is not the statutory position with respect to either the EP&A Act or the TSC Act, the protection of all EECS (in accordance with the DECCW '*Verification Rules*' for *High Conservation Value* areas) has been adopted in the rezoning proposal for the Badgee Lagoon site (Chapter 15; Figures 14 and 15).

The areas of EECs mapped by Environmental InSites include some fringing forest to act as a buffer, and further buffers to the EECs are not proposed to be zoned for conservation purposes. Rather, appropriate buffers to EECs and management of the interface between EECs and development areas will form part of any future development of the site.

13.4 Old Growth Forest

13.4.1 Definition of Old Growth Forest

The DECCW *Verification Rules* note *inter alia* that "*old growth forests are ecologically mature forests where the effects of disturbance are now negligible*" (emphasis added). The DECCW notes that such forests "*are of high conservation significance as they support a relatively high level of biodiversity, are relatively uncommon and quite fragmented*".

The DECCW *Verification Rules* further define 'Old Growth Forest' as forest vegetation "*which should largely consist of senescing or mature trees. Regrowth should be less than 30% of the canopy. There should also be negligible evidence of disturbances such as logging or catastrophic fires*".

13.4.2 Assessment of Old Growth Forest

The investigations undertaken on the subject site at Badgee Lagoon by BES/ELA and Environmental InSites have included *inter alia* detailed surveys of hollow-bearing tree densities through the site (Chapter

5; Figure 9). That mapping identified the densities of hollow-bearing trees in different parts of the subject site, and was used as part of the array of data to identify the higher conservation value lands.

It is also noted, however, that the "*effects of disturbance*" on the subject site at Sussex Inlet are not "*now negligible*". The subject land is not fenced, and there is an array of tracks and disturbances as a result of access by surrounding residents and by visitors to Sussex Inlet during holiday periods (particularly closer to Badgee and north of the golf course). Further, the subject land has been affected by long-term timber harvesting, and parts of the site are affected by bushfire, the golf course and human access.

Doubtless, much of the forest vegetation present on the subject site contains moderate numbers of hollow-bearing trees, as is typical of much of the Shoalhaven LGA (Chapter 5). However, many of those hollows are in species (such as the Scribbly Gum) which form hollows at a young age and/or in species which only form small hollows (*eg* the Bloodwoods). Consequently, many of the tree-hollows are small.

However, there are also moderate numbers of large hollow-bearing trees through many parts of the Badgee Lagoon site (see Chapter 5), containing moderate to large (and occasional very large) tree-hollows. These resources, particularly where distant from existing disturbance, are potentially of special value for certain species (such as Glossy Black Cockatoos and forest owls), although no nesting by either the Glossy Black Cockatoo or the Masked Owl has been observed on the subject site. The single known breeding site of the Powerful Owl is located in the centre of the proposed conservation area (Figure 8) between Badgee and the existing 9-hole golf course.

13.4.3 Distribution of Old Growth Forest

It is also to be noted that "*senescing*" trees are not particularly abundant, although there is a moderate supply of "*mature trees*", including moderate to large 'over-mature' hollow-bearing trees, in parts of the subject site. Most of the areas containing moderately high to high densities of hollow-bearing trees are intentionally incorporated into the proposed conservation-zoned land through the centre of the subject site in a north-south direction and into the northwest of the site.

On the basis of the data which have been collected from the subject site and observations made during several driven surveys of the subject land, it is the opinion of the author of this *Report* that most of the vegetation which may be considered "*Old Growth Forest*" (as defined in the *Verification Rules* of DECCW) is located predominantly through the central parts of the subject site, in the lands proposed to be zoned for conservation purposes (Figure 14).

13.4.3 Hollow-bearing Tree Management

The importance of hollow-bearing trees and tree-hollows for a range of native (including threatened) biota was recognised during the iterative process of determining an appropriate development footprint on the subject site at Sussex Inlet by the consultant team for the proponent. It is for those reasons *inter alia* that the substantial tracts of vegetation through the centre and northwestern parts of the subject site had been identified as appropriate for retention, management, enhancement and zoning for conservation purposes in the earlier development concept for the site.

Furthermore, it is anticipated that any future development of the site would involve:

- the salvage of tree-hollows from any hollow-bearing trees which need to be removed from development areas, with tree-hollows relocated into areas of retained vegetation (by wiring or otherwise installing in extant trees and/or onto erected timber 'transmission line' poles);
- the use of salvaged tree-hollows as hollow logs in retained bushland; and/or
- the replacement of any tree-hollow lost by artificial nest-boxes.

13.4.4 Old Growth Forest Outcomes

The rezoning proposal detailed in Chapter 15 of this *Report* retains most of the areas on the subject site which contain relatively high numbers of hollow-bearing trees and of tree-hollows. In this regard:

- the proposed development area in the northwest of the subject site has a relatively lower density of hollow-bearing trees and of tree-hollows (see Chapter 5);
- most of the areas with relatively high densities of hollow-bearing trees and of tree-hollows are located in the land proposed to be zoned for conservation purposes through the centre of the subject site;
- whilst small areas containing relatively high densities of hollow-bearing trees and of tree-hollows are located within the northern extension of the golf course land, these areas have relatively fewer threatened species records and/or are peripheral to the main band of retained vegetation through the centre of the site; and
- the existing golf course land and the land already zoned for residential development on the subject site do not have high densities of hollow-bearing trees or of tree-hollows (*pers obs*).

On the basis of the observations and considerations detailed above, the proposed rezoning of the subject site at Sussex Inlet has accommodated the retention of those areas of 'Old Growth Forest' which are regarded as satisfying the criteria for *High Conservation Value* areas, as discussed in Chapter 13.8 of this *Report*. That determination relies *inter alia* on the cumulative evaluation of hollow-bearing tree resources, threatened species numbers and densities, and existing and/or likely future levels of disturbance.

13.5 Threatened Species

13.5.1 General Considerations

The DECCW *Verification Rules* provide *inter alia* a list of 31 threatened fauna species and 5 threatened flora species (Appendix I) which are considered to be relevant to the assessment of conservation values in the Sussex Inlet area. Those threatened species have been addressed in detail in this *Ecological Issues & Constraints Report* on the basis of the extensive investigations on the site conducted by both BES/ELA and InSites, and on the basis of data from relevant databases (see Chapter 2; Figures 8 and 9) and previous investigations in the study area.

Eighteen threatened species have been recorded on or immediately adjacent to the subject site (see Chapters 4 and 5):

- the Leafless Tongue Orchid and *Speculantha ventricosa*;
- the Glossy Black and Gang Gang Cockatoos, the Powerful and Masked Owls and the Square-tailed Kite;

- the Grey-headed Flying Fox;
- the Common Bent-wing, Little Bent-wing, Yellow-bellied Sheath-tail, East Coast Freetail, Large-eared Pied and Greater Broad-nosed Bats, the Eastern Falsistrelle and the Large-footed Myotis; and
- the Yellow-bellied Glider and Eastern Pygmy Possum.

A detailed analysis and consideration of all of those species and their habitat requirements with respect to the subject site, and the relevance of the vegetation and habitats present, has also been undertaken (Appendix I).

Substantial areas of suitable potential habitat and resources for all of those threatened biota, and for other forest-dependent threatened species, are to be retained and protected within the areas proposed for rezoning to *E2 – Conservation* through the northern and central parts of the subject site (Figures 6, 14 and 16). Further, the retention of all EECs, SEPP 14 Wetlands and natural aquatic habitats on the site will ensure the protection of threatened biota dependent on those resources.

Nevertheless, it is acknowledged that some areas of habitat and some resources for some threatened biota will unavoidably be removed. That process is essentially inevitable in any 'greenfield' development on the South Coast (and elsewhere through NSW), given:

- the number of threatened biota which have been listed in the TSC Act;
- the widespread distribution of many of those biota (and of all of them *in toto*); and
- the likely use of virtually any area of native vegetation throughout NSW, particularly coastal NSW, by at least some threatened fauna and/or flora species.

13.5.2 Important Habitat for Threatened Biota

The approach which has been taken to the relevant threatened biota in this EICR is one of maintaining large patches and swathes of habitat through the subject site, containing representative examples of all of the habitat requirements of these species, in the broad bands of vegetation in the lands proposed for rezoning to conservation (Figures 14-16; Chapter 15). Those broad swathes of vegetation include most of the higher density records of the relevant threatened species (Figures 8 and 15), and areas of suitable habitat for these and other threatened species (Figure 14).

The rezoning proposal detailed below and in Chapter 15 of this *Report* (Figures 14-16) retains most of the areas on the subject site which contain relatively high numbers of threatened species records, and the most important habitat for those biota (including most of the areas of high density hollow-bearing trees), in addition to two major "*wildlife connections*" through the subject site.

Whilst some loss of habitat and resources for some threatened biota is inevitable on a site such as that at Sussex Inlet:

- the proposed rezoning has concentrated on retaining the best and highest conservation value portions of the subject site for biodiversity conservation purposes whilst providing a sensible and reasonable development outcome (in accordance with the SISS and the SCRS);

- the loss of possible or moderate HCV areas has been limited to vegetation peripheral to the main bands of habitat and 'corridors' through the site; and
- suitable habitat and resources for all of the threatened species recorded on the subject site is to be retained and protected.

13.5.3 Relevant Threatened Species

Glossy Black Cockatoo and Yellow-bellied Glider

With respect to the Glossy Black Cockatoo and Yellow-Bellied Glider "*on Millalen and Vernon Estates*", the DECCW *Verification Rules* state that "*approval should not be given to the clearance of native vegetation ... unless Council can be satisfied that no feed, den or nesting trees of these species are being cleared*" (emphasis added).

Whilst that 'directive' does not strictly apply to the subject site (as it is confined to the "*Millalen and Vernon Estates*"), the advice from the DECCW has been considered.

It is important to note that that DECCW 'directive' substantially exceeds the relevant statutory considerations, being the imposition or otherwise of a "*significant effect*" (emphasis added) upon threatened biota. A requirement that "*no feed, den or nesting tree of these* [or any other] *species*" (emphasis added) be cleared for development purposes is both excessive and unworkable, and represents a prohibition on development which is not mandated by any relevant statutory power or process. It is also not justified by either the SISS or the SCRS, or the Draft *South Coast Regional Conservation Plan.* With respect to the subject site at Sussex Inlet, that requirement would render a very significant proportion of the subject site incapable of development activities.

Nevertheless, substantial areas of habitat and resources for these threatened species have been retained in the proposed rezoning of the subject site. In this regard:

- substantial areas containing high densities of hollow-bearing trees are to be retained within the central north-south "*wildlife connection*";
- substantial areas of food tree resources for both the Yellow-bellied Glider and Glossy Black Cockatoo are to be retained in the less disturbed parts of the forested lands (as represented in the proposed re-zoning);
- the area of high density Yellow-bellied Glider feed trees identified in the northern part of the Central Development Area (Chapter 13.5.4) is to be retained at the edge of a benign land use (part of the proposed golf course) and the patch of very large hollow-bearing trees in the Northeastern Development Area is also to be retained in association with the proposed golf course (see Chapter 15); and
- future detailed design of the proposed new golf course fairways and holes would specifically accommodate the retention of resources and habitat features of potential value for these (and other) threatened species, including hollow-bearing trees and potential or identified feed trees.

Potentially suitable habitat and resources for both the Glossy Black Cockatoo and Yellow-Bellied Glider are widely distributed through the locality (Figure 7), and both species are widely distributed and commonly recorded in the Shoalhaven LGA (see map included in Chapter 5).

Eastern Pygmy Possum

Whilst there is only one record of the Eastern Pygmy Possum on the subject site, suitable habitat for this species is moderately abundant, particularly in the northern and northwestern parts of the subject site.

The preferred vegetation/habitat type for this species (particularly Scribbly Gum Forest with a heath understorey) and to some extent the Currambene Lowland Forest with heath understoery) is widespread in the northern and central parts of the proposed north-south "*wildlife connection*" through the subject site. It is also of significance to note that this vegetation types extends for some considerable distance to the immediate north and northwest (Figure 12) onto adjoining lands which (due to their location and condition) are never likely to be developed.

Areas regarded as "*important habitat*" for the Eastern Pygmy Possum are the larger intact areas of xeric woodland and open forest with a heath understorey. These are located to the north of the existing golf course, beyond those areas which have been adversely affected by a high density of vehicle tracks and other 'edge effects'.

Powerful Owl

This species has been recorded roosting and nesting (breeding) on the subject site, approximately in the centre of the proposed (and existing) north-south corridor, east of the existing nine-hole golf course.

The Powerful Owl has a large home range, and the subject site itself would constitute only part of the home range for a single breeding pair. The substantial tracts of native forest and woodland vegetation through the centre and in the south of the subject site, as well as the substantial areas of native vegetation to be retained to the immediate north and northwest, constitute "*important*" habitat for the Powerful Owl.

Conversely, vegetation peripheral to existing residential development is not regarded as "important" for the survival of this species at this location. Further, there are substantial areas of suitable habitat in the locality (Figure 7).

Masked Owl and Square-tailed Kite

Neither of these species have been recorded breeding on the subject site at Sussex Inlet, and both are very highly mobile and wide-ranging.

The retention of habitat and resources both on the subject site and on the land to the immediate north and northwest is considered satisfactory for the survival of these species at this location. Further, there are substantial areas of suitable habitat in the locality (Figure 7).

Grey-Headed Flying Fox

This also is a highly mobile and wide-ranging species, which travels considerably distances in a single evening for foraging and feeding purposes.

None of the vegetation on the subject site *per se* is regarded as "*important*" for the survival of the Grey-Headed Flying Fox at this location. Nevertheless, the retention of substantial areas of native vegetation on the subject site and in the immediate vicinity (particularly to the north and northwest), as well as the provision of some foraging habitat and resources within residential areas, is considered satisfactory in terms of the long-term survival of the Grey-Headed Flying Fox at this location. Further, there are substantial areas of suitable habitat in the locality (Figure 7).

Microchiropteran Bats

Microchiropteran bats have been recorded throughout the subject site at Sussex Inlet. These are highly mobile and generally wide-ranging species, and most threatened microchiropteran bats utilise tree-hollows for roosting and the forest canopy for foraging.

For most of the threatened microchiropteran bats, the presence of numbers of hollow-bearing trees and/or trees with decorticating bark are considered "*important*" for their survival. The proposed re-zoning of the subject site maintains substantial tracts of forest and woodland habitat through the subject site, containing relatively high densities of hollow-bearing trees. This approach will maintain both *in situ* habitat and resources, and provide "*wildlife connections*" or "*corridors*" through the landscape.

Given the mobility of those threatened species, their wide-ranging habits and the distribution of suitable resources and habitats, the areas of the subject site proposed for re-zoning for development and/or golf course purposes are not regarded as "*important habitat*" for threatened microchiropteran bats pursuant to the '*Verification Rules'* of the DECCW.

Several of the threatened microchiropteran bats (the Common and Little Bent Wing Bats, Large-eared Pied Bat and the Large-Footed Myotis) utilise caves and tunnels as their primary roosting resource. The subject site does not support any such resources, and individuals of those threatened microchiropteran bats recorded on the subject would either have been using tree-hollows for temporary roosting purposes or would have travelled to the subject site to forage from distant roost sites.

Suitable foraging habitat, and potentially suitable roosting habitat, for the Bent-Wing Bats and the Large-eared Pied Bat will be retained in the substantial tracts of vegetation identified for re-zoning for biodiversity conservation purposes on the subject site. Whilst existing foraging resources for the Large-footed Myotis (the artificial dams on the golf course) will or may be removed or modified in the subsequent development of the subject site, the requirement for additional stormwater detention and water quality treatment basins will provide suitable supplementary or additional habitat for this species.

Leafless Tongue Orchid

Two small stands of the Leafless Tongue Orchid were recorded on the subject site:

- within the Central Development Area, north of the existing nine-hole golf course at the edge of a dirt track; and
- two other sub-populations slightly further to the north (Figure 8) in land proposed to be zoned for conservation purposes.

This species, it is noted, often occurs in disturbed locations immediately adjacent to dirt tracks and other areas of soil disturbance (F D Fanning *pers obs*). Further, suitable habitat for the species is widely distributed in the xeric Currambene Lowland Forest and Shoalhaven Sandstone Forest communities, which constitute most of the north-south 'corridor' through the central parts of the subject site. In addition, there are substantial areas of suitable habitat in the locality (Figure 7).

Speculantha ventricosa

Two small patches of the threatened Orchid *Speculantha ventricosa*[7] were tentatively recorded on the subject site (Figure 8):

- one on the western side of the Northeastern Development Area; and
- a second to the east of the existing 9-hole golf course.

The former area is proposed to be rezoned as part of the golf course and managed exclusively for the conservation of that Orchid. The latter area is contained within the main north-south 'corridor', and is to be zoned for conservation purposes.

13.5.4 Contentious Areas

Following preparation of a previous potential rezoning concept for the subject site at Badgee Lagoon, and an inspection of the site by the DECCW (Miles Boak and Dimitri Young), SCC (Elizabeth Dixon) and Environmental InSites, two '*Areas of Contention*' were identified by the DECCW (see plan below). These were translated by Environmental InSites into three '*Areas of Contention*' (Figure 4), which were the focus of supplementary ecological investigations (along with adjoining vegetation in the proposed central 'corridor').

The rezoning proposal detailed in Chapter 15 of this *Report* does propose the loss and development of threatened species habitat within those '*Areas of Contention*' on the subject site at Sussex Inlet. However, those three areas are not considered to represent *High Conservation Value* (HCV) areas pursuant to the DECCW *'Verification Rules'* because of:

- low densities of hollow-bearing trees; and/or
- relatively low densities of threatened species; and/or
- relatively low numbers of threatened species; and/or
- the cosmopolitan nature of most of the threatened species involved; and/or
- the levels of existing disturbance; and/or
- current and/or likely future impacts (including inter alia 'edge effects' and adjoining clearing of native vegetation).

[7] This species was the subject of a *Preliminary Determination* for listing as an "*endangered*" species at the time of this *Report*.

Northeastern Development Area

This patch of vegetation in the northeast (Area 1A in Figure 4) of the subject site (to the immediate north and northwest of the existing Badgee village) generally has relatively low numbers of hollow-bearing trees, and a low density of threatened species records (other than the number of microchiropteran bats recorded at one location).

However, given the mobility and wide-ranging characteristics of this group of threatened species, and their wide distribution both through the subject site and in the locality, this single location cannot reasonably be considered "*important*" for microchiropteran bats in general, or for a single species in particular. As noted above, suitable habitat for all of these species is widely distributed through the region (Figure 7), and relevant resources (hollow-bearing trees, ponds and dams *etc*) are also widespread and at least moderately abundant.

Conversely, it is noted that there is a small patch in the centre of this area with a high density of large hollow-bearing trees (see attached map, below). The zoning proposal has been modified to retain most of those large hollow-bearing trees in or adjacent to the proposed new golf course at this location. The implementation of a *Hollow-bearing Tree Protocol* would also be anticipated at this location in any future development of the site, involving the salvage and re-use of tree-hollows in conservation areas.

Central Development Area

This patch of vegetation (Figure 4) is located to the north of the existing 9-hole golf course, and is affected to some extent by disturbance ("*edge effects*") from the golf course, and by a high density of vehicle tracks and general human use.

This area has a relatively high number of hollow-bearing trees (Figure 9; Chapter 5), however, and a high density of threatened species records in its northern half. The southern half of this area, on the other hand, is considered to be of lesser "*importance*" due to the higher levels of disturbance, and is designated in the proposal for residential and/or golf course development (Figures 14-16).

Western Development Area

This patch of vegetation (Figure 4) in the northwest of the subject site (to the immediate north of the existing 9-hole golf course) also has a relatively high number of hollow-bearing trees (Figure 9; Chapter 5), but a lower density of threatened species records.

This latter circumstance, no doubt, is a reflection of relatively higher levels of disturbance from 'unmanaged' adjoining land use activities (the golf course to the south, and the clearing of vegetation to the immediate northwest and southwest). In addition, this area has a high density of vehicle tracks and general disturbance, and is not regarded as particularly "*important*" for or *"essential"* any threatened species.

13.5.5 Threatened Species Outcomes

The identification of "*important*" or *"essential"* habitat and resources for threatened species, based *inter alia* on the results of the investigations undertaken for this *Report* and the DECCW '*Verification Rules*', has facilitated the establishment of the true *High Conservation Value* (HCV) areas on the subject site at Sussex Inlet.

Three '*Areas of Contention*' identified by the DECCW have been considered pursuant to supplementary field investigations, and the appropriate areas for biodiversity conservation and for potential future development on the site have been identified and 'verified' (Figures 14-16). Suitable resources and habitat for threatened biota has been retained in the rezoning proposal detailed in Chapter 15 of this *Report*.

13.6 Wildlife Corridors and Connectivity

13.6.1 General Considerations

Considerable detailed discussion regarding connectivity and "*wildlife corridors*" has been provided within Chapters 5.1.3 and 8 of this *Report* for the Sussex Inlet Golf Course site.

This issue has been a significant element in the iterative process which was previously undertaken during the development design process to date, and has substantially influenced the intended development footprint (Chapter 15), both with respect to the location and extent of the residential footprint and in the alignment and locations of the various golf course elements in the proposed rezoning.

13.6.2 Wildlife Corridors

The Sussex Inlet Project site is located essentially at the southern extremity of a broad band of vegetated lands which extends for some considerable distance to the north and northwest (around the St Georges Basin). Conversely, land to the immediate east, southeast, south and west of the Sussex Inlet Golf Course site has already long been substantially cleared of native vegetation for agricultural purposes or has been developed for industrial and urban purposes (Figures 13 and 14).

Other than for highly mobile species tolerant of peri-urban landscapes, the subject site at Sussex Inlet does not constitute part of a "*wildlife corridor*", other than possibly being the southern terminus of a north-south "*corridor*" through the general landscape. The subject site is not so much part of a "*corridor*" as the 'cul-de-sac' of such a "*corridor*".

In any case, the rezoning of the subject site will:

- maintain the main north-south "*wildlife connection*" through the subject site from the Badgee Lagoon habitats, in a northwesterly direction;
- maintain the east-west "*wildlife connection*" from Badgee Lagoon in a southwesterly direction (noting that both rural-residential development and clearing, and Sussex Inlet Road, traverse that "*connection*"); and

- have no impact upon any purported southerly "*wildlife connection*" from Badgee Lagoon through the residential areas to the south of the subject site (which does not now exist other than for highly mobile and/or urban-tolerant species).

13.6.3 Connectivity

As noted above, the subject site for the Sussex Inlet Golf Course Project does have good connectivity to the extensive vegetated lands to the north and northwest (Figure 13). The site represents (as noted above) the southern extremity of a broad band of vegetation which extends for some considerable distance to the northwest (Figure 13). That band of vegetation is also contiguous with very extensive further tracts of native vegetation to the northwest and west, linking *inter alia* to Morton and Jerrawangala National Parks and an array of other Nature Reserves and State Forests.

However, it should be noted that these 'connective links' or "*wildlife corridors*" are traversed by rivers, roads and/or electricity transmission easements, as well as being affected to various extents by the previous clearing of land for agricultural and/or residential purposes.

An important feature of the Sussex Inlet Golf Course site is that a substantial band of vegetation is to be retained in the rezoning process through the central parts of the subject land to maintain connectivity between Badgee Lagoon and vegetated lands to the north and northwest. A second broad band of vegetated land is to be maintained (in an east-west direction) through the southern part of the subject land.

13.6.4 Conclusions

Given the location of the subject site and the nature and location of surrounding land uses, the Sussex Inlet Golf Course site is not regarded as of particular significance with respect to wildlife movements or to connectivity through the landscape generally. Other than on a local and immediate basis, the Sussex Inlet Golf Course site does not contribute in a significant or meaningful manner to the maintenance of connectivity or to the provision of habitat and resources of relevance for any potential or purported "*wildlife corridor*".

Nevertheless, as noted above, the proposal incorporates measures to retain substantial areas of native vegetation to facilitate the conservation of native biota on a local basis and to facilitate movements of wildlife through the area generally (to the extent that such movements currently occur).

Rezoning and subsequent development of the Sussex Inlet Golf Course site (Chapter 15):

- would retain native vegetation in an appropriate configuration so as to maintain connectivity and *in situ* habitat;
- would "*not significantly*" impact on habitat "*connectivity*" at this location; and
- would maintain vegetation "*at a width that is likely to retain functionality*" of any corridor or ecological linkage at this location.

13.7 SEPP 14 Wetlands

All of the SEPP 14 Wetland areas on the subject site at Sussex Inlet have been identified for retention and protection, pursuant to the *Verification Rules* of the DECCW, which identify SEPP 14 Wetlands as 'No Go Areas' (see Chapter 11).

13.8 Determination of High Conservation Value Areas at Badgee

The *Verification Rules* of the DECCW, which were prepared in respect of the Sussex Inlet area as an *Action* pursuant to the *South Coast Regional Strategy*, have been addressed in specific terms in this *Ecological Issues & Constraints Report* for the rezoning of the Sussex Inlet Golf Course site.

As discussed above with respect to the relevant matters to be addressed in determining the extent and distribution of *High Conservation Value* (HCV) areas on the subject site, some elements of HCV are readily identified (*eg* areas of SEPP 14 Wetlands and of EECs), whilst others (the presence of "*Old Growth Forest*", and the presence and extent of "*wildlife connections*" and of "*important habitat*" or *"essential habitat"* for threatened species) are open to greater interpretation and evaluation.

The EECs and SEPP 14 areas on the subject site at Sussex Inlet have all been excluded from the land to be rezoned for residential or golf course purposes (Chapter 15; Figures 14-16).

The detailed assessment of other parts of the subject site, with respect to the relevant matters contained in the DECCW *Verification Rules* designed to identify *High Conservation Value* (HCV) areas on the subject site (as documented above), has determined *inter alia* that whilst many parts of the site support some features or elements of HCV, it is not appropriate to determine that all vegetation on the site is in fact HCV.

Significantly, following a site inspection and detailed consultation between the DECCW (Miles Boak and Dimitri Young, as well as Julian Thompson) and SCC (Elizabeth Dixon) with Environmental InSites, three patches on the subject site were identified as '*Areas of Contention*' (Figure 4).

Northeastern Development Area

This patch of vegetation (Area 1A in Figure 4) is located in the northeast of the subject site, to the immediate north and northwest of the existing Badgee village. Whilst this area of vegetation is not significantly disturbed and is not adjoined by existing development (other than distantly to the southeast), it is not regarded as an HCV area for the site because:

- it has relatively low numbers of hollow-bearing trees (see Chapter 5.1.2; Figure 9);
- it has a low number of and density of threatened species, other than the number of microchiropteran bats recorded at one location. However, given the mobility and wide-ranging characteristics of this group of threatened species, that single location cannot reasonably be considered "*important*" or *"essential"* for microchiropteran bat conservation

(*ie* there is no reason to consider this location of special value or importance to these species)[8];

- it does not support other features considered to be *important*" for threatened species; and
- it does not constitute a "*wildlife connection*" or "*corridor*" of any relevance.

As a consequence, the northeastern development area is proposed for rezoning for development purposes. Whilst this area had previously been zoned for conservation purposes, that zoning was clearly not based on any objective or ground-truthed assessment of the biodiversity conservation values of the vegetation present (as acknowledged by the DECCW (M Boak and D Young) and SCC (E Dixon) during the site inspection in October). The previous (current) zoning is of no relevance to the determination of HCV areas.

Central Development Area

This patch of vegetation (Figure 4) is located to the north of the existing 9-hole golf course, and is affected to some extent by disturbance ("*edge effects*") from the golf course, and by a high density of vehicle tracks and general human use.

This area has a relatively high number of hollow-bearing trees (Figure 9; Chapter 5.1.2), and a high density of threatened species records in its northern half. The southern half of the area, however, is considered to be of lesser "*importance*" because:

- it has somewhat lower numbers and densities of threatened species;
- it has been more heavily disturbed (with a substantial number of dirt tracks);
- it is close to the existing golf course, and is therefore somewhat affected by that feature; and
- it is not located within the main body of the north-south "*wildlife connection*" through the site.

On the basis of those considerations, the southern part of the Central Development Area is not considered to be an HCV area, notwithstanding the presence of HCV features to varying extents.

Western Development Area

This patch of vegetation (Figure 4) is located in the west of the subject site (to the immediate northwest of the existing 9-hole golf course), and also has a relatively high number of hollow-bearing trees (Figure 9; Chapter 5.1.2). However, this area also has a lower density of threatened species records.

Like the Central Development Area, the Western Development Area is considered to be of lesser "*importance*" because:

[8] It is noted that there is a small (~1ha) patch in the centre of the proposed Northwest Development Area (Figure 9) that contains a high number of very large hollow-bearing trees. Most of these trees are to be retained in and around an expanded golf course area in the centre of that Development Area.

- it has somewhat lower numbers and densities of threatened species;
- it has been heavily disturbed (with a substantial number of dirt tracks and other evidence of human activities);
- it is close to the existing golf course, and is therefore somewhat affected by that feature;
- it is adjoined to the immediate northwest and southwest by cleared and disturbed land; and
- it is not located within the main body of the north-south "*wildlife connection*" through the site.

On the basis of those considerations, the part of the Western Development Area is not considered to be an HCV area, notwithstanding the presence of HCV features to varying extents.

13.9 Conclusions

The *Verification Rules* of the DECCW, which were prepared in respect of the Sussex Inlet area as an *Action* pursuant to the *South Coast Regional Strategy*, have been addressed in specific terms in this *Ecological Issues & Constraints Report* for the Sussex Inlet Golf Course site.

In this regard, the specific issues which are considered in this *Report* include *inter alia*:

- a full consideration, mapping and assessment of "*endangered ecological communities*" (EECs) listed in the TSC Act;
- design of the proposed rezoning of the subject site to retain all of the EECs present;
- identification of the locations and densities of hollow-bearing trees, and their substantial retention in a broad tract of vegetation through the subject site, irrespective of the presence of otherwise of "*Old Growth Forest*" as defined in the DECCW *Verification Rules*;
- full and detailed consideration of threatened species listed in the TSC Act, and consideration of their relevance with respect to the rezoning design, and the appropriate impact amelioration and environmental management measures which would be incorporated into any future development of the site;
- analysis of the location and extent of "*important habitat*" or *"essential habitat"* for threatened species, including consideration of the extent and location of existing habitat disturbances and adjoining clearing;
- detailed consideration of 'wildlife corridors' and habitat connectivity through the landscape, noting that the subject site is located at the southern extremity of a band of native vegetation and thus, whilst having 'good connectivity' with adjoining vegetated land to the north and northwest, does not constitute a "*wildlife corridor*" (but in any case, existing connectivity through the site will be maintained); and
- consideration of the relevant SEPP 14 Wetlands and other wetland habitat and aquatic ecosystems with respect to the proposed rezoning (including the retention of all SEPP 14 Wetlands on the site in a conservation zoning) and any future development of the site.

The rezoning of the subject site proposed by the Lucas Property Group P/L (as detailed in Chapter 15 and Figures 14-16) involves:

- the retention of all of the mapped EECs and SEPP 14 Wetlands throughout the subject site in an *E2 – Conservation* zone;
- the retention of a broad (minimum 250m wide) band of vegetation and habitats through the centre of the site, extending northerly and northwesterly from Badgee Lagoon to the northern boundary. That band of vegetation connects with the broad band of vegetation to be retained on the One Tree Bay lands to the immediate north, forming an extensive "*wildlife corridor*" or "*wildlife connection*" through this location;
- the retention of a broad band of vegetation and habitats east-west through Badgee Lagoon in the south of the site. That band of vegetation provides a "*wildlife corridor*" or "*wildlife connection*" 250-500m wide through this part of the subject site, to the east and west;
- an 18-hole golf course (as identified as an opportunity and as a community requirement in the *Sussex Inlet Settlement Strategy*), located so as to provide *inter alia* a buffer between intense (residential) development and retained conservation lands;
- the provision of a 'flood-free access road' for Badgee (identified in the SISS as a Council requirement); and
- four parcels of land zoned for residential purposes:
  - the existing residential-zoned land to the immediate west of the Badgee settlement, on the eastern side of the subject site;
  - existing residential-zoned land to the southwest of Badgee Lagoon (in the southwestern corner of the site);
  - the area of the existing 9-hole golf course, as well as a minor northern extension of that area into potential HCV lands to its immediate north (leaving the broad "*wildlife corridor*" or "*wildlife connection*" at this location intact); and
  - a patch of residential development land in the northeast of the subject site, in an area which has been assessed as not constituting HCV land (due to the relatively low numbers of hollow-bearing trees and the relatively low numbers of threatened species records).

On the basis of all of those considerations, the proposed rezoning and future development of the subject site at Sussex Inlet is appropriate, reasonable, balanced and acceptable. This project provides:

- an appropriate and reasonable development footprint;
- a substantial and beneficial environmental outcome; and
- a reasonable balance between environmental outcomes and appropriate social and economic outcomes.

14 ENVIRONMENT PROTECTION & BIODIVERSITY CONSERVATION ACT

14.1 Introduction

The *Environment Protection & Biodiversity Conservation Act 1999* (EPBC Act), of the Commonwealth of Australia, seeks *inter alia*:

- "*to provide for the protection of the environment, especially those aspects of the environment that are Matters of National Environmental Significance*";
- "*to provide ecologically sustainable development*"; and
- "*to promote the conservation of biodiversity*".

Implementation of the EPBC Act requires *inter alia* consideration as to whether a development or activity is likely to impose a "*significant impact*" on "*Matters of National Environmental Significance*" (MNES), which include:

- listed threatened biota (ecological communities and species);
- alleged "*migratory species*" listed in international treaties (JAMBA, CAMBA, RoKAMBA)[9];
- actions relating to "*nuclear activities*";
- actions on Commonwealth lands or Commonwealth marine areas;
- actions in or affecting RAMSAR Wetlands; and
- World Heritage sites.

14.2 Relevant EPBC Act Considerations

The proposed rezoning and any future development of the subject site at Sussex Inlet would have no relevant effect with respect to nuclear activities, Commonwealth lands, World Heritage properties, Ramsar wetlands or the Commonwealth marine environment.

Only two threatened species (the Grey-headed Flying Fox which was recorded foraging on the subject site and the Leafless Tongue Orchid) listed in the EPBC Act have been recorded on or in the immediate vicinity the subject site (Appendix D), although individuals of a number of other highly mobile threatened biota are likely to be present on occasions at least. In addition, a significant number of real or alleged "*migratory species*" have been recorded in the locality (Appendix D).

With respect to threatened biota listed in the EPBC Act:

- there is no relevant "*threatened ecological community*" present on the subject site;
- the majority of listed threatened species are not of relevance, being marine or pelagic species;
- other than the Grey-headed Flying Fox, none of the threatened species listed in the EPBC Act have been recorded on the subject site. This is a wide-ranging and highly mobile species, tolerant of urban environments, for which the subject site represents only a small

[9] JAMBA *Japan-Australia Migratory Bird Agreement*
CAMBA *China-Australia Migratory Bird Agreement*
RoKAMBA *Republic of Korea-Australia Migratory Bird Agreement*

area of potential foraging habitat. The proposed rezoning and subsequent development of the subject site would have no relevant impact on the Grey-headed Flying Fox;

- whilst a number of other threatened fauna species could potentially occur on the subject site (Appendix K), the likelihood of potential impacts upon these species is regarded as low and the effect or likely effect is regarded as either marginal or low because of the extent of habitat and resources to be retained on the subject site itself and the extent of such habitats and resources in the general locality, and/or the mobility of many of those species; and
- habitat for the Leafless Tongue Orchid is widely distributed on the subject site, as this species was recorded in the abundant Currambene Lowlands Forest, much of which will be retained in the conservation zoning on the subject site. There are also extensive tracts of this community in the immediate vicinity and general locality, and it can reasonably be assumed that the species is more widely distributed than generally thought.

It is not considered likely that a "*significant impact*" would be imposed upon any threatened species listed in the EPBC Act as a result of the proposed rezoning and future development of the subject site at Sussex Inlet.

With respect to migratory "*terrestrial*" species listed in the EPBC Act, there is some potential for individuals of some of the migratory terrestrial bird species to occur on the site, on occasions at least (Appendix K). However, it is not likely that the subject site would constitute significant or important habitat for any such species, and it is not likely that any such species would be reliant or dependent upon the site for their survival in this locality.

Even if individuals of any such migratory "*terrestrial*" species do occur on the subject site on occasions, it is not considered likely that the proposal would impose a significant or substantial adverse impact on either individuals or populations of any such migratory *"terrestrial"* species, as substantial areas of potential habitat are to be retained on the subject site itself and on the adjoining lands to the immediate north.

With respect to the 'so-called' migratory wetland species and migratory marine birds, the subject site is not of any particular relevance or value. The only species which could possibly use the subject site (Appendix K) are the White Egret, the Cattle Egret and (to an extremely limited extent) possibly Latham's Snipe and the Painted Snipe. In the latter two cases, however, any use of the subject site would be limited to the surrounds of Badgee Lagoon, and it is not likely that development of the subject site as proposed for any of those species would impose any adverse impacts upon those species, even if present.

None of the aquatic or marine species listed on the EPBC Act would be likely to be affected by any activities on the subject site. No direct impacts are likely or would be proposed on habitats or resources of any potential relevance for any such species, and future development of the site in accordance with the rezoning proposed would not result in any impacts of significance upon any of those species. It is anticipated that appropriate 'best practice' standards with respect to stormwater quality and volumes would be imposed on any future development of the site to protect *inter alia* any potential areas of habitat for any such species in Badgee Lagoon, the Sussex Inlet on the St Georges Basin.

14.3 Conclusions

That part of the subject site proposed for development activities does not constitute a significant element of the potential resources for any individuals of the species listed on the EPBC Act within their normal home ranges. It is not likely that an individual of any such species would be reliant on or dependent on those parts of the subject site proposed for development activities for their survival, even on a local basis. There is no likelihood of a "*significant impact*" being imposed on any such biota listed on the EPBC Act as a result of the proposed development of the site at Sussex Inlet.

Given those considerations, there is no relevant issue with respect to the EPBC Act. There is no proposal to or requirement for 'Referral' of the proposed development to the Commonwealth for the purposes of assessment or for an approval by the Federal Minister for the Environment.

PART D PART 3 REZONING PROPOSAL

15 REZONING PROPOSAL

Based on all of the details contained in the foregoing, and the consideration both of the appropriate constraints imposed by ecological matters and the achievement of appropriate development outcomes pursuant to the SISS and the SCRS, as well as the SCRCP, a rezoning proposal for the subject site at Sussex Inlet has been prepared.

The rezoning of the subject site proposed by the Lucas Property Group P/L (as detailed in Figures 14, 15 and 16) involves:

- the retention of all of the mapped EECs and SEPP 14 Wetlands throughout the subject site in an *E2 – Conservation* zone;
- the retention of a broad (minimum 250m wide) band of vegetation and habitats through the centre of the site, extending northerly and northwesterly from Badgee Lagoon to the northern boundary. That band of vegetation connects with the broad area of vegetation on the One Tree Bay lands to the immediate north, forming an extensive "*wildlife corridor*" or "*wildlife connection*" through this location;
- the retention of a broad band of vegetation and habitats east-west through Badgee Lagoon in the south of the site. That band of vegetation provides a "*wildlife corridor*" or "*wildlife connection*" 250-500m wide through this part of the subject site, to the east and west;
- an 18-hole golf course (identified as an opportunity and as a community requirement in the *Sussex Inlet Settlement Strategy*; and
- four parcels of land zoned for residential purposes (Figure 16):
  - the existing residential-zoned land to the immediate west of the Badgee settlement, on the eastern side of the subject site;
  - existing residential-zoned land to the southwest of Badgee Lagoon (in the southwestern corner of the site);
  - the area of the existing 9-hole golf course, as well as a minor northern extension of that area into potential HCV lands to its immediate north (leaving the broad "*wildlife corridor*" or "*wildlife connection*" at this location intact); and
  - a patch of residential development land in the northeast of the subject site, in an area which has been assessed as not constituting HCV land (due to the relatively low numbers of hollow-bearing trees and the relatively low numbers of threatened species records).

Of the four plant communities that will be zoned in part (or are already zoned) for residential purposes and/or for golf course (Table 16), the majority (58.4ha) consists of the two main xeric communities (the Currambene Lowlands Forest and the Shoalhaven Sandstone Forest). These two communities are the most abundant on the subject site, and are widely distributed through the region (Figure 7 – regional vegetation mapping of the DECCW).

Importantly, as discussed above, all of the EECs are excluded from the residential zoning, with the exception of a small area (approximately 0.93ha) of the Coastal Sand Swamp Forest community to the immediate northwest of the of the existing Badgee settlement (Table 16). This area is already somewhat

disturbed as a consequence of unmanaged access and its proximity to the existing residential area, and is not regarded as of particular conservation value or concern.

Table 16 Representation of the vegetation types on the subject site at Sussex Inlet in the different zonings proposed

Vegetation Community		**E2 Conservation**	**RE2 Golf Course**	**Various Residential**
Coastal Sand Swamp Forest	EEC	26.31 (97%)	-	0.93 (3%) #
Coastal Sand Forest		4.32 (19.7%)	-	17.57 (80.3%)
Currambene Lowlands Forest		30.22 (34.7%)	15.28 (17.5%)	41.60 (47.8%)
Shoalhaven Sandstone Forest		12.53 (35.2%)	6.34 (17.8%)	16.78 (47%)

The proposed rezoning which has been drafted by and on behalf of Lucas Property Group P/L (Figure 16) is the culmination of a long iterative process of:

- identifying potential constraints to development opportunities on the subject site;
- investigating the ecological features of the site with respect to threatened biota in general and the relevant planning instruments;
- application of the '*Verification Rules*' of the DECCW, prepared in the response to the *South Coast Regional Strategy*, to determine *inter alia* areas of *High Conservation Value* within the subject site; and
- determining an appropriate footprint for both residential development areas and portions of the golf course, the latter of which are intended, at certain locations, to constitute a buffer between the intense residential development and the proposed conservation lands through the centre of the subject site.

The final rezoning footprint (Figure 16) has taken into account *inter alia*:

- the constraint imposed by "*endangered ecological communities*" and areas of SEPP 14 Wetland;
- significant threatened biota and "*important*" or "*essential*" habitat for those biota;
- the distribution of vegetation and habitats and resources through the subject site and through the general locality;
- the determination of *High Conservation Value Areas* by application of the '*Verification Rules'* of the DECCW;
- *Matters of National Environmental Significance* listed in the EPBC Act; and

- the location and functionality of "*wildlife corridors*" or "*wildlife connections*" (being vegetated linkages) through the subject site in a north-south and east-west direction.

In addition to identifying those areas of the subject site which are of the highest conservation value, and which should therefore be protected through a conservation zoning, the final resulting footprint (Figure 16) has considered *inter alia*:

- the ecological issues enunciated above;
- considerations in respect of the social and economic requirements for development in the Sussex Inlet area, as enunciated in the *Sussex Inlet Settlement Strategy* and *South Coast Regional Plan*;
- the "*objectives*" of the EP&A Act which require *inter alia* both achievement of appropriate conservation goals and responsible and economic development of lands; and
- a philosophical approach which seeks to achieve an appropriate balance between the achievement of bio diversity conservation goals and reasonable and responsible development opportunities.

GLOSSARY

Activity	(a) the erection of a building; (b) the carrying out of a work in, on, over or under land; (c) the use of land or of a building or work; and (d) the subdivision of land, and includes any act, matter or thing for which provision may be made under Section 26 of the EP&A Act and which is prescribed for the purposes of this definition, but does not include: (e) any act, matter or thing for which development consent under Part 4 is required or has been obtained; or (f) any act, matter or thing which is prohibited under an environmental planning instrument.
DA	*Development Application* prepared pursuant to the EP&A Act.
Development	in relation to land, means: (a) the erection of a building on that land; (b) the carrying out of a work in, on, over or under that land; (c) the use of that land or of a building or work on that land; and (d) the subdivision of that land, but does not include any development of a class or description prescribed by the regulations for the purposes of this definition.
DEC	Department of Environment & Conservation.
DECC	Department of Environment & Climate Change.
DECCW	Department of Environment, Climate Change & Water.
DGRs	*Director-General's Requirements* (see below).
Director-General	*the Director-General of the Department of Planning*.
Endangered Ecological Community	"*an ecological community specified in Part 3 of Schedule 1*" of the TSC Act.
Endangered Population	"*a population specified in Part 2 of Schedule 1*" of the TSC Act.
EP&A Act	*Environmental Planning & Assessment Act 1979*.
Key Threatening Process	"*a threatening process specified in Schedule 3*" of the TSC Act.
Locality	"*the area within a 10km radius of the study area*" (DGRs).
NPWS	NSW National Parks & Wildlife Service.
Proposal	"*the development, activity or action proposed*" (DGRs).
Recovery Plan	"*a plan prepared and approved under Part 4*" of the TSC Act.
Region	"*a bioregion defined in a national system of bioregionalisation that is determined (by the Director-General by order published in the Gazette) to be appropriate for those purposes*" (TSC Act).
Subject Site	the area which is the subject of the current Part 3A Project Application – Lot 52 in DP 831284 and Lot 84 in DP 792945.
Study Area	the catchment of Badgee Lagoon and the area which was the subject of the LES.
Threatening Process	"*a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities*" (TSC Act).
Threatened Species	"*a species specified in Part 1 or 4 of Schedule 1 or in Schedule 2*" of the TSC Act.
TSC Act	*Threatened Species Conservation Act 1995*.

BIBLIOGRAPHY

Allison F.R. 1989. Chapter 43. Molossidae. In D.W. Walton and B.J. Richardson (Eds). *Fauna of Australia Volume 1B Mammalia.* Australian Government Publishing Service, Canberra.

Allison F.R. and Hoye G.A. 1995. Eastern Freetail-bat *Mormopterus norfolkensis*. p. 484 in R. Strahan (Ed.) *The Mammals of Australia*. Reed Books, Chatswood. NSW.

Birds Australia. 2003. *New Atlas of Australian Birds*.

Bushfire & Environmental Services (BES). 2009. *DRAFT Threatened Biodiveristy Survey – Rezoning Investigations Badgee Lagoon, Sussex Inlet*. Unpublished Report. Reference: E1070080, January 2009.

Briggs JD and JH Leigh. 1988. *Rare or Threatened Australian Plants*. Special Publication 14. Australian National Parks & Wildlife Service.

Briggs JD and JH Leigh. 1996. *Rare or Threatened Australian Plants*. CSIRO, Australia.

Brooker MIH and Kleinig DA. 1990. *Field Guide to Eucalypts Volume 1 - South-Eastern Australia*. Inkata Press, Melbourne.

Brouwer J and Garnett S (*eds*). 1990. *Threatened Birds of Australia*: *An Annotated List*. Royal Australasian Ornithologists Union Report No. 68.

Campbell, B. 2001, 'Aspects of roost selection by microchiropteran bats in Bundjalung National Park, north-eastern NSW', *Aust. Bat. Soc. Newsl.,* vol. 17, pp. 16-33.

Cogger HG. 1992. *Reptiles and Amphibians of Australia*. AH & AW Reed, Sydney.

Churchill, S. 2008. *Australian Bats*. Second Edition. Jacana Books, Allen & Unwin. Crows Nest NSW.

Churchill S. 1998. *Australian Bats*. New Holland Publishers.

Debus, S.J.S. & Chafer, C.J (1994) The Powerful Owl (*Ninox strenua*) in New South Wales. *Aust. Birds* (supplement) 28: 21-39.

Department of Housing. 1998. *Managing Urban Stormwater: Soils and Construction.* Department of Housing, Sydney.

Environmental InSites. 2007. *Flora & Fauna Assessment Report. Lot 101 in DP 1093762 Sussex Inlet Road, Sussex Inlet. Proposed Medium-density Residential Development*. Unpublished *Report*.

Environmental InSites. 2007. *Supplementary Green & Golden Bell Frog Assessment Report. Lot 101 in DP 1093762 Sussex Inlet Road, Sussex Inlet. Proposed Medium-density Residential Development*. Unpublished *Report*.

Fairley A and Moore P. 1989. *Native Plants of the Sydney District*. Kangaroo Press, Sydney.

Garnett ST and Crowley GM. 2000. *The Action Plan for Australian Birds.* Environment Australia, Canberra.

Gunninah Environmental Consultants. 1999. *Flora & Fauna Assessment Report. Rural Subdivision of Part Portions 4 & 5 in DP 755937 Sussex Inlet Road, Sussex Inlet. Proposed Residential Subdivision*. Unpublished *Report*.

Gunninah Environmental Consultants. 2000. *Flora & Fauna Assessment Report. Rural-Residential Subdivision of Part Portions 2 & 5 in DP 755937 Sussex Inlet Road, Sussex Inlet. Proposed Residential Subdivision*. Unpublished *Report*.

Gunninah Environmental Consultants. 2000. *Flora & Fauna Assessment Report. Rural-Residential Subdivision of Part Portion 7 in DP 755937 Sussex Inlet Road, Sussex Inlet. Proposed Residential Subdivision*. Unpublished *Report*.

Gunninah Environmental Consultants. 2000. *Flora & Fauna Assessment Report. Rural-Residential Subdivision of Part Portion 8 in DP 755937 Sussex Inlet Road, Sussex Inlet. Proposed Residential Subdivision*. Unpublished *Report*.

Gunninah Environmental Consultants. 2001. *Flora & Fauna Assessment Report. Part Lot A DP372654 & Lot 1 DP129449 Springs Road, Sussex Inlet. Proposed Residential Subdivision*. Unpublished *Report*.

Gunninah Environmental Consultants. 2003. *Supplementary Threatened Species Assessment Report. Part Lot A DP372654 & Lot 1 DP129449 Springs Road, Sussex Inlet. Proposed Ambulance Station*. Unpublished *Report*.

Gunninah Environmental Consultants. 2003. *Hollow-bearing Trees Assessment Report. Thomson Street, Sussex Inlet. Proposed Residential Subdivision*. Unpublished *Report*.

Hall LS and Richards GC. 1979. *Bats of Eastern Australia*. Queensland Museum Booklet No 12. Queensland Museum, Brisbane.

Harden G (*ed*). 1992. *Flora of NSW*. *Vol 3*. NSW University Press, Kensington.

Harden G (*ed*). 1993. *Flora of NSW. Vol 4*. NSW University Press, Kensington.

Harden G (*ed*). 2000. *Flora of NSW. Vol 1 (revised).* NSW University Press, Kensington

Harden G (*ed*). 2002. *Flora of NSW. Vol 2 (revised).* NSW University Press, Kensington

Higgins PJ (*ed*). 1999. *Handbook of Australian, New Zealand and Antarctic Birds. Volume 4 - Parrots to Dollarbird.* Oxford University Press, Melbourne.

Higgins PJ and Davies SJJF (*eds*). 1996. *Handbook of Australian*, *New Zealand and Antarctic Birds*. *Volume 3 - Snipe to Pigeons*. Oxford University Press, Melbourne.

Higgins PJ, Peter JM and Steele WK (*eds*). 2001. *Handbook of Australian*, *New Zealand and Antarctic Birds*. *Volume 6 - Pardalotes to Shrike-thrushes*. Oxford University Press, Melbourne.

Higgins PJ and Peter JM (*eds*). 2002. *Handbook of Australian*, *New Zealand and Antarctic Birds*. *Volume 5 - Tyrant-flycatchers to Chats*. Oxford University Press, Melbourne.

Higgins PJ, Peter JM and Cowling SJ (*eds*). 2006. *Handbook of Australian*, *New Zealand and Antarctic Birds*. *Volume 7 Part A - Boatbill to Starlings*. Oxford University Press, Melbourne.

Higgins PJ, Peter JM and Cowling SJ (*eds*). 2006. *Handbook of Australian*, *New Zealand and Antarctic Birds*. *Volume 7 Part B - Boatbill to Starlings*. Oxford University Press, Melbourne.

Hoye G.A. and Richards G.C. 1995. Greater Broad-nosed Bat *Scoteanax rueppellii*. pp. 527–528 *in* R. Strahan (Ed.) *The Mammals of Australia*. Reed Books, Chatswood, NSW.

InSites. 2008. *The Green & Golden Bell Frog Additional Information Report. Lot 101 in DP 1093762 Sussex Inlet Road, Sussex Inlet. Proposed Medium-density Residential Development*. Unpublished report prepared for Malbec Properties. January 2008.

Kevin Mills & Associates. 2003. *Definition of Wetlands. Lucas Property Group Land Sussex Inlet, City of Shoalhaven.* Unpublished report. August 2003

Marchant S and Higgins PJ. 1990a. *Handbook of Australian, New Zealand & Antarctic Birds. Volume 1 Part A - Ratites to Ducks*. Oxford University Press, Melbourne.

Marchant S and Higgins PJ. 1990b. *Handbook of Australian, New Zealand & Antarctic Birds. Volume 1 Part B - Ratites to Ducks*. Oxford University Press, Melbourne.

Marchant S and Higgins PJ (*eds*). 1993. *Handbook of Australian*, *New Zealand and Antarctic Birds*. *Volume 2 - Raptors to Lapwings*. Oxford University Press, Melbourne.

McDonald RC, Isbell RF, Speight JG, Walker J and Hopkins M. 1990. *Australian Soil and Land Survey Field Handbook* (2nd Edition). Inkata, Melbourne.

NPWS. 1998. *Species Profile for Yellow-bellied Glider*.

Pennay, M., Law, B. & Reinhold, L. 2004, 'Bat calls of New South Wales: Region based guide to the echolocation calls of microchiropteran bats', report published by the NSW Department of Environmental and Conservation, Hurstville.

Robinson L. 1991. *Field Guide to the Native Plants of Sydney*. Kangaroo Press, Sydney.

Robinson M. 1994. *A Field Guide to Frogs of Australia*. Australian Museum/Reed Books, Sydney.

Simpson K and Day N. 1998. *The Claremont Field Guide to the Birds of Australia (5th Edition)*. Penguin Books, Australia.

Slater P, Slater P and Slater R. 1989. *The Slater Field Guide to Australian Birds*. Weldon Publishing, Sydney.

Specht RL. 1988. Major Vegetation Formations in Australia. In *Ecological Biogeography of Australia*. Keast A (*ed*). Junk, The Hague.

Strahan R. (*ed*). 1995. *The Mammals of Australia*. Reed Books, Chatswood.

Travers Morgan Pty Ltd. 1988. *Sussex Inlet Environmental Studies*. Unpublished report prepared for Shoalhaven City Council. Ref: 1112 June 1988.

Travers Morgan Pty Ltd. 1994. *Local Environmental Study in Respect of Lands in the Badgee Lagoon Area, Sussex Inlet, Owned by the Lucas and Tait Group*. Unpublished report prepared for Shoalhaven City Council. Ref: 2981 November 1994.