WHELANS INSITES
DEVELOPMENT CONSULTANTS

Culburra 18-Hole Golf Course
Long Bow Point, Culburra

Ecological & Riparian Assessment Report

24th June 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

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Author: F Dominic Fanning	Version: 1.2	Date: 24th June 2011

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PART A	**INTRODUCTION & INFORMATION BASE**

1 INTRODUCTION

1.1 Background

This *Ecological & Riparian Assessment Report* has been prepared in respect of a proposed 18-hole championship level golf course on Long Bow Point, to the immediate southwest of the township of Culburra, on the south coast of NSW (Figure 1). The township of Culburra (Figure 2) is located on the coast on the northern side of Lake Wollumboola, east of the main town of Nowra.

The land which is the subject of this *Ecological & Riparian Assessment Report*, and within which the proposed Culburra Golf Course is to be located, consists of a substantial tract of privately owned land to the south of Culburra Road, immediately southwest of the existing Culburra township (Figures 1 and 2). The "*subject site*" for the golf course occupies a total of approximately 273.6ha, and includes:

- the southern part of Lot 5 in DP 1065111 (which comprises the eastern part of the "*subject site*"; and
- the southern part of Lot 6 in DP 1065111 (which comprises the western part of the "*subject site*").

The subject site is mostly naturally vegetated, with significant disturbance being limited to the central part of Long Bow Point (Figure 2). Other clearing and land modification has taken place for access tracks, fencing and maintenance throughout the subject site. In addition, the site had been the subject of previous timber harvesting, partial clearing for grazing purposes and other modifications over a long period (see historical aerial photographs in Appendix A).

Pursuant to the Shoalhaven City Council *Local Environmental Plan 1985* (LEP 1985), various parts of the subject site is zoned for a variety of purposes (Figure 3):

- 1(d) – General Rural
- 2(c) – Residential (New Living Areas)
- 5(c) – Special Uses (Reservation)
- 6(c) – Open Space (Proposed Recreation)
- 7(a) – Environmental Protection (Wetlands).

1.2 Definitions

For the purposes of this *Report*, three specific areas at Culburra (the "*subject site*", "*study area*" and "*locality*") have been identified within the general locality (Figure 4).

Subject Site

The "*subject site*" (Figure 4) is identified as two private landholdings (currently owned by Realty Realizations Pty Ltd) located south of the Culburra Road and west of Lake Wollumboola. These lands (the southern parts of Lots 5 and 6 in DP 1065111) occupy an area of approximately 273.6ha, are referred to in this *Report* as the "*subject site*".

The subject site (Figure 4) is bound by:

- Culburra Road to the north, with the northern parts of the lots which comprise the "*subject site*" located further to the north;
- Lake Wollumboola to the east and southeast;
- the township of Culburra to the northeast; and
- other private landholdings to the south and west.

The golf course itself (see Chapter 2) will occupy a total of approximately 6ha of the subject site.

Study Area

The total extent of the "*study area*" includes all of the lands to the west and southwest of Culburra which have been the subject of previous investigations for urban development, as well as other lands within the Lake Wollumboola catchment. In addition, given the 'connectivity' of habitats through the area, lands to the south and west of Lake Wollumboola which had been the subject of previous investigations by Gunninah Environmental Consultants (Figures 4 and 5) are considered part of the "*study area*".

Locality

The "*locality*" for the purposes of this *Report* encompasses the area of contiguous, or near-contiguous, ecosystems and habitats within a radius of up to 20km (depending on species) of the "*subject site*".

Region

The *"region"*, when generally referred to in this *Report*, constitutes the *Jervis Bay Regional Area*, as identified in the *Jervis Bay Regional Environmental Plan*. That area is relevant for many of the threatened and other native biota discussed in this *Report*, and correlates generally to the *Shoalhaven Local Government Area* (LGA).

This is considered the relevant *"region"* with respect to local populations of potentially relevant or known threatened biota such as the Powerful and Masked Owl, Glossy Black Cockatoo and an array of microchiropteran bats.

It is noted that the term *"region"* is also used in the TSC Act with respect to "*biogeographical regions*" or "*bioregions*". These are often used to define the distributions of threatened species and/or endangered ecological communities, but are generally considered too extensive when considering the potential for a proposal to impose adverse impacts upon threatened biota or their habitats. Where relevant, the biogeographical regions will be identified separately as "*bioregions*".

1.3 Scope of This *Report*

This *Ecological & Riparian Assessment Report* addresses the ecological and riparian issues as they currently apply to the subject site, on the basis of the proposed Culburra Golf Course *Concept Plan* detailed herein.

The scope of this *Ecological & Riparian Assessment Report* is:

- to provide a baseline description of the nature and condition of the subject site, in terms of the ecological communities, and wildlife habitats and resources, present and/or likely to occur on the site;
- to categorise the vegetation types present in terms of their status with respect to the *Threatened Species Conservation Act 1995* (TSC Act) and as habitat for native biota (particularly for threatened species);
- to collate other existing information (publications and empirical data) regarding the subject site and native biota of potential relevance;
- to consider the likelihood of and the potential for adverse impacts to be imposed upon threatened, and other, native biota as a consequence of the proposal;
- to recommend impact amelioration and environmental management measures to be implemented to minimise, avoid and/or offset any adverse impacts on the natural environment; and
- to address the relevant statutory issues and matters, including:
  - the *Environmental Planning & Assessment Act 1979* (EP&A Act), including the "*objects*" of the Act as well as Section 5A and Section 79C;
  - *State Environmental Planning Policy No. 14 – Coastal Wetlands* (SEPP 14);
  - *State Environmental Planning Policy No. 44 – Koala Habitat Protection* (SEPP 44); and
  - the *Water Management Act 2000* (WM Act).

The *Report* also considers the *Environmental Protection & Biodiversity Conservation Act* (EPBC Act). It is noted that the EPBC Act is not a relevant Matter for a consent authority in NSW when considering an application pursuant to the EP&A Act. Shoalhaven City Council cannot take the EPBC Act into consideration, and has no power to require the proponent to address that Act. The consideration of

the EPBC Act contained herein, therefore, is provided for completeness rather than as a relevant consideration in determination of the *Development Application* by Shoalhaven City Council.

1.4 Assumptions

The impact assessments and conclusions contained in this *Report* are based *inter alia* on a number of assumptions, including:

- that the clearing of vegetation will be confined to those areas identified for the 18 golf holes, the access road, the clubhouse and carpark, the green-keepers shed and stormwater basins;
- that final design of golf holes and fairways will involve input from an ecologist to facilitate the selective and preferential retention of hollow-bearing trees or other features of potential ecological value;
- that the provision of *Asset Protection Zones* (APZs) and of golf cart paths will involve selective clearing of vegetation, with the preferential retention of valuable assets (such as hollow-bearing trees);
- that the stormwater management and treatment regime will be implemented as designed (see *Stormwater Report* by Martens 2011a), and will be monitored and maintained so as to ensure the highest water quality standards;
- that development of the subject site will be undertaken in an environmentally responsible and legal manner; and
- that the recommendations contained in this *Report* with respect to impact amelioration and environmental management measures will be implemented as part of the development.

As discussed in Chapter 3.5, and as is essentially always the case, the consideration of and the assessment of potential impacts upon the natural landscape (including *inter alia* threatened biota and their habitats) is based on 'incomplete' data. In the case of Long Bow Point, however, there have been substantial investigations over the last 17+ years.

The ecosystems, native biota and biodiversity generally of the Long Bow Point area is doubtless one of the best documented in the whole of the Shoalhaven LGA. As a consequence, the likely impacts of the proposed Culburra Golf Course on Long Bow Point are readily amenable to consideration with respect to potential impacts, and more so than many other projects or a similar nature elsewhere in the state.

As noted above it is assumed, and it is (in fact) an inherent element of the Culburra Golf Course project, that the golf course will be constructed, managed and maintained in a manner which enhances biodiversity conservation outcomes. In this regard, the project will involve *inter alia*:

- the selective retention of trees and habitats of significance (*eg* hollow-bearing specimens, feed trees for gliders and Glossy Black Cockatoos);
- the extensive removal of weeds from retained vegetation between golf course fairways;
- implementation of a *Hollow-bearing Tree Protocol*;
- supplementary planting of native vegetation, using indigenous and local provenance

specimens, in areas which had previously been cleared and/or become highly weed-infested; and

- an ongoing management regime for APZs and other managed parts of the landscape designed *inter alia* to facilitate the retention and enhance the condition of native vegetation, habitats and resources.

The consideration of potential impacts upon the natural environment (including the likelihood or otherwise of a *"significant effect"* being imposed upon any threatened biota or their habitats), contained in the remainder of this *Report*, is predicated on an assumption that the Culburra Golf Course will be managed in a manner which protects surrounding areas of the natural environment and provides additional habitat, resources and opportunities for native biota. It is an inherent assumption of this *Report* that a properly managed golf course is not inimical to the survival of threatened biota generally, and can be constructed and maintained in a manner which enhances biodiversity conservation outcomes.

It is also a fundamental tenet of the principal author of this *Report* (Mr F Dominic Fanning), and of his team, that the observations contained within this *Report* and the opinions expressed herein are based on an objective analysis of the relevant circumstances. The assessment and conclusions of this *Report* are independent of the desires or preferences of the proponent, or of any other persons or authorities. That is, the *Report* has been prepared in an objective and independent manner sufficient to satisfy their requirements of the *Uniform Civil Procedures Rules* (UCPRs) with respect to expert witnesses in the NSW Land & Environment Court.

2 DEVELOPMENT CONCEPT

2.1 Basis for the Concept Design

The proposed Culburra Golf Course has been designed in full cognisance of the potential or likely environmental and ecological constraints which pertain to the site, and with respect to its location and context. Analysis of the proposed golf course is based *inter alia* on:

- the substantial previous investigations of various parts of the study area, and particularly of the subject site (Gunninah 1995, 1999f, 2001c, g, 2002a, 2003);
- previous *Reports* regarding the biota on the subject site by other investigators (*eg* Daly 1994; Daly & Leonard 1996a, b; Hoye 1996); and
- further investigations undertaken *inter alia* for the compilation of this *Report* (in 2008, 2010 and 2011).

The approach which has been adopted in this investigation and *Report* is one of:

- identifying the nature and condition of the vegetation types, ecosystems and habitats;
- determining the assemblage of native biota present on and/or likely to use the subject site and habitats in its vicinity; and
- determining the ecological, environmental and statutory constraints relevant to the potential for the creation of a golf course on the land.

Issues of particular relevance in determining the potential constraints to the proposed golf course have included *inter alia*:

- the significance of Lake Wollumboola as habitat for native wildlife (particularly wetland and water birds) and as an Intermittently Closed and Open Lake or Lagoon (ICOLL);
- the presence of SEPP 14 Coastal Wetlands adjacent to Long Bow Point;
- the presence of several "*endangered ecological communities*" within and adjacent to the golf course site; and
- the presence of threatened biota, and of relevant or potential habitats or resources for such species within the proposed golf course area.

The habitat and vegetation type analysis contained in this *Report* provides a means of identifying the ecological constraints and opportunities present on the proposed golf course site. In assessing the potential constraints to the construction and operation of the golf course, it is assumed that those activities would be undertaken in an environmentally sensitive and sound manner. The creation and future management of the Culburra Golf Course would utilise current 'best practice' construction, development and long-term management methods designed *inter alia* to minimise or avoid the imposition of adverse impacts upon the natural environment and on sensitive habitats and features downstream (such as Lake Wollumboola and Downs Creek).

In particular, the need for 'best practice' stormwater management and treatment has been recognized as a fundamental requirement of the proposed golf course.

2.2 Golf Course Design Elements

The proposed Culburra Golf Course has been located and designed specifically *inter alia* to avoid or limit the potential for adverse impacts to be imposed upon the natural environment. Specific features of the golf course proposal include *inter alia*:

- *the avoidance (with the exception of small parts of two fairways) of the lands zoned 7(a) – Environmental Protection (Wetlands)* on the subject site (Figure 6);
- the provision of a carefully designed stormwater management regime and system which will facilitate the capture and re-use of stormwater discharges, and the treatment of all stormwater to avoid the discharge of contaminants into adjoining watercourses and wetland environments, pursuant to the *Stormwater Report* of Martens (2011a);
- the provision of a mechanism for, and a commitment to, the future detailed engineering design of individual golf holes and fairways to retain significant hollow-bearing tree and other resources of potential value both during the detailed design for each golf hole and fairway and within areas of retained vegetation between the holes, using input from a project ecologist; and
- the location of the proposed golf course, in part at least, through areas of land that have been variously modified over a long period for timber harvesting and agricultural purposes.

Of particular importance is the design and implementation of a stormwater strategy for the proposed Culburra Golf Course (Martens 2011a) which is designed specifically to capture and treat stormwater discharges from areas that could potentially provide contaminants (such as fertilisers, pesticides or other golf course chemicals). As noted above, the requirement for very high standards of water quality to be discharged from the golf course site has been a fundamental basis for the project.

In addition to the 18 holes of the proposed golf course, the Culburra Golf Course development will include:

- stormwater detention ponds scattered throughout the facility (which will *inter alia* provide supplementary habitat and resources for native biota (including potentially for threatened species);
- a clubhouse and carpark area near the lake end of Long Bow Point, which are to be the subject of a separate *Development Application* (DA);
- the provision of a green-keepers shed, also to be the subject of a separate DA;
- concrete and/or crushed sandstone/gravel paths for golf carts; and
- a new access road from Culburra Road.

The proposed golf course will occupy a total area of approximately 39.78ha (not including the access road, cart tracks or the facilities), or 14.5% of the whole of the subject site. Importantly, no element of the proposed golf course is located closer than approximately 100m to Lake Woollumboola, and is set back from the SEPP 14 Wetlands present (Figure 6). Further, the intervening band of xeric vegetation would act as a buffer to the Lake and to the important ecosystems adjoining it, in addition to the protection provided by the stormwater management regime which is an integral element of the project.

It is also noted that the requirements for bushfire protection, particularly *Asset Protection Zones* (APZs) pursuant to *Planning Bushfire Protection 2006* (PBP), will be relatively minor because of the nature of the proposed development. The only requirements for APZs (Martens 2011b), which will be the subject of separate DAs (but which are considered in a conceptual sense in this *Report*), are:

- around the clubhouse (25m wide);
- around the carpark (10m wide); and
- along parts of the access road in bushland (10m on both sides).

It is noted that much of the access road is located in already cleared parts of the site, and no clearing for APZs would be required in those areas. Any removal of vegetation required for any APZ will be undertaken in a sensitive manner, under the direction of a project ecologist, to enable the avoidance of features of value (*eg* hollow-bearing trees, stands of she-oaks *etc*).

2.3 Culburra Golf Course Development Philosophy

The approach which has been adopted to design of the Culburra Golf Course by the whole of the project team has been cognisant of and highly sensitive to the concerns which have been expressed in various forums regarding the values of Lake Wollumboola and its associated ecosystems. The proposal has taken into account relevant issues with respect to threatened biota and their habitats.

The Culburra Golf Course project is intended specifically *inter alia*:

- to respect significant elements of the natural environment;
- to enhance areas of previous disturbance and modified land; and
- to provide opportunities for either additional or alternative habitat and for the retention of important elements of the natural environment for threatened biota in particular.

In this regard, the proposed Culburra Golf Course has been designed specifically *inter alia*:

- to avoid areas of higher biodiversity conservation value or significance (on both a local and regional basis);
- to facilitate the retention of features and resources of relatively high conservation value (*eg* hollow-bearing trees, glider and Glossy Black Cockatoo feed trees);
- to substantially avoid ecosystems regarded as of particularly high conservation value (*ie* Lake Wollumboola and its associated wetlands, and "*endangered ecological communities*");
- to facilitate the retention and/or the relocation of habitat features of particular conservation value (*eg* hollow-bearing trees and tree-hollows);
- to ensure that stormwater discharges and maintenance of the golf course in the long-term do not adversely affect the natural environment, by the implementation of a dedicated stormwater management and water quality treatment regime intended to avoid the discharge of any contaminants or pollutants into the natural environment; and
- to provide additional and supplementary habitat and resources for native biota.

The underlying approach to the Culburra Golf Course project is one of providing a valuable recreational facility for the residents of Culburra and the general area while also respecting the natural environment.

Further, the golf course is a relatively benign development option for Long Bow Point which:

- facilitates use of the land in an environmentally sensitive manner;
- provides a valuable resource for the local community;
- provides opportunities for environmental enhancement; and
- limits the likelihood of potential adverse impacts upon the natural environment in general.

Generation of the current development design for the subject site has been responsive to the existing environmental and ecological constraints of the subject site, as well as its context with respect to natural features and to existing development. This approach *per se* constitutes a measure which ameliorates the potential for adverse impacts to be imposed by development of the site.

This approach also promotes an appropriate environmental management regime by avoiding development of those areas of highest ecological value or 'sensitivity'. Thus, the potential impacts which could have been imposed by development of the site as identified in LEP 1985 have already been substantially ameliorated by the development design itself.

In addition to the creation of a development design which acknowledges the environmental constraints of the site, the impact amelioration and environmental management measures proposed are relevant to the assessment of potential environmental impacts. The environmental management and impact amelioration measures outlined in Chapters 16 and 17 of this *Report* are designed to limit the extent of impacts which could or may be imposed by development of the Culburra Golf Course, and to ensure that the development is and remains an environmentally sensitive project.

The environmental management measures are 'best practice' or better, and reflect an approach of environmental responsibility. These measures are generally recommended in urban development projects, although it is intended that the Culburra Golf Course will achieve absolute 'best practice' in this regard.

3 INFORMATION BASE

3.1 Published Information

Portions of the "*subject site*" on Long Bow Point and of the study area have been investigated on previous occasions for a range of potential residential and/or industrial development opportunities (Figure 5; Appendix B; Table 1). A significant array of flora and fauna investigations have been conducted within the study area by Gunninah Environmental Consultants (*eg* Gunninah 1995, 1999f, 2001c, g, 2002a, 2003). Several other ecological consultants have also previously investigated part of the subject site itself, *inter alia* for the *Long Bow Point Commission of Inquiry* (Daly 1994; Daly & Leonard 1996; Hoye 1996; NPWS[1] (1996, 1997).

This *Ecological & Riparian Assessment Report* collates the information from a wide range of studies and investigations including:

- the investigations undertaken by Gunninah Environmental Consultants for a previous development proposal at Long Bow Point (Gunninah 1995, 1999f);
- information provided by other consultants during the *Long Bow Point Commission of Inquiry*, particularly with respect to Long Bow Point and Lake Wollumboola (see *Bibliography*);
- a survey of lands to the west and south of Culburra for the Culburra West UEA study (Gunninah 2001c, g, 2002a);
- information contained in the *Flora & Fauna Assessment Report* for industrial development at Culburra West (Gunninah 2003);
- detailed investigations for a draft *Concept Plan* for urban development in the Culburra West UEA (Environmental InSites 2008);
- further detailed investigations on land to the north of the Culburra Road in 2010 (Environmental InSites 2011);
- information from additional surveys undertaken by Environmental InSites for dwellings on several allotments to the immediate south and west of the subject site, now approved by Shoalhaven City Council (Environmental InSites 2010a, b, c, d, e);
- data contained in the DECC Wildlife Atlas regarding the subject site and species known to occur in the locality (Appendix C), and on the EPBC website (Appendix D); and
- information regarding threatened biota and other native biota contained within the scientific and published literature, including Matterial published by the NPWS/DECC.

Information regarding potential constraints to development of the site, in part, as a golf course has also been obtained from a variety of investigations and sources, including:

- inspection of recent aerial photography of the subject site and study area;

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[1] NPWS – the NSW National Parks & Wildlife Service, which is now part of the Office of Environment & Heritage (OEH), in the Department of Premier & Cabinet.

The NPWS had previously been incorporated into the Department of Environment & Conservation (DEC), which became the Department of Environment & Climate Change (DECC) and subsequently the Department of Environment, Climate Change & Water (DECCW).

- contour mapping of the subject site and adjoining lands, provided at 1m intervals by Realty Realizations and digitised by Whelans InSites (Figure 7); and
- the riparian zone definitions and analysis undertaken by the previous Department of Water & Energy (DWE)[2] for implementation of the *Water Management Act 2000*.

3.2 Previous Studies of the Subject

As noted above, parts of the Culburra study area, including particularly the subject site, have been investigated on previous occasions for other development proposals or concepts. Those investigations have included the application of an array of flora and fauna assessment techniques by a variety of ecologists (Appendix B), which provide a comprehensive and substantial database of the native biota within the study area.

With respect to native flora and vegetation communities, various parts of the Culburra study area have been surveyed on foot on several occasions over a period of 16 years (Appendix B). The survey techniques have included:

- driven transects throughout the study area, with the recording of plant communities and inspections for threatened plant species;
- extensive walked surveys to provide floristic details of plant communities, and to establish a comprehensive plant species list for the study area; and
- dedicated surveys for individual threatened plant species known to occur in the locality, and which could potentially occur on the subject lands.

In addition, a substantial array of surveys for native fauna (particularly for threatened species and their habitats and resources) have been undertaken over a long period (17 years) within the study area. Those investigations (Appendix B; Table 1) have involved the application of a comprehensive and extensive array of fauna survey techniques, including:

- trapping for native fauna using a variety of techniques (pit traps, Elliott traps – both terrestrial and tree-mounted, cage traps, harp traps, hair tubes and mist nets);
- extensive diurnal surveys for native fauna and for habitats and features of particular relevance over many years and all seasons, involving a substantial number of days of investigation;
- extensive spotlighting surveys for nocturnal species, including the use of call playback for amphibians, gliders and forest owls;
- targeted surveys for threatened species known to occur in the locality;
- the use of Anabat recorders for microchiropteran bats; and
- targeted searches for habitats and resources of special relevance for native species (*eg* hollow-bearing trees).

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[2] The DWE includes *inter alia* the previous Department of Natural Resources (DNR). Implementation and management of the *Water Management Act 2000* is now relevantly a function of the NSW Office of Water (NOW), which is part of the Department of Primary Industries (DPI).

As indicated in Chapter 2.1 of this *Report*, Gunninah Environmental Consultants and Whelans Insites have surveyed various parts of the subject lands on a number of occasions since 1995. A brief summary of the *Reports* that have been prepared during this time is provided below, with details of the field surveys conducted provided in Appendix B.

Fauna Impact Statement - Long Bow Point, Culburra (Gunninah 1999)

A *Fauna Impact Statement* (FIS) was prepared for a proposed residential development on Long Bow Point, based on field investigations throughout the Culburra West UEA, as well as on lands which had been dedicated as National Park (*ie* the "*study area*" – Figure 4) between 1995 and 1999.

The southern part of that proposal is substantially the same as the current "*subject site*" for the proposed Culburra Golf Course, located on the northwestern shore of Lake Wollumboola, south of the Culburra Road (see map below). The total area of that proposed development site was approximately 195 hectares, of which 125ha was proposed to be subdivided for residential development.

As part of the database for the FIS, extensive surveys were undertaken not only on the Long Bow Point site itself but also in adjoining lands, both within the Jervis Bay National Park and within other private landholdings in the locality (Appendix B; Figure 5). A number of previous surveys were also considered within that assessment, including:

- *Investigation of the Fauna & Flora of Long Bow Point* (Daly & Leonard 1996a);
- *Fauna Assessment – Culburra Urban Expansion Stage 1* (Daly & Leonard 1996b);
- *Supplementary Assessment of Protected Fauna – Culburra Urban Expansion Stage 1* (Daly 1996);
- *Survey of the Bat Fauna of the Proposed Long Bow Point Residential Development Area, Culburra, New South Wales* (Hoye 1996);
- *Consideration of the Potential Impact of the Proposed Development at Long-Bow Point on Threatened Fauna* (NPWS 1996); and
- *A Regional Assessment of the Natural Heritage Values of the Proposed Culburra Urban Expansion Area and Environs* (NPWS 1997).

Several threatened fauna species (currently listed in the TSC Act) were recorded within the Long Bow Point development area or in its vicinity during those substantial and comprehensive investigations. The recorded threatened species included twelve diurnal avifauna species, two large forest owls, one arboreal mammal, six microchiropteran bats and one threatened amphibian (see Chapter 6).

Culburra Urban Expansion Area. Proposed Rural - Residential Subdivision. Flora & Fauna Assessment (Gunninah 2001)

A *Development Strategy Plan* for the Culburra West UEA was the subject of a detailed *Flora & Fauna Assessment Report* and associated investigations (Gunninah 2001). The area of relevance for that *Report* was confined to that part of the subject lands and study area north of the Culburra Road (Figure 5).

In addition to extensive investigations for threatened plant species and the identification of plant communities, the Gunninah 2001 *Report* provides documentation of the extensive fauna surveys undertaken throughout the Culburra West UEA (Appendix B).

The specific field investigations for the Gunninah 2001 investigation (Appendix B; Table 2) included:

- walked and driven flora surveys throughout the land which was the subject of that investigation (Figure 5), including the identification of plant community boundaries and dedicated surveys for threatened plant species known to occur in the general locality;
- dedicated and intensive fauna surveys including:
  - the use of Elliot traps, cage traps and pit traps for terrestrial fauna;
  - the deployment of Elliot traps in trees for arboreal mammal species;
  - spotlighting surveys throughout the Culburra UEA study area;
  - the deployment of harp traps and Anabat recorders for microchiropteran bats;
  - call playback and spotlighting surveys for nocturnal fauna species; and
  - diurnal surveys for birds, reptiles and other native fauna throughout the Culburra UEA site, particularly in areas likely to support threatened species or which contained resources of potential relevance for such species.

The 2001 Gunninah *Report* identifies a number of threatened fauna species within the subject lands, but no threatened plant species were recorded. Threatened fauna species which are of potential relevance to the Culburra West UEA, and which are considered in further detail in this *Report*, include the Powerful Owl, Glossy Black Cockatoo, Green & Golden Bell Frog and a number of threatened microchiropteran bats (East-coast Freetail Bat, Common Bent-wing Bat, Greater Broad-nosed Bat, Yellow-bellied Sheath-tail Bat, Large-footed Myotis and Eastern False Pipistrelle).

Culburra Road, Culburra. Proposed Industrial Subdivision. Flora & Fauna Assessment (Gunninah 2003)

A flora and fauna investigation was undertaken in 2003 on land north of Culburra Road, south of the Culburra STP and to the east of Strathstone Street (Part Lot 5 in DP 872852) for a proposed industrial subdivision (Gunninah 2003).

The small area of land immediately south of the STP which was investigated for the proposed industrial development was surveyed both for flora and fauna by walked transects and 'Random Meander' searches (*sensu* Cropper 1993), and by dedicated fauna surveys to identify threatened species which could potentially be present. Relevant information from that investigation has been

incorporated into this *Report*, particularly with respect to the identification and locations of threatened flora and fauna species.

Table 2 Earlier investigations of the subject site and other lands in the vicinity

Year	Who	Technique	Effort
1993		Trapping survey	110 trap nights – pitfall traps 75 trap nights – arboreal Elliott Traps
1993-6		Spotlighting	11hrs 30 mins
1996		Trapping Hair tube surveys Anabat Survey Spotlighting – microchiropteran bats Harp Trap – microchiropteran bats	55 trap nights – terrestrial Elliott Traps 380 trap nights – hair tubes 4 nights 4 nights 4 nights
1997		Spotlighting Call playback Anabat surveys Harp Trap Amphibian surveys Hair tube survey	62hrs 30mins 1hr 30 mins 18 nights 16 nights 62hrs 30 mins 425 trap nights
2001		Trapping Amphibian surveys Avifauna surveys Anabat survey Harp Trap Hairtube survey Call playback (Owls, Yellow-bellied Glider, Koala and Black Bittern) Spotlighting (microchiropteran bats) Spotlighting	805 trap nights – terrestrial Elliott traps 101 trap nights – cage traps 170 trap nights – pitfall traps 150 trap nights – arboreal Elliott traps 13 hrs 1 hr 14 nights 25 trap nights 1700 trap nights 4hrs 15 mins 11hrs 55mins 22hrs 40mins
2002		Spotlighting Call playback (Owls, Squirrel Glider, Yellow-bellied Glider, Koala) Anabat surveys Amphibian surveys Reptile surveys	4hrs 1hr 52 mins 2 nights 6 hours 6 hours

3.3 Recent Investigation in the Study Area

Culburra West Demonstration Project – 2007/2008 Surveys

Supplementary investigations for flora and fauna were undertaken for the preparation of an *Ecological & Riparian Assessment Report* for the Culburra West Demonstration Project, which included the Culburra Golf Course site. Those investigations included:

- the refinement of the vegetation mapping which had previously been undertaken;
- the identification of threatened biota more recently listed on the TSC Act and/or suitable habitat and resources for such biota; and
- the conduct of supplementary targeted and general flora and fauna studies.

The dedicated flora surveys of the study area in 2007-2008 (Table 3) included:

- walked and/or driven surveys through most of the subject lands, with the collection of supplementary species lists (Appendix B);
- the mapping of vegetation community boundaries by GPS; and
- the undertaking of flora quadrats and surveys at various locations (Appendix A), including dedicated searches for threatened flora species.

The supplementary fauna surveys of the study area in 2007 and 2008 (Appendix B; Table 3) included:

- supplementary spotlighting and call playback surveys throughout the subject site, particularly focusing on threatened nocturnal fauna known to occur in this locality (the Powerful Owl, Yellow-bellied Glider, other threatened forest owls and the Green & Golden Bell Frog);
- the deployment of Anabat recorders to detect microchiropteran bat species;
- the inspection of tree-hollows for threatened fauna or for evidence of their presence (*eg* scratches, feathers or fur, owl 'whitewash');
- dedicated diurnal surveys of fauna habitats and resources throughout the subject site; and
- searches for indirect evidence of threatened fauna species (*eg* diggings, scratches, feeding indications, footprints, remains and other indirect evidence).

Culburra West Residential Development - 2010 Investigations

Further field investigations for native fauna within the study area were undertaken in December 2010, to supplement the previous fauna surveys that had been undertaken previously on the subject site and in the study area. Those investigations involved three field biologists over a period of a full 5 days, and included a complete array of standard fauna survey techniques (Table 3), including:

- trapping – using pit traps, cage traps and Elliott traps (terrestrial and arboreal);
- hair tubes for terrestrial mammals;
- harp traps and Anabat detectors for Microhiropteran Bats;

- call playback and spotlighting surveys for nocturnal mammals and birds and for amphibians;
- dedicated herpetological and bird surveys; and
- the deployment of infra-red cameras.

Table 3 Summary of more recent field surveys on the subject site and adjoining lands

Year	Technique	Effort
2007	Avifauna surveys Spotlighting Anabat surveys Avifauna surveys Call playback (Owls, Yellow-bellied Glider)	12 hours 11 hours 4 nights 4 hours 1 hour
2010	**Echolocation**	**Dusk to dawn totalling ~ 70 hours**
	Elliott traps – ground and arboreal Cage traps Hairtube trapping Harp trapping Pitfall trapping Call playbacks Spotlighting Herp searches Bird surveys Infrared cameras	300 trap-nights 24 trap-nights 400 trap-nights 4 trap-nights 72 trap-nights ~ 3 hours ~ 24 person hours ~ 3 person hours/day ~ 5 person hours/day ~ 192 camera hours

3.4 Supplementary Field Investigations for This Report

Further field investigations specifically for the purposes of this *Report* were undertaken in April and June 2011, to refine and clarify the vegetation mapping of the subject site, and to undertake additional diurnal surveys for native biota – both flora and fauna.

Those investigations involved a total of 20 person-hours on the subject site over two days, utilising an accurate GPS unit to confirm and/or refine the vegetation types. The surveys involved substantial walked and driven transects through the subject site, recording both vegetation characteristics and fauna habitat types, and recording native biota.

The supplementary investigations for this *Report* have not included additional intensive or lengthy fauna surveys, because of the substantial number of investigations which have occurred on the subject site and in the study area (see above) over a considerable period (approximately 17 years), and because of the recent intensive surveys on the land to the immediate north.

The investigations undertaken to date have fulfilled the requirements and expectations of the DECC *Guidelines* for the surveying of relevant threatened biota, either by virtue of the investigations

undertaken during previous individual projects or as a result of the accumulated data and surveys on the relevant threatened biota, both on the subject site itself and in the vicinity.

3.5 Limitations

It is a function of all ecological studies, virtually without exception, that the information regarding flora and fauna on any one site is incomplete. That circumstance arises because the natural environment is dynamic, not static, and because there will be variations in the flora and fauna assemblage on any one site through seasons and through different climatic circumstances over a few years or decades.

As a consequence, all ecological assessments are unavoidably reliant on only a partial and incomplete information base. All such assessments must also rely *inter alia* on:

- various other sources of information, in addition to field investigations;
- informed assumptions of the biota (including threatened species) likely to occur on a site, based on the habitats and resources present;
- the general and scientific knowledge of native biota and their habits and habitats; and
- the experience of the investigators and assessors.

With respect to the "*subject site*" and the land at Long Bow Point, however, it must be noted that there have been a considerable and substantial array of investigations undertaken both on the subject site itself and in its immediate vicinity. Those investigations have included *inter alia*:

- studies by the principal author of this *Report* and his staff over a period of 16 years;
- investigations undertaken by other ecological consultants for the proponent of the previous residential subdivision proposal on Long Bow Point (see *Bibliography*);
- investigations undertaken by opponents of that proposal, as documented in the *Long Bow Point Commission of Inquiry* (1999); and
- investigations undertaken by the then National Parks & Wildlife Service (NPWS) on Long Bow Point and in the vicinity for the *Long Bow Point Commission of Inquiry*.

Long Bow Point, therefore, has been the subject of a considerable array of investigations by a variety of ecological consultants and agencies over a period of at least 17 years. The *"subject site"* has been subjected to a greater level of inspection, investigation and survey than almost any other location within the *Jervis Bay Regional Area*. It cannot reasonably or rationally be asserted that there have been insufficient investigations of the subject site at Culburra.

Furthermore, the approach adopted in this *Report* is, *inter alia*, that threatened species for which there is suitable habitat present on the subject site should be assumed to be present, even if there is no evidence for their presence on the site. Obviously, on that basis, if assumed to be present in potentially suitable habitat on the subject site, any such species should also be assumed to be present in all other potential habitat in the locality.

Thus, the approach has been one of an 'abundance of caution', and an assumption that species which have not been recorded on the subject site or in its immediate vicinity (despite the plethora of

investigations) could in any case potentially be present. The likelihood (or otherwise) of an adverse impact, or of a "*significant effect*" pursuant to Section 5A of the EP&A Act, on such threatened biota has been considered, whether or not there is any evidence for such biota being present on the site.

4 EXISTING ENVIRONMENT

The "*subject site*" to which this *Report* refers (the Culburra Golf Course site on Long Bow Point), is located within the greater *Jervis Bay Regional Area*[3]. The existing residential area of Culburra is located on the northern shore of Lake Wollumboola, with the Crookhaven River to the north and west, and the Pacific Ocean to the east. The subject site is bound to the north by Culburra Road, to the south and west by native vegetation on private lands, to the east by Lake Wollumboola and to the northeast by the township of Culburra (Figures 1 and 2).

The land which is specifically the subject of this *Report* (*ie* the land on which the Culburra Golf Course is proposed – the "*subject site*") occupies approximately 287 hectares of land directly to the west and southwest of Culburra (Figures 1 and 2).

The subject site is predominantly gently undulating, with slopes of less than 10% being characteristic of most of the area (Figure 7). The only areas where slopes are greater than 10% is around Lake Wollumboola and small patches along Downs Creek and at scattered locations (Figure 7). It is also of note that the subject site does not contain rock outcrops, rocky ridges or significant cliff lines, which represent specific habitat or resources for a range of native fauna species. As a consequence, biota which specialise in rocky habitats are unlikely to be present within the subject site.

There are two watercourses which traverse the subject site at Culburra:

- Wattle Creek in northeast, which flows into Lake Wollumboola on the northern side of *Long Bow Point*; *and*
- Downs Creek (which flows through the centre of the subject site) and its tributary (which traverses the southwestern part of the site), to the west of Long Bow Point.

Wattle Creek drains an area of gentle slopes and gradual topography, and does not generally contain a formed channel, except in a few isolated locations its lower reaches. There are broad areas of swamp and mesic vegetation types in the lower parts of the Wattle Creek catchment.

By contrast, Downs Creek is more deeply incised into the land, particularly in its lower reaches. There is a long channel of open water through the mudflats at the bottom of Downs Creek, which extends for some considerable distance towards Culburra Road. Similarly, the western tributary to Downs Creek is well incised (with a discernible channel in most places), although this feature is not of relevance for the proposal.

The mudflats at the lower end of Downs Creek are extensive (approximately 500m x 300m), whilst those at the end of Wattle Creek are much smaller (no more than 100m wide at the greatest). These are currently exposed due to the recent opening and substantial emptying of the Lake, but had been inundated for a considerable period previously.

The majority of the "*subject site*", and much of the study area (as identified in Figure 4), is vegetated by a mosaic of (predominantly) native xeric (dry) and (less common) mesic (moist) plant communities.

3 The *Jervis Bay Regional Area* is defined as the land identified in the *Jervis Bay Regional Environmental Plan 1996*, and corresponds essentially with the Shoalhaven LGA.

Whilst the xeric open forest and woodland communities have previously been harvested for timber (as indicated by the large tree stumps present and the rarity of very large trees within the subject site), most of the forest and woodland communities in the study area are in good to very good condition with respect to levels of degradation or disturbance and/or levels of weed infestation. There are, however, patches of significant weed infestation (Bitou Bush, Lantana and introduced grasses) within the subject site.

As indicated in the historical aerial photographs contained in Appendix A, parts of the subject site at Culburra had been subjected to considerably greater clearing of vegetation than in more recent times. In 1949 and at least through until 1963 (see Appendix A), there was a larger area of clearing in the centre of the subject site than is currently the case, as well as a substantial clearing in the northeastern part of the site, near Culburra Road.

Other small areas of clearing had also occurred in the central western part of the subject site (see Appendix A). Subsequent regeneration has occurred in many of those areas, although the central part of the subject site remains either cleared grassland or contains dense regrowth stands of Tick Bush *Kunzea ambigua* and Tea-tree.

The subject site is located within the catchment of Lake Wollumboola, and extends to the west of the Lake itself (Figure 8). Other than the southern parts of the existing township of Culburra, the Lake Wollumboola catchment is largely undeveloped, and supports a substantially native cover of open forest and woodland communities. It is noted that there is essentially no active treatment of stormwater into Lake Wollumboola from the Culburra township by Council. The majority of the catchment is contained within the Jervis Bay National Park, including the body of Lake Wollumboola itself (Figure 9).

The soil landscapes on the subject lands can be classified into two main types (Hazelton 1992) - the Greenwell Point and Seven Mile soil landscapes:

- the Greenwell Point soil landscape consists of "*gently undulating rises on siltstone with small coastal cliffs*", and is predominantly found on ridges and elevated areas of the site. The soils are generally "*shallow ... structured loams or moderately deep yellow podzolic soils on coastal cliffs. Red Podzolic Soils occur on simple slopes and in drainage lines*"; and
- the Seven Mile soil landscape is described as a "*series of dune ridges and swales, swamps or lagoons on Quaternary marine sands*". These landscapes support "*deep siliceous sands*" and "*podzols occur on ridges*".

The water table is described in Hazelton 1992 as generally being close to the surface, and it is stated standing water is common in these landscapes. On Long Bow Point, however, areas of "*standing water*" are confined predominantly to the lower parts of the Wattle Creek catchment (to the north of the proposed golf course), and there are no areas of "*standing water*" within those parts of the subject site which are proposed for the Culburra Golf Course.

5 FLORA AND VEGETATION

5.1 Plant Communities

The mapping of vegetation within the subject site (and on surrounding lands) contained in this *Report* (Figure 10) has identified a total of thirteen main vegetation community types, with a number of variants within some of those community types (Table 4). The vegetation mapping of other parts of the study area has identified a number of additional plant community types, but several of these are not present on the "*subject site*" itself.

The vegetation types have been grouped into four main classes of vegetation:

- cleared and disturbed areas, some of which remain open grassland and some of which are regenerating as shrubland;
- xeric (dry) plant communities, which are typically located on the ridges and slopes of the subject site and subject lands;
- mesic or swamp plant community types, which are confined to the watercourses and drainage features or low-lying parts in the study area; and
- wetland communities, which are either confined to the edges of Lake Wollumboola (which include the mudflats at the lower end of both Downs Creek and Wattle Creek); or (in a single instance) include an artificial farm dam.

It should be noted that the mapped 'boundaries' of vegetation communities are in most instances somewhat arbitrary, given that distinct boundaries rarely occur naturally, and that adjacent communities will often share a number of species. Further, the gentle slopes on much of the subject site, there are often broad ecotones, both within the xeric community types and the moist communities and between adjoining xeric and mesic communities. There are, however, a number of vegetation types that are quite distinct and readily distinguishable (*eg* the shrublands and herblands around Lake Wollumboola, cleared areas and the artificial wetland).

As a consequence of the observations noted above, and the nature of the subject site, the mapping of vegetation types contained within this *Report* is approximate only. It is, for the most part at least, inappropriate to regard the boundary of a vegetation type as depicted in this *Report* as being the precise edge of that community type.

It is relevant to note that there are many different approaches to the identification, classification and mapping of vegetation communities. It is not to be assumed by readers of this *Report* either that the vegetation mapping contained herein is the only possible depiction of vegetation on the subject site or that there are no variations within the vegetation types which are depicted.

It is also to be noted that the mixed forest of Swamp Oaks and eucalypts is not, in all locations within the subject site, regarded as an *"endangered ecological community"*. As discussed below (in Chapter 5.3) examples of that vegetation type are located in areas which are neither *"on"* nor *"associated with"* a *"Coastal Floodplain"*. In those circumstances, the stands of Eucalypt - Swamp Oak Open Forest vegetation (particularly along the upper parts of Downs and Wattle Creeks) do not constitute examples of that EEC.

Table 4 Summary of plant communities recorded on the subject site

Map Unit	Description	Corresponding EEC[#]
Modified Communities		
CD	Cleared and Disturbed	-
Xeric Communities		
D1a	Grey Ironbark – Rough-barked Apple Open Forest	-
D1b[4]	Grey Ironbark – Woolybutt Open Forest	-
D2	Bangalay Woodland/Open Forest	-
D3	Blackbutt Open Forest	-
D4	Bangalay – Woolybutt – Rough-barked Apple Open Forest	-
D5	Forest Red Gum Open Forest	-
D6	Hard-leaved Scribbly Gum Woodland	-
Mesic Communities		
M1a	Swamp Oak – Eucalypt Open Forest on flats	SSFCF
M1b	Eucalypt - Swamp Oak Open Forest on slopes	-
M2a	Swamp Paperbark Closed Forest	SSFCF
M2b	Swamp Paperbark – Swamp Oak Closed Shrubland/Closed Forest	SSFCF
M3	Swamp Oak Closed Forest	SOFF
M4	Swamp Mahogany Open Forest	SSFCF
Wetland Communities		
W1b	Sea Rush – Twig Rush Herbland	-
W4	Artificial Wetland/Sedgeland	-

[#] *Endangered Ecological Communities* (EECs) listed in the *Threatened Species Conservation Act 1995* (TSC Act)

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

SOFF Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions

[4] The Grey Ironbark – Woolybutt Open Forest community is located at low elevations, particularly in the lower catchment of Wattle Creek. This vegetation type is a transitional community between the xeric and the mesic vegetation types, with the Grey Ironbark typically found in more xeric environments and the Woolybutt in more mesic locations.

5.1.1 Xeric Vegetation Communities

The xeric (dry) forest communities occupy the majority of the subject site and, indeed, the remainder of the vegetated land in the Culburra West UEA (Figure 10).

Within the "*subject site*" on Long Bow Point, the xeric forest communities occupy the overwhelming majority of the areas proposed for the Culburra Golf Course, covering most of the ridges, plateaus and slopes. The mesic and/or lacustrine communities are generally confined to narrow bands along the watercourses and to somewhat broader areas along the edges of Lake Wollumboola (Figure 10; Table 5), and most of these areas are to be avoided by the proposal.

As elsewhere on the subject site (and, indeed, generally), vegetation types or communities are no 'precise'. There are patches within any xeric community where different tree species may be dominant, and adjoining vegetation types merge across ecotones.

Table 5 Xeric forest communities on the subject site at Culburra

Map Unit	Community Type	Comments
D1a	Grey Ironbark – Rough-barked Apple Open Forest	Scattered distribution on mid to upper slopes. Occurs in the northeastern part of the site south of Culburra Road and on the southwestern slope of Long Bow Point.
D1b	Grey Ironbark – Woolybutt Open Forest	Around the lower parts of Wattle Creek. Generally on mid to lower slopes and flats adjacent to the swamp communities bordering Lake Wollumboola. A more 'mesic' variant of Community D1a.
D2	Bangalay Woodland/Open Forest	Along the ridge and slopes in the west of Long Bow Point. Limited to small patches on the ridgeline and lower slopes adjacent to Wattle Creek.
D3	Blackbutt Open Forest	Extensive distribution on mid to upper slopes. At eastern and western ends of Long Bow Point, and in the southwest of the site.
D4	Bangalay Woolybutt – Rough-barked Apple Open Forest	At scattered locations on lower slopes. Generally occurs adjacent to drainage lines and along the banks of Lake Wollumboola.
D5	Forest Red Gum Open Forest	Mid slope. At the southern tip of Long Bow Point.
D6	Hard-leaved Scribbly Gum Woodland	Generally on mid to upper slopes and plateaus. Patches in the north, northwest (along Culburra Road) and in the southwest of the site.

Grey Ironbark - Rough-barked Apple Open Forest (Map Unit D1a)

This vegetation type is small patches on the subject site, intergrading with similar vegetation communities including the Grey Ironbark - Woolybutt Forest/Open Forest downslope and Hard-leaved Scribbly Gum Woodland upslope (Figure 10).

The canopy foliage projective cover (FPC) is 30% to 40%, with the canopy reaching a height of 20m, occasionally to 25m where mature trees exist. The mid-canopy layer is generally discontinuous, to 8m high where isolated mature examples exist or where regeneration is occurring extensively. The shrub layer appears similarly discontinuous throughout much of the community. Where continuous stands exist, shrub species occur to 2.5m, and occasionally to 3.5m high. The herb layer consists of a mixture of hardy native species, with occasional exotic species.

Common canopy species are Grey Ironbark and Rough-barked Apple, with a number of other less common eucalypts (Appendix F). Mid-canopy species include Forest Oak, Black She-oak, Two-veined Hickory, Sweet Pittosporum, Prickly-leaved Paperbark and Narrow-leaved Geebung. Native shrub species recorded include Tick Bush, Prickly Heath, Sweet Wattle, Tea-trees and Rice Flower.

The groundcover layer comprises a range of native grasses, sedges and vines, including Bordered Panic, Hedgehog Grass, Speargrass, Bracken, Sword Sedge, *Poranthera microphylla*, Love Creeper, Mat Rush, Stinkweed and Apple Dumplings.

Weeds are generally uncommon, although patches of Lantana, Flaxleaf Fleabane and Bitou Bush are present along exposed edges of the community and along tracks.

Grey Ironbark - Woolybutt Open Forest (Map Unit D1b)

This community is located in the northeastern part of the subject site, in the lower catchment of Wattle Creek (Figure 10), adjacent to and above the swamp communities bordering Lake Wollumboola.

The canopy has an FPC of 20% to 35% and reaches a height of 20m, occasionally to 22m where mature trees exist. The canopy species are broad, upright and commonly single-trunked. The mid-canopy layer is discontinuous (typically 6 to 8m high) and the understorey is generally patchy, at a height of around 2m, but more commonly to 1.2m high. The groundcover is generally continuous, with indigenous grass and herb species to 1m high. Sedge and rush species are common in damper areas, with bracken occasionally forming dense monotypic stands.

Common canopy species are Grey Ironbark and Woolybutt, with occasional Swamp Oak (Appendix F). Characteristic mid-canopy species include Black She-oak, Sweet Pittosporum, Cherry Ballart, Forest Oak, Coffee Bush, Hickory, Prickly-leaved Paperbark and Two-veined Hickory.

Common shrub layer species include paperbarks, Prickly Heath, Sweet-scented Wattle, Prickly Moses, *Daviesia ulicifolia*, Sydney Golden Wattle, Rice Flower and Narrow-leaved Geebung. Typical groundcover species include Blue Flax Lily, Blady Grass, Bordered Panic, Weeping Meadow Grass, White Root, Wallaby Grass, Kidney Weed, Pomax, Sword Sedge, Tick Trefoil, *Poranthera microphylla*, Common Couch, Mat-rush and Bracken.

Native grass and fern species are regenerating along disturbed margins of this community (*eg* Blady Grass, Mat Rush and Bracken), with occasional exotic species (such as Paddy's Lucerne, Paspalum and Flaxleaf Fleabane). Weeds are generally confined to tracks and forest edges.

Bangalay Woodland/Open Forest (Map Unit D2)

This community is limited to small patches on the upper slopes tin the northwestern part of Long Bow Point (Figure 10).

The FPC is 25% to 35%, with trees 18m in height, occasionally to 20m. The majority of the canopy is of semi-mature individuals and juvenile specimens, with mature forms scattered throughout. A discontinuous mid-canopy layer to 8m high is present along the Wattle Corner Creek corridor. The understorey is open, to 2-4m in high. The groundcover is generally continuous throughout, and is composed of endemic species and occasional exotic species.

Common upper canopy species are Bangalay, with occasional Blackbutt, White Stringybark, Red Bloodwood, Hard-leaved Scribbly Gum, Woolybutt, Swamp Mahogany and Rough-barked Apple. Occasional mid-canopy species include Forest Oak, Hickory, Pittosporum, Hickory, Two-veined Hickory, Snow-in-Summer and Prickly-leaved Paperbark. Characteristic species where the mid-canopy layer is less disturbed are Tick Bush, Sweet Wattle, Broad-leaved Hakea, Hairpin Banksia, *Lomatia ilicifolia*, Tea-tree, Geebungs, *Gahnia* species and Prickly Moses.

Typical climbers and groundcover species include False Sarsaparilla, Blue Flax Lily, Common Couch, *Pratia purpurascens*, Guinea Flower, Bordered Panic, Fishbones, *Lindsaea microphylla*, *Eustrephus latifolius*, Hedgehog Grass, *Billardiera scandens*, Love Creepers, Common Silkpod, Weeping Meadow Grass, Wallaby Grass, Blady Grass and *Xanthorrhoea* species. In damper sites, close to the drainage line, species include Basket Grass, *Gahnia sieberiana*, Commelina, Mat Rush and Maiden Hair Fern.

Common exotic species in disturbed areas include Paddys' Lucerne, Cats' Ears, Bitou Bush, *Sporobolus indicus* var. *capensis*, Quaking Grass, Trembling Grass, *Oxalis corniculata* and Plantago.

Blackbutt Open Forest (Map Unit D3)

This community is the most extensive vegetation type on the subject site, generally occupying the mid-slopes and upper slope areas (Figure 10).

The FPC is 25% to 40%, with trees to 25m in height, occasionally to 30m where mature specimens occur. The mid-canopy layer is generally discontinuous, with occasional dense pockets in more protected areas, typically 6m to 8m high. The understorey is patchy throughout, and 1-3m high. The groundcover is continuous throughout, with endemic grass and herb species to 0.5m high. Sedge and rush species are common in open areas adjacent to minor drainage features.

The community is generally dominated by the Blackbutt, with scattered Grey Ironbark, Red Bloodwood, White Stringybark, Bangalay, Swamp Mahogany, Rough-barked Apple, Grey Gum, Turpentine, Woolybutt and Hard-leaved Scribbly Gum. Common mid canopy species include *Acacia implexa*, Two-veined Hickory, Black She-oak, Sweet Pittosporum, Mock Olive, Snow-in-Summer and Narrow-leaved Geebung.

Typical shrub species include Tick Bush, Sydney Golden Wattle, Corkwood, Narrow-leaved Geebung, Cherry Ballart and Tea-tree. Common groundcover species include Weeping Meadow Grass, Mat Rush, Kangaroo Grass, *Gahnia sieberiana*, *Carex appressa*, Spear-grass, Hedgehog Grass, Wombat Berry, Stinkweed, Apple Berry, Blue Flax Lily, Wallaby Grass, Sword Sedge, Bracken and Pomax.

Common exotic species include Bitou Bush, Fireweed, Paddys' Lucerne, Paspalum, Common Centaury, Cats' Ears and Senna. These tend to be concentrated along tracks and in previously cleared areas, although Bitou Bush is common.

Bangalay – Woolybutt – Rough-barked Apple Open Forest (Map Unit D4)

This community is restricted to the lower slopes around Long Bow Point (adjacent to Lake Wollumboola) and near the northern tributary, as well as adjacent to the small tributary to Downs Creek in the southwest of the subject site (Figure 10).

The FPC through this community is 20% to 35%, with trees generally to 18m in height, occasionally to 25m where mature specimens are present. The mid-canopy is generally discontinuous, and occasionally absent, typically to 3m high, and the understorey is also discontinuous, with occasional dense thickets of exotic species to 2.5m high. The groundcover is generally continuous, with endemic grass and herb species to 1m high.

Common tree species are Bangalay, Woolybutt and Swamp Oak, with occasional other eucalypts and the Rough-barked Apple. Common mid canopy species include Two-veined Hickory, Snow-in-Summer, Prickly-leaved Paperbark and Narrow-leaved Geebung.

Common shrub species include Tick Bush, Blackthorn, Native Olive, Prickly Heath and Cherry Ballart. Common groundcover species are *Brunoniella pumilio,* Blady Grass, Mat Rush, Weeping Meadow Grass, Blue Flax Lily, White Root, Saw Sedge, Common Couch, *Entolasia stricta,* Kangaroo Grass, *Viola hederacea,* Sword Sedge and Bracken. Characteristic climbing and twining species include Golden Guinea Flower, False Sarsaparilla, Silkpod, Wonga Wonga Vine and Apple Berry.

Bitou Bush and Lantana are scattered throughout this community, but do form dense thickets along the margins and in patches.

Forest Red Gum Open Forest (Map Unit D5)

This vegetation type is confined in the subject site to a small patch on the southern top of Long Bow Point (Figure 10).

The FPC is 30% to 40%, with trees 25m in height, and occasional specimens to 30m. The mid-canopy is generally patchy and typically 6-8m high, and the understorey is also patchy to 1.5m high. The groundcover is continuous, with endemic grass and herb species to 1.5m high.

The dominant tree species is the Forest Red Gum, with occasional Blackbutt, Rough-barked Apple, Woolybutt and other species. Common mid-canopy species include Two-veined Hickory, Narrow-leaved Geebung, Sweet Pittosporum and Black She-oak.

Common shrub species include Sydney Golden Wattle, Native Olive, Hairy Clerodendron and Blackthorn. Characteristic groundcover species include Blady Grass, Mat Rush, Hedgehog Grass, Bordered Panic, Kangaroo Grass, White Root, Blue Flax Lily and Bracken. Characteristic climbing and twining species include *Marsdenia rostrata*, Common Silkpod and Apple Berry.

Bitou Bush and Lantana are present as scattered individuals, but form dense thickets along exposed margins of this community.

Hard-leaved Scribbly Gum Woodland (Map Unit D6)

This vegetation type is present on the mid to upper slopes in the north and northwest of the site, and in an extensive band in the west of the site (Figure 10).

The FPC is 30% to 40%, with trees growing 18m in height (with occasional individuals to 22m). The mid-canopy layer is generally sparse (typically to 6m high, but is locally dense, particularly near the watercourses). The understorey is generally continuous, to 3m, but more commonly to 1.5m high. The groundcover is also continuous, with endemic grass and herb species to 1.5m high, and sedge and rush species in damper sites.

The dominant tree species is the Hard-leaved Scribbly Gum, with occasional specimens of White Stringybark, Rough-barked Apple, Blackbutt and Red Bloodwood. Typical mid-canopy species include Black She-oak, Bushy Needlebush, Old Man Banksia and Finger Hakea.

The shrub layer is typically diverse, and common species include *Banksia oblongifolia, Pultenaea daphnoides*, Narrow-leaved Geebung, Hairpin Banksia, Broad-leaved Wedge-pea, Prickly Moses, Mountain Devil and Cone-sticks and Drumsticks. Characteristic groundcover species include Bracken, Kangaroo Grass, Mat Rush, Blue Flax Lily, Rock Xanthosia, Silky Purple Flag, Sword Sedge and Milkmaids. The Large Tongue Orchid, Hyacinth Orchid and Hooded Orchid occur sporadically, and characteristic climbing species include Variable-leaved Goodenia, Snake Flower, False Sarsaparilla and Apple Berry.

Disturbed margins of this community generally harbour a few exotic species, and the regeneration of shrub layer species is commonplace along tracks and fire trails.

5.1.2 Mesic Vegetation Communities

The subject site also supports smaller areas of mesic vegetation types, predominantly associated with the watercourses and drainage features on the subject site, and the low-lying lands (Figure 10), including along Wattle and Downs Creeks, to the north and south of Long Bow Point.

As indicated below (Table 6), some of the mesic forest communities within the subject site (and throughout the study area) constitute "*endangered ecological communities*" (EECs) listed in the TSC Act. However, not all of those areas of mesic vegetation are regarded as constituting EECs, as not all are located on "*coastal floodplains*" (see discussion in Chapter 5.3).

As indicated elsewhere in this *Report*, the presence of EECs can represent a significant constraint to development opportunities within the subject site at Culburra, although they are not a 'prohibition' on development. In any case, the proposal has sought wherever possible to avoid either direct or indirect impacts upon any such communities.

Table 6 The mesic forest communities on and adjacent to the subject site at Culburra

Map Unit	Community Type	Comments
M1a	Swamp Oak – Eucalypt Forest	On low-lying lands in the north of the site and around the margins of the Downs Creek 'mudflats'.
M1b	Eucalypt-Swamp Oak Forest	Regrowth on lower slopes to the south of Wattle Creek.
M2a	Swamp Paperbark Closed Forest	Wattle Creek. On low-lying land along the lower parts of SSFCF.
M2b	Swamp Paperbark – Swamp Oak Closed Shrubland/Closed Forest	Bands along the foreshores of the embayments to the south and north of Long Bow Point, upslope of the herbland/ sedgeland community. SSFCF.
M3	Swamp Oak Closed Forest	A small band in the upper reaches of Wattle Creek. Also patchy in M1 and M2b. SOFF.
M4	Swamp Mahogany Open Forest	Along the upper parts of Downs Creek and the main Downs Creek tributary. SSFCF

Swamp Oak – Eucalypt Open Forest (Map Unit M1a)

The Swamp Oak - Eucalypt Open Forest community (Map Unit M1a) is confined to predominantly low-lying land around the margins of the Downs Creek mudflats (above the Swamp Oak – Swamp Paperbark Closed Shrubland) as well as low-lying land along and adjacent to Wattle Creek (Figure 10).

The FPC of this community is 25-35%, with trees to 8-14m high and occasionally to 18m. A discontinuous mid-canopy layer of sclerophyllous and mesic tall shrub species is present to 8m in height along the Downs Creek corridor, and the understorey is moderately dense (to 4m high). The groundcover stratum is generally continuous throughout, composed of a mixture of hardy endemic species and occasional exotic species.

Common canopy species include Swamp Oak, Bangalay, Woolybutt and Rough-barked Apple, with occasional specimens of other eucalypts (Appendix F). Mid-canopy species include Prickly-leaved Paperbark, Snow-in-Summer, Black She-oak and Two-veined Hickory.

Common understorey species include Sydney Golden Wattle, Rice Flower, Sweet-scented Wattle, Coffee Bush, Sandfly Zieria, Flaky-barked Tea-tree and Tick Bush. Common groundcover species include Blue Flax Lily, Mat Rush, Weeping Meadow Grass, Common Couch, Blady Grass, Kidney Weed, Lacy Wedge Fern and Bracken. Occasional specimens of Bare Twig Rush, Sea Rush and Warrigal Cabbage are present in more saline areas, and occasional climbing species include Love Creepers, Golden Guinea Flower, Scrambling Lily, Common Silkpod and Apple Berry.

Introduced species are not common, and include Paddys' Lucerne, Cats' Ears, Bitou Bush, Lantana, Fireweed, Slender Rat's Tail Grass, Winter Senna and Plantain.

This variant of the vegetation type has characteristics of the "*endangered ecological community*" known as Swamp Sclerophyll Forest on Coastal Floodplains (SSFCF), as discussed in Chapter 5.3.

Eucalypt – Swamp Oak Forest (Map Unit M1b)

This variant of the community is located on lower slopes, above any 'floodplain' on the northern side of Long Bow Point. It is an area which has been regenerating from previous clearing.

The floristic and structural characteristics of this vegetation type are similar to those of Map Unit M1a, with the Swamp Oak forming a dense upper canopy and numbers of regenerating eucalypts, as well as large remnant eucalypts.

Despite its floristic characteristics, this vegetation type is not an EEC, as if does not occur on a *"floodplain"*, xeric community.

Swamp Paperbark Closed Forest (Map Unit M2a)

This community is confined to a patch in the lower part of the Wattle Creek catchment.

The FPC is between 60 and 90%, with a canopy height of 6-8m, occasionally to 12m in height. The canopy is discontinuous, although dense in areas, and the herb layer is generally dense, to 0.2m to 0.5m high, with many sedge and rush species.

The canopy is dominated by the Swamp Paperbark, with occasional specimens of Snow-in-Summer and Bottlebrush. Characteristic groundcover species include a range of native herbs, grasses and vines, such as Flax Lily, *Brunoniella pumilio*, Yellow Stars, Vanilla Lily, Mat Rush, Hedgehog Grass, *Billardiera scandens*, Silky Purple Flag, Kidney Weed, White Root, Bordered Panic, Wiry Panic and Kangaroo Grass.

Very few exotic species were recorded within this community.

This community has characteristics of the "*endangered ecological community*" known as Swamp Sclerophyll Forest on Coastal Floodplains (SSFCF), as discussed in Chapter 5.3.

Swamp Paperbark – Swamp Oak Closed Shrubland (Map Unit M2b)

This community occurs as narrow bands along the foreshores of the embayments to the south and north of Long Bow Point, upslope of the Sea Rush – Twig Rush Herbland community and mudflats at those locations (Figure 10).

The community is predominantly composed of dense Swamp Paperbark and Swamp Oak scrub between 4m and 6m in height, occasionally to 8m where mature specimens exist. The FPC is between 60% to 80%, and there is an occasional lower shrub layer. The herb layer is generally dense, 0.2 to 0.5m high, with sedge and rush species.

The canopy is dominated by Swamp Paperbark and Swamp Oak, with occasional specimens of Snow-in-Summer, Bottlebrush and Paperbark Tea-tree.

Common groundcover species include Yellow Stars, Mat Rush, Native Violet, *Parsonsia straminea*, Vanilla Lily, Fringe Lily, Spear-grass, Kidney Weed and *Lepidosperma laterale*. In wetter areas, sedge and rush species present include Tassel Rush, Saw Sedge, White Root, *Restio tetraphyllus*, Common Rush and Round-headed Bristle Rush.

Very few exotic species were recorded within this community.

This community has characteristics of the "*endangered ecological community*" known as Swamp Sclerophyll Forest on Coastal Floodplains (SSFCF), as discussed in Chapter 5.3.

Swamp Oak Closed Forest (Map Unit M3)

This community is restricted to a small band at the upper end of Wattle Creek. It is also patchily distributed within the Swamp Oak – Eucalypt Open Forest (M1a and M1b) and Swamp Paperbark – Swamp Oak Shrubland (M2b) communities.

The FPC is between 25% and 45%, with trees to 12-16m in height, and mature specimens to 20m high. The mid-canopy and shrub layers are generally absent, with only occasional native or dense thickets of exotic species to 2.5m. The groundcover is patchy, and exotic groundcover species occur sporadically throughout.

The dominant (sometimes only) canopy species is the Swamp Oak, with occasional Woolybutt, Bangalay, Grey Ironbark and Rough-barked Apple. Mid-canopy and shrub layer species include Prickly-leaved Paperbark, Snow-in-Summer, Two-veined Hickory and Lillypilly, as well as Bearded Heath, Swamp Paperbark and Mutton-wood.

Characteristic groundcover species are Yellow Stars, Mat Rush, Flax Lily, *Lobelia alata*, Swamp Pennywort and Sword Sedge. Species in low-lying, slightly more saline, areas include Bare Twig Rush, *Leptinella longipes*, Salt Couch, Sea-blite, Sea Rush and Swamp Goodenia. Occasional climbing and trailing species are Common Silkpod, Common Milk Vine and Apple Berry.

Scattered introduced species include Paddy's Lucerne, Cats' Ears, Bitou Bush, Lantana, Rats' Tail Grass, Winter Senna and Plantago.

This community has characteristics of the "*endangered ecological community*" known as Swamp Oak Floodplain Forest (SOFF), as discussed in Chapter 5.3.

Swamp Mahogany Open Forest (Map Unit M4)

This community occurs predominantly along the upper parts of Downs Creek and its tributary, in the western and southwestern parts of the site.

The FPC is 35% to 40%, with trees growing to 16 to 18m in height, occasionally to 20m. A continuous mid-canopy layer to 8m in height is present throughout this community. The understorey is generally dense, to 3m high, and the groundcover is generally continuous, composed of a mixture of hardy indigenous species and occasional exotic species.

Common canopy species are Swamp Mahogany, with occasional Woolybutt, Blackbutt, Bangalay and Rough-barked Apple. Where present, the mid-canopy comprises Forest Oak, Hickory, Pittosporum, Snow-in-Summer and Prickly-leaved Paperbark. Characteristic shrub species include Sweet Wattle, Broad-leaved Hakea, Hairpin Banksia, Geebungs, *Gahnia* and Prickly Moses.

Typical climbing and groundcover species include False Sarsaparilla, Blue Flax Lily, Guinea Flower, Fishbones, Lacy Wedge Fern, Wombat Berry, Common Silkpod, Weeping Meadow Grass and Blady Grass. In moister sites, mainly along the creeklines, species include Basket Grass, Saw Sedge, Scurvy Weed, Mat Rush and Maiden Hair Fern.

Common exotic species in disturbed sites include Paddys' Lucerne, Cats' Ears, Bitou Bush, Quaking Grass, Trembling Grass, Yellow Wood Sorrel and Plantago.

This community has characteristics of the "*endangered ecological community*" known as Swamp Sclerophyll Forest on Coastal Floodplains (SSFCF), as discussed in Chapter 5.3.

5.1.3 Wetland Communities

Of the five wetland plant communities identified in the Culburra West UEA (Environmental InSites 2011), only two are present on the subject site on Long Bow Point or adjacent to it (Figure 10):

- the Sea Rush – Twig Rush Herbland around Lake Wollumboola; and
- the Artificial Wetland/Sedgeland in and around a farm dam in the southwestern part of the subject site.

The mudflats at the end of Wattle and Downs Creeks, along Lake Wollumboola (Figure 10), are considered part of the Sea Rush-Twig Rush Herbland, although their nature and condition varies considerably depending on water depth in Lake Wollumboola.

Table 7 Wetland communities on and adjacent to the subject site at Culburra

Map Unit	Community Type	Comments
W1b	Sea Rush – Twig Rush Herbland	This community occasionally covers large parts of the mudflats at the end of Downs and of Wattle Creek, but (when Lake lands are high) retreats to narrow bands along the Lake Wollumboola Shoreline.
W4	Artificial Wetland/Sedgeland	Located in and around an artificial pond created southwestern part of the subject site

The Sea Rush - Twig Rush Herbland has been mapped in an extensive area at the bottom of Downs Creek (where it discharges into Lake Wollumboola) and a more narrow band at the base of Wattle Creek (on the northern side of Long Bow Point).

The recent 'breakout' of Lake Wollumboola to the ocean has drained a significant volume of water from the Lake, and those areas are now exposed mudflats with a cover of decaying algae. Under some circumstances, those areas would support the Sea Rush - Twig Rush Herbland community, but they are currently areas of exposed mudflat and decaying algae (see photographs in Appendix E).

Sea Rush - Twig Rush Herbland

As noted above, the large areas of mudflats at the base of Downs Creek and the smaller areas of mudflats at the base of Wattle Creek (Figure 10) would, during moderate lake levels, support a Sea Rush - Twig Rush Herbland. When lake levels are high, that community would be confined to a narrow band above the deeper water levels, and during lower lake levels, the Sea Rush - Twig Rush Herbland would be expected to expand over much of the mudflats of the Lake Wollumboola periphery.

Given the circumstances at the time of this *Report*, those mudflats had been exposed as a result of the lowering of the Lake level, by virtue of its 'breakout' to the ocean. Instead of the Rush plants occupying much of those exposed mudflats, therefore, there is currently a broad area of mudflat with decaying algae.

Characteristic species in this vegetation type include Bare Twig Rush, *Leptinella longipes*, Salt Couch, Sea-blite, Sea Rush and Swamp Goodenia

This community is not part of any EEC, as discussed in Chapter 5.3.

Artificial Wetland/Sedgeland (Map Unit W4)

This community is located in and around a farm dam which had been constructed along the tributary to Downs Creek, in the southwest of the subject site (Figure 10).

The vegetation generally consists of semi-aquatic reed, sedge and rush species along the banks of the wetland, with occasional low herb species. In more elevated areas around the wetland, occasional patches of native shrub and regenerating tree species are present, generally less than 5m high, with a mixture of native and occasional exotic herb species.

Common aquatic and semi-aquatic sedge and rush species are Cumbungi, Jointed Twig Rush, Native Reed, Tall Spike Rush, Branching Rush, Common Rush and Woolly Frogsmouth. Along the margins, common native species are Blady Grass, Mat Rush, Bracken, Swamp Pennywort, *Lobelia alata*, Common Rush and Swamp Goodenia.

Occasional introduced species include Cats' Ears, Fireweed and Paspalum.

Shrub and tree species on adjacent slopes are Woolybutt, Hard-leaved Scribbly Gum, Grey Gum, Golden Spray and Sydney Golden Wattle.

This vegetation, although entirely artificial, conforms (at least floristically, although not in terms of location) to the "*endangered ecological community*" known as Freshwater Wetlands on Coastal Floodplains (see Chapter 5.3).

5.1.4 Cleared and Disturbed Land

Cleared and disturbed areas occur predominantly in the central parts of the Long Bow Point site and as smaller patches in previously cleared vegetation (Figure 10).

In those areas that remain cleared and open, the canopy, mid-canopy and shrub layers have been removed, apart from small isolated patches of canopy and shrub species, with some occasional patchy regeneration. Other parts of the previously cleared lands have regenerated, with dense areas of Tick Bush and/or Tea-tree. The more open disturbed areas often have a groundcover layer composed of a mixture of native and introduced species, with the composition dependent on previous disturbance history.

Occasional canopy species include Rough-barked Apple, Grey Ironbark and Hard-leaved Scribbly Gum, and stands of native shrub species (particularly Tick Bush and Tea-tree) are becoming common. Native groundcover species include Weeping Meadow Grass, Kidney Weed, Love Creepers, Common Rush, Wallaby Grass, Browns' Love Grass and Common Couch.

Common exotic species in the groundcover layer include Perennial Ryegrass, Fireweed, Clover, Paddys Lucerne, Cats Ears, Plantain, Rats Tail Grass and Paspalum.

The occurrence of woody weed species is generally limited to adjacent vegetation communities where disturbance along vegetation margins has enabled their penetration. Species include Lantana and Bitou Bush.

5.2 Plant Species

A total of 359 plant species have been recorded in the study area during the various field investigations (Appendix F), of which 60 are introduced species.

The floristic diversity on the site is typical of substantial tracts of land containing an array of native vegetation in the *Jervis Bay Regional Area*, and is indicative of the number of different vegetation communities present and the range of physical characteristics across the site (such as a variety of soil types, drainage and topographic features, and land uses).

Whilst the subject site represents only a small part of the study area, most (although certainly not all) of the plant species recorded in the study area would be present on the subject site. For example, there are no mangroves within Lake Wollumboola and no saltmarsh species dependant on either ocean water inundation or tidal influences.

Discussed in detail in Chapter 4, and as indicated in Appendix A, parts of the subject site had previously been cleared for grazing activities (Appendix A). Some of these areas, however, have regenerated either to a dense Tick Bush shrubland or to areas of regrowth eucalypts with a dense shrub understorey. Plant species diversity in these areas tends to be relatively low.

The types and locations of disturbance and/or weed infestation through the Culburra Golf Course site include:

- disturbance associated with existing (long-term) and previous tracks through the site, including soil compaction and erosion, plant loss and some areas of weed invasion;
- localised areas of weed invasion adjacent to cleared and otherwise disturbed lands;
- the modified vegetation and soils along and adjacent to Culburra Road;
- cleared and modified vegetation in the central part of Long Bow Point, and elsewhere on the subject site (see historical aerial photographs in Appendix A), which had previously been used for agricultural and grazing purposes;
- the band of vegetation around Long Bow Point adjacent to Lake Wollumboola. This area of vegetation (approximately 100m wide) has high levels of Bitou Bush infestation, presumably as a result of previous clearing activities along the foreshores of Lake Wollumboola and derived from high levels of Bitou Bush along the coast and around the Lake Wollumboola foreshores. In some places, the extent of invasion by Bitou Bush is greater than 100m from the edge of Lake Wollumboola, and a substantial management effort will be required to address that problem; and
- isolated patches of weed along the watercourses through the subject site and around the edges of Lake Wollumboola, where there has been previous disturbance and subsequent weed invasion.

Of the 60 introduced flora species recorded on the site, four are classified as noxious weed species under the *NSW Noxious Weeds Act 1993* (NW Act) for the Shoalhaven City LGA (Table 8). Fireweed is classified as a 'W3' category weed and should be "*prevented from spreading and its numbers and distribution reduced*" in accordance with the requirements of the NW Act. Blackberry and Bitou Bush are both classified as 'W2' weeds and should be "*fully and continuously suppressed and destroyed*". Prickly Pears are classified as 'W4f' weeds and should not be "*sold, propagated or knowingly*

distributed". Furthermore, "*any biological control or other control program directed by a local control authority must be implemented*" for W4f weeds.

Table 8 Noxious weed species recorded on the subject site at Culburra

Scientific Name	Common Name	Code[5]
Senecio madagascariensis	Fireweed	W3
Opuntia sp.	Prickly Pear	W4f
Rubus fruticosus species aggregate	Blackberry	W2
Chrysanthemoides monilifera	Bitou Bush	W2

5.3 Threatened Biota

Threatened Species

No threatened plant species listed in the *Threatened Species Conservation Act 1995* (TSC Act) have been recorded during any investigations within the subject site or the study area. Further none of the areas proposed for the golf course development are particularly likely to support those threatened plant species known to occur in the locality.

Moreover, even if any such species are present:

- the majority of the vegetation that would be affected by the proposed golf course is of little or no relevance; and
- the subject site, and the study area generally, contain substantial areas of potentially suitable habitat for any such species.

Endangered Ecological Communities

Of the fourteen plant communities which have been identified and mapped within the subject site at Culburra (Figure 10; Table 4), five possess at least the floristic characteristics of three "*endangered ecological communities*" (EECs) listed in the TSC Act (Table 9). The EECs which are represented within or immediately adjacent to the subject lands (Figure 11) include:

- Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions (SSFCF); and
- Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions (SOFF).

[5] W2 The weed must be fully and continuously suppressed and destroyed.
W3 The weed must be prevented from spreading and its numbers and distribution reduced.
W4f The weed must not be sold, propagated or knowingly distributed. Any biological control or other control program directed by the local control authority must be implemented.

The vegetation types that are or may be "*endangered ecological communities*" (EECs) are located either around the periphery of the subject lands (along the Lake Wollumboola foreshore) or along the watercourses within parts of the subject site (particularly along Downs Creek and its tributary and in the lower parts of the Wattle Creek catchment). None of the drier forest communities is listed as an EEC in the TSC Act. The future development of the golf course on Long Bow Point specifically involves design elements and activities intended to avoid the imposition of adverse impacts upon the EECs present.

Table 9 *Endangered Ecological Communities* recorded on or around the subject site

Map Unit	**Endangered Ecological Community**	
M1a, M2a, M2b, M4	Swamp Sclerophyll Forest on Coastal Floodplains	SSFCF
M3	Swamp Oak Floodplain Forest	SOFF

Some of the mesic forest communities on the subject site at Culburra have the floristic characteristics of several "*endangered ecological communities*" (EECs), as identified in Table 9. However, only parts of those mesic communities would satisfy the criteria contained within the *Final Determinations* for those EECs, because, in many instances, at least parts of those communities are not located on "*coastal floodplains*".

In the instance of Downs Creek, the "*floodplain*" is very narrow, and occupies an area generally of only a few metres each side of the channel. Whilst the mesic communities in some instances extend up the lower slopes adjacent to that narrow floodplain (particularly to the west), those patches of vegetation are not "*on*" the Downs Creek "*floodplain*".

Similarly, some of the vegetation in the lower parts of the Wattle Creek catchment are not located "*on coastal floodplains*", or indeed on a "*floodplain*" at all, but on the lower slopes. These patches of vegetation arguably do not constitute EECs at all, by reference to the locational and geographic criteria contained in the *Final Determinations* for several of those communities.

Those areas of Swamp Forest on the subject site which are regarded as satisfying **all** of the relevant criteria contained in the *Final Determinations* for those EECs (edaphic, locational, geomorphological **and** floristic) are identified in Figure 11 of this *Report*. The areas of the Swamp Forest communities which are considered to satisfy the criteria for the EECs are located on low-lying and nearly flat areas of the landscape (*ie* on "*floodplains*"), and exclude those areas which, whilst floristically similar or identical, are located on slopes above any feature that could relevantly be termed a "*floodplain*".

There are two vegetation types on the subject site which potentially could (floristically at least) constitute EECs:

- the artificial farm dam in the southwestern part of the subject site, which contains plant species and features typical of the Freshwater Wetlands on Coastal Floodplains (FWCF) community, notwithstanding that the dam is entirely artificial; and
- the Sea Rush-Twig Rush Herbland located around the Lake margins (located at the

entrances of Downs and Wattle Creeks), which has been identified by Council (in other places and in respect of other matters) as an example of the Coastal Saltmarsh (CSM) community.

It is the opinion of the author of this *Report*, however, that neither of those EECs are present. In any case, neither vegetation type is to be affected by the proposed Culburra Golf Course.

With respect to the Artificial Wetland/Sedgeland in the farm dam to the southwest of the proposed Culburra Golf Course, this is (as noted above) an entirely artificial feature. The wetland is present only because of the construction of a farm dam across the tributary to Downs Creek. Whilst that feature contains floristic characteristics and some physical characteristics which reflect those of the FWCCF community, this is an entirely artificial feature. In that regard, whilst the *Final Determination* for the FWCF community does not specifically preclude artificial wetlands from the EEC, the *Final Determination* does refer to *"relicts"* of that community, rather than to artificially created examples of the community, as being of relevance.

In any case, as noted above, the Artificial Wetland/Sedgeland on the subject site is not to be affected in any way by the proposed golf course. That feature is located in a different catchment to any of the golf course elements, and there will be no impacts of any nature whatsoever imposed upon that community. It is, therefore, of no relevance even if deemed to constitute the FWCF community (which is not conceded).

Similarity, the Sea Rush-Twig Rush Herbland which is located around the bays at the entrances of Downs and Wattle Creeks into Lake Wollumboola is not regarded as an example of the Coastal Saltmarsh (CSM) community. Whilst a number of plant species present in that community (as listed in the *Final Determination* by the NSW Scientific Committee) are present on the subject site and within the Sea Rush-Twig Rush Herbland (map unit W1b), Lake Wollumboola does not satisfy a key and critical criterion for the CSM community.

Paragraph No.1 of the *Final Determination* states that *"Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Coast Bioregions is the name given to the ecological community occurring in the **intertidal zone** on the shores of **estuaries** and **lagoons** including when they are intermittently close"* (emphases added).

The *"Coastal Saltmarsh"* community cannot exist in Lake Wollumboola because:

- there is **no** *"intertidal zone"* in Lake Wollumboola. Even when open to the ocean, Lake Wollumboola is **not** tidal in nature;
- Lake Wollumboola is **not** an 'estuary' by definition; and
- Lake Wollumboola is **not** a 'lagoon' by definition.

Lake Wollumboola is a lake. It is not an estuary, and it is not a lagoon. It has no tidal influence. There is no *"intertidal zone"* within Lake Wollumboola.

As a consequence of all of the above vegetation within Lake Wollumboola fails the first paragraph of the *Final Determination* of the Coastal Saltmarsh community. Vegetation within Lake Wollumboola, cannot therefore, constitute the CSM community, by a matter of pure logic.

Notwithstanding all of the above considerations, the proposed Culburra Golf Course has been designed *inter alia* to minimise any requirement for the removal of vegetation with even the floristic characteristics of EECs known to occur in the general locality.

In that regard:

- several of the golf holes (Nos. 2 and 3) have been re-designed by the principal author of this *Report* in order to avoid or minimise moist communities at the lower end of Wattle Creek;
- holes 12 and 13 have been moved upslope (to the southwest) from Downs Creek;
- the stormwater management regime for the project will *inter alia* protect areas of retained EECs in the vicinity of the proposed golf course; and
- specific attention will be paid to the rehabilitation of areas of EECs adjacent to the golf course, wherever possible.

6 FAUNA AND FAUNA HABITATS

6.1 Fauna Habitats

The diversity of vegetation types within the study area, and on the subject site for the proposed Culburra Golf Course, provides a range of habitats and resources for native fauna species.

Four broad fauna habitat types are present on the site at Culburra:

- forest and woodland through the majority of the site, including areas of regenerating sclerophyll forest and woodland, with canopy trees, tree-hollows and a variable flowering understorey;
- riparian habitats, with moist elements (depressions, rotting logs, ponds, dense understorey *etc*);
- aquatic and lacustrine habitats associated with Downs Creek and its tributaries, Wattle Creek and with Lake Wollumboola; and
- cleared areas supporting mostly grasses and regenerating shrubs and small trees, located in the central part of the subject site.

Much of the vegetation on the subject site displays only relatively low levels of disturbance (other than the substantial cleared area in the centre of the subject site and the various tracks created through it). It is noted, however, that the area of clearing on the subject site had previously been much greater, and long-term low-level timber harvesting has resulted in a relatively low abundance of hollow-bearing trees throughout the site. In general, hollow-bearing tree densities are low to at best moderate, and the majority of tree-hollows are relatively small. There are very large tree-hollows (such as are required by the Glossy Black Cockatoo and/or forest owls), scattered throughout the Blackbutt Forest vegetation.

Forest and Woodland

The open forest and woodland across the majority of the subject site at Culburra provides an array of habitat and resources for a variety of native fauna species. It is to be noted, however, that these resources and habitat types are abundant throughout the study area and general locality, and are not confined to the subject site.

The canopy of the forest and woodland vegetation provides foraging and nesting resources for a range of native arboreal mammal (*eg* gliders and possums) and a wide array of bird species. The canopy also provides foraging habitat for some microchiropteran bat species that hunt for insects whilst flying above, through or just below the canopy, and may provide habitat for the larger Grey-headed Flying Fox which forages on fruits and blossoms within the canopy. Stands of Forest Oak and Black She-oak in more elevated parts of the site provide foraging resources for the Glossy Black-Cockatoo, and the canopy may also provide roosting habitats for forest owls.

Tree-hollows, ranging in size from small holes along limbs to large hollows in senescent trees (and occasional stags), are distributed throughout the woodland and open forest communities. However, these resources are not abundant on the subject site because of the previous clearing of the site and

its use for timber harvesting. Trunk and limb hollows are utilised by arboreal mammals and a range of birds for nesting, and some microchiropteran bats also utilise tree-hollows for roosting.
The mid-canopy and shrub layer of the forest and woodland, where present, on the subject site (as elsewhere throughout the study area) provide resources for a range of native mammal, bird and reptile species. Small terrestrial mammals (*eg* bandicoots, native rats and dasyurids) would shelter, forage and nest amongst the shrub layer, whilst small cryptic birds (*eg* thornbills, wrens and gerygones) forage and nest in the dense mid-canopy and shrub layers. Several native lizard species (*eg* skinks) also utilise this habitat for shelter and foraging.

The composition of the groundcover varies throughout the forest and woodland of the subject site, and includes areas of dense leaf litter, woody debris, vegetation and bare earth. Such resources provide habitat for native herpetofauna (*eg* skinks, dragons and frogs), including shelter and foraging resources. Large terrestrial mammals (*eg* kangaroos and wallabies) would forage amongst the native grasses and shrubs. These species are also commonly found in open grassland or cleared and disturbed areas in the study area.

The native fauna on the subject site (including small mammals, birds, reptiles and frogs) also constitute prey for carnivorous species, both native (such as the Powerful and Masked Owls), and introduced (*ie* the Fox, Dog and Feral Cat).

The subject site also contains an array of mesic forest types and vegetation communities. These are predominantly located along the lower parts of the Downs Creek and Wattle Creek catchments, and (with the exception of the two minor crossings of Downs Creek for fairways) are located at some distance from any proposed development activity.

The mesic communities do not generally provide any particular additional habitat features or resources for native biota, although there is a greater density of groundcover and lower vegetative strata, which are relevant to a number of native fauna. Features of particular potential significance are generally confined to the watercourses themselves, swamp and flooded areas, and associated features.

As noted elsewhere in this *Report*, much of the subject site had either been previously cleared (see historical photographs in Appendix A) or had been used for timber harvesting over an extended period. There are many large cut stumps through the site, and large hollow-bearing trees (particularly those containing the very large hollows necessary for breeding by species such as the Glossy Black Cockatoo, Powerful Owl and Masked Owl) are not common.

Riparian Habitats

Riparian habitats are confined to narrow bands of vegetation along Downs Creek and its minor tributary (to the southwest) and along Wattle Creek (in the northeastern part of the subject site). Whilst there is some change in vegetation (both floristically and structurally) between the xeric vegetation types upslope and the riparian vegetation types, the generally narrow widths of these bands of riparian vegetation and the nature of the subject site means that riparian habitats *per se* do not generally provide particularly specialised or different habitats or resources for native biota.

Nevertheless, riparian vegetation is generally avoided in the Culburra Golf Course design, other than for the single narrow golf cart crossing of Downs Creek (Figure 6). That crossing, however, will be created in as sensitive a manner as possible, involving *inter alia* the retention of most of the lower

vegetative strata and the avoidance of trees, by meandering the structure through the trees on a meandering bridge structure.
There are only very limited riparian vegetation and habitats along Wattle Creek (in the northeastern part of the site), although there are broad areas of swamp vegetation in the lower parts of the catchment. The main area of 'true riparian vegetation' being located in upper parts of that watercourse (to the immediate south of Culburra Road).

Aquatic and Lacustrine Habitats

Aquatic and lacustrine habitats are located primarily along Downs Creek and its tributaries (in the southwest of the site), in the lower parts of Wattle Creek (in the northeast), and along Lake Wollumboola.

A number of smaller water bodies, including temporary swamps and pondages, are present in the low-lying parts of the site. These features provide a range of habitats for an array of native fauna species, including amphibians, mammals and birds. A single farm dam is located in the western part of the site, which may be utilised by native frog and bird species.

The lacustrine habitats in and around Lake Woolumbulla are of particular conservation value and significance, because of the significant array of aquatic and wading wetland birds that utilise this feature. The Lake itself provides habitat for a significant array of wetland birds (the Black Swan, an array of ducks and cormorants, grebes and species such as the Darter). It is to be noted, however, that whilst the species are often in abundance on Lake Woolumbulla, the subject site itself provides little or no habitat for such species.

The shallows and mudflats at the ends of both Downs Creek and Wattle Creek also provide extensive habitat for those bird species that utilise mudflats and wading environments. An array of herons, dotterels, stilts, egrets and other such species would regularly utilise those resources, with different suites of species present depending on water depths.

The immediate shoreline below the 'drop-off' at the end of Long Bow Point (approximately 6m or 8m below the plateau of Long Bow Point) also contains areas of mudflat and exposed rock, which would also provide habitat for wetland and wading species typical of lake foreshores and lacustrine habitats.

Cleared Land

The areas of cleared land on the subject site, whilst not constituting a significant habitat or resource for native biota, would nevertheless be utilised by a range of species which are characteristic either of open grasslands or of the interface between woodland habitats and open grasslands.

This habitat type, whilst being artificial, provides resources for granivorous and insectivorous bird species particularly, and also provides foraging resources for kangaroos, wallabies and bandicoots.

6.2 Fauna Assemblage

A total of 153 vertebrate fauna species have been recorded during the various field investigations within the subject site and the Culburra West UEA, including 103 birds, 34 mammals, 10 amphibians and 6 reptiles (Appendix H). A further 77 species have been recorded within the subject lands or in the immediate vicinity, during previous investigations (Gunninah 1999; Daly & Leonard 1996; Hoye 1996), including 72 birds, 1 mammal, 1 amphibian and 3 reptiles (Appendix B). A total of 11 introduced fauna species have also been recorded during the fauna investigations.

The diversity of fauna species recorded reflects the array of habitats and resources within the study area, and the structural and floristic diversity of the vegetation present. It is also reflective of the substantial area of vegetation and habitats present on the subject site and in the study area.

Birds

The avifauna recorded within the subject site and study area consists of an array of waterbird species, whose habitat preferences are largely coastal and/or marine, and of species which utilise areas of coastal woodland and heath in the region. The species recorded reflect the variety of foraging resources (such as insects and other invertebrates, seeds, fruit, nectar, sap, lerps on eucalypt leaves, manna and small vertebrates) and nesting habitats (such as hollow-bearing trees, dense shrub layer and heathland) present within the subject lands.

Four broad guilds of birds (based on foraging and habitat requirements) were identified during the survey, including:

- waterbirds, which forage in or along the margins of lakes, lagoons or shallow ponds and which nest along beaches or on rocky cliffs (*eg* cormorants, herons, dotterels, terns and the Purple Swamp Hen);
- large and more aggressive terrestrial species which prey on vertebrates and large invertebrates, and cover large distances whilst foraging (*eg* Powerful Owl, Southern Boobook, Kookaburra). These birds generally have large home ranges;
- granivorous and nectarivorous terrestrial species which utilise forests and woodlands (*eg* Crimson Rosella, Glossy Black Cockatoo, Rainbow Lorikeet and honeyeaters); and
- smaller and more cryptic 'terrestrial' birds which utilise dense shrubs and mid-storey vegetation for shelter (*eg* the Eastern Yellow Robin, Eastern Whipbird, Brown Thornbill and Golden Whistler).

A number of threatened bird species have been recorded within the subject site and/or in the vicinity during the current and previous field surveys. The conservation significance of the subject site with respect to these threatened bird species is discussed in further detail in Chapter 6.3.

The aquatic species which utilise Lake Wollumboola (*eg* the Black Swan, ducks, Australasias and Little Grebes) are not addressed in any particular detail because the Culburra Golf Course project will not affect such species to any significant extent, if at all. As discussed elsewhere, the project does not involve any activities in or even in close proximity to the Lake.

Reptiles

The reptile species which have been recorded on the subject site and in its vicinity during the current and previous field surveys (Appendix B) are generally widespread and abundant in distribution, and have been recorded from a wide variety of habitats throughout the Jervis Bay region. It is likely that a range of other reptiles could occur on the subject site, given the understorey vegetation, the variety of substrates and habitats, and the depth of the leaf litter in places.

No threatened reptile species have been recorded within the subject site, and none are considered likely to occur given the habitats and resources present. There is no suitable habitat present for Rosenberg's Goanna on the subject site at Culburra. There are no termite mounds present (which provide both food and shelter for Rosenberg's Goanna), and there have been no records of this species in the locality or vicinity.

Amphibians

An array of amphibian species have been recorded on the subject site and in the vicinity during the current and previous field investigations. Of these, the majority are common and widespread, and utilise a wide array of ponds, dams and other moist habitats.

One threatened amphibian species has been identified on the subject site - the Green & Golden Bell Frog (listed as "*Vulnerable*" in the TSC Act), which was recorded in a dam in the southwestern part of the subject site (Figure 10). One individual male Green & Golden Bell Frog was recorded in aquatic vegetation surrounding the dam but, despite dedicated searches for this species elsewhere on the subject site, no other individuals have been recorded.

The conservation significance of the Green & Golden Bell Frog is discussed in detail in Chapter 6.3 of this *Report*.

Mammals

The variety of habitats and resources within the subject site support (or potentially support) an array of mammal species, with a total of twenty-eight native and seven introduced mammal species having been recorded in the study area during the current or previous field investigations (Appendix B). Of the native species identified, five species utilise arboreal habitats, seven are predominantly terrestrial and sixteen are aerial species.

The open forest and woodland communities provide habitats and resources for arboreal mammal species, such as the Common Brushtail Possum, Common Ringtail Possum, Greater Glider and Sugar Glider. These arboreal marsupials, all frequently recorded throughout the forested areas in the region, utilise tree-hollows as dens and exhibit varying tolerances to disturbance. The Common Ringtail Possum, which also builds dreys within dense vegetation, is a common resident of bushland fragments within disturbed areas.

One threatened arboreal mammal species, the Yellow-bellied Glider (listed as "*Vulnerable*" in the TSC Act), was recorded to the southwest of the subject site during the field investigations, but has not been

recorded on the subject site itself. Potentially suitable habitat is available on the site, although the species was not recorded elsewhere and no evidence for its presence (*ie* characteristic incisions on trees) has been obtained from the site itself.

Large macropods, including the Eastern Grey Kangaroo and Swamp Wallaby, are recorded regularly on the subject site. These species graze on the grasses and understorey species of forests and woodlands of southeastern Australia. Small mammals, such as the Long-nosed Bandicoot, Southern Brown Bandicoot, Brown Antechinus and Bush Rat, have also been recorded on the site or in the general vicinity. Such species are common ground-dwelling 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 generally highly mobile and wide-ranging species, and are unlikely to be dependent on a single area of bushland for their foraging requirements. Whilst they may utilise the site for foraging on occasions, critical resources for many of the species (particularly caves or tree-hollows) are either not present on the site, or are not restricted to the subject site.

Seven introduced mammal species have been recorded in the study area, reflecting the proximity of the site to urban development. The presence of two introduced predators (*ie* the Cat and Fox) potentially reduces the value of the subject site for native fauna to some degree, particularly for terrestrial fauna. Rabbits and Hares compete with many native herbivorous mammals for foraging resources, and can cause high levels of disturbance within the understorey. The introduced Black Rat also predates on the eggs of native birds.

6.3 Threatened Biota

6.3.1 Fauna Species

Ten threatened fauna species were recorded on the subject site during the current field surveys, and eleven additional species have been recorded nearby, in the past (Gunninah 1999). In total, fourteen threatened bird species, six threatened mammal species and one threatened amphibian have been recorded from the subject site or in the vicinity in the past (Table 10; Figure 12).

With the exception of the Little Tern and the Green & Golden Bell Frog, these species are all listed as "*Vulnerable*" on Schedule 2 of the TSC Act. The Little Tern and the Green & Golden Bell Frog are listed as "*Endangered*" in Schedule 1 of the TSC Act.

Given the presence of relevant resources and habitat features on the site, it is possible (indeed likely) that individuals of a number of other threatened species could also potentially occur within the subject site on occasions (Chapter 6.3.3).

A large number of the threatened species recorded immediately adjacent to or near the subject site during the current and previous surveys (Gunninah 1999; Table 10) are waterbirds, some of which are migratory, and utilise the coastal habitats of Lake Wollumboola and the Crookhaven River (Appendix B). Many of these species (the Black-tailed Godwit, Great Knot, Sanderling, and Greater and Lesser Sand Plovers) forage on the mudflats or shallow waters of estuaries, lagoons, brackish swamps and ponds, and nest or roost in nearby coastal vegetation, on beaches or behind dunes. Others (such as the Little Tern, Pied Oystercatcher and Sooty Oystercatcher) generally utilise beach habitats, but could also use Lake Wollumboola and/or its margins at appropriate water levels.

None of these species are of relevance to the proposal at Culburra. The proposed Culburra Golf Course project does not involve activities in or near Lake Wollumboola, and the habitats for those threatened bird species which utilise either the deep waters of the Lake or the Lake shores will not be affected by the proposal. Given those circumstances, the wetland and wading birds identified in Table 10 are not regarded as any relevance for the proposal on Long Bow Point.

Foraging habitats for these species are not present in the relevant parts of the subject site, being located on or just beyond the eastern boundary of the site, on the tidal flats and foreshores of Lake Wollumboola. However, some limited sheltering and nesting habitats for some of these species is present along the foreshores on the subject site.

The majority of the threatened species recorded on the subject site or on adjacent land during the current and previous fauna investigations (see *Bibliography*) utilise woodland and forest environments *(see below)*.

Table 10 Threatened fauna species that have been recorded on the subject site or in the vicinity during the current and previous field investigations

Common Name	Scientific Name	Status	Habitat	Likelihood
Birds				
Australasian Bittern	*Botaurus poiciloptilus*	V	Wetland edges	Possible
Black-tailed Godwit	*Limosa limosa*	V	Coastal/Estuarine	Low
Great Knot	*Calidris tenuirostris*	V	Coastal/Estuarine	Low
Sanderling	*Calidris alba*	V	Coastal/Estuarine	Low
Pied Oystercatcher	*Haematopus longirostris*	V	Coastal/Estuarine	Low
Sooty Oystercatcher	*Haematopus fuliginosus*	V	Coastal/Estuarine	Low
Lesser Sand Plover	*Charadrius mongolus*	V	Coastal/Estuarine	Low
Greater Sand Plover	*Charadrius leschenaulti*	V	Coastal/Estuarine	Low
Little Tern	*Sterna albifrons*	E	Coastal	No
Square-tailed Kite	*Lophoictinia isura*	V	Woodland/forest	Yes
Glossy Black Cockatoo	*Calyptorhynchus lathami*	V	Woodland/forest	Yes
Gang Gang Cockatoo	*Callocephalon fimbriatum*	V	Woodland/forest	Yes
Powerful Owl	*Ninox strenua*	V	Woodland/forest	Yes
Masked Owl	*Tyto novaehollandiae*	V	Woodland/forest	Yes
Mammals				
Yellow-bellied Glider	*Petaurus australis*	V	Woodland/forest	Possible
East-coast Freetail Bat	*Micronomous norfolkensis*	V	Woodland/forest	Yes
Common Bent-wing Bat	*Miniopterous schreibersii*	V	Woodland/forest	Yes
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	V	Woodland/forest	Yes
Large-footed Myotis	*Myotis adversus*	V	Woodland/waterbodies	Yes
Greater Broad-nosed Bat	*Scoteanax rueppellii*	V	Woodland/forest	Yes
Yellow-bellied Sheath-tail Bat	*Saccolaimus flaviventris*	V	Woodland/forest	Yes
Amphibians				
Green & Golden Bell Frog	*Litoria aurea*	E	Freshwater ponds	Yes

6.3.2 Relevant Threatened Species Profiles

The Powerful Owl

The Powerful Owl is the largest of Australia's owl species, and has a total distribution which includes the whole of the eastern part of Australia from the Cape York Peninsula to Tasmania. This species inhabits tall, generally moist, forest communities, although it also utilises open dry forest and even patches of remnant trees in urban environments.

Important elements of the Powerful Owl's habitat requirements and behavior include:

- a healthy population of arboreal mammals upon which this species primarily feeds, noting that the owl also takes flying foxes and some birds as prey;
- a substantial home range (of approximately 1000ha for a breeding pair) to provide suitable roosting and nesting habitats, and a sufficient food supply;
- patches of suitable trees for diurnal roost sites (such as Turpentines and other species with a dense canopy); and
- very large tree-hollows in which to nest and rear their young.

The Powerful Owl has been recorded from a number of widely distributed locations in the Culburra West study area and in the surrounding forested lands (Figures 12 and 13). Observations of the Powerful Owl have been obtained by Gunninah Environmental Consultants and Whelans InSites between 1993 and the present, with scattered records over that period within the Culburra West study area. In addition to the sighting of animals, two nest trees of the Powerful Owl have been identified to the north of the Culburra Road (Figure 12).

Recent surveys of the subject site and of the lands to the north (in 2010 and 2011) have revealed no evidence of those trees currently being used by Powerful Owls for nesting and breeding purposes. Further, recent use of call playback (in February 2011) elicited no response from Powerful Owls, and there have been no records of nests or breeding by this species on Long Bow Point.

In addition to the records obtained by Gunninah Environmental Consultants and Environmental Insites during investigations in the Culburra locality, there are substantial other records of Powerful Owls both in this immediate vicinity and in the general Jervis Bay area (OEH Wildlife Atlas). The Powerful Owl is widespread in the Jervis Bay area (Figures 12 and 13), and the extensive naturally forested areas of the Shoalhaven LGA clearly provide a valuable resource for this species.

Glossy Black Cockatoo

The Glossy Black Cockatoo is a large member of the cockatoo family, distributed widely throughout eastern Australia, particularly east of the Great Dividing Range. This species is highly mobile and sometimes nomadic, moving in response to the availability of suitable food resources.

The Shoalhaven Local Government Area (LGA) appears to be a stronghold for the Glossy Black Cockatoo. This species is regularly recorded throughout the Shoalhaven LGA, particularly within the substantial state forest, conservation areas and private forested lands throughout the LGA.

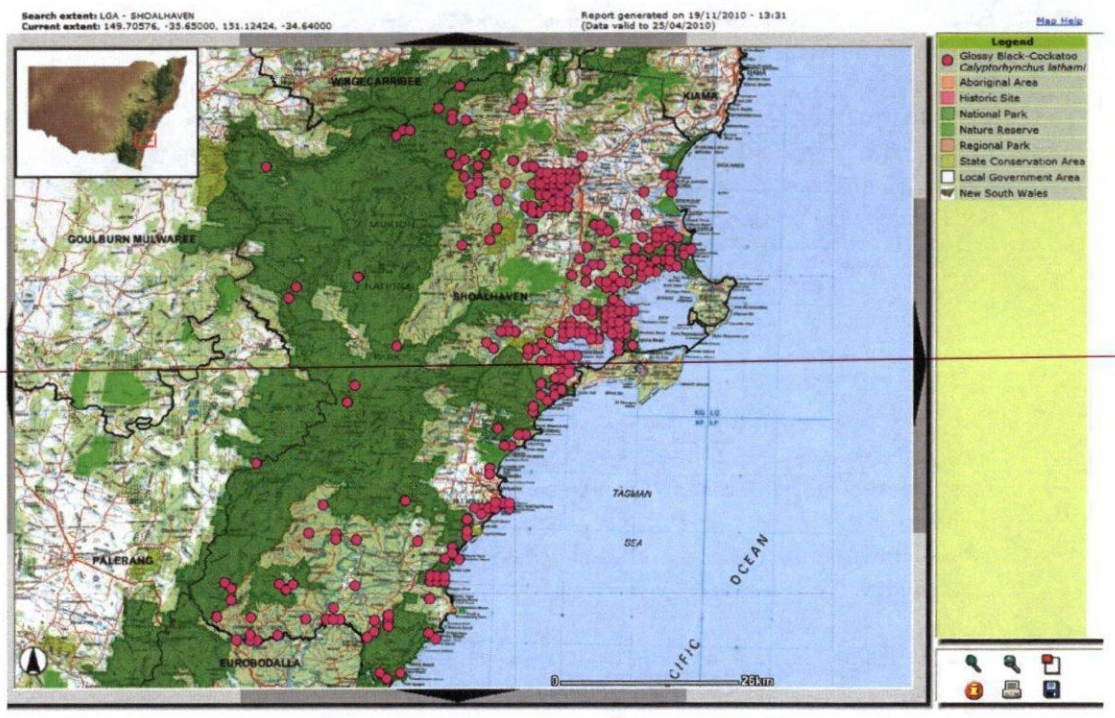
Critical resources for the Glossy Black Cockatoo include:

- areas of dense she-oak stands (particularly the Black She-oak *Allocasuarina torulosa* and the Forest Oak *A. littoralis*), on which the Glossy Black Cockatoo feeds; and
- hollow-bearing trees with 'pipes' or 'chimneys' in which to nest and rear young.

As noted above, the Glossy Black Cockatoo is regularly recorded in the Shoalhaven LGA (see Gunninah references), and is represented by a substantial number of records on the OEH Wildlife Atlas. As also noted above, this species appears to be common to abundant in the Shoalhaven LGA, with the dry forest and woodland communities providing significant areas of suitable foraging habitat for this species.

The Glossy Black Cockatoo has been recorded both on Long Bow Point and throughout the lands subject to this *Report*. Whilst the vegetation north of the Culburra Road does not support particularly dense or substantial areas of she-oaks suitable for foraging by Glossy Black Cockatoos (and there are relatively few records of the species in this part of the study area), land south of the Culburra Road on Long Bow Point contains moderate to large patches of she-oaks in which Glossy Black Cockatoos have been regularly recorded.

Evidence of Glossy Black Cockatoo foraging has also been obtained within lands which are now part of the Jervis Bay National Park (to the south of the subject lands). As noted elsewhere, this species is regularly recorded during field investigations in the Shoalhaven LGA, and the subject lands are not unusual or particularly significant in this regard.



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

The Green & Golden Bell Frog

The Green & Golden Bell Frog is a large, highly mobile and terrestrial amphibian species which is considered a 'pioneer species' and a 'disturbance specialist'. This species is regularly recorded in artificial ponds and water bodies, and appears to thrive in situations where competition from other amphibian species in better established water bodies is less intense.

The Green & Golden Bell Frog breeds in either temporary or permanent ponds, dams and swamps, but does not utilise flowing streams or watercourses for breeding purposes. It prefers ponds with reeds and/or other emergent vegetation, as well as with rock piles or other substrates on which to bask and in which to shelter or hibernate.

There is no suitable habitat for the Green & Golden Bell Frog within the areas proposed for the Culburra Golf Course. Whilst there would doubtless be some temporary flooded areas within parts of the Culburra Golf Course development area following heavy rainfall events, there are no permanent or even semi-permanent ponds or dams present in which the Green & Golden Bell Frog would be likely to breed.

A single Green & Golden Bell Frog was recorded in a small dam along the tributary to Downs Creek in the southwest of the subject site (Daly 1994). However, that feature is located a considerable distance from any element of the proposed Culburra Golf Course (Figure 6).

Green & Golden Bell Frogs have also been located at other locations within the Shoalhaven LGA and in the locality around Culburra. There are records of the Green & Golden Bell Frog within Culburra itself (along the southern edge of the town adjacent to Lake Wolllumboola and in ponds at the southwestern extremity of the town), and a key population of the species inhabits the Coomonderry Swamp, to the west of the Seven Mile Beach National Park (DECC 2005). This species has also been recorded at Sussex Inlet to the south of Jervis Bay.

It is noted that the Culburra Golf Course project will involve the provision of basins and ponds required for water quality treatment, flow control and irrigation purposes. These features are to be designed by the project ecologist, constructed and planted to provide supplementary habitat for Green & Golden Bell Frogs by the provision of emergent vegetation (reeds and sedges) and piles of rocks for shelter and basking.

East-coast Freetail Bat

The East-coast Freetail Bat *Micronomus norfolkensis* is a small insectivorous bat which utilises 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 has been recorded within the subject site at Culburra, and is likely to utilise all forested areas of the site, as well as surrounding lands. There is a reasonable supply of potential roosting habitat for this species (hollow-bearing and large trees), and it is intended that most of the hollow-

bearing trees will be retained as part of the golf course development. Any tree-hollows that do require removal will be the subject of a *Hollow-bearing Tree Protocol* (see Chapter 17).

Given the high mobility of this species and the extent of large areas of habitat within the subject site and in the study area (Figure 6), the site at Culburra (being a golf course with substantial retention of native forest on the site itself), and given the extent of suitable habitat in the locality, the proposed golf course is not likely to impose a significant adverse effect 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 Matternity caves are used by females during summer to give birth.

The Common Bent-wing Bat has been recorded 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 is present on 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 6), the proposed development is unlikely to have any significant adverse impacts upon any local population of the Common (Eastern) 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 has been recorded within the subject site, and would most likely utilise ponds in the lower reaches of Downs Creek and Wattle Creek, as well as the dam in the western part of the subject site and (probably) the Lake Wollumboola shoreline. No notable potential roosting habitat is present, although this species does on occasion use tree-hollows for roosting.

Future development of the subject site as a golf course, as proposed, would result in the provision of an array of additional artificial dams and other such features around the golf course, providing extensive new habitat for this species. 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 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 has been recorded within the subject site at Culburra and would be expected to utilise much or all of the forested areas of the site and surrounding lands, as well as the Estuarine Scrub Community around Lake Wollumboola. There is reasonable supply of hollow-bearing trees as potential roosting habitat for this species, most of which will be retained as part of the proposed Culburra Golf Course. Any removal of tree-hollows or hollow-bearing trees will be subject to implementation of the *Hollow-bearing Tree Protocol* (see Chapter 17) for 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 locality (Figure 6), the proposed golf course development on Long Bow Point would not be likely to impose any significant adverse impacts upon a 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 flies "*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 has been recorded on the subject site at Culburra, and would be expected to utilise all of the forested areas of the site and surrounding lands. There is also potential roosting habitat for this species, most of which will be retained as part of the proposed golf course development on the subject site.

Given the high mobility of this species and the retention of large areas of habitat containing suitable foraging and roosting resources within the subject site and in the vicinity (Figure 6), the proposed development of the site is not likely to impose any significant adverse impacts upon the local population of the Yellow-bellied Sheath-tail Bat.

Eastern False Pipistrelle

The Eastern False Pipistrelle has been recorded from coastal mallee and moist forest, and generally with a dense understorey (Churchill 2008). This species is a "*swift and direct*" flier generally targeting larger prey (Churchill 2008), and generally roosts in tree-hollows.

The Eastern False Pipistrelle was recorded on the subject site at Culburra, and would be expected to utilise most or all of the forested areas of the site and surrounding lands. There is a reasonable supply of hollow-bearing trees present as roosting habitat for this species on the site, most of which is to be retained.

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 6), the proposed golf course development on the site at Culburra is unlikely to impose any significant adverse impacts upon the local population of the Eastern False Pipistrelle.

Yellow-bellied Glider

The Yellow-bellied Glider is an arboreal mammal which is dependent on tree-hollows and utilises woodlands and open forests that support suitable foraging and nesting resources (Goldingay & Kavanagh 1990; Henry & Craig 1984). This species requires tree-hollows for shelter and breeding.

The Yellow-bellied Glider was recorded only by the identification of 'v-shaped' notches in trees to the southwest of the subject site in the early 1990s. This species has never been recorded by spotlighting or call playback on Long Bow Point, or on any other lands in the immediate vicinity, despite appropriate surveys over a very extensive period (in excess of 17 years). There are no indications that the Yellow-bellied Glider uses Long Bow Point.

Given the lack of records of this species around the golf course area, and the selective retention of hollow-bearing trees and the retention of large areas of habitat containing suitable foraging resources

within the subject site and in the vicinity (Figure 6), the proposed golf course development on the site at Culburra is unlikely to impose any significant adverse impacts upon the local population of the Yellow-bellied Glider.

6.3.3 Other Potentially Relevant Threatened Fauna

Several species of threatened fauna previously recorded in the locality have not been recorded on the subject site *per se* during any investigations, despite the presence of potential habitat and despite the conduct of appropriate surveys (Table 11; Appendix I).

Table 11 Additional threatened fauna species which may utilise the subject site on occasion.

Common Name	Scientific Name	Status	Comments
Masked Owl	*Tyto novaehollandiae*	V	Potentially present, but never recorded; habitat to be affected is insignificant
Square-tailed Kite	*Lophoictinia isura*	V	Wide-ranging; insignificant area of habitat to be affected
Australasian Bittern	*Botaurus poiciloptilus*	V	All potential habitat to be retained
White-footed Dunnart	*Sminthopsis leucopus*	V	Never recorded in vicinity; potential habitat widespread
Koala	*Phascolarctos cinereus*	V	Not present in vicinity or locality
Squirrel Glider	*Petaurus norfolcensis*	V	Not recorded in vicinity or locality
Tiger Quoll	*Dasyurus maculatus*	V	Not recorded in vicinity or locality
Osprey	*Pandion haliaetus*	V	Potential overhead but no relevant habitat on site *per se*

The Masked Owl, a large nocturnal predator of small and medium-sized terrestrial mammals, was observed roosting, and heard calling, within Currambene State Forest to the southwest of the subject site during previous fauna investigations (Gunninah 1999f). Although it is recorded frequently within the Shoalhaven LGA (NPWS 1996), it has not been recorded on Long Bow Point or in the Culburra UEA. Being territorial, the Masked Owl will frequently respond to taped calls broadcast within its territory, and may compete with the Powerful Owl for large hollow-bearing trees for roosting and nesting.

The Masked Owl prefers to forage in open areas adjacent to forest and woodland vegetation with a sparse understorey (Higgins 1999), and although the subject site supports suitable foraging resources for the Masked Owl, these resources are not restricted to the site or the locality, and are well represented regionally. Furthermore, the likely even occasional presence of a resident pair of Powerful Owls on the subject site decreases the likelihood that Masked Owls utilise the subject site on a regular basis.

The Square-tailed Kite has been tentatively recorded from the subject site in the past (Daly & Leonard 1996a), and has been recorded previously in the locality (NPWS 1996). This is a wide-ranging raptor which preys upon small birds and large insects and is generally solitary, with breeding pairs requiring large home ranges of at least 100km^2 (Daly & Evison 1995; Debus & Czechura 1989). The subject site provides suitable foraging and roosting habitat for the Square-tailed Kite, but would only form a small part of a much larger home range.

The Australasian Bittern has been recorded previously in the vicinity of the subject site (Daly & Leonard 1996a), although Daly & Leonard did not specify the location of their record. This species is also known from other records in the locality (OEH Wildlife Atlas; Birds Australia). Although it has not been recorded recently on the subject site, potentially suitable habitat is present on the shores of Lake Wollumboola along the southeastern border and within the estuarine area at the mouth of Downs Creek. No habitat for this species will be affected by the proposed Culburra Golf Course project.

The most recent observation of the White-footed Dunnart in the locality of the subject site was in 1988 (OEH Wildlife Atlas). This species is a small terrestrial carnivorous marsupial, which feeds on a variety of invertebrates and small lizards (Lunney *et al* 1989; Lunney & Leary 1989; Menkhorst 1995; King 1980). The White-footed Dunnart occupies xeric grassy woodlands and open forests, generally with relatively low densities of shrubs. This species has not been recorded on the subject site despite intensive survey efforts using suitable methods (*ie* Elliott traps, pitfall traps, hairtubes, predator scats).

The Koala is presumed to be locally extinct in the locality, as only two records exist within 10km of the subject site (OEH Wildlife Atlas). One of these records is from 1930, and the other, from 1995, is located to the west of Callala Beach, some distance to the south of the subject site. Recent surveys have not revealed any evidence that the species exists in the locality (Gunninah 1999, 2001a; Environmental InSites 2010a, b, c, d, e, 2011). The subject site does not constitute "*potential koala habitat*" pursuant to *State Environmental Planning Policy No. 44 – Koala Habitat Protection* (SEPP 44), and the *Policy* does not apply.

The Squirrel Glider was not recorded during the current (Appendix C) or previous (Gunninah 1999; Daly & Leonard 1996) field investigations on the subject site or in the immediate locality, and only one record of the Squirrel Glider (from 1970) exists from the locality (OEH Wildlife Atlas). This species inhabits dry sclerophyll forests and woodlands away from the coast in southeastern Australia, although it is found in coastal vegetation in northern NSW and Queensland (Suckling 1995; Menkhorst *et al* 1988). It has very similar habitat preferences to the Sugar Glider, and it is possible that its absence from the subject site is a result of competition from the large Sugar Glider population in the area.

The Tiger Quoll was not recorded during the current field investigations, and has not been recorded on the subject site or in the immediate vicinity during previous surveys (Gunninah 1999). Only one record of its presence exists from the locality, dating back to 1980 (OEH Wildlife Atlas). This species is known to inhabit a range of forest and woodland environments (Edgar & Belcher 1995). It preys on insects and small to medium-sized vertebrates, and utilises hollow logs, stages, caves or rock crevices for denning. Although some potentially suitable foraging and denning habitat is present on the subject site, the lack of any recent records of the species suggests it may no longer occur in the locality.

The Osprey, although seen regularly (albeit infrequently) along the coast around Jervis Bay, has not been recorded on the subject site during the investigations undertaken to date. No doubt, however, this species utilises Lake Wollumboola for hunting purposes, and may perch in large trees along the

Lake Wollumboola shoreline. However, no nests of the Osprey have been recorded in the vicinity or locality.

6.3.4 Endangered Populations

No "*endangered populations*" of any fauna species listed in the TSC Act are of relevance to the subject site.

6.3.5 Non-Relevant Threatened Fauna

A number of additional threatened species have been recorded within the locality of the subject site (Appendices H and I; OEH Wildlife Atlas), but are not regarded as relevant to the site (Table 12). Together with a range of threatened waterbirds (Table 12), these species require habitats and resources which are either not present on the site or in adjoining lands, or they are considered locally extinct. Furthermore, none of these species have been recorded on the subject site or on adjacent land during the current or previous field surveys (see Bibliography).

There is no suitable habitat present for species such as the Little Tern or the Pied or Sooty Oystercatchers, other than possible very limited rock platforms around the end of Long Bow Point (for the Oystercatchers). The other estuarine species (the Black-tailed Godwit, Great Knot, Sanderling and Lesser and Greater Sand Plovers) could possibly utilise the mudflats and sandflats within Lake Wollumboola near Long Bow Point when the Lake is at suitable levels. There is no proposal for any development occurring within or near the potentially suitable habitat for these species.

Whilst individuals of the Turquoise Parrot and/or Swift Parrot could theoretically utilise some of the open forest and woodland vegetation on the subject site, on occasions at least, neither of these species have been recorded from the subject site itself or in other lands in the immediate vicinity. Both of these species are highly nomadic, and will move significant distances in response to the availability of foraging resources (flowering eucalypts in particular).

Given those circumstances, the species could potentially occur throughout the forests of the study area, although (as noted above) neither species has been recorded on the subject site or in the immediate vicinity during the substantial investigations that were undertaken (for example) for the Long Bow Point proposal. In any case, the proposed Culburra Golf Course will retain significant areas of potential resources for these species.

Other species recorded on the vicinity (Table 12) are confined to marine or pelagic environments, and are not of any relevance with respect to the subject site at Culburra. The whales, Wandering Albatross, Providence Petrel and Little Shearwater would not utilise resources even within Lake Wollumboola, and cannot be considered even of marginal relevance to the proposal.

Table 12 Other threatened fauna species recorded within 10km of the subject site (OEH Wildlife Atlas), which are not considered of relevance to the subject site given the absence of suitable habitats in the golf course area or because they are considered locally and/or regionally extinct.

Common Name	Scientific Name	Explanation
Beach-stone Curlew	*Esacus neglectus*	• Marginal habitat around Lake Wollumboola • No habitat to be affected
Black Bittern	*Ixobrychus flavicollis*	• Little potentially suitable habitat (swamps and reed beds), and that present will be retained • All habitat to be retained • New habitat to be created
Blue-billed Duck	*Oxyura australis*	• No suitable habitat
Broad-billed Sandpiper	*Limicola falcinellus*	• No suitable habitat on site • Mudflats or rocky reefs at periphery will be protected
Bush-stone Curlew	*Burhinus grallarius*	• Limited potential habitat on site • Not recorded in study area
Great Knot	*Calidris tenuirostris*	• No suitable habitat on site • Mudflats at periphery will be protected
Ground Parrot	*Pezoporus wallicus*	• No records on site or adjacent land • Limited (and widespread) potential habitat on site
Hooded Plover	*Thinornis rubricollis*	• No suitable habitat on site (sandy ocean beaches)
Little Shearwater	*Puffinus assimilus*	• No suitable habitat (marine and island habitats)
Providence Petrel	*Pterodroma solandri*	• No suitable habitat (marine)
Swift Parrot	*Lathamus discolor*	• Favoured tree species not common on the site • Few recent records in the vicinity, and never recorded in study area
Terek Sandpiper	*Xenus cinereus*	• No suitable habitat on site • Mudflats at periphery will be protected
Turquoise Parrot	*Neophema pulchella*	• Site lacks preferred foraging habitat; • Species not recorded on site or adjacent land
Wandering Albatross	*Diomedea exulans*	• No suitable habitat on site (strictly marine)
Eastern Quoll	*Dasyurus viverrinus*	• Species thought to be extinct on mainland Australia
Southern Right Whale	*Eubalaena australis*	• No suitable habitat (oceanic species)
Sperm Whale	*Physeter macrocephalus*	• No suitable habitat (oceanic species)

7 STATUTORY ISSUES

The relevant policies, environmental planning instruments and statutes which have been taken into account in respect of the potential environmental impacts of the Culburra Golf Course project include:

- the *Environmental Planning & Assessment Act 1979* (EP&A Act):
  - the "*objects*" of the Act, including *Ecologically Sustainable Development* (ESD);
  - Section 5A of the Act, with respect to the potential for a "*significant effect*" to be imposed upon threatened biota; and
  - Section 79C of the Act, with respect to potential impacts on the natural environment generally;
- *State Environmental Planning Policy No. 14 – Coastal Wetlands* (SEPP 14);
- *State Environmental Planning Policy No. 44 – Koala Habitat Protection* (SEPP 44);
- *State Environmental Planning Policy No. 71 – Coastal Protection* (SEPP 71) and the *NSW Coastal Policy*; and
- the *Water Management Act 2000* (the WM Act), with respect to the protection of water sources, waterfront land, and riparian and aquatic habitats.

The following Chapters of this *Report* address those statutory matters with respect to the proposed Cullburra Golf Course, and consider the likelihood (or otherwise) of adverse impacts being imposed upon the natural environment in general and on threatened biota and/or their habitats in particular.

As discussed throughout this *Report*, the proposed Culburra Golf Course is to be constructed and managed in the long-term according to 'best practice' water quality and environmental management standards. In addition to the application of 'best practice' (and better if possible) measures for the management and quality control of stormwater discharges, and to ensure that contaminants are not discharged into the natural environment, it also needs to be recognised that the proposed activity (being a golf course) is a relatively benign development. That assessment needs to be considered by comparison particularly with the previous proposal for a substantial residential development of the subject site at Culburra.

Proper management of pesticides, fertilisers and other chemicals within the golf course (which would in any case be sensible economic practice), and the implementation of stringent water quality control measures, will result in a development of the subject site which imposes minimal (or at best no) adverse impacts upon the natural environment, other than some relatively minor clearing of native vegetation.

In addition, as discussed in detail in subsequent Chapters of this *Report*, implementation of a *Hollow-bearing Tree Protocol* which ensures the salvage, re-use and/or replacement of tree-hollows (see Chapter 17) provides further mitigation of the potential adverse impacts from the proposed golf course. As also noted, some elements of the golf course (*eg* the stormwater detention and water quality control basins, as well as areas of open grassland) will provide supplementary and/or enhanced habitat for a range of native (including threatened) species.

8 ECOLOGICAL ISSUES & CONSTRAINTS

8.1 Ecosystems and Biota

Assessment of the impacts which would or might be imposed on the natural environment by development of the Culburra Golf Course, as proposed, has taken into account both the requirements for the removal of vegetation and the amelioration of potential impacts and the implementation of environmental management measures which are integral parts of the proposal, as well as the likely impacts of the project.

The locations of elements of the golf course within the subject site, as well as specific design elements of the proposal (particularly the stormwater detention and treatment basins), have been determined *inter alia* in response to the constraints imposed by features of the natural environment on the site and in the immediate vicinity, as reflected substantially (but neither precisely nor exclusively) in the current zoning of the land.

Specific features of relevance on the subject site at Culburra and adjacent to it, which have been identified during the extensive field investigations conducted in the locality, and *inter alia* during the *1999 Long Bow Point Commission of Inquiry* (CoI), include:

- Lake Wollumboola, which is located immediately to the east and southeast of the subject site (Figures 1 and 2). Lake Wollumboola has been the subject of intensive investigations and analysis over a long period, including during the *Commission of Inquiry*, and extensive documentation of its environmental features has been prepared over a long period;
- areas of two SEPP 14 Wetlands located within and adjacent to the subject site, at the downstream ends of Downs and Wattle Creeks;
- the watercourses through the subject site, and the need for their protection from contaminants (such as might potentially be derived from a golf course);
- the presence of "*endangered ecological communities*" (EEC) on the site and adjacent to it (Figure 11). As discussed elsewhere, these communities are generally located at the edge of Lake Wollumboola and/or along the watercourses, and will be protected (in the main); and
- a range of "*threatened species*" (Chapter 6), including:
  - the Green & Golden Bell Frog, which had been recorded in 1996 in an artificial pond in the southwestern part of the subject site (Daly 1996), as well as in artificial wetlands associated within the existing urban area of Culburra and around the margins of Lake Wollumboola (see Chapter 6);
  - the presence of the Powerful Owl (including two nest trees to the north of Culburra Road in the Culburra West UEA lands, and records of previous (although not current) breeding by this species at these locations;
  - the apparent presence of Yellow-bellied Gliders (by feeding marks on trees) in forested lands to the southwest of the subject site;
  - the presence of a number of threatened microchiropteran bats on the subject site and on adjoining lands to the north, south and southwest. These species are

regularly recorded throughout the Shoalhaven LGA and in the *Jervis Bay Regional Area* (see Chapter 6), and are generally wide-ranging and highly mobile; and

- records of the Glossy Black Cockatoo throughout the subject site and the study area. As is the case with the microchiropteran bats, the Glossy Black Cockatoo is frequently recorded in the Shoalhaven LGA and the *Jervis Bay Regional Area*, and suitable habitat for this species is widespread in the immediate vicinity and locality.

The potential for adverse impacts to be imposed upon Lake Wollumboola (including its ecosystems and dependent biota), and on listed *"endangered ecological communities"* and listed *"threatened species"* has been a principal consideration in the design of the proposed Culburra Golf Course (see Chapter 8.4). These issues have long been a key focus for development possibilities in the Culburra area, and were considered at length at the *Long Bow Point Commission of Inquiry* in 1999 (see Chapter 8.3).

Given those circumstances, the proposed Culburra Golf Course has been designed with a high degree of regard to the sensitivity of Lake Wollumboola and its ecosystems, and the need to ensure protection of the natural environment at this location. The proposal seeks to achieve an appropriate balance between development opportunities (in this case for a golf course) and biodiversity conservation aspirations at a local level.

In addition to the natural features of the site, consideration of the location and nature of adjacent land uses is of relevance in generating an appropriate development design and in assessing the potential relevant considerations in this regard include:

- the proximity of the existing Culburra township to the immediate northeast of the subject site;
- the existing development of adjacent land (for community uses, aged persons, sewage treatment and industrial activities);
- the considerable extent of vegetated lands in the immediate vicinity and general locality (Figure 4) is also of relevance in assessing the likelihood and the relevance of impacts from development of the subject site; and
- the extent of conservation reserves and other protected land in the vicinity and the locality.

8.2 Impacts of the Golf Course Project

The proposed Culburra Golf Course on Long Bow Point will doubtless, both in its creation and in its ongoing operation, involve the imposition of some impacts upon the *"natural environment"* in general. However, the relevant consideration is not whether any impacts at all will be imposed, but rather whether any such adverse impacts upon the natural environment:

- are adequately ameliorated and/or managed; and
- achieve an appropriate balance between development opportunities (and in this instance the opportunity for reasonable and appropriate recreational activities for humans) and biodiversity goals and aspirations.

The Culburra Golf Course project has been designed in full cognisance of the ecological sensitivities associated with Lake Wollumboola and its associated ecosystems and biota, as well as the *ecosystems and biota on Long Bow Point. In this regard:*

- the golf course has been specifically designed (with the exception of a single/pedestrian/golf cart crossing of Downs Creek) to avoid disturbance to areas currently zoned *7(a) – Environmental Protection*, and possible "*endangered ecological communities*";
- the golf course has been located to ensure a substantial 'buffer' between any elements of the golf course and any SEPP 14 wetlands (of at least 100m);
- particular attention has been afforded to the stormwater detention and water quality management regime within and around the golf course, to ensure that there is minimal discharge of contaminants (fertilisers, pesticides or other chemicals) into the natural environment downslope or downstream of the golf course; and
- the final detail design of golf course fairways, tees and greens, and the associated infrastructure (such as golf cart paths, sand bunkers and water features) will be undertaken in consultation with a project ecologist in order to facilitate the retention of valuable elements of the natural environment wherever possible (such as significant hollow-bearing trees, glider feed trees (if present) and stands of she-oaks).

That approach to the design and associated features of the proposed Culburra Golf Course has been both cognisant of and sensitive to the potential impacts of the proposal. The project has been designed to facilitate the provision of a valuable recreational resource for people in the Shoalhaven area whilst concomitantly limiting and managing the potential adverse impacts of the golf course on the natural environment in general.

The Culburra Golf Course project (unavoidably) will require the clearing of some areas of native vegetation, including:

- approximately 33.5 hectares of extant native forest and woodland (Table 13);
- the crossing of Downs Creek at one location involving an elevated bridge for pedestrians and golf carts (as well as small maintenance vehicles) which will be designed in detail and located precisely following development consent with advice from a project ecologist;
- the creation of golf course fairways and associated features which, it should be noted, will actually provide additional habitat for some native biota; and
- the provision of an array of stormwater and water quality treatment basins, which will also provide supplementary habitat for native biota.

The proposed golf course will require the clearing of various areas of mostly xeric vegetation types (Table 13), as well as disturbance to some mesic vegetation along Downs Creek for the pedestrian and golf cart bridge crossing. As discussed below, the latter works will involve disturbance to areas of vegetation which might constitute an "*endangered ecological community*" known as the Swamp Sclerophyll Forest on Coastal Floodplains (SSFCF).

Table 13 Areas of plant communities to be removed for the Culburra Golf Course

Map Unit	Description	Area on Site hectares	To be Lost hectares	% of Total
Modified Communities				
CD	Cleared and Disturbed	19.45	6.26	32.2
Xeric Communities				
D1a	Grey Ironbark – Rough-barked Apple Open Forest	14.35	5.5	38.3
D1b	Grey Ironbark – Woolybutt Open Forest	16.7	2.21	13.2
D2	Bangalay Woodland/Open Forest	4.5	1.46	32.4
D3	Blackbutt Open Forest	77.7	15.19	19.6
D4	Bangalay – Woolybutt – Rough-barked Apple	26.18	0.06	0.2
D5	Forest Red Gum Open Forest	1.78	0	0
D6	Hard-leaved Scribbly Gum Woodland	48.84	7.4	15.2
Mesic Communities				
M1a	Swamp Oak – Eucalypt Open Forest on flats	7.6	0	0
M1b	Eucalypt - Swamp Oak Open Forest on slopes	3.44	1.05	30.5
M2a	Swamp Paperbark Closed Forest	5.64	0	0
M2b	Swamp Paperbark – Swamp Oak	6.5	0	0
M3	Swamp Oak Closed Forest	1.31	0	0
M4	Swamp Mahogany Open Forest	10.33	0	0
Wetland Communities				
W1b	Sea Rush – Twig Rush Herbland	18.56	0	0
W4	Artificial Wetland/Sedgeland	1.17	0	0

As discussed in detail in Chapter 16 of this *Report*, the adverse impacts which will be imposed upon the natural environment in general and/or on threatened biota in particular are ameliorated by:

- confining the golf course development to areas of native vegetation which are widespread and abundant in the locality and in the *Jervis Bay Regional Area*;
- avoiding or limiting impacts on ecosystems and vegetation communities of specially high conservation value;
- facilitating a final development design approach which will enable the retention of features or resources of particular biodiversity value (*eg* hollow-bearing trees, natural watercourses, glider or Glossy Black Cockatoo feed trees);
- implementing a stormwater management regime designed specifically to protect the natural environment, and the implementation of design and planting measures in the water features to provide supplementary habitat for native (including threatened) biota;
- being cognisant in the final design process of the potential for the golf course to provide

supplementary or alternative habitat for a range of native biota; and

- facilitating the dedication of areas of native vegetation within the subject site for biodiversity conservation purposes.

The potential impacts of the proposed Culburra Golf Course on relevant, or likely relevant, threatened biota, and their habitats, are considered in detail in Chapter 10 of this *Ecological & Riparian Assessment Report.*

There is little or no likelihood of adverse impacts being imposed upon the majority of the additional threatened species recorded on the Wildlife Atlas (Appendix I).

Oceanic species (such as the Wandering Albatross, Providence Petrel, Little Shearwater, Southern Right Whale and Sperm Whale) would not be affected in any way by the proposed golf course on Long Bow Point. In addition, the subject site does not support appropriate resources or habitat for the Beach Stone-curlew, Blue-billed Duck, Broad-billed Sandpiper, Great Knot, Hooded Plover or Terek Sandpiper, although individuals of some of these species could potentially utilise the mudflats in Lake Wollumboola to the south and north of Long Bow Point. These features are at least 100m from any element of the golf course, and are not to be the subject of any development activities.

The subject site *per se* is of no relevance for the Osprey, and there are no recent (or any) records of the Square-tailed Kite or Bush Stone-curlew on the site or in the vicinity. There are only extremely limited potential resources for the Turquoise Parrot, Swift Parrot, Australasian and Black Bitterns and the Osprey) on the subject lands or general vicinity. Given the substantial extent of vegetated lands contained within conservation reserves and National Parks in the immediate vicinity and general locality (Figure 9), there is no likelihood of those species being adversely affected to any significant (if any) extent as a consequence of the proposed Culburra Golf Course on Long Bow Point.

With the respect to those threatened biota which have been recorded on or which are considered highly likely to occur on the subject site at Culburra:

- no "*significant effect*" will be imposed upon any "*endangered ecological community*" (EEC) given the extremely small areas of any such possible communities which might be affected directly by the proposal, and given the stormwater management regime to be implemented;
- none of the threatened species known or likely to occur on the subject site would be the subject of a "*significant effect*", given the extent of habitat to be retained on the subject site and in the general locality, and given the approach to final design of the golf course; and
- additional impact amelioration and environmental management measures are proposed (see Chapters 16 and 17 of this *Report*) to offset any adverse impacts which may be imposed upon any such threatened biota.

8.3 Long Bow Point Commission of Inquiry

In 1996, a *Commission of Inquiry* was convened to address a proposal for substantial residential development to the west of the township of Culburra, including on Long Bow Point. The proposed development addressed by the *Commission of Inquiry* was for the subdivision and creation of a

substantial residential development on Long Bow Point, within the Lake Wollumboola catchment. Residential development was also proposed in the Crookhaven River catchment for that proposal.

The *Commission of Inquiry* determined that development on Long Bow Point should not proceed because of *inter alia*:

- perceived potential impacts on listed "*endangered*" (pursuant to the relevant legislation at the time – the *Endangered Fauna (Interim Protection) Act 1991*) fauna species; and
- the potential for adverse impacts to be imposed upon Lake Wollumboola by virtue of stormwater runoff from the proposed substantial of residential development.

The *Report* of the *Commission of Inquiry* contained *inter alia* a map prepared by the then NPWS identifying areas of alleged high conservation value or significance (Figure 15). That map had been prepared on the basis of a number of maps of vegetation and habitat or resources which had been presented to the *Commission of Inquiry* (including those by the applicant). The map (Figure 15) identified the position of the NPWS at that time (*ie* in 1999) to residential development on Long Bow Point.

The information available to the *Commission of Inquiry* (and to the NPWS and others) in 1999 has long been superseded by the investigations and data which are presented in this *Report*. The issues and concerns which were raised at the 1999 *Commission of Inquiry* have been addressed both in this *Report* and in the proposed Culburra Golf Course project by:

- a considerable increase the quantum and detail of information regarding native biota and ecosystems on the subject site and in its vicinity since 1999;
- relevant changes in legislation since 1999;
- a total change in the proposal, being now a golf course (which is a much more benign activity than a dense residential development); and
- the incorporation into the proposal of an array of impact amelioration and environmental management measures.

Given those considerations, the NPWS mapping of purported areas of 'regional conservation significance' in 1999 is of no current relevance, because:

- there are substantial additional local data which have been obtained since that date;
- the vegetation has been accurately mapped; and
- the proposal is of an entirely different nature and footprint.

8.4 Culburra Golf Course Development Philosophy

The proposed Culburra Golf Course is intended to impose minimal impacts upon the natural environment of Long Bow Point and its surrounds. The underline principles and philosophy of the Golf Course project are:

- the protection of Lake Wollumboola, and important habitats and ecosystems, by implementation of the 'best practice' stormwater management regime;

- the provision of a golf course which facilities the retention and protection of important habitat or resources (such as hollow-bearing trees, glider and Glossy Black Cockatoo feed trees);
- the facilitation of opportunities to provide supplementary habitat for native (including threatened) biota (such as ponds created as habitat for the Green & Golden Bell Frog and wading bird species); and
- the retention, to the greatest extent possible, of native vegetation between golf course fairways and throughout the golf course area to provide ongoing habitat and resources for native (including threatened) biota.

It is a basic principle of the proposed Culburra Golf Course project that every available method and measure will be implemented to avoid or minimise the imposition of adverse impacts upon the natural environments. It is also a fundamental principle of the project that the highest standards of environmental protection and water quality management will be implemented throughout the life of the project.

9 ENVIRONMENTAL PLANNING & ASSESSMENT ACT

9.1 General Considerations

As discussed in some detail above (in Chapter 8 of this *Report*), the proposed Culburra Golf Course concept has been developed and designed in full cognisance of the known and likely ecological constraints which emanate from the nature and condition of the subject site, and the surrounding 'lands' (including Lake Wollumboola). In particular, the proposal has been developed in order to minimise or avoid adverse impacts upon the natural environment in general, and particularly to limit the potential for adverse impacts to be imposed upon Lake Wollumboola and/or on threatened biota or their habitats on the subject site itself and in its immediate vicinity.

In that regard, it is relevant to note that the subject site is located at the periphery of broad and extensive tracts of native vegetation (Figure 4), including substantial areas of which have been dedicated for permanent biodiversity conservation purposes (Figure 9). Further, the subject site has been affected over many years by ongoing grazing and timber harvesting activities (Appendix A), and parts of the golf course area remain cleared and/or are dense regenerating Tick Bush and other vegetation (Figures 2 and 10).

It cannot reasonably be asserted that the proposed golf course would place any native biota "*at risk of extinction*"[6]. Indeed, it is not likely that even a "*local population*" of a single species would be threatened as a result of the proposed golf course development, given the extent of suitable habitat and the resources locality and the limited areas to be affected by the golf course in relative terms, given:

- the detailed considerations above, and particularly the golf course project design philosophy;
- the considerable extent of habitats and resources for threatened biota present in the immediate vicinity and general locality;
- the wide distribution of the relevant threatened biota in the locality;
- the nature of the project, and the retention of habitat and resources around and through the golf course; and
- the impact amelioration measures (Chapter 16) and the environmental management measures (Chapter 17) which form an integral part of the project.

9.2 Objects of the EP&A Act

The relevant "*objects*" of the EP&A Act with respect to ecological issues are:

- "*the proper management, development and conservation of natural and artificial resources for the purpose of promoting the social and economic welfare of the community and a better environment*";

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[6] The term "*extinction*" means the complete obliteration of a species, population or community, requiring that the relevant biota ceases to exist *in toto* at a location. It is not sufficient that there be some reduction in numbers of the species or the extent of habitat, but rather that the species or community can no longer survive at the location.
Relevantly, "*extinction*" does not equal 'reduction'.

- "*the promotion and co-ordination of the orderly and economic use and development of land*";
- "*the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats*"; and
- the achievement of "*ecologically sustainable development*".

The "*objects*" of the EP&A Act seek to achieve a balance between development opportunities (undertaken in an environmentally responsible manner) and biodiversity conservation. The intent of the EP&A Act is to facilitate both development and conservation, rather than to guarantee one at the expense of the other.

The proposed golf course on Long Bow Point at Culburra seeks to achieve and facilitate the "*objects*" of the EP&A Act. The project has been designed to ensure the best possible water quality controls, and golf course fairways have been located beyond the boundaries of significant habitat and/or "*endangered ecological communities*" (EECs).

Further, future detailed engineering design of the various golf holes will be undertaken on site and in consultation with a project ecologist to ensure the maximum retention of features of potential ecological significance (such as hollow-bearing trees, feed trees for Glossy Black Cockatoos and gliders *etc*). Given the nature of the proposal (being a golf course) and the ability to amend or modify fairway designs to facilitate the retention of those features, the proposal will adequately and appropriately involve "*the protection of the environment*".

By virtue of the nature of the project, and the design and the environmental features incorporated into it, the proposed Culburra Golf Course has sought to achieve the "*objects*" of the EP&A Act with respect to an appropriate balance between development and conservation. By its nature, and assuming appropriate environmental management, a golf course can be a relatively benign type of development in terms of its potential impacts upon adjoining native vegetation. In addition, it is intended that the Culburra Golf Course project provides supplementary habitat for native biota, and thus provide for "*a better environment*".

Given those considerations, the proposed Culburra Golf Course satisfies the "*objects*" of the EP&A Act, particularly with respect to:

- the conservation of biodiversity in NSW;
- the protection and conservation of native biota, including threatened biota and their habitats; and
- the achievement of "*ecologically sustainable development*" (ESD) outcomes (as discussed in detail below).

9.3 Ecologically Sustainable Development

9.3.1 The Principles of ESD

The "*objects*" of the *Environmental Planning & Assessment Act 1979* (EP&A Act), as defined in Section 5 of the Act, include *inter alia* encouragement of the application of the principles of *Ecologically Sustainable Development* (ESD) in the management and use of lands within New South Wales.

The *Protection of the Environment Administration Act 1991* (PoEA Act) states (in Section 6 of that Act) that "*ecologically sustainable development requires* ***effective integration*** *of economic* ***and*** *environmental considerations in decision-making processes*" (emphases added). The Act identifies four "*principles and programs*", the implementation of which are indicated as facilitating the achievement of ESD.

Section 6 of the PoEA Act further states that ESD "*can be achieved through the implementation of*":

- the precautionary principle - namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

  In the application of the precautionary principle, public and private decisions should be guided by:

  (i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and

  (ii) an assessment of the risk-weighted consequences of various options,

- inter-generational equity - namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations,

- conservation of biological diversity and ecological integrity - namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,

- improved valuation, pricing and incentive mechanisms - namely, that environmental factors should be included in the valuation of assets and services, such as:

  (i) polluter pays – that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,

  (ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,

  (iii) environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximize benefits or minimize costs to develop their own solutions and responses to environmental problems.

9.3.2 Discussion

It is important to acknowledge that the concept of *Ecologically Sustainable Development* (ESD) does not mean or imply a prohibition on development activities. Rather, ESD (and its underlying principles) require:

- that there be "***effective integration*** *of economic* ***and*** *environmental considerations in decision-making processes*" (emphases added);
- that appropriate 'caution' be used in the conduct of development activities; and
- that appropriate "*measures to prevent environmental degradation*" be applied.

If, as is popularly and incorrectly asserted, ESD required that no adverse impacts at all be imposed on the natural environment, then virtually no development of any sort almost anywhere would be possible. The requirements of ESD, therefore, are not that there be no adverse impacts, but that any adverse impacts which are imposed by development are minimised, as best as possible, and/or are appropriately mitigated.

The proposed Culburra Golf Course will impose some (relatively limited) adverse impacts upon the natural environment by virtue of the removal of vegetation required for creation of the golf course. However:

- the construction and ongoing use of the Culburra Golf Course does not contravene the *"precautionary principle"* because *inter alia*:
  - the proposal does not involve *"threats of* **serious** *or* **irreversible** *environmental damage"* (emphases added); and
  - the proposal has incorporated a substantial array of *"measures to prevent environmental degradation"*, in any case.

Whilst the proposal will involve the removal of some native vegetation from the subject site, those impacts are not regarded as "*serious*" given the extent of vegetation to be retained in and around the golf course, the extent of vegetation and habitats in the locality (including in the substantial conservation and other reserves) and the nature of proposal on Long Bow Point. The combination of those factors, and the considerable impact amelioration and environmental management measures which are integral parts of the proposed development are sufficient, and have been specifically designed, to avoid the imposition of "*serious ... environmental damage*".

Furthermore, the impacts which will be imposed upon the natural environment are not "*irreversible*" (whilst it is acknowledged that the removal of the golf course is not likely once approved). However, given that the impacts will not be of significance with respect to the natural environment in general or to threatened biota or their habitats in particular, the reversibility or otherwise of impacts which will be imposed is not regarded as of particular relevance or concern.

Furthermore, the proposed golf course (as discussed above):

- will involve 'best practice' (and/or better) stormwater quality control measures to ensure that contaminants are not discharged into the natural environment;
- has set the development back from Lake Wollumboola and important ecosystems and habitats to ensure that they are adequately 'buffered' and protected;

- involves implementation of the *Hollow-bearing Tree Protocol* to ensure that there is no net loss of tree-hollows as a result of the proposal;
- will provide supplementary habitat and resources (including areas of open grassland for foraging by kangaroos and other herbivores, and additional wetland habitats for amphibians and wading birds); and
- will involve the implementation of a dedicated *Vegetation Management Plan* (VMP) to ensure that habitats and resources for native biota (particularly threatened species) are retained, maintained and/or enhanced.

Given all of those circumstances, the proposed Culburra Golf Course satisfies the requirements of ESD, including the "*Precautionary Principle*".

9.4 Section 79C of the EP&A Act

As noted above, the proposed development of the subject site will unavoidably involve the imposition of some adverse impacts upon the "*natural environment*". The site is largely (although not completely) covered by native forest, woodland and wetland vegetation, and development of the site for the golf course will require the removal of some vegetation, and the displacement or loss of fauna from the development areas on the site.

However, the vegetation and the biota present within the proposed golf course area on Long Bow Point are broadly distributed in the locality and region. The plant communities which are predominantly to be affected are of generally lower conservation value relative to other vegetation on the site given *inter alia* their abundance in the locality and region, and the extent of their representation in the considerable conservation reserves in the locality and region.

The majority of the significant and sensitive plant communities and areas of vegetation on the subject site have been identified for retention and protection in the development design for the Culburra Golf Course. Those plant communities and ecosystems which have been identified as of the highest conservation value (*ie* those listed as "*endangered ecological communities*" on the TSC Act) are essentially to be avoided in the proposed golf course development.

The impacts which will be imposed by development of the site as proposed are regarded as acceptable and appropriate given:

- the extent of those plant communities and ecosystems which are to be affected throughout the locality and region;
- the relatively small area of land to be affected compared to the total size of the subject site and the extent of vegetation in the locality;
- the concentration of development activities within the most common plant communities, and those of the lowest conservation significance (by reference to the TSC Act); and
- the protection of substantial areas of native vegetation in the vicinity.

The proposed development provides for an appropriate balance between urban development requirements (including the reasonable expectations for recreational facilities for the local population)

and biodiversity conservation goals and aspirations, in respect of the relevant considerations pursuant to the EP&A Act.

10 SECTION 5A ASSESSMENTS of SIGNIFICANCE

10.1 The Statutory Regime

The *Threatened Species Conservation Act 1995* (TSC Act) has modified the *Environmental Planning & Assessment Act 1979* (EP&A Act) by, *inter alia*, including a requirement to determine "*whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats*". The relevant factors of Section 5A of the EP&A Act "*must be taken into account*" by a consent or determining authority when considering a *Development Application*, and in administering Sections 78A, 79B, 79C, 111 and 112 of the EP&A Act, as relevant.

The *Threatened Species Amendment Act 2003* (TSAA Act) has *inter alia* amended Section 5A of the EP&A Act, and replaced the factors which "*which must be taken into account*" in determining whether or not there is "*likely*" to be a "*significant effect*" imposed upon any "*threatened species, populations or ecological communities, or their habitats*".

10.2 Basis for the Assessment

The likelihood or otherwise of a "*significant effect*" being imposed upon threatened biota or their habitats as a result of the subsequent development of the Culburra Golf Course, as currently proposed, needs to be considered in a regional[7] and local context. In that regard:

- there are substantial areas of native forest and other relevant habitats present around the subject site at Culburra; and
- there are substantial resources present in those lands for the relevant threatened biota (including extensive areas of lake and river habitats and foreshores, substantial numbers of hollow-bearing trees throughout the forested lands to the south and southwest of the subject site, and a range of wetlands and other resources); and
- there are considerable tracts of the relevant vegetation types, habitats and resources in the extensive conservation reserves in the locality and *Jervis Bay Regional Area.*

Furthermore, consideration of the likelihood or otherwise of a "*significant effect*" being imposed upon any "*threatened species*" or "*endangered ecological communities*" as a result of the proposed Culburra Golf Course project is predicated *inter alia* on:

- the extent of vegetation to be reserved in the locality;
- in particular with respect to "*endangered ecological communities*", the retention of the majority of those communities on the subject site and in the immediate vicinity;
- the extremely low likelihood of any "*viable local population*" of any threatened species, or the "*local occurrence*" of any "*endangered ecological community*", being "*placed at risk of **extinction***"[8] (emphasis added). In this regard, it is critical to note that a reduction in the

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[7] The "*region*" is defined for this *Report* as the *Jervis Bay Regional Area*.

[8] The term "*extinction*" means the complete obliteration of a species, population or community, requiring that the relevant biota ceases to exist *in toto* at a location. It is not sufficient that there be some reduction in numbers of the species or the extent of habitat, but rather that the species or community can no longer survive at the location.

extent of or in the numbers of, or in the extent of habitat of, threatened biota cannot be regarded as representing a threat of a "*risk of* ***extinction***" (emphasis added);

- the retention in the vicinity of habitat and resources for all of the relevant threatened biota which have been recorded on the subject site or which could reasonably be expected to occur on occasions;
- the small number of individuals of any species which would be likely to be affected by the proposed development (again given the extent of suitable habitat in the vicinity and locality);
- the extent of habitat in the locality which would provide for the viability and survival of any "*viable local population*" any and all of the relevant threatened fauna and flora species; and
- the mobility of most of the threatened fauna species of relevance.

10.3 Recorded Threatened Biota

As discussed in considerable detail in Chapters 5 and 6 of this *Report*, two *"endangered ecological communities"* (EECs) and eleven *"threatened species"* listed in the TSC Act have been recorded on or In the immediate vicinity of the Culburra Golf Course site during the various investigations undertaken over the last 17+ years. An additional ten threatened species have been recorded in reasonably close proximity to the subject site, and there is potentially suitable habitat and resources for most of those species either within the subject site itself or in close proximity to it (Appendix I).

All of those threatened biota recorded on or immediately adjacent to the site have been the subject of detailed *Section 5A Assessments of Significance* (Appendix J) in respect of the Culburra Golf Course project. In considering the likelihood or otherwise in a *"significant effect"* to be imposed upon by those biota, the considerations described above (in Chapter 10.2) have been applied, particularly in respect of the distribution of potentially suitable habitat and the extent of habitat to be affected by the proposed golf course.

The proposed Culburra Golf Course has been designed specifically *inter alia* to avoid and to protect most areas of even possible "*endangered ecological communities*" (EECs) on the subject site. All of the EECs on the edges of Lake Wollumboola will be located at least 100m from any element of the golf course. There are only two areas where possible EECs will be affected:

- at the upper end of Downs Creek, where a small pedestrian/golf cart bridge is to be constructed across the creek through an area which has been identified as possibly being the SSFCF community; and
- on lower slopes on the northern side of Lake Wollumboola, along the lower parts of Wattle Creek, where vegetation with at least the floristic characteristics of the SSFCF community are located. At this location, however, most of this vegetation is located above any potential "*floodplain*", and the areas of Eucalypt – Swamp Oak Open Forest (Community M1b) on the slopes are not regarded as the SSFCF community.

Of critical importance and relevance, the proposed development of the Culburra Golf Course will also involve the implementation of a substantial water management regime which is intended to protect any

EECs located downslope or downstream of the golf course. Given those circumstances, the proposal is not "*likely*" to involve the imposition of a "*significant effect*" upon any EEC (Appendix J).

Most of the threatened fauna species known to occur on the subject site are moderately to highly wide-ranging and highly mobile, and/or occupy large home ranges. Given those circumstances, and given the nature of the subject site and of vegetation proposed to be removed for the Culburra Golf Course, it cannot be regarded as likely (or even possible) that the areas proposed for development activities would be necessary for the survival of a *"viable local population"* of any such species.

Resources and habitats of relevance will be retained in the long-term on the subject site, and there are considerable of suitable habitats and resources in the immediate vicinity and general locality. Many of those areas of habitat are contained within National Parks, and will consequently be protected in the long-term.

Given those considerations, it is not considered likely, or even possible, that a *"viable local population"* of any such species would be dependent solely upon those portions of the subject site proposed for development activities. As a consequence, it is not *"likely"* that a *"significant effect"* would be imposed upon any such species (Appendix J).

Several of the threatened fauna species known to occur on the subject site or in its immediate vicinity (particularly the Green & Golden Bell Frog) are more sedentary, or occupy smaller or more confined home ranges. With respect to those threatened species, however, the areas proposed for development activities do not constitute significant (or even relevant) current habitat. It cannot be regarded as likely that a *"viable local population"* of those species would be confined to or dependent upon those areas of the subject site proposed for the Culburra Golf Course project. Indeed, with respect to the Green & Golden Bell Frog, the proposal involves the creation of additional habitat (in the water quality basins and detention ponds) for that species.

Given those considerations, there is no likelihood of a *"significant effect"* being imposed upon any such threatened species (Appendix J).

10.4 Other Threatened Biota

An array of additional threatened fauna species could potentially occur on the subject site at Culburra, and there is the possibility of (albeit despite investigations over 17 years no evidence for) some threatened plant species to be present (see Chapter 5). Consideration of the potential for such species to occur on the subject site, and of the likely relevance of habitat to be affected by the proposal on the subject site, is provided in Appendix I of this *Report*.

Whilst there is some (generally limited) potential for some of the additional threatened fauna species identified in this *Report* to occur on the subject site on occasions at least, it is not particularly likely that even individuals of such species are in fact present. As noted below, there are substantial areas of suitable habitat on the subject site, in the vicinity and in the general locality for such species, and it cannot reasonably be assumed that even individuals of any such species (even if present) would be confined to or dependent upon the subject site at Culburra.

With respect to those additional threatened species, it is relevant to note that:

- the subject site does not provide habitats or resources which are unique in the local

environment or confined to the subject site;

- there are extensive areas of similar or identical vegetation communities, habitats and resources in the immediate vicinity and general locality;
- substantial areas of such resources, habitats and ecosystems are contained within the extensive National Parks and other reserves in the immediate vicinity and general locality; and
- it cannot reasonably be assumed that a "*viable local population*" of any such species, even if present, would be confined to either the "*subject site*" or, more relevantly, to the areas proposed for the Culburra Golf Course project.

The *Assessment of Significance* contained below, prepared pursuant to Section 5A of the EP&A Act, deals with those threatened biota which could theoretically or potentially occur on the subject site (including the Koala). It considers the potential for impacts to be imposed upon any threatened biota which might occur on the subject site or in the immediate vicinity, including generally wide-ranging threatened fauna which may visit the subject site on occasions or on a seasonal basis.

This *Section 5A Assessment of Significance* considers the potential impacts on such biota:

- on the basis that they may be present either seasonally or occasionally; and/or
- on the basis that a "*viable local population*" could potentially (theoretically) be present within the subject site, and/or
- on the basis that, if present, any such species would be present in and utilising both the subject site and other areas of suitable habitat in the vicinity.

Factor a Threatened Species – Risk of Extinction

Whilst a number of additional threatened fauna species could certainly be present on the subject site at Culburra (see Chapter 6), and individuals or populations of some threatened plants could theoretically be present (despite the lack of any evidence to date), it cannot reasonably be asserted or assumed that populations of any such species would be confined either to the subject site *in toto* or (relevantly) to that area of the subject site proposed for the Culburra Golf Course project.

The soils, vegetation and landscape elements of Long Bow Point are not unique to the subject site. Nor are the resources or habitats within either the "*subject site*" generally or the proposed golf course itself unique to the site or the locality. In the event that it is assumed that any of the additional threatened species are present on the subject site, it must also be assumed that they are distributed throughout all of the suitable habitat which is present in the locality.

Given those considerations, the removal of some vegetation from the subject site could not be regarded as likely to be significant in terms of the "*life cycle*" of a "*viable local population*" of any of those possible threatened biota. It cannot reasonably be assumed that any such species, even if present, would be confined either to the subject site *in toto* or to those parts of the subject site proposed for the Culburra Golf Course development.

As discussed in detail above, there have been no records of any threatened plant species from the subject site, despite a range of dedicated investigations over a period of 17 years by a number of

ecological experts. Even if individuals or populations of some threatened plant species did occur on the subject site, it cannot reasonably be assumed that they would be confined to those areas proposed for the Culburra Golf Course. If indeed any such species are present, the only reasonable assumption is that they occur widely across the site, and are likely to occur through a range of other vegetated lands in the immediate vicinity and general locality.

There are two groups or types of additional threatened fauna that could utilise those parts of the subject site proposed for the golf course:

- highly mobile and wide-ranging species - which could utilise the site either on an occasional basis or on a seasonal basis (such as the Square-tailed Kite, Osprey and other threatened birds); and
- more sedentary species (such as the White-footed Dunnart).

With respect to the former group of species, relevant considerations include:

- the small extent of the subject site and of its potentially relevant habitat compared to the extent and availability of such habitat in the immediate vicinity and general locality;
- the extent of suitable habitat contained in the substantial conservation reserves and State Forests in the general locality; and
- the high mobility of these species and their wide-ranging habits, with most species being seasonally migratory and/or occupying very large home ranges.

Given all of those considerations, there is no likelihood that the subject site in isolation would provide essential resources or habitat for a "*viable local population*" of any such species. Indeed, it is not likely that even an individual of any such species would be reliant or dependent upon the habitats and resources present within the area of the proposed golf course on the subject site.

With respect to the more sedentary species, it cannot reasonably be assumed that a "*viable local population*" of any such species would be restricted or confined to the subject site, or move particularly to those parts of the site proposed for the golf course development, in isolation. The site contains habitats and resources which are typical of vegetation throughout the immediate vicinity and general locality, and any "*viable population*" of any such species would doubtless be distributed throughout those areas of habitat.

It is, in fact, a requirement of the DECC 2005 *Assessment Guidelines for Threatened Species* that where habitat for a threatened species is present, it "*must*" be assumed that the species is also present. That approach is adopted in this *Report* with respect to the considerable extent of potentially suitable habitat for those threatened species in the immediate vicinity and general locality.

It is not likely that a "*viable local population*" of any of the potential additional threatened fauna species would be dependent on the subject site, either in isolation or as a significant element in a broader area of habitat. Given the considerations discussed above, it is not likely that a "*viable local population*" of any "*threatened species*" would be "*placed at risk of* ***extinction***"[9] (emphasis added) as a consequence of the proposed Culburra Golf Course project.

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[9] The term "*extinction*" means the complete obliteration of a species, population or community, requiring that the relevant biota ceases to exist *in toto* at a location. It is not sufficient that there

Factor b Endangered Populations – Risk of Extinction

The TSC Act defines an "*endangered population*" as "*a population specified in Part 2 of Schedule 1*" of the Act.

There is no "*endangered population*" of any species likely to occur or be present on the subject site at Culburra or in the immediate locality, or to be dependent on any of the resources which would be affected.

Factor c Endangered Ecological Communities – Risk of Extinction

The TSC Act defines an "*endangered ecological community*" (EEC) as "*a community specified in Part 3 of Schedule 1*" of the Act.

The relevant "*endangered ecological communities*" on the subject site have been addressed separately (Appendix J).

Factor d Impacts on Habitat for Threatened Biota

The subject site at Culburra is not regarded as containing "*significant*" or "*important*" habitat or resources for any of the additional threatened flora or fauna species which could potentially occur, given:

- the modified nature of much of the vegetation on the subject site in the vicinity of the proposed Culburra Golf Course, as a consequence of long-term timber harvesting and agricultural activities;
- the extent of native vegetation and potential threatened species habitat to be retained on the subject site itself;
- the considerable extent of native vegetation and habitats of potential relevance to any such threatened biota in the immediate vicinity and general locality, including substantial areas contained in conservation reserves for biodiversity conservation purposes in perpetuity; and
- the connectivity between vegetation on the subject site and that in adjoining areas.

The proposed Culburra Golf Course will only remove a small area of native vegetation relative to that which is present in the immediate vicinity and general locality. It cannot reasonably be assumed that any threatened species would be reliant or dependent solely upon those areas proposed for the golf course for their long-term survival in this general locality.

The proposed Culburra Golf Course project is not likely to result in the removal or modification of significant areas of potential habitat for any threatened species – Factor (d)(i). Whilst the proposal

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be some reduction in numbers of the species or the extent of habitat, but rather that the species or community can no longer survive at the location.

Relevantly, "*extinction*" does not equal 'reduction'.

does involve the removal of native vegetation (albeit some of it already modified and disturbed), the areas of vegetation and habitats to be affected by the proposal:

- are not likely to be of any particular relevance or significance for any threatened species in isolation;
- are not unique to the subject site;
- the habitats and resources present, and the vegetation types and ecosystems within the subject site which are to be affected by the proposal, are not restricted either to the subject site itself or in respect of the distribution of those resources and ecosystems through the landscape; and
- the areas of vegetation to be removed constitute only a small proportion of potentially suitable habitat in the locality and region for any of the additional threatened biota that could possibly occur on the subject site.

The proposed Culburra Golf Course project is not likely to result in any habitat for any threatened species becoming "*fragmented or isolated from other areas of habitat*" – Factor (d)(ii), given:

- the proximity of the existing township of Culburra to the immediate northeast;
- the presence of Lake Wollumboola to the immediate east and southeast;
- the proposed retention of a 100m-150m wide band of vegetation around Long Bow Point, adjacent to Lake Wollumboola;
- the connectivity of the subject site to the substantial and extensive vegetated lands to the west and southwest;
- the retention of significant areas of vegetation and relevant habitats on the subject site; and
- the high mobility of most of the potentially relevant threatened fauna species.

As discussed above, the proposed Culburra Golf Course development is not likely to result in disturbance to 'important' or 'significant' habitat for any additional threatened fauna or flora species, even if individuals or any such species are present on the site – Factor (d)(ii). In this regard:

- only a very small area of potential habitat or resources would be removed by the proposed golf course;
- potentially relevant habitat and resources (such as hollow-bearing trees) are to be preferentially retained, and/or salvaged and re-used;
- there are substantial suitable habitats and resources for all of the potentially relevant threatened biota in the extensive vegetated lands to the south and west of the subject site;
- habitat and resources for wetland or wading species that could potentially occur on the subject site are to be protected and retained, and/or will be protected by the substantial 'buffer' between the golf course and Lake Wollumboola;
- the extensive areas of habitat contained in the substantial conservation reserves in the vicinity and locality will facilitate the survival of any threatened biota that could potentially utilise the subject site; and

- most of the threatened species that could potentially occur on the subject site are highly mobile and wide-ranging.

Factor e Critical Habitat

The subject site does not represent listed "*critical habitat*" for any threatened biota.

Factor f Recovery Plans and Threat Abatement Plans

There are no relevant *Recovery Plans* or *Threat Abatement Plans* which relate to any of the additional threatened biota or the "*Key Threatening Processes*" of potential relevance to the subject site at Culburra.

Factor g Key Threatening Processes

The "*clearing of native vegetation*" is listed as a "*key threatening process*" in the TSC Act, as is the "*removal of dead wood and dead trees*" and the "*loss of hollow-bearing trees*".

The proposed Culburra Golf Course will doubtless involve the *"clearing of native vegetation"*, with much of the area to be occupied by the proposed golf holes being extant (albeit variously disturbed) woodland or open forest. Some of the areas to be occupied by the golf course, however, had previously been cleared and are either open grassland or areas of dense regenerating Tick Bush. These areas are not regarded as of conservation value or significance.

In addition, many of the areas of open woodland and open forest on the site had long been the subject of timber harvesting and/or long-term grazing, and consequently have been somewhat modified over a long period (Appendix A).

The proposal will also likely involve the *"removal of dead wood and dead trees"* and the "*loss of hollow-bearing trees*". However, both of those "*key threatening processes*" will be ameliorated by:

- the collection of dead wood and its use in areas of retained vegetation around the golf course area;
- the re-use of dead wood and dead trees in areas to be rehabilitated; and
- implementation of the *Hollow-bearing Tree Protocol* (Chapter 17), which is designed to salvage tree-hollows and to re-deploy them in areas of retained vegetation, and/or to provide supplementary artificial nest boxes to replace any tree-hollows that cannot be salvaged.

Given those approaches to the golf course development, only very limited and immediate[10] loss of hollow-bearing trees and/or dead wood or dead trees will occur as a result of the proposed Culburra Golf Course. As a consequence, the potential for those "*key threatening processes*" to impose significant impacts upon any threatened biota will be extremely limited.

[10] Immediate – *ie* highly local.

Notwithstanding the required loss of "*native vegetation*", as well as some dead wood and a few dead trees, and a very few hollow-bearing trees, the proposed activity (as discussed in detail above) is not considered "*likely*" to involve the imposition of "*significant effect*" upon any threatened biota. In this regard it is not considered likely that any threatened species would be "*placed at risk of extinction*", notwithstanding the imposition of those "*key threatening processes*" within the subject site.

Indeed, it is not considered likely that any threatened biota would be adversely affected to any relevant extent by the proposal.

The reasons for that conclusion are *inter alia*:

- the very small area of vegetation removal required for the proposal with respect to the extent of "*native vegetation*" in the immediate vicinity and locality;
- the availability of extensive additional areas of suitable habitat for all of the potentially relevant threatened biota in the immediate vicinity and general locality;
- the substantial extent of suitable habitat and resources for those threatened biota within the extensive conservation reserves and State Forests in the general locality;
- the high mobility and wide-ranging habits of most of the relevant or potentially relevant threatened fauna species;
- the likely distribution of any "*viable local population*" of any such species at this general location, including within the extensive areas of potentially suitable habitat in the vicinity; and
- the implementation of the impact amelioration and environmental management measures contained in this *Report* (Chapters 16 and 17), including the *Hollow-bearing Tree Protocol,* and in other relevant *Reports.*

There are a number of other "*key threatening processes*" that would theoretically or potentially be imposed and/or exacerbated by the proposed development of the Culburra Golf Course. There is already significant infestation by Bitou Bush and Lantana on the subject site, and (in the absence of any appropriate management measures) those infestations could potentially increase. Similarly, invasion by introduced grasses could potentially (or at least theoretically) be exacerbated by the proposed activity.

Conversely, the construction of the Culburra Golf Course and its future management, and management of the retained areas of vegetation on the subject site, could actually decrease those "*key threatening processes*". It is an assumption of this *Report* that retained vegetation around the golf course would be the subject of a comprehensive *Vegetation Management Plan* (VMP) which would be designed *inter alia* to remove those introduced plant species, and to reduce the effects of Bitou Bush, Lantana and other introduced weeds. The Culburra Golf Course project, therefore, has the potential to reduce the impact of those "*key threatening processes*", rather than to exacerbate those processes.

Similar considerations apply to "*key threatening processes*" associated with the European Red Fox, European Rabbit and Feral Cat. It is not inherently likely that a golf course would exacerbate those "*key threatening processes*". Further, the long-term management of the subject site pursuant to a VMP and for the purposes of managing the golf course would facilitate opportunities to reduce the impacts of those introduced fauna species.

Given all of the considerations detailed above, it is not likely that the proposed development of the Culburra Golf Course on Long Bow Point would involve the imposition or exacerbation of any "*key threatening process*" to the extent of threatening the survival of any threatened biota. It is not likely that the activities associated with the Culburra Golf Course would impose any "*key threatening process*" to the extent that it represented a threat to the survival of a "*vial local population*" of any such species, or would place any such population (if present) "*at risk of extinction*".

10.5 Conclusions

Given the considerations outlined above, the proposed development on the subject site for the Culburra Golf Course is not considered "***likely***" (emphasis added) to impose a "***significant effect***" (emphasis added) upon any "*threatened species, populations or ecological communities, or their habitats*", pursuant to Section 5A of the EP&A Act.

Even if some additional threatened biota (beyond those known to be present) do use the subject site, it is not likely that the vegetation to be affected by the Culburra Golf Course would support a "*viable local population*" of any such biota in isolation. It is not likely that any such "*population*", nor indeed any individuals of any such species, would be dependent or reliant solely (or to any relevant extent) on that portion of the subject site proposed for the golf course activities, even if individuals of some such threatened do occur on the site.

In this regard, it is relevant to note:

- parts of the subject site are already modified and/or highly disturbed, and do not constitute relevant or special habitat for any threatened biota;
- the extent of native vegetation containing relevant habitats or resources to be removed by the proposed Culburra Golf Course project is small, particularly with respect to other areas of similar vegetation in the immediate vicinity and general locality;
- there are substantial areas of suitable habitat for the potentially relevant threatened biota within the extensive National Parks and State Forests in the general locality and region;
- most of the potentially relevant threatened fauna species are highly mobile and wide-ranging and/or occupy substantial home ranges;
- there is no likelihood that a "*viable local population*" of any threatened flora or fauna species would be present solely within or confined to the development area on the subject site, given the proximity of suitable and appropriate habitat and resources; and
- the subject site does not contain habitats or resources which are restricted in nature or confined to the subject site in even their local distribution.

There is no requirement for the preparation of a *Species Impact Statement* (SIS) for the proposed Culburra Golf Course.

11 STATE ENVIRONMENTAL PLANNING POLICY NO. 14 – COASTAL WETLANDS

State Environmental Planning Policy No. 14 – Coastal Wetlands (SEPP 14) aims "*to ensure that the coastal wetlands* [of NSW] *are preserved and protected in the environmental and economic interests of the State*". The Department of Planning (DoP) maintains a series of maps which identify the Coastal Wetlands of NSW pursuant to SEPP 14. The SEPP notes that the "*Policy relates to the land outlined by the outer edge of the heavy black line on the map*".

The *Coastal Wetlands Policy* establishes that the clearing, draining, filling or constructing of a levee on an SEPP 14 Coastal Wetland shall not be undertaken "*except with the consent of the Council and the concurrence of the Director*" of the Department. The *Policy* also identifies, in Clause 7(2), those matters which must be taken into consideration by the Director-General in determining whether or not to grant concurrence to works within an SEPP 14 Wetland, including *inter alia*:

- "*the environmental effects of the proposed development*" on native biota and on the salinity and water quality of surrounding areas;
- whether the development would "*be consistent with the aims of this Policy*"; and
- the adequacy of "*safeguards and rehabilitation measures .. to protect the environment*".

There are two SEPP 14 Wetlands located close to or (in part within) the Culburra Golf Course site (Figure 16):

- Wetland No. 364, located at the entrance of Wattle Creek into Lake Wollumboola, northeast of the proposed golf course; and
- Wetland No. 343, located at the entrance of Downs Creek into Lake Wollumboola, south and southeast of the golf course.

It is important to note with respect to SEPP 14 that there is no 'requirement' in the *Policy* for any setbacks from or buffers to SEPP 14 Wetlands.

Further, importantly (indeed crucially), the design of the proposed Culburra Golf Course is predicated upon appropriate stormwater capture, treatment and management in order to prevent the imposition of adverse impacts upon the natural environment (including SEPP 14 Wetlands). Stormwater controls and water quality management are considered a critical and crucial element of the Culburra Golf Course project, given the sensitivity of elements of the landscape (including the SEPP 14 Wetlands and Lake Wollumboola) to water quality and stormwater flow discharges.

The northern SEPP 14 Wetland (No. 364) is located partly on the subject site, in the 7(a) – zoned land to the northeast of the proposed golf course. There are no proposed golf course holes, fairways or other infrastructure closer than about 40m from that wetland.

SEPP 14 Wetland No. 343, located to the southeast of fairways 10 and 11, is also predominantly (but not entirely) contained within the 7(a) – zoned land at the base of the Downs Creek. However, part of that SEPP 14 Wetland (as mapped), along its northeastern boundary (Figure 10), is actually located on a slope with one or two xeric vegetation types (Blackbutt Open Forest and Bangalay-Woolybutt-Rough-barked Apple Open Forest). That portion of the SEPP 14 Wetland abuts (or may slightly overlap) fairway No. 10, which is located close to the zone boundary.

It is noted that that discrepancy may (in part at least) be a simple mapping mis-alignment. Further, as noted above, that part of the mapped SEPP 14 Wetland which does or may encroach into or close to fairway No. 10 involves an area of xeric forest, and is not in fact a wetland at all.

The proposed Culburra Golf Course has been designed and is to be managed specifically *inter alia*:

- to avoid direct impacts upon any SEPP 14 wetlands;
- to avoid the clearing of vegetation in the immediate vicinity of SEPP 14 wetlands;
- to contain and manage stormwater runoff from the golf course post-development so as to maintain existing hydrological regimes; and
- to ensure the capture and treatment of all stormwater runoff from golf course elements to ensure that no contaminants (pesticides, fertilisers or other chemicals) are discharged from the golf course into any SEPP 14 wetlands.

12 STATE ENVIRONMENTAL PLANNING POLICY NO. 44 – KOALA HABITAT

State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44) has as its aims:

> "*to encourage to proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline*".

The aims of SEPP 44 are to be achieved:

- "*(a) by requiring the preparation of Plans of Management before development consent can be granted in relation to areas of core koala habitat*";
- "*(b) by encouraging the identification of areas of core koala habitat*"; and
- "*(c) by encouraging inclusion of areas of core koala habitat in environmental protection zones*".

The *Policy* establishes a process for determining whether or not a *Koala Plan of Management* (KPoM) is required for a proposed development activity, and the circumstances under which development consent may be granted by a Council to a *Development Application* for works on land which has been identified as "*core koala habitat*".

The *Policy* also provides relevant definitions including:

- *Potential Koala Habitat* –

  "*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*".

- *Core Koala Habitat* –

  "*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*".

There are no records of Koalas on the subject site or in the locality.

Further, Long Bow Point (and indeed the whole "*study area*") does not constitute "*potential koala habitat*" pursuant to SEPP 44, as the Koala food trees listed in the *Policy* do not constitute "*at least 15% .. of the tree component*". As a consequence, the "*subject site*" does constitute "*potential Koala habitat*".

As noted above, there are no recent records of Koalas on the subject site or in the locality. There is no evidence of a "*resident population of koalas*", and there have been no "*recent sightings of and historical records of a population*" in the study area at Culburra. On that basis, the subject site and the subject lands do not constitute an area of "*core koala habitat*" pursuant to SEPP 44.

Given that conclusion, and irrespective of whether parts or even all of the subject site could theoretically constitute "*potential koala habitat*", there is no requirement for the preparation of a *Koala Plan of Management* pursuant to SEPP 44 in respect of the Culburra Golf Course.

13 STATE ENVIRONMENTAL PLANNING POLICY NO. 71 – COASTAL PROTECTION

13.1 Aims of SEPP 71

State Environmental Planning Policy No. 71 – Coastal Protection (SEPP 71) is intended to assist in the protection and management of the NSW coast. The aims of SEPP 71 (as expressed in clause 2 of the *Policy*) are:

(a) to protect and manage the natural, cultural, recreational and economic attributes of the New South Wales coast, and

(b) to protect and improve existing public access to and along coastal foreshores to the extent that this is compatible with the natural attributes of the coastal foreshore, and

(c) to ensure that new opportunities for public access to and along coastal foreshores are identified and realised to the extent that this is compatible with the natural attributes of the coastal foreshore, and

(d) to protect and preserve Aboriginal cultural heritage, and Aboriginal places, values, customs, beliefs and traditional knowledge, and

(e) to ensure that the visual amenity of the coast is protected, and

(f) to protect and preserve beach environments and beach amenity, and

(g) to protect and preserve native coastal vegetation, and

(h) to protect and preserve the marine environment of New South Wales, and

(i) to protect and preserve rock platforms, and

(j) to manage the coastal zone in accordance with the principles of ecologically sustainable development (within the meaning of section 6 (2) of the *Protection of the Environment Administration Act 1991*), and

(k) to ensure that the type, bulk, scale and size of development is appropriate for the location and protects and improves the natural scenic quality of the surrounding area, and

(l) to encourage a strategic approach to coastal management.

The proposed Culburra Golf Course satisfies the aims of SEPP 71 by virtue of the nature of the project (being a golf course) and by virtue of the setbacks from Lake Wollumboola and its associated ecosystems as a consequence of the 7(a) – zoned conservation land around the margins of the Lake. In addition, as discussed in detail in other parts of the *Report*, the stormwater management and treatment regime proposed for the Culburra Golf Course is designed *inter alia* to prevent the discharge of significant contaminants into the Lake and into watercourses which drain into it.

With respect to the specific aims of SEPP 17, the proposed Culburra Golf Course project:

(a) protects the natural attributes of the coast at this location, whilst also providing for appropriate recreational and economic attributes on the subject site;

(b) will facilitate "*existing public access to and along coastal foreshores*" around Lake Wollumboola;

(c) could provide "*new opportunities for public access to and along coastal foreshores*", dependent upon approval of the golf course and co-operation with Shoalhaven City Council;

(d) will have no impact upon any "*aboriginal cultural heritage*" or any "*aboriginal places, values, customs, beliefs and traditional knowledge*";

(e) will maintain "*vision amenity*" by virtue of the nature of the proposal itself (*ie* a golf course) and by virtue of the substantial band of vegetation which will remain between the golf course and the Lake;

(f) will have no adverse impacts at all on "*beach environments and beach amenity*";

(g) will "*protect and preserve native coastal vegetation*" in the broad 7(a) – zoned land around the edge of Lake Wollumboola;

(h) will not have any adverse impact upon "*the marine environment of NSW*";

(i) will not have any impact upon "*rock platforms*";

(j) satisfies the "*principles of ecologically sustainable development*" (see Chapter 9.3);

(k) proposes a "*type, bulk, scale and size of development*" that is entirely "*appropriate for the location*". The proposed Culburra Golf Course has been designed *inter alia* to protect and improve (by weed removal in and around the golf course) "*the natural scenic quality of the surrounding area*"; and

(l) constitutes an appropriate element of a "*strategic approach to coastal management*" by providing a recreational facility in an area which will not involve significant environmental damage or vegetation removal, and which provides a resource which is currently unavailable in the vicinity.

13.2 Matters for Consideration

Clause 8 of SEPP 71 sets out the "*matters for consideration*" for a consent authority with respect to any development to which SEPP 71 and/or the Coastal Policy applies, which are:

(a) the aims of this Policy set out in clause 2,

(b) existing public access to and along the coastal foreshore for pedestrians or persons with a disability should be retained and, where possible, public access to and along the coastal foreshore for pedestrians or persons with a disability should be improved,

(c) opportunities to provide new public access to and along the coastal foreshore for pedestrians or persons with a disability,

(d) the suitability of development given its type, location and design and its relationship with the surrounding area,

(e) any detrimental impact that development may have on the amenity of the coastal foreshore, including any significant overshadowing of the coastal foreshore and any significant loss of views from a public place to the coastal foreshore,

(f) the scenic qualities of the New South Wales coast, and means to protect and improve these qualities,

(g) measures to conserve animals (within the meaning of the *Threatened Species*

Conservation Act 1995) and plants (within the meaning of that Act), and their habitats,

(h) measures to conserve fish (within the meaning of Part 7A of the *Fisheries Management Act 1994*) and marine vegetation (within the meaning of that Part), and their habitats

(i) existing wildlife corridors and the impact of development on these corridors,

(j) the likely impact of coastal processes and coastal hazards on development and any likely impacts of development on coastal processes and coastal hazards,

(k) measures to reduce the potential for conflict between land-based and water-based coastal activities,

(l) measures to protect the cultural places, values, customs, beliefs and traditional knowledge of Aboriginals,

(m) likely impacts of development on the water quality of coastal waterbodies,

(n) the conservation and preservation of items of heritage, archaeological or historic significance,

(o) only in cases in which a council prepares a draft local environmental plan that applies to land to which this Policy applies, the means to encourage compact towns and cities,

(p) only in cases in which a development application in relation to proposed development is determined:

  (i) the cumulative impacts of the proposed development on the environment, and

  (ii) measures to ensure that water and energy usage by the proposed development is efficient.

As is the case with the aims of the SEPP 71, the proposed Culburra Golf Course project appropriately addresses the "*matters for consideration*" of the *Policy*.

With respect to the "*matters for consideration*" contained in SEPP 71, the proposed Culburra Golf Course:

(a) satisfies the aims of the *Policy* (see Chapter 13.1);

(b) could readily facilitate "*public access to and along*" the Lake Wollumboola foreshore (DoP);

(c) has the capacity "*to provide new public access to and along the coastal foreshore for pedestrian and persons with disability*";

(d) is an entirely appropriate development type given the nature of the site and its environs, the nature of the project, and the design of the golf course and its water management features;

(e) will not involve "*any detrimental impact ... on the amenity of the coastal foreshore*". In this regard, the proposal is a golf course which will be located at some distance from the foreshores of Lake Wollumboola. There is no potential for any "*overshadowing of the coastal foreshore*", and there will be no "*loss of views from a public place to the coastal foreshore*" as a result of the proposal;

(f) will not adversely affect the "*scenic qualities of the NSW coast*", given the band of forest which is located between the golf course and Lake Wollumboola;

(g) has incorporated appropriate measures to protect threatened biota, and has appropriately considered those biota in the project;

(h) will not involve adverse impacts upon fish or marine vegetation, or their habitats. In this regard, the development has incorporated specific measures to maintain high water quality and to ensure that there is no adverse impact upon the condition of ecosystems, habitats and/or Lake Wollumboola itself;

(i) will not involve detrimental impacts to any "*existing wildlife corridors*" given the extent of vegetation to be retained on the subject site, around the golf course and the location and distribution of the habitats and vegetation in the locality;

(j) will not impose any impact upon "*coastal processes and coastal hazards*", and will not be adversely affected by any "*coastal processes or coastal hazards*";

(k) will not involve any "*conflict between land-based and water-based coastal activities*";

(l) will have no impact upon "*the cultural places, values, customs, beliefs and traditional knowledge of Aboriginals*";

(m) will not involve the imposition of significant (or any) adverse impacts "*on the water quality of coastal waterbodies*". As noted above, and as discussed at some length in this *Report* and in detail in the *Stormwater Management Report* by Martens (2011), the proposed Culburra Golf Course has incorporated an array of appropriate and 'best quality' stormwater management measures intended to avoid the potential for discharges of contaminated runoff into Lake Wollumboora or its tributaries;

(n) will have no impact on any "*items of heritage, archaeological or historic significance*";

(o) is not relevant; and

(p) has incorporated measures (including the appropriate management and treatment of stormwater and the retention and rehabilitation of native vegetation) which are specifically intended to:

- minimise any "*cumulative impacts of the proposed development on the environment*" (see Chapters 16 and 17); and
- has incorporated detail measures with respect to water management and water quality treatment. Being a golf course, energy usage will be minimal.

13.3 NSW Coastal Policy

The *NSW Coastal Policy 1997* was adopted by the NSW Government in order to set a *"new direction for coastal zone management, planning and conservation in NSW"*. The *Policy* states that its *"overriding vision .. is the ecologically* [sic] *sustainability of the NSW coast"*.

The *Coastal Policy* has adopted nine goals (or objectives) "*which represent a commitment to*":

- protecting, rehabilitating and improving the natural environment of the coastal zone;
- recognising and accommodating the natural processes of the coastal zone;
- protecting and enhancing the aesthetic qualities of the coastal zone;
- protecting and conserving the cultural heritage of the coastal zone;

- providing for ecologically sustainable development and use of resources;
- providing for ecologically sustainable human settlement in the coastal zone;
- providing for appropriate public access and use;
- providing information to enable effective management of the coastal zone; and
- providing for integrated planning and management of the coastal zone.

The *Coastal Policy* also notes that the *"nine goals are inter-related. No one is more or less important than another. It is fundamental when using the policy that a specific goal is placed in the context of the other eight goals".*

The proposed Culburra Golf Course development has taken into consideration the *NSW Coastal Policy* in the formulation of the proposed development. The relevant matters in this regard are addressed in various chapters of this *Report*, and can be summarised on the basis that:

- the golf course is, of its nature, a relatively benign development form, capable of imposing minimal impacts upon the natural environment;
- the proposed Culburra Golf Course project has incorporated design features intended specifically to minimise impacts upon important features of the natural environment including *inter alia*:
  - the location of golf hole fairways outside of the conservation-zoned land;
  - relocation of proposed golf fairways away from moist forest communities; and
  - identification of opportunities for the selective retention of important features during final engineering design (*eg* hollow-bearing rees, glider and Glossy Black Cockatoo food trees *etc*);
- the incorporation of 'best practice' stormwater management and water quality treatment regime's within and around the golf course to ensure that there is little or no contaminant or fertiliser discharge from the golf course either during construction or during subsequent use;
- the retention of vegetated buffers between elements of the golf course and either Lake Wollumboola or its tributaries (Downs and Wattle Creeks);
- the provision of supplementary habitat and resources for native biota, including *inter alia* vegetated stormwater treatment basins and supplementary plantings of relevant native food trees.

In addition, the proposed golf course:

- provides for *"ecologically sustainable development and use of resources"*;
- provides for *"ecologically sustainable human settlement"*;
- provides for *"appropriate public access and use".*

The proposed Culburra Golf Course provides an appropriate balance between the protection and enhancement of the coastal zone on Long Bow Point and around Lake Wollumboola whilst also providing for environmentally sound and ecologically sustainable development of the subject site and

the provision of a recreational facility for the residents of and visitors to the local area.

As indicated, the *Coastal Policy* states that it is *"fundamental when using the policy that a specific goal is placed in the context of the other eight goals".* That *"fundamental"* requirement is for the achievement of an appropriate balance between development and conservation, not the achievement of one at the exclusion of the other.

The Culburra Golf Course project provides for and facilitates the achievement of both appropriate biodiversity conservation goals and an ecologically sustainable and appropriate development outcome.

14 RIPARIAN ISSUES

14.1 The Statutory Regime

The *Water Management Act 2000* (WM Act) establishes *inter alia* that any activities to be undertaken within 40m of the "*highest bank*" of a "*watersource*" (relevantly either a "*coastal lake*" or a "*river*") constitute a "*controlled activity*", as defined in the Act. Any such activities (on "waterfront land"[11]) would require the provision of a "*controlled activity approval*" (CAA) by the Department of Primary Industries[12] (DPI).

The consideration of riparian issues and the protection of riparian habitat and aquatic environments, encompassed by the WM Act, includes *inter alia* the identification of a "*controlled activity*", which is defined as:

- *"the erection of a building or the carrying out of a work (within the meaning of the Environmental Planning and Assessment Act 1979)*";
- "*the removal of material (whether or not extractive material) or vegetation from land, whether by way of excavation or otherwise*";
- "*the deposition of material (whether or not extractive material) on land whether by way of landfill operations or otherwise*"; or
- "*the carrying out of any other activity that affects the quantity or flow of water in a watersource*".

Any of those activities would require a "*controlled activity approval*" (CAA), which "*confers a right on its holder to carry out a specified controlled activity at a specified location in, on or under waterfront land*".

In the first instance, it is noted that the proposed Culburra Golf Course will not involve any works or activities within 40m of Lake Wollumboola.

There will, however, be a requirement for activities within 40m of the highest bank of Downs Creek for the provision of the pedestrian/golf cart crossing of Downs Creek (Figure 6). This element of the golf course is therefore located on "*waterfront land*", and triggers the need for a CAA. This situation also renders the proposal "*integrated development*".

Whilst those activities will require the clearing of some native vegetation, both the construction and the ongoing management of the golf course is intended specifically to avoid the imposition of adverse impacts upon Downs Creek and its associated habitats and ecosystems. Both construction works and ongoing management and maintenance of those parts of the golf course will be undertaken in a manner which prevents any sediment discharges into Downs Creek, and which protects riparian habitats along Downs Creek at this location.

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[11] The *Water Management Act* defines "*waterfront land*" relevantly as "*the bed of any river, together with any land lying between the bed of the river and a line drawn parallel to, and the prescribed distance inland of, the highest bank of the river*".

[12] DPI – The Department of Primary Industries is responsible for agriculture, fisheries, earth resources, energy and forestry in Victoria.

As discussed elsewhere, there is also a proposal for a single (*ie* one) pedestrian and two-way/golf cart crossing of Downs Creek (Figure 6). That crossing will involve the construction of a narrow bridge across the upper part of Downs Creek, which will be designed and located to minimise impacts upon the watercourse and its associated ecosystems. In this regard, a bridge crossing can be provided which avoids or limits any requirement for the removal of trees within the Downs Creek corridor, and which minimises adverse impacts upon native vegetation at this location.

Whilst the proposed Culburra Golf Course project will involve activities on "*waterfront land*", as defined in the *Water Management Act 2000*, those elements of the Culburra Golf Course which are involved are to be constructed and maintained in a manner which avoids the imposition of significant adverse impacts upon riparian habitats along Downs Creek.

In addition to undertaking the works near Downs Creek with additional care and attention to detail, the proposed Culburra Golf Course project involves the application of measures to offset and compensate for the loss of vegetation and disturbance to habitats and resources. Relevant measures in this regard include:

- preparation and implementation of a comprehensive *Vegetation Management Plan* (VMP) for retained vegetation in and around the golf course;
- rehabilitation of areas along Downs Creek which contain weeds and other disturbances; and
- the provision of supplementary habitat for native biota by virtue of the planting out of the stormwater detention bases and ponds associated with the golf course.

14.3 Conclusions

The proposed Culburra Golf Course will involve some limited activities within *"waterfront land"* along Downs Creek. Those activities constitute a *"controlled activity"* pursuant to the *Water Management Act 2000*, and therefore will require the provision of a *Controlled Activity Approval* (CAA) by the NSW Office of Water.

Whilst the proposal involves some limited activities within *"waterfront land"* along Downs Creek, the proposed Culburra Golf Course project is intended to avoid the imposition of significant adverse impacts upon riparian habitats and the watercourse itself. The proposal involves the implementation of appropriate measures to prevent or avoid adverse impacts with respect to sediment and erosion, stormwater quality and stormwater flows, and both the construction and ongoing management of the golf course and the Downs Creek crossing will be undertaken in a manner which protects riparian habitats along that watercourse.

15 ENVIRONMENT PROTECTION & BIODIVERSITY CONSERVATION ACT

15.1 The Statutory Regime

The *Commonwealth Environment Protection & Biodiversity Conservation Act 1999* (EPBC Act) aims:

- "*to provide for the protection of the environment, especially those aspects of the environment that are matters of national environmental significance*"; and
- "*to promote the conservation of biodiversity*".

Pursuant to the EPBC Act, any action which "*has, will have, or is likely to have a significant impact on a matter of national environmental significance*" is defined as a "*controlled action*", and will require approval from the Minister for the Environment.

The "*matters of national environmental significance*" (MNES) listed in the EPBC Act are:

- World Heritage properties;
- wetlands protected by international treaty (the Ramsar Convention);
- nationally listed threatened species and ecological communities;
- nationally listed migratory species protected under international agreements;
- nuclear actions; and
- the environment of Commonwealth marine areas.

Pursuant to Section 68 of the EPBC Act, "*a person proposing to take an action that the person thinks may be or is a controlled action must refer the proposal to the Minister for the Minister's decision whether or not the action is a controlled action*". However, a person proposing to take an action that the person thinks is not a "*controlled action*" may also refer the proposal to the Minister for the Minister's decision, whether or not the action is a "*controlled action*".

It is noted that consideration of the EPBC Act is not a relevant matter for Shoalhaven City Council as the consent authority for the proposed Culburra Golf Course pursuant to the EP&A Act. The Council cannot take the EPBC Act into account in determining the application, and the EPBC Act does not empower the Council to require the applicant to refer the project to the Commonwealth for consideration.

15.2 The Assessment Process

The EPBC Act provides a mechanism for assessing the potential environmental impacts of activities and developments, where "*matters of national environmental significance*" (MNES) may be affected by the proposed activities. It is intended that the environmental assessment and approval process required by the Commonwealth government ultimately be delegated to individual states through the development of *Bilateral Agreements* between the relevant state and the Commonwealth government. In the interim, MNES which may be affected by a development or activity are to be assessed by the Commonwealth Minister for the Environment, through the Department of Sustainability, Environment, Water, Population and Communities[13].

[13] The SEWPaC was formerly the Department of the Environment, Water, Heritage & the Arts (DEWHA), and previously Environment Australia.

A set of "*Administrative Guidelines*" has been prepared by the then Environment Australia for implementation of the EPBC Act in the period until bilateral agreements with state governments are established. The *Guidelines* are provided to assist a proponent in determining whether an action should be referred to the Minister for the Environment for a decision on whether approval is required. In particular, the *Guidelines* include a set of criteria "*for determining whether an action has, will have, or is likely to have a significant impact on a matter of national environmental significance*".

15.3 Culburra Golf Course Project

With respect to the MNES listed in the EPBC Act:

- there are no "*world heritage properties*" on Long Bow Point or in the vicinity;
- notwithstanding its value as a wetland and haven for waterbirds, Lake Wollumboola is not protected by the Ramsar Convention;
- the proposal will not involve any "*nuclear actions*"; and
- the proposed Culburra Golf Course will have no impact upon the environment of any "*Commonwealth marine areas*".

The *Online Database* of items of "*national environmental significance*" listed in the EPBC Act was accessed with respect to Culburra Golf Course proposal (Appendix D). A number of items were identified within an area of approximately 25km^2 around and including the subject site at Culburra:

- 43 threatened species;
- 45 migratory (terrestrial and wetland) fauna species;
- 64 marine protected fauna species;
- 13 whales and other cetaceans; and
- a number of "*other matters protected by the EPBC Act*", including the Beecroft Peninsula, various Natural, Indigenous and Historic Places, Nationally Important Wetlands (including Lake Wollumboola) and State and Territory Reserves.

Other than Lake Wollumboola, none of the "*other matters*" identified in Appendix D are of any relevance as they are neither located on or near Long Bow Point nor will be affected to any extent whatsoever by the proposal.

Lake Wollumboola is identified as a *"Nationally Important Wetland"* in the listing of "*other matters protected by the EPBC Act*" (Appendix D). It is acknowledged and recognised in this *Report* that Lake Wollumboola has considerable environmental significance and value, and is widely recognised *inter alia* as an important wading and wetland bird habitat.

Importantly, the significance of Lake Wollumboola and its ecosystems has been a key matter for the Culburra Golf Course project, and has *inter alia* driven the design of the golf course and of its stormwater management and water quality treatment regime. It is intended that stormwater flows and water quality in and around the golf course be maintained to the highest possible standards to ensure there are no adverse impacts imposed upon Lake Wollumboola, its ecosystems or its dependent biota.

It is important also to note the substantial range of natural fluctuations in water level and water quality in Lake Wollumboola, dependent upon factors such as uncontrolled nutrient input from the township of Culburra and from the remainder of the Lake catchment, rainfall events and 'break-outs' of the Lake entrance, and the densities of wetland birds and algae produced under certain circumstances. The inputs from the Culburra Golf Course will be insignificant with respect to those natural fluctuations (see *Stormwater Report* by Martens), in particular because of the stringent water quality control measures which have been incorporated into the project.

None of the "*marine protected fauna species*" and none of the whales, other cetaceans and/or pelagic birds are of any relevance to the proposed Culburra Golf Course on Long Bow Point. There is no potential for the proposed development to impose adverse impacts upon any of these biota or their habitats.

With respect to the alleged migratory species (some of which are not, in fact, migratory at all), the subject site at Culburra constitutes only minor habitat in terms of their home ranges and distributions. There are no populations, or even likely individuals, of any such species which would be dependent upon those parts of the subject site at Culburra which are proposed for development activities. It cannot be considered likely that a "*significant impact*" (if indeed any impact at all) would be imposed upon any individuals of such species. Those MNES, therefore, are not of relevance to the proposal at Culburra.

With respect to threatened species listed in the EPBC Act, the same considerations apply as have been considered with respect to threatened species listed within the TSC Act. In this regard, it is relevant to note:

- parts of the subject site are already modified and/or highly disturbed, and do not constitute relevant or special habitat for any threatened biota;
- the extent of native vegetation containing relevant habitats or resources to be removed by the proposed Culburra Golf Course project is small, particularly with respect to other areas of similar vegetation in the immediate vicinity and general locality;
- there are substantial areas of suitable habitat for the potentially relevant threatened biota within the extensive National Parks and State Forests in the general locality and region;
- most of the potentially relevant threatened fauna species are highly mobile and wide-ranging and/or occupy substantial home ranges;
- other species occupy habitats or environments that will not be affected significantly, or at all, by the proposal;
- there is no likelihood that a "*viable local population*" of any threatened flora or fauna species would be present solely within or confined to the development area on the subject site, given the proximity of suitable and appropriate habitat and resources; and
- the subject site does not contain habitats or resources which are restricted in nature or confined to the subject site in even their local distribution.

The ecological and biodiversity value of Lake Wollumboola and its associated ecosystems has been recognised as a key issue and constraint throughout the development of the Culburra Golf Course concept. The importance of avoiding any significant adverse impacts upon the Lake either as a result of human activities or by the discharge of contaminants or nutrients has been a fundamental issue for the project, and both the design of the golf course itself and of the stormwater management and water

quality treatment systems has specifically taken into account the potential for impacts upon Lake Wollumbulla itself.

As discussed in earlier chapters of this *Report*, project has been designed specifically *inter alia* to avoid the imposition of significant adverse impacts upon Lake Wollumbulla, even on a micro-scale. Relevant measures and approaches in this regard are detailed in the impact amelioration measures (Chapter 16) and the environmental management measures (Chapter 17) of this *Report.*

Unlike the situation with respect to the discharge of untreated and uncontrolled stormwater from the existing town of Culburra into Lake Wollumboola, the proposed golf course will not permit the discharge of any untreated stormwater into the Lake. Further, it should be noted that the proposed golf course occupies a minute proportion of the catchment of Lake Wollumboora, and it is well documented that the significant fluctuations in conditions within the Lake would swamp any potential impacts which would arise from a well-managed golf course.

Given those circumstances, there is no likelihood of a "*significant impact*" being imposed upon Lake Wollumboola or its ecosystems as a result of the Culburra Golf Course. There is, consequently, no requirement for a "*referral*" of the proposal with respect to Lake Wollumboola.

15.4 Conclusions

Consideration has been given to the potential for the proposed Culburra Golf Course project to impose a *"significant impact"* upon any *"matter of national environmental significance"* (MNES).

It cannot be concluded that any MNES would be the subject of a *"significant impact"* as a consequence of the proposed Culburra Golf Course, given:

- the nature and condition of vegetation in the area to be affected;
- the extent of other vegetation in the vicinity and locality;
- the impact amelioration and environmental management measures which are integral parts of the project; and
- the habits and habitat requirements of the potentially relevant threatened biota.

Given those considerations, there is no requirement for a referral of the project to the Commonwealth for consideration.

16 IMPACT AMELIORATION

An array of environmental management measures are detailed below (in Chapter 17), which are intended to minimise potential impacts from contaminants during the life of golf course and to maintain water quality. In addition, the potential impacts of the proposed Culburra Golf Course on native biota and on the natural landscape have been the subject of a number of specific impact amelioration measures.

The amelioration of potential impacts which could potentially have arisen as a result of the Culburra Golf Course project has been achieved by:

- locating the golf course almost entirely outside of the *7(a) – Environmental Protection (Wetlands) Zone*;
- avoiding the significant and/or sensitive wetlands and mesic communities present on and around Long Bow Point (with the minor exception of a single pedestrian and golf cart crossing of Downs Creek); and
- the incorporation of measures to be implemented during final design of the golf course, including:
  - preferential retention of hollow-bearing trees during the final golf course layout design (subject to expert advice from an ecologist);
  - preferential retention of glider feed trees and stands of she-oaks for Glossy Black Cockatoos;
  - implementation of the *Hollow-bearing Tree Protocol* (see below), which will facilitate the salvage and re-use, and/or the replacement, of tree-hollows which require removal; and
  - the design of water quality features and ponds to provide supplementary habitat for a range of native biota.

All of these elements of the proposed Culburra Golf Course act to ameliorate the impacts which could otherwise be imposed by a less sensitive or less environmentally sound approach.

In addition, the golf course project will facilitate a substantial regime of weed removal (particularly of Bitou Bush and Lantana) and a supplementary planting program of native indigenous plant species. This approach is to be adopted to enhance retained habitat and vegetation communities on the subject site, *inter alia* in order to further ameliorate (or 'offset') the impacts of the proposed golf course.

It is also noted that the majority of the Culburra Golf Course is to be located in the more common xeric vegetation types and communities on the subject site, and that all elements of the golf course are located at least 100m away from Lake Wollumboola. That approach, in addition to the rigorous treatment of stormwater discharges is intended to ensure that adverse impacts are not imposed upon Lake Wollumboola and its ecosystems, including its dependent native biota.

As discussed in Chapter X of this *Report*, the Culburra Golf Course project has adopted a philosophy of 'abundant caution' in its design approach. Environmental issues and sensitivities have been pre-eminent in the project's inception and development.

17 ENVIRONMENTAL MANAGEMENT MEASURES

In addition to the impact amelioration measures discussed above (Chapter 16), an array of specific environmental management measures are to be implemented both during construction of the Culburra Golf Course and its associated features and during the ongoing management of the golf course.

It is anticipated that all works associated with the golf course will be undertaken in an environmentally sensitive manner, involving the use of current 'best practice' techniques to contain and manage sediment and stormwater discharges. In particular, the use of temporary sediment basins, sediment fences and protection fencing for retained vegetation and retained trees would be anticipated as standard elements of the future works to be undertaken on the site.

One of the key environmental management measures for the Culburra Golf Course project is the stormwater regime. Notwithstanding that the project is for a golf course, and does not therefore involve substantial areas of impervious surfaces, there is still the potential for adverse impacts to be imposed upon the adjoining natural environment both during the construction phase of the golf course and during its subsequent use.

Given the acknowledged sensitivity of Lake Wollumboola and of ecosystems around Long Bow Point, the stormwater management regime for the proposed golf course has been designed *inter alia*:

- to strictly control and manage sediment and erosion during the construction phase of the golf course;
- to capture run-off (particularly from greens and tees, and other areas where fertilisers may be used) and to ensure its treatment prior to any discharges of such waters;
- to capture and re-use stormwater run-off to avoid any requirement for the use of potable water within the golf course;
- to capture, treat and re-use roof run-off and run-off from the carpark; and
- to ensure that all discharges into Downs and Wattle Creeks and/or into Lake Wollumboola are of the highest water quality standards.

Other environmental management measures which are to be implemented during the construction phase of the Culburra Golf Course and its associated facilities will include *inter alia*:

- the collection of native plant Matterial where the clearing of vegetation is required, and its re-use in areas to be rehabilitated within and around the golf course;
- implementation of the *Hollow-bearing Tree Protocol* (see below); and
- the preparation and implementation of a *Tree & Vegetation Protection Protocol* to ensure that vegetation which is to be retained is protected during construction works.

Environmental management measures which are proposed for implementation throughout the life of the Culburra Golf Course include a number of measures to ensure the maintenance of native vegetation on the subject site and to protect water quality throughout the life of the golf course. Relevant features in this regard include:

- preparation of a detailed *Vegetation Management Plan* (VMP) which is to be implemented throughout the areas of retained vegetation on the subject site;

- incorporation into the VMP of specific measures to control and manage the maintenance requirements for APZs where they are located within native vegetation; and
- the ongoing monitoring and management of all stormwater detention and quality control basins, ponds and bioretention swales to both provide supplementary habitat for native biota and to ensure the highest standards of stormwater discharge from the golf course. In this regard, a detailed *Golf Course Plan of Management* is to be prepared prior to use of the golf course to ensure that fertilisers, pesticides and other chemicals are not applied in such qualities anywhere on the golf course so as to result in contaminated runoff.

The project will also involve the implementation of a *Hollow-bearing Tree Protocol*, designed to ensure that there is no net loss of tree-hollows as a consequence of the golf course project. The *Hollow-bearing Tree Protocol* includes *inter alia*:

- the segmental 'dismantling' by professional tree experts of hollow-bearing trees in order to salvage tree-hollows, wherever possible;
- the placement of salvaged tree-hollows on existing large trees or on dedicated posts in the *Conservation Area*;
- alternatively, the placement of salvaged tree-hollows on the ground as hollow log habitat, where placement in existing trees is not practical; and
- the use of artificial nest boxes to replace tree-hollow which cannot be salvaged and to supplement that resource on the site.

18 CONCLUSIONS

This *Ecological & Riparian Assessment Report* for the proposed Culburra Golf Course within the Culburra West Urban Expansion Area (UEA):

- has collated data and information contained in previous *Reports* and obtained during previous investigations in the Culburra West UEA, particularly within the proposed Culburra Golf Course area on Long Bow Point;
- has reviewed the previous vegetation mapping and survey data to identify "*threatened species*" and "*endangered ecological communities*" which are of significance or potential constraint value within the study area;
- has provided reviewed and refined vegetation mapping for the proposed Culburra Golf Course and the Long Bow Point "*subject site*"; and
- provides a consideration of the statutory, ecological and riparian issues pertaining to the Culburra Golf Course project.

The current *Report* has refined the vegetation mapping from the previous investigations, and provides a sound basis for assessing the ecological constraints and potential impacts of the Culburra Golf Course project. It is critical in that assessment:

- to acknowledge the impact amelioration and environmental management measures that are integral part of the project; and
- to accept that a golf course can (and in the case of the Culburra Golf Course most certainly will) be constructed and managed in the long-term to provide environmental benefits, including *inter alia* for threatened biota.

The relevant (or potentially relevant) constraints are concentrated around:

- threatened fauna species known or likely to utilise the subject site;
- the significance of, and the need to protect, Lake Wollumboola and its wildlife;
- the "*endangered ecological communities*" present, which are generally located at the periphery of the subject site and/or along the watercourses; and
- the presence of SEPP 14 wetlands around the subject site.

The proposed golf course on Long Bow Point has been designed in full cognisance of the ecological issues and sensitivities of both the subject site and surrounding lands (particularly including Lake Wollumboola). The proposal includes a commitment to the implementation of 'best practice' (or better) environmental management measures, and incorporates features and elements which are intended to ameliorate potential adverse impacts upon the natural environment and to provide additional habitat and to enhance resources for a range of native biota.

Notwithstanding the removal of vegetation which will be required for the proposal, the net outcome from the golf course project will *inter alia* include:

- the retention of areas of high conservation value within the subject site;
- the protection of watercourses and water features (particularly including Lake Wollumboola and the SEPP 14 Wetlands, but also both Downs and Wattle Creeks);

- the maintenance of tree-hollows and hollow-bearing tree resources for native biota;
- the maintenance of important food resources for species such as the Glossy Black Cockatoo;
- the provision of additional habitat and resources for species such as wading and wetland birds and the Green & Golden Bell Frog; and
- the implementation of a management regime (including a dedicated *Vegetation Management Plan* and a *Golf Course Plan of Management*) designed specifically *inter alia* to protect threatened biota and their habitats and resources.

The Culburra Golf Course development on Long Bow Point will implement dedicated measures for the conservation and re-use of water and for the maintenance of the highest possible water quality standards, particularly with respect to discharges into Wattle and Downs Creeks, and into Lake Wollumboola (as detailed in associated *Reports* for the *Concept Plan*). This requirement has long been recognised as a necessary and appropriate response for any development on Long Bow Point, given the significance of Lake Wollumboola as an Intermittently Closed and Open Lake or Lagoon (ICOLL), and as an area of significant waterbird habitat and an environment for a range of other native fauna species.

A key element of the project, in addition to the sustainable use of stormwater, is the maintenance of existing water flows and water quality being discharged into Lake Wollumboola. In particular, the maintenance of water quality and water flows into Lake Wollumboola are important because the Lake is an ICOLL, and is mostly a closed system with no tidal or marine flushing. Conversely, it should be noted that the proposed Culburra Golf Course constitutes only a very minor part of the catchment of Lake Wollumboola (Figure 8), and the natural fluctuations within that system (with respect to water levels, nutrient levels and algal blooms in the Lake) are related primarily to the natural rainfall regime.

With respect to threatened fauna species located within the Culburra Golf Course area, it is noted that the majority of species present:

- are highly mobile and wide-ranging (with many species occupying substantial home ranges well in excess of the area to be affected by the proposal);
- are widely distributed and common to abundant in the *Jervis Bay Regional Area*, including around Culburra;
- are dependent or reliant on resources which are widely distributed in the Jervis Bay regional area, which are common to abundant and are extremely well conserved; and
- are sufficiently widely distributed and sufficiently abundant that the loss of habitat and/or individuals of those species for the Culburra Golf Course would not threaten the species in the *Jervis Bay Regional Area*.

The proposed Culburra Golf Course project has been designed *inter alia* to minimise adverse impacts upon the natural environment in general. The project incorporates an array of measures and management regimes designed specifically to protect and/or enhance native biota and their habitats at this location. In addition to the golf course being inherently a 'benign' activity (which can both retain and/or provide specific habitat and resources for an array of native biota), the Culburra Golf Course project is to be implemented in a manner which enshrines the highest levels of habitat and natural resource protection.

In addition to minimising the potential impacts of the proposed Culburra Golf Course on the natural environment in general, and on threatened biota and their habitats in particular, the proposal has been designed specifically *inter alia*:

- to ameliorate the potential adverse impacts that could be imposed absent appropriate design and management measures;
- to provide offsets to impacts on the natural environment which will inevitably occur (eg by retaining, re-using and/or replacing tree-hollows, by ensuring the highest possible water quality standards and by providing supplementary habitat and resources); and
- to contribute in a net beneficial matter to long-term management and enhancement of the natural environment, including by measures such as the removal of weeds in lands surrounding the golf course, the implementation of a *Vegetation Management Plan* (VMP) intended specifically to enhance native plant communities and habitats around the golf course, and the implementation of a stringent *Golf Course Plan of Management* designed to control and manage stormwater, irrigation and chemicals (fertilisers, pesticides *etc*).

The Culburra Golf Course project will also create additional habitat for threatened (and other native) biota including:

- supplementary plantings of relevant trees (*eg Allocasuarinas* for the Glossy Black Cockatoo) and flowering shrub species for gliders and small birds;
- habitat within and around ponds and detention basins, including *inter alia* emergent reeds and sedges and rock piles for Green & Golden Bell Frogs; and
- maintained grassland along fairways and on greens and tees which will provide foraging habitat for macropods and other herbivores, as well as for bird species such as the Willie Wagtail, Kookaburra and Masked Lapwing.

Given all of those considerations, the proposed Culburra Golf Course project on Long Bow Point will offer a significant environmental benefit at this location, rather than constituting an adverse impact. The proposal constitutes an appropriate balance between development goals and biodiversity conservation aspirations. The Culburra Golf Course project is designed *inter alia* to avoid the imposition of adverse impacts upon the natural environment, by virtue of the offsetting of the loss of native vegetation by the enhancement and long-term maintenance of important habitat and resource features through the land, and by the dedication of land for biodiversity conservation purposes.

GLOSSARY

Activity	Relevantly means: (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.
Bioregion	"*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).
DA	*Development Application* prepared pursuant to the EP&A Act.
Development	Relevantly means: (a) the erection of a building on that land; (b) the carrying out of a work in, on, over or under that land; and (c) the use of that land or of a building or work on that land.
DEC	the Department of Environment & Conservation (part of the DECCW).
DECC	the Department of Environment & Climate Change (part of the DECCW).
DECCW	the Department of Environment, Climate Change & Water (now part of the OEH).
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 20km radius of the study area*".
NPWS	NSW National Parks & Wildlife Service.
OEH	Office of the Environment & Heritage, which is part of the Department of Premier & Cabinet, and which incorporates most of the DECCW.
Recovery Plan	"*a plan prepared and approved under Part 4*" of the TSC Act.
Region	The Jervis Bay Regional Area, which essentially comprises the Shoalhaven Local Government Area.
SIS	*Species Impact Statement* prepared pursuant to Sections 109, 110 and 111 of the TSC Act.
Study Area	The broad area of Lands around the subject site that have been the subject of previous and current studies and investigations.
Subject Lands	The lands of the Culburra West Urban Expansion Area, owned by Realty Realizations, and including the subject site.
Subject Site	The southern parts of Lots 5 and 6 in DP 1065111 on which the Culburra Golf Course is proposed, including *inter alia* Long Bow Point.
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.*

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