BIODIVERSITY ASSESSMENT

PROPOSED SHAOLIN TEMPLE AND ASSOCIATED DEVELOPMENTS COMBERTON GRANGE CITY OF SHOALHAVEN, NEW SOUTH WALES

prepared by

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Plate 1 (cover): Typical Spotted Gum *Corymbia maculata* forest in the study area; this has been heavily logged over a long period, hence the small average size and high density of the trees and the lack of large, old specimens. Most of the trees shown are "regrowth trees".

CONTENTS

APPENDICES

TABLES

FIGURES

SUMMARY

The flora and fauna of the Comberton Grange property is identified, described and assessed. Intensive and targeted field surveys were undertaken in spring-summer 2009/2010, with additional surveys at other times during the following 12 months. Previously prepared reports, documents and maps were identified and assessed, with relevant information being incorporated into the current report.

Among other things, the report provides:
- a description of the topography, geology and climate of the property;
- vegetation descriptions and mapping, including a vegetation community map;
- wetland descriptions and mapping, including a wetland map;
- extensive lists of the plants and animals recorded in the area;
- the methods and results of targeted surveys for threatened species and communities.

The surveys produced a list of 393 plant species, 66 of which are exotic (introduced or weed species). The surveys also recorded 152 species of vertebrate animal, six of which are introduced (feral) species. The surveys recorded 14 threatened animal species, seven of which are bats. No threatened plant species were located. Detailed plant community descriptions are provided along with cross-referencing to descriptions in previous studies in the area and in the region. Of the 15 plant communities recognised on the property, five are listed endangered ecological communities; all of the endangered communities are associated with wetlands, both fresh and salt.

The condition of the natural vegetation is generally good to excellent, although the Spotted Gum forest has been heavily logged. Weeds are largely restricted to cleared land. Disturbance to most of the land is slight, with occasional old vehicle tracks being the only disturbance in most places.

The following material was particularly considered as part of the study:
- Part 3A of the NSW *Environmental Planning & Assessment Act* 1979;
- NSW *Threatened Species Conservation Act 1995*;
- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*;
- South Coast Regional Strategy (NSW Dept. of Planning);
- Draft South Coast Regional Conservation Plan (NSW DECC);
- Jervis Bay Regional Environmental Plan (NSW Dept. of Planning);
- Relevant State Environment Planning Policies (NSW Dept. of Planning).

The key constraints on development on the property are identified as:
- presence of habitat for several species of threatened forest fauna;
- presence of several endangered ecological communities, all of which are associated with wetlands;
- occurrence of major watercourses through the property;
- the identified habitat corridor in the Jervis Bay Regional Environmental Plan.

The proposed development has been designed with the above constraints in mind. It is assessed in terms of Part 3A of the above Act by following the steps set out in the document *Guidelines for Threatened Species Assessment* (DEC 2005).

The development is primarily contained to previously cleared land; i.e. an old pine plantation and grazing land with a long history of farming use. Impingement upon forested land is minimised in deference to the identified habitat corridor. The total area of forest that would be removed is relatively small given the extensive areas of surrounding natural forest and the type of forest involved is common and widespread in the region. An assessment of the impact of the loss of this forest on recorded threatened fauna species and the identified habitat corridor is presented.

In compensation for the removal of forest, a package of measures is proposed that enhance the environment and habitats on the property as a whole, including wetlands. These measures and protection measures during and after construction shall fully set out in a plan of management for the site.

* * * * *

1 INTRODUCTION

1.1 Background

The property known as Comberton Grange, located between Nowra and Jervis Bay, is being investigated for the development of a Shaolin Temple and residential complex. Kevin Mills & Associates have been engaged to undertake the flora and fauna studies to meet the requirements of relevant State and Commonwealth legislation. In particular the Director-General's Requirements from the Department of Planning for the proposal, which is a Part 3A matter under the NSW *Environmental Planning & Assessment Act* (1979), must be fully addressed.

The aim of this report is, firstly, to identify the key flora and fauna issues and set out the survey and assessment program undertaken to address these issues. In undertaking this assessment, we have been provided with a copy of the Director-General's Requirements along with the submissions from the Department of Environment and Climate Change and other relevant government authorities. Secondly, the results of the surveys are provided and assessed. Lastly, the constraints on the proposed development are considered.

For the purposes of this investigation, the study area is defined as the Comberton Grange property and the adjoining abandoned pine plantation to the north; see **Figure 1.**

1.2 Previous Studies

Several flora and fauna studies have been undertaken at Comberton Grange over the years; these have primarily concerned the western half of the property. The earliest studies were to assess a proposal by Shoalhaven City Council to develop a quarry on the land (Griffith & Griffith 1987, Kevin Mills & Associates 1989). The quarry was subsequently approved, and operated until recently.

In the late 1980s, the CSIRO undertook surveys around Jervis Bay in association with the proposed Navy armaments depot (Braithwaite, Austin, Mangules, Catling & Bedford 1988). These surveys greatly increased our knowledge of the ecology and conservation values of the general area. Subsequent studies by Kevin Mills & Associates further added to the ecological information available on the area in the context of much larger study areas. The first study, commissioned under the NSW Heritage Assistance Program, classified, described and mapped the natural vegetation of the Jervis Bay region, and identified the vegetation conservation values of the region (Mills 1993). The second study, commissioned by Shoalhaven City Council, described, mapped and assessed the conservation values of the natural vegetation in the coastal parts of the Shoalhaven local government area (Kevin Mills & Associates 1996).

Several years later, Kevin Mills & Associates undertook further investigations of the flora and fauna on the western half of the Comberton Grange property, this time to assess the impact of a proposed rural residential subdivision (Kevin Mills & Associates 1997). Investigations continued in 1999 and 2000 (Kevin Mills & Associates 2000), but subdivision of the land did not occur. Most recently the land was investigated in the report by Kevin Mills & Associates (2004).

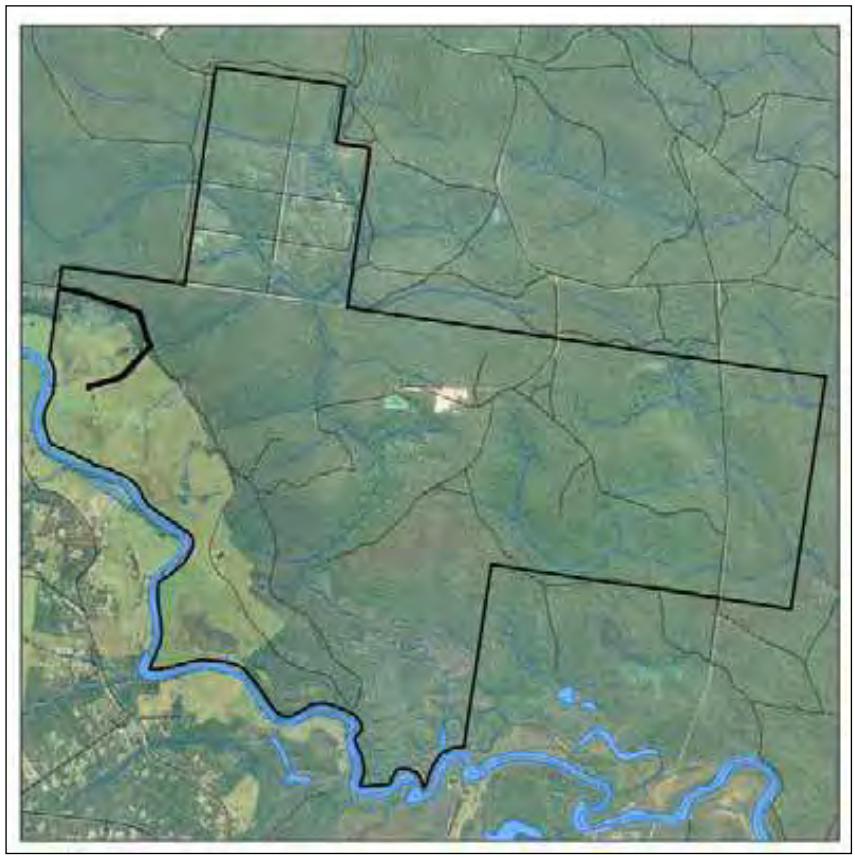

Figure 1. Location of the Comberton Grange Study Area.
(Source: Independent Review Panel)

1.3 Location and General Character of the Study Area

Comberton Grange is about 11 kilometres to the south of Nowra, on the eastern side of the Princes Highway; see **Figure 1**. The property has a total area of about 1,115 hectares, with approximately 169 hectares contained within the adjoining abandoned pine plantation; the total holding is therefore 1,284 hectares. Until recently the property was owned by Shoalhaven City Council. The Comberton Grange property is comprised of Lot 4 DP 63405, Lot 1 DP 550098 and Lot 1 DP 725955.

The 'study area' is all of the above land (the holding), that is, the Comberton Grange property and the old pine plantation. The 'primary investigation area' is that area surrounding the proposed development. The parts of the holding outside the primary investigation area will not be impacted in any way by the proposed development. The main survey effort is directed to the primary investigation area.

Currambene Creek, which is the main stream flowing into Jervis Bay forms the southern and western boundaries of the property, and enters Jervis Bay about four kilometres to the southeast. Georges Creek, a tributary of that creek, flows through the centre of the property and has its headwaters in and around the old pine plantation. The third named creek crossing the property is Bid Bid Creek, part of the catchment of which occurs in the far eastern section of the property.

About 75% of the Comberton Grange property is covered by forest, woodland and wetlands. The remainder has been cleared and farmed over a period of many years. The bushland is in a fairly natural condition, the only signs of disturbance being the quarry operated by Shoalhaven City Council, a few bush tracks, and evidence of logging, mostly undertaken many years ago.

The bushland on the property is contiguous with similar forests and woodlands to the north and east, in Currambene State Forest and Jervis Bay National Park, respectively, and with the wetlands around Currambene Creek to the south.

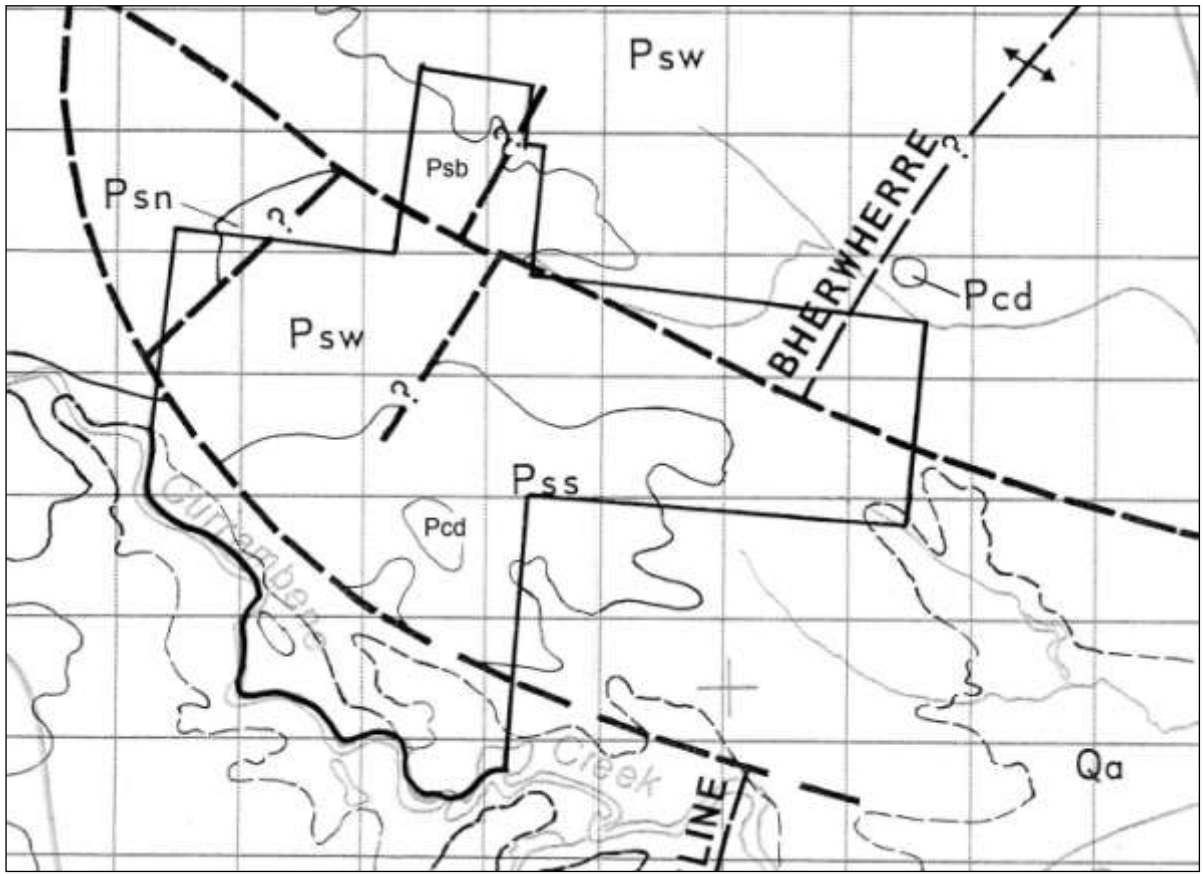

Figure 2. Geology of the Comberton Grange Area
Psw-Wandrawandian Siltstone; Pss-Snapper Point Formation; Psn-Nowra Sandstone; Psb-Berry Siltstone; Pcd-Currambene Dolerite.
(Source: Bembrick & Holmes 1976).

The old pine plantation was logged and abandoned many years ago and supports a regrowth vegetation of mainly native plants; much of the area is a shrubland with scattered small native trees and wildling pines.

Comberton Grange and the surrounding areas are towards the southern edge of the Sydney Basin Bio-Region and Sydney Basin geological province, and near the northern edge of the South Coast Botanical Subdivision.

The land is underlain by the Permian Shoalhaven Group, namely Wandrawandian Siltstone, Snapper Point Formation (sandstone) and the Berry Siltstone. There is also a small outcrop of the Currambene Dolerite on the eastern part of the property and extensive areas of Quaternary alluvium on the low lying areas near Currambene Creek. **Figure 2** shows the geology of the area (after Bembrick & Holmes 1974).

The study area is in the Jervis Bay region, as defined by the *Jervis Bay Regional Environmental Plan* (Department of Planning 1996). Most of the bushland on the property is within a habitat corridor delineated under that Regional Plan.

The areas of bushland on Comberton Grange have also been identified as "land of ecological sensitivity" under the Shoalhaven Local Environmental Plan (LEP); this plan overlay is defined below.

"Land of ecological sensitivity
21. (1) This clause applies to land shown on the map by distinctive hatching. That land is taken to be land of ecological sensitivity.
(2) The objective of this clause is to minimise adverse impacts of development on natural features, including flora, fauna, landforms and other physical features, and ecological processes.
(3) Despite clause 9, the consent of the Council is required for any development, including forestry and agriculture, on land to which this clause applies.
(4) In deciding whether to grant consent, the Council must take into account:
(a) the objectives of this clause; and
(b) the adequacy of the measures proposed by the applicant to avoid, mitigate or remedy any adverse effects of the proposed development on the ecological values of the land and other land in its vicinity."

The study area is within the South Coast Region, as defined in the South Coast Regional Strategy (Department of Planning 2007). The strategy is "an initiative of the NSW Government to guide sustainable growth throughout the South Coast over the next 25 years." Among other things, the aim of the Strategy is to: "Protect high value environments including pristine coastal lakes, estuaries, aquifers, threatened species, vegetation communities and habitat corridors by ensuring that no new urban development occurs in these important areas and their catchments."

Environmental assets of high conservation value are identified by the DECCW in the South Coast Regional Conservation Plan; that document includes a series of maps indicating the distribution of the significant environmental assets throughout the South Coast Region, including the Currambene Creek area.

1.4 Director-General's Requirements

The Director-General's Requirements are set out in the document issued by the Department of Planning and dated 11 September 2008. That document contained submissions from various government agencies; the most relevant here are those from the then Department of Environment and Climate Change (DECC), now the Department of Environment, Climate Change and Water (DECCW), and the Department of Primary Industries (State Fisheries). The flora and fauna issues raised by these agencies are summarised in **Table 1,** along with our initial response to each issue.

The following relevant matters to be addressed were set out in Attachment 1 to the Director-General's Requirements.

"10. Flora and Fauna.

10.1 Assess the potential impacts (both direct and indirect) of the development on flora and fauna taking into consideration impacts on any threatened species, populations, ecological communities and/or critical habitat, groundwater dependent ecosystems, and any relevant recovery plan in accordance with DECC's draft *Guidelines for Threatened Species Assessment* (2005). Provide measures for the conservation of flora and fauna, where relevant.

10.2 Outline measures for the conservation and long term management of existing wildlife corridors and the connective importance of any vegetation on the subject land. Potential for the re-establishment of corridors down drainage lines to wetlands and Currambene Creek should be explored.

10.3 Demonstrate suitable riparian corridor management and appropriate corridor widths/buffering between the development and adjacent waterways/drainage lines or SEPP 14 wetlands in accordance with DECC's stream classification system.
10.4 Investigate the opportunity to permanently conserve the eastern portion of the site (east of the existing quarry and including the SEPP 14 wetland in the southern portion of the site)."

2 KEY ISSUES

2.1 Survey Precincts and Primary Investigation Area

For the purposes of this investigation, the study area is divided into four study precincts, based on ground features and vegetation cover. **Figure 3** shows the extent of these precincts; these are identified as:
Pine Plantation – the old pine plantation adjoining the Comberton Grange property to the north;
Farmland – the cleared grazing land along Currambene Creek;
Western Forests – the forest and woodland to the west of Georges Creek; and
Eastern Forests – the forest and woodland to the east of Georges Creek.
These precincts are used to describe the distribution of flora and fauna species, and for convenience in describing the study area and its features. As noted above, a primary investigation area is identified and this takes in parts of all of the above precincts.

This study was mainly concerned with the land on and around the development area. The study therefore delineated a 'primary investigation area', where most of the intensive surveys were carried out. The extent of that area is shown on **Figure 3**. A summary of all survey time spent in the study area is presented in **Appendix 1**.

2.2 General Flora and Fauna Surveys

There have been several previous surveys of the Comberton Grange property and nearby area, see Section 1.2. The information gained in those studies provides a good basis upon which to assess the flora and fauna of the study area. Additional surveys are required, as not all of the study area was covered in these previous studies and these were carried out at least nine years ago. General flora and fauna surveys were undertaken across the whole of the study area, with particular attention being given to the three precincts where the majority of the development would take place, namely Pine Plantation, Farmland and Western Forests; i.e. the primary investigation area.

The survey methods outlined in the document *Threatened Species Survey and Assessment: Guidelines for Developments and Activities* (DECC 2004) have been followed in this investigation. The aims of the general surveys were mainly to:

- Compile a list of all plant species in the study area;
- Compile a list of all animal species in the study area;
- Prepare a description of the vegetation types and a vegetation map for the study area;
- Prepare a description of the habitats in the study area.

Nomenclature - Plants
The plant species names in this report are generally the current names published by the National Herbarium of New South Wales in the *Flora of New South Wales* (Harden 1992-2002); a few more recent taxonomic changes have been recognised in the report and come from the Herbarium's website. Most of the common names are from the *Flora of New South Wales* (op. cit.), *Australian Plant Genera* by Baines (1981) and *Weeds of the South-east* by Richardson, Richardson and Shepherd (2006).

Table 1
Response to Issues Raised by Government Authorities

Authority	Issue	Response	Section(s) of this Report
1. Department of Planning	1.1 General impact on flora and fauna.	The presence of flora and fauna species were systematically searched for and recorded across the study area.	Sections 2 and 3 of the report deal with the survey methods employed and the results of the surveys in the study area.
	1.2 Impact on threatened species, populations and ecological communities.	A full assessment is undertaken of the likelihood of threatened species etc. occurring in the study area; the list was developed primarily from the species listed in the DECC submission. Targeted surveys were undertaken for all relevant species and communities. The potential to impact on each species was assessed separately.	Sections 2 and 3 of the report deal with the survey methods employed for threatened species, etc., and the results of the surveys in the study area.
	1.3 Outline measures to conserve and manage wildlife corridors, including re-creation of habitat links between wetlands.	The conservation and management of habitat (wildlife) corridors was considered separately form other matters in the report.	Habitat corridors are discussed in Section 4.3 of the report and an assessment of the development in relation to the identified corridor is set out in that section.
	1.4 Investigate riparian corridors and their management.	Riparian habitats and corridors were investigated and mapped in the study.	Riparian corridors are specifically discussed in Section 3.1.1 of the report. A map of the wetlands and riparian habitats is provided at Figure 4.
	1.5 Investigate opportunity to permanently reserve the eastern part of the property.	The permanent reservation of the eastern portion of the holding was considered.	Section 5 contains a discussion on this issue.
	1.6 Assess vegetation clearing and consider need for 'offset' strategy.	The amount and type of vegetation proposed for clearing is documented and assessed. The need for an 'offset' was considered.	Section 4 contains a discussion on this issue.
	1.7 Liaise with relevant agencies and authorities.	Contact was made with the following agencies during this investigation: - Shoalhaven City Council (threatened species officer); - DECCW, Queanbeyan; - DPI (State Fisheries); and - Southern River Catchment Management Authority.	The results of agency consultation are provided in Section 4.5 of the report.

Authority	Issue	Response	Section(s) of this Report
2. Department of Environment, Climate Change and Water	2.1 Adequate surveys and assessments for threatened species.	Each species listed by the DECCW is assessed for its relevance to the site, followed by identifying the appropriate surveys techniques for each species.	Sections 2, 3.1.7 and 3.2.3 identify and assess threatened species.
	2.2 Adequate surveys and assessments for threatened ecological communities.	Each community listed by the DECCW is assessed for its relevance to the study area and the development. Field surveys were developed to locate, map and asses each community.	Sections 3.1.6, 3.1.8 and 3.3.1 discuss these communities.
	2.3 Verification of high conservation value mapping in the South Coast Regional Strategy.	Those matters covered in the Strategy were investigated and assessed in this study.	Section 4.2 deals with the South Coast Regional Strategy.
	2.4 Addressing the recommendations of the Independent Review Panel for Sensitive Urban Lands	Those matters covered in the Independent Review Panel for Sensitive Urban Lands were investigated and assessed in this study.	Section 4.5 reviews the recommendations of the Independent Review Panel for Sensitive Urban Lands
	2.5 Assessment of the identified habitat corridor under the Jervis Bay Regional Environmental Plan.	The habitat corridor delineated across the study area is fully assessed in this report.	Section 4.3 discusses the habitat corridor.
3. State Fisheries	3.1 Description of aquatic environments, including watercourses and wetlands.	All aquatic habitats are described and assessed.	Sections 2.6 and 3.1.1, describe and assess wetland throughout the study area.
	3.2 Predict impacts on aquatic environments.	Wetland habitats likely to be impacted by the development are investigated to determine the level of impact, if any.	Section 4 discusses wetland issues.
	3.3 Mitigation of impacts upon aquatic environments, including SEPP No.14 wetlands, saltmarsh, mangroves.	Mitigation measures were developed for protecting wetland habitat on the subject land.	Proposals to mitigate potential impacts upon wetland environments are described in Section 4.

Authority	Issue	Response	Section(s) of this Report
	3.4 Predict impacts on threatened species, populations and communities listed under the Fisheries Management Act.	All likely threatened species, populations and communities listed under the Fisheries Management Act are assessed for potential impacts.	Section 2.4 discusses potential species.
	3.5 Details regarding consistency with South Coast Regional Strategy.	Relevant matters in the South Coast Regional Strategy are addressed.	Section 4.2 deals specifically with the South Coast Regional Strategy.
	3.6 Compliance with Independent Review Panel for Sensitive Urban Lands, Section 6, Oct. 2006.	The recommendations of the Independent Review Panel for Sensitive Urban Lands are assessed.	Section 4.5 deals specifically with the recommendations of the Independent Review Panel for Sensitive Urban Lands
4. Shoalhaven City Council	4.1 Need for targeted surveys for threatened species.	Targeted surveys were undertaken for all relevant threatened species, developed from the list provided by the DECCW.	Sections 2.3, 2.4, 3.1.7 and 3.2.3 deal with this issue.
	4.2 Existing vegetation mapping to be ground-truthed.	A fresh vegetation map has been prepared for the study area.	Section 3.1 describes and maps the vegetation in the study area.
	4.3 Endangered ecological communities to be identified.	All endangered ecological communities on the subject land are described, mapped and assessed.	Sections 2.5 and 3.1.8 discuss endangered ecological communities.
	4.4 Survey to include all areas directly or indirectly impacted by the development.	The study area covers all areas likely to be impacted by the development and all other adjoining land.	The study area is clearly defined in Section 2.1, including the primary investigation area, where the development is to take place.
	4.5 Survey methods to comply with standard techniques for targeted species.	The survey methods are those contained in the document prepared by the DECC (2004).	The survey methods are set out in detail in Sections 2 and 3.

Nomenclature - Animals

The scientific and common names for fauna species in this report are based on the Australian Museum's *The Mammals of Australia* (Strahan 1995), *Australian Bats* (Churchill 1998), *The Taxonomy and Species of Birds of Australia and its Territories* (Christidis & Boles 2008) and *Reptiles and Amphibians of Australia* (Cogger 1992).

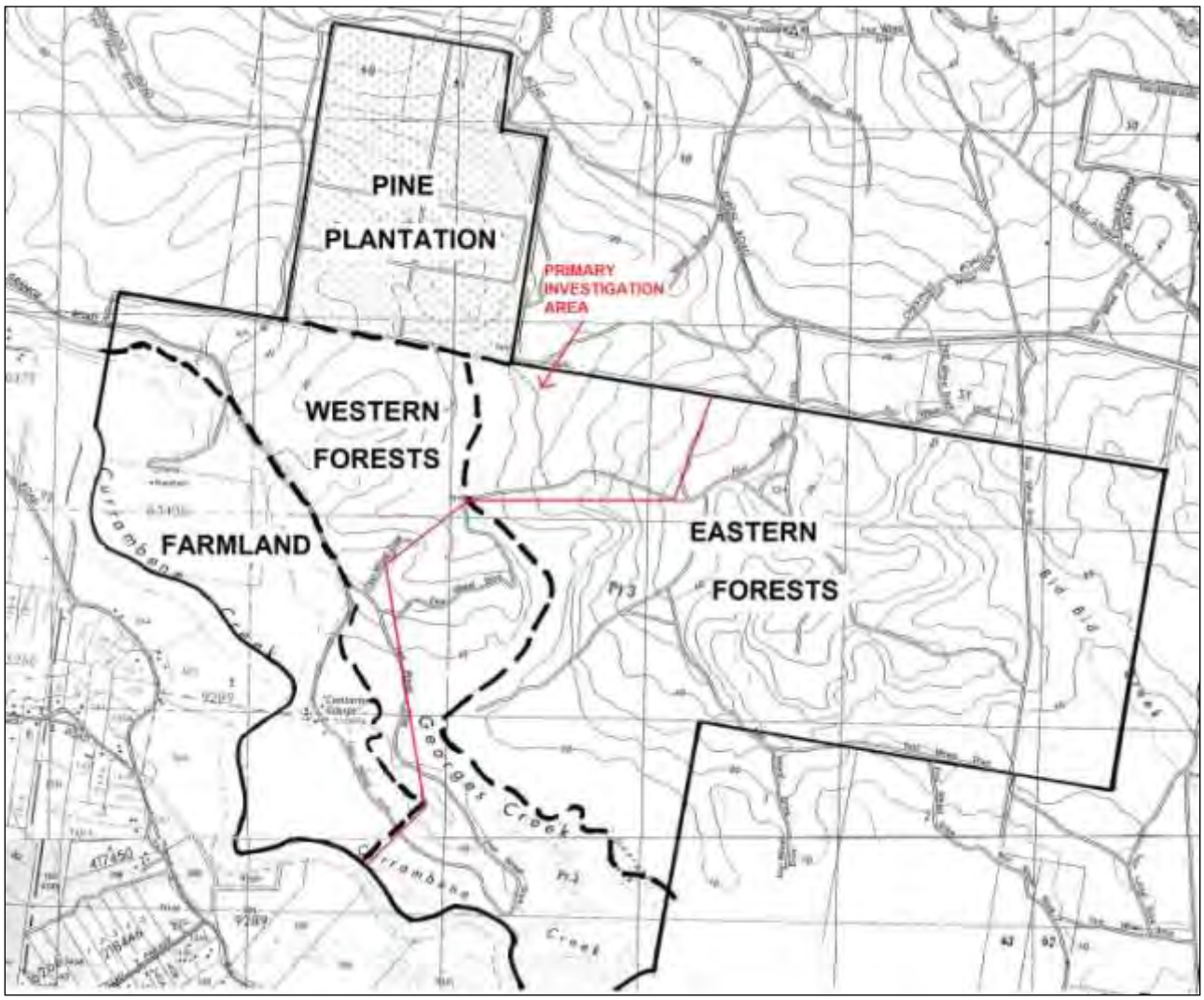

Figure 3. Survey Precinct and Primary Investigation Area.

2.3 Threatened Plants

A list of threatened plants known to occur in the general district around the study area was compiled from various sources, primarily the previous studies and the NSW Wildlife Atlas (NPWS on line), as well as a list in a submission from the DECC to the Department of Planning that accompanied that department's DG's requirements dated 11 September 2008. Targeted survey methods were then developed for each species, following examination of the DECC (2004) document referred to above. Those species identified for initial assessment are listed in **Table 2**. That table briefly discusses each species and identifies the type of targeted survey required for each relevant species. For several species, no such surveys are required as no suitable habitat occurs in or adjacent to the study area.

Table 2
List of Threatened Plant Species Requiring Initial Assessment

Species	Notes	Survey Response
Albatross Mallee *Eucalyptus langleyi*	A very obvious mallee that grows on sandstone soils to the west of Nowra; the closest known occurrence is 10 kilometres to the west. Not recorded during several previous studies in the study area.	Searches of all sandstone areas to be undertaken, particularly in more open heathlands where rock outcrops may be present.
Bauer's Midge Orchid *Genoplesium baueri*	A small ground orchid that can be difficult to find. The habitat is reported to be "drier, heathy eucalypt forests" (Bishop 1996). The closest record (NSW Wildlife Atlas) is from south of Vincentia, about nine kilometres to the south.	Searches of areas to be impacted during flowering period – February to May.
Eastern Australian Underground Orchid *Rhizanthella slateri*	This orchid has been found below Scribbly Gums, but is very rare in the region. The closest known occurrence (NSW Wildlife Atlas) is off Jarvis Bay Road at Falls Creek.	Need for targeted surveys during flowering period - October to November.
Ettrema Mallee *Eucalyptus sturgissiana*	A very obvious mallee that grows on higher altitude sandstone soils well to the southwest of Nowra; the closest known occurrence is 15 kilometres to the west. Not recorded during several previous studies on the property.	Searches of all sandstone areas to be undertaken, particularly in more open heathlands where rock outcrops may be present.
Tangled Bedstraw *Galium australe*	This small herb is very difficult to find amongst other low-growing vegetation. There are few regional records. The closest known occurrence (NSW Wildlife Atlas) is from Conjola National Park, about 20 kilometres to the south.	Difficult to find; vegetation plots were surveyed on site and extensive searches on many occasions were undertaken throughout the primary investigation area.
Bi-convex Paperbark *Melaleuca biconvex*	A very obvious tree that usually grows in very wet soils in the area west of Jervis Bay. Not recorded during several previous studies on the property.	Searches of all low-lying freshwater areas, including creeks and floodplain swamps. Maintain vigilance when carrying out vegetation surveys and other field studies.
Magenta Lilly Pilly *Syzygium paniculatum*	A very obvious tree that occurs in rainforest around Jervis Bay, including sites near Tomerong. The closest known occurrence (NSW Wildlife Atlas) is near Wollamia to the south. Not recorded during several previous studies on the property.	Searches of gully forest and elsewhere where rainforest plants occur.
Small-flowered Grevillea *Grevillea parviflora*	An obvious shrub. The closest known occurrence (NSW Wildlife Atlas) is near the Princes Highway and Parma Road.	Vegetation plots were surveyed on site and extensive searches on many occasions were undertaken throughout the primary investigation area.
Tessellated Spider Orchid *Caladenia tessellata*	This orchid is seldom seen in the Shoalhaven. The closest known occurrence (NSW Wildlife Atlas) is near Huskisson.	Searches of areas to be impacted during flowering period – September to November.
Jervis Bay Leek Orchid *Prasophyllum affine*	A terrestrial orchid restricted to about four sites around Jervis Bay; it grows on sandy clay soils amongst low-growing vegetation, usually with abundant sedge plants. The closest known occurrence (NSW Wildlife Atlas) is near Vincentia.	Searches of areas to be impacted during flowering period – November to December. Potential habitat probably not present.

Species	Notes	Survey Response
Leafless Tongue-orchid *Cryptostylis hunteriana*	A leafless terrestrial orchid visible from about December to February, although it does not flower every year. The south coast habitat of this orchid is described by Clark et al. (2004). The closest known occurrence is to the north of Vincentia.	Assessment of described habitat; searches of areas to be impacted during the flowering period – December to February.
Illawarra greenhood *Pterostylis gibbosa*	A small terrestrial orchid found only in a small number of locations near Nowra and further north in Shellharbour and Wollongong. Can be located prior to flowering by its distinctive rosette of leaves. The closest known occurrence is to the north in Worrigee Nature Reserve.	Searches of clayey soils, particularly the Berry Siltstone, on which the species is growing near Nowra. Flowering period is August to November. Leaves were found at the Worrigee site east of Nowra on 10 September 2009.

Table 3
List of Threatened Fauna Species Requiring Initial Assessment

Mammals	**Notes**	**Survey Response**
Large Bentwing Bat *Miniopterus schreibersii*	A cave-dwelling bat, commonly recorded during bat surveys.	Bat surveys required in suitable locations throughout the study area.
Eastern Falsistrelle *Falsistrellus tasmaniensis*	A forest inhabitant that uses tree hollows for roosting.	Bat surveys required in suitable locations throughout the study area.
Grey-headed Flying-fox *Pteropus poliocephalus*	Common in summer throughout the district; camps are mainly established along the escarpments in moist forest.	Auditory and spotlighting surveys in spring/summer, particularly around flowering eucalypts.
Eastern Pygmy-possum *Cercartetus nanus*	Widespread in localised populations, from heathland to moist forest. The closest record (NSW Wildlife Atlas) is at Vincentia.	Spotlighting and box traps were used.
Koala *Phascolarctos cinereus*	Extremely rare and likely to be absent from the Jervis Bay region today; at most only wandering animals reach this area from their colonies well to the west (e.g. Morton National Park). The closest previous records (NSW Wildlife Atlas) are from Myola and HMAS Albatross, although colonies do not occur in these locations.	Several methods are used to detect Koalas: spotlighting and vigilance for calls at night; searches for droppings below known food trees (e.g. *Eucalyptus punctata*); and searches of smooth-barked food trees for claw marks.
Large-eared Pied Bat *Chalinolobus dwyeri*	Most common in dry forests and woodlands; roost in caves and old mines.	Bat surveys required in suitable locations throughout the study area.
Large-footed Myotis *Myotis adversus*	A cave-dwelling bat, usually recorded over water.	Bat surveys required in suitable locations throughout the study area, i.e. primarily near water bodies.
Spotted-tailed Quoll *Dasyurus maculatus*	Occasional records from forest throughout the region; extirpated from most districts.	Cage traps to be included in trapping program.
White-footed Dunnart *Sminthopsis leucopus*	This species occurs in a variety of habitats, from heathland to forest. The closest record (NSW Wildlife Atlas) is from Currambene State Forest, about one kilometre to the east.	Box traps were employed at five transects.
Yellow-bellied Glider *Petaurus australis*	Known to occur near the study area; locally, mainly associated with forests containing Grey Gum and/or Spotted Gum.	Methods used were spotlighting and vigilance for calls at night; using call playback techniques (either this species or the Powerful Owl); and searches of food trees for feeding evidence (‘sap trees’).
Birds		
Black Bittern *Ixobrychus flavicollis*	Occasional around coastal lakes and estuaries.	Dedicated bird surveys in potential habitat are sufficient.
Eastern Bristlebird *Dasyornis brachypterus*	No suitable habitat present. No nearby records.	Dedicated bird surveys are sufficient.
Flame Robin *Petroica phoenicea*	Inhabits woodland and open country; more likely to be seen on the coast in winter when it visits from the tablelands.	Dedicated bird surveys are sufficient.
Gang-gang Cockatoo *Callocephalon fimbriatum*	Forests and woodlands throughout region; some birds are winter visitors.	Dedicated bird surveys are sufficient.

Birds	Notes	Survey Response
Glossy Black-Cockatoo *Calyptorhynchus lathami*	Populations occur throughout the region; mostly associated with stands of *Allocasuarina littoralis*.	The methods used to detect this species are: observations of feeding birds in stands of *Allocasuarina littoralis*; observations at water holes in the late afternoon for birds coming to drink and searches below Casuarina trees for the remains of chewed cones.
Little Eagle *Hieraaetus morphnoides*	A bird of prey that is an uncommon, breeding resident of the region; inhabits open country.	Dedicated bird surveys are sufficient.
Masked Owl *Tyto novaehollandiae*	Records from forests throughout the region.	Targeted surveys are difficult because of the unpredictability of the presence of this species. Nocturnal bird surveys across the study area would be sufficient.
Australian Pied Oystercatcher *Haematopus longirostris*	A coastal species. No suitable habitat on or adjacent to the property.	No need for special surveys.
Powerful Owl *Ninox strenua*	A moderately common owl in the forests of the region; previously recorded breeding in an old pine plantation (1988). All forests are potential habitat.	Spotlighting, call playback, searching for whitewash and other evidence below potential nest trees and roost sites; and stag-watching at potential nest trees in winter are the main methods of detecting the presence of this owl.
Regent Honeyeater *Anthochaera phyrgia*	A very rare visitor to this region.	Targeted surveys are difficult because of the unpredictability of the presence of this species. General bird surveys across the study area would be sufficient.
Scarlet Robin *Petroica multicolor*	A woodland bird, also seen in open country; more likely to be seen on the coast in winter when it visits from the tablelands.	Dedicated bird surveys are sufficient.
Sooty Oystercatcher *Haematopus fuliginosus*	A coastal species. No suitable habitat on or adjacent to the property.	No need for special surveys.
Sooty Tern *Sterna fuscata*	A coastal species. No suitable habitat on or adjacent to the property.	No need for special surveys.
Square-tailed Kite *Lophoictinia isura*	A regular summer breeding migrant in the Nowra to St Georges Basin area.	Vigilance for birds and nest trees during bird surveys and other field studies.
Swift Parrot *Lathamus discolour*	This species visits the region in winter, outside their breeding period (all birds breed in Tasmania). Numbers on the NSW coast fluctuate greatly from year to year, probably related to the availability of flowering trees and drought conditions.	Observations of flowering eucalypts in winter is the only survey method that can be used to detect this species.
Turquoise Parrot *Neophema pulchella*	A rare visitor to the region, with few recent records. The habitat appears to be open woodland and heathlands as well as open forest with a grassy understorey.	Targeted surveys are difficult because of the unpredictability of the presence of this species. General bird surveys across the study area would be sufficient.

Birds	**Notes**	**Survey Response**
Varied Sittella *Daphoenositta chrysoptera*	A bird of forest and woodland; usually seen in small foraging flocks in the tops of trees.	Dedicated bird surveys are sufficient.
Frogs		
Green and Golden Bell Frog *Litoria aurea*	Probably no suitable habitat is present in the study area, although the farm damns may provide a little potential habitat. The closest record (NSW Wildlife Atlas) is from Falls Creek, on the southern, opposite side of Currambene Creek.	Undertake auditory surveys in spring-summer at potential habitat sites, including call playback. Tadpoles can also be searched for in these habitats.
Giant Burrowing Frog *Heleioporus australiacus*	Could conceivably occur along Georges Creek. The closest record (NSW Wildlife Atlas) is from Vincentia, about ten kilometres to the south.	Undertake auditory surveys in spring-summer at potential habitat sites. Tadpoles can also be searched for in these habitats.

2.4 Threatened Animals

As with the threatened plants, a list of threatened animals known to occur in the general district around the study area was compiled from various sources, primarily the previous studies and the NSW Wildlife Atlas (NPWS on line), as well as a list in a submission from the DECC to the Department of Planning. Relevant species listed by the NSW Scientific Committee since the Director-general's requirements were issued, have been added to **Table 3**. Targeted survey methods were then developed for each fauna species, following examination of the DECC (2004) document referred to above. Those species identified for initial assessment are listed in **Table 3**. As with the threatened plants, the table briefly assesses each species and identifies the survey requirements for all relevant species.

2.5 Endangered Ecological Communities

Several endangered ecological communities occur in the study area; these are communities listed in Part 3 of Schedule 1 of the *Threatened Species Conservation Act 1995* (NSW). There are no such communities on the land that are listed under the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth). The listed communities are summarised in **Table 4**; the Final Determinations made by the NSW Scientific Committee to list each community are provided in **Appendices 8 to 12.**

Table 4
Summary of Endangered Ecological Communities in the Study Area

Name	Occurrence
Coastal Saltmarsh	Broad flats with a muddy substrate near Currambene Creek, these experience at least some tidal inundation. Also minor occurrences along the banks of this creek.
Swamp Oak Floodplain Forest	On the lowlands around Currambene Creek, mainly where the soils are alluvial and moist. Also occurs along the banks of this creek as a narrow band of trees. The stands growing on the previously cleared dry ridges nearby may not be this community.
Swamp Sclerophyll Forest	Along Georges Creek and Bid Bid Creek and their tributaries, on deep moist alluvial soils.
River Flat Forest	Small remnants occur on the cleared farmland. There are also stands in a natural condition near the lower part of Georges Creek.
Freshwater Wetland	There are three broad depressions on the farmland that support this community, mainly as a sedgeland, with some stands of shrub paperbark.

The field surveys aimed to map and describe these communities. A draft map was prepared from aerial photographs and previous surveys and then this was field checked to ensure accuracy. It was soon realised that the *SEPP No. 14 – Coastal Wetlands* map did not cover all of the local wetlands; see Section 2.6.

Although not an endangered ecological community, it is noted that mangroves are protected marine vegetation under the *Fisheries Management Act 1994* (NSW).

2.6 Wetlands

The map in *SEPP No. 14 - Coastal Wetlands* (New South Wales 1985) delineates several wetlands in the study area and nearby; see **Figure 4.** However, the map attached to the SEPP does not cover all of the wetlands in the area. The additional wetlands are also shown on **Figure 4**.

Figure 4. Distribution of Wetlands in the Study Area.
Bid Bid Creek on the far eastern edge of the study area is not shown.

3 RESULTS

3.1 The Vegetation

3.1.1 Wetlands

"Wetlands are areas that are wet for a long enough period such that the plants and animals living in them are adapted to, and often dependent on, living in wet conditions for at least part of their life cycle." (NSW Wetlands Management Policy 1996)

The study area contains an extensive area of wetland in the vicinity of Currambene Creek and the lower section of Georges Creek. This area supports a complex of freshwater and saltwater wetlands, ranging from very low-growing saltmarsh to dense forest. There are also three separate freshwater wetlands on the cleared farmland, attached to Currambene Creek by small floodplain channels. As noted above, nearly all of these wetlands are identified as endangered ecological communities of one type or another in New South Wales.

For convenience, the following discussion on the wetlands in the study area is divided into freshwater wetlands and saltwater wetlands. These are distinct in terms of their habitat features and the vegetation that they support. A distinct suite of plant species is associated with each wetland type; see **Table 5**, where their occurrence in the study area is indicated. The distribution of the wetlands is shown in **Figure 4.**

Freshwater Wetlands
Natural freshwater wetlands are associated with two distinct environments in the study area, namely low-lying floodplain flats and riparian corridors along some local creeks. The three floodplain wetlands are ephemeral and dominated by Tall Sedge *Carex appressa*. Other wetland herbaceous species are present but are much less common; see **Table 5**. Three species of tree, commonly associated with floodplain wetlands, occur as remnants of the original wetland forest around the edges of these wetlands. The species are Prickly-leaved Paperbark *Melaleuca styphelioides*, Swamp Oak *Casuarina glauca* and Cabbage Gum *Eucalyptus amplifolia.* In the northern area of these wetlands and near the southern of the three wetlands, there are stands of the shrub Swamp Paperbark *Melaleuca ericifolia*. Farm dams occur in a few places and support small stands of wetland vegetation, particularly Tall Spike-rush *Eleocharis sphacelata* and the exotic Club-rush *Isolepis prolifera.*

The tributaries of Georges Creek in the old pine plantation support a wetland forest containing the trees Swamp Mahogany *Eucalyptus robusta*, Narrow-leaved Paperbark *Melaleuca linariifolia* and Woollybutt *Eucalyptus longifolia*. The understorey is typically a dense growth of the large sedge Tall Saw-sedge *Gahnia clarkei*. Many of the wetland species, including the above trees, also occur along the lower section of Georges Creek.

Saltwater Wetlands
Saltwater wetlands occur where there is some influence of saline water from Currambene Creek, even though this may be occasional. In addition to Currambene Creek itself, there is a broad low-lying flat on the floodplain in the southern corner of the property that is connected to the creek and is inundated frequently enough that is supports estuarine vegetation. Similar undisturbed flats occur near the junction of Currambene and Georges Creek.

Table 5 ***Wetland Plant Species in the Study Area***					
Habit/Species	**Freshwater**			**Saltwater**	
	Floodplain	**Creeks**	**Dams**	**Currambene Creek**	**Estuarine Flat**
Trees and Shrubs					
Aegiceras corniculatum				U	E
Amyema cambagei				On *C. glauca*	
Avicennia marina				U	E
Casuarina glauca	F			U	E
Eucalyptus amplifolia	F				
Eucalyptus robusta		C			
Melaleuca ericifolia	F				
Melaleuca linariifolia	F	C			
Melaleuca squarrosa		C			
Melaleuca styphelioides	F				
Sedges and Rushes					
Baumea articulata			D		
Baumea juncea				U	E
Carex appressa	F				
Eleocharis sphacelata			D		
Gahnia clarkei		C			
Ficinia nodosa				U	
*Isolepis prolifera**			D		
Juncus kraussii	F			U	E
Juncus planifolius		C			
Juncus prismatocarpus		C			
Juncus usitatus	F		D		
Schoenoplectus validis	F				
Forbs					
Alternanthera denticulata	F				
Apium prostratum				U	
Atriplex australasica				U	E
Centella asiatica	F		D		
Centipeda minima	F				
Leptinella longipes					E
*Ludwigea peploides**			D		
Lythrum hyssopifolia	F				

Habit/Species	**Freshwater**			**Saltwater**	
	Floodplain	**Creeks**	**Dams**	**Currambene Creek**	**Estuarine Flat**
Persicaria decipiens	F				
Persicaria hydropiper	F				
Persicaria orientalis	F				
Persicaria strigosa	F				
Philydrum lanuginosum			D		
Ranunculus inundatus	F				
Samolus repens	F				
Sarcocornia quinqueflora				U	E
Selliera radicans					E
Suaeda australis				U	E
Tetragonia tetragonoides				U	
Triglochin procerum		C	D		
Triglochin striatum					E
Typha orientalis	F		D		
Grasses					
Hemarthria uncinata		C			
Isachne globosa	F				
Paspalum distichum	F				
Phragmites australis	F				
Sporobolus virginicus				U	E
Ferns					
Azolla filiculoides			D		
Gleichenia dicarpa		C			
Hypolepis muelleri		C			
Sticherus flabellatus		C			

*Introduced species.

The creek supports a narrow band of estuarine vegetation; most commonly the trees Swamp Oak *Casuarina glauca* and Grey Mangrove *Avicennia marina*. Smaller wetland plants occur here and there, including Common Reed *Phragmites australis* and Sea Rush *Juncus kraussii*.

The broad estuarine flat is mainly covered in the saltmarsh herb Beaded Glasswort *Sarcocornia quinqueflora*, with a few other saltmarsh species, mainly around the edges. These species include Saltbush *Atriplex australasica* and Salt Couch *Sporobolus virginicus*. The sedge Sea Rush *Juncus kraussii* is dominant in the southern section, near the creek. A channel through the flat is lined with Grey Mangrove *Avicennia marina* and occasionally River Mangrove *Aegiceras corniculatum*. Stands of Swamp Oak *Casuarina glauca* are common in the south and west of this area.

3.1.2 Forests and Woodlands

Most of the natural vegetation on the Comberton Grange property is either forest or woodland. Several different forest and woodland communities have been identified in the area. The main areas of forest are dominated by either Blackbutt *Eucalyptus pilularis* or Spotted Gum *Corymbia maculata*. Their common tree associates include White Stringybark *Eucalyptus globoidea,* Red Bloodwood *Corymbia gummifera*, Turpentine *Syncarpia glomulifera* and Grey Ironbark *Eucalyptus paniculata.* The forest often contains stands of the medium-sized tree Black She-oak *Allocasuarina littoralis*. The deep valley of Georges Creek supports a tall forest of Blackbutt *Eucalyptus pilularis* and Southern Blue Gum *Eucalyptus saligna/E. botryoides*, often with some rainforest plants in the understorey.

The woodlands are typical of the sandy soils of the district. The well-spaced trees mainly have a heathland understorey, quite distinct from the above forests. The prominent trees in the woodland are Hard-leaved Scribbly Gum *Eucalyptus sclerophylla*, Red Bloodwood *Corymbia gummifera,* Brown Stringybark *Eucalyptus capitellata* and Old Man Banksia *Banksia serrata*.

3.1.3 Secondary Regrowth

Secondary regrowth is native vegetation that has regrown on previously cleared land. This vegetation, ranging from shrubland to young forest, occurs across most of the old pine plantation and on the edges of the farmland above Currambene Creek, particularly in the south.

The old pine plantation is mainly covered in White Kunzea *Kunzea ambigua* shrubland, with scattered young trees, including pines. The forest along the creeks in the plantation area are described elsewhere. Dense stands of Black Wattle *Acacia mearnsii* occur in the south of the farmland, on the edge of the forest. Elsewhere, patches of wattles, eucalyptus and other natives can be found. In the far south of the farmland, an extensive area of previously cleared land has been invaded by Swamp Oak *Casuarina glauca* that now forms a dense forest in some places.

3.1.4 Farmland

The cleared farmland above Currambene Creek is covered in exotic grasses and other introduced species. On the higher land the main grasses are Carpet Grass *Axonopus fissifolius* and other exotic grasses and herbs. Kikuyu Grass *Pennisetum clandestinum* is mainly dominant on the moister lower areas. Pasture weeds and other exotics are scattered throughout, including Yorkshire Fog *Holcus lanatus*, Fireweed *Senecio madagascariensis,* Ribbed Plantain *Plantago lanceolata,* Paddy's Lucerne *Sida rhombifolia,* Whiskey Grass *Andropogon virginicus* and Spear Thistle *Cirsium vulgare*. Thickets of Blackberry *Rubus fruticosus* sp. agg. occur here and there. Various natives are colonising the paddocks, including some trees and shrubs.

The band of trees along Currambene Creek is generally very narrow. Other than the wetland plants already discussed, the natives present include forest trees, shrubs and other plants; these are listed in the plant species list under farmland. The main forest trees are Southern Blue

Gum *Eucalyptus saligna/E. botryoides* and Spotted Gum *Corymbia maculata*. Occasional trees include Grey Ironbark *Eucalyptus paniculata*, Forest Red Gum *Eucalyptus tereticornis*, Woollybutt *Eucalyptus longifolia* and Lilly Pilly *Syzygium smithii*.

3.1.5 Plant Species Recorded

A total of 393 plant species have been recorded at Comberton Grange; this includes 327 indigenous species and 66 introduced species. Floristic diversity is considered to be high, reflecting the presence of so many different vegetation communities which, in turn, are associated with considerable variations in the geology and topography across the property.

The plant species recorded at Comberton Grange have been listed in **Appendix 2**, together with the introduced species. No threatened species were found there; Section 2.3 contains a discussion of the potential for threatened plant species to occur on the property. One nationally rare plant species (Briggs & Leigh 1996), the wattle *Acacia subtilinervis*, is located on the far eastern part of the property.

3.1.6 Plant Communities

Comberton Grange supports 15 distinct types of forest, woodland and treeless community, each with a different structure and assemblage of plant species, this includes saltwater and freshwater wetlands. These communities have been summarised below, in **Table 6**. The distribution of the plant communities across the study area is shown on **Figure 5**, and detailed descriptions of each are provided in the following pages. Vegetation survey sheets were completed for each vegetation community on and near the development areas; these sheets are provided in **Appendix 3**.

Blue Gum - Blackbutt Tall Forest
Eucalyptus saligna/Eucalyptus botryoides, Eucalyptus pilularis

Occurrence: Blue Gum - Blackbutt Tall Forest occurs in the deep gullies in the upper reaches of Georges Creek and Bid Bid Creek.

Structure: The community reaches a height of more than 30 metres, and sometimes has a closed middle canopy of rainforest and other trees. Vines and ferns are often common.

Description: The forest is dominated by Blackbutt *Eucalyptus pilularis*, Southern Blue Gum *Eucalyptus saligna/E. botryoides* and Turpentine *Syncarpia glomulifera.* The understorey is composed of many small trees and shrubs, including rainforest species such as Lilly Pilly *Syzygium smithii,* Rosewood *Synoum glandulosum,* Cabbage Tree Palm *Livistona australis* and Corkwood *Duboisia myoporoides.* Water Vine *Cissus hypoglauca* often covers many of the small trees. Rough-barked Apple *Angophora floribunda* and Old Man Banksia *Banksia serrata* occur on the edges of the forest, where the ground is rocky.

Equivalent Community in Other Studies
Mills (1993): Community 5.1, Tall Forest (*Eucalyptus saligna/E. botryoides*).
Kevin Mills & Associates (1989 & 2000): Community 3, Blue Gum - Rough-barked Apple - Blackbutt Open Forest (*Eucalyptus saligna/E. botryoides, Eucalyptus pilularis, Angophora floribunda*).
Braithwaite et al. (1988): Included in Community 8, *Eucalyptus tereticornis - Angophora floribunda - Eucalyptus saligna.*
Mills (1998): Blue Gum – Blackbutt Tall Forest (SAL-PIL)

Table 6 ***Vegetation Communities in the Study Area***		
Community (Map Code)	**Key Species**	**Occurrence**
1. Blue Gum – Blackbutt Tall Forest (SAL-PIL)	*Eucalyptus saligna/ E.botryoides* *Eucalyptus pilularis*	In deep valleys of Georges and Bid Bid Creeks.
2. Spotted Gum – Ironbark Forest (MAC-PAN)	*Corymbia maculata* *Eucalyptus paniculata* *Eucalyptus globoidea* *Syncarpia glomulifera*	On the Wandrwandian Siltstone along the edge of the cleared land in the western part of the property.
3. Blackbutt-Turpentine Forest (PIL-SYN)	*Eucalyptus pilularis* *Syncarpia glomulifera* *Eucalyptus globoidea* *Allocasuarina littoralis*	On deeper sandy soils of the gully slopes and broad ridges.
4 .Stringybark – Bloodwood Forest (GLB-GUM)	*Eucalyptus globoidea* *Corymbia gummifera*	On gently sloping land in the northern-central part of the property.
5 .Red Gum – Angophora Forest (TER-ANG)	*Eucalyptus tereticornis* *Angophora floribunda* *Acacia irrorata* *Acacia mearnsii*	Dolerite soil in the valley of Georges Creek.
6. Swamp Mahogany Forest (ROB-MEL)	*Eucalyptus robusta* *Casuarina glauca* *Melaleuca linariifolia* *Melaleuca styphelioides*	Occurs on alluvial soils along Georges and Bid Bid Creeks, and their tributaries.
7. Woollybutt – Paperbark Forest/ Woodland (LON-MEL)	*Eucalyptus longifolia* *Melaleuca linariifolia* *Eucalyptus saligna/ E.botryoides*	Narrow occurrences on poorly drained gully floors.
8. Scribbly Gum – Bloodwood Woodland (SCL-GUM)	*Eucalyptus sclerophylla* *Corymbia gummifera*	Common on broad ridges of sandstone soils.
9. Wattle Forest – Woodland (ACA-FOR)	*Acacia mearnsii* *Kunzea ambigua*	Regrowth on previously cleared land in south-western part of property.
10. Swamp Oak Forest (CAS-GLA)	*Casuarina glauca*	On floodplain along Currambene Creek in southern part of property.
11. Saltwater Juncus Rushland (JUN-SAL)/ Saltmarsh (SAR-SUA)	*Juncus kraussii* *Sarcocornia quinqueflora* *Selliera radicans*	Tidally inundated flats along Currambene Creek.
12. Fresh Juncus Rushland (JUN-FRH)	*Juncus usitatus* *Carex appressa* *Paspalum distichum* *Persicaria* spp.	In depressions across the cleared floodplain of Currambene Creek.
13. Mangrove Forest/Woodland (AVI-FOR)	*Avicennia marina* *Aegiceras corniculatum*	Small area in the far south-east corner of the property.
14. Sandstone Sedgeland/ Heathland (SST-SDG)	*Kunzea ambigua* *Leptospermum* spp. *Sedges*	On poorly-drained sites on the northern boundary of the property; also on old farmland.
15. Kunzea Shrubland (KUN-SHR)	*Kunzea ambigua*	Naturally on sandstone outcrop in far northeast corner of the property; regrowth also covers most of the old pine plantation.

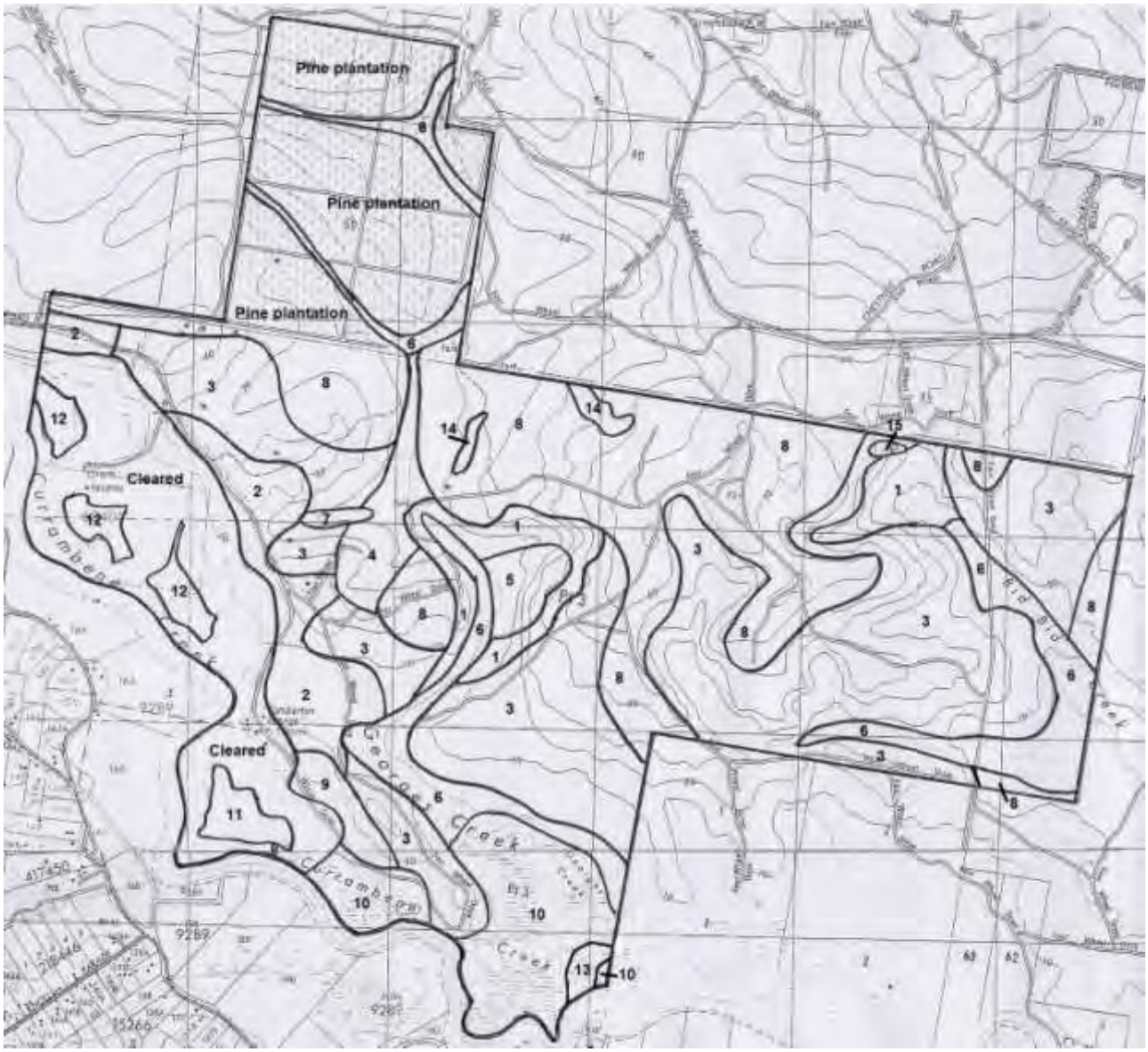

Figure 5. Distribution of the Plant Communities in the Study Area.
Numbers correspond to those in Table 6.

Spotted Gum – Blackbutt - Ironbark Forest
Corymbia maculata, Eucalyptus pilularis, Eucalyptus paniculata

Occurrence: Spotted Gum - Blackbutt - Ironbark Forest occurs on the clayey Wandrawandian Siltstone in the western part of the property. The large Spotted Gums in the paddocks are relics of the original forest.

Structure: The community reaches a height of about 25 metres, but large trees are uncommon because the forest has been logged. There is a dense middle storey of casuarinas in some places, and the understorey is often dry, grassy and rather open.

Description: The forest is dominated by Spotted Gum *Corymbia maculata,* Blackbutt *Eucalyptus pilularis* and Grey Ironbark *Eucalyptus paniculata*, these species growing in association with Turpentine *Syncarpia glomulifera* and White Stringybark *Eucalyptus globoidea.* Two-veined Hickory *Acacia binervata,* a medium sized tree, is common in some places.

The understorey is characterised by Hairpin Banksia *Banksia spinulosa,* Gorse Bitter Pea *Daviesia ulicifolia,* Blackthorn *Bursaria spinosa,* Narrow-leaved Geebung *Persoonia linearis* and Burrawang *Macrozamia communis.* The ground cover species include Dwarf Blue Trumpet *Brunoniella pumilio*, Wiry Panic *Entolasia stricta,* Juniper Beard-heath *Leucopogon juniperinus,* Variable Sword-sedge *Lepidosperma laterale* and Tussock Grass *Poa* sp.

Equivalent Community in Other Studies
Mills (1993): Community 5.2, Tall Forest - Forest (*Eucalyptus maculata, Eucalyptus paniculata*).
Braithwaite et al. (1988): Community 3, *Eucalyptus maculata - E. globoidea - E. paniculata.*
Mills (1998): Spotted Gum - Blackbutt Forest (MAC-PIL).

Blackbutt – Turpentine Forest
Eucalyptus pilularis, Syncarpia glomulifera, Corymbia gummifera,

Occurrence: Blackbutt – Turpentine Forest occurs mainly on broad ridges and gully slopes on deep, sandy soils.

Structure: The community reaches a height of about 25 metres, and often has a well developed middle storey of casuarinas. Shrubs are common in the understorey, except where the casuarinas are dense. The forest has been logged, so large trees are uncommon.

Description: The forest is dominated by Blackbutt *Eucalyptus pilularis* and Red Bloodwood *Corymbia gummifera,* occurring in association with Turpentine *Syncarpia glomulifera* and White Stringybark *Eucalyptus globoidea.* Black She-oak *Allocasuarina littoralis* forms dense strands in some places. Hairpin Banksia *Banksia spinulosa,* Narrow-leaved Geebung *Persoonia linearis,* Mountain Devil *Lambertia formosa* and Sweet Wattle *Acacia suaveolens* are common shrubs in the understorey. The characteristic ground cover species include Common Bracken *Pteridium esculentum,* Shrubby Platysace *Platysace lanceolata,* Variable Sword-sedge *Lepidosperma laterale* and Wiry Panic *Entolasia stricta.*

Equivalent Community in Other Studies
Mills (1993): Community 5.3, Tall Forest - Forest (*Eucalyptus pilularis*).
Kevin Mills & Associates (1989 & 2000): Community 2b, Blackbutt - Bloodwood Open Forest (*Eucalyptus pilularis, Eucalyptus gummifera*).
Braithwaite et al. (1988): Community 4, *Eucalyptus pilularis - Corymbia gummifera.*
Mills (1998): Blackbutt Tall Forest (PIL-SYN)

Stringybark - Bloodwood Forest
Eucalyptus globoidea, Corymbia gummifera, Eucalyptus piperita

Occurrence: Stringybark - Bloodwood Forest occurs on rather deep, sandy soils in the area along the western edge of the Georges Creek valley. The community appears to be intermediate between the Blackbutt Forest and Scribbly Gum Woodland.

Structure: The community varies from forest to woodland. Shrubs are common, except where there is a dense middle canopy of casuarinas.

Description: The forest contains Red Bloodwood *Corymbia gummifera,* White Stringybark *Eucalyptus globoidea* and Sydney Peppermint *Eucalyptus piperita,* and occasional Blackbutt *Eucalyptus pilularis,* Scribbly Gum *Eucalyptus sclerophylla* and Rough-barked Apple *Angophora floribunda.* Black She-oak *Allocasuarina littoralis* is common in some places. The characteristic understorey shrubs include White Kunzea *Kunzea ambigua*, Hairpin Banksia *Banksia spinulosa* and Narrow-leaved Geebung *Persoonia linearis.* Gorse Bitter-Pea *Daviesia ulicifolia*, Flax-lily *Dianella caerulea* and Spear-grass *Stipa* sp. occur in the understorey.

Equivalent Community in Other Studies
Mills (1993): Not identified; this community was mapped within Community 5.3.
Braithwaite et al. (1988): Probably included in Community 14, *Eucalyptus gummifera - Banksia serrata - Eucalyptus sieberi.*
Mills (1998): Stringybark – Bloodwood Forest (GLB-GUM)

Red Gum – Angophora Forest
Eucalyptus tereticornis - Angophora floribunda - Acacia irrorata - Acacia mearnsii

Occurrence: Red Gum – Angophora Forest occurs on the Currambene Dolerite on the eastern part of Georges Creek valley.

Structure: This was originally a forest although it is now partly cleared and somewhat disturbed. Trees over 25 metres tall and a grassy understorey are characteristic features.

Description: This is a forest characterised by Forest Red Gum *Eucalyptus tereticornis* and Woollybutt *Eucalyptus longifolia* and Rough-barked Apple *Angophora floribunda*, with Southern Blue Gum *Eucalyptus saligna/Eucalyptus botryoides* and, in disturbed sections, the tree wattles *Acacia irrorata* and *Acacia mearnsii*. Rainforest plants are common towards the creek, and the ground cover is mostly grassy.

Equivalent Community in Other Studies
Mills (1993): Community 5.5; *Eucalyptus tereticornis* Forest
Kevin Mills & Associates (1989): Red Gum - Rough-barked Apple Open Forest/ Woodland
Braithwaite et al. (1988): Community 8, *Eucalyptus tereticornis* Forest Red Gum, Rough-barked Apple *Angophora floribunda* and Blue Gum *Eucalyptus saligna*.
Mills (1998): Red Gum – Angophora Forest (TER-ANG)

Woollybutt – Paperbark Forest/Woodland
Eucalyptus longifolia – Melaleuca spp.

Occurrence: This forest occurs amongst other forest types on the floors of small gullies that are apparently poorly drained.

Structure: Woodland to forest with an open to dense shrubby understorey. The groundcover is grassy.

Description: The main trees are Woollybutt *Eucalyptus longifolia*, Southern Blue Gum *Eucalyptus saligna/E. botryoides* and Narrow-leaved Paperbark *Melaleuca linariifolia*. The understorey is composed of a mixture of forest species and some wetland plants. Typical species include Tal Saw-sedge *Gahnia clarkei*, Tall Tussock *Poa labilladeiri* and Five-leaved Water Vine *Cissus hypoglauca*.

Equivalent Community in Other Studies:
Mills (1993): 3.3 *Eucalyptus longifolia – Melaleuca* forest-woodland
Braithwaite et al. (1988): Community 5. *E. longifolia*
Mills (1998): Woollybutt - Paperbark Forest (LON-MEL)

Swamp Mahogany Forest
Eucalyptus robusta - Casuarina glauca - Melaleuca linariifolia

Occurrence: Swamp Mahogany Forest occurs along the Georges Creek and Bid Bid Creek valleys, on water-logged soils near the creek in the base of the valleys.

Structure: This is a forest or woodland, with moderately large trees to around 25 metres tall; there are usually smaller paperbark trees. The understorey is often a dense growth of shrubs and sedges.

Description: The characteristic tree species, and indeed most of the plants in the community, are wetland species or at least those that prefer wet soil conditions. The trees are Swamp Mahogany *Eucalyptus robusta,* Woollybutt *Eucalyptus longifolia,* Swamp Oak *Casuarina glauca,* Narrow-leaved Paperbark *Melaleuca linariifolia* and, sometimes around the edges, Forest Red Gum *Eucalyptus tereticornis* and Bangalay *Eucalyptus botryoides*. The understorey species include Swamp Paperbark *Melaleuca ericifolia*, Tassel Cord-rush *Restio tetraphyllus,* Bare Twig-rush *Baumea juncea* and Tall Saw-sedge *Gahnia clarkei*.

Equivalent Community in Other Studies
Mills (1993): Community 3.2; *Eucalyptus robusta* Forest-Woodland.
Braithwaite et al. (1988): Community 10; *Eucalyptus robusta.*
Mills (1998): Swamp Mahogany – Paperbark Forest (ROB-MEC)
NSW Scientific Committee (2004): Swamp Sclerophyll Forest on Coastal Floodplains.

Scribbly Gum - Bloodwood Woodland
Eucalyptus sclerophylla, *Corymbia gummifera, Eucalyptus capitellata*

Occurrence: Scribbly Gum - Bloodwood Woodland occurs on the northern and eastern parts of the property, on broad ridge crests with sandy soils. The woodland contrasts markedly with the adjacent forest; the trees are smaller and more sparsely distributed, and have a dense heathland understorey.

Structure: The canopy of the woodland is quite open, allowing shrubs and other understorey plants to grow in abundance. The woodland is taller on the northern part of the property, where it occurs almost as forest.

Description: The woodland is dominated by Scribbly Gum *Eucalyptus sclerophylla*, Red Bloodwood *Corymbia gummifera* and Brown Stringybark *Eucalyptus capitellata*; other trees are usually rare, although Old Man Banksia *Banksia serrata* is sometimes common. There are many shrubs in the understorey, species such as Hairpin Banksia *Banksia spinulosa,* Broad-leaved Geebung *Persoonia levis*, Paperbark Teatree *Leptospermum trinervium,* Mountain Devil *Lambertia formosa,* Finger Hakea *Hakea dactyloides* and Conesticks *Petrophile pedunculata*. The characteristic ground cover species include Wiry Panic *Entolasia stricta,* Heathland Mirbelia *Mirbelia rubiifolia,* Narrow-leaved Platysace *Platysace linearifolia,* Heath *Epacris pulchella,*

Common Aotus *Aotus ericoides* and several sedge species, including Scale-rush *Lepyrodia scariosa.*

Equivalent Community in Other Studies
Mills (1993): Community 4.2, Woodland - Open Woodland (*Eucalyptus sclerophylla, Eucalyptus gummifera*).
Kevin Mills & Associates (1989 & 2000): Community 1, Bloodwood - Scribbly Gum Woodland (*Eucalyptus gummifera - Eucalyptus sclerophylla - Eucalyptus sieberi*).
Braithwaite et al. (1988): Community 12, *Eucalyptus sclerophylla - Eucalyptus gummifera.*
Mills (1998): Scribbly Gum – Bloodwood Woodland (SCL-Gum)

Wattle Forest - Woodland
Acacia mearnsii, *Kunzea ambigua*

Occurrence: A patch of Wattle Forest - Woodland is regenerating on previously cleared land in the far southern part of the property, and in a few other places.

Structure: The community occurs mainly as woodland and shrubland. It is not a natural community, having regrown on previously cleared land.

Description: Blackwood *Acacia mearnsii,* Swamp Oak *Casuarina glauca* and Spotted Gum *Corymbia maculata* are the main tree species. Dense White Kunzea *Kunzea ambigua* occurs in the understorey. Juniper Beard-heath *Leucopogon juniperinus* is also common. The community merges with Swamp Oak Forest regenerating on some areas.

Equivalent Community in Other Studies
Mills (1998): Wattle Forest (ACA-FOR)

Swamp Oak Forest
Casuarina glauca

Occurrence: There is a large stand area of Swamp Oak Forest adjacent to Currambene Creek, across the southern part of the property where the floodplain is low and the watertable high. The community is closely associated with the mangrove and saltmarsh communities in the same area.

Structure: The community is a dense forest of casuarinas. The density of the forest varies with the height of the watertable, salinity and past disturbance. The understorey is mostly quite open.

Description: The forest is a dense growth of Swamp Oak *Casuarina glauca*; almost no other trees are present. The understorey is open, but contains occasional saltwater and freshwater wetland plants such as Swamp Weed *Sellaria radicans,* Common Rush *Juncus usitatus,* NZ Spinach *Tetragonia tetragonioides,* Native Violet *Viola hederacea,* Large Creeping Cotula *Leptinella longipes,* Tall Sedge *Carex appressa* and Sea Rush *Juncus kraussii.* The mistletoe *Amyema cambagei* is common on *Casuarina glauca* in some places.

Equivalent Community in Other Studies
Mills (1993): Community 2.3, Forest - Woodland (*Casuarina glauca*).
Braithwaite et al. (1988): Community 9, *Casuarina glauca.*
Mills (1998): Swamp Oak Forest (CAS-GLA)
NSW Scientific Committee (2004): Swamp Oak Floodplain Forest.

Sandstone Sedgeland-Heathland
Sedges, *Leptospermum* spp.

Occurrence: Occurs on poorly drained areas on the central-northern edge of the property.
Structure: This is a shrubland - sedgeland to about two metres tall; the ground cover plants are very dense. The community is treeless.
Description: This community is a rather dense shrubland to sedgeland, is almost treeless and contains plants that prefer moist soils. The common plants include White Kunzea *Kunzea ambigua,* Diosma Heath-myrtle *Baeckea diosmifolia,* Yellow Teatree *Leptospermum polygalifolium,* Finger Hakea *Hakea dactyloides*, Silky Hakea *Hakea sericea,* Coral Heath *Epacris microphylla* and sedges such as Scale-rush *Lepyrodia scariosa*.

The species indicating a wet soil include Native Broom *Viminaria juncea*, Narrow-leaved Bottlebrush *Callistemon linearis*, Thyme Honey-myrtle *Melaleuca thymifolia* and Prickly Teatree *Leptospermum juniperinum*.

Equivalent Community in Other Studies
Mills (1993): Community 4.4, Sedgeland - heathland (fresh swamp)
Braithwaite et al. (1988): Community 2, Intermittent fresh water.
Mills (1998): Sandstone Sedgeland (SST-SDG)

Kunzea Shrubland
Kunzea ambigua

Occurrence: Only occurs naturally on a sandstone outcrop in the far north-eastern corner of the property. This scrubland covers most of the old pine plantation, where it has regrown after the removal of the pines.

Structure: This is a closed to open shrubland to about three metres tall; bare areas are common, as are scattered trees.

Description: The regrowth across most of the old pine plantation is Kunzea Shrubland. Various native species have recolonised that area since the removal of the pines some years ago. The natural community is dominated by the large shrub White Kunzea *Kunzea ambigua*. In the natural occurrence, typical rock outcrop species are present, including Bushy Parrot Pea *Dillwynia ramosissima,* Heart-leaved Shaggy Pea *Oxylobium cordifolium* and Scale-rush *Lepyrodia scariosa*. On the northern edge of the rock outcrop, a poorly drained area with deeper soils supports species such as Narrow-leaved Bottlebrush *Callistemon linearis*, Thyme Honey-myrtle *Melaleuca thymifolia* and Narrow-leaved Paperbark *Melaleuca linariifolia.* The plants on the old pine plantation are a mix of woodland and forest species, the original vegetation cover being either woodland or forest.

Equivalent Community in Other Studies:
Mills (1998); Kunzea Shrubland (KUN-SHR)

Mangrove Forest/Woodland/Shrubland
Avicennia marina, Aegiceras corniculatum

Occurrence: Mangroves occur along Currambene Creek, and across the nearby flats that experience saltwater influence; the largest stand is in the far south-eastern corner of the property.

Structure: Mangroves range from shrubs to trees; the community is usually a woodland.

Description: Grey Mangrove *Avicennia marina* and/or River Mangrove *Aegiceras corniculatum* dominate the community. Various saltmarsh species occur here and there, mainly on the edges; these include Beaded Glasswort *Sarcocornia quinqueflora* and Sea Rush *Juncus kraussii*.
Equivalent Community in Other Studies:
Mills (1993): Community 2.2, Mangrove Woodland-Shrubland.
Mills (1998): Mangrove Forest (AVI-FOR)

Saltwater Juncus Rushland/Saltmarsh
Juncus kraussii, *Sarcocornia quinqueflora*

Occurrence: These two saltmarsh communities were mapped together, because they are closely associated and difficult to differentiate at the scale of the mapping. Saltmarsh and a few mangroves occur on the lowest parts of the floodplain, in the southern part of the property. The largest patch, which is connected to Currambene Creek by a small channel, is surrounded by cleared land.

Structure: This vegetation is a mixture of rushes and succulent herbaceous plants less than a metre in height. The saltmarsh is usually less than 20 cm high. Saline mud flats are common between the plants. There are sometimes small areas of casuarinas and mangroves in the saltmarsh.

Description: The main species in the saltmarsh are Beaded Glasswort *Sarcocornia quinqueflora,* Saltwater Couch *Sporobolus virginicus,* Swamp Weed *Selliera radicans* and Saltbush *Atriplex australasica.* Dense patches of Sea Rush *Juncus kraussii* more than a metre in height are also present, mainly around the edges. Grey Mangrove *Avicennia marina* occurs along Currambene Creek and other channels. River Mangrove *Aegiceras corniculatum,* Swamp Oak *Casuarina glauca* and most of the saltmarsh species also occur along Currambene Creek.

Equivalent Community in Other Studies
Mills (1993): Community 2.1, Herbland - Shrubland (saltmarsh) (*Sarcocornia, Suaeda, Sporobolus, Wilsonia*).
Braithwaite et al. (1988): Saltmarsh.
Mills (1998): Saltwater Juncus Rushland (JUN-SAL)
NSW Scientific Committee (2004): Coastal Saltmarsh.

Fresh Juncus Rushland
Carex appressa, Juncus usitatus

Occurrence: Juncus Rushland occurs in the ephemeral wetlands on the lowest, poorly drained parts of the floodplain near Currambene Creek. Most of the wetlands are surrounded by cleared land. The least disturbed wetland is to the south, within dense Swamp Oak Forest.

Structure: The rushes and sedges are mostly less than a metre tall. Most of the other species are ephemeral, their presence determined by fluctuating water levels which vary with rainfall. The swamp on the southern part of the property supports reeds more than a metre tall. Where this community is surrounded by cleared land, it has been grazed and trampled by domestic stock, and is therefore less natural.

Description: Common Rush *Juncus usitatus,* Tall Sedge *Carex appressa,* Water Couch *Paspalum distichum* and Knotweeds *Persicaria* spp. are the main species in these wetlands. The southernmost patch is the most natural example of the community; it is taller, denser and more diverse, and contains additional species such as Cumbungi *Typha orientalis,* Common Reed *Phragmites australis* and Tall Spike-rush *Eleocharis sphacelata.* Small stands of the shrub Swamp Paperbark *Melaleuca ericifolia* occur in some places and the tree Cabbage Gum *Eucalyptus amplifolia* is sometimes on the edges of the wetlands.

Equivalent Community in Other Studies
Braithwaite et al. (1988): Permanent Fresh Swamp.
NSW Scientific Committee (2004): Freshwater Wetlands on Coastal Floodplains.
Mills (1998): Fresh Juncus Rushland (JUN-FRH)

3.1.7 Threatened Plants

The DECC (now OEH) has sought investigation and assessment of the threatened plant species listed in **Table 2** in their submission to the Part 3A application. We have summarised our response to each species in terms of survey requirements in **Table 2**. The species fall into two groups, depending upon the ease of detection. One group, containing the terrestrial orchids and *Galium australe*, are very hard to detect and require considerable survey effort to locate; they are also generally visible only seasonally and for a short period of time, and they are not seen every year. The second group are trees and shrubs that are obvious and are able to be located all year round.

The critical determining factor for locating terrestrial orchids is their flowering times; as they are generally not able to be found unless they are flowering. The flowering times of the relevant orchid species are set out in **Table 7**. It can be seen that the most opportune time to survey for most of these threatened orchids is October to December; that is, spring. The survey times for these orchids in the study area are summarised in **Appendix 4**.

Table 7
Threatened Orchid Flowering Times

Orchid Species	**Months of the Year**											
	J	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Cryptostylis hunteriana	X	X										X
Caladenia tessellata									X	X	X	
Genoplesium baueri		X	X	X	X							
Prasophyllum affine											X	X
Pterostylis gibbosa								X	X	X	X	
Rhizanthera slateri										X	X	

Despite targeted surveys, no threatened plant species were found in the study area, and none have been found there in the several previous surveys of the land; this includes species listed under NSW and Commonwealth legislation.

Cryptostylis hunteriana
This terrestrial orchid is scattered throughout the eastern parts of the Shoalhaven region. Clark et al (2003) have described the floristic and landscape attributes of the preferred habitat of this species to assist in identifying suitable habitat in that region. **Table 8** lists those plant species found by Clark et al (2003) as being positively and negatively associated with *C. hunteriana*. The presence/absence of these species on the eight vegetation plots in this study is indicated in the table. 'Positive' or indicator species are mostly absent from the forests surveyed. Most of the sites have all of the 'negative' species. Site 8 has the most positive species (5 out of 10); that is in eh area that was surveyed intensively for the orchid.

Table 8
***Negative and Positive Plant Species in* C. hunteriana *Habitat*[1]**

Plot	1	2	3	4	5	6	7	8
Positive Species								
Dampiera stricta								
Entolasia marginata								
Hakea dactyloides			X			X	X	X
Isopogon amemonifolius								X
Kunzea capitata								
Lambertia formosa			X		X		X	X
Lomandra filiformis								
Lomandra obliqua	X	X	X	X	X	X		X
Pimelea linifolia	X	X		X	X	X		X
Xanthposia tridentata						X		
Negative Species								
Dianella caerulea	X	X		X	X	X		X
Lepidosperma laterale	X	X	X	X	X	X	X	X
Persoonia linearis	X	X		X	X			X

1. Based on Clark et al. (2003).

The paper by Clark et al. (2003) also assesses the geology upon which this orchid has been recorded. They found that most records of this orchid are on one of the following geologies; berry formation, Hawkesbury Sandstone, Conjola Formation and Wandrawandian Siltstone. The study area is underlain by all of these units except the Hawkesbury Sandstone. On this land the vegetation types mostly exclude the probability of the orchid being present; i.e. thick forest covers most of the land. The most likely places where the orchid could be found were surveyed in this study; these are sites on sandy soils with typical woodland/heathland vegetation that is not too thick with shrubs. It was not located during surveys during its flowering period.

In summary, it is concluded that the orchid probably does not occur on the land that was surveyed for the species because of the absence of the species dung the surveys, the low occurrence of 'positive plant species' as identified by Clark et al. (2003) and the predominantly dense vegetation.

Caladenia tessellata
This ground orchid is very rare in the Shoalhaven, where there are only three records (NSW Wildlife Atlas); one is from near Vincentia The species inhabits "low open forest with a heathy or sometimes grassy understorey" (Bishop 2996). The probability of this orchid occurring on the study area, which is mostly forest, is slim. It was not located during surveys during its flowering period.

Genoplesium baueri
This is a tiny terrestrial orchid that has been found at few sites on the south coast. There are 68 records of this orchid in the NSW Wildlife Atlas (as at 7 Feb. 2010); of these one record comes from south of the Shoalhaven River, near Vincentia. The probability of this orchid occurring on the study area, which is mostly forest, is slim. No species of *Genoplesium* were found during the various orchid surveys undertaken in late 2009, nor during many earlier surveys of this property.

Prasophyllum affine
This rare orchid is known fro m a handful of sites from Vincentia to Kinghorn Point, southeast of Lake Wollumboola. The habitat is treeless heathland, with a high sedge component and low shrub cover. This vegetation is often growing on a clayey soil. the consultants are very familiar with this species and its habitat, having surveyed for it for many years. The habitat in the current study area is not suitable for this species.

Pterostylis gibbosa
This small ground orchid occurs in a few places southeast of Nowra. The habitat is Spotted Gum Forest with a fairly open understorey, growing under a relatively low rainfall. The geology is the Berry Siltstone. There is a small area of habitat that could support this species in the study area. Searches at the time of year that this species flowers (proved by finding the species at Wollamia at the time) failed to find any specimens.

Rhizanthera slateri
There are two records of this orchid in the Shoalhaven (NSW Wildlife Atlas); one from west of Vincentia and one from Wollamia, northwest of Huskisson. This orchid is seldom seen, as it grows 'underground', only the flowering parts emerging below organic litter where they are very difficult to locate. The method employed to find the species was to rake the litter below *Eucalyptus sclerophylla* trees, the local tree that decorticates its bark each year so builds up a deep humus layer around the trunk of the tree. The trees of this species in woodland habitat south of the pine plantation were searched using this method but no orchids were found.

3.1.8 Endangered Ecological Communities

The DECC has sought investigation and assessment of the threatened communities discussed in Section 2.5 in their submission to the Part 3A application. These communities have been mapped in the study area, see **Figures 4 and 5.**

These communities occur on the lowlands and all are wetland communities or closely associated with wetlands. The Final determinations for each relevant endangered community is provided in **Appendices 8 to 12.**

3.1.9 Endangered Populations

Endangered populations in New South Wales are listed under the TSC Act (Schedule 1, Part 2). There are no provisions under the EPBC Act for the listing of endangered populations. No endangered populations have been declared on or near the subject land at Comberton Grange.

3.2 Fauna

3.2.1 Animal Species recorded

The fauna recorded in the study area during this study are listed in **Table 9.** The number of indigenous species recorded is large, and includes 28 species mammal, 103 species of bird, 9 reptiles and 6 frogs. During the surveys, a total of over 2,500 individual fauna records were made in and adjacent to the study area. The species recorded are listed in **Appendix 5**, in the last column on the right. The species previously recorded are also listed in that appendix. The completed fauna survey sheets in this study area are provided at **Appendix 6**.

Table 9
Comberton Grange Project, Number of Fauna Species Recorded

Group	Indigenous	Introduced	Total
Mammals	28	3	31
Birds	103	3	106
Reptiles	9	-	9
Frogs	6	-	6
Fauna Total	146	6	152

In all 46 bird surveys were completed, recording a total of 91 species during 38.9 hours of observation. The species accumulation plot in **Figure 6** demonstrates that the species able to

be recorded on the property were almost exhausted, indicating that enough field survey was carried out.

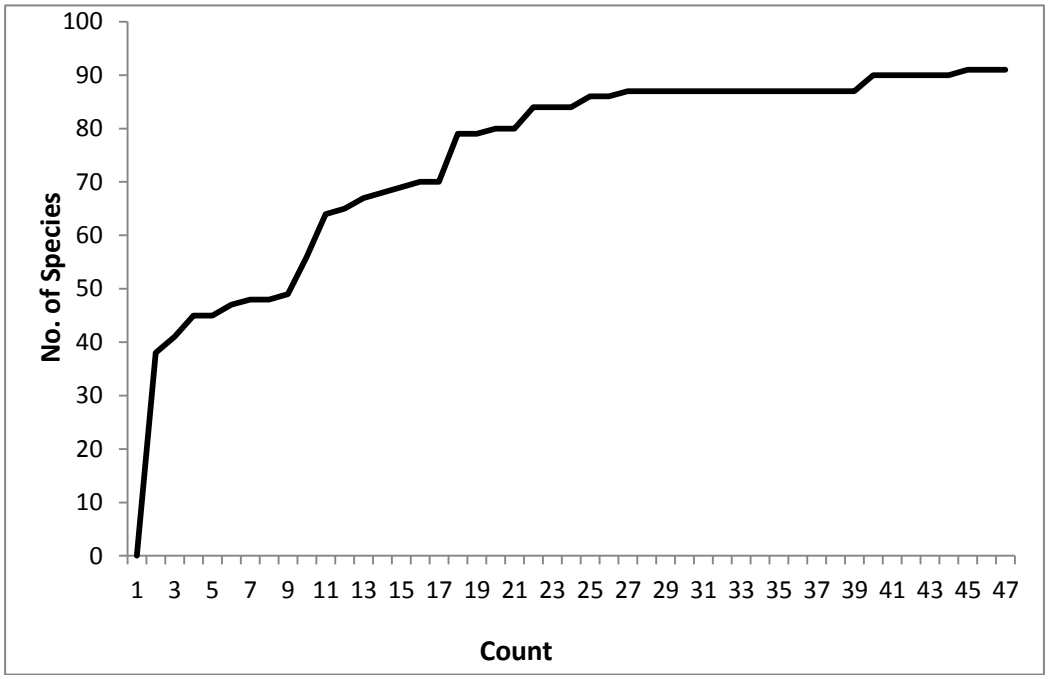

Figure 6. Cumulative species plot for the bird surveys at Comberton Grange.

3.2.2 Fauna Habitats

The type of habitat in an area influences which animals occur there, as well as fauna diversity and abundance. Habitat assessment also plays an important role in predicting whether threatened fauna are likely to occur in an area. The information collected during surveys usually includes the type of vegetation present, the presence or absence of rock outcrops, tree hollows, watercourses, wetlands and special food plants for individual species.

There are several dominant fauna habitats at Comberton Grange: forest, wetlands (freshwater and saltwater) and cleared land covered by exotic grasses. These habitats are described below.

Forest
As previously discussed, there are several types of forest at Comberton Grange, each dominated by different tree species. Most are tall forest tree species, such as Blackbutt *Eucalyptus pilularis,* Spotted Gum *Corymbia maculata,* Southern Blue Gum *Eucalyptus saligna - E. botryoides* and Grey Ironbark *Eucalyptus paniculata*, which are good hollow-producing species. Tree hollows are important for many fauna species, including several threatened species, because they provide opportunities for roosting and nesting. The forest understorey is often a dense tangle of shrubs and small trees, in some places rainforest trees and vines are common.

Spotted Gum *Corymbia maculata* is an important source of nectar and pollen when flowering. So are Swamp Mahogany *Eucalyptus robusta,* Forest Red Gum *Eucalyptus tereticornis* and Woollybutt *Eucalyptus longifolia*, although they are not as common at Comberton Grange as Spotted Gum *Corymbia maculata*. Swamp Mahogany is important because it flowers in winter. The medium-sized tree Black She-oak *Allocasuarina littoralis* is common in many places; this is

the main food plant for the threatened Glossy Black-cockatoo. Little, if any, of the forest on the study area is old growth forest; see Section 3.2.6.

Woodland
The Scribbly Gum - Bloodwood Woodland is generally composed of well-spaced and usually smallish trees, although in some places it is more like forest and has a rather open understorey. The understorey is usually a shrub species rich heathland. As noted elsewhere, the main tree species are Hard-leaved Scribbly Gum *Eucalyptus sclerophylla*, Red Bloodwood *Corymbia gummifera*, Brown Stringybark *Eucalyptus capitellata* and Old Man Banksia *Banksia serrata*. The last-named tree is an important winter nectar source.

Wetlands
The main wetlands at Comberton Grange are associated with Currambene Creek, with saltwater wetlands along the creek and ephemeral freshwater wetlands on the floodplain. The freshwater wetlands are on low-lying swales, and are still dominated by native plant species. Dense Swamp Oak Forest is common on the southern part of the property, on the floodplain.

Saltmarsh and mangroves occur along Currambene Creek which, at Comberton Grange, is tidal. The broadest area of saltmarsh is on a low-lying section of floodplain connected to Currambene Creek by a small channel.

There are also freshwater wetland forests along the upper and lower sections of Georges Creek and Bid Bid Creek. These are very important as habitat because of the presence of the key food tree Swamp Mahogany *Eucalyptus robusta*.

There are a few farm dams here and there, partially covered in wetland plants.

Cleared Land
Most of the cleared land at Comberton Grange is on the floodplain of Currambene Creek and the adjoining low ridges. The original forest was cleared and replaced by introduced pasture species suitable for grazing. Grazing is still undertaken, although only a few cattle were seen during the current survey.

3.2.3 Threatened Animals

The DECC has sought investigation and assessment of the threatened animal species listed in their submission to the Part 3A application. We have summarised our response to each species in terms of survey requirements in **Table 3**. We have set out in **Table 10**, a summary of the relevant threatened animal species and survey effort for each species.

The following species were not especially targeted as they are so rare in the region that targeted surveys would not be very useful; however extensive dedicated bird surveys were undertaken throughout the study area. The Swift Parrot is only present during winter.

- Regent Honeyeater
- Swift Parrot
- Turquoise Parrot

Table 10
Summary of Survey effort for each Threatened Animal Species

Species[1]	Field Survey Effort in this Study
Threatened Bats	ANABAT surveys in primary survey area; on 4 nights of recording at 11 sites. Assessment of roosting opportunities within the study area.
Grey-headed Flying-fox	Opportunistic observations while carrying out night-time work in the study period. Particular attention being given to calling animals and flowering eucalypts.
Spotted-tailed Quoll	Cage trapping along five trapping transects through the primary survey over 4 nights.
Yellow-bellied Glider	Extensive spotlighting in the study area. Call payback was used at various sites. Sap trees were searched for in Spotted Gum forest and stands of Grey Gum nearby to the study area.
White-footed Dunnart	Small box traps, 400 trap nights along 5 transects.
Flame Robin	Dedicated bird surveys along 45 transects for a total of 37.4 hours of diurnal observation throughout the study period; opportunistic observations while carrying out all other field work.
Gang-gang Cockatoo	Dedicated bird surveys along 45 transects for a total of 37.4 hours of diurnal observation throughout the study period; opportunistic observations while carrying out all other field work.
Glossy Black-Cockatoo	Dedicated bird surveys along 45 transects for a total of 37.4 hours of diurnal observation throughout the study period; opportunistic observations while carrying out all other field work. Searches were made for chewed cones below Black She-oak trees wherever they were growing densely.
Little Eagle	Dedicated bird surveys along 45 transects for a total of 37.4 hours of diurnal observation throughout the study period; opportunistic observations while carrying out all other field work.
Masked Owl	Extensive spotlighting in the study area. Call payback was used on nine nights.
Powerful Owl	Extensive spotlighting in the study area; 11.5 hours in total. Call payback was used on nine nights.
Scarlet Robin	Dedicated bird surveys along 45 transects for a total of 37.4 hours of diurnal observation throughout the study period; opportunistic observations while carrying out all other field work.
Square-tailed Kite	Dedicated bird surveys along 45 transects for a total of 37.4 hours of diurnal observation throughout the study period; opportunistic observations while carrying out all other field work.
Black Bittern	Dedicated bird surveys along Currambene Creek and adjacent wetlands; opportunistic observations while carrying out other field work.
Varied Sittella	Dedicated bird surveys along 45 transects for a total of 37.4 hours of diurnal observation throughout the study period; opportunistic observations while carrying out all other field work.

1. Species in bold were recorded in the study area or nearby.

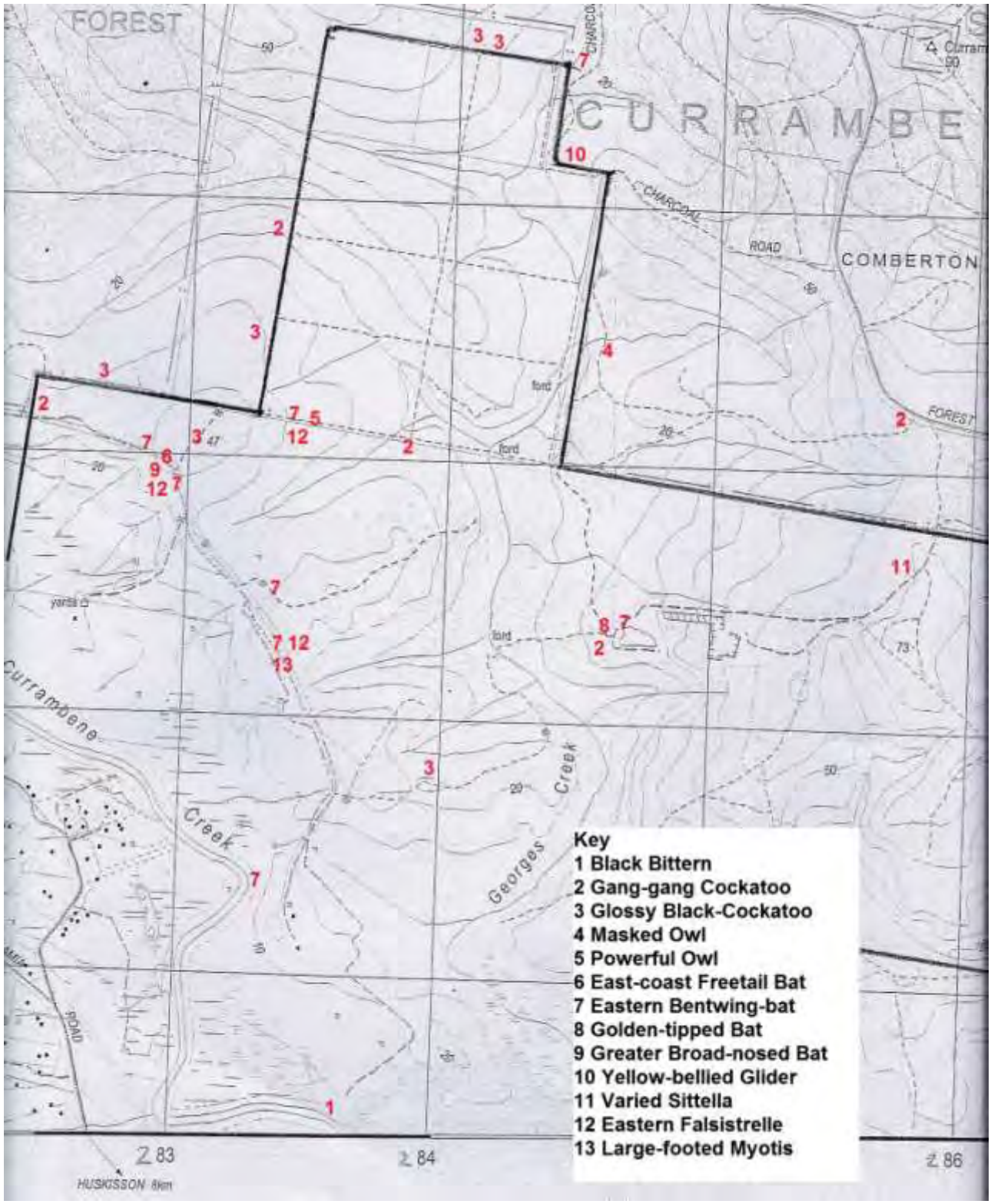

Figure 7. Location of recorded Threatened Animal Species.

Discussion of Relevant Species

The surveys recorded 14 threatened animals in the study area; six birds, seven bats and one other mammal. Each of these species is discussed separately below; the records are summarised for each species.

Black Bittern

The Black Bittern is occasionally observed around coastal lakes and estuaries along the south coast. Birds are usually flushed from the edges of waterbodies, particularly amongst Swamp Oak. At Comberton Grange, one bird was flushed from the channel in the southern part of the property on 13 October 2009. The habitat of this wetland bird would include the edges of Currambene Creek and the saline wetlands throughout the southern part of the property.

13.10.09	0283550 6124570	1 bird observed

Gang-gang Cockatoo

The Gang-gang Cockatoo is moderately common throughout the forests of the south coast. Birds are usually observed in pairs or small groups. Foraging habitat, stands of eucalypts, and breeding habitat, hollow-bearing trees, are abundant in the region. These resources are also abundant in the study area. This cockatoo was recorded in several locations during the current study period; as documented below.

21.12.09	0284642 6126356	4 birds observed
12.10.09	0282388 6127122	1 bird observed
15.10.09	0283366 6127881	2 birds observed
01.10.09	0285832 6127192	roadkill
26.02.10	0282380 6127110	2 birds heard

Glossy Black-Cockatoo

This cockatoo is relatively common in the Shoalhaven, and is nearly always observed near stands of Black She-oak *Allocasuarina littoralis*, its primary food tree in this region. The species' presence in an area is usually apparent by the discovery of heavily chewed cones below the above tree, the birds having removed the seeds to eat and discarded the woody remains of the cone. Although birds were only observed on one day, evidence of their feeding was found in a few places.

21.12.09	0282580 6127261	9 birds observed
21.12.09	0283085 6127044	3 birds observed
15.10.09	0284076 6128636	feed tree
15.10.09	0284175 6128634	feed tree
10.09	0283222 6126741	feed tree
13.07.09	0283919 6125835	feed tree

Masked Owl

The Masked Owl is widespread but apparently thinly distributed across the region, typical of a top order predator. The owl lives in forests and woodlands. One observation of a Masked Owl during the current survey, was made just to the west of the old pine plantation.

15.10.09	0284552 6127434	1 bird observed

Powerful Owl

Like the Masked Owl, the Powerful Owl is widespread in the region, inhabiting most areas of tall forest. A pair have a very large territory and nest in very tall eucalypt with large hollows. One observation of this owl was made during night-time surveys; no owls were attracted to call playback sessions. The observation was made at the southern edge of the old pine plantation.

12.10.09	0283468 6127136	1 bird observed

Square-tailed Kite
The Square-tailed Kite is a regular summer breeding visitor to the Nowra-Jervis bay region. Birds range widely over a very large foraging territory, where they forage in forests and woodlands. The nest is a large stick structure high in a tall tree.

15.10.09	North of pine forest	1 possible observation

East-coast Freetail Bat
This bat roosts in tree hollows and lives in forest and woodlands.

12.10.09	0282971 6126956	ANABAT recording

Eastern Bentwing-bat
The bentwing-bat roosts in caves and cave-like artificial structures such as drains and buildings. The bat forages widely from their roost sites. There is probably no roosting habitat in the study area. This bat is commonly recorded during bat surveys, even if there are no roost sites nearby.

12.10.09	0283337 6126270	ANABAT recording
12.10.09	0282971 6126956	ANABAT recording
12.10.09	0283328 6126439	ANABAT recording
13.10.09	0282862 6127006	ANABAT recording
14.10.09	0284442 6128519	ANABAT recording
14.10.09	0283365 6127142	ANABAT recording
15.10.09	0284673 6126348	ANABAT recording
15.10.09	0283294 6125357	ANABAT recording

Golden-tipped Bat
This bat inhabits moist forests, including rainforest, and dry forests; the bats have been recorded roosting in the abandoned nests of Gerygones and Scrubwrens.

15.10.09	0284673 6126348	ANABAT recording

Greater Broad-nosed Bat
This bat prefers moist gullies, mainly in the near-coastal regions. The bats roost in tree hollows and have been recorded in the roofs of old buildings.

12.10.09	0282971 6126956	ANABAT recording

Yellow-bellied Glider
This arboreal mammal is quite common in the region, usually associated with Spotted Gum *Corymbia* maculata Forest and, in the north, Grey Gum. Despite many hours of spotlighting in the area, the glider was not found in the study area; the only record is of calls heard to the northeast of the old pone plantation, in state fort land. Powerful Owl call back tapes, as used here, is also a method of finding the species. There are Grey Gums *Eucalyptus punctata* in that area, but this tree was not found on the Comberton Grange property.

14.08.09	0284295 6128112	Calls heard at night

Varied Sittella
A small flock of six birds was observed in woodland just to the northeast of the quarry. This is a relatively uncommon bird of the forests and woodlands of this region.

14.10.09	0285800 6126600	6 birds observed

Eastern Falsistrelle
This largish bat inhabits forests, usually moister types. This species roosts in tree hollows, although they have been found inj caves and old buildings.

12.10.09	0283337 6126270	ANABAT recording
12.10.09	0282971 6126956	ANABAT recording
14.10.09	0283365 6127142	ANABAT recording

Large-footed Myotis
This bat roosts in caves and may forage across long distances from its roost site at night; it is usually associated with water bodies, where it forages by skimming across the surface of the water. There is no roosting habitat in the study area.

12.10.09	0283337 6126270	ANABAT recording

3.2.4 Migratory Species

In addition to threatened species, the EPBC Act allows for the listing of internationally protected migratory species, i.e. species listed under the Japan-Australia Migratory Bird Agreement (JAMBA), the China - Australia Migratory Bird Agreement (CAMBA) and the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention). Several of the species recorded on or adjacent to the Comberton Grange land are internationally protected migratory species; these include diurnal birds of prey and ducks. Many common Australian bird species have been listed as internationally protected migratory species under the EPBC Act, so other listed species would also occur on the subject land from time to time.

3.2.5 Critical Habitat

Critical habitat refers only to those areas of land listed in the Registers of Critical Habitat, as established by the NSW *Threatened Species Conservation Act 1995*. No critical habitat has been declared on or in the vicinity of the study area.

3.2.6 Old Growth Forest

The methods used in this study are those methods that are set out in the document titled *Identification of Old Growth Forests, Field Identification on Private Land* (DEC 2004). That document covers field survey methods as well as the analysis of the data collected. The following is an outline of the methods used, based upon the steps identified in the above document.

Field Methods
The field survey initially identified locations where the forest was fairly consistent and representative of the forest types in the area. Surveys were undertaken in the primary study area, as delineated earlier in the report. GPS points were recorded at each end of the transect and where there was an angle in the transect**.**

A total of 10 points were sampled along each transect and these were temporarily established 100 metres apart (determined by pacing) along the transect. Note that the exact distance between sample points is not relevant to the calculations made later or the results obtained, as long as the same trees are not being sampled by adjacent survey points.

The transects are numbered CG.0G.01, CG.0G.02 and CG.0G.03; these numbers consistently refer to the three transects throughout this report. Three survey transects were chosen because the DEC document states that three transects should be surveyed per 100 hectares.

At each sample point, the closest tree in the three growth stages (described below) within 30 metres of the point was identified and the distance from the point to each tree was measured. If an example of a growth stage was not present then a null result was recorded. For each of the above trees, the average radii of the tree crown was measured.

All location information and survey measurements were recorded separately for each transect on a *pro forma* survey sheet obtained from the above DEC document; see **Appendix 7**.

Identification of tree growth stage
Three different growth stages are relevant to determining the presence of 'old growth forest'; these are 'senescent', 'mature' and 'regrowth'. The differentiation of the trees into the three relevant growth stages are explained, with pictorial examples, in the DEC (2007) document. Prior to undertaking the field measurements along the three transects, on site experience was gained in identifying each growth stage using the guidelines in that document.

Plates 1 to 3 show examples of 'senescent', 'mature' and 'regrowth' trees that were photographed along the survey transects within the study area at Comberton Grange at the time of the surveys.

Disturbance to the forest
Human induced disturbances within 30 metres of the sample point were recorded; the categories used were recent logging, old logging, exotic woody weeds, grazing infrastructure and constructed tracks. Plates 4 and 5 show examples of logging disturbance found along the survey transects. The evidence of past logging in the forests is abundant; stumps are very common. Multi-stemmed trees are also common, where suckering has occurred following cutting down of the tree.

Data Analysis
The calculation and analysis of growth stage and disturbance level for each transect follows the methods in the DEC document. These methods are summarised below.

Step One:
The data collected during the transect is used to average the distance measured for each growth stage and to calculate the 'stocking rate' (i.e. tree density) using the following formula:

$$N = \frac{10{,}000}{(2D)^2}$$

Where N = stocking in trees/ha, and
D = average distance from point to tree centre.

Determine the average distance of senescing, mature and regrowth trees by applying the above formula.

Step Two:
Correct stocking rate (N) for null scores by multiplying by the conversion factor from Table 12 in the DEC document. Null records are expressed as a ratio of null counts to total counts:
e.g.. for 10 survey samples, 1 null count = 10% = 1/10 = 0.1

Step Three:
Crown area per hectare is then calculated separately for each of the regrowth, mature and senescent components of the stand. This is done by taking the average crown radius, squaring it and multiplying by π (the formula being πr^2 denoting the area of a nominal circular crown) for each sample point. The resultant average is then multiplied by the stocking rate.

Step Four:
The relative crown cover percentage of each of the regrowth, mature and senescent components is then formulated. The crown area/hectare of each component is divided by the

total crown area/hectare for all components put together. Then the total crown area and the relative crown cover for each growth stage is determined as a percentage. The results are used to determine the relative crown cover percent of the regrowth, mature and senescent components of the stand.

Calculation for Disturbance Indicators

If any individual disturbance indicators are recorded for 6 out of the 10 or 8 out of 15 site sampling points (i.e. > 50%) then disturbance level should be considered significant. Where individual disturbance indicators are recorded at less than 6 out of 10 or 8 out of 15 sample sites then disturbance should be considered as negligible. The table below should be used to determine revised growth stage for the sampled site based on revised growth stage code and level of disturbance indicators.

Summary of Attribute Codes for Growth Staging

Code	Relative Crown Cover %	
	Regrowth Trees	**Senescent Trees**
tA	<10%	>30%
tB	<10%	10-30%
tC	<10%	<10%
sA	10-30%	>30%
sB	10-30%	10-30%
sC	10-30%	<10%
eN	>30%	no value recorded (as N)

The following table is used for deriving a revised 'Successional Growth Stage' using site survey results of growth stage and disturbance level.

Growth Stage as derived by site survey	**Disturbance level as derived by site survey**	**Revised successional growth stage at the site**
tA, tB or sA	Negligible	Candidate Old-Growth
tA, tB or sA	Significant	Disturbed Old Forest
sC, sB or tC	Negligible	Mature Forest
sC, sB or tC	Significant	Disturbed Mature Forest
e	Greater than 30% regrowth	Young Forest
Post photo disturbance	Recent disturbance	Recently Disturbed Forest

The pro forma survey sheets for the three transects are provided at **Appendix 7**. The sheets show the raw data recorded at the time of the surveys. A summary of the data prepared from these sheets and in accordance with the methods outlined in the DEC document is provided in **Table 11**. The results presented in **Table 11** are used to calculate the 'successional growth stage' using the 'growth stage' and 'disturbance level' data. This determines if 'old growth forest' is present or not.

Plate 2. Example of a 'senescent' tree.
Grey Ironbark *Eucalyptus paniculata*

Plate 3. Example of a 'mature' tree.
Blackbutt *Eucalyptus pilularis*

Plates 4 and 5.
Examples of disturbance (old logging evidence) in the forest. Stumps such as these are common throughout the forests of the area. Note the axe holes in the left hand example; such holes were cut for holding springboards (platforms for the axeman to work from).

Table 11 Summary of Old Growth Transect Data					
	Trees per ha/crown area per ha (% of transect)			Disturbance[2]	
Transet	**Regrowth**	**Mature**	**Senescent[1]**	**Old logging**	**Tracks**
CG.OG.01	113 927 m^2 (11%)	76 6,620 m^2 (82%)	2.7 574 m^2 (7%)	100%	10%
CG.OG.02	595 3,808 m^2 (27%)	108 9,212 m^2 (67%)	4.6 778 m^2 (6%)	100%	20%
CG.OG.03	278 1,362 m^2 (28%)	370 2,786 m^2 (57%)	3.8 689 m^2 (14%)	100%	30%
1. A correction factor has been used to account for null records. *2. No other disturbances were recorded.*					

The resulting classification of each transect is shown in **Table 12.** The results indicate that all three transects can be classified as 'Disturbed Mature Forest'.

Table 12 Calculated Old Growth details for each Transect				
Transect	***Growth Stage***	***Total Crown Area (%) Regrowth-Mature-Senescent***	***Disturbance Level***	***Determined Successional Growth Stage***
CG.OG.01	sC	11-82-7	Significant	Disturbed Mature Forest
CG.OG.02	sC	27-67-6	Significant	Disturbed Mature Forest
CG.OG.03	sB	28-57-14	Significant	Disturbed Mature Forest

The results of this survey have determined that 'old growth forest', as defined by DEC (2007), does not occur in the forests sampled. This is not surprising, as casual observation in these forests indicates that (i) there are few very large, old trees remaining and (ii) there is evidence of cut trees (stumps) throughout the forests.

4 AVOIDING AND MINIMISING IMPACTS

4.1 Implications of the Biodiversity Surveys

The flora and fauna surveys undertaken in this study identified several key species, habitats and communities within the broader study area. These are summarised in **Table 13** along with broad comment on the implications for the design of the proposed development.

The proposed Comberton Grange Masterplan is shown in **Figure 8**; this plan has responded to the significant biodiversity issues identified in this report.

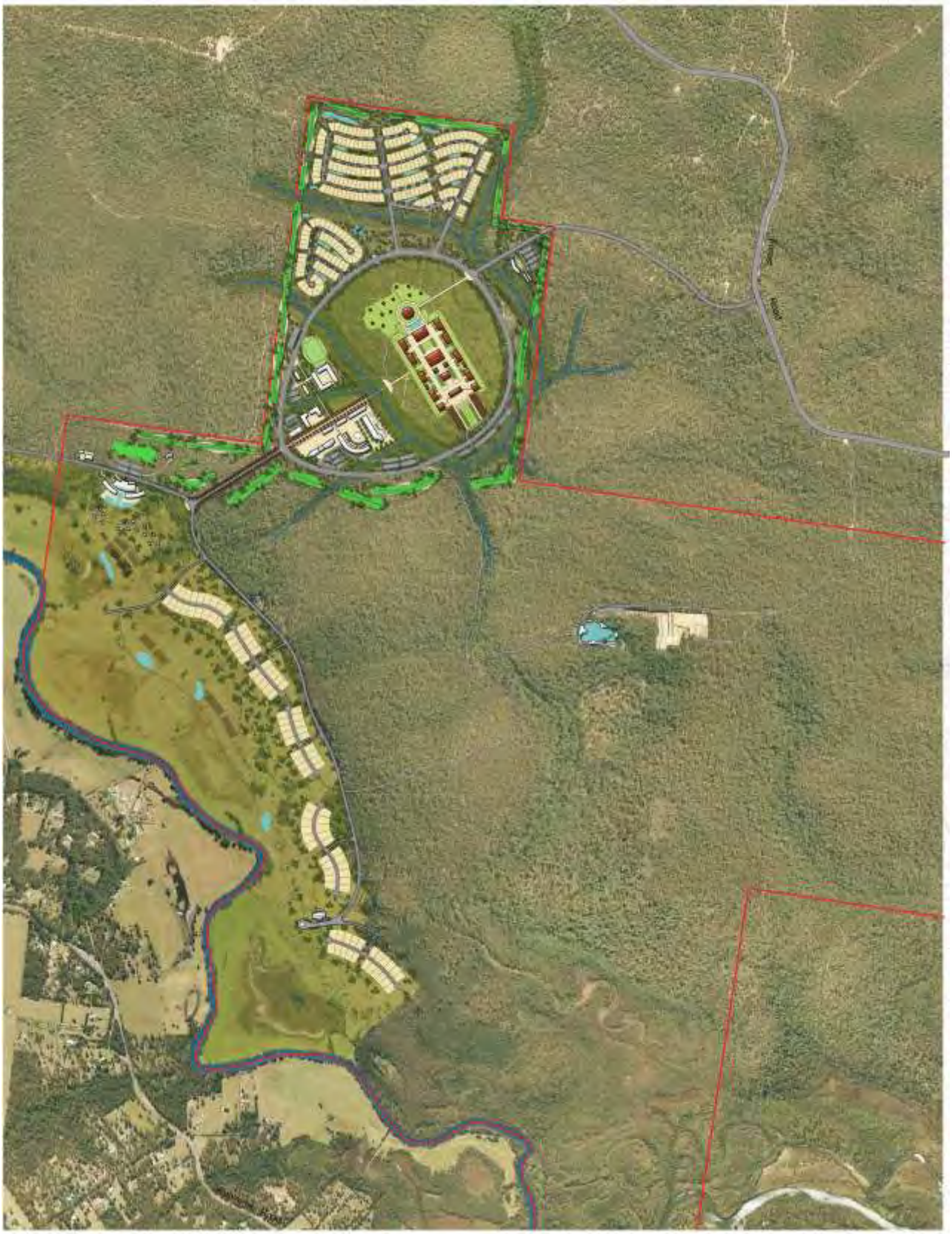

Figure 8. The proposed Comberton Grange Masterplan.

4.2 Avoiding Significant Impact

During formulation of the proposed development the following recommendations were made on avoiding impacts on the biodiversity values.

Biodiversity in general
The development in general has avoided the key biodiversity areas on the Comberton Grange property. Areas of wetland, forest, particularly tall forest, watercourses have all been taken into account when designing the location of the components of the development. The footprint of the development on natural forest is therefore very small.

Habitat corridor
The habitat corridor delineated in the Jervis Bay Regional Plan is shown in **Figure 9**. The proposed development impinges upon this area by proposing development to the southwest of the old pine plantation; see **Figure 8**. That development within the corridor would remove about 34.5 hectares of forest and woodland.

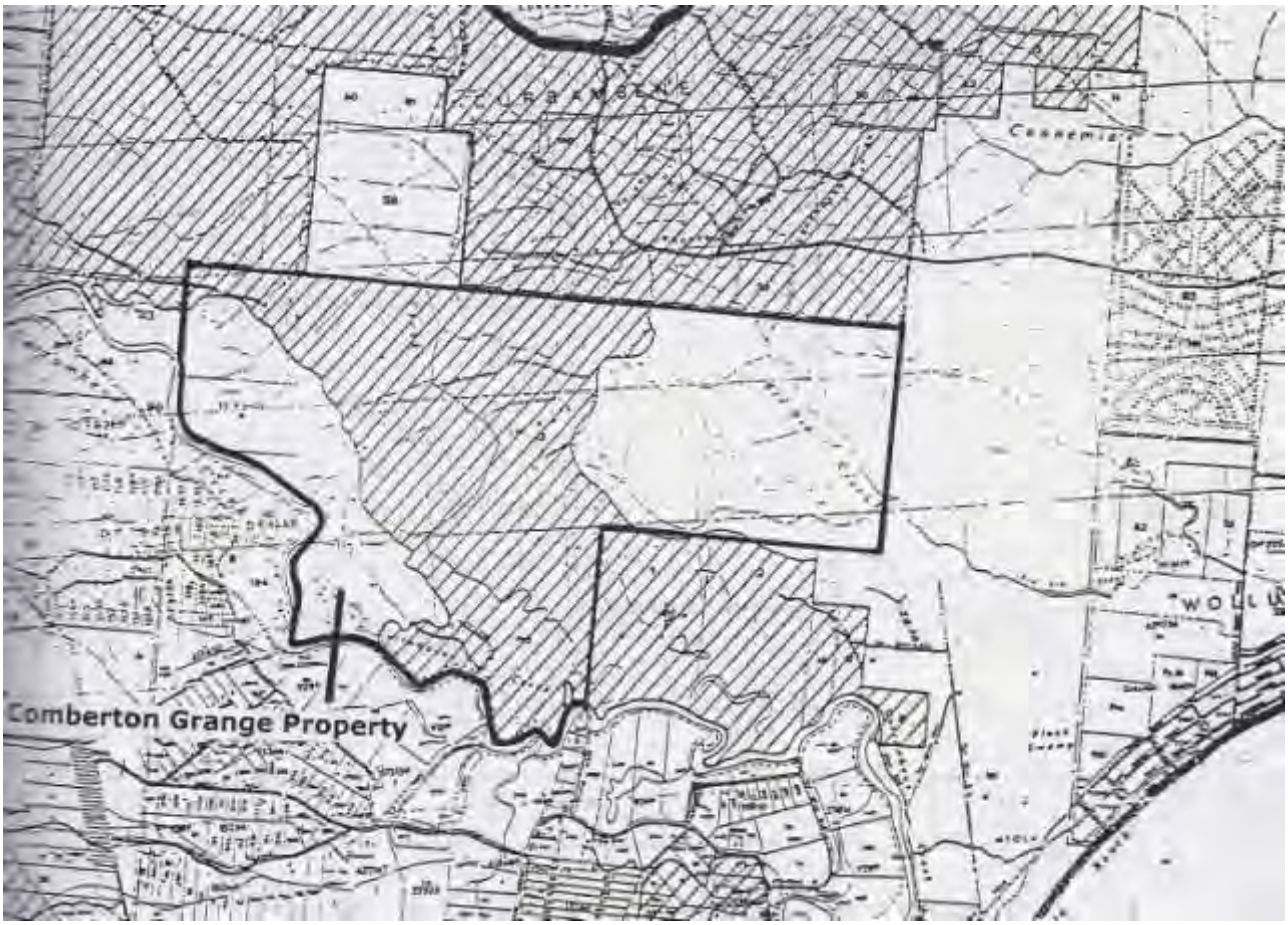

Figure 9. Habitat Corridor on and near the Study Area.
Hatched area indicates habitat corridor.

Currambene Creek
This is a major tributary entering into Jervis Bay. The development is set back a minimum of 100 metres from the bank of this watercourse. This will ensure that there are no direct impacts upon the creek. Measures are suggested later to enhance the riparian zone of the creek.

Table 13
Summary of Biodiversity Values

Issue	Occurrence in relation to proposed development	Implications for development
Threatened Plants		
-	No species located and none are expected to occur within the development footprint.	No implications.
Threatened Animals		
Black Bittern	Recorded adjacent to Currambene Creek; probably present on other wetlands.	All wetlands must be avoided by the development and protected in the long term.
Gang-gang Cockatoo	Recorded several times. Probably occasional in all forest areas.	Avoid treed areas; minimise clearing of forest and woodland.
Glossy Black-Cockatoo	Recorded through location of several fed trees. Appears to not utilise the forest in the study area to any great extent, even though *Allocasuarina littoralis* trees are abundant.	Avoid clearing stands of *Allocasuarina littoralis* trees.
Grey-headed Flying-fox	No doubt occurs in the forests and woodlands on occasion, although it was not recorded during the surveys.	Maximise retention of forest.
Masked Owl	Recorded once near the pine plantation; probably inhabits most of the forest in the study area.	Minimise removal of forest.
Powerful Owl	Recorded once near the pine plantation; probably inhabits most of the forest in the study area.	Minimise removal of forest.
Square-tailed Kite	No doubt occurs in the forests and woodlands in summer, one possible sighting during the study.	Maximise retention of forest.
Threatened Bats	Several species recorded in the area, some roost in tree hollows.	Maximise retention of forest and woodland, particularly those areas with good numbers of tree hollows.
Varied Sittella	A species with a preliminary listing at vulnerable. A small flock was recorded near the quarry.	Maximise retention of forest and woodland.
Yellow-bellied Glider	Recorded in adjoining state forest; the key food tree *Eucalyptus punctata* does not occur in the study area except for a handful of trees in the pine plantation.	Maximise retention of forest.

Issue	Occurrence in relation to proposed development	Implications for development
Endangered Ecological Communities		
Coastal Saltmarsh	None near development areas.	Drainage eventually reaches these areas. Control quality of runoff.
Swamp Oak Floodplain Forest	None near development areas.	Drainage eventually reaches these areas. Control quality of runoff.
Swamp Sclerophyll Forest	Occurs along watercourses in pine plantation and along Georges Creek.	Maintain forest along watercourse in pine plantation. Control quality of runoff into Georges Creek.
River Flat Forest	None near development areas.	Do not clear remnant forest on farmland. Control quality of runoff into Georges Creek.
Freshwater Wetland	None near development areas.	Do not clear or fill low-lying wetland areas on the farmland. Control quality of runoff.
Wetlands		
SEPP No.14 Wetlands	None near proposed development.	Control quality of runoff.
Other Wetlands	Most of the land drains to a wetland of one type or another.	Control quality of runoff.
Riparian Areas	Watercourses in pine plantation, all drainage does to Currambene Creek, much of it via Georges Creek.	Control quality of runoff.

Creek corridors in old pine plantation
There are two watercourses crossing the old pine plantation, both are tributaries of Georges Creek and join at the south-eastern corner of the pine plantation. The riparian zones of these creeks are retained in the development zone; see **Figure 8**.

Enhancement of wetlands
The wetlands on the floodplain of Currambine Creek will be retained within the buffer zone to that creek. The major benefit for these wetlands will be the removal of grazing stock.

Access roads
Access to the site is via existing road/tracks from the Princes Highway in the west and Forest Way in the east. These roads will be upgraded, with the result that some fringing vegetation will be removed.

The residual forest land and its management
There is little direct impact upon the forest on the site. The design specifically avoids incursions into the forest as far as possible. It is proposed here that a management plan be prepare fort he whole site, part of which will provide direction to marinating and enhancing the forest environment.

5 IMPACT ASSESSMENT

5.1 *Independent Review Panel for Sensitive Urban Lands*

The Independent Review Panel for the South Coast Sensitive Urban Lands identified the following key environmental issues on the Comberton Grange land (Independent Review Panel 2006):

- native flora and fauna;
- estuaries, coastal lakes and wetlands;
- soil and landscape capability;
- groundwater;
- flood risk;
- cultural heritage.

The panel went on to state that "development of certain parts of the site is considered acceptable if adequate measures are taken to ensure that:

- riparian vegetation is rehabilitated and protected;
- there is no significant disturbance to saltmarshes and mangroves along the banks of Currambene Creek;
- There is no significant disturbance to other EECs on the site;
- Water quality of Currambene Creek is maintained;
- There is no significant disturbance to areas with high cultural heritage values; and
- Sufficient natural vegetation is retained within habitat corridors on the site to maintain the integrity of these corridors.

Areas suitable for development include the cleared and elevated grazing land immediately south of Comberton Grange Road and the former pine plantation block. The eastern portion of the site (east of the existing quarry and including the SEPP 14 Wetland in the southern corner of the site) is not suitable for development. This area provides habitat for numerous threatened species, has important habitat corridor functions and supports EECs.

The Review Panel made the following relevant recommendations:
"1a. Suitability of site. This site is unsuitable for development in areas characterised as floodplain (1:100 year flood), the eastern vegetated portion of the site (east of the existing quarry and including the SEPP 14 wetland in the southern corner of the site), and where EECs occur.
Portions of the site that are suitable for limited development include the cleared land outside the floodplain, the area occupied by the former pine plantation, the plateau land and portions of the western forest areas that are not on the floodplain of Currambene Creek.

1b. Scale and type of land release
The Panel does not support the development of a stand-alone residential settlement at Comberton Grange on the grounds that it conflicts with one of the key principles of the Draft South coast Strategy, and its potential impacts on the delivery of essential services. Development of the land is supported only if it comprises a fully integrated tourist facility with associated residential development, on the grounds of the potential employment benefits to the Shoalhaven.
The amount of residential development should be limited to in the order of 200-300 dwellings. This could be reviewed upon reaching this level.
The amount of residential development in the first stage (and subsequent stages) should be limited, with the tourism component being the predominant use.
Site planning must include best practice water sensitive urban design to minimise impacts on Currambene Creek. Riparian and wildlife corridors are to be provided (greater than Category 1-50m buffer on either side of stream bank) along Currambene Creek.
The floodplain of Currambene Creek should be the subject of early revegetation with locally indigenous plant species to restore the riparian ecology.
The density of the residential component should be planned to achieve a higher dwelling yield per hectare than traditionally achieved to use the land resource more efficiently. The land developed for tourism and residential purposes should be retained in one ownership.
The Panel does not have any issue with permanent occupancy of dwellings under the arrangements above.

2. Priority and timing Development could occur according to market demand, following adequate environmental, social and economic assessment.

3. Alternate land uses
The Eastern portion of the site (ease of the existing quarry and including the SEPP 14 wetland in the southern corner of the site) should be added to the Jervis Bay National Park."

The implications of the flora and fauna recommendations made by the Panel for the Comberton Grange property are:

- The report of the Panel informed the Department of Planning's South Coast regional strategy, as discussed below.

- Although a recommendation was made of an area that could be investigated for development potential, not all of that land is necessarily suitable for development.

- Adequate surveys have to be made of the recommended area, to determine the limits to potential development, a theme strongly picked up in the south coast regional strategy and the subsequent Draft South Coast Regional Conservation Plan (DECC 2009), see below.

5.2 The South Coast Regional Strategy

The South Coast Regional Strategy (SCRC) follows the recommendations of the Independent Review Panel for Sensitive Urban Lands, see Section 5.1. The SCRC aims to guide sustainable

growth in the region for the next 25 years. Among other things, the Strategy aims to "protect high value environments including pristine coastal lakes, estuaries, aquifers, threatened species, vegetation communities and habitat corridors".

The DECC (2009) has recently released a Draft South Coast Regional Conservation Plan to accompany the Regional Strategy. An important component of the document is setting out of verification rules for the identification of high conservation values. The following draft verification rules were supplied by DECCW in Queanbeyan. These are recommended procedures for on-ground 'truthing' of mapped high conservation values within the South Coast region.

Value	**Verification Rules**
Vegetation-related Values - EECs - Rare vegetation types - Over-cleared vegetation types - Vegetation in over-cleared landscapes	Vegetation is not of high conservation value if it is poor condition (this is defined in the document). The vegetation community descriptions and listing of diagnostic species and associated environmental parameters in Tozer et al. (2006) should be consulted for on-ground verification of vegetation type. The final determinations for EECs under the TSC Act and EPBC Act are the key documents in deciding whether or not a patch of vegetation is an EEC.
Old Growth Vegetation	Old growth is largely defined by the current canopy structure which should largely consist of senescing or mature trees. Regrowth should be less than 30% of the canopy. There should also be negligible evidence of disturbances such as logging or catastrophic fires. The old growth information is probably the least accurate of all environmental information on the south coast. Thus it is suggested the occurrence of mapped old growth features should be informed or checked on-ground. The document by DEC (2004) set out a method of identifying told growth forest.
Threatened Fauna	The data provided by the South coast Regional Strategy ties verified records to mapped vegetation polygons. The NSW Wildlife Atlas can be consulted to determine what threatened fauna records are involved. Until an appropriate survey demonstrates otherwise, the mapped habitat should be regarded as important habitat. The Threatened Species Web Tool provides further assistance in habitat identification and advises what other fauna species should be considered.
Threatened Flora	The data provided by the South coast Regional Strategy ties verified records to mapped vegetation polygons. The NSW Wildlife Atlas can be consulted to determine what threatened plant records are involved.

	Targeted surveys for the identified plant species should occur within the proposed development or planning area. The Threatened Species Web Tool provides further assistance in habitat identification and advises what other plant species should be considered.
Significant Aquatic Habitats - Nationally important wetlands - ICOLL lake catchments - Habitat of migratory wetland species	The key question is whether or not a planning or development decision is within or affects the catchment of these environmental assets, and (as required by the SCRS) whether the impact will have a neutral or beneficial effect.
Statutory Conservation Protection - Conservation and property agreements - Declared wilderness - SEPP No. 14 Wetlands - SEPP No. 26 Littoral Rainforest	These assets have surveyed or described tenure boundaries. Verification is a matter of determining whether or not the planning or development decision occurs within a defined area.

This study has undertaken the investigation and assessments cognisant of the above verification rules. In particular, the study has identified significant features on the property, described these in detail and undertaken specific field surveys where required and assessed the potential impact of the development.

5.3 Jervis Bay Regional Environmental Plan

The *Jervis Bay Regional Environmental Plan 1996* was made under Section 51 of the *Environmental Planning and Assessment Act 1979* on 10 January 1997. From 1 July 2009 this plan is taken to be a State Environmental Planning Policy; see clause 120 of Schedule 6 to the *Environmental Planning and Assessment Act 1979*.

The aims of the Plan are:
(a) to protect the natural and cultural values of Jervis Bay, and
(b) to allow proposals that contribute to the natural and cultural values of the area.

The Plan applies to land within the Jervis Bay Region, as shown on Map 1 attached to the Plan. The Comberton Grange study area is wholly within the Jervis Bay Region. The following matters covered by the Plan are relevant to the Comberton Grange property.

Catchment Protection
A proposal must:
(c) rehabilitate and restore any degraded areas along a waterbody on the site;
(e) protect ecosystems and natural habitats, including waterbodies, from degradation.

Habitat Corridors
(1) A proposal on land in a habitat corridor, as shown on map 3, must:
(a) be designed to minimise disturbance to the existing structure and species composition of native vegetation communities,
(b) allow native fauna and flora to feed, breed, disperse, colonise or migrate (whether seasonally or nomadically),
(c) regenerate and revegetate degraded lands with local native species.

(2) If your proposal is on land in a habitat corridor, as shown on map 3, you must show how subclause (1) can be achieved. This should include:
(a) retaining natural vegetation,
(b) clustering development, sharing driveways, setting building envelopes,

(c) landscaping with local native species (or non-invasive exotic species for areas close to buildings), and
(d) designing fences so that fauna movement is not restricted, and
(e) minimising the use of herbicides and pesticides, and
(f) providing for bushfire protection.

(3) If your proposal involves a public utility undertaking, or a public or private access road, through a habitat corridor, you must consult with the Director-General of National Parks and Wildlife and the Council.

Much of the forest and woodland on the Comberton Grange property is within a Habitat Corridor identified in the Plan; see **Figure 9**. As noted above, the development has generally been designed to avoid the identified corridor; part of the golf course is within the defined corridor, to the southwest of the old pine plantation; see **Figure 8**.

National Park
Section 18 of the Plan relates to the dedication of Jervis Bay National Park (NSW), as shown on Map 5 attached to the Plan. This section does not apply to the Comberton Grange area as it is not identified as either Zone 8(a) or Zone 8(b). The closest land dedicated as national park is about 500 metres north of the extreme northeast corner of the Comberton Grange property. The land adjoining the eastern boundary of the property is identified as 'proposed national park' in the Regional Plan.

5.4 Assessment under Part 3A

The Department of Environment and Conservation (now the Department of Environment, Conservation, Climate Change and Water) and the Department of Primary Industries prepared a document titled *Guidelines for Threatened Species Assessment* specifically for matters considered under Part 3A of the EP&A Act (DEC 2005).

The above document sets out a series of steps to be followed in assessing a development under Part 3A; the following steps are identified.

Step 1. Preliminary Assessment
The main purpose of a preliminary assessment is to determine the likelihood of the study area and subject site supporting threatened species. This step is primarily a desktop assessment involving searches of relevant databases.

Response: Section 2 of this report sets out the key threatened species issues to be addressed and how they were identified. **Tables 2 and 3**, in particular, identify all relevant threatened species and the required survey response.

Step 2. Field Survey and Assessment
Field surveys and assessments should be conducted by suitably qualified investigators that are experienced with survey and assessment of threatened species in the region of the study. The objective of the field survey is to ensure that a reliable assessment of the presence or absence of threatened species can be made. Surveys are required to be undertaken during optimal climatic and seasonal conditions and consider issues such as migratory species movements, availability of shelter, breeding and food resources.

Response: Section 2 sets out the survey methods used in the study, including general survey techniques as well as targeted surveys for threatened species. Appropriate survey methods are utilised for each identified threatened species. Section 3 describes the results of the surveys.

Step 3. Evaluation of Impacts

This step involves identifying not only the magnitude and extent of impacts, but also the significance of the impacts as related to the conservation importance of the habitat, individuals and populations likely to be affected.

Impacts will be more significant if:
- areas of high conservation value are affected;
- individual animals and/or plants and/or subpopulations that are likely to be affected by the proposal play an important role in maintaining the long-term viability of the species, population or ecological community;
- habitat features that are likely to be affected by the proposal play an important role in maintaining the long-term viability of the species, population or ecological community;
- the duration of impacts are long-term;
- the impacts are permanent and irreversible.

Response: Section 4 sets out the constraints on development identified as a result of this study and from statutory documents. That section also assesses the impact of the development. Impact assessments for individual threatened species recorded the study are provided in **Appendix 13**.

Step 4. Avoid, Mitigate and then Offset
This step requires the description and justification of measures to mitigate any adverse effects. Consideration is to be given to measures to avoid or minimise the impacts. The measures must be practical, must be implemented and there needs to be a reasonable level of confidence in their effectiveness. Acknowledged authorities with particular species or conservation practices should be consulted to determine if the measures proposed constitute appropriate management.

Where measures to avoid and mitigate are not possible, then offset strategies need to be considered. These may include offsite or local area proposals that contribute to the long term conservation of the threatened species.

Offset strategies are a last resort and should only be considered where the impacts cannot be avoided or mitigated.

Response: Section 6 describes the package of measures proposed in compensation or offset for the impact of the development. That section also addressees the "improve or maintain test" in terms of biodiversity conservation.

Step 5. Key Thresholds.
The development application needs to contain a justification of the preferred option based on:
- whether or not the proposal, including actions to avoid or mitigate impacts or compensate to prevent unavoidable impacts will maintain or improve biodiversity values.
- Whether or not the proposal is likely to reduce the long-term viability of a local population of the species, population or ecological community.
- Whether or not the proposal is likely to accelerate the extinction of the species, population or ecological community or place it at risk of extinction.
- Whether or not the proposal will adversely affect critical habitat.

The compensation or offset package, as described in Section 6, identifies how the development will maintain or improve biodiversity values. Section 4 assesses the impact on specific threatened species and communities.

5.5 Commonwealth Legislation

The impact of a proposed action on matters of national environmental significance is assessed under the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Matters of national environmental significance are World Heritage properties, National Heritage places, wetlands of international importance (RAMSAR wetlands), threatened species and ecological communities listed under the EPBC Act, migratory species listed under the EPBC Act, Commonwealth marine environment, and nuclear actions (including uranium mining).

An "action" is a project, a development, an undertaking, an activity or a series of activities, and an alteration of any of the above. An action can be on Commonwealth land, State land council land, private land, or water.

Approval is required from the Commonwealth Environment Minister for actions that are likely to have a significant impact on a matter of national environmental significance; these are called "controlled actions". A proposed action is a "controlled action" if:

- is likely to have a significant impact on a matter of national environmental significance,
- is likely to have a significant impact on the environment of Commonwealth land,
- is to be undertaken on Commonwealth land and is likely to have a significant impact on the environment anywhere, and
- is an action to be taken by the Commonwealth that is likely to have a significant impact on the environment anywhere.

Only the Commonwealth can advise definitively whether a proposed action is a controlled action; however, the Department of the Environment and Heritage has prepared guidelines to help proponents decide whether an action is likely be a controlled action that should be referred to the Minister for assessment and approval; these are known as the *Significant Impact Guidelines: Matters of National Environmental Significance* (DEH May 2006).

Assessment under the EPBC Act

The following questions in the *Significant Impact Guidelines* (DEH May 2006) must be addressed when deciding whether or not to refer a proposed action to the Commonwealth Minister for the Environment:

1. Are there any matters of national environmental significance located in the area of the proposed action (noting that 'the area of the proposed action' is broader than the immediate location where the action is undertaken; consider also whether there are any matters of national environmental significance adjacent to or downstream from the immediate location that may potentially be impacted)?

Response: None of the relevant endangered ecological communities listed in NSW are listed under the EP{BC Act. No plant species listed under the EPBC Act have been recorded in the area. None of the 14 species of NSW listed threatened animal species recorded are listed under the EPBC Act. The Grey-headed Flying-fox is predicted to occur but was not recorded.

Listed migratory species are common in the study area. These species include all diurnal birds of prey and all species of duck, although populations in the study area are small.

2. Considering the proposed action at its broadest scope (that is, considering all stages and components of the action, and all related activities and infrastructure), is there potential for impacts, including indirect impacts, on matters of national environmental significance?

Response: Considering the proposed action at its broadest scope, the proposed development is not likely to have a serious impact on Grey-headed Flying-foxes and migratory species. Small areas of forest will be effected, but these could not possible seriously affect these species.

3. Are there any proposed measures to avoid or reduce impacts on matters of national environmental significance (and if so, is the effectiveness of these measures certain enough to reduce the level of impact below the 'significant impact' threshold)?

Response: The proposed development is only likely to have a minor impact on foraging resources for the Grey-headed Flying-fox and listed migratory species (diurnal birds of prey). The development is designed to avoid removing forest. A plan of management for the forest and wetlands on the site is proposed.

4. Are any impacts of the proposed action on matters of national environmental significance likely to be significant impacts (important, notable, or of consequence, having regard to their context or intensity)?

Response: The proposed development is not likely to have a significant impact on Grey-headed Flying-foxes or on any other matter of national environmental significance.

An action must be referred to the Commonwealth Minister if the action has, will have, or is likely to have a significant impact on matters of national environmental significance. In addition to setting out "significant impact criteria" for the various matters of national environmental significance, e.g. endangered species, vulnerable species, endangered ecological communities and listed migratory species, the *Guidelines* provide the following important definitions.

> "A *significant impact* is an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts. You should consider all of these factors when determining whether an action is likely to have a significant impact on matters of national environmental significance."
>
> "To be *likely*, it is not necessary for a significant impact to have a greater then 50% chance of happening, it is sufficient if a significant impact on the environment is a real or not remote chance or possibility."
>
> "*Population*, in relation to critically endangered, endangered or vulnerable, threatened species, means:
> - a geographically distinct regional population, or collection of local populations; or
> - a regional population, or collection of local populations occurring within a particular bioregion."
>
> "An *important population* is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:
> - key source populations either for breeding or dispersal,
> - populations that are necessary for maintaining genetic diversity, and/or
> - populations that are near the limit of the species' range.
>
> "*Habitat critical to the survival of a species or ecological community*" refers to areas that are necessary:
> - for activities such as foraging, breeding, roosting, or dispersal;

- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators);
- to maintain genetic diversity and long term evolutionary development, or
- for the reintroduction of populations or recovery of the species or ecological community."

Such habitat may be, but is not limited to: habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community; and/or habitat listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act.

Significant Impact Criteria for Vulnerable Species
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

- lead to a long-term decrease in the size of an important population of a species;
- reduce the area of occupancy of an important population;
- fragment an existing important population into two or more populations;
- adversely affect habitat critical to the survival of a species;
- disrupt the breeding cycle of an important population;
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;
- result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;
- introduce disease that may cause the species to decline; or
- interfere substantially with the recovery of the species.

Impact of the Proposal
The proposed development is only likely to have a very minor impact on foraging resources for the vulnerable Grey-headed Flying-fox by removing a small amount of forest, while retaining and managing a much larger area for its conservation.

Significant Impact Criteria for Listed Migratory Species
An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

- substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species;
- result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species; or
- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

An area of "important habitat" for a migratory species is:

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; and/or
- habitat that is of critical importance to the species at particular life-cycle stages; and/or
- habitat utilised by a migratory species which is at the limit of the species range; and/or
- habitat within an area where the species is declining.

Listed migratory species cover a broad range of species with different life cycles and population sizes. An "ecologically significant proportion" of a population therefore varies from species to species.

In relation to migratory species, "population" means the entire population or any geographically separate part of the population of any species or lower taxon of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries including Australia.

Impact of the Proposal
The proposed development is not likely to have a significant impact on listed migratory species. There is no "important habitat" for such species within the development area and the habitat in that area is not likely to support an ecologically important proportion of a population of such species. Only small populations of listed migratory species inhabit the area, and most of that habitat is unaffected by the proposals.

Conclusion, EPBC Act
In our opinion, the proposed development is not likely to have a significant impact on matters of national environmental significance listed under the *Environment Protection and Biodiversity Conservation Act*. Referral to the Commonwealth Minister for the Environment for assessment and approval is therefore not warranted. The proposed development is not likely to constitute a "controlled action" because is it not "likely to have a significant impact on a matter of national environmental significance".

6 ENVIRONMENTAL MANAGEMENT

A compensation package has been developed as an offset to the impact of the development on flora and fauna, albeit a relatively minor impact because of the design of the development. The design of the development is such that almost all of the biodiversity values associated with the site are avoided. The elements of the package are described below.

Management of the Eastern and Western Forests
The eastern and western forest areas (see **Figure 3**) will remain intact except for the incursion for a roadway and part of the golf course in the far north-western corner near the pine plantation. Those areas will be the focus of a proposed plan of management that would guide the protection and enhancement of those forests for their conservation. The plan will address matters such as interfacing with the development areas, access and passive recreation, pest control and rehabilitation of disturbed areas. It is proposed to develop the plan in consultation with the NSW Office of Environment and Heritage.

There would be a loss of about 34.5 hectares of delineated habitat corridor under the Jervis Bay Regional Plan. The clearing of that forest and woodland would disrupt the corridor to the southwest of the pine plantation. The plans at **Figures 7 and 8** show that there are extensive areas of forest to the east of the pine plantation and subject land. The heavily forested eastern-most part of the subject land is not identified as habitat corridor, although it is clearly contiguous with the identified corridor. As compensation for clearing part of the defined corridor near the opine plantation, it is recommended that the defined corridor be modified to incorporate the forest in the eastern part of the subject land, which for intents and purposes is a part of the same habitat link. That area is much larger than the 34.5 hectares to be cleared.

From a fauna conservation point of view, the loss of the forest and woodland at that location in the corridor is not of high importance. As noted above, there are vast areas of forest to the east and north of the subject land that form an extensive habitat link, albeit not delineated as habitat corridor. With careful clearing for the golf course, the function of that part of the corridor can remain viable for most species.

Rehabilitation and Management of Wetlands, Currambene Creek, Minor Riparian Zones
The above wetland areas will also be managed for their conservation and subject to a sub-plan of the above management plan. Several key issues are recognised as important in these areas, particularly protection during construction activities, stormwater management following the completion of the development, water quality and rehabilitating the floodplain wetlands.

* * * * *

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Appendix 1
Summary of Survey Dates, Times and Activities

Date	Time	Surveys Undertaken
06.07.09	1 day	General diurnal flora and fauna surveys of the northern part of the study area, particularly the old pine plantation.
10.07.09	1 day	General diurnal flora and fauna surveys, western forest, farmland and wetlands; site orientation.
13.07.09	1 day	General diurnal flora and fauna surveys, western forest, farmland and wetlands. Searching for feeding signs of Yellow-bellied Gliders and Glossy Black-ockatoo.
21.07.09	2 hrs	General diurnal flora and fauna surveys of the old pine plantation; investigating the swamp forest along creeks through old plantation.
03.08.09	1 day	General diurnal flora and fauna surveys, western forest, farmland and wetlands. Particular attention given to wetlands. Photogarphs taken of key sites.
14.08.09	4.5 hrs	Late afternoon/evening surveys; general fauna surveys. In and near old pine plantation. Call playback of Powerful Owl east of pines; general spotlighting.
24.08.09	8 hrs	General diurnal flora and fauna surveys, western forest, farmland and wetlands. Old growth tree surveys in western forest. Searching for feeding signs of Glossy Black-Cockatoo. Call playback of Powerful Owl in south near Georges Creek; general spotlighting.
10.09.09	10 hrs	Diurnal bird surveys throughout western part of site. Orchid searches in western forest. General plant and animal recordings. Spotlighting throughout western part of site. Powerful Owl call playback in several locations.
11.09.09	7 hrs	Diurnal bird surveys in western forest. Surveys around quarry and dam in eastern forests, including route of potential road north of quarry.
10.09.09	0.75 hrs	Targeted orchid surveys.
13.10.09	1 hrs	Targeted orchid surveys.
12.10.09	1 day (4 people)	Trapping program began: box traps, cage traps, hair tubes on five transects; plus bird surveys, spotlighting, reptile suervys, general flora and fauna surveys. Vegetation survey plots.
13.10.09	1 day (2 people)	Trapping program began: box traps, cage traps, hair tubes on five transects; plus bird surveys, spotlighting, reptile suervys, general flora and fauna surveys. Vegetation survey plots.
14.10.09	1 day (2 people)	Trapping program began: box traps, cage traps, hair tubes on five transects; plus bird surveys, spotlighting, reptile suervys, general flora and fauna surveys. Vegetation survey plots.
15.10.09	1 day (2 people)	Trapping program began: box traps, cage traps, hair tubes on five transects; plus bird surveys, spotlighting, reptile suervys, general fauna surveys.
16.10.09	1 day (2 people)	Trapping program began: box traps, cage traps, hair tubes on five transects; plus bird surveys, spotlighting, reptile suervys, general fauna surveys.
28.10.09	3 hrs	Targeted orchid surveys; bird surveys.
02.11.09	0.5 hrs	Targeted orchid surveys, bird survey
01.12.09	4 hrs	Targeted orchid surveys, bird survey.
24.11.09	4 hrs	General surveys, bird surveys, targeted ochid surevys.
21.12.09	2hrs 5m	Targeted orchid surveys, bird survey.
04.01.10	1.5 hrs	Targeted orchid surveys, bird survey.
04.02.10	1 hr	Targeted orchid survey.
26.02.10	4 hrs	Targeted bird survey, general surevys.
25.02.10	1.5hrs	Bird survey
09.04.10	1hr	Targeted orchid survey
19.04.10	1hr	Bird survey
19.04.10	0.75hr	Targeted orchid survey

Appendix 2
Plant Species List for the Comberton Grange Property

FAMILY Species		Precinct: Wetlands (L)	Cleared Farmland (F)	Western Forest (W)	Eastern Forest (E)	Pine Plantation (P)
PTERIDOPHYTA (Ferns)						
Adiantaceae						
Adiantum aethiopicum	Common Maidenhair		F	W	E	P
Azollaceae						
Azolla filiculoides	Pacific Azolla	L				
Blechnaceae						
Blechnum cartilagineum	Gristle Fern			W	E	
Doodia aspera	Prickly Rasp Fern				E	
Cyatheaceae						
Cyathea australis	Rough Tree Fern				E	P
Dennstaedticeae						
Hypolepis muelleri	Harsh Ground Fern	L	F	W	E	P
Pteridium esculentum	Bracken		F	W	E	P
Dicksoniaceae						
Calochlaena dubia	Common Ground Fern			W	E	
Gleicheniaceae						
Gleichenia dicarpa	Pouched Coral Fern			W	E	P
Sticherus flabellatus	Umbrella Fern					P
Lindsaeaceae						
Lindsaea linearis	Screw Fern			W	E	
Lindsaea microphylla	Lacy Wedge Fern			W	E	
Polypodiaceae						
Platycerium bifurcatum	Elkhorn				E	
Pyrrosia rupestris	Rock Felt Fern			W		

Schizaeaceae						
Schizaea bifida	Forked Comb Fern			W		P
Selaginellaceae						
Selaginella uliginosa	Selaginella					P
Sinopteridaceae						
Cheilanthes sieberi	Mulga Fern				E	
Pellaea falcata	Sickle Fern		F		E	
Gymnospermae (Conifers)						
Pinaceae						
**Pinus pinaster*	Cluster Pine					P
**Pinus radiata*	Radiata Pine		F			P,W
Podocarpaceae						
**Podocarpus elatus*	Plum Pine		F			
Zamiaceae						
Macrozamia communis	Burrawang			W	E	P
Angiospermae (Flowering Plants)						
Acanthaceae						
Brunoniella pumilio	Dwarf Blue Trumpet			W		P
Pseuderanthemum variabile	Pastel Flower		F			
Aizoaceae						
Tetragonia tetragonoides	New Zealand Spinach	L		W		
Amaranthaceae						
Alternanthera denticulata	Lesser Joyweed	L				
Anthericaceae						
Caesia parviflora	Pale Grass Lily			W		
Laxmannia gracilis	Slender Wire-lily					P
Thysanotus tuberosus	Common Fringe Lily			W		
Tricoryne elatior	Yellow Rush-lily				E	
Tricoryne simplex	Rush-lily			W		

Apiaceae						
Apium prostratum	Sea Celery	L				
Centella asiatica	Indian Pennywort		F		E	
Hydrocotyle laxiflora	Stinking Pennywort		F	W	E	P
Platysace lanceolata	Shrubby Platysace		F	W	E	
Platysace linearifolia	Narrow-leaved Platysace			W	E	P
Xanthosia tridentata	Xanthosia			W		
**Foeniculum vulgare*	Fennel		F			
**Hydrocotyle bonariensis*	Pennywort				E	
Apocynaceae						
Marsdenia rostrata	Common Milk Vine			W	E	P
Marsdenia suaveolens	Scented Marsdenia			W		P
Parsonsia straminea	Monkey-Rope Vine		F	W	E	P
Tylophora barbata	Bearded Tylophora		F	W	E	P
**Nerium oleander*	Oleander		F			
Araceae						
Gymnostachys anceps	Settler's Flax			W	E	
**Philodendron selloum*	Philodendron		F			
Arecaceae						
Livistona australis	Cabbage Palm			W	E	
Asclepiadaceae						
**Araujia hortorum*	Moth Vine		F			
Asteraceae						
Cassinia aculeata	Common Cassinia			F		E
Cassinia quinquefaria	Rosemary Cassinia				E	
Centipeda minima	Spreading Sneezeweed	L				
Epaltes australis	Spreading Nut-heads				E	
Helichrysum elatum	Tall Everlasting				E	
Helichrysum scorpioides	Button Everlasting				E	P
Lagenifera stipitata	Blue Bottle-daisy			W		P
Leptinella longipes	Large Creeping Cotula		F	W		
Olearia microphylla	Bridal Daisy-bush			W		
Olearia viscidula	Brush Daisy-bush		F	W		P
Ozothamnus diosmifolius	Everlasting		F	W	E	P

Pseudognaphalium luteoalbum	Jersey Cudweed				E	
Senecio linearifolius	Fireweed Groundsel		F	W	E	
**Ageratina riparia*	Mistflower				E	
**Aster subulatus*	Bushy Starwort	L		W		E
**Bidens pilosa*	Cobbler's Pegs				E	
**Cirsium vulgare*	Spear Thistle		F	W	E	
**Conyza* sp.	Fleabane		F		E	
**Cotula coronopifolia*	Water Buttons	L		W		
**Delairea odorata*	Cape Ivy		F			
**Gamochaeta americana*	American Cudweed	L			E	
**Hypochaeris radicata*	Flatweed		F	W	E	P
**Senecio madagascariensis*	Fireweed		F	W	E	P
**Sonchus oleraceus*	Common Sowthistle	L	F		E	
Avicenniaceae						
Avicennia marina	Grey Mangrove	L				
Basellaceae						
**Anredera cordifolia*	Madeira Vine		F			
Bignoniaceae						
Pandorea pandorana	Wonga Vine		F	W	E	
Podranea ricasoliana	Pink Trumpet Vine		F			
Caryophyllaceae						
Stellaria flaccida	Forest Starwort			W		
**Cerastium glomeratum*	Mouse-ear Chickweed		F			
**Paronychia brasiliensis*	Chilean Whitlow Wort		F			
**Spergularia marina*	Salt Sand Spurrey	L				
Casuarinaceae						
Allocasuarina distyla	Sheoak			W	E	
Allocasuarina littoralis	Black She-oak			W	E	P
Casuarina glauca	Swamp Oak	L	F	W		E
Chenopodiaceae						
Atriplex australasica	Saltbush	L				
Einadia hastata	Berry Saltbush		F	W		
Sarcocornia quinqueflora	Beaded Glasswort	L				
Suaeda australis	Austral Seablite	L				

Colchicaceae						
Burchardia umbellata	Milkmaid			W		
Commelinaceae						
Commelina cyanea	Wandering Sailor		F	W		
Convolvulaceae						
Calystegia marginata	Forest Bindweed			W		
Convolvulus erubescens	Australian Bindweed					
Dichondra repens	Kidney Weed		F	W	E	P
Polymeria calycina	Swamp Bind-weed			W	E	P
Crassulaceae						
**Crassula* sp.	Crassula (garden plant)			F		
Cunoniaceae						
Ceratopetalum gummiferum	NSW Christmas Bush			W	E	P
Cyperaceae						
Baumea articulata	Jointed Twig-rush	L				
Baumea juncea	Bare Twig-rush			W		
Carex appressa	Tall Sedge	L	F	W	E	
Carex ? inversa	Sedge			W		
Carex longebrachiata	Bergalia Tussock				E	
Caustis flexuosa	Curly Wig			W	E	P
Cyathochaeta diandra	Sedge				E	
Eleocharis sphacelata	Tall Spike-rush	L		W		
Gahnia clarkei	Tall Saw-sedge	L	F	W	E	P
Gahnia radula	Thatch Saw-sedge			W		P
Isolepis cernua	Nodding Club-rush			W		
Isolepis nodosa	Knobby Club-rush	L		W		
Lepidosperma filiforme	Common Rapier-sedge			W	E	
Lepidosperma laterale	Variable Sword-sedge			W	E	P
Schoenoplectus validus	River Club-rush			W		
**Isolepis prolifera*	Budding Club-rush	L		W	E	
Dilleniaceae						
Hibbertia aspera	Rough Guinea Flower				E	P
Hibbertia dentata	Trailing Guinea Flower			W		
Hibbertia empetrifolia	Guinea Flower			W	E	P
Hibbertia linearis	Showy Guinea Flower			W	E	P

Hibbertia riparia	Erect Guinea Flower		W	E	P
Hibbertia scandens	Twining Guinea Flower	F	W	E	
Droseraceae					
Drosera auriculata	Tall Sundew		W		
Drosera spatulata	Rosy Sundew		W		P
Elaeocarpaceae					
Elaeocarpus reticulatus	Blueberry Ash		W	E	P
Epacridaceae					
Astroloma humifusum	Cranberry Heath			E	
Epacris microphylla	Coral Heath		W	E	P
Epacris pulchella	Heath		W		P
Leucopogon esquamatus	Beard-heath		W		
Leucopogon juniperinus	Juniper Beard-heath	F	W	E	P
Leucopogon lanceolatus	Lance Beard-heath		W	E	P
Lissanthe strigosa	Peach Heath		W		P
Monotoca scoparia	Prickly Broom-heath		W	E	P
Euphorbiaceae					
Amperea xiphoclada	Broom Spurge		W		P
Breynia oblongifolia	Coffee Bush	F	W	E	P
Glochidion ferdinandi	Cheese Tree	F	W	E	P
Phyllanthus hirtellus	Thyme Spurge			E	P
Poranthera corymbosa	Clustered Poranthera			E	
Eupomatiaceae					
Eupomatia laurina	Bolwarra			E	
Fabaceae					
Caesalpinioideae (subfamily)					
**Senna pendula* var. *glabrata*	Winter Senna	F	W	E	
Faboideae (subfamily)					
Aotus ericoides	Common Aotus		W	E	P
Bossiaea ensata	Sword Bossiaea		W	E	P
Bossiaea heterophylla	Variable Bossiaea		W	E	P
Bossiaea prostrata	Creeping Bossiaea		W		
Daviesia acicularis	Sharp Bitter Pea			E	
Daviesia alata	Winged bush-pea				E

Daviesia squarrosa	Rough Bush-pea		W		
Daviesia ulicifolia	Gorse Bitter Pea	F	W	E	P
Desmodium varians	Slender Tick-trefoil		W	E	
Dillwynia ramosissima	Bushy Parrot Pea			E	
Dillwynia retorta	Twisted Parrot Pea		W	E	P
Glycine sp.	Glycine		W	E	P
Gompholobium grandiflorum	Large Wedge Pea		W	E	P
Gompholobium pinnatum	Pinnate Wedge Pea		W	E	
Goodia lotifolia	Golden-tips			E	
Hardenbergia violacea	Native Sarsaparilla		W	E	P
Hovea linearis	Erect Hovea		W	E	
Kennedia prostrata	Scarlet Coral Pea			E	
Kennedia rubicunda	Dusky Coral Pea	F	W	E	
Mirbelia rubiifolia	Heathland Mirbelia		W	E	P
Platylobium formosum	Handsome Flat-pea		W	E	P
Podolobium ilicifolium	Prickly Shaggy Pea		W		
Pultenaea daphnoides	Large-leaved Bush Pea		W	E	P
Pultenaea linophylla	Halo Bush Pea		W	E	P
Pultenaea villosa	Bronze Bush Pea		W	E	P
Sphaerolobium vimineum	Leafless Globe Pea			E	
Viminaria juncea	Native Broom			E	
**Erythrina* x *sykesii*	Coral Tree	F			
**Erythrina crista-galli*	Cockspur Thorn	F			
**Trifolium repens*	White Clover	F			
Mimosoideae (subfamily)					
Acacia binervata	Two-veined Hickory	F	W	E	P
Acacia brownii	Heath Wattle		W	E	P
Acacia falcata	Sickle Wattle		W	E	
Acacia implexa	Hickory Wattle		W	E	
Acacia irrorata	Rough-stemmed Wattle	F	W	E	P
Acacia longifolia	Golden Wattle		W	E	P
Acacia mabellae	Mabel's Wattle			E	
Acacia maidenii	Maiden's Wattle			E	
Acacia mearnsii	Black Wattle	F	W	E	P
Acacia myrtifolia	Myrtle Wattle		W	E	
Acacia obtusifolia	Wattle				P
Acacia stricta	Straight Wattle	F	W	E	
Acacia suaveolens	Sweet Wattle	F	W	E	P
Acacia terminalis	Sunshine Wattle		W	E	
Acacia ulicifolia	Prickly Moses	F	W	E	P

**Acacia longifolia* ssp. *sophorae*	Coast Wattle				E	
**Acacia saligna*	Golden Wreath Wattle				E	
Geraniaceae						
Geranium solanderi	Native Geranium			W	E	
Goodeniaceae						
Dampiera stricta	Blue Dampiera					P
Goodenia bellidifolia	Rocket Goodenia			W	E	P
Goodenia hederacea	Ivy Goodenia			W		
Goodenia heterophylla	Variable Goodenia			W	E	P
Goodenia ovata	Hop Goodenia		F			
Selliera radicans	Swamp Weed	L		W		
Haloragaceae						
Gonocarpus teucrioides	Germander Raspwort			W	E	
Hemerocallidaceae						
Geitonoplesium cymosum	Scrambling Lily		F	W	E	
Hypericaceae						
Hypericum gramineum	Small St John's Wort			W	E	P
Iridaceae						
Patersonia sericea	Silky Purple Flag			W	E	P
**Romulea rosea*	Onion Grass		F			
Juncaceae						
Juncus kraussii subsp. *australiensis*	Sea Rush	L				
Juncus planifolius	Rush			W		
Juncus prismatocarpus	Branching Rush			W	E	
Juncus sp.	Rush				E	
Juncus usitatus	Common Rush	L			E	
**Juncus acutus*	Sharp Rush				E	
Juncaginaceae						
Triglochin procerum	Water Ribbons	L				
Triglochin striatum	Streaked Arrowgrass	L				
Lamiaceae						
Clerodendrum tomentosum	Hairy Clerodendrum		F	W	E	

Lauraceae						
Cassytha glabella	Slender Dodder-laurel			W	E	
Cassytha pubescens	Downy Dodder-laurel			W	E	P
Cryptocarya glaucescens	Jackwood				E	
Lobeliaceae						
Pratia purpurascens	Lobelia Pratia		F	W	E	P
Loganiaceae						
Mitrasacme polymorpha	Varied Mitrewort			W		
Lomandraceae						
Lomandra glauca	Pale Mat-rush			W	E	
Lomandra longifolia	Spiny-headed Mat-rush		F	W	E	P
Lomandra multiflora	Many-flowered Mat-rush			W	E	P
Lomandra obliqua	Twisted Mat-rush			W	E	P
Loranthaceae						
Amyema cambagei	Mistletoe	L				
Amyema congener	Mistletoe		F			
Muellerina eucalyptoides	Mistletoe		F		E	
Luzuriagaceae						
Eustrephus latifolius	Wombat Berry		F	W	E	
Lythraceae						
Lythrum hyssopifolia	Hyssop Loosestrife	L				
Malvaceae						
**Lagunaria patersonia*	Norfolk Island Hibiscus		F			
**Modiola caroliniana*	Red-flowered Mallow		F			
Meliaceae						
Synoum glandulosum	Scentless Rosewood			W	E	
Menispermaceae						
Sarcopetalum harveyanum	Pearl Vine		F			
Stephania japonica	Snake Vine				E	
Moraceae						

Ficus coronata	Sandpaper Fig		F	W	E	
Myoporaceae						
Myoporum acuminatum	Boobialla			W		
Myrsinaceae						
Aegiceras corniculatum	River Mangrove	L				
Myrsine howittiana	Brush Muttonwood		F	W	E	
Myrsine variabilis	Muttonwood		F	W		
Myrtaceae						
Angophora floribunda	Rough-barked Apple			W	E	P
Babingtonia pluriflora	Tall Baeckea			W	E	
Backhousia myrtifolia	Ironwood		F			
Baeckea diosmifolia	Diosma Heath-myrtle				E	
Callistemon linearis	Narrow-leaved Bottlebrush				E	
Corymbia gummifera	Red Bloodwood			W	E	P
Corymbia maculata	Spotted Gum		F	W		P
Eucalyptus amplifolia	Cabbage Gum	L			E	
Eucalyptus capitellata	Brown Stringybark			W	E	P
Eucalyptus eugenioides	Thin-leaved Stringybark			W		P
Eucalyptus globoidea	White Stringybark		F	W	E	P
Eucalyptus longifolia	Woollybutt		F	W		P
Eucalyptus paniculata	Grey Ironbark		F	W	E	P
Eucalyptus pilularis	Blackbutt		F	W	E	P
Eucalyptus piperita	Sydney Peppermint			W	E	P
Eucalyptus robusta	Swamp Mahogany			W	E	P
Eucalyptus saligna/E. botryoides	Southern Blue Gum		F	W	E	P
Eucalyptus sclerophylla	Hard-leaved Scribbly Gum			W	E	P
Eucalyptus sieberi	Silvertop Ash				E	
Eucalyptus tereticornis	Forest Red Gum		F		E	
Kunzea ambigua	White Kunzea		F	W	E	P
Leptospermum arachnoides	Spider Teatree				E	
Leptospermum continentinale	Prickly Teatree					P
Leptospermum juniperinum	Prickly Teatree			W	E	
Leptospermum morrisonii	Teatree		F	W	E	P
Leptospermum polygalifolium	Yellow Teatree		F	W	E	P
Leptospermum trinervium	Paperbark Teatree			W	E	P
Melaleuca ericifolia	Swamp Paperbark	L	F	W	E	P
Melaleuca linariifolia	Narrow-leaved Paperbark	L	F	W	E	P
Melalueca squarrosa	Scented Paperbark			W		P

Melaleuca styphelioides	Prickly-leaved Paperbark	L	F	W	E	
Melaleuca thymifolia	Thyme Honey-myrtle				E	
Rhodamnia rubescens	Scrub Turpentine				E	
Syncarpia glomulifera	Turpentine		F	W	E	P
Syzygium smithii	Lilly Pilly		F	W	E	
Oleaceae						
Notelaea longifolia	Long-leaved Native Olive			W	E	
**Jasminum mesneyi*	Primrose Jasmine		F			
**Ligustrum sinense*	Small-leaved Privet		F			
Orchidaceae						
Acianthus fornicatus	Pixie Caps			W		
Caladenia picta	Caladenia			W	E	
Caleana major	Large Duck Orchid			W		
Calochilus sp.	Beardy Orchid			W		
Cryptostylis erecta	Tartan Tongue Orchid			W		
Cryptostylis subulata	Large Tongue Orchid			W		P
Cymbidium suave	Snake Orchid			W	E	
Dipodium punctatum	Purple Hyacinth			W		
Orthoceras strictum	Horned Orchid			W		
Pterostylis concinna	Trim Greenhood				E	
Pterostylis longiflora	Tall Greenhood			W		
Pterostylis nutans	Nodding Greenhood			W		
Pterostylis parviflora	Baby Greenhood			W		
Thelymitra ixioides	Spotted Sun-orchid			W		
Oxalidaceae						
Oxalis sp. (*?)	Wood Sorrel			W	E	P
Passifloraceae						
Passiflora herbertiana	Native Passionfruit				E	
Philydraceae						
Philydrum lanuginosum	Frog's-mouth	L				
Phormiaceae						
Dianella caerulea	Flax-lily			W	E	
Dianella revoluta	Spreading Flax-lily		F		E	P
Phytolaccaceae						

**Pittosporaceae*						
Phytolacca octandra	Inkweed		F	W		
Pittosporaceae						
Billardiera scandens	Apple Berry			W	E	P
Bursaria spinosa	Blackthorn		F	W	E	
Pittosporum revolutum	Rough-fruit Pittosporum		F	W	E	
Pittosporum undulatum	Sweet Pittosporum		F	W	E	
Rhytidosporum procumbens	White Marianth					P
Plantaginaceae						
**Plantago lanceolata*	Ribbed Plantain		F	W		
Poaceae						
Aristida sp.	Three-awned Speargrass			W	E	P
Austrodanthonia sp.	Wallaby Grass					P
Austrostipa ramosissima	Stout Bamboo Grass		F			
Austrostipa sp.	Spear-grass			W	E	P
Cymbopogon refractus	Barbed-wire Grass			W	E	
Cynodon dactylon	Couch Grass	L	F		E	P
Dichelachne micrantha	Short-hair Plume-grass		F			
Echinopogon caespitosus	Tufted Hedgehog Grass		F	W		P
Entolasia marginata	Bordered Panic			W	E	P
Entolasia stricta	Wiry Panic			W	E	P
Eragrostis sp.	Love-grass			W	E	P
Hemarthria uncinata	Mat Grass					P
Imperata cylindrica	Blady Grass		F	W	E	P
Isachne globosa	Swamp Millet	L				
Microlaena stipoides	Weeping Grass		F	W	E	P
Oplismenus aemulus	Australian Basket-grass			W		
Oplismenus imbecillis	Pademelon Grass			W		
Panicum simile	Panic Grass			W		P
Paspalum distichum	Water Couch	L		W		
Phragmites australis	Common Reed	L	F	W		P
Poa labillardieri	River Tussock			W	E	
Poa sieberiana	Poa Tussock			W		P
Sporobolus virginicus	Salt Couch	L				
Themeda australis	Kangaroo Grass			W	E	P
**Andropogon virginicus*	Whiskey Grass		F		E	
**Anthoxanthum odoratum*	Sweet Vernal Grass		F			
**Axonopus fissifolius*	Carpet Grass		F		E	P
**Briza maxima*	Large Quaking Grass		F			

**Briza minor*	Lesser Quaking Grass		F			
**Cortaderia selloana*	Pampas Grass				E	
**Holcus lanatus*	Yorkshire Fog		F			
**Paspalum dilatatum*	Paspalum		F			
**Paspalum urvillei*	Vasey Grass				E	
**Pennisetum clandestinum*	Kikuyu Grass		F		E	
**Phalaris aquatica*	Phalaris		F			
**Sporobolus fertilis*	Giant Parramatta Grass		F			
**Sporobolus indicus*	Parramatta Grass		F		E	
Polygalaceae						
Comesperma ericinum	Heath Milkwort			W	E	P
Polygonaceae						
Persicaria decipiens	Slender Knotweed	L				
Persicaria hydropiper	Water Pepper	L				
Persicaria orientalis	Princes Feathers	L				
Persicaria strigosa	Spotted Knotweed	L				
**Acetosa sagittata*	Rambling Dock		F			
Primulaceae						
Samolus repens	Creeping Brookweed	L		W		
**Anagallis arvensis*	Blue Pimpernel		F		E	
Proteaceae						
Banksia ericifolia	Heath-leaved Banksia			W	E	
Banksia paludosa	Swamp Banksia				E	P
Banksia serrata	Old Man Banksia			W	E	P
Banksia spinulosa	Hairpin Banksia			W	E	P
Hakea dactyloides	Finger Hakea			W	E	P
Hakea salicifolia	Willow-leaved Hakea		F			
Hakea sericea	Silky Hakea		F	W	E	P
Hakea teretifolia	Dagger Hakea			W	E	
Isopogon anemonifolius	Drumsticks			W	E	P
Lambertia formosa	Mountain Devil			W	E	P
Lomatia ilicifolia	Holly Lomatia			W	E	P
Persoonia levis	Broad-leaved Geebung			W	E	P
Persoonia linearis	Narrow-leaved Geebung		F	W	E	P
Persoonia mollis	Soft Geebung			W	E	P
Petrophile pedunculata	Stalked Conesticks			W	E	P
Telopea speciosissima	Waratah				E	

**Grevillea robusta*	Silky Oak		F			
Ranunculaceae						
Clematis aristata	Traveller's Joy			W	E	
Ranunculus inundatus	River Buttercup	L		W	E	
**Ranunculus repens*	Creeping Buttercup	L	F			
Restionaceae						
Leptocarpus tenax	Slender Twine-rush				E	
Lepyrodia scariosa	Scale-rush				E	P
Rhamnaceae						
Alphitonia excelsa	Red Ash		F			
Pomaderris aspera	Hazel Pomaderris				E	
Pomaderris ferruginea	Rusty Pomaderris			W		
Rosaceae						
Rubus moluccanus var. *trilobus*	Molucca Bramble			W	E	
Rubus parvifolius	Native Rasberry		F		E	
Rubus rosifolius	Rose-leaved Bramble				E	
**Chaenomeles lagenaria*	Flowering Quince		F			
**Malus* x *domestica*	Apple		F			
**Rosa* sp.	Garden Rose		F			
**Rubus fruticosus* sp. agg.	Blackberry		F			
**Spiraea* sp.	May Bush		F			
Rubiaceae						
Morinda jasminoides	Morinda			W	E	P
Opercularia aspera	Coarse Stinkweed			W	E	
Pomax umbellata	Pomax			W	E	P
Psychotria loniceroides	Hairy Psychotria				E	
Rutaceae						
Boronia thujona	Boronia			W	E	
Boronia polygalifolia	Waxy Boronia			W		
Zieria smithii	Sandfly Zieria			W		P
**Citrus* x *taitensis*	Lemon		F		E	
Santalaceae						
Exocarpos cupressiformis	Native Cherry		F	W	E	
Leptomeria acida	Sour Currant-bush			W	E	

Santalum obtusifolium	Sandalwood		F	W	E	
Sapindaceae						
Dodonaea triquetra	Large-leaved Hop-bush			W		
Scrophulariaceae						
Veronica ? *calycina*	Cup Speedwell				E	P
Smilacaceae						
Smilax australis	Austral Sarsaparilla				E	
Smilax glyciphylla	Sweet Sarsaparilla			W	E	P
Solanaceae						
Duboisia myoporoides	Corkwood		F	W		
Solanum pungetium	Jagged Nightshade			W	E	
Solanum sp.	Nightshade			W		
**Physalis peruviana*	Cape Gooseberry			W		
**Solanum americanum*	Glossy Nightshade		F			
**Solanum pseudocapsicum*	Madeira Winter Cherry			W	E	
Stackhousiaceae						
Stackhousia monogyna	Creamy Stackhousia			W		
Stylidiaceae						
Stylidium graminifolium	Grass Triggerplant			W		
Theaceae						
**Camellia* sp.	Camellia		F			
Thymelaeaceae						
Pimelea linifolia	Slender Rice-flower			W	E	P
Tremandraceae						
Tetratheca thymifolia	Pink Bells			W	E	
Typhaceae						
Typha orientalis	Cumbungi	L		W	E	
Ulmaceae						
Trema tomentosa var. *viridus*	Native Peach				E	

Urticaceae						
Urtica incisa	Stinging Nettle		F	W		
Uvulariaceae						
Schelhammera undulata	Lilac Lily			W	E	
Verbenaceae						
**Lantana camara*	Lantana		F	W	E	
**Verbena bonariensis*	Purpletop		F			
Violaceae						
Viola betonicifolia	Purple Violet			W		P
Viola hederacea	Native Violet		F	W	E	P
Visaceae						
Notothixos subaureus	Golden Mistletoe	L	F			
Vitaceae						
Cissus hypoglauca	Five-leaved Water Vine		F	W	E	
Xanthorrhoeaceae						
Xanthorrhoea concava	Grass-tree			W		P
Xanthorrhoea resinifera	Grass-tree			W		

Appendix 3
Vegetation Survey Sheets

Survey Sheet - Vegetation Plot		**Plot Size:** 20m x 20m	**Kevin Mills & Associates**
Site Name: Comberton Grange		**Plot No.** CG01	**Photo:** yes
Location: Shallow gully south-west of pine plantation.		**Recorder:** K. Mills	
Date: 12/10/09	**Community:** Blackbutt – Turpentine Tall Forest		
GPS (centre): 56 0283062 6126764 (WGS84)		**Soil:** Sandy	
Land Tenure: Freehold	**Alt:** 25 metres	**Geology:** Wandrawandian Siltstone	
Slope: Gentle	**Aspect:** South	**Topography:** Gully side	
Species Cover: 1:<5% (uncommon); 2:<5% (common), 3:5-25%; 4:25-50%; 5:50-75%; 6:75-100%.			

Natives		**Exotics**	
Trees		*Hypochaeris radicata*	1
Angophora floribunda	3		
Eucalyptus eugenioides	3		
Eucalyptus pilularis	4		
Syncarpia glomulifera	4		
Understorey			
Banksia spinulosa	1		
Billardiera scandens	1		
Boronia thujona	1		
Breynia oblongifolia	1		
Brunoniella pumilio	1		
Clematis aristata	1		
Corymbia gummifera	1		
Cymbidium suave	1		
Dianella caerulea	2		
Entolasia stricta	2		
Glycine sp.	1		
Hardenbergia violacea	1		
Hibbertia linearis	1		
Hibbertia scandens	1		
Imperata cylindrica	1		
Lagenifera stipitata	1		
Lepidosperma laterale	3		
Leucopogon juniperinus	3		
Leucopogon lanceolatus	2		
Lomandra cylindrica	1		
Lomandra multiflora	1		
Lomandra obliqua	1		
Lomatia ilicifolia	2		
Marsdenia rostrata	1		
Opercularia aspera	1		
Parsonsia straminea	1		
Patersonia sericea	3		
Persoonia linearis	2		
Pimelea linifolia	1		
Platylobium formosum	1		
Pomax umbellata	1		
Pteridium esculentum	2		
Pultenaea linophylla	1		
Schelhammera undulata	1		
Smilax glyciphylla	1		
Themeda australis	1		
Zieria smithii	1		

Survey Sheet - Vegetation Plot		**Plot Size:** 20m x 20m	**Kevin Mills & Associates**
Site Name: Comberton Grange		**Plot No.** CG02	**Photo:** yes
Location: Ridge south of pine plantation.		**Recorder:** K. Mills	
Date: 12/10/09	**Community:** Spotted Gum – Blackbutt Tall Forest		
GPS (centre): 56 0283484 6126430 (WGS84)		**Soil:** Sandy clay	
Land Tenure: Freehold	**Alt:** 40 metres	**Geology:** Wandrawandian Siltstone	
Slope: Level	**Aspect:** North	**Topography:** Broad ridge	
Species Cover: 1:<5% (uncommon); 2:<5% (common), 3:5-25%; 4:25-50%; 5:50-75%; 6:75-100%.			
Natives			
Trees			
Corymbia gummifera	1		
Corymbia maculata	5		
Eucalyptus globoidea	3		
Eucalyptus pilularis	4		
Syncarpia glomulifera	3		
Understorey			
Acacia irrorata	1		
Acacia terminalis	1		
Billardiera scandens	1		
Brunoniella pumilio	1		
Cymbidium suave	1		
Dianella caerulea	1		
Dianella caerulea	1		
Echinopogon caespitosus	1		
Entolasia stricta	3		
Gonocarpus teucrioides	1		
Goodenia heterophylla	1		
Hakea sericea	1		
Hardenbergia violacea	1		
Hovea linearis	2		
Hypericum gramineum	1		
Imperata cylindrica	1		
Lagenifera stipitata	1		
Lepidosperma laterale	3		
Leucopogon juniperinus	3		
Leucopogon lanceolatus	1		
Lomandra cylindrica	1		
Lomandra longifolia	1		
Lomandra multiflora	1		
Lomandra obliqua	1		
Lomatia ilicifolia	1		
Macrozamia communis	3		
Notelaea longifolia	1		
Persoonia linearis	1		
Pimelea linifolia	1		
Platylobium formosum	1		
Poa sp.	1		
Pomax umbellata	1		
Pteridium esculentum	1		
Pultenaea linophylla	1		
Thelymitra	1		
Themeda australis	1		
Xanthorrhoea concava	1		

Survey Sheet - Vegetation Plot		**Plot Size:** 20m x 20m	**Kevin Mills & Associates**
Site Name: Comberton Grange		**Plot No.** CG03	**Photo:** yes
Location: Between north west entry gate and pine plantation.		**Recorder:** K. Mills	
Date: 12/10/09	**Community:** Scribbly Gum – Bloodwood Woodland		
GPS (centre): 56 0283083 6127138 (WGS84)		**Soil:** Sandy/gravelly	
Land Tenure: Freehold	**Alt:** 45 metres	**Geology:** Wandrawandian Siltstone	
Slope: Level	**Aspect:** North	**Topography:** Broad ridge	

Species Cover: 1:<5% (uncommon); 2:<5% (common), 3:5-25%; 4:25-50%; 5:50-75%; 6:75-100%.

Natives			
Trees			
Banksia serrata	4		
Corymbia gummifera	3		
Eucalyptus capitellata	4		
Eucalyptus sclerophylla	4		
Understorey			
Acacia brownii	1		
Acacia suaveolens	1		
Aotus ericoides	1		
Austrostipa rudis	5		
Banksia spinulosa	1		
Boronia thujona	1		
Bossiaea ensata	2		
Bossiaea heterophylla	1		
Cassytha glabella	1		
Caustis flexuosa	2		
Cryptostylis ? subulata	1		
Cymbidium suave	1		
Entolasia stricta	2		
Epacris pulchella	1		
Gompholobium grandiflorum	1		
Hakea dactyloides	1		
Hakea sericea	2		
Hibbertia riparia	1		
Hovea linearis	1		
Lambertia formosa	3		
Lepidosperma laterale	3		
Leptospermum polygalifolium	1		
Leptospermum trinervium	1		
Lindsaea linearis	2		
Lomandra cylindrica	1		
Lomandra glauca	1		
Lomandra obliqua	1		
Lomandra obliqua	1		
Mirbelia rubiifolia	1		
Patersonia sericea	1		
Persoonia levis	2		
Petrophile pedunculata	2		
Tetratheca thymifolia	2		
Xanthorrhoea resinifera	1		

Survey Sheet - Vegetation Plot		**Plot Size:** 20m x 20m	**Kevin Mills & Associates**
Site Name: Comberton Grange		**Plot No.** CG04	**Photo:** yes
Location: Between north-south track and east-west track (gully).		**Recorder:** K. Mills	
Date: 13/10/09	**Community:** Spotted Gum Tall Forest		
GPS (centre): 56 0283502 6123997 (WGS84)		**Soil:** Clayey	
Land Tenure: Freehold	**Alt:** 20 metres	**Geology:** Snapper Point Formation (sandstone).	
Slope: Very gentle	**Aspect:** NE	**Topography:** Side of ridge	
Species Cover: 1:<5% (uncommon); 2:<5% (common), 3:5-25%; 4:25-50%; 5:50-75%; 6:75-100%.			

Natives		**Exotics**	
Trees			
Angophora floribunda	3	*Senecio madagascariensis*	1
Corymbia maculata	5		
Eucalyptus pilularis	3		
Syncarpia glomulifera	3		
Understorey			
Acacia binervata	1	*Pteridium esculentum*	1
Allocasuarina littoralis	1	*Schelhammera undulata*	1
Austrostipa sp. ?	1	*Themeda australis*	2
Breynia oblongifolia	1	*Xanthorrhoea concava*	1
Brunoniella pumilio	1		
Bursaria spinosa	1		
Carex ? *inversa*	1		
Clematis aristata	1		
Cymbopogon refractus	1		
Daviesia ulicifolia	1		
Dianella caerulea	3		
Echinopogon caespitosus	1		
Entolasia stricta	3		
Eragrostis sp.	1		
Eucalyptus eugenioides	1		
Eustrephus latifolius	1		
Glycine sp.	1		
Hardenbergia violacea	1		
Hibbertia scandens	1		
Imperata cylindrica	3		
Kennedia rubicunda	1		
Lagenifera stipitata	1		
Lepidosperma laterale	1		
Leucopogon juniperinus	2		
Leucopogon lanceolatus	1		
Lindsaea linearis	1		
Lomandra cylindrica	1		
Lomandra obliqua	1		
Macrozamia communis	3		
Microlaena stipoides			
Myrsine variabilis	1		
Notelaea longifolia	1		
Opercularia aspera	1		
Pandorea pandorana	1		
Persoonia levis	1		
Persoonia linearis	1		
Pimelea linifolia	1		
Pittosporum undulatum	1		
Poa sp.	1		

Survey Sheet - Vegetation Plot		**Plot Size:** 20m x 20m **Kevin Mills & Associates**	
Site Name: Comberton Grange		**Plot No.** CG05	**Photo:** yes
Location: Between north-south track and east-west track (ridge).		**Recorder:** K. Mills	
Date: 13/10/09	**Community:** Blackbutt Forest		
GPS (centre): 56 0283767 6125729 (WGS84)		**Soil:** Clayey – sand.	
Land Tenure: Freehold	**Alt:** 25 metres	**Geology:** Snapper Point Formation (sandstone).	
Slope: Gentle	**Aspect:** West	**Topography:** Gentle side slope	
Species Cover: 1:<5% (uncommon); 2:<5% (common), 3:5-25%; 4:25-50%; 5:50-75%; 6:75-100%.			
Natives			
Trees			
Allocasuarina littoralis	4		
Corymbia gummifera	3		
Eucalyptus pilularis	4		
Understorey			
Acacia brownii	1		
Acacia irrorata	1		
Allocasuarina littoralis	2		
Amperea xiphoclada	1		
Aotus ericoides	1		
Austrostipa sp.	1		
Banksia spinulosa	1		
Billardiera scandens	1		
Brunoniella pumilio	1		
Cassytha pubescens	1		
Cissus hypoglauca	1		
Cryptostylis? subulata	1		
Daviesia ulicifolia	2		
Dianella carulea	2		
Elaeocarpus reticulatus	1		
Entolasia stricta	4		
Epacris pulchella	1		
Glycine sp.	1		
Hakea sericea	1		
Hibbertia empetrifolia	1		
Hovea linearis	1		
Imperata cylindrica	1		
Lambertia formosa	1		
Lepidosperma laterale	3		
Leptospermum trinervium	1		
Leucopogon juniperinus	1		
Lomandra obliqua	1		
Lomatia ilicifolia	1		
Patersonia sericea	2		
Persoonia linearis	1		
Persoonia mollis	3		
Petrophile pedunculata	1		
Pimelea linifolia	1		
Platylobium formosum	3		
Platysace lanceolata	1		
Platysace linearifolia	1		
Pomax umbellata	1		
Pteridium esculentum	3		

Survey Sheet - Vegetation Plot		**Plot Size:** 20m x 20m **Kevin Mills & Associates**	
Site Name: Comberton Grange		**Plot No.** CG06	**Photo:** yes
Location: Just outside south west corner of pine plantation.		**Recorder:** K. Mills	
Date: 13/10/09	**Community:** Scribbly Gum – Bloodwood Woodland		
GPS (centre): 56 0283313 6127125 (WGS84)		**Soil:** Clayey sand	
Land Tenure: Freehold	**Alt:** 30 metres	**Geology:** Wandrawandian Siltstone	
Slope: Very gentle	**Aspect:** East	**Topography:** Upper slope	
Species Cover: 1:<5% (uncommon); 2:<5% (common), 3:5-25%; 4:25-50%; 5:50-75%; 6:75-100%.			
Natives			
Trees			
Corymbia gummifera	3		
Eucalyptus capitellata	5		
Eucalyptus sclerophylla	4		
Understorey			
Acacia brownii	1	*Patersonia sericea*	2
Acacia terminalis	1	*Persoonia mollis*	1
Allocasuarina littoralis	1	*Pimelea linifolia*	1
Aristida sp.	1	*Platysace linearifolia*	1
Austrostipa sp.	2	*Pultenaea linophylla*	1
Banksia spinulosa	3	*Schizaea bifida*	1
Billardiera scandens	1	*Themeda australis*	1
Boronia thujona	3	*Viola hederacea*	1
Bossiaea heterophylla	1	*Xanthosia tridentata*	1
Brunoniella pumilio	1	Unidentified sedge	1
Cassytha glabella	1		
Caustis flexuosa	3		
Comesperma ericinum	1		
Cryptostylis subulata	1		
Daviesia squarrosa	1		
Dianella caerulea	1		
Dillwynia retorta	3		
Entolasia stricta	3		
Epacris pulchella	2		
Gompholobium pinnatum	1		
Gonocarpus teucrioides	1		
Goodenia bellidifolia	1		
Hakea dactyloides	1		
Hakea sericea	3		
Hibbertia empetrifolia	1		
Hovea linearis	1		
Imperata cylindrica	1		
Lagenifera stipitata	1		
Lepidosperma laterale	1		
Leptomeria acida	1		
Leptospermum polygalifolium	1		
Leptospermum trinervium	1		
Lindsaea linearis	1		
Lomandra cylindrica	1		
Lomandra multiflora	1		
Lomandra obliqua	1		
Mirbelia rubiifolia	1		
Mitrasacme polymorpha	1		
Panicum simile	1		

Survey Sheet - Vegetation Plot		**Plot Size:** 20m x 20m	**Kevin Mills & Associates**
Site Name: Comberton Grange		**Plot No.** CG07	**Photo:** yes
Location: South-west corner of Pine plantation.			**Recorder:** K. Mills
Date: 13/10/09	**Community:** Kunzea Shrubland (regrowth)		
GPS (centre): 56 0283446 6127300 (WGS84)		**Soil:** Gravelly clay	
Land Tenure: Freehold	**Alt:** 20 metres	**Geology:** Wandrawandian Siltstone	
Slope: Level	**Aspect:** North	**Topography:** Gentle mid slope	
Species Cover: 1:<5% (uncommon); 2:<5% (common), 3:5-25%; 4:25-50%; 5:50-75%; 6:75-100%.			
Natives			
Trees			
Corymbia gummifera	3		
Understorey			
Acacia obtusifolia	1		
Acacia suaveolens	1		
Acacia terminalis	1		
Allocasuarina littoralis	1		
Banksia spinulosa	1		
Boronia thujona	1		
Bossiaea heterophylla	1		
Caustis flexuosa	3		
Comesperma ericinum	1		
Dillwynia retorta	2		
Epacris microphylla	2		
Eucalyptus sclerophylla	1		
Gahnia clarkei	1		
Gompholobium grandiflorum	1		
Hakea dactyloides	1		
Hakea sericea	2		
Hibbertia empetrifolia	1		
Kunzea ambigua	6		
Lambertia formosa	1		
Lepidosperma laterale	1		
Leptospermum continentinale	1		
Leptospermum polygalifolium	3		
Lepyrodia scariosa	1		
Leucopogon esquamatus	1		
Lindsaea linearis	1		
Lomandra multiflora	1		
Lomatia ilicifolia	1		
Mirbelia rubiifolia	2		
Patersonia sericea	1		
Persoonia levis	1		
Persoonia mollis	1		
Petrophile pedunculata	1		
Schoenus brevifolius	1		

Survey Sheet - Vegetation Plot		**Plot Size:** 20m x 20m **Kevin Mills & Associates**	
Site Name: Comberton Grange		**Plot No.** CG08	**Photo:** yes
Location: Between quarry and Georges Creek. West of quarry dam.		**Recorder:** K. Mills	
Date: 14/10/09	**Community:** Scribbly Gum – Bloodwood Woodland.		
GPS (centre): 56 0284351 6126357 (WGS84)		**Soil:** Sandy	
Land Tenure: Freehold.	**Alt:** 10 metres	**Geology:** Snapper Point Formation (sandstone).	
Slope: Gentle	**Aspect:** West	**Topography:** Mid slope.	
Species Cover: 1:<5% (uncommon); 2:<5% (common), 3:5-25%; 4:25-50%; 5:50-75%; 6:75-100%.			

Natives		**Exotics**	
Trees		*Hypochaeris radicata* *	1
Eucalyptus sclerophylla	4		
Eucalyptus piperita	4	**Natives**	
Corymbia gummifera	3	*Lomandra multiflora*	1
Banksia serrata	4	*Lomandra obliqua*	1
Eucalyptus sieberi	3	*Lomatia ilicifolia*	1
Understorey		*Monotoca scoparia*	1
Acacia longifolia	1	*Panicum simile*	1
Acacia myrtifolia	1	*Patersonia sericea*	3
Acacia suaveolens	1	*Persoonia levis*	1
Allocasuarina littoralis	1	*Persoonia linearis*	1
Aotus ericoides	2	*Persoonia mollis*	1
Astroloma humifusum	1	*Petrophile pedunculata*	3
Austrostipa sp.	1	*Pimelea linifolia*	2
Baeckea virgata	1	*Platylobium fromosum*	3
Banksia paludosa	1	*Platysace linearifolia*	3
Banksia spinulosa	1	*Poranthera corymbosa*	1
Billardiera scandens	1	*Pteridium esculentum*	3
Bossiaea ensata	1	*Pultenaea linophylla*	1
Bossiaea heterophylla	1	*Telopea speciosissima*	1
Brunoniella pumilio	1	*Themeda australis*	1
Caustis flexuosa	1	Unknown sedge	1
Cyathochaeta diandra	1		
Daviesia alata	1		
Dianella caerulea	1		
Entolasia stricta	2		
Eragrostis sp.	1		
Eucalyptus capitellata	1		
Goodenia hederacea	1		
Hakea dactyloides	1		
Hakea sericea	1		
Hibbertia linearis	1		
Hovea linearis	1		
Isopogon anemonifolius	1		
Kunzea ambigua	1		
Lambertia formosa	4		
Lepidosperma laterale	1		
Leptomeria acida	1		
Leptospermum polygalifolium	1		
Lepyrodia scariosa	1		
Leucopogon juniperinus	1		
Leucopogon lanceolatus	1		
Lindsaea linearis	2		
Lomandra glauca	1		

Appendix 4
Summary of Orchid Searches

Date	Location	Target Species	Search Time	Results
10.09.09	0283446 6126046	*Pterostylis gibbosa*	15 mins	nil
10.09.09	0283310 6126439	*Pterostylis gibbosa*	15 mins	nil
13.10.09	0283502 6125997	*Pterostylis gibbosa*	60 mins	nil
29.10.09	0283123 6127179 & surrounding areas	*Caladenia tessellata* *Rhizanthella slateri*	30 minutes	nil
29.10.09	0283330 6127143 & surrounding area	*Rhizanthella slateri* *Caladenia tessellata*	30 minutes	*Dipodium punctatum* *Cryptostylis* sp. (leaves)
02.11.09	0283044 6127065 to 0283161 6127166 woodland/forest	*Rhizanthella slateri* *Caladenia tessellata*	30 mins	*Caleana major* *Dipodium punctatum* *Cryptostylis* sp. (leaves)
23.11.09	Woodland southwest of pine plantation.	*Rhizanthella slateri*	60 minutes	*Cryptostylis erecta* *Dipodium punctatum* *Caleana major* *Thelymitra* sp.
23.11.09	Woodland - west of quarry dam, south of pine plantation.	*Rhizanthella slateri*	45 minutes	*Thelymitra* sp. (old fruit) *Cryptostylis subulata* (1)
01.12.09	Woodland – south and southwest of pine plantation. 0283111 6127085 to 0283328 6127133	*Cryptostylis hunteriana*	120 mins	*Dipodium punctatum* (51) *Caleana major* (12) *Cryptostylis erecta* (38) *Cryptostylis* sp. (leaves) (68)
8.12.09	Woodland – south of pine plantation.	*Cryptostylis hunteriana*	90 mins	*Dipodium punctatum* (37) *Caleana major* (2) *Cryptostylis erecta* (34) *Cryptostylis* sp. (leaves) (49) *Thelymitra* sp. (old stem) (2) *Orthoceras strictum*
21.12.09	Woodland – south of pine plantation. 0283118 6127159 to 0283201 6127125	*Cryptostylis hunteriana*	25 mins	*Cryptostylis erecta* (4) *Cryptostylisi sp.* leaves (6) *Dipodium punctatum* (14) *Thelymitra* (old stem) (2) *Cealeana major* (2)
Date	**Location**	**Target Species**	**Search Time**	**Results**
21.12.09	Woodland - west of quarry	*Cryptostylis hunteriana*	35 mins	*Calochilus paludosus* (1)

	0283336 6127144 to 0283247 6127072			*Cryptostylis erecta* (13) *Cryptostylis* sp. leaves (25) *Dipodium punctatum* (21) *Cryptostylis subulata* (3) *Thelymitra* (old stem) (2)
21.12.09	Eastern forests – west of dam 0284642 6126356 to 0284348 6126425	*Cryptostylis hunteriana*	30 mins	*Cryptostylis subulata* (1) *Thelymitra* (old stem) (1)
04.01.10	Woodland – south of pine plantation; around 0283316 6127146	*Cryptostylis hunteriana*	60 mins	*Calochilus paludosus* (1) *Cryptostylis erecta* (20) *Cryptostylis* sp. leaves (22) *Dipodium punctatum* (12) *Thelymitra* (old stem) (1)
04.02.10	Woodland – south of pine plantation; around 0283316 6127146	*Cryptostylis hunteriana*	60 mins	*Calochilus paludosus* (1) *Cryptostylis erecta* (8) *Cryptostylis* sp. leaves (22) *Dipodium punctatum* -fruit (3) *D.punctatum - flowers* (2)
26.03.10	Woodland – south of pine plantation; around 0283316 6127146	*Genoplesium baueri*	Notes lost	Notes lost
09.04.10	Woodland – south of pine plantation; around 0283316 6127146	*Genoplesium baueri*	60 mins	*Cryptostylis* (mnay leaves) *C. erecta* - old flowers (4) *Dipodium punctatum* - fruit (1)
19.04.10	Woodland – south and southwest of pine plantation	*Genoplesium baueri*	45 mins	*Cryptostylis* (mnay leaves) *Pterostylis parviflora* (1) *Calochilus* (leaf?)

Appendix 5
Fauna Species List on/near the Comberton Grange Property

GROUP FAMILY Common Name	Taxonomic Name	Dames & Moore [1] (1987)	Braithwaite et al. [2] (1988)	KMA [3] (2004)	KMA [4] (2009)
MAMMALS					
TACHYGLOSSIDAE					
Short-beaked Echidna	*Tachyglossus aculeatus*	1	2	3	N
DASYURIDAE					
Brown Antechinus	*Antechinus stuartii*	1	2		W
Dusky Antechinus	*Antechinus swainsonii*				W
White-footed Dunnart	*Sminthopsis leucopus*		2		
PERAMELIDAE					
Long-nosed Bandicoot	*Perameles nasuta*			3	W,E
VOMBATIDAE					
Common Wombat	*Vombatus ursinus*		2		
PETAURIDAE					
Yellow-bellied Glider	*Petaurus australis*		2	3	N
Sugar Glider	*Petaurus breviceps*	1	2	3	P,W,N
PSEUDOCHEIRIDAE					
Greater Glider	*Petauroides volans*	1	2	3	
Common Ringtail Possum	*Pseudocheirus peregrinus*	1	2	3	E,W, P,N
PHALANGERIDAE					
Common Brushtail Possum	*Trichosurus vulpecula*	1	2	3	W,E
MACROPODIDAE					
Eastern Grey Kangaroo	*Macropus giganteus*	1	2	3	F,W,L,P,E,N
Red-necked Wallaby	*Macropus rufogriseus*	1	2	3	W,N
Swamp Wallaby	*Wallabia bicolor*	1	2	3	P,W,F,N
RHINOLOPHIDAE					
Eastern Horseshoe Bat	*Rhinolophus megaphyllus*				W
MOLOSSIDAE					
East-coast Freetail Bat	*Mormopterus norfolkensis*				W
Eastern Freetail Bat	*Mormopterus* species				W
White-striped Freetail Bat	*Nyctinomus australis*				W
VESPERTILIONIDAE					
Golden-tipped Bat	*Kerivoula papuensis*				E
Large Bentwing Bat	*Miniopterus schreibersii*				W
Gould's Wattled Bat	*Chalinolobus gouldii*				W
Chocolate Wattled Bat	*Chalinolobus morio*				W
Eastern Falsistrelle	*Falsistrellus tasmaniensis*		2		W
Large-footed Myotis	*Myotis adversus*				W
Greater Broadnosed Bat	*Scoteanax rueppellii*				W
Lesser Long-eared Bat	*Nyctophilus geoffroyi*				W
Large Forest Bat	*Vespadelus darlingtoni*		2		W,E,F
Southern Forest Bat	*Vespadelus regulus*				W
Little Forest Bat	*Vespadelus vulturnus*				W,E,F
Long-eared Bat	*Nyctophilus* sp.				W

GROUP FAMILY Common Name	Taxonomic Name	Dames & Moore [1] (1987)	Braithwaite et al. [2] (1988)	KMA [3] (2004)	KMA [4] (2009)
MURIDAE					
Water-rat	*Hydromys chrysogaster*				L
House Mouse*	*Mus musculus*		2		
Bush Rat	*Rattus fuscipes*	1	2		E,W
Swamp Rat	*Rattus lutreolus*		2		E(?)
Black Rat*	*Rattus rattus*		2		
CANIDAE					
Feral Dog*	*Canis lupus*	1	2		W,F,P
European Red Fox*	*Vulpes vulpes*		2	3	W,E,F,N
FELIDAE					
Feral Cat*	*Felis catus*		2	3	
LEPORIDAE					
Rabbit*	*Oryctolagus cuniculus*	1	2	3	
EQUIDAE					
Feral Horse*	*Equus caballus*	1	2	3	
SUIDAE					
Feral Pig*	*Sus scrofa*		2	3	
BOVIDAE					
Domestic Cattle*	*Bos taurus*			3	F
BIRDS					
PHASIANIDAE					
Brown Quail	*Coturnix ypsilophora*				L
ANATIDAE					
Black Swan	*Cygnus atratus*			3	
Australian Wood Duck	*Chenonetta jubata*			3	L
Pacific Black Duck	*Anas superciliosa*	1	2	3	L
Grey Teal	*Anas gracilis*			3	L
Chestnut Teal	*Anas castanea*		2	3	L
PODICIPEDIDAE					
Australasian Grebe	*Tachybaptus novaehollandiae*				L
ANHINGIDAE					
Australasian Darter	*Anhinga novaehollandiae*				L
PHALACROCORACIDAE					
Little Pied Cormorant	*Microcarbo melanoleucos*			3	L
Little Black Cormorant	*Phalacrocorax sulcirostris*				L
Great Cormorant	*Phalacrocorax carbo*			3	L
PELECANIDAE					
Australian Pelican	*Pelecanus conspicillatus*				N
ARDEIDAE					
Cattle Egret	*Ardea ibis*				F
Great Egret	*Ardea alba*			3	
White-faced Heron	*Egretta novaehollandiae*			3	L,F
White-necked Heron	*Ardea pacifica*				F
Black Bittern	*Ixobrychus flavicollis*				L
GROUP		**Dames**	**Braithwaite**	**KMA [3]**	**KMA [4]**

FAMILY Common Name	Taxonomic Name	Dames & Moore [1] (1987)	Braithwaite et al. [2] (1988)	KMA [3] (2004)	KMA [4] (2009)
THRESKIORNITHIDAE					
Australian White Ibis	*Threskiornis molucca*			3	L
Straw-necked Ibis	*Threskiornis spinicollis*			3	
ACCIPITRIDAE					
Black-shouldered Kite	*Elanus axillaris*				F
Whistling Kite	*Haliastur sphenurus*			3	
White-bellied Sea-Eagle	*Haliaeetus leucogaster*			3	F
Swamp Harrier	*Circus approximans*			3	F
Brown Goshawk	*Accipiter fasciatus*				F
Grey Goshawk	*Accipiter novaehollandiae*		2		
Collared Sparrowhawk	*Accipiter cirrhocephalus*	1			F
Wedge-tailed Eagle	*Aquila audax*			3	E,F,N
FALCONIDAE					
Brown Falcon	*Falco berigora*		2		
Australian Hobby	*Falco longipennis*				E,F
Nankeen Kestrel	*Falco cenchroides*	1		3	F
RALLIDAE					
Dusky Moorhen	*Gallinula tenebrosa*			3	
Purple Swamphen	*Porphyrio porphyrio*				F
TURNICIDAE					
Painted Button-quail	*Turnix varius*		2		W
CHARADRIIDAE					
Masked Lapwing	*Vanellus miles*			3	L,F,N
COLUMBIDAE					
Brown Cuckoo-Dove	*Macropygia amboinensis*		2		
Common Bronzewing	*Phaps chalcoptera*		2	3	W
Brush Bronzewing	*Phaps elegans*		2	3	
Crested Pigeon	*Ocyphaps lophotes*			3	P,F
Wonga Pigeon	*Leucosarcia picata*		2		
Topknot Pigeon	*Lopholaimus antarcticus*		2		
CACATUIDAE					
Glossy Black-Cockatoo	*Calyptorhynchus lathami*		2	3	W
Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*	1	2	3	W,P,E
Gang-gang Cockatoo	*Callocephalon fimbriatum*	1	2	3	W,N
Galah	*Eolophus roseicapillus*		2	3	F
Long-billed Corella*	*Cacatua tenuirostris*				F
Sulphur-crested Cockatoo	*Cacatua galerita*		2	3	E,F,N
PSITTACIDAE					
Rainbow Lorikeet	*Trichoglossus haematodus*		2	3	P,W,F,E
Musk Lorikeet	*Glossopsitta concinna*		2	3	P,W
Little Lorikeet	*Glossopsitta pusilla*	1	2		
Australian King-Parrot	*Alisterus scapularis*		2	3	W,E
Crimson Rosella	*Platycercus elegans*	1	2	3	P,W,F,E
Eastern Rosella	*Platycercus eximius*		2	3	F
CUCULIDAE					
Pallid Cuckoo	*Cacomantis pallidus*		2		F
Brush Cuckoo	*Cacomantis variolosus*		2	3	W
Fan-tailed Cuckoo	*Cacomantis flabelliformis*	1	2	3	W,E,P
GROUP FAMILY		**Dames & Moore [1]**	**Braithwaite et al. [2]**	**KMA [3] (2004)**	**KMA [4] (2009)**

Common Name	Taxonomic Name	(1987)	(1988)		
CUCULIDAE cont...					
Horsfield's Bronze-Cuckoo	*Chalcites basalis*		2		
Shining Bronze-Cuckoo	*Chalcites lucidus*		2		W
Channel-billed Cuckoo	*Scythrops novaehollandiae*		2		F
Common Koel	*Eudynamys scolopacea*				F
STRIGIDAE					
Powerful Owl	*Ninox strenua*		2		W
Southern Boobook	*Ninox novaeseelandiae*	1	2	3	W
TYTONIDAE					
Masked Owl	*Tyto novaehollandiae*		2		N
PODARGIDAE					
Tawny Frogmouth	*Podargus strigoides*	1	2	3	W,F,N,E
CAPRIMULGIDAE					
White-throated Nightjar	*Eurostopodus mystacalis*		2		
AEGOTHELIDAE					
Australian Owlet-nightjar	*Aegotheles cristatus*		2		W,E
APODIDAE					
White-throated Needletail	*Hirundapus caudacutus*		2	3	
HALCYONIDAE					
Laughing Kookaburra	*Dacelo novaeguineae*	1	2	3	W,F,E
Sacred Kingfisher	*Todiramphus sanctus*		2	3	W,E
CORACIIDAE					
Dollarbird	*Eurystomus orientalis*		2	3	F,W
MENURIDAE					
Superb Lyrebird	*Menura novaehollandiae*				E
CLIMACTERIDAE					
White-throated Treecreeper	*Cormobates leucophaea*	1	2	3	P,W,E
Red-browed Treecreeper	*Climacteris erythrops*		2		
MALURIDAE					
Superb Fairy-wren	*Malurus cyaneus*	1	2	3	F,L,P,W,E,N
Variegated Fairy-wren	*Malurus lamberti*		2	3	W
Southern Emu-wren	*Stipiturus malachurus*		2	3	L,F
PARDALOTIDAE					
Spotted Pardalote	*Pardalotus punctatus*	1	2	3	P,W,E,N
Striated Pardalote	*Pardalotus striatus*		2		
White-browed Scrubwren	*Sericornis frontalis*	1	2	3	P,W,E
Chestnut-rumped Heathwren	*Calamanthus pyrrhopygia*		2	3	
Brown Gerygone	*Gerygone mouki*		2	3	
White-throated Gerygone	*Gerygone albogularis*		2		W
Brown Thornbill	*Acanthiza pusilla*	1	2	3	W,F,P,E
Buff-rumped Thornbill	*Acanthiza reguloides*		2	3	
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	1			
Yellow Thornbill	*Acanthiza nana*		2	3	F
Striated Thornbill	*Acanthiza lineata*		2	3	P,W,E,N

GROUP FAMILY Common Name	Taxonomic Name	Dames & Moore [1] (1987)	Braithwaite et al. [2] (1988)	KMA [3] (2004)	KMA [4] (2009)
MELIPHAGIDAE					
Red Wattlebird	*Anthochaera carunculata*		2	3	P,W,F,E
Little Wattlebird	*Anthochaera chrysoptera*		2		
Noisy Friarbird	*Philemon corniculatus*	1		3	P,F,W,E,N
Noisy Miner	*Manorina melanocephala*			3	F
Lewin's Honeyeater	*Meliphaga lewinii*	1	2	3	W,E
Yellow-faced Honeyeater	*Lichenostomus chrysops*	1	2	3	P,W,F,E,N
White-eared Honeyeater	*Lichenostomus leucotis*		2		
Fuscous Honeyeater	*Lichenostomus fuscus*		2		
Brown-headed Honeyeater	*Melithreptus brevirostris*		2		E
White-naped Honeyeater	*Melithreptus lunatus*		2	3	P,W
New Holland Honeyeater	*Phylidonyris novaehollandiae*		2	3	W,P,E
White-cheeked Honeyeater	*Phylidonyris niger*				F
Eastern Spinebill	*Acanthorhynchus tenuirostris*	1	2	3	W,F,P,E,N
PETROICIDAE					
Jacky Winter	*Microeca fascinans*		2		
Scarlet Robin	*Petroica boodang*		2		
Rose Robin	*Petroica rosea*		2		
Eastern Yellow Robin	*Eopsaltria australis*	1	2	3	P,W,E,N
CINCLOSOMATIDAE					
Eastern Whipbird	*Psophodes olivaceus*	1	2	3	P,W,E,N
Spotted Quail-thrush	*Cinclosoma punctatum*	1	2	3	
NEOSITTIDAE					
Varied Sittella	*Daphoenositta chrysoptera*		2		E
PACHYCEPHALIDAE					
Crested Shrike-tit	*Falcunculus frontatus*		2	3	E
Golden Whistler	*Pachycephala pectoralis*		2	3	P,W,E
Rufous Whistler	*Pachycephala rufiventris*		2	3	W,E,N,P
Grey Shrike-thrush	*Colluricincla harmonica*	1	2	3	F,P,W,E,N
DICRURIDAE					
Black-faced Monarch	*Monarcha melanopsis*		2	3	E
Leaden Flycatcher	*Myiagra rubecula*		2	3	W
Magpie-lark	*Grallina cyanoleuca*		2	3	F,L
Rufous Fantail	*Rhipidura rufifrons*		2	3	W
Grey Fantail	*Rhipidura albiscapa*	1	2	3	P,W,E
Willie Wagtail	*Rhipidura leucophrys*			3	F
CAMPEPHAGIDAE					
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*		2	3	P,W,E
Cicadabird	*Coracina tenuirostris*		2	3	W
ORIOLIDAE					
Olive-backed Oriole	*Oriolus sagittatus*		2	3	W,E
ARTAMIDAE					
Dusky Woodswallow	*Artamus cyanopterus*		2		
Grey Butcherbird	*Cracticus torquatus*	1	2	3	W,F,N,E
Australian Magpie	*Cracticus tibicen*	1	2	3	P,F,N
Pied Currawong	*Strepera graculina*	1	2	3	P,W,F,N,E

GROUP	Dames	Braithwaite	KMA [3]	KMA [4]

FAMILY Common Name	Taxonomic Name	& Moore [1] (1987)	et al. [2] (1988)	(2004)	(2009)
CORVIDAE					
Australian Raven	*Corvus coronoides*	1	2	3	F,W,E,N
CORCORACIDAE					
White-winged Chough	*Corcorax melanorhamphos*	1	2		P,N
PTILONORHYNCHIDAE					
Satin Bowerbird	*Ptilonorhynchus violaceus*		2	3	W,E,P
MOTACILLIDAE					
Australasian Pipit	*Anthus novaeseelandiae*			3	L,F
PASSERIDAE					
Red-browed Finch	*Neochmia temporalis*			3	F,P
Beautiful Firetail	*Stagonopleura bella*		2		
Red-browed Firetail	*Emblema temporalis*	1	2		
FRINGILLIDAE					
European Goldfinch*	*Carduelis carduelis*		2		
DICAEIDAE					
Mistletoebird	*Dicaeum hirundinaceum*		2	3	
HIRUNDINIDAE					
White-backed Swallow	*Cheramoeca leucosterna*				
Welcome Swallow	*Hirundo neoxena*		2	3	F,N
Tree Martin	*Petrochelidon nigricans*			3	F
Fairy Martin	*Petrochelidon ariel*				F
SYLVIIDAE					
Golden-headed Cisticola	*Cisticola exilis*			3	F
ZOSTEROPIDAE					
Silvereye	*Zosterops lateralis*	1	2	3	P,W,E
MUSCICAPIDAE					
Bassian Thrush	*Zoothera lunulata*		2	3	W
STURNIDAE					
Common Starling*	*Sturnus vulgaris*			3	F
Common Myna*	*Sturnus tristis*			3	F
FROGS					
MYOBATRACHIDAE					
Common Eastern Froglet	*Crinia signifera*		2	3	P,F,W,L,N,E
Brown-striped Frog	*Limnodynastes peronii*		2		W,F
Brown Toadlet	*Pseudophryne bibronii*		2		
Haswell's Frog	*Paracrinia haswelli*				W
Smooth Toadlet	*Uperoleia laevigata*			3	
HYLIDAE					
Green and Golden Bell Frog	*Litoria aurea*		2		
Bleating Tree Frog	*Litoria dentata*		2	3	W,E,N
Peron's Tree Frog	*Litoria peronii*			3	W,E
Verreaux's Tree Frog	*Litoria verreauxii*		2		W,P,N

GROUP FAMILY Common Name	Taxonomic Name	Dames & Moore [1] (1987)	Braithwaite et al. [2] (1988)	KMA [3] (2004)	KMA [4] (2009)
REPTILES					
CHELIDAE					
Long-necked Tortoise	*Chelodina longicollis*				W
AGAMIDAE					
Jacky Lizard	*Amphibolurus muricatus*		2	3	F,E
VARANIDAE					
Lace Monitor	*Varanus varius*		2		
SCINCIDAE					
Copper-tailed Skink	*Ctenotus taeniolatus*		2		
Eastern Water Skink	*Eulamprus quoyii*		2		W,E,P
Delicate Skink	*Lampropholis delicata*		2		E,F
Grass Skink	*Lampropholis guichenoti*			3	F
Weasel Skink	*Saproscincus mustelinus*			2	
Eastern Blue-tongued Lizard	*Tiliqua scincoides*				F
ELAPIDAE					
Red-bellied Black Snake	*Pseudechis porphyriacus*		2	3	W,F
Eastern Small-eyed Snake	*Rhinoplocephalus nigrescens*		2		F

1. Currambene State Forest (Dames & Moore 1987)
2. Currambene State Forest and nearby areas (Braithwaite et al. 1988)
3. Comberton Grange property (Kevin Mills & Associates 2004)
4. Comberton Grange property (Kevin Mills & Associates 2009)
   Precinct: Wetlands (L)
   Cleared Farmland (F)
   Western Forests (W)
   Eastern Forests (E)
   Pine Plantation (P)
   Nearby to study area (N)

Appendix 6
Fauna Survey Sheets

MAMMALS

Survey Sheet – Mammals/Trapping		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. 1**
Location:	**Observer:** D. Engel	
Land Tenure:	**Topography:**	
Date: 13/10/09	Traps opened 12/10/09 – closed 16/10/09	
GPS (WGS84): Start: 283041 6127064	Finish: 283365 6127142	
Time: Start: 09.35	Finish: 10.05	EDST

Species	**Tally/Notes** (micro-habitat, etc.)	**No.**
13.10.09		
Antechinus stuartii		
Antechinus stuartii		
Rattus fuscipes		
Antechinus stuartii		
Rattus fuscipes		
14.10.09		
Antechinus stuartii	Trap No. 4 (ground)	
Common Brushtail Possum	Cage No. 1	
15.10.09		
Antechinus stuartii	Tree Trap No. 2	
Antechinus stuartii	Ground Trap No. 8	
16.10.09 (Traps closed)		
Common Brushtail Possum		1
Antechinus stuartii		1
1 Grass skink observed		

Shrub cover:	Ground cover:
Rock outcrops:	Wetlands:
Ground debris:	Rocks turned:
Special features/notes:	

Survey Sheet – Mammals/Trapping		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. 2**
Location: Gully	**Observer:** D. Engel	
Land Tenure:	**Topography:**	
Date: 13/10/09	Traps opened 12/10/09 – closed 16/10/09	
GPS (WGS84): Start: 283049 6126628	Finish: 283339 6126826	
Time: Start: 08.50	Finish: 09.28	EDST

Species	**Tally/Notes** (micro-habitat, etc.)	**No.**
13.10.09		
Antechinus stuartii		
Rattus fuscipes	1 cage 1 Elliot swamp	2
Rattus fuscipes	Tree Elliot swamp	
Rattus fuscipes	Elliot swamp	
Rattus fuscipes	Elliot swamp	
Antechinus stuartii	Elliot LL/swamp	
Rattus fuscipes	Elliot fallen log	
Rattus fuscipes	Elliot LL/log	
Rattus fuscipes	LL	
Sugar Glider	On dead stag – end of transect.	
14.10.09		
Rattus fuscipes		5
Antechinus stuartii	Both females with pouch young	2
Sugar Glider	Last tree trap (No. 10) end transect	
15.10.09		

Antechinus stuartii		2
Rattus fuscipes		5
Sugar Glider		1
16.10.09		
Rattus fuscipes		4
Sugar Glider		1
Shrub cover:	Ground cover:	
Rock outcrops:	Wetlands:	
Ground debris:	Rocks turned:	
Special features/notes:		

Survey Sheet – Mammals/Trapping			**Kevin Mills & Associates**
Site Name: Comberton Grange			**Site No. 3**
Location:		**Observer:** D. Engel	
Land Tenure:		**Topography:**	
Date: 13/10/09	Traps opened 12/10/09 – closed 16/10/09		
GPS (WGS84): Start: 283369 6126374		Finish: 283691 6126493	
Time: Start: 08.35	Finish: 08.44	EDST	
Species	**Tally/Notes** (micro-habitat, etc.)		**No.**
13.10.09			
Antechinus stuartii			
14.10.09			
No captures.			
15.10.09			
Antechinus stuartii	Ground trap Elliot No. 12		
Antechinus stuartii	Ground trap Elliot No. 18		
16.10.09 (Trap closed)			
No captures.			
Common Bronzewing x 2 nesting.			
Shrub cover:	Ground cover:		
Rock outcrops:	Wetlands:		
Ground debris:	Rocks turned:		
Special features/notes:			

Survey Sheet – Mammals/Trapping			**Kevin Mills & Associates**
Site Name: Comberton Grange			**Site No. 4**
Location:		**Observer:** D. Engel	
Land Tenure:		**Topography:**	
Date: 13/10/09	Traps opened 12/10/09 – closed 16/10/09		
GPS (WGS84): Start: 283493 6126116		Finish: 283813 6126194	
Time: Start: 08.10	Finish: 08.28	EDST	
Species	**Tally/Notes** (micro-habitat, etc.)		**No.**
13.10.09			
Antechinus stuartii	Elliot – gully/woodland		1
Antechinus stuartii in babies	Elliot – gully/woodland		
14.10.09			
Antechinus stuartii	Pouch young		
Rufous Fantail	)283574 6126114		
Variegated Fairywren	)1/2 way along transect		
15.10.09			
Rattus fuscipes	Elliot trap No. 10		
Antechinus stuartii	Elliot trap No. 16		
16.10.09			
Rattus fuscipes			1
Antechinus stuartii	Females		2
Shrub cover:	Ground cover:		
Rock outcrops:	Wetlands:		
Ground debris:	Rocks turned:		
Special features/notes:			

Survey Sheet – Mammals/Trapping			**Kevin Mills & Associates**
Site Name: Comberton Grange			**Site No. 5**
Location: Dam		**Observer:** D. Engel	
Land Tenure:		**Topography:**	
Date: 13/10/09	Traps opened 12/10/09 – closed 16/10/09		
GPS (WGS84): Start: 284336 6126326		Finish: 284426 6126651	
Time: Start: 09.35	Finish: 10.05	EDST	

Species	**Tally/Notes** (micro-habitat, etc.)	**No.**
13.10.09		
Rattus fuscipes		3
Antechinus stuartii		1
Little Forest Bats	Harp trap located at start of transect	3
Vespadelus vulturnus	[284336 6126326]	
14.10.09		
Rattus fuscipes	All in Elliots on ground.	3
	Once checked – harp trap relocated to near	3
	Trapping Transect No. 3	
	Harp trap – no captures	
15.10.09		
Rattus fuscipes	3 in Elliot traps, 1 in cage trap.	4
Antechinus stuartii	Tree trap.	
16.10.09		
Rattus fuscipes		3
Antechinus stuartii		1
1 Grass skink observed		

Shrub cover:	Ground cover:
Rock outcrops:	Wetlands:
Ground debris:	Rocks turned:
Special features/notes:	

Survey Sheet – Spotlighting			**Kevin Mills & Associates**
Site Name: Comberton Grange			**Site No. 1**
Location:		**Observer:** D. Engel	
Land Tenure:		**Topography:**	
Date: 12/10/09	**Habitats:**		
GPS (WGS84): Start: 283041 6127064		Finish: 283365 6127142	
Time: Start: 09.35	Finish: 10.05	EDST	

Species	**Tally/Notes** (calls or observed, etc.)	**No.**
0.0 km		
0.7 km Powerful Owl	283 468 observed	
	6127136	
0.9 km *Crinia signifera*	Heard	
Owlet Nightjar	Heard	
Limnodynastes peronii	Heard	
Fox tracks	Seen	
	Commenced on track leading to transect 4,	
	headed north then took track south of	
	pine forest.	

Special features/notes: 20.1°C light breeze, clear skies, intermittent rain during day. Vehicle transect low 4@D = 5 km/hr.

Survey Sheet – Spotlighting			**Kevin Mills & Associates**
Site Name: Comberton Grange			**Site No. 2**
Location:		**Observer:** D. Engel	
Land Tenure:		**Topography:**	
Date: 12/10/09	**Habitats:**		
GPS (WGS84): Start: 282936 6126934		Finish: 283753 6125705	
Time: Start: 21.12	Finish: 22.07	EDST	

Species	**Tally/Notes** (calls or observed, etc.)	No.
0.0 km		
0.2 km *Litoria peronii*	Heard	Numerous
Crinia signifera	Heard	Numerous
Litoria fallax	Heard	Numerous
Tawny Frogmouth	Observed	1
	Started on east-west track south of Transect No and ended up to east of Transect No. 4.	
Special features/notes: 21.6°C N/W wind, clear skies. Vehicle transect low 4@D = 5 km/hr.		

Survey Sheet – Spotlighting		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. 3**
Location: East of Transect No. 3.	**Observer:** D. Engel	
Land Tenure:	**Topography:**	
Date: 13/10/09 **Habitats:**		
GPS (WGS84): Start: 283630 6126351	Finish: 252373 6127117	
Time: Start: 19.40 pm	Finish: 20.30 EDST	

Species	**Tally/Notes** (calls or observed, etc.)	No.
Eastern Grey Kangaroo	Observed	1
Sugar Glider	Observed	1
	Started in gully to east at Transect No. 3 and ended at entrance gate.	
Special features/notes: 21.0°C moderate to light – southerly winds, clear skies.		

Survey Sheet – Spotlighting		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. 4**
Location: Spotlight transect	**Observer:** D. Engel	
Land Tenure:	**Topography:**	
Date: 12/10/09 **Habitats:**		
GPS (WGS84): Start: 283251 6126433	Finish: 283387 6128247	
Time: Start: 18.03	Finish: 21.50 EDST	

Species	**Tally/Notes** (calls or observed, etc.)	No.
Common Brushtail Possum	Started south of Transect 1, did loop westward and ended up north of Transect No. 1.	

Survey Sheet – Spotlighting		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. 5**
Location:	**Observer:** D. Engel	
Land Tenure:	**Topography:**	
Date: 14/10/09 **Habitats:**		
GPS (WGS84): Start: 284442 6128519	Finish: 283337 6127152	
Time: Start: 20.27	Finish: 21.15 EDST	

Species	**Tally/Notes** (calls or observed, etc.)	No.
	Vehicle transect commencing in north east corner of pine forest and heading west then south ending near where Powerful Owl recorded.	
Common Ringtail Possum	Observed	2
Special features/notes: 16°C clear skies, wind from south.		

Survey Sheet – Spotlighting		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. 6**
Location: Spotlight transect	**Observer:** D. Engel	
Land Tenure:	**Topography:**	
Date: 15/10/09 **Habitats:**		
GPS (WGS84): Start: 284552 6127434	Finish: 284673 6126348	
Time: Start: 20.20	Finish: 21.19 EDST	

Species	**Tally/Notes** (calls or observed, etc.)	No.
Ringtail Possum	Spotlit	2

Survey Sheet - Spotlighting		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. SP1**
Location: N-S E-W tracks and return same way		**Observer: K. Mills**
Land Tenure: Freehold.	**Topography:**	
Date: 10.09.09	**Habitats:**	
GPS (WGS84): Start: 0283295 6126433	Finish: 0284417 6125931	
Time: Start: 6.30	Finish: 7.40	EST

Species	**Tally/Notes** (calls or observed, etc.)	**No.**
Crinia haswellii	calls	few
Crinia signifera	calls	few
Tawny Frogmouth		1
Powerful Owl call playback	0283780 6125651	nil
Grey Kangaroo		1

Survey Sheet - Spotlighting		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. SP2**
Location: N/S track and return same way		**Observer:** K. Mills
Land Tenure: Freehold.	**Topography:**	
Date: 10.09.09	**Habitats:**	
GPS (WGS84): Start: 0283295 6126433	Finish: 0282375 6127115	
Time: Start: 7.40	Finish: 8.44 – 9.00	EST

Species	**Tally/Notes** (calls or observed, etc.)	**No.**
Powerful Owl playback	0283137 6126532	Nil

Survey Sheet - Spotlighting		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. SP3**
Location: W of pine forest		**Observer:** K. Mills
Land Tenure: Freehold.	**Topography:**	
Date: 10.09.09	**Habitats:**	
GPS (WGS84): Start: 0282375 6127115	Finish: 0283372 6128125	
Time: Start: 8.10	Finish: 8.44	EST

Species	**Tally/Notes** (calls or observed, etc.)	**No.**
Boobook Owl	Calls, N end	1
Sugar Glider	Calls, N end	1
Common Ringtail Possum	Observed, N end	1

Survey Sheet - Spotlighting		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. SP4**
Location: Mainly across farmland.		**Observer:** K. Mills
Land Tenure: Freehold.	**Topography:**	
Date: 13.10.09	**Habitats:** Spotted Gum Forets, farmland (dams).	
GPS (WGS84): Start: 0283300 6126431	Finish: 0283746 6124955	
Time: Start: 20.15	Finish: 21.20	EDST

Species	**Tally/Notes** (calls or observed, etc.)	**No.**
Eastern Grey Kangaroo	4	4
Tawny Frogmouth	1	1
Litoria peronii	Calls – few.	
Crinia signifera	Calls – many.	
Limnodynastes peronii	Calls, few	
Litoria verreauxi	Calls, few.	
Litoiria dentata	Calls, few.	

Bat Results

KEY

- indicates species listed under the NSW *Threatened Species Conservation Act 1995.*

* - indicates species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*

Note:

In relation to the analysis of those microchiropteran calls obtained, it is noted that some insectivorous bat species have distinctive echolocation calls that are unlikely to be confused with those of other species. Other bat species overlap in both call frequency and structure making identification problematic in some cases. The degree of confidence attached to call identifications will depend on the quality of the recordings as well as the activity of the bat at the time of recording and its direction of flight. In some instances a particular species may be identified with confidence, while at other times its identification will be less certain. For this report, echolocation call identifications have been assigned to three categories with regard to certainty of identification. These are:

C - Confident Identification. Small possibility of confusion of calls with those of other bat species.
P - Probable Identification. Some possibility of confusion of calls with those of other bat species.
Po - Possible Identification. Likely to be confused with calls with those of other bat species.

Date Surveyed – 12/10/09
Location – Opposite camp, edge of woodland/farmland. Site - A
Easting – 283337 Northing – 6126270 Time – 1850 -0630

Survey Location	*Common Name*	*Scientific Name*	Call Confidence	No. of Passes
SD 1	Eastern Horseshoe Bat	*Rhinolophus megaphyllus*	C	2
	Gould's Wattled Bat	*Chalinolobus gouldii*	C	10
			Pr	12
			Po	10
	Chocolate Wattled Bat	*Chalinolobus morio*	C	71
			Pr	49
			Po	15
	# Eastern Falsistrelle	*Falsistrellus tasmaniensis*	C	1
			Pr	2
			Po	4
	# Large-footed Myotis	*Myotis adversus*	Po	4
	# Eastern Bentwing Bat	*Miniopterus (schreibersii) orianae oceansis*	Pr	1
			Po	2
	Longeared Bat	*Nyctophilus* sp.	C	4
			Pr	3
			Po	8
	Large Forest Bat	*Vespadelus darlingtoni*	C	13
			Pr	9
			Po	3
	Southern Forest Bat	*Vespadelus regulus*	Po	2
	Little Forest Bat	*Vespadelus vulturnus*	C	229
			Pr	85
			Po	21
	White-striped Freetail Bat	*Austronomus australis*	C	3
			Pr	2
			Po	1
	Eastern Freetail Bat	*Mormopterus ridei*	C	2
			Pr	8
			Po	9

Date Surveyed – 12/10/09
Location – Start of East-West track **Site B**
Easting – 282971 Northing – 6126956 **Time – 1901 - 0645**

Survey Location	*Common Name*	*Scientific Name*	Call Confidence	No. of Passes
ZCAIM 2				
	Gould's Wattled Bat	*Chalinolobus gouldii*	C	20
			Pr	11
			Po	18
	Chocolate Wattled Bat	*Chalinolobus morio*	C	48
			Pr	30
			Po	10
	# Eastern Falsistrelle	*Falsistrellus tasmaniensis*	C	19
			Pr	17
			Po	8
	# Eastern Bentwing Bat	*Miniopterus (schreibersii) orianae oceansis*	Pr	3
			Po	6
	Longeared Bat	*Nyctophilus* sp.	C	2
			Po	1
	# Greater Broadnosed Bat	*Scoteanax rueppellii*	Pr	2
			Po	3
	Large Forest Bat	*Vespadelus darlingtoni*	C	77
			Pr	17
			Po	7
	Little Forest Bat	*Vespadelus vulturnus*	C	117
			Pr	42
			Po	10
	White-striped Freetail Bat	*Austronomus australis*	C	2
	Eastern Freetail Bat	*Mormopterus ridei*	C	62
			Pr	31
			Po	11
	# East-coast Freetail Bat	*Micronomus norfolkensis*	Pr	2
			Po	4

Date Surveyed – 12/10/09
Location – Back of campsite, woodland. **Site - C**
Easting – 283328 Northing – 6126439 **Time – 1910 – 0650**

Survey Location	*Common Name*	*Scientific Name*	Call Confidence	No. of Passes
ZCAIM 1	Eastern Horseshoe Bat	*Rhinolophus megaphyllus*	Po	1
	Chocolate Wattled Bat	*Chalinolobus morio*	C	35
			Pr	30
			Po	11
	# Eastern Bentwing Bat	*Miniopterus (schreibersii) orianae oceansis*	C	9
			Pr	21
			Po	11
	Longeared Bat	*Nyctophilus* sp.	Pr	2
	Large Forest Bat	*Vespadelus darlingtoni*	C	18
			Pr	16
			Po	4
	Little Forest Bat	*Vespadelus vulturnus*	C	200
			Pr	53
			Po	14
	Southern Forest Bat	*Vespadelus regulus*	C	1
			Pr	6
			Po	6

Date Surveyed – 13/10/09
Location – To east of the entrance gate. **Site - D**
Easting – 282862 Northing – 6127006 **Time – 1930 - 0630**

Survey Location	*Common Name*	*Scientific Name*	Call Confidence	No. of Passes
SD 1	Eastern Horseshoe Bat	*Rhinolophus megaphyllus*	C	2
	Gould's Wattled Bat	*Chalinolobus gouldii*	C	2
			Pr	2
			Po	3
	Chocolate Wattled Bat	*Chalinolobus morio*	C	67
			Pr	23
			Po	4
	# Eastern Bentwing Bat	*Miniopterus (schreibersii) orianae oceansis*	C	2
			Pr	2
			Po	1
	Longeared Bat	*Nyctophilus* sp.	C	4
			Pr	10
			Po	1
	Large Forest Bat	*Vespadelus darlingtoni*	C	9
			Pr	7
			Po	2
	Little Forest Bat	*Vespadelus vulturnus*	C	126
			Pr	38
			Po	1
	Eastern Freetail Bat	*Mormopterus ridei*	Po	1

Date Surveyed – 14/10/09
Location – North-east corner of pine forest on Charcoal Road. Site - E
Easting – 284442 Northing – 6128519 Time – 1930 - 2030

Survey Location	*Common Name*	*Scientific Name*	Call Confidence	No. of Passes
ZCAIM 1				
	Gould's Wattled Bat	*Chalinolobus gouldii*	Po	1
	Chocolate Wattled Bat	*Chalinolobus morio*	Pr	2
			Po	2
	# Eastern Bentwing Bat	*Miniopterus (schreibersii) orianae oceansis*	Po	1
	Large Forest Bat	*Vespadelus darlingtoni*	Po	1
	Little Forest Bat	*Vespadelus vulturnus*	Pr	9
			Po	10
	White-striped Freetail Bat	*Austronomus australis*	Po	1

Date Surveyed – 14/10/09
Location – Track following north and western boundaries of Pine Forest. Site F
Easting - N/A Northing - N/A Time – 2030 - 2115

Survey Location	*Common Name*	*Scientific Name*	Call Confidence	No. of Passes
SD 1				
	Chocolate Wattled Bat	*Chalinolobus morio*	C	5
			Pr	6
			Po	3
	Little Forest Bat	*Vespadelus vulturnus*	C	26
			Pr	3

Date Surveyed – 14/10/09
Location – End of Transect 1. Site G
Easting - N/A Northing - N/A Time – 2115 - 0600

Survey Location	*Common Name*	*Scientific Name*	Call Confidence	No. of Passes
SD 1				
	Gould's Wattled Bat	*Chalinolobus gouldii*	C	24
			Pr	33
			Po	4
	# Eastern Falsistrelle	*Falsistrellus tasmaniensis*	C	1
	# Eastern Bentwing Bat	*Miniopterus (schreibersii) orianae oceansis*	C	6
			Pr	2
	Longeared Bat	*Nyctophilus* sp.	Po	1
	Large Forest Bat	*Vespadelus darlingtoni*	Pr	1
			Po	2
	White-striped Freetail Bat	*Austronomus australis*	C	1
	Eastern Freetail Bat	*Mormopterus ridei*	C	1
			Pr	1

Date Surveyed – 15/10/09
Location – Vehicle transect Charcoal Road to east side of Pine Forest. Site - H
Easting - 284552 Northing - 6127434 to Easting – 284673 Northing – 6126348
Time – 1956 - 2020

Survey Location	*Common Name*	*Scientific Name*	Call Confidence	No. of Passes
SD 1				
	Chocolate Wattled Bat	*Chalinolobus morio*	C	4
	# Eastern Bentwing Bat	*Miniopterus (schreibersii) orianae oceansis*	Pr	3
	Large Forest Bat	*Vespadelus darlingtoni*	C	4
	Little Forest Bat	*Vespadelus vulturnus*	C	14

Date Surveyed – 15/10/09
Location – Vehicle transect Charcoal Road to Quarry Dam. Site - I
Easting - 284552 Northing – 6127434 to Easting - 284673 Northing – 6126348
Time – 2020 - 2119

Survey Location	*Common Name*	*Scientific Name*	Call Confidence	No. of Passes
SD 1				
	Gould's Wattled Bat	*Chalinolobus gouldii*	C	3
	Chocolate Wattled Bat	*Chalinolobus morio*	C	2
			Pr	1
			Po	4
	# Eastern Bentwing Bat	*Miniopterus (schreibersii) orianae oceansis*	C	5
			Pr	4
	Longeared Bat	*Nyctophilus* sp.	Pr	1
			Po	1
	Large Forest Bat	*Vespadelus darlingtoni*	C	2
			Pr	2
	Little Forest Bat	*Vespadelus vulturnus*	C	8
			Pr	2
			Po	1
	White-striped Freetail Bat	*Austronomus australis*	Pr	2

Date Surveyed – 15/10/09
Location – Quarry Dam. Site - J
Easting – 284673 Northing – 6126348 Time – 2119 - 0630

Survey Location	*Common Name*	*Scientific Name*	Call Confidence	No. of Passes
SD 1				
	Gould's Wattled Bat	*Chalinolobus gouldii*	C	3
			Pr	4
			Po	1
	Longeared Bat	*Nyctophilus* sp.	Pr	1
	# Golden-tipped Bat	*Phoniscus papuensis*	Po	1
	Large Forest Bat	*Vespadelus darlingtoni*	C	2
	Little Forest Bat	*Vespadelus vulturnus*	C	5
	White-striped Freetail Bat	*Austronomus australis*	C	4
			Pr	1
	Eastern Freetail Bat	*Mormopterus ridei*	Pr	1

Date Surveyed – 15/10/09
Location – Currambene Creek, east of old homestead. **Site - K**
Easting – 283294 Northing – 6125357 **Time – 1645 - 0633**

Survey Location	*Common Name*	*Scientific Name*	Call Confidence	No. of Passes
ZCAIM 2				
	Eastern Horseshoe Bat	*Rhinolophus megaphyllus*	C	1
	Gould's Wattled Bat	*Chalinolobus gouldii*	C	20
			Pr	13
			Po	3
	Chocolate Wattled Bat	*Chalinolobus morio*	C	5
			Pr	4
			Po	6
	# Eastern Bentwing Bat	*Miniopterus (schreibersii) orianae oceansis*	C	17
			Pr	5
			Po	4
	Longeared Bat	*Nyctophilus* sp.	C	1
			Pr	5
			Po	10
	Large Forest Bat	*Vespadelus darlingtoni*	C	1
			Pr	1
	Little Forest Bat	*Vespadelus vulturnus*	C	11
			Pr	5
			Po	4
	Eastern Freetail Bat	*Mormopterus ridei*	Pr	1
			Po	1

Survey Sheet – Mammals/Trapping		**Kevin Mills & Associates**
Site Name: Comberton Grange		
Location: Near Transect No. 3	**Observer:** D. Engel	
Land Tenure:	**Topography:**	
Date: 15/10/09 Harp Traps opened 12/10/09 – closed 16/10/09		
GPS (WGS84): Start: 283570 6126427	Finish:	
Time: Start:	Finish:	EDST

Species	**Tally/Notes** (micro-habitat, etc.)	**No.**
15/10/09		
Vespadelus vulturnus		2
16/10/09		
Vespadelus vulturnus		2
Nyctophilus geoffroyi		

Shrub cover:	Ground cover:
Rock outcrops:	Wetlands:
Ground debris:	Rocks turned:
Special features/notes:	

BIRDS

Survey Sheet - Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B1**
Location: Farmland precinct.		**Observer:** K. Mills
Land Tenure: Freehold.	**Topography:** Broad valley side.	
Date: 10/09/09	**Habitats:** Exotic grassland, fresh wetlands, remnant trees and bushland, edge of forest, saline wetlands.	
GPS (WGS84): Start: 56 0282618 6127091	Finish: 56 0283541 6124528	
Time: Start: 12.00	Finish: 02.15	EST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Australasian Pipit		3
Australian Magpie		14
Australian White Ibis		1
Black-faced Cuckoo-Shrike		2
Brown Thornbill		2
Common Myna*		2
Crimson Rosella		6
Eastern Yellow Robin		1
Fan-tailed Cuckoo		2
Great Cormorant		1
Grey Butcherbird		2
Grey Fantail		3
Grey Shrike-thrush		2
Grey Teal		8
Laughing Kookaburra		1
Little Black Cormorant		14
Little Pied Cormorant		1
Magpie-lark		2
Musk Lorikeet		1
Nankeen Kestrel		1
Noisy Friarbird		1
Olive-backed Oriole		1
Painted Button Quail		1
Rainbow Lorikeet		1
Red Wattlebird		6
Rufous Whistler		1
Southern Emu-wren	Fresh wetland in paddock.	2
Spotted Pardalote		1
Striated Pardalote		1
Striated Thornbill		3
Superb Fairy-wren		6
Swamp Harrier	Over farmland.	1
Variegated Fairy-wren		2
Welcome Swallow		2
White-faced Heron		2
White-necked Heron	At fresh wetland in paddock.	1
Willie Wagtail		4
Yellow-faced Honeyeater		11
	38 species	116 birds

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B2**
Location: Western forest.		**Observer:** K. Mills
Land Tenure: Freehold.	**Topography:** Almost level land.	
Date: 10/09/09	**Habitats:** *Corymbia maculata* Tall Open Forest	
GPS (WGS84): Start: 56 0283310 5126439	Finish: 56 0283464 6126785	
Time: Start: 02.51	Finish: 03.31	EST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Australian Raven		1
Brown Thornbill		1
Crimson Rosella		2
Eastern Spinebill		1
Grey Fantail		2
Grey Shrike-thrush		1
Noisy Friarbird		1
Red Wattlebird		2
Rufous Whistler		2
Spotted Pardalote		1
Striated Thornbill		2
White-throated Treecreeper		1
Yellow-faced Honeyeater		4
	13 species	21 birds

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B3**
Location: Western forest.		**Observer:** K. Mills
Land Tenure: Freehold.	**Topography:** Broad ridge.	
Date: 10/9/09	**Habitats:** *Corymbia maculata – Syncarpia glomulifera* Tall Open Forest	
GPS (WGS84): Start: 56 0283635 6126265	Finish: 56 0283742 6126205	
Time: Start:03.40	Finish: 04.10	EST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Bassian Thrush		2
Brown Thornbill		1
Eastern Yellow Robin		1
Grey Fantail		1
Pied Currawong		1
Silvereye		3
Striated Thornbill		5
White-naped Honeyeater		2
White-throated Treecreeper		1
Yellow-faced Honeyeater		5
	10 species	22 birds

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B4**
Location: East-west track, western forest.		**Observer:** K. Mills
Land Tenure: Freehold.	**Topography:** Broad level ridge	
Date: 10/09/09	**Habitats:** *Eucalyptus pilularis* forest to *E. sclerophylla* woodland.	
GPS (WGS84): Start: 56 0283922 6125753	Finish: 56 0284403 6125937	
Time: Start: 04.20	Finish: 05.00	EST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Brown Thornbill		2
Crimson Rosella		1
Eastern Yellow Robin		1
Fan-tailed Cuckoo		1
Grey Fantail		1
Grey Shrike-thrush		1
Noisy Friarbird		3
Pied Currawong		1
Rainbow Lorikeet		2
Red Wattlebird		2
White-throated Treecreeper		1
Yellow-faced Honeyeater		2
	12 species	18 birds

Survey Sheet - Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B5**
Location: N-S track (S end)		**Observer:** K. Mills
Land Tenure: Freehold.	**Topography:** Broad ridge.	
Date: 10/09/09	**Habitats:** *Eucalyptus pilularis* Open Forest – farmland.	
GPS (WGS84): Start: 56 0283793 6125669	Finish: 56 0283517 6125527	
Time: Start: 12.00	Finish: 02.15	EST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Australian Raven		1
Brown Thornbill		2
Common Bronzewing		1
Eastern Yellow Robin		1
Grey Fantail		1
Grey Shrike-thrush		1
Laughing Kookaburra		3
Noisy Friarbird		3
Olive-backed Oriole		1
Rainbow Lorikeet		1
Red Wattlebird		2
Spotted Pardalote		1
Superb Fairy-wren		2
Yellow-faced Honeyeater		3
Yellow-tailed Black-Cockatoo		2
	15 species	25 birds

Survey Sheet - Birds			**Kevin Mills & Associates**
Site Name: Comberton Grange			**Site No. B6**
Location: Western edge of western forest			**Observer:** K. Mills
Land Tenure:		**Topography:**	
Date: 10/09/09	**Habitats:** Exotic grassland, fresh wetlands, remnant trees and bushland, edge of forest, saline wetlands.		
GPS (WGS84): Start: 56 0283295 6126433		Finish: 56 0283084 6126587	
Time: Start: 06.00	Finish: 07.00	EST	

Species	**Tally/Notes** (breeding, etc.)	**No.**
Australian Magpie		1
Australian Raven		1
Brown Thornbill		4
Common Bronzewing		1
Common Myna*		1
Crimson Rosella		2
Eastern Spinebill		1
Grey Butcherbird		2
Grey Fantail		2
Grey Shrike-thrush		1
Noisy Friarbird		3
Rainbow Lorikeet		1
Red Wattlebird		4
Rufous Whistler		1
Spotted Pardalote		1
Striated Thornbill		4
Superb Fairy-wren		2
White-browed Scrubwren		1
White-throated Treecreeper		1
Yellow-faced Honeyeater		9
	20 species	43 birds

Survey Sheet - Birds			**Kevin Mills & Associates**
Site Name: Comberton Grange			**Site No. B7**
Location: N-S track (N end) and cross track to pines.			**Observer:** K. Mills
Land Tenure: Freehold.		**Topography:** Broad ridge.	
Date: 10/09/09	**Habitats:** Forest – Woodland, edges of pines.		
GPS (WGS84): Start: 56 0282993 6126775		Finish: 56 0283305 6127147	
Time: Start: 07.15	Finish: 08.00	EST	

Species	**Tally/Notes** (breeding, etc.)	**No.**
Black-faced Cuckoo-Shrike		1
Brown Thornbill		4
Common Bronzewing		1
Crimson Rosella		5
Eastern Whipbird		1
Grey Butcherbird		1
Grey Fantail		3
Grey Shrike-thrush		2
Laughing Kookaburra		1
Noisy Friarbird		2
Rainbow Lorikeet		2
Rufous Whistler		1
Spotted Pardalote		2
White-throated Treecreeper		1
Yellow-faced Honeyeater		10
	15 species	37 birds

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B8**
Location:		**Observer:** K. Mills
Land Tenure: Freehold.	**Topography:** Very gentle slope.	
Date: 01/10/09	**Habitats:**	
GPS (WGS84): Start: 56 0282336 6127160	Finish: 56 0284059 6127043	
Time: Start: 07.00	Finish: 08.21	EST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Black-faced Cuckoo-shrike	2	2
Brown Thornbill	5	5
Common Bronzewing	1	1
Crimson Rosella	7	7
Eastern Whipbird	4	4
Fan-tailed Cuckoo	1	1
Grey Fantail	2	2
Grey Shrike-thrush	3	3
Musk Lorikeet	1	1
Olive-backed Oriole	1	1
Pied Currawong	1	1
Red Wattlebird	2	2
Rufous Whistler	8	8
Spotted Pardalote	1	1
Superb Fairy-wren	2	2
Variegated Fairy-wren	4	4
White-throated Treecreeper	1	1
Yellow-faced Honeyeater	1	1
	18 species	47 birds

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B9**
Location:		**Observer:** K. Mills
Land Tenure: Freehold.	**Topography:** Broad valley.	
Date: /10/09	**Habitats:** Spotted Gum forest, cleared land, creek.	
GPS (WGS84): Start: 56 0282490 6127115	Finish: 55 0283440 6125180	
Time: Start: 08.25	Finish: 09.45	EST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Australian Magpie	7 young birds	7
Australian Pipit	2 probably nesting	2
Black-shouldered Kite	1	1
Brown Thornbill	2	2
Chestnut Teal	2	2
Collared Sparrowhawk	1 young bird	1
Common Bronzewing	1	1
Common Myna*	4	4
Common Starling*	2	2
Crimson Rosella	6	6
Crimson Rosella	3	3
Eastern Rosella	1	1
Galah	7	7
Grey Butcherbird	1	1
Grey Fantail	1	1
Grey Shrike-thrush	2	2
Laughing Kookaburra	1	1
Little Pied Cormorant	1	1
Pallid Cuckoo	1	1
Red Wattlebird	4	4
Rufous Whistler	1	1
Southern Emu-wren	2	2
Striated Thornbill	2	2
Site Name: Comberton Grange		**Site No. B9 cont...**

Superb Fairy-wren	1	1
Welcome Swallow	9	9
Willie Wagtail	3	3
	26 species	67 birds

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B10**
Location: N/S and E/W tracks		**Observer:** K. Mills
Land Tenure: Freehold.	**Topography:** Broad ridges.	
Date: 12/10/09	**Habitats:** Forest, edge of farmland, woodland (gate to dam).	
GPS (WGS84): Start: 56 0282383 6127122	Finish: 56 0284649 6126353	
Time: Start: 08.30	Finish: 10.00	EDST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Australasian Grebe	2	2
Australian King-Parrot	1	1
Australian Magpie	2	2
Australian Raven	1	1
Black-faced Cuckoo-shrike	2	2
Brown Thornbill	3	3
Brush Cuckoo	1	1
Common Bronzewing	2	2
Common Myna *	2	2
Crimson Rosella	7	7
Eastern Spinebill	4	4
Eastern Whipbird	2	2
Eastern Yellow robin	2	2
Fan-tailed Cuckoo	1	1
Gang-gang Cockatoo	1 56 0282388 6127122	1
Grey Butcherbird	1	1
Grey Fantail	1	1
Grey Shrike-thrush	4	4
Laughing Kookaburra	1	1
Magpie-lark	1	1
Musk Lorikeet	6	6
New Holland Honeyeater	2	2
Noisy Friarbird	8	8
Olive-backed Oriole	2	2
Red Wattlebird	2	2
Rufous Whistler	6	6
Sacred Kingfisher	2	2
Satin Bowerbird	1	1
Shining Bronze-Cuckoo	1	1
Silvereye	4	4
Spotted Pardalote	2	2
Striated Thornbill	3	3
Superb Fairy-wren	2	2
Wedge-tailed Eagle	1	1
White-throated Treecreeper	2	2
Yellow-faced Honeyeater	6	6
Yellow-tailed Black-Cockatoo	3	3
	37 species	94 birds

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B11**
Location: Farmland above creek.		**Observer:** K. Mills
Land Tenure: Freehold.	**Topography:** Broad valley side.	
Date: 12/10/09	**Habitats:** Farmland.	
GPS (WGS84): Start: 56 0283413 6125090	Finish: 56 0283005 6126767	
Time: Start: 10.10	Finish: 10.30	EDST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Australian Magpie	1	1
Black-shouldered Kite	1	1
Chestnut Teal	2	2
Common Myna*	3	3
Common Starling*	2	2
Crimson Rosella	2	2
Eastern Rosella	4	4
Golden-headed Cisticola	1	1
Grey Shrike-thrush	1	1
Grey Teal	2	2
Nankeen Kestrel	1	1
Superb Fairy-wren	2	2
Swamp Harrier	1	1
Welcome Swallow	2	2
White-faced Heron	1	1
	15 species	26 birds

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B12**
Location: Central ridge.		**Observer:** K. Mills
Land Tenure: Freehold.	**Topography:** Ridge.	
Date: 13/10/09	**Habitats:** Forest – Spotted Gum.	
GPS (WGS84): Start: 56 0283308 6126424	Finish: 56 0283630 6126238	
Time: Start: 06.00	Finish: 07.15	EDST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Australian Magpie	1	1
Black-faced Cuckoo-shrike	1	1
Brown Thornbill	3	3
Brush Cuckoo	1	1
Cicadabird	1	1
Common Bronzewing	2	2
Crimson Rosella	3	3
Eastern Spinebill	1	1
Eastern Yellow Robin	2	2
Grey Butcherbird	2	2
Grey Shrike-thrush	1	1
Laughing Kookaburra	1	1
Musk Lorikeet	1	1
Noisy Friarbird	2 nests (2)	2
Olive-backed Oriole	2	2
Pied Currawong	1	1
Rufous Fantail	1	1
Rufous Whistler	4	4
Spotted Pardalote	1	1
Striated Thornbill	4	4
White-throated Treecreeper	2	2
Yellow-faced Honeyeater	4	4
	22 species	41 birds

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B13**
Location: Heading east from Transect No. 5 to dam.		**Observer:** D. Engel
Land Tenure: Freehold.	**Topography:**	
Date: 13/10/09	**Habitats:**	
GPS (WGS84): Start: 56 0284348 6126327	Finish: 56 0284637 6126339	
Time: Start: 7.08	Finish: 7.52	EDST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Australasian Grebe	Observed	1
Black-faced Cuckoo-shrike	Heard	1
Crimson Rosella	O	2
Eastern Spinebill	H	1
Eastern Whipbird	H	2
Eastern Yellow Robin	O	1
Fan-tailed Cuckoo	H	1
Grey Butcherbird	H	1
Grey Fantail	H	1
Grey Shrike-Thrush	O	1
King Parrot	O	1
Magpie	H	1
New Holland Honeyeater	O	5
Noisy Friarbird	H	1
Olive-backed Oriole	H	1
Pied Currawong	H	1
Rainbow Lorikeet	H	1
Red Wattlebird	H	1
Rufous Whistler	O	1
Sacred Kingfisher	H	1
Satin Bowerbird	H	1
Spotted Pardalote	H	1
Superb Fairywren	O	3
Tawny Frogmouth (? Calls)	H	1
White-browed Scrubwren	H	1
White-throated Treecreeper	H	1
Yellow-faced Honeyeater	O	2
Yellow-tailed Black-Cockatoo	H	1
	28 species	37 birds

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B14**
Location: Near north-south track.		**Observer:** K. Mills
Land Tenure: Freehold.	**Topography:** Valley, ridges.	
Date: 13/10/09	**Habitats:** Edge of farmland, forest.	
GPS (WGS84): Start: 56 0283233 6126408	Finish: 56 0282991 6126753	
Time: Start: 07.45	Finish: 08.45	EDST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Australian King-Parrot	1	1
Australian Magpie	2	2
Australian Raven	1	1
Black-faced Cuckoo-shrike	1	1
Black-shouldered Kite	1 (nest building)	1
Brown Thornbill	2	2
Brown Thornbill	3	3
Cicadabird	1	1
Common Bronzewing	2	2
Common Myna*	1	1
Crimson Rosella	4	4
Eastern Spinebill	5	5
Eastern Whipbird	1	1
Fan-tailed Cuckoo	1	1
Galah	1	1
Grey Butcherbird	1	1
Grey Fantail	2	2
Grey Shrike-thrush	2	2
Laughing Kookaburra	2	2
Long-billed Corella*	2 over farmland.	2
Magpie-lark	1	1
Musk Lorikeet	2	2
Noisy Friarbird	4	4
Olive-backed Oriole	1	1
Red Wattlebird	1	1
Rufous Whistler	3	3
Sacred Kingfisher	1	1
Shining Bronze-Cuckoo	1	1
Spotted Pardalote	1	1
Striated Thornbill	7	7
Superb Fairy-wren	2	2
White-faced Heron	1	1
White-throated Treecreeper	1	1
Willie Wagtail	1	1
Yellow-faced Honeyeater	10	10
	35 species	73 birds

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B15**
Location: Road track west Transect No. 4		**Observer:** D. Engel
Land Tenure: Freehold.	**Topography:**	
Date: 13/10/09	**Habitats:**	
GPS (WGS84): Start: 56 0283457 6126106	Finish: 56 0283421 6126186	
Time: Start: 08.03	Finish: 08.18	EDST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Black-faced Cuckoo-shrike	Observed	2
Crimson Rosella	O	2
Grey Butcherbird	Heard	1
Laughing Kookburra	H	1
Leaden Flycatcher	O	2
Masked Lapwing	H	1
Noisy Friarbird	O	2
Olive-backed Oriole	O	1
Red Wattlebird	O	3
Spotted Pardalote	H	1
Striated Thornbill	H	1
Tawny Frogmouth (? Calls)	H	1
Yellow-faced Honeyeater	H	1
	13	19

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B16**
Location: "Camp" heading west to Transect No. 3.		**Observer:** D. Engel
Land Tenure: Freehold.	**Topography:**	
Date: 13/10/09	**Habitats:**	
GPS (WGS84): Start: 56 0283312 6126436	Finish: 56 0282973 6126953	
Time: Start: 08.25	Finish: 09.10	EDST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Australian Magpie	H Generally clear skies – 50% cloud cover	1
Australian Raven	H Southerly breezes moderate 20.7°C	1
Black-faced Cuckoo-shrike	O	5
Brown Thornbill	O	5
Crimson Rosella	O	5
Eastern Spinebill	O	5
Eastern Whipbird	H	1
Grey Fantail	O	6
Musk Lorikeet	H	1
Noisy Friarbird	H	1
Olive-backed Oriole	O	3
Pallid Cuckoo	H	1
Pied Currawong	H	1
Red Wattlebird	O	1
Rufous Whistler	O	1
Sacred Kingfisher	H	1
Spotted Pardalote	H	1
Striated Thornbill	O	6
Superb Fairywren	H	1
White-browed Scrubwren	O	2
White-throated Treecreeper	O	1
Yellow-faced Honeyeater	H	1
Yellow-faced Honeyeater	O	2
	23 species	53 birds

Survey Sheet – Birds	**Kevin Mills & Associates**

Site Name: Comberton Grange		**Site No. B17**
Location: Farmland.		**Observer:** K. Mills
Land Tenure: Freehold.	**Topography:** Broad valley.	
Date: 13/10/09	**Habitats:** Farmland.	
GPS (WGS84): Start: 56 0283233 6126408	Finish: 56 0283784 6124393	
Time: Start: 08.55	Finish: 10.45	EDST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Australian Hobby	1	1
Australian Magpie	9	9
Australian Pipit	2	2
Australian Raven	2	2
Australian Wood Duck	6	6
Black Bittern	1 56 0283550 6124570	1
Black-faced Cuckoo-shrike	2	2
Black-shouldered Kite	1	1
Brown Thornbill	1	1
Chestnut Teal	9	9
Common Myna*	2	2
Common Starling*	1	1
Crimson Rosella	4	4
Darter	1 near creek	1
Great Cormorant	1	1
Grey Fantail	1	1
Grey Teal	10	10
Little Black Cormorant	1	1
Little Pied Cormorant	2	2
Magpie-lark	1	1
Masked Lapwing	1	1
Noisy Friarbird	5	5
Noisy Miner	2	2
Pacific Black Duck	2	2
Rufous Whistler	1	1
Sacred Kingfisher	2	2
Superb Fairy-wren	6	6
Tree Martin	4	4
Welcome Swallow	4	4
White-faced Heron	3	3
Willie Wagtail	3	3
Yellow Thornbill	2	2
Yellow-faced Honeyeater	3	3
	33 species	96 birds

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B18**
Location: Transect No. 1 North		**Observer:** D. Engel
Land Tenure: Freehold.	**Topography:**	
Date: 13/10/09	**Habitats:**	
GPS (WGS84): Start: 56 0283040 6127063	Finish: 56 0283339 6127143	
Time: Start: 09.35	Finish: 09.58	EDST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Australian Raven	1 Moderate westerly breezes.	1
Black-faced Cuckoo-shrike	1	1
Brown Thornbill	1	1
Crimson Rosella	1	1
Eastern Spinebill	1	1
Eastern Spinebill	1	1
Eastern Whipbird	2	2
Grey Shrike-thrush	1	1
Musk Lorikeet	1	1
Olive-backed Oriole	1	1
Rufous Whistler	1	1
Spotted Pardalote	1	1
Striated Thornbill	1	1
White-browed Scrubwren	1	1
White-throated Treecreeper	2	2
Yellow-tailed Black-Cockatoo	1	1
	16 species	18 birds

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B19**
Location: East Transect No. 3		**Observer:** D. Engel
Land Tenure: Freehold.	**Topography:**	
Date: 13/10/09	**Habitats:**	
GPS (WGS84): Start: 56 0283632 6126367	Finish: 56 02	
Time: Start: 19.03	Finish: 19.16	EDST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Common Bronzewing	H Lots of birds heard whilst there was a lull	1
Crimson Rosella	H in the winds.	1
Eastern Spinebill	H 18.4°C moderate light southerly winds.	1
Eastern Yellow Robin	H Clear skies.	1
Grey Butcherbird	H	1
Grey Fantail	H	1
Laughing Kookaburra	H	1
Leaden Flycatcher	H	1
Noisy Friarbird	H	1
Olive-backed Oriole	H	1
Red Wattlebird	H	1
Sulphur-crested Cockatoo	H	1
Tawny Frogmouth (? Calls)	H	1
White-throated Treecreeper	H	1
Yellow-faced Honeyeater	H	1
	15 species	15

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B20**
Location: Trapping Transect No. 1		**Observer:** D. Engel
Land Tenure: Freehold.	**Topography:**	
Date: 14/10/09	**Habitats:**	
GPS (WGS84): Start: 56 0283044 6127067	Finish: 56 0283365 6127142	
Time: Start: 06.31	Finish: 07.14	EDST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Australian Magpie	H	1
Black-faced Cuckoo-shrike	H	1
Crimson Rosella	O	6
Eastern Spinebill	O	3
Eastern Whipbird	H	1
Eastern Yellow Robin	H	1
Grey Fantail	O	3
Olive-backed Oriole	H	1
Rainbow Lorikeet	H	1
Red Wattlebird	H	1
Rufous Whistler	O	2
Silvereye	H	1
Striated Thornbill	O	6
White-browed Scrubwren	O	5
White-throated Treecreeper	O	3
	15 species	36 birds

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B21**
Location: Around quarry.		**Observer:** K. Mills
Land Tenure: Freehold.	**Topography:** Plateau to small gully.	
Date: /10/09	**Habitats:** Woodland.	
GPS (WGS84): Start: 56 0285865 6126753	Finish: 56 0284186 6126166	
Time: Start: 07.15	Finish: 08.35	EDST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Australasian Grebe	2	2
Broad-headed Honeyeater	2	2
Brown Thornbill	5	5
Chestnut Teal	2	2
Common Bronzewing	2	2
Crimson Rosella	5	5
Eastern Spinebill	6	6
Eastern Whipbird	2	2
Eastern Yellow Robin	1	1
Fan-tailed Cuckoo	2	2
Galah	1	1
Golden Whistler	1	1
Grey Fantail	1	1
Grey Shrike-thrush	3	3
Lewin's Honeyeater	1	1
Olive-backed Oriole	2	2
Pacific Black Duck	2	2
Rainbow Lorikeet	2	2
Rufous Whistler	4	4
Sacred Kingfisher	1	1
Satin Bowerbird	1	1
Spotted Pardalote	4	4
Sulphur-crested Cockatoo	2	2
Superb Fairy-wren	2	2
Varied Sitella	6	6
White-browed Scrubwren	2	2

White-throated Treecreeper	3	3
Yellow-faced Honeyeater	12	12
	28 species	79 birds

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B22**
Location: On E/W track east of Transect No. 3.		**Observer:** D. Engel
Land Tenure: Freehold.	**Topography:**	
Date: 14/10/09	**Habitats:**	
GPS (WGS84): Start: 56 0283758 6125695	Finish: 56 0283703 6125683	
Time: Start: 07.21	Finish: 07.54	EDST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Australian Magpie		1
Crimson Rosella	Light southerly breezes. 16.2°C – 50% cloud cover.	1
Eastern Spinebill		1
Eastern Yellow Robin		1
Grey Butcherbird		1
Grey Fantail		1
Grey Shrike-thrush		1
Musk Lorikeet		1
Noisy Friarbird		3
Olive-backed Oriole		1
Pied Currawong		2
Rainbow Lorikeet		1
Red Wattlebird		1
Sacred Kingfisher		1
Satin Bowerbird		1
Spotted Pardalote		1
Striated Thornbill		9
White-browed Scrubwren		1
White-throated Treecreeper		1
	19 species	30 birds

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B23**
Location: Trapping Transect No. 5		**Observer:** D. Engel
Land Tenure: Freehold.	**Topography:**	
Date: 14/10/09	**Habitats:**	
GPS (WGS84): Start: 56 02	Finish: 56 02	
Time: Start: 08.08	Finish: 08.38 am	EDST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Crimson Rosella	O	7
Eastern Spinebill	H	1
Eastern Whipbird	H	1
Grey Fantail	H	1
Musk Lorikeet	H	1
Pied Currawong	H	1
Rainbow Lorikeet	H	1
Spotted Pardalote	H	1
White-browed Scrubwren	H	1
White-throated Treecreeper	H	1
	10 species	16 birds

Survey Sheet – Birds		Kevin Mills & Associates
Site Name: Comberton Grange		**Site No. B24**
Location: South of quarry dam.		**Observer:** K. Mills
Land Tenure: Freehold.	**Topography:** Valley.	
Date: 14/10/09	**Habitats:** Tall forest.	
GPS (WGS84): Start: 56 0284847 6126268	Finish: 56 0284918 6125731	
Time: Start: 08.40	Finish: 09.35	EDST

Species	Tally/Notes (breeding, etc.)	No.
Brown Goshawk	1	1
Brown Thornbill	5	5
Cicadabird	1	1
Common Bronzewing	1	1
Crimson Rosella	3	3
Eastenr Whipbird	1	1
Eastern Spinebill	1	1
Eastern Yellow Robin	2	2
Golden Whistler	2	2
Grey Fantail	2	2
Grey Shrike-thrush	2	2
Lewin's Honeyeater	2	2
Rainbow Lorikeeet	2	2
Satin Bowerbird	1 (active Bower)	1
Silvereye	1	1
Spotted Pardalote	1	1
Striated Thornbill	2	2
Superb Lyrebird	1	1
Wedge-tailed Eagle	1	1
White-browed Scrubwren	1	1
White-throated Treecreeper	2	2
Yellow-faced Honeyeater	2	2
	22 species	37 birds

Survey Sheet – Birds		Kevin Mills & Associates
Site Name: Comberton Grange		**Site No. B25**
Location: Transect No. 3		**Observer:** D. Engel
Land Tenure: Freehold.	**Topography:**	
Date: 14/10/09	**Habitats:**	
GPS (WGS84): Start: 56 0283378 6126373	Finish: 56 0283691 6136493	
Time: Start: 08.53	Finish: 09.37	EDST

Species	Tally/Notes (breeding, etc.)	No.
Australian Magpie	H Overcast – 80% cloud cover	1
Black-faced Cuckoo-shrike	O southerly breezes – 18.4°C	3
Eastern Spinebill	O	1
Grey Butcherbird	H	1
Grey Fantail	H	1
Grey Shrike-thrush	H	1
Olive-backed Oriole	H	1
Rainbow Lorikeet	O	3
Red Wattlebird	O	2
Rufous Whistler	H	1
Spotted Pardalote	H	1
Striated Thornbill	H	1
Sulphur-crested Cockatoo	H	1
Tawny Frogmouth (? Calls)	H	1
Wedge-tailed Eagle	O	1
White-browed Scrubwren	H	1
Willie Wagtail	H	1
Yellow-faced Honeyeater	O	2
	18 species	24 birds

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B26**
Location:		**Observer:** D. Engel & J. Edwards
Land Tenure: Freehold.		**Topography:**
Date: /10/09	**Habitats:**	
GPS (WGS84): Start: 56 0282878 6125726		Finish: 56 0282620 6125907
Time: Start: 11.19	Finish: 11.51	EDST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Australasian Darter	O	1
Australian Magpie	O	3
Australian Wood Duck	O	6
Brush Wattlebird	O	1
Common Myna*	O	4
Crimson Rosella	O	2
Fairy Martin	O	10
Galah	H	1
Great Cormorant	O	1
Grey Butcherbird	H	1
Grey Fantail	O	3
Laughing Kookaburra	O	2
Little Corella	O	2
Magpie-lark	O	1
Masked Lapwing	O	2
Pacific Black Duck	O	2
Pied Cormorant	O	1
Purple Swamphen	O	2
Rainbow Lorikeet	H	1
Red Wattlebird	O	2
Richard's Pipit	H	1
Sacred Kingfisher	O	1
Striated Thornbill	O	3
Sulphur-crested Cockatoo	H	1
Superb Fairywren	H	1
Welcome Swallow	O	6
Willie Wagtail	O Westerly winds – 22.1°C –	2
Yellow-faced Honeyeater	O 70% cloud cover	2
	28 species	65 birds

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B27**
Location: West of pines and pines		**Observer:** K. Mills
Land Tenure: Freehold.		**Topography:** Very broad slope.
Date: 14/10/09	**Habitats:** Forest, woodland, old pine plantation.	
GPS (WGS84): Start: 56 0282358 6127126		Finish: 56 0283362 6128076
Time: Start: 11.20	Finish: 12.30	EDST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Crimson Rosella	2 Weather – light intermittent drizzle/sunny,	2
Eastern Spinebill	2 cloudy, gusty breezes.	2
Grey Fantail	2	2
Grey Shrike-thrush	1	1
Noisy Friarbird	1	1
Olive-backed Oriole	1	1
Rufous Whistler	6	6
Striated Thornbill	3	3
White-browed Scrubwren	2	2
White-throated Treecreeper	2	2
Yellow-faced Honeyeater	2	2
	11 species	24 birds

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B28**
Location: North-south track.	**Observer:** D. Engel & J. Edwards	
Land Tenure: Freehold.	**Topography:**	
Date: 14/10/09	**Habitats:** Low Scribbly Gum Woodland.	
GPS (WGS84): Start: 56 02841081 6125742	Finish: 56 0284220 6125816	
Time: Start: 16.58	Finish: 17.09	EDST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Noisy Friarbird	19.4°C moderate to strong southerly winds.	1
Red Wattlebird	Relatively clear skies – 40% cloud cover.	1
Rufous Whistler	Poor results. Strong winds made detection	1
White-throated Treecreeper	Difficult	1
4 species		4 birds

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B29**
Location: SE corner pine plantation.	**Observer:** D. Engel & J. Edwards	
Land Tenure: Freehold.	**Topography:**	
Date: 14/10/09	**Habitats:** Woodland.	
GPS (WGS84): Start: 56 02753832 6279556	Finish: 56 0284550 6127309	
Time: Start: 17.30	Finish: 18.00	EDST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Brown Thornbill		17
Crimson Rosella		1
Eastern Spinebill		2
Eastern Yellow Robin		2
Fan-tailed Cuckoo		2
Grey Fantail		3
Musk Lorikeet		2
Rainbow Lorikeet		10
Red Wattlebird		1
Rufous Whistler		2
Spotted Pardalote		4
White-browed Scrub-wren		1
White-throated Treecreeper		5
Yellow-faced Honeyeater		1
	14 species	53 birds

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B30**
Location: Charcoal Road NE corner pine forest.	**Observer:** D. Engel & J. Edwars	
Land Tenure: Freehold.	**Topography:**	
Date: /10/09	**Habitats:** Point Location – dusk survey.	
GPS (WGS84): Start: 56 0284442 6128519	Finish: 56 02	
Time: Start: 19.00	Finish: 19.30	EDST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Brown Thornbill		1
Crimson Rosella		4
Eastern Spinebill		2
Eastern Whipbird	16.0°C Clear skies and southerly winds	3
Grey Fantail	moderate to strong gusty.	5
Lewin's Honeyeater		1
New Holland Honeyeater		3
Noisy Friarbird		1
Red Wattlebird		1
Spotted Pardalote		1
Striated Thornbill		4
Superb Fairywren		1
White-browed Scrubwren		1

White-throted Treecreeper		3
Yellow-faced Honeyeater		1
Yellow-tailed Black-Cockatoo		24
	16 species	56 birds

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B31**
Location: Track NW of Transect 1	**Observer:** D. Engel & J. Edwards	
Land Tenure: Freehold.	**Topography:**	
Date: 15/10/09 **Habitats:**		
GPS (WGS84): Start: 56 0282414 6124290	Finish: 56 0283038 6127059	
Time: Start: 06.30	Finish: 07.07	EDST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Australian Magpie		4
Eastern Whipbirrd		3
Grey Fantail		7
Grey Shrike-thrush		1
Laughing Kookaburra		1
Leaden Flycatcher		1
Musk Lorikeet		3
Noisy Friarbird		1
Olive-backed Oriole		3
Rainbow Lorikeet		2
Rufous Fantail		1
Rufous Whistler		2
Spotted Pardalote		4
Striated Pardalote		3
Striated Thornbill		8
White-browed Scrubwren		1
White-throated Treecreeper		4
Yellow-tailed Black-Cockatoo		2
	18 species	51 birds

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B32**
Location: Start Transect No. 2 – heading east.		**Observer:** D. Engel
Land Tenure: Freehold.	**Topography:**	
Date: 15/10/09 **Habitats:**		
GPS (WGS84): Start: 56 0283054 6126630	Finish: 56 0283312 6126431	
Time: Start: 07.05	Finish: 07.43	EDST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Australian Magpie	O	3
Brown Thornbill	O	4
Common Bronzewing	O	2
Common Myna*	H	1
Crimson Rosella	O	6
Eastern Spinebill	O	1
Grey Butcherbird	O	1
Grey Fantail	O	2
Grey Shrike-thrush	H	1
Laughing Kookaburra	H	1
Magpie-lark	H	1
Musk Lorikeet	O	2
Noisy Friarbird	H	1
Pallid Cuckoo	H	1
Rainbow Lorikeet	O	3
Red Wattlebird	O	4
Spotted Pardalote	H	1
Striated Thornbill	O	10
Sulphur-crested Cockatoo	O	20

Superb Fairywren	O	4
Tawny Frogmouth (? Calls)	H	1
White-browed Scrubwren	O	2
White-throated Treecreeper	O	3
Willie Wagtail	H	1
Yellow-faced Honeyeater	O	2
	25 species	78 birds
	20.5° C Light south-easterly breezes overcast 80% cloud cover.	

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B33**
Location: Transect No. 4 & track heading east.	**Observer:** D. Engel & J. Edwards	
Land Tenure: Freehold.	**Topography:**	
Date: 15/10/09 **Habitats:**		
GPS (WGS84): Start: 56 0283813 6126194	Finish: 56 0283694 6125783	
Time: Start: 08.32	Finish: 09.05	EDST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Black-faced Cuckoo-shrike		1
Brown Thornbill		20
Common Bronzewing		3
Crimson Rosella		9
Eastern Spinebill		3
Eastern Yellow Robin		1
Grey Fantail		7
Grey Shrike-thrush		3
Leaden Flycatcher		1
Lewin's Honeyeater		1
Noisy Friarbird		4
Olive-backed Oriole		4
Rainbow Lorikeet		3
Red Wattlebird		2
Rufous Whistler		1
Sacred Kingfisher		1
Spotted Pardalote		3
Striated Thornbill		1
Tawny Frogmouth (? Calls)		1
Variegated Fairywren		3
White-browed Scrubwren		5
White-throated Treecreeper		6
Yellow Thornbill		10
Yellow-faced Honeyeater		1
	24 species	94 birds

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B34**
Location: Track near quarry.		**Observer:** D. Engel
Land Tenure: Freehold.	**Topography:**	
Date: 15/10/09 **Habitats:**		
GPS (WGS84): Start: 56 0285114 6126442	Finish: 56 0285377 6126426	
Time: Start: 09.11	Finish: 09.34	EDST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Black-faced Monarch	O	1
Brown Thornbill	O	6
Crimson Rosella	O	3
Eastern Spinebill	O	2
Grey Fantail	O	4
Grey Shrike-thrush	H	1
New Holland Honeyeater	H	1
Pallid Cuckoo	H	1

Red Wattlebird	H Difficult to hear calls due to wind.	1
Rufous Whistler	O 17.4°C – Cloudy – 50% cloud cover.	2
Superb Fairywren	O Moderate to strong winds.	3
Wedge-tailed Eagle	O	1
Yellow-faced Honeyeater	O	2
	13 species	28 birds

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B35**
Location: Track along northern boundary of pine forest.	**Observer:** D. Engel & J. Edwards	
Land Tenure: Freehold.	**Topography:**	
Date: 15/10/09 **Habitats:**		
GPS (WGS84): Start: 56 0283840 6128667	Finish: 56 0284394 6128578	
Time: Start: 17.30	Finish: 18.10	EDST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Black-faced Monarch	0 284394 6128578	2
Brown Thornbill	O	6
Brush Wattlebird	O	1
Crimson Rosella	H	1
Eastern Spinebill	O	4
Eastern Whipbird	H	2
Eastern Yellow Robin	H	1
Fan-tailed Cuckoo	H	1
Glossy Black-Cockatoo Feed Trees	284076 6128636 (several chewed cones found, not	
Glossy Black-Cockatoo Feed Trees	284175 6128634 many but a few under each tree)	
Grey Fantail	O	1
Grey Shrike-thrush	H	1
New Holland Honeyeater	O	4
Rainbow Lorikeet	O	6
Rufous Whistler	O	3
Sacred Kingfisher	O	1
Silvereye	O	6
Spotted Pardalote	H	1
Square-tailed Kite (? possible)		
Striated Thornbill	H	4
Superb Fairy-wren	O	3
White-browed Scrubwren	O	3
White-throated Treecreeper	O	2
Yellow-faced Honeyeater	O	2
	21 species	55 birds

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B36**
Location: Charcoal Rd/eastern boundary of pine forest	**Observer:** D. Engel & J. Edwards	
Land Tenure: Freehold.	**Topography:**	
Date: 15/10/09 **Habitats:**		
GPS (WGS84): Start: 56 0284537 6128129	Finish: 56 0284316 6128146	
Time: Start: 18.20	Finish: 18.37	EDST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Eastern Spinebill	O	5
Grey Fantail	O	3
Grey Shrike-thrush	O	2
New Holland Honeyeater	O	3
Rainbow Lorikeet	O	3
Silvereye	H	1
Spotted Pardalote	H	1
Superb Fairywren	O	3
White-browed Scrubwren	H	1
White-throated Treecreeper	O	3
Yellow-tailed Black-Cockatoo	O	3
	11 species	28 birds

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B37**
Location: Site 5 – Trapping transect 5.	**Observer:** D. Engel & J. Edwards	
Land Tenure: Freehold.	**Topography:**	
Date: 16/10/09 **Habitats:**		
GPS (WGS84): Start: 56 02	Finish: 56 02	
Time: Start: 06.40	Finish: 07.10	EDST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Australian Magpie		1
Crimson Rosella		2
Eastern Spinebill		2
Eastern Whipbird		1
Fan-tailed Cuckoo		2
Grey Fantail		1
Olive-backed Oriole		1
Rainbow Lorikeet		3
Rufous Whistler		1
Spotted Pardalote		1
White-throated Treecreeper		2
	11 species	17 birds

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B38**
Location: Site 4 Trapping Transect No. 4	**Observer:** D. Engel & J. Edwards	
Land Tenure: Freehold.	**Topography:**	
Date: 16/10/09 **Habitats:**		
GPS (WGS84): Start: 56 02	Finish: 56 02	
Time: Start: 07.30	Finish: 07.55	EDST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Black-faced Cuckoo-shrike		1
Grey Fantail		2
Leaden Flycatcher		2
Noisy Friarbird		2
Olive-backed Oriole		1
Sacred Kingfisher		1
Spotted Pardalote		2
Striated Thornbill		5
White-browed Scrubwren		1
White-throated Treecreeper		1

	10 species	18 birds

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B39**
Location: Entry gate to old house site.	**Observer:** K. Mills	
Land Tenure: Freehold.	**Topography:**	
Date: 29/10/09	**Habitats:** Forest, Farmland.	
GPS (WGS84): Start: 56 0282386 6127117	Finish: same place	
Time: Start: 09.15	Finish: 10.35	EDST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Australian Kestrel	1	1
Australian Magpie	4	4
Australian Pipit	2	2
Australian Raven	1	1
Black-faced Cuckoo-shrike	1	1
Black-shouldered Kite	1	1
Brown Thornbill	2	2
Channel-billed Cuckoo	1	1
Chestnut Teal	1	1
Common Koel	1	1
Common Myna*	5	5
Common Starling	4	4
Crimson Rosella	6	6
Dollarbird	1	1
Eastern Rosella	5	5
Eastern Spinebill	1	1
Galah	4	4
Grey Butcherbird	1	1
Grey Fantail	1	1
Grey Shrike-thrush	1	1
Laughing Kookaburra	2	2
Lewin's Honeyeater	1	1
Little Black Cormorant	1	1
Masked Lapwing	1	1
Mistletoe Bird	2	2
Noisy Friarbird	2	2
Olive-backed Oriole	1	1
Red Wattlebird	1	1
Rufous Whistler	2	2
Sacred Kingfisher	1	1
Sulphur-crested Cockatoo	1	1
Superb Fairy-wren	5	5
Swamp Harrier	1	1
Tree Martin	3	3
Welcome Swallow	2	2
White-faced Heron	3	3
White-necked Heron	1	1
White-throated Treecreeper	1	1
Willie Wagtail	4	4
Yellow Thornbill	1	1
Yellow-faced Honeyeater	3	3
	41 species	83 birds
Bleating Tree Frog	Calls	

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B40**
Location: Gate to quarry.	**Observer:** K. Mills	
Land Tenure: Freehold.	**Topography:**	
Date: 29/10/09 | **Habitats:** Forest, Farmland.		
GPS (WGS84): Start: 56 0282380 6127111	Finish: 56 0285741 6126624	
Time: Start: 09.00	Finish: 11.30	EDST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Australasian Grebe	2 dam	2
Australian Kestrel	1	1
Australian King-Parrot	1	1
Australian Magpie	1	1
Australian Raven	1	1
Black-faced Cuckoo Shrike	2	2
Brown Thornbill	9	9
Common Bronzewing	1	1
Common Koel	1	1
Crimson Rosella	8	8
Eastern Spinebill	4	4
Fan-tailed Cuckoo	4	4
Golden Whistler	1	1
Grey Butcherbird	1	1
Grey Fantail	3	3
Grey Shrike-thrush	3	3
Laughing Kookaburra	1	1
Leaden Flycatcher	1	1
Magpie-lark	2	2
New Holland Honeyeater	4	4
Noisy Friarbird	8	8
Olive-backed Oriole	3	3
Pacific Black Duck	1 dam	1
Pied Currawong	1	1
Rainbow Lorikeet	1	1
Rufous Whistler	9	9
Sacred Kingfisher	3	3
Satin Bowerbird	4	4
Spotted Pardalote	2	2
Superb Fairywren	2	2
White-throated Treecreeper	1	1
Yellow-faced Honeyeater	6	6
	32 species	92 birds

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B41**
Location: Gate to house site and return..	**Observer:** K. Mills	
Land Tenure: Freehold.	**Topography:** Undulating, creekside.	
Date: 24/11/09	**Habitats:** Forest, Farmland, Wetlands.	
GPS (WGS84): Start: 56 0282394 6127108	Finish: 56	
Time: Start: 08.30	Finish: 09.45	EDST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Australasian Pipit	1	1
Australian Magpie	5	5
Australian Raven	2	2
Black-faced Cuckoo-Shrike	2	2
Brown Thornbill	3	3
Chestnut Teal	2	2
Common Bronzewing	3	3
Common Koel	1	1
Common Myna*	8	8
Common Starling	1	1
Crimson Rosella	16	16
Eastern Rosella	2	2
Eastern Spinebill	2	2
Eastern Yellow robin	1	1
Galah	9	9
Grey Butcherbird	1	1
Grey Fantail	2	2
Grey Shrike-thrush	2	2
Laughing Kookaburra	2	2
Magpie-lark	2	2
Nankeen Kestrel	1	1
Noisy Friarbird	1	1
Olive-backed Oriole	1	1
Pallid Cuckoo	1	1
Rainbow Lorikeet	2	2
Red Wattlebird	1	1
Rufous Whistler	1	1
Striated Thornbill	2	2
Sulphur-crested Cockatoo	3	3
Superb Fairy-wren	8	8
Tree Martin	17	17
Wedge-tailed Eagle	1	1
Welcome Swallow	4	4
White-faced Heron	1	1
White-necked Heron	2	2
White-throated Treecreeper	1	1
Willie Wagtail	2	2
Yellow-faced Honeyeater	7	7
	38 species	123

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B42**
Location: Eastern forests..	**Observer:** K. Mills	
Land Tenure: Freehold.	**Topography:** Gentle.	
Date: 24/11/09	**Habitats:** Forest, Woodland, Dam.	
GPS (WGS84): Start: 56 0285860 6127165	Finish: 56 0284449 6126333	
Time: Start: 08.30	Finish: 09.45	EDST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Australasian Grebe	2	2
Black-faced Cuckoo-shrike	1	1
Brown Thornbill	3	3
Common Bronzewing	2	2
Crimson Rosella	3	3
Eastern Spinebill	3	3
Eastern Yellow Robin	2	2
Fan-tailed Cuckoo	1	1
Grey Fantail	2	2
Grey Shrike-thrush	2	2
Laughing Kookaburra	1	1
Musk Lorikeet	2	2
New Holland Honeyeater	1	1
Noisy Friarbird	4	4
Olive-backed Oriole	1	1
Red Wattlebird	1	1
Rufous Whistler	8	8
Sacred Kingfisher	2	2
Satin Bowerbird	1	1
White-throated Treecreeper	1	1
Yellow-faced Honeyeater	7	7
	21 species	50

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B43**
Location: Gate to farm house.	**Observer:** K. Mills	
Land Tenure: Freehold.	**Topography:** Gentle slopes, flats..	
Date: 1/12/09 | **Habitats:** Forest, farm land.		
GPS (WGS84): Start: 56 0282384 6127106	Finish: 56 0283430 6125107	
Time: Start: 08.25	Finish: 09.30	EDST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Australian Kestrel	1	1
Australian Magpie	5	5
Australian Pipit	3	3
Black-faced Cuckoo-shrike	1	1
Black-shouldered Kite	3	3
Chestnut Teal	1	1
Common Bronzewing	4	4
Common Myna*	5	5
Common Starling*	1	1
Crimson Rosella	4	4
Eastern Rosella	4	4
Eastern Spinebill	1	1
Galah	3	3
Golden-headed Cisticola	2	2
Grey Butcherbird	1	1
Magpie-lark	3	3
Musk Lorikeet	2	2
Noisy Friarbird	3	3
Red Wattlebird	2	2
Rufous Whistler	3	3
Sacred Kingfisher	1	1
Silvereye	4	4
Striated Thornbill	2	2
Superb Fairy-wren	3	3
Tree Martin	5	5
Welcome Swallow	14	14
White-faced Heron	1	1
Willie Wagtail	6	6
Yellow Thornbill	2	2
Yellow-faced Honeyeater	4	4
	30 species	94

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B44**
Location: Entry east to pine forest edge.	**Observer:** K. Mills	
Land Tenure: Freehold.	**Topography:**. Very gentle.	
Date: 21/12/09 | **Habitats:** Forest, woodland.		
GPS (WGS84): Start: 56 0282407 6127128	Finish: 56 0283119 6127157	
Time: Start: 08.10	Finish: 08.45	EDST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Australian Magpie	1	1
Australian Raven	1	1
Black-faced Cuckoo-shrike	3	3
Brown-headed Honeyeater	3	3
Crimson Rosella	1	1
Dollarbird	1	1
Eastern Spinebill	3	3
Glossy Black-Cockatoo	9 0282580 6127261	9
Grey Fantail	1	1
Musk Lorikeet	2	2
Noisy Friarbird	1	1
Red-browed Finch	1	1
Rufous Whistler	1	1
Spotted Pardalote	1	1
White-throated Treecreeper	1	1
Yellow-faced Honeyeater	1	1
	16 species	31

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B45**
Location: Western forest to pine plantation.	**Observer:** K. Mills	
Land Tenure: Freehold.	**Topography:** Very gentle.	
Date: 05/01/10 | **Habitats:** Forest, woodland, farmland.		
GPS (WGS84): Start: 56 0282987 6126740	Finish: 56 0283316 6127146	
Time: Start: 09.00	Finish: 09.30	EDST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Australian Magpie	1	1
Common Bronzewing	1	1
Crimson Rosella	4	4
Eastern Spinebill	5	5
Grey Fantail	1	1
Musk Lorikeet	4	4
Noisy Friarbird	3	3
Olive-backed oriole	1	1
Red Wattlebird	2	2
Superb fairy-wren	3	3
Yellow-faced Honeyeater	3	3
	11 species	29

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B46**
Location: Gate to farm house.	**Observer:** K. Mills	
Land Tenure: Freehold.	**Topography:** Gentle slopes, flats.	
Date: 26/02/10 | **Habitats:** Forest, farm land.		
GPS (WGS84): Start: 56 0282384 6127106	Finish: 56 0283430 6125107	
Time: Start: 08.00	Finish: 09.30	EDST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Australian Hobby		1
Australian Magpie		2
Australian Raven		2
Black-faced Cuckoo-shrike		1
Brown thornbill		3
Chestnut Teal		6
Common Myna*		1
Crimson Rosella		7
Eastern Whipbird		1
Gang-gang cockatoo		2
Grey Shrike-thrush		2
Grey Fantail		1
Grey Butcherbird		1
Laughing Kookaburra		5
Little Pied Cormorant		1
Magpie-lark		2
Musk Lorikeet		2
New holland Honeyeater		1
Pacific Black Duck		2
Rainbow lorikeet		2
Red Wattlebird		2
Rufous Whistler		2
Spotted Pardalote		2
Superb Fairy-wren		3
White-throated Treecreeper		2
Yellow-tailed Black-Cockatoo		1
Yellow-faced Honeyeater		3
	28 species	61

Survey Sheet – Birds		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. B47**
Location: Gate to farm house.	**Observer:** K. Mills	
Land Tenure: Freehold.	**Topography:** Gentle slopes, flats.	
Date: 19/04/10 | **Habitats:** Forest, farm land.		
GPS (WGS84): Start: 56 0282384 6127106	Finish: 56 0283430 6125107	
Time: Start: 10.30	Finish: 11.30	EST

Species	**Tally/Notes** (breeding, etc.)	**No.**
Australian Magpie		3
Brown Thornbill		2
Cattle Egret		3
Common Starling*		5
Crimson Rosella		4
Eastern Rosella		3
Golden Whistler		1
Golden-headed cisticola		1
Grey Shrike-thrush		1
Grey Butcherbird		1
Grey Teal		1
Laughing Kookaburra		2
Magpie-lark		2
Masked Lapwing		1
Purple Swamphen		2
Satin Bowerbird		1
Spotted Pardalote		2
Superb Fairy-wren		7
Welcome Swallow		4
Whistling Kite		1
Willie Wagtail		1
Yellow-faced Honeyeater		4
	22 species	52

Summary of Bird Surveys in the Study Area

No.	Date	Times (D – EDST)	Period (mins)	No. Spp	No. Birds	Cumulative No. Spp. Recorded
B1	10.09.09	12.00-14.15	135	38	116	38
B2	10.09.09	14.51-15.31	40	13	21	41
B3	10.09.09	15.40-16.10	30	10	22	45
B4	10.09.09	16.20-17.00	40	12	18	45
B5	10.09.09	17.05-17.35	30	14	25	47
B6	11.09.09	06.00-07.00	60	20	43	48
B7	11.09.09	07.15-08.00	45	15	37	48
B8	01.10.09	07.00-08.21	81	18	47	49
B9	01.10.09	08.25-09.45	80	26	67	56
B10	12.10.09	08.30-10.00 (D)	90	37	94	64
B11	12.10.09	10.10-10.30 (D)	30	15	26	65
B12	13.10.09	06.00-07.15 (D)	75	22	41	67
B13	13.10.09	07.08-07.52 (D)	44	28	37	68
B14	13.10.09	07.45-08.45 (D)	60	35	73	69
B15	13.10.09	08.03-08.18 (D)	15	13	18	70
B16	13.10.09	08.25-09.10 (D)	45	23	51	70
B17	13.10.09	08.55-10.45 (D)	110	33	96	79
B18	13.10.09	09.35-09.58 (D)	23	16	18	79
B19	13.10.09	19.03-19.16 (D)	13	15	15	80
B20	14.10.09	06.31-07.14 (D)	43	15	37	80
B21	14.10.09	07.15-08.35 (D)	80	28	80	84
B22	14.10.09	07.21-07.54 (D)	33	19	15	84
B23	14.10.09	08.08-08.38 (D)	30	9	15	84
B24	14.10.09	08.40-09.35 (D)	55	22	37	86
B25	14.10.09	08.53-09.37 (D)	44	18	24	86
B26	14.10.09	11.19-11-51 (D)	32	28	65	87
B27	14.10.09	11.20-12.30 (D)	70	11	24	87
B28	14.10.09	16.58-17.09 (D)	11	4	4	87
B29	14.10.09	17.30-18.00 (D)	30	14	53	87
B30	14.10.09	19.00-19.30 (D)	30	16	56	87
B31	15.10.09	06.30-07.07 (D)	37	18	51	87
B32	15.10.09	07.07-07.43 (D)	38	25	80	87
B33	15.10.09	08.32-09.05 (D)	33	24	94	87
B34	15.10.09	09.11-09.34 (D)	23	13	28	87
B35	15.10.09	17.30-18.10 (D)	40	21	54	87
B36	15.10.09	18.20-18.37 (D)	17	11	28	87
B37	16.10.09	06.40-07.10 (D)	30	11	17	87
B38	16.10.09	07.30-07.55 (D)	25	10	17	87
B39	29.10.09	09.15-10.35 (D)	80	41	84	90
B40	02.11.09	09.00-11.30 (D)	150	32	92	90
B41	24.11.09	08.30-09.45 (D)	75	38	123	90
B42	24.11.09	11.30-12.30 (D)	60	21	50	90
B43	01.12.09	08.25-09.30 (D)	65	30	94	90
B44	21.12.09	08.10-08.45 (D)	35	16	31	91
B45	05.01.10	09.00-09.30 (D)	30	11	29	91
B46	25.02.10	08.00-09.30 (D)	90	28	61	91
B47	19.04.10	10.30-11.30	60	22	52	92
Totals	-	-	2,392mins	91	2,276	92
			39.9 hrs			

SPOTLIGHTING/CALL PLAYBACKS

Survey Sheet – Spotlighting/Call Playbacks			**Kevin Mills & Associates**
Site Name: Comberton Grange			**Site No. 1**
Location: West of transect 1		**Observer:** J. Edwards & D. Engel	
Land Tenure:		**Topography:**	
Date: 12/10/09	**Habitats:**		
GPS (WGS84): Start: 282734 6127027		Finish: 283387 6128247	
Time: Start: 20.14	Finish: 21.25	EDST	
Species	**Tally/Notes** (calls or observed, etc.)		**No.**
No response			
Shrub cover:		Ground cover:	
Rock outcrops:		Wetlands:	
Ground debris:		Rocks turned:	
Special features/notes:			

Survey Sheet – Spotlighting/Call Playbacks			**Kevin Mills & Associates**
Site Name: Comberton Grange			**Site No. 2**
Location: West of Pine Plantation.		**Observer:** J. Edwards & D. Engel	
Land Tenure:		**Topography:**	
Date: 12/10/09	**Habitats:**		
GPS (WGS84): Start: 283206 6127203		Finish:	
Time: Start: 21.30	Finish: 21.45	EDST	
Species	**Tally/Notes** (calls or observed, etc.)		**No.**
No response			
Shrub cover:		Ground cover:	
Rock outcrops:		Wetlands:	
Ground debris:		Rocks turned:	
Special features/notes:			

Survey Sheet – Spotlighting/Call Playbacks			**Kevin Mills & Associates**
Site Name: Comberton Grange			**Site No. 3**
Location: North east corne rof Pine Forest on Charcoal Road.		**Observer:** J. Edwards & D. Engel	
Land Tenure:		**Topography:**	
Date: 12/10/09	**Habitats:**		
GPS (WGS84): Start: 284442 6128519		Finish:	
Time: Start: 20.00	Finish: 20.27	EDST	
Species	**Tally/Notes** (calls or observed, etc.)		**No.**
No response			
Shrub cover:		Ground cover:	
Rock outcrops:		Wetlands:	
Ground debris:		Rocks turned:	
Special features/notes: 16.4°C clear skies. Wind from south.			

Survey Sheet – Spotlighting/Call Playbacks		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. 4**
Location: Track south of Pine Forest near where Powerful Owl observed.	**Observer:** J. Edwards & D. Engel	
Land Tenure:	**Topography:**	
Date: 14/10/09 **Habitats:**		
GPS (WGS84): Start: 283337 6127152	Finish:	
Time: Start: 21.20	Finish: 21.38	EDST

Species	**Tally/Notes** (calls or observed, etc.)	**No.**
No response		

Shrub cover:	Ground cover:
Rock outcrops:	Wetlands:
Ground debris:	Rocks turned:
Special features/notes: 17°C clear skies. Strong SW winds.	

Survey Sheet – Spotlighting/Call Playbacks		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. 5**
Location: Charcoal Road – east side of Pine Forest.	**Observer:** J. Edwards & D. Engel	
Land Tenure:	**Topography:**	
Date: 15/10/09 **Habitats:**		
GPS (WGS84): Start: 284552 6127434	Finish:	
Time: Start: 19.56	Finish: 20.20	EDST

Species	**Tally/Notes** (calls or observed, etc.)	**No.**
Masked Owl	Observed	1

Shrub cover:	Ground cover:
Rock outcrops:	Wetlands:
Ground debris:	Rocks turned:
Special features/notes:	

Survey Sheet – Spotlighting/Call Playbacks		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. 6**
Location: Quarry dam.	**Observer:** J. Edwards & D. Engel	
Land Tenure:	**Topography:**	
Date: 15/10/09 **Habitats:**		
GPS (WGS84): Start: 284673 6126348	Finish:	
Time: Start: 21.20	Finish: 21.34	EDST

Species	**Tally/Notes** (calls or observed, etc.)	**No.**
No response		
Sugar Glider heard calling.		
Crinia signifera	Heard	
Littoria verreauxia	Heard	

Shrub cover:	Ground cover:
Rock outcrops:	Wetlands:
Ground debris:	Rocks turned:
Special features/notes:	

FROGS/REPTILES

Survey Sheet - Frogs/Reptiles		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. 01**
Location: Old house site.		**Observer:** K. Mills
Land Tenure:	**Topography:**	
Date: 10/09/09 **Habitats:**		
GPS (WGS84): Start: 56 0283404 6125180	Finish:	
Time: Start: 1.15	Finish: 1.30	EDST

Species	**Tally/Notes** (micro-habitat, etc.)	**No.**
Small-eyed Snake		1
Crinia signifera		1

Shrub cover:	Ground cover:
Rock outcrops:	Wetlands:
Ground debris:	Rocks turned:
Special features/notes:	

Survey Sheet - Frogs/Reptiles		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. 02**
Location: NW corner Pine Plantation		**Observer:** D. Engel
Land Tenure:	**Topography:** Flat	
Date: 13/10/09 **Habitats:**		
GPS (WGS84): Start: 283478 6128645	Finish: 283403 6128640	
Time: Start: 11.51	Finish: 12.10	EDST

Species	**Tally/Notes** (micro-habitat, etc.)	**No.**
Lampropholis delicata	Leaf litter	4
	Numerous (>20) logs turned and leaf litter accumulation at base of trees raked.	
Incidental record		
Eastern Water Skink	283409 6128234	

Shrub cover: Open to sparse = 1.2m high	Ground cover: Native grass & forb = 30cm high
Rock outcrops: N/A	Wetlands: N/A
Ground debris: Leaf litter and natural debris	Rocks turned:
Special features/notes: 23.3°C, 20% cloud, westerly winds.	

Survey Sheet - Frogs/Reptiles		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. 03**
Location: Between Trap Lines No. 2 & No. 3		**Observer:** D. Engel
Land Tenure:	**Topography:** Slopey, northerly aspect	
Date: 13/10/09 **Habitats:** Woodland		
GPS (WGS84): Start: 283126 6126553	Finish: 283219 6126565	
Time: Start: 12.30	Finish: 13.04	EDST

Species	**Tally/Notes** (micro-habitat, etc.)	**No.**
Lampropholis delicata	Under leaf litter	3
Eastern Water Skink	283409 6128234	

Shrub cover:	Ground cover:
Rock outcrops:	Wetlands:
Ground debris:	Rocks turned:
Special features/notes:	

Survey Sheet - Frogs/Reptiles		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. 04**
Location: Old homestead		**Observer:** D. Engel
Land Tenure:	**Topography:**	
Date: 13/10/09 **Habitats:**		
GPS (WGS84): Start: 283418 6128145	Finish: 283418 612145	
Time: Start: 13.13	Finish: 13.37	EDST

Species	**Tally/Notes** (micro-habitat, etc.)	**No.**
Eastern blue-tongued lizard	Under iron (corrugated)	1
Jacky Lizard	Under iron	1
Lampropholis delicata	Under log, on grass, under iron	5
Incidentals		
White-faced Heron		
Welcome Swallow		
Willie Wagtail		
Black-shouldered Kite		
Noisy Miner		
Fairy Martin	Nest in water tank with eggs.	
Common Starling		
Richard's Pipit		

Shrub cover:	Ground cover:
Rock outcrops:	Wetlands:
Ground debris:	Rocks turned:
Special features/notes:	

Survey Sheet - Frogs/Reptiles		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. 05**
Location: Creek crossing – north-south track		**Observer:** D. Engel
Land Tenure:	**Topography:**	
Date: 13/10/09 **Habitats:**		
GPS (WGS84): Start: 284195 6126286	Finish: 284315 6126234	
Time: Start: 14.03	Finish: 14.34	EDST

Species	**Tally/Notes** (micro-habitat, etc.)	**No.**
Crinia signifera	Under rock	1
Eastern Water Skink	On log	2
Lampropholis delicata	On leaf litter	5
	Walked along creek line	

Shrub cover:	Ground cover:
Rock outcrops:	Wetlands:
Ground debris:	Rocks turned:
Special features/notes: 24.4°C – 50% cloud cover, strong breezes.	

Survey Sheet - Frogs/Reptiles		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. 06**
Location: Near main gate to site.		**Observer:** D. Engel
Land Tenure:	**Topography:**	
Date: 13/10/09 **Habitats:**		
GPS (WGS84): Start: 282500 6127120	Finish: 282500 6127120	
Time: Start: 4.36 pm	Finish: 5.02 pm	EDST

Species	**Tally/Notes** (micro-habitat, etc.)	**No.**
Zero		

Shrub cover:	Ground cover:
Rock outcrops:	Wetlands:
Ground debris:	Rocks turned:
Special features/notes:	

Survey Sheet - Frogs/Reptiles		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. 07**
Location: Track to gully east Transect 3		**Observer:** D. Engel
Land Tenure:	**Topography:**	
Date: 13/10/09	**Habitats:**	
GPS (WGS84): Start: 283629 6126350	Finish:	
Time: Start: 17.15	Finish: 17.44	EDST

Species	**Tally/Notes** (micro-habitat, etc.)	**No.**
Zero		

Shrub cover:	Ground cover:
Rock outcrops:	Wetlands:
Ground debris:	Rocks turned:
Special features/notes: 23.3°C, clear skies, southerly wind, moderate to strong.	

Survey Sheet - Frogs/Reptiles		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. 08**
Location: Near quarry	**Observer:** J. Edwards & D. Engel	
Land Tenure:	**Topography:**	
Date: 15/10/09	**Habitats:**	
GPS (WGS84): Start: 284743 6126429	Finish:	
Time: Start: 09.40	Finish: 10.05	EDST

Species	**Tally/Notes** (micro-habitat, etc.)	**No.**
Jacky Lizard	Rock/rubble	
Crinia signifera		
	"Point search" 25 minutes spent surveying one area.	

Shrub cover:	Ground cover:
Rock outcrops:	Wetlands:
Ground debris:	Rocks turned:
Special features/notes: 19.3°C, wind from south.	

Survey Sheet - Frogs/Reptiles		**Kevin Mills & Associates**
Site Name: Comberton Grange		**Site No. 09**
Location: North of Quarry/Dam	**Observer:** J. Edwards & D. Engel	
Land Tenure:	**Topography:**	
Date: 15/10/09	**Habitats:** Roadside cleared areas, rocks, timber debris, dumped urban rubbish.	
GPS (WGS84): Start:	Finish:	
Time: Start: 10.13	Finish: 10.31	EDST

Species	**Tally/Notes** (micro-habitat, etc.)	**No.**
Grass Skink	5 – leaf litter	7
	1 – tile (refuse)	
	1 – timber (refuse)	
	Overturned 6 rocks, 26 logs/branches, 10 random rubbish "Point search"	

Shrub cover:	Ground cover:
Rock outcrops:	Wetlands:
Ground debris:	Rocks turned:
Special features/notes:	

Survey Sheet - Frogs/Reptiles			**Kevin Mills & Associates**
Site Name: Comberton Grange			**Site No. 10**
Location:		**Observer:** J. Edwards & D. Engel	
Land Tenure:		**Topography:**	
Date: 15/10/09	**Habitats:**		
GPS (WGS84): Start: 285803 6126797		Finish: 284406 6126999	
Time: Start:	Finish:	EDST	
Species	**Tally/Notes** (micro-habitat, etc.)		**No.**
Eastern Water Skink	Log by creek		1
284904 6126927	Overturned 27 rocks		
	Slow vehicle transect – 5 km/hr		
	Looking for basking reptiles and doing point		
	searches where rocks, debris or logs seen.		
Shrub cover:		Ground cover:	
Rock outcrops:		Wetlands:	
Ground debris:		Rocks turned:	
Special features/notes:			

Survey Sheet - Frogs/Reptiles			**Kevin Mills & Associates**
Site Name: Comberton Grange			**Site No. 11**
Location: East – west Track prior to Site 1.		**Observer:** J. Edwards & D. Engel	
Land Tenure:		**Topography:**	
Date: 15/10/09	**Habitats:**		
GPS (WGS84): Start:		Finish:	
Time: Start: 16.50	Finish: 17.03	EDST	
Species	**Tally/Notes** (micro-habitat, etc.)		**No.**
No reptiles recorded.			
Shrub cover:		Ground cover:	
Rock outcrops:		Wetlands:	
Ground debris:		Rocks turned:	
Special features/notes:			

Survey Sheet - Frogs/Reptiles			**Kevin Mills & Associates**
Site Name: Comberton Grange			**Site No. 12**
Location: Track along western boundary Pine Forest.		**Observer:** J. Edwards & D. Engel	
Land Tenure:		**Topography:**	
Date: 15/10/09	**Habitats:**		
GPS (WGS84): Start: 283366 6127881		Finish:	
Time: Start: 17.05	Finish: 17.23	EDST	
Species	**Tally/Notes** (micro-habitat, etc.)		**No.**
Grass skinks			2
Two Gang Gang Cockatoos heard calling in woodland to west of track.			
Shrub cover:		Ground cover:	
Rock outcrops:		Wetlands:	
Ground debris:		Rocks turned:	
Special features/notes:			

Survey Sheet - Frogs/Reptiles			**Kevin Mills & Associates**
Site Name: Comberton Grange			**Site No. 13**
Location: Track along northern Pine Forest.		**Observer:** J. Edwards & D. Engel	
Land Tenure:		**Topography:**	
Date: 15/10/09	**Habitats:**		
GPS (WGS84): Start: 283840 6128667		Finish:	
Time: Start:	Finish:	EDST	
Species	**Tally/Notes** (micro-habitat, etc.)		**No.**
No reptiles recorded.			
Shrub cover:		Ground cover:	
Rock outcrops:		Wetlands:	
Ground debris:		Rocks turned:	
Special features/notes:			

Survey Sheet - Frogs/Reptiles			**Kevin Mills & Associates**
Site Name: Comberton Grange			**Site No. 14**
Location: Track crosing of Georges Creek		**Observer:** K. Mills	
Land Tenure: Freehold.		**Topography:** Creek sides.	
Date: 15/10/09	**Habitats:** Creekside vegetation, rocky creek bed, pools.		
GPS (WGS84): Start: 028420 6126244		Finish:	
Time: Start: 10.30	Finish: 10.45	EDST	
Species	**Tally/Notes** (micro-habitat, etc.)		**No.**
Eastern Water Skink	1		
Shrub cover:		Ground cover:	
Rock outcrops:		Wetlands:	
Ground debris:		Rocks turned:	
Special features/notes:			

Appendix 7
Old Growth Survey Sheets

Date: 24.08.09	**Recorder:** Kevin Mills
Landholder: Shaolin Temple	**1:25,000 map sheet:** Nowra
Vegetation Type: Blackbutt Forest to Spotted Gum Forest	**Transect No:** CG.OG.01
Location: Comberton Grange property, Shoalhaven City Council.	D = distance to nearest tree in that growth stage (metres). r = radius of crown (metres).
Starting Point: EASTING 0282932 NORTHING 6126975	**Finishing Point:** EASTING 0283397 NORTHING 6126322
Angle: na	GPS system: WGS84

Sample Point No.	**Regrowth**		**Mature**		**Senescent**		**Disturbance Indicators**					
	D	r	D	r	D	r	Recent Logging	Older Logging	Exotics	Stags or dieback	Grazing Infrastructure	Constructed tracks
1	3.5	1.0	4.1	4.0	-	-	-	Yes	-	-	-	-
2	2.2	2.0	3.4	3.5	-	-	-	Yes	-	Yes	-	-
3	2.6	2.0	5.7	6.0	9.6	5.5	-	Yes	-	-	-	-
4	1.9	1.7	10.9	4.0	-	-	-	Yes	-	-	-	-
5	6.1	2.2	3.3	7.7	-	-	-	Yes	-	-	-	-
6	6.1	1.0	5.8	5.0	20.5	5.7	-	Yes	-	-	-	-
7	4.2	1.7	3.9	4.0	7.2	8.0	-	Yes	-	-	-	-
8	5.6	2.0	5.8	3.5	13.8	12.0	-	Yes	-	Yes	-	-
9	8.5	0.9	13.5	8.0	-	-	-	Yes	-	-	-	Yes
10	6.4	0.9	0.8	4.5	-	-	-	Yes	-	-	-	-
Total or Average	4.71		5.72		12.8		0	10	0	2	0	1

Date: 24.08.09	**Recorder:** Kevin Mills
Landholder: Shaolin Temple	**1:25,000 map sheet:** Nowra
Vegetation Type: Blackbutt Forest to Peppermint Forest to Scribbly Gum Forest	**Transect No:** CG.OG.02
Location: Comberton Grange property, Shoalhaven City Council.	D = distance to nearest tree in that growth stage (metres). r = radius of crown (metres).
Tree Hollows:	
Starting Point: EASTING 0282963 NORTHING 6126929	**Finishing Point:** EASTING NORTHING
Angle: EASTING 0283489 NORTHING 6126892	GPS system: WGS84

Sample Point No.	**Regrowth**		**Mature**		**Senescent**		**Disturbance Indicators**					
	D	r	D	r	D	r	Recent Logging	Older Logging	Exotics	Stags or dieback	Grazing Infrastructure	Constructed tracks
1	2.9	0.5	4.0	5.0	-	-	-	Yes	-	Yes	-	Yes
2	0.8	0.5	11.3	9.0	15.6	10.0	-	Yes	-	Yes	-	-
3	1.7	1.5	5.8	6.5	-	-	-	Yes	-	-	-	-
4	7.9	2.0	3.1	3.0	14.5	3.0	-	Yes	-	Yes	-	-
5	1.7	1.0	6.6	6.0	-	-	-	Yes	-	-	-	-
6	2.7	1.7	3.2	4.5	-	-	-	Yes	-	-	-	-
7	3.2	1.1	1.0	2.7	2.5	4.0	-	Yes	-	-	-	-
8	0.8	0.5	3.4	1.0	25.0	9.0	-	Yes	-	Yes	-	-
9	2.6	2.7	4.4	5.0	18.0	9.0	-	Yes	-	Yes	-	-
10	2.2	1.0	5.2	5.0	16.0	6.0	-	Yes	-	Yes	-	Yes
Total or Average	2.05		4.8		15.3		0	10	0	6	0	2

Date: 24.08.09	**Recorder:** Kevin Mills
Landholder: Shaolin Temple	**1:25,000 map sheet:** Nowra
Vegetation Type: Spotted Gum Forest – Blackbutt Forest	**Transect No:** CG.OG.03
Location: Comberton Grange property, Shoalhaven City Council.	D = distance to nearest tree in that growth stage (metres). r = radius of crown (metres).
Starting Point: EASTING 0283423 NORTHING 6126289	**Finishing Point:** EASTING NORTHING
Angle: na	GPS system: WGS84

Sample Point No.	**Regrowth**		**Mature**		**Senescent**		**Disturbance Indicators**					
	D	r	D	r	D	r	Recent Logging	Older Logging	Exotics	Stags or dieback	Grazing Infrastructure	Constructed tracks
1	4.5	0.8	3.4	3.7	-	-	-	Yes	-	-	-	-
2	1.8	1.1	2.6	4.5	-	-	-	Yes	-	-	-	Yes (old)
3	5.2	1.7	1.3	4.0	-	-	-	Yes	-	-	-	-
4	1.3	2.0	2.0	7.5	-	-	-	Yes	-	-	-	Yes
5	2.2	0.6	2.7	5.5	-	-	-	Yes	-	-	-	-
6	1.7	1.0	2.4	4.7	-	9.0	-	Yes	-	-	-	-
7	1.4	0.6	4.8	5.7	14.0	6.0	-	Yes	-	Yes	-	-
8	4.1	2.0	2.5	5.5	4.6	-	-	Yes	-	Yes	-	-
9	4.1	0.6	1.3	2.5	-	7.5	-	Yes	-	Yes	-	Yes
10	3.7	1.0	3.0	3.5	14.0	-	-	Yes	-	Yes	-	-
Total or Average	3.0		2.6		10.9		0	10	0	4	0	3

NSW Scientific Committee - Final Determination

The Scientific Committee, established by the Threatened Species Conservation Act, has made a Final Determination to list the Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions, as an ENDANGERED ECOLOGICAL COMMUNITY in Part 3 of Schedule 1 of the Act. Listing of endangered ecological communities is provided for by Part 2 of the Act.

The Scientific Committee has found that:

1. Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner 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 closed along the NSW coast. Coastal saltmarsh has been recorded from sites along the NSW coast. (NSW North Coast, Sydney Basin and South East Corner Bioregions).

2. Characteristic vascular plant species of Coastal Saltmarsh are:

Baumea juncea	*Isolepis nodosa*
Juncus kraussii	*Samolus repens*
Sarcocornia quinqueflora	*Selliera radicans*
Sporobolus virginicus	*Suaeda australis*
Triglochin striata	*Zoysia macrantha*

The total list of species is larger, with many species present in low abundance or at few sites. A more extensive list of species is provided by Adam *et al.* (1988). The sediment surface may support a diversity of both micro-algae and macro-algae.

3. Communities with similar floristic composition, but with a different fauna, are found supratidally on exposed headlands (Adam *et al.* 1988). These headland communities and those of inland saline areas are not included within this Determination of the Coastal Saltmarsh Ecological Community.

4. Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions provide habitat for a diverse invertebrate fauna, which includes both marine (crabs and molluscs) and terrestrial (insects and spiders) elements. During tidal flooding a number of fish species utilise saltmarsh habitats. Grazing by macropods may occur between tidal events. Some coastal saltmarshes provide important high tide roosts for migratory wading birds, and a range of other birds also utilise coastal saltmarsh as habitat. Diversity of macrofauna in mangrove forests adjacent to saltmarsh has been found to be greater than in mangroves that do not border saltmarsh (Yerman & Ross 2004)

5. Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions is frequently found as a zone landward of mangrove stands. Occasional scattered mature *Avicennia marina* trees occur through saltmarsh at some sites, and *Avicennia* (and less frequently *Aegiceras corniculatum*) seedlings may occur throughout saltmarsh. In brackish areas dense stands of tall reeds (*Phragmites australis*, *Bulboschoenus* spp., *Schoenoplectus* spp., *Typha* spp.) may occur as part of the community.

6. West *et al.* (1985) estimated the total area of coastal saltmarsh in NSW was approximately 5700 hectares distributed in fragmented patches mostly less than 100 hectares. Since this estimate, further reduction and fragmentation have occurred.

7. Species composition within Coastal Saltmarsh varies with elevation. *Sarcocornia quinqueflora* dominates at lower, and hence more frequently flooded, levels than *Sporobolus virginicus* which dominates the mid saltmarsh, while *Juncus kraussii* and *Baumea juncea* are upper saltmarsh species. There is also geographic variation, with much more extensive stands of *Sporobolus virginicus* being found in northern NSW, and conversely more extensive *Sarcocornia quinqueflora* stands in the south. Coastal Saltmarsh in southern NSW is generally more species rich than further north, with *Austrostipa stipoides*, *Gahnia filum*, *Limonium australe* and *Sclerostegia arbuscula* forming a characteristic southern suite of

species. A number of other species with restricted distribution in Coastal Saltmarsh include *Distichlis distichophylla* (endangered), *Halosarcia pergranulata* subsp. *pergranulata, Wilsonia backhousei* (vulnerable) and *Wilsonia rotundifolia* (endangered).

8. Saltmarshes are globally threatened, and many of the threatening processes identified by Adam (2002) operate in NSW including infilling, modified tidal flow, weed invasion, damage by domestic and feral animals, human disturbance, altered fire regimes and climate change.

9. Historically, substantial areas of saltmarsh have been infilled for roads and aerodromes and for residential, recreational, waste disposal, industrial and agricultural purposes. With increased recognition of the ecological value of saltmarshes, the threat of further large-scale reclamation is less, but smaller scale infilling still occurs (Harty and Cheng 2003).

10. Patterns of tidal flow have been restricted by artificial structures in many NSW saltmarshes (Williams and Watford 1997), while discharge of stormwater alters salinity regimes, increases nutrient levels and facilitates the spread of *Phragmites* and weeds.

11. In recent decades there has been widespread invasion of saltmarsh in southeast Australia by mangroves (Mitchell and Adam 1989, Saintilan and Williams 1999, 2000). The factors driving mangrove invasion are still unclear. The mangrove invasion limits the use of saltmarshes by birds that would normally make use of this habitat and has been a factor in their decline (Saintilan 2003, Straw 1999, 2000).

12. A large number of weed species occur in NSW saltmarshes (Adam 1981, Adam *et al.* 1988). In terms of change to the community structure and function, the most serious weed is *Juncus acutus*; other major weeds include *Baccharis halimifolia, Cortaderia selloana* and *Hydrocotyle bonariensis*. The upper saltmarsh zone may be dominated by introduced annuals or shortlived perennials, including *Parapholis incurva, Plantago coronopus* and *Polypogon monspeliensis*.

13. Damage to saltmarshes by recreational vehicles, including four wheel drives, is widespread, and deep wheel ruts persist for many years even after exclusion of vehicles. Use of BMX and mountain bikes is increasing, and even saltmarshes within conservation reserves have been seriously damaged (Adam 2002).

14. Grazing and trampling by domestic stock and feral herbivores occurs at a number of sites. Stock grazing has been shown to substantially change the vegetation composition and structure (Adam 1990), while on muddy substrates trampling can cause loss of plant cover and modify drainage patterns.

15. Saltmarshes have frequently been used for casual rubbish dumping and are at risk from waterborne pollution – including oil and chemical spills, both from shipping and road accidents, and catchment runoff of nutrients and agricultural chemicals.

16. Upper saltmarsh stands dominated by *Juncus kraussii* and *Baumea juncea* have high flammable fuel loads. While the natural incidence of fire in saltmarshes is likely to have been low, a number of saltmarshes have been burnt in recent years. The recovery of these sites is relatively slow and the long-term impacts of burning are uncertain.

17. Global warming and increased relative sea level are likely to pose an increasing threat to the survival of many areas of Coastal Saltmarsh (Adam 2002, Hughes 2003).

18. Coastal Saltmarsh occurs in a number of conservation reserves including the Ramsar listed sites at Towra Point and Kooragang Island Nature Reserves. Reserve status, however, does not confer protection from mangrove and weed invasion, recreational vehicles, pollution, fire or sea level rise without active management.

19. In view of the above the Scientific Committee is of the opinion that the Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions is likely to become extinct in nature in New South Wales unless the circumstances and factors threatening its survival cease to operate.

Dr Lesley Hughes

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NSW Scientific Committee - Final Determination

The Scientific Committee, established by the Threatened Species Conservation Act, has made a Final Determination to list Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions, as an ENDANGERED ECOLOGICAL COMMUNITY in Part 3 of Schedule 1 of the Act. Listing of endangered ecological communities is provided for by Part 2 of the Act.
The Scientific Committee has found that:

1. Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions is the name given to the ecological community associated with grey-black clay-loams and sandy loams, where the groundwater is saline or sub-saline, on waterlogged or periodically inundated flats, drainage lines, lake margins and estuarine fringes associated with coastal floodplains. Floodplains are level landform patterns on which there may be active erosion and aggradation by channelled and overbank stream flow with an average recurrence interval of 100 years or less (adapted from Speight 1990). Swamp Oak Floodplain Forest generally occurs below 20 m (rarely above 10 m) elevation in the NSW North Coast, Sydney Basin and South East Corner bioregions. The structure of the community may vary from open forests to low woodlands, scrubs or reedlands with scattered trees. Typically these forests, woodlands, scrubs and reedlands form mosaics with other floodplain forest communities and treeless wetlands, and often they fringe treeless floodplain lagoons or wetlands with semi-permanent standing water (e.g. Pressey 1989a).
The composition of Swamp Oak Floodplain Forest is primarily determined by the frequency and duration of waterlogging and the level of salinity in the groundwater. Composition also varies with latitude. The community is characterised by the following assemblage of species:

Acmena smithii	*Alphitonia excelsa*
Alternanthera denticulata	*Baumea juncea*
Blechnum indicum	*Callistemon salignus*
Carex appressa	*Casuarina glauca*
Centella asiatica	*Commelina cyanea*
Crinum pedunculatum	*Cupaniopsis anacardioides*
Cynodon dactylon	*Dianella caerulea*
Entolasia marginata	*Enydra fluctuans*
Flagellaria indica	*Gahnia clarkei*
Geitonoplesium cymosum	*Glochidion ferdinandi*
Glochidion sumatranum	*Hypolepis muelleri*
Imperata cylindrica var*. major*	*Isolepis inundata*
Juncus kraussii subsp*. australiensis*	*Juncus planifolius*
Juncus usitatus	*Lobelia alata*
Lomandra longifolia	*Lophostemon suaveolens*
Maundia triglochinoides	*Melaleuca alternifolia*
Melaleuca ericifolia	*Melaleuca quinquenervia*
Melaleuca styphelioides	*Myoporum acuminatum*
Oplismenus imbecillis	*Parsonsia straminea*
Persicaria decipiens	*Persicaria strigosa*
Phragmites australis	*Selliera radicans*
Smilax australis	*Stephania japonica* var*. discolor*
Viola banksii	

2. The total species list of the community is considerably larger than that given above, with many species present at only one or two sites or in low abundance. The species composition of a site will be influenced by the size of the site, recent rainfall or drought conditions and by its disturbance (including fire, grazing, flooding and land clearing) history. The number and relative abundance of species will change with time since fire, flooding or significant rainfall, and may also change in response to changes in grazing regimes. At any one time, above-ground individuals of some species may be absent, but the species may be represented below ground in the soil seed banks or as dormant structures such as bulbs, corms, rhizomes, rootstocks or lignotubers. The list of species given above is of vascular plant species, the community also includes micro-organisms, fungi, cryptogamic plants and a diverse fauna, both vertebrate and invertebrate. These components of the community are poorly documented.

3. Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions is known from parts of the Local Government Areas of Tweed, Byron, Lismore, Ballina,

Richmond Valley, Clarence Valley, Coffs Harbour, Bellingen, Nambucca, Kempsey, Hastings, Greater Taree, Great Lakes, Port Stephens, Maitland, Newcastle, Cessnock, Lake Macquarie, Wyong, Gosford, Pittwater, Warringah, Hawkesbury, Baulkham Hills, Hornsby, Lane Cove, Blacktown, Auburn, Parramatta, Canada Bay, Rockdale, Kogarah, Sutherland, Penrith, Fairfield, Liverpool, Bankstown, Wollondilly, Camden, Campbelltown, Wollongong, Shellharbour, Kiama, Shoalhaven, Eurobodalla and Bega Valley but may occur elsewhere in these bioregions. Bioregions are defined in Thackway and Creswell (1995). Major examples once occurred on the floodplains of the Clarence, Macleay, Hastings, Manning, Hunter, Hawkesbury, Shoalhaven and Moruya Rivers.

4. Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions has a dense to sparse tree layer in which *Casuarina glauca* (swamp oak) is the dominant species northwards from Bermagui. Other trees including *Acmena smithii* (lilly pilly), *Glochidion* spp. (cheese trees) and *Melaleuca* spp. (paperbarks) may be present as subordinate species, and are found most frequently in stands of the community northwards from Gosford. Tree diversity decreases with latitude, and *Melaleuca ericifolia* is the only abundant tree in this community south of Bermagui (Keith and Bedward 1999). The understorey is characterised by frequent occurrences of vines, *Parsonsia straminea* (common silkpod), *Geitonoplesium cymosum* (scrambling lily) and *Stephania japonica* var. *discolor* (snake vine), a sparse cover of shrubs, and a continuous groundcover of forbs, sedges, grasses and leaf litter. The composition of the ground stratum varies depending on levels of salinity in the groundwater. Under less saline conditions prominent ground layer plants include forbs such *Centella asiatica* (pennywort), *Commelina cyanea, Persicaria decipiens* (slender knotweed) and *Viola banksii*; graminoids such as *Carex appressa* (tussock sedge), *Gahnia clarkei* (a saw-sedge), *Lomandra longifolia* (spiny-headed mat-rush), *Oplismenus imbecillis*; and the fern *Hypolepis muelleri* (batswing fern). On the fringes of coastal estuaries, where soils are more saline, the ground layer may include the threatened grass species, *Alexfloydia repens*, as well as *Baumea juncea, Juncus kraussii* subsp. *australiensis* (sea rush), *Phragmites australis* (common reed), *Selliera radicans* and other saltmarsh species. The composition and structure of the understorey is also influenced by grazing history, changes to hydrology and soil salinity and other disturbance, and may have a substantial component of exotic grasses, vines and forbs.

5. Unlike most other coastal floodplain communities, Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions are not a significant habitat for waterbirds (Goodrick 1970). However, they do sometimes provide food resources for the Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*), and Yellow-tailed Black Cockatoo (*Calyptorhynchus funereus*) (Marchant and Higgins 1990). The fauna of Swamp Oak Floodplain Forest also includes the Squirrel Glider (*Petaurus norfolcensis*) and several species of frogs in the families Myobatrachidae (southern frogs) and Hylidae (tree frogs).

6. Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions forms part of a complex of forested wetland and treeless wetland communities found throughout the coastal floodplains of NSW. A recent analysis of available quadrat data from these habitats identified a distinct grouping of vegetation samples attributable to this community (Keith and Scott 2005). The combination of features that distinguish Swamp Oak Floodplain Forest from other endangered ecological communities on the coastal floodplains include: its dominance by a tree canopy of either *Casuarina glauca* or, more rarely, *Melaleuca ericifolia* with or without subordinate tree species; the relatively low abundance of *Eucalyptus* species; and the prominent groundcover of forbs and graminoids. It generally occupies low-lying parts of floodplains, alluvial flats, drainage lines, lake margins and fringes of estuaries; habitats where flooding is periodic and soils show some influence of saline ground water. This latter habitat feature sets it apart from other floodplain communities.

7. Swamp Oak Floodplain Forest may adjoin or intergrade with several other endangered ecological communities, which collectively cover all remaining native vegetation on the coastal floodplains of New South Wales. These include Lowland Rainforest on Floodplain in the NSW North Coast bioregion, Subtropical Floodplain Forest of the NSW North Coast bioregion, River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (including the formerly listed Sydney Coastal River-Flat Forest in the Sydney Basin bioregion), Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (including the formerly listed Sydney Coastal Estuary Swamp Forest in the Sydney Basin bioregion) and Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions. For example, in less saline habitats, Swamp Oak Floodplain Forest may adjoin or intergrade with several other endangered ecological communities including River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions and Subtropical Floodplain Forest of the NSW North Coast bioregion. The most saline forms of Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions may adjoin

or intergrade with Coastal Saltmarsh of the NSW North Coast, Sydney Basin and South East Corner bioregions. The boundaries between these communities are dynamic and may shift in response to changes in hydrological regimes, fire regimes or land management practices (e.g. Johnston *et al.* 2003). The Determinations for these communities collectively encompass the full range of intermediate assemblages in transitional habitats.

8. A number of vegetation surveys and mapping studies have been conducted across the range of Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions. This community includes 'Sheoak Swamps' in the general coastal wetlands classification of Goodrick (1970). In the Tweed valley lowlands, this community includes '*Casuarina glauca* tall to very tall open to closed forest' (F10) of Pressey and Griffith (1992) and parts of the 'Floodplain Wetland Complex' (FL) that include *Casuarina glauca* with *Melaleuca* spp. (Pressey and Griffith 1992). In the Comprehensive Regional Assessment of the north-eastern NSW (NPWS 1999), areas mapped as 'Forest Ecosystem 143, Swamp Oak', fall within this community. In the lower Hunter valley, 'Swamp Oak – Rushland Forest' (map unit 40) and 'Swamp Oak Sedge Forest' (map unit 41) of NPWS (2000) fall within this community. On the Cumberland Plain, 'Riparian Woodland' (map unit 5) of Tozer (2003) and parts of 'Alluvial Woodland' (map unit 11) dominated by *Casuarina glauca* (Tozer 2003) are included within this community, while those parts of Benson's (1992) 'River Flat Forest' (map unit 9f) dominated by *C. glauca* also fall within this community, as do parts of the 'River-flat forests' of Benson and Howell (1990) and Benson et al. (1996) that are dominated by *C. glauca*. On the Illawarra Plain, 'Coastal Swamp Oak Forest' (map unit 36) of NPWS (2002) occurs within this community. In the Comprehensive Regional Assessment of southern New South Wales (Thomas *et al*. 2000), this community includes 'Coastal Wet Heath Swamp Forest' (forest ecosystem 24), 'South Coast Swamp Forest' complex (forest ecosystem 25) and those parts of 'Ecotonal Coastal Swamp Forest' (forest ecosystem 27) dominated by *Casuarina glauca*. In the Sydney - South Coast region, this community includes parts of 'Floodplain Swamp Forest' (map unit 105) dominated by *Casuarina glauca*, 'Estuarine Fringe Forest' (map unit 106) and 'Estuarine Creek Flat Scrub' (map unit 107) of Tindall *et al*. (2004). In the Eden region, this community includes 'Estuarine Wetland Scrub' (map unit 63) of Keith and Bedward (1999) and parts of 'Floodplain Wetlands' (map unit 60) that include *Casuarina glauca* or *Melaleuca ericifolia* (Keith and Bedward 1999). Swamp Oak Floodplain Forest South East Corner is included within the 'Coastal Floodplain Wetlands' vegetation class of Keith (2002, 2004). There may be additional or unmapped occurrences of Swamp Oak Floodplain Forest within and beyond these surveyed areas.

9. The extent of the Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions prior to European settlement has not been mapped across its entire range. However, one estimate based on a compilation of regional vegetation maps suggests that Coastal Floodplain Wetlands, which include Swamp Oak Floodplain Forest, currently cover 800-1400 km2, representing less than 30% of the original extent of this broadly defined vegetation class (Keith 2004). Compared to this combined estimate, the remaining area of Swamp Oak Floodplain Forest is likely to be considerably smaller and is likely to represent much less than 30% of its original range. Major occurrences include: less than 350 ha on the Tweed lowlands in 1985 (Pressey and Griffith 1992); less than 650 ha on the lower Clarence floodplain in 1982 (Pressey 1989a); less than 400 ha on the lower Macleay floodplain in 1983 (Pressey 1989b); less than 3200 ha in the lower Hunter – central Hunter region in the 1990s (NPWS 2000); less than 5200 ha in the Sydney - South Coast region in the mid 1990s (Tindall *et al*. 2004), including up to 4700 ha on the Cumberland Plain in 1998 (Tozer 2003) and less than 250 ha on the Illawarra Plain in 2001 (NPWS 2002); and less than 1000 ha in the Eden region in 1990 (Keith and Bedward 1999).

10. Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions has been extensively cleared and modified. Large areas that formerly supported this community are occupied by exotic pastures grazed by cattle, market gardens, other cropping enterprises (e.g. sorghum, corn, poplars, etc.) and, on the far north coast, canefields. On the Tweed lowlands, Pressey and Griffith (1992) estimated that less than 3% of the original Floodplain Wetlands and Floodplain Forest remained in 1985. Similar estimates are likely to apply to Swamp Oak Floodplain Forests in other parts of the NSW North Coast bioregion (Pressey 1989a, 1989b, NPWS 1999). In the lower Hunter – central coast region, less than 30-40% was estimated to have remained during the 1990s (NPWS 2000), while approximately 13% remained on the Cumberland Plain in 1998 (Tozer 2003). In the Sydney – South Coast region, less than 20% was estimated to remain in the mid 1990s (Tindall *et al*. 2004), in the Eden region about 30% was estimated to remain during the 1990s (Keith and Bedward 1999).

11. Land clearing continues to threaten Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions. A small minority of the remaining area occurs on public land

(e.g. Pressey 1989a, b; Pressey and Griffith 1992), with most occurring on productive agricultural land or in close proximity to rural centres. The remaining stands are severely fragmented by past clearing and further threatened by continuing fragmentation and degradation, flood mitigation and drainage works, landfilling and earthworks associated with urban and industrial development, pollution from urban and agricultural runoff, weed invasion, overgrazing, trampling and other soil disturbance by domestic livestock and feral animals including pigs, activation of 'acid sulfate soils' and rubbish dumping (e.g. Pressey 1989a, b; Pressey and Griffith 1992, Boulton and Brock 1999, Johnson *et al*. 2003). Anthropogenic climate change may also threaten Swamp Oak Floodplain Forest if sea levels rise as predicted or if future flooding regimes are affected (IPCC 2001, Hughes 2003). Localised areas, particularly those within urbanised regions, may also be exposed to frequent burning which reduces the diversity of woody plant species. Clearing of native vegetation; Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands; Invasion of native plant communities by exotic perennial grasses; Predation, habitat destruction, competition and disease transmission by feral pigs; Anthropogenic climate change and High frequency fire are listed as Key Threatening Processes under the Threatened Species Conservation Act (1995).

12. Large areas of habitat formerly occupied by Swamp Oak Floodplain Forest have been directly drained by construction of artificial channels (e.g. Pressey 1989a, Boulton and Brock 1999). By the early 1900s, drainage unions or trusts were formed on the major floodplains to enable adjacent landholders to arrange for co-ordinated drainage systems, which were designed and constructed by the NSW Department of Public Works. Additional areas that have not been directly drained may have been altered hydrologically by changed patterns of flooding and drainage following flood mitigation works, particularly the construction of drains, levees and floodgates (Pressey and Griffith 1992). On the north coast of NSW, expansion of *Melaleuca quinquenervia* and *Casuarina glauca* into open floodplain swamps has been attributed to artificial drainage and shortening of the hydroperiod (Johnston *et al*. 2003, Stevenson 2003). There have also been anecdotal reports of recruitment by *Casuarina glauca* in pastures during extended dry periods, though not necessarily by other components of the community. These changes appear to be closely associated with enhanced acidity, altered ionic ratios, increased dissolved organic carbon and sulfide oxidation in the soil profile (Johnston *et al*. 2003). Alteration of tidal flows may have lead to decreased soil salinity and localised expansion of *Casuarina glauca* into areas that previously supported Coastal Saltmarsh or mangroves (Stevenson 2003).

13. Very few examples of Swamp Oak Floodplain Forest remain unaffected by weeds. The causes of weed invasion include physical disturbance to the vegetation structure of the community, dumping of landfill rubbish and garden refuse, polluted runoff from urban and agricultural areas, construction of roads and other utilities, and grazing by domestic livestock. The principal weed species affecting Swamp Oak Floodplain Forest include *Araujia sericiflora* (moth plant)*, Asparagus asparagoides* (bridal creeper), *Baccharis halimifolia* (groundsel bush)*, Cyperus eragrostis* (umbrella sedge)*, Cinnamomum camphora* (camphor laurel), *Conyza* spp. (fleabanes)*, Hydrocotyle bonariensis* (American pennywort), *Ipomoea cairica*, *I. purpurea* and *I. indica* (morning glories), *Lantana camara, Paspalum dilatatum* (paspalum), *Pennisetum clandestinum* (kikuyu) *Rubus fruticosis* agg. (blackberries), *Solanum pseudocapsicum* (Madeira winter cherry)*, S. nigrum* (black-berry nightshade)*, Tradescantia fluminensis* (wandering jew) and *Verbena bonariensis* (purpletop), (Tozer 2003, Keith and Scott 2005). In general, remaining examples of Swamp Oak Floodplain Forest from the most saline environments are in better condition, while those from less saline habitats are generally more degraded.

14. Small areas of Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions are contained within existing conservation reserves, including Stotts Island, Ukerebagh, Tuckean, Pambalong, Wamberal, Towra Point and Cullendulla Creek Nature Reserves and Bongil Bongil, Myall Lakes and Conjola National Parks. These occurrences are unevenly distributed throughout the range and unlikely to represent the full diversity of the community. In addition, wetlands within protected areas are exposed to hydrological changes that were, and continue to be initiated outside their boundaries. Some areas of Swamp Oak Floodplain Forest are protected by State Environmental Planning Policy 14, although this has not always precluded impacts on wetlands from the development of major infrastructure.

15. Given the dynamic hydrological relationship between Swamp Oak Floodplain Forest, Coastal Saltmarsh and other endangered ecological communities on coastal floodplains, future management of water and tidal flows may result in the expansion of some communities at the expense of others. Proposals for the restoration of natural hydrological regimes and for the rehabilitation of acid sulfate soils may also result in changes to the distribution and composition of floodplain communities. Co-ordinated planning and management approaches across whole catchments will be required to address and resolve priorities between different management objectives.

16. In view of the above the Scientific Committee is of the opinion that Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions is likely to become extinct in nature in New South Wales unless the circumstances and factors threatening its survival or evolutionary development cease to operate.

Associate Professor Paul Adam
Chairperson
Scientific Committee

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NSW Scientific Committee - Final determination

The Scientific Committee, established by the Threatened Species Conservation Act, has made a Final Determination to list Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions, as an ENDANGERED ECOLOGICAL COMMUNITY in Part 3 of Schedule 1 of the Act, and as a consequence to omit reference to Sydney Coastal Estuary Swamp Forest in the Sydney Basin bioregion from Part 3 of Schedule 1 of the Act. Listing of endangered ecological communities is provided for by Part 2 of the Act.
The Scientific Committee has found that:

1. Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is the name given to the ecological community associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. Floodplains are level landform patterns on which there may be active erosion and aggradation by channelled and overbank stream flow with an average recurrence interval of 100 years or less (adapted from Speight 1990). Swamp Sclerophyll Forest on Coastal Floodplains generally occurs below 20 m (though sometimes up to 50 m) elevation, often on small floodplains or where the larger floodplains adjoin lithic substrates or coastal sand plains in the NSW North Coast, Sydney Basin and South East Corner bioregions. The structure of the community is typically open forest, although partial clearing may have reduced the canopy to scattered trees. In some areas the tree stratum is low and dense, so that the community takes on the structure of scrub. The community also includes some areas of fernland and tall reedland or sedgeland, where trees are very sparse or absent. Typically these forests, scrubs, fernlands, reedlands and sedgelands form mosaics with other floodplain forest communities and treeless wetlands, and often they fringe treeless floodplain lagoons or wetlands with semi-permanent standing water (e.g. Pressey 1989a).

The composition of Swamp Sclerophyll Forest on Coastal Floodplains is primarily determined by the frequency and duration of waterlogging and the texture, salinity nutrient and moisture content of the soil. Composition also varies with latitude. The community is characterised by the following assemblage of species:

Acacia irrorata	*Acacia longifolia*
Acmena smithii	*Adiantum aethiopicum*
Allocasuarina littoralis	*Banksia oblongifolia*
Banksia spinulosa	*Baumea articulata*
Baumea juncea	*Blechnum camfieldii*
Blechnum indicum	*Breynia oblongifolia*
Callistemon salignus	*Calochlaena dubia*
Carex appressa	*Casuarina glauca*
Centella asiatica	*Dianella caerulea*
Dodonaea triquetra	*Elaeocarpus reticulatus*
Entolasia marginata	*Entolasia stricta*
Eucalyptus botryoides	*Eucalyptus longifolia*
Eucalyptus resinifera subsp. *hemilampra*	*Eucalyptus robusta*
Ficus coronata	*Gahnia clarkei*
Gahnia sieberiana	*Glochidion ferdinandi*
Glycine clandestina	*Gonocarpus tetragynus*
Hydrocotyle peduncularis	*Hypolepis muelleri*
Imperata cylindrica var. *major*	*Isachne globosa*
Leptospermum polygalifolium subsp. *polygalifolium*	*Livistona australis*
Lomandra longifolia	*Lophostemon suaveolens*
Melaeuca ericifolia	*Melaleuca linariifolia*
Melaleuca quinquenervia	*Melaleuca sieberi*
Melaleuca styphelioides	*Morinda jasminoides*
Omalanthus populifolius	*Oplismenus aemulus*
Oplismenus imbecillis	*Parsonsia straminea*
Phragmites australis	*Polyscias sambucifolia*
Pratia purpurascens	*Pteridium esculentum*
Stephania japonica var. *discolor*	*Themeda australis*
Villarsia exaltata	*Viola banksii*

Viola hederacea

2. The total species list of the community is considerably larger than that given above, with many species present at only one or two sites or in low abundance. The species composition of a site will be influenced by the size of the site, recent rainfall or drought conditions and by its disturbance (including fire, grazing, flooding and land clearing) history. The number and relative abundance of species will change with time since fire, flooding or significant rainfall, and may also change in response to changes in grazing regimes. At any one time, above-ground individuals of some species may be absent, but the species may be represented below ground in the soil seed banks or as dormant structures such as bulbs, corms, rhizomes, rootstocks or lignotubers. The list of species given above is of vascular plant species, the community also includes micro-organisms, fungi, cryptogamic plants and a diverse fauna, both vertebrate and invertebrate. These components of the community are poorly documented.

3. Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is known from parts of the Local Government Areas of Tweed, Byron, Lismore, Ballina, Richmond Valley, Clarence Valley, Coffs Harbour, Bellingen, Nambucca, Kempsey, Hastings, Greater Taree, Great Lakes and Port Stephens, Lake Macquarie, Wyong, Gosford, Hornsby, Pittwater, Warringah, Manly, Liverpool, Rockdale, Botany Bay, Randwick, Sutherland, Wollongong, Shellharbour, Kiama and Shoalhaven but may occur elsewhere in these bioregions. Bioregions are defined in Thackway and Creswell (1995). Major examples once occurred on the floodplains of the Tweed, Richmond, Clarence, Macleay, Hastings and Manning Rivers, although smaller floodplains would have also supported considerable areas of this community.

4. Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions has an open to dense tree layer of eucalypts and paperbarks, which may exceed 25 m in height, but can be considerably shorter in regrowth stands or under conditions of lower site quality. For example, stands dominated by *Melaleuca ericifolia* typically do not exceed 8 m in height. The most widespread and abundant dominant trees include *Eucalyptus robusta* (swamp mahogany), *Melaleuca quinquenervia* (paperbark) and, south from Sydney, *Eucalyptus botryoides* (bangalay) and *Eucalyptus longifolia* (woollybut). Other trees may be scattered throughout at low abundance or may be locally common at few sites, including *Callistemon salignus* (sweet willow bottlebrush), *Casuarina glauca* (swamp oak) and *Eucalyptus resinifera* subsp. *hemilampra* (red mahogany), *Livistona australis* (cabbage palm) and *Lophostemon suaveolens* (swamp turpentine). A layer of small trees may be present, including *Acacia irrorata* (green wattle), *Acmena smithii* (lilly pilly), *Elaeocarpus reticulatus* (blueberry ash), *Glochidion ferdinandi* (cheese tree), *Melaleuca linariifolia* and *M. styphelioides* (paperbarks). Shrubs include *Acacia longifolia* (Sydney golden wattle), *Dodonaea triquetra* (a hopbush), *Ficus coronata* (sandpaper fig), *Leptospermum polygalifolium* subsp. *polygalifolium* (lemon-scented tea tree) and *Melaleuca* spp. (paperbarks). Occasional vines include *Parsonsia straminea* (common silkpod), *Morinda jasminoides* and *Stephania japonica* var. *discolor* (snake vine). The groundcover is composed of abundant sedges, ferns, forbs, and grasses including *Gahnia clarkei, Pteridium esculentum* (bracken), *Hypolepis muelleri* (batswing fern), *Calochlaena dubia* (false bracken), *Dianella caerulea* (blue flax lily), *Viola hederacea, Lomandra longifolia* (spiny-headed mat-rush) and *Entolasia marginata* (bordered panic) and *Imperata cylindrica* var. *major* (blady grass). The endangered swamp orchids *Phaius australis* and *P. tankervillei* are found in this community. On sites downslope of lithic substrates or with soils of clay-loam texture, species such as *Allocasuarina littoralis* (black she-oak), *Banksia oblongifolia, B. spinulosa* (var. *collina* or var. *spinulosa*) (hairpin banksia), *Ptilothrix deusta* and *Themeda australis* (kangaroo grass), may also be present in the understorey. The composition and structure of the understorey is influenced by grazing and fire history, changes to hydrology and soil salinity and other disturbance, and may have a substantial component of exotic grasses, vines and forbs.

5. Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions provides habitat for a broad range of animals, including many that are dependent on trees for food, nesting or roosting (Law *et al*. 2000). The blossoms of *Eucalyptus robusta* and *Melaleuca quinquenervia* are also an important food source for the Grey-headed Flying Fox (*Pteropus poliocephalus*) and Common Blossom Bat (*Sycoyncteris australis*) (Law 1994), as well as the Yellow-bellied Glider (*Petaurus australis*), Sugar Glider (*Petaurus breviceps*), Regent Honeyeater (*Xanthomyza phrygia*) and Swift Parrot (*Lathamus discolor*). Other animals found in this community include the Osprey (*Pandion haliaetus*), Australasian Bittern (*Botaurus poiciloptilus*), Large-footed myotis (*Myotis adversus*), *Litoria olongburensis* and Wallum Froglet (*Crinia tinnula*).

6. Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions forms part of a complex of forested and treeless wetland communities found throughout the coastal floodplains of NSW. A recent analysis of available quadrat data from these

habitats identified a distinct grouping of vegetation samples attributable to this community (Keith and Scott 2005). The combination of features that distinguish Swamp Sclerophyll Forest on Coastal Floodplains from other endangered ecological communities on the coastal floodplains include: its relatively dense tree canopy dominated by *Eucalyptus robusta, Melaleuca quinquenervia* or *E. botryoides*, the relatively infrequent occurrence of other eucalypts, *Casuarina glauca* or *Lophostemon suaveolens*; the occasional presence of rainforest elements as scattered trees or understorey plants; and the prominence of large sedges and ferns in the groundcover. It generally occupies small alluvial flats and peripheral parts of floodplains where they adjoin lithic substrates or coastal sandplains. The soils are usually waterlogged, stained black or dark grey with humus, and show little influence of saline ground water.

7. Swamp Sclerophyll Forest on Coastal Floodplains includes and replaces Sydney Coastal Estuary Swamp Forest in the Sydney Basin bioregion. It may adjoin or intergrade with several other endangered ecological communities, which collectively cover all remaining native vegetation on the coastal floodplains of New South Wales. These include Lowland Rainforest on Floodplain in the NSW North Coast bioregion, River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (including the formerly listed Sydney Coastal River-Flat Forest in the Sydney Basin bioregion), Subtropical Floodplain Forest, Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions and Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions. For example, as soils become less waterlogged, Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions may adjoin or intergrade with River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions. As soil salinity increases Swamp Sclerophyll Forest on Coastal Floodplains may intergrade with, and be replaced by, Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions. The boundaries between these communities are dynamic and may shift in response to changes in hydrological regimes, fire regimes or land management practices (e.g. Johnston *et al.* 2003, Stevenson 2003). The Determinations for these communities collectively encompass the full range of intermediate assemblages in transitional habitats.

8. A number of vegetation surveys and mapping studies have been conducted across the range of Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions. This community includes the *Eucalyptus robusta* (Swamp Mahogany) community identified on coastal alluvium by Douglas and Anderson (2002) and the Coastal Alluvium Swamp Forest complex defined by Anderson and Asquith (2002). In the Comprehensive Regional Assessment of the north-eastern NSW (NPWS 1999), those areas on floodplains mapped as 'Forest Ecosystem 112, Paperbark', and those areas on floodplains mapped as 'Forest Ecosystem 142, Swamp Mahogany' are included within this community. On the Tweed lowlands, this community includes '*Eucalyptus robusta* mid-high to very tall closed forest' (F7), '*Archontophoenix cunninghamiana-Melaleuca quinquenervia* very tall feather palm swamp forest' (F9), those parts of *Melaleuca quinquenervia* tall to very tall open to closed forest' (F8) on alluvial soils and parts of 'Floodplain Wetland Complex' (FL) dominated by *Eucalyptus robusta* or *Melaleuca quinquenervia* (Pressey and Griffith 1992). In the lower Hunter district, this community includes 'Swamp Mahogany-Paperbark Swamp Forest' (map unit 37), Riparian Melaleuca Swamp Woodland (map unit 42) and Melaleuca Scrub (map unit 42a) of NPWS (2000). In the Sydney-Gosford region, this community includes those parts of 'Freshwater Swamp complex' (map unit 27a) dominated by *Eucalyptus robusta* or *E. botryoides* (Benson 1986, Benson and Howell 1994) and parts of the 'Freshwater wetlands – on the floodplains' of Benson and Howell (1990) and Benson et al. (1996). In the Illawarra, this community includes 'Alluvial swamp mahogany forest' (map unit 35) of NPWS (2002). On the south coast, this community includes 'Northern Coastal Lowlands Swamp Forest' (forest ecosystem 175) of Thomas *et al*. (2000) and 'Coastal Sand Swamp Forest' (map unit 45) of Tindall *et al*. (2004). Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is included within the 'Coastal Floodplain Wetlands' and 'Coastal Swamp Forest' vegetation classes of Keith (2002, 2004). There may be additional or unmapped occurrences of Swamp Sclerophyll Forest on Coastal Floodplains within and beyond these surveyed areas.

9. The extent of the Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions prior to European settlement has not been mapped across its entire range. However, one estimate estimate based on a compilation of regional vegetation maps suggests that Coastal Floodplain Wetlands, which include Swamp Sclerophyll Forest on Floodplains, currently cover 800-1400 km2, representing less than 30% of the original extent of this broadly defined vegetation class (Keith 2004). Compared to this combined estimate, the remaining area of Swamp Sclerophyll Forest on Coastal Floodplains is likely to be considerably smaller and is likely to represent much less than 30% of its original range. For example, there were less than 350 ha of native vegetation

attributable to this community on the Tweed lowlands in 1985 (Pressey and Griffith 1992), less than 2500 ha on the Clarence floodplain in 1982 (Pressey 1989a), less than 700 ha on the Macleay floodplain in 1983 (Pressey 1989b), up to 7000 ha in the lower Hunter – central coast district during the 1990s (NPWS 2000), and less than 1000 ha in the Sydney – South Coast region in the mid 1990s (Tindall *et al*. 2004), including less than 40 ha on the Illawarra plain in 2001 (NPWS 2002) and about 450 ha on the South Coast in the 1990s (Thomas *et al*. 2000).

10. Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions has been extensively cleared and modified. Large areas that formerly supported this community are occupied by exotic pastures grazed by cattle, market gardens, other cropping enterprises (e.g. sorghum, corn, poplars, etc.) and, on the far north coast, canefields. On the Tweed lowlands, Pressey and Griffith (1992) estimated that less than 3% of the original Floodplain Wetlands and Floodplain Forest remained in 1985. Similar estimates are likely to apply to Swamp Sclerophyll Forest on Coastal Floodplains in other parts of the NSW North Coast bioregion (Goodrick 1970, Pressey 1989a, 1989b). In the lower Hunter – central coast district, about 30 % of the original area of Swamp mahogany – paperbark forest was estimated to remain in the 1990s (NPWS 2000).

11. Land clearing continues to threaten Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions. A small minority of the remaining area occurs on public land (e.g. Pressey and Griffith 1992, NPWS 2000), with most occurring on productive agricultural land or in close proximity to rural centres. The remaining stands are severely fragmented by past clearing and further threatened by continuing fragmentation and degradation, flood mitigation and drainage works, landfilling and earthworks associated with urban and industrial development, pollution from urban and agricultural runoff, weed invasion, overgrazing, trampling and other soil disturbance by domestic livestock and feral animals including pigs, activation of 'acid sulfate soils', removal of dead wood and rubbish dumping (e.g. Pressey 1989a, b; Pressey and Griffith 1992, Boulton and Brock 1999, Johnston *et al*. 2003). Anthropogenic climate change may also threaten Swamp Sclerophyll Forest on Coastal Floodplains if future flooding regimes are affected (IPCC 2001, Hughes 2003). Localised areas, particularly those within urbanised regions, may also be exposed to frequent burning which reduces the diversity of woody plant species. Clearing of native vegetation; Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands; Invasion of native plant communities by exotic perennial grasses; Predation, habitat destruction, competition and disease transmission by feral pigs; Anthropogenic climate change; High frequency fire and Removal of dead wood and dead trees are listed as Key Threatening Processes under the Threatened Species Act (1995).

12. Large areas of habitat formerly occupied by Swamp Sclerophyll Forest on Coastal Floodplains have been directly drained by construction of artificial channels (e.g. Pressey 1989a, Boulton and Brock 1999). While much of the early drainage works were associated with agricultural development, more recently they are associated with urban expansion. Additional areas that have not been directly drained may have been altered hydrologically by changed patterns of flooding and drainage following flood mitigation works, particularly the construction of drains, levees and floodgates (Pressey and Griffith 1992). On the north coast of NSW, expansion of *Melaleuca quinquenervia* into open floodplain swamps has been attributed to artificial drainage and shortening of the hydroperiod (Johnston *et al*. 2003, Stevenson 2003). These changes appear to be closely associated with enhanced acidity, altered ionic ratios, increased dissolved organic carbon and sulfide oxidation in the soil profile (Johnston *et al*. 2003).

13. Relatively few examples of Swamp Sclerophyll Forest on Coastal Floodplains remain unaffected by weeds. The causes of weed invasion include physical disturbance to the vegetation structure of the community, dumping of landfill rubbish and garden refuse, polluted runoff from urban and agricultural areas, construction of roads and other utilities, and grazing by domestic livestock. The principal weed species affecting Swamp Sclerophyll Forest on Coastal Floodplains include *Andropogon virginicus* (whiskey grass), *Anredera cordifolia* (Madeira vine), *Ageratina adenophora* (crofton weed), *Baccharis halimifolia* (groundsel bush), *Cinnamomum camphora* (camphor laurel), *Lantana camara* (lantana), *Ligustrum sinense* (small-leaved privet), *Lonicera japonica* (Japanese honeysuckle) and *Ludwigia peruviana* (Keith and Scott 2005).

14. Small areas of Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions are contained within existing conservation reserves, including Bungawalbin, Tuckean and Moonee Beach Nature Reserves, and Hat Head, Crowdy Bay, Wallingat, Myall Lakes and Garigal National Parks. These occurrences are unevenly distributed throughout the range and unlikely to represent the full diversity of the community. In addition, wetlands within protected areas are exposed to hydrological changes that were, and continue to be initiated outside their boundaries. Some areas of Swamp Oak Floodplain Forest are protected by State Environmental Planning

Policy 14, although this has not always precluded impacts on wetlands from the development of major infrastructure.

15. Given the dynamic hydrological relationship between Swamp Sclerophyll Forest on Coastal Floodplains, Coastal Saltmarsh and other endangered ecological communities on coastal floodplains, future management of water and tidal flows may result in the expansion of some communities at the expense of others. Proposals for the restoration of natural hydrological regimes and for the rehabilitation of acid sulfate soils may also result in changes to the distribution and composition of floodplain communities. Co-ordinated planning and management approaches across whole catchments will be required to address and resolve priorities between different management objectives.

16. In view of the above the Scientific Committee is of the opinion that Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is likely to become extinct in nature in New South Wales unless the circumstances and factors threatening its survival or evolutionary development cease to operate.

Associate Professor Paul Adam
Chairperson
Scientific Committee

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NSW Scientific Committee - Final Determination

The Scientific Committee, established by the Threatened Species Conservation Act, has made a Final Determination to list River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions, as an ENDANGERED ECOLOGICAL COMMUNITY in Part 3 of Schedule 1 of the Act, and as a consequence to omit reference to Sydney Coastal River-Flat Forest from Part 3 of Schedule 1 of the Act. Listing of endangered ecological communities is provided for by Part 2 of the Act.
The Scientific Committee has found that:

1. River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is the name given to the ecological community associated with silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. Floodplains are level landform patterns on which there may be active erosion and aggradation by channelled and overbank stream flow with an average recurrence interval of 100 years or less (adapted from Speight 1990). River-Flat Eucalypt Forest on Coastal Floodplains generally occurs below 50 m elevation, but may occur on localised river flats up to 250 m above sea level in the NSW North Coast, Sydney Basin and South East Corner bioregions. The structure of the community may vary from tall open forests to woodlands, although partial clearing may have reduced the canopy to scattered trees. Typically these forests and woodlands form mosaics with other floodplain forest communities and treeless wetlands, and often they fringe treeless floodplain lagoons or wetlands with semi-permanent standing water (e.g. Goodrick 1970).

The composition of River-Flat Eucalypt Forest on Coastal Floodplains is primarily determined by the frequency and duration of waterlogging and the texture, nutrient and moisture content of the soil. Composition also varies with latitude. The community is characterised by the following assemblage of species:

Acacia floribunda	*Acacia parramattensis*
Acmena smithii	*Adiantum aethiopicum*
Angophora floribunda	*Angophora subvelutina*
Austrostipa ramosissima	*Backhousia myrtifolia*
Breynia oblongifolia	*Bursaria spinosa*
Casuarina cunninghamiana subsp. *cunninghamiana*	*Casuarina glauca*
Cayratia clematidea	*Centella asiatica*
Cheilanthes sieberi subsp. *sieberi*	*Clematis aristata*
Clematis glycinoides	*Commelina cyanea*
Cymbopogon refractus	*Desmodium varians*
Dichelachne micrantha	*Dichondra repens*
Digitaria parviflora	*Doodia aspera*
Echinopogon caespitosus var. *caespitosus*	*Echinopogon ovatus*
Einadia hastata	*Einadia trigonos*
Entolasia marginata	*Entolasia stricta*
Eragrostis leptostachya	*Eucalyptus amplifolia*
Eucalyptus baueriana	*Eucalyptus benthamii*
Eucalyptus botryoides	*Eucalyptus elata*
Eucalyptus grandis	*Eucalyptus longifolia*
Eucalyptus moluccana	*Eucalyptus ovata*
Eucalyptus saligna	*Eucalyptus tereticornis*
Eucalyptus viminalis	*Euchiton sphaericus*
Eustrephus latifolius	*Galium propinquum*
Geitonoplesium cymosum	*Geranium solanderi*
Glycine clandestina	*Glycine microphylla*
Glycine tabacina	*Hardenbergia violacea*
Hydrocotyle peduncularis	*Hymenanthera dentata*
Hypolepis muelleri	*Imperata cylindrica* var. *major*
Livistona australis	*Lomandra filiformis*
Lomandra longifolia	*Lomandra multiflora* subsp. *multiflora*
Melaleuca decora	*Melaleuca linariifolia*
Melaleuca styphelioides	*Melia azedarach*

Microlaena stipoides var. *stipoides*
Oplismenus aemulus
Ozothamnus diosmifolius
Paspalidium distans
Phyllanthus gunnii
Poranthera microphylla
Pteridium esculentum
Sigesbeckia orientalis subsp. *orientalis*
Stephania japonica var. *discolor*
Trema aspera
Vernonia cinerea
Viola hederacea
Opercularia diphylla
Oxalis perennans
Pandorea pandorana
Persicaria decipiens
Plectranthus parviflorus
Pratia purpurascens
Rubus parvifolius
Solanum prinophyllum
Themeda australis
Tristaniopsis laurina
Veronica plebeia
Wahlenbergia gracilis

2. The total species list of the community is considerably larger than that given above, with many species present at only one or two sites or in low abundance. The species composition of a site will be influenced by the size of the site, recent rainfall or drought conditions and by its disturbance (including fire, grazing, flooding and land clearing) history. The number and relative abundance of species will change with time since fire, flooding or significant rainfall, and may also change in response to changes in grazing regimes. At any one time, above-ground individuals of some species may be absent, but the species may be represented below ground in the soil seed banks or as dormant structures such as bulbs, corms, rhizomes, rootstocks or lignotubers. The list of species given above is of vascular plant species, the community also includes micro-organisms, fungi, cryptogamic plants and a diverse fauna, both vertebrate and invertebrate. These components of the community are poorly documented.

3. River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is known from parts of the Local Government Areas of Port Stephens, Maitland, Singleton, Cessnock, Lake Macquarie, Wyong, Gosford, Hawkesbury, Baulkham Hills, Blacktown, Parramatta, Penrith, Blue Mountains, Fairfield, Holroyd, Liverpool, Bankstown, Wollondilly, Camden, Campbelltown, Sutherland, Wollongong, Shellharbour, Kiama, Shoalhaven, Eastern Capital City Regional, Eurobodalla and Bega Valley but may occur elsewhere in these bioregions. Bioregions are defined in Thackway and Creswell (1995). Major examples once occurred on the floodplains of the Hunter, Hawkesbury, Moruya, Bega and Towamba Rivers, although many smaller floodplains and river flats also contain examples of the community.

4. River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions has a tall open tree layer of eucalypts, which may exceed 40 m in height, but can be considerably shorter in regrowth stands or under conditions of lower site quality. While the composition of the tree stratum varies considerably, the most widespread and abundant dominant trees include *Eucalyptus tereticornis* (forest red gum), *E. amplifolia* (cabbage gum), *Angophora floribunda* (rough-barked apple) and *A. subvelutina* (broad-leaved apple). *Eucalyptus baueriana* (blue box), *E. botryoides* (bangalay) and *E. elata* (river perppermint) may be common south from Sydney, *E. ovat*a (swamp gum) occurs on the far south coast, *E. saligna* (Sydney blue gum) and *E. grandis* (flooded gum) may occur north of Sydney, while *E. benthamii* is restricted to the Hawkesbury floodplain. Other eucalypts including *Eucalyptus longifolia* (woollybutt), *E. moluccana* (grey box) and *E. viminalis* (ribbon gum) may be present in low abundance or dominant in limited areas of the distribution. A layer of small trees may be present, including *Melaleuca decora, M. styphelioides* (prickly-leaved teatree), *Backhousia myrtifolia* (grey myrtle), *Melia azaderach* (white cedar), *Casuarina cunninghamiana* subsp. *cunninghamiana* (river oak) and *C. glauca* (swamp oak). Scattered shrubs include *Bursaria spinosa* subsp. *spinosa* (blackthorn), *Solanum prinophyllum* (forest nightshade), *Rubus parvifolius* (native raspberry), *Breynia oblongifolia* (coffee bush), *Ozothamnus diosmifolius, Hymenanthera dentata* (tree violet), *Acacia floribunda* (white sally) and *Phyllanthus gunnii*. The groundcover is composed of abundant forbs, scramblers and grasses including *Microlaena stipoides* (weeping grass), *Dichondra repens* (kidney weed), *Glycine clandestina, Oplismenus aemulus, Desmodium gunnii, Pratia purpurascens* (whiteroot), *Entolasia marginata* (bordered panic), *Oxalis perennans* and *Veronica plebeia* (trailing speedwell). The composition and structure of the understorey is influenced by grazing and fire history, changes to hydrology and soil salinity and other disturbance, and may have a substantial component of exotic shrubs, grasses, vines and forbs.

5. River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions provides habitat for a broad range of animals, including many that are dependent on trees for food, nesting or roosting (Law *et al*. 2000a, b). These include cormorants (*Phalacrocorax* spp.) and egrets (*Ardea* spp. and *Egrettia* spp.), the Osprey (*Pandion haliaetus*), Whistling Kite (*Haliastur sphenurus*), White-bellied Sea-eagle (*Haliaeetus leucogaster*), as well as the Brush-tailed Phascogale (*Phascogale tapoatafa*), Yellow-bellied Glider (*Petaurus australis*), Squirrel Glider (*Petaurus norfolcensis*)

(Law *et al*. 2000a), Sugar Glider (*Petaurus breviceps*) and Grey-headed Flying Fox (*Pteropus poliocephalus*). The fauna of River-Flat Eucalypt Forest also includes a number of species of frogs in the families Myobatrachidae and Hylidae, particularly *Litoria* spp., and many species of forest birds including honeyeaters, kingfishers, cuckoos, owls, doves, whistlers and fantails.

6. River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions forms part of a complex of forested wetland and treeless wetland communities found throughout the coastal floodplains of NSW. A recent analysis of available quadrat data from these habitats identified a distinct grouping of vegetation samples attributable to this community (Keith and Scott 2005). The combination of features that distinguish River-Flat Eucalypt Forest on Coastal Floodplains from other endangered communities on the coastal floodplains include: its dominance by either a mixed eucalypt canopy or by a single species of eucalypt belonging to either the genus *Angophora* or the sections *Exsertaria* or *Transversaria* of the genus *Eucalyptus* (Hill 2002); the relatively low abundance or sub-dominance of *Casuarina* and *Melaleuca* species; the relatively low abundance of *Eucalyptus robusta*; and the prominent groundcover of soft-leaved forbs and grasses. It generally occupies central parts of floodplains and raised levees; habitats where flooding is periodic and soils are rich in silt, without deep humic horizons and show little or no influence of saline ground water.

7. River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions includes and replaces Sydney Coastal River-Flat Forest Endangered Ecological Community. River-Flat Eucalypt Forest on Coastal Floodplains may adjoin or intergrade with several other endangered ecological communities, which collectively cover all remaining native vegetation on the coastal floodplains of New South Wales. These include Lowland Rainforest on Floodplain in the NSW North Coast bioregion, Subtropical Floodplain Forest of the NSW North Coast bioregion, Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (including the formerly listed Sydney Coastal Estuary Swamp Forest in the Sydney Basin bioregion), Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions and Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions. For example, northwards from the Hunter valley, River-Flat Eucalypt Forest on Coastal Floodplains may intergrade with, or be replaced by, Subtropical Floodplain Forest of the NSW North Coast bioregion. As soil salinity increases, River-Flat Eucalypt Forest may adjoin or intergrade with Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions. The boundaries between all of these communities are dynamic and may shift in response to changes in hydrological regimes, fire regimes or land management practices. The Determinations for these communities collectively encompass the full range of intermediate assemblages in transitional habitats.

8. A number of vegetation surveys and mapping studies have been conducted across the range of River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions. In the Comprehensive Regional Assessment of the north-eastern NSW (NPWS 1999), areas that were mapped on coastal floodplains of the Manning River as 'Forest Ecosystem 47, Escarpment Red Gums' are included within this community. In the lower Hunter valley, 'Central Hunter Riparian Forest' (map unit 13), 'Wollombi Redgum-River Oak Woodland' (map unit 14) and 'Redgum Roughbarked Apple Swamp Forest' (map unit 38) of NPWS (2000) fall within this community. On the Cumberland Plain, 'Riparian Forest' (map unit 12) of Tozer (2003) and parts of 'Alluvial Woodland' (map unit 11) that are dominated by eucalypts (Tozer 2003) are included within this community. Benson's (1992) 'Camden White Gum Forest' (map unit 6d) and those parts of 'River Flat Forest' (map unit 9f) dominated by eucalypts also fall within this community, as do parts of the 'River-flat forests' of Benson and Howell (1990) and Benson *et al.* (1996) that are dominated by eucalypts. In the Warragamba catchment, small areas of 'Burragorang River Flat Forest' (map unit 88b) and 'Oakdale Alluvial Rough-barked Apple Forest' (map unit 88c) of NPWS (2002) are included within this community. On the south coast of NSW, this community includes those parts of 'Ecotonal Coastal Swamp Forest' (forest ecosystem 27) of Thomas *et al.* (2000) dominated by eucalypts, those parts of 'Coastal Lowlands Riparian Herb/Grass Forest' (forest ecosystem 48) and 'Southern Hinterland Shrub/Herb/Grass Riparian Forest' (forest ecosystem 49) of Thomas *et al*. (2000) mapped on alluvial soils, and those parts of 'Cumberland River Flat Forest' (map unit 33) and 'Floodplain Swamp Forest' (map unit 105) of Tindall et al. (2004) that are dominated by eucalypts. In the Eden region, this community includes forested parts of 'Floodplain Wetlands' (map unit 60) that are dominated by eucalypts and parts of 'Bega Wet Shrub Forest' (map unit 19) that are mapped on floodplains (Keith and Bedward 1999). River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is included within the 'Coastal Floodplain Wetlands' vegetation class of Keith (2002, 2004). There may be additional or unmapped occurrences of River-Flat Eucalypt Forest on Coastal Floodplains within and beyond these surveyed areas.

9. The extent of the River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions prior to European settlement has not been mapped across its entire range. However, one estimate based on a compilation of regional vegetation maps suggests that Coastal Floodplain Wetlands, which include Temperate Eucalypt Forest on Coastal Floodplains, currently cover 800-1400 km2, representing less than 30% of the original extent of this broadly defined vegetation class (Keith 2004). Compared to this combined estimate, the remaining area of River-Flat Eucalypt Forest on Coastal Floodplains is likely to be considerably smaller and is likely to represent much less than 30% of its original range. Major occurrences include: about 2000 ha in the lower Hunter region in 1990s (NPWS 2000); less than 10 000 ha on the NSW south coast from Sydney to Moruya in the mid 1990s (Tindall et al. 2004), of which up to about three-quarters occurred on the Cumberland Plain in 1998 (Tozer 2003); and less than 1000 ha in the Eden region in 1990 (Keith and Bedward 1999).

10. River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions has been extensively cleared and modified. Large areas that formerly supported this community are occupied by exotic pastures grazed by cattle, market gardens and other cropping enterprises (e.g. turf). In the lower Hunter region, about one-quarter of the original extent was estimated to have remained during the 1990s (NPWS 2000), while less than one-quarter remained on the Cumberland Plain in 1998 (Tozer 2003). In the Sydney – South Coast region, less than one-fifth was estimated to remain in the late 1990s (Tindall et al. 2004), in the Eden region about 30% was estimated to remain during the 1990s (Keith and Bedward 1999).

11. Land clearing continues to threaten River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions. A small minority of the remaining area occurs on public land (e.g. Benson and Howell 1990), with most occurring on productive agricultural land or in close proximity to rural centres. The remaining stands are severely fragmented by past clearing and are further threatened by continuing fragmentation and degradation, flood mitigation and drainage works, landfilling and earthworks associated with urban and industrial development, pollution from urban and agricultural runoff, weed invasion, overgrazing, trampling and other soil disturbance by domestic livestock and feral animals including pigs, activation of 'acid sulfate soils', removal of dead wood and rubbish dumping (e.g. Benson and Howell 1990, Boulton and Brock 1999, Johnston *et al*. 2003). Anthropogenic climate change may also threaten River-Flat Eucalypt Forest on Coastal Floodplains if this affects future flooding regimes (IPCC 2001, Hughes 2003). Localised areas, particularly those within urbanised regions, may also be exposed to frequent burning which reduces the diversity of woody plant species. Clearing of native vegetation; Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands; Invasion of native plant communities by exotic perennial grasses; Predation, habitat destruction, competition and disease transmission by feral pigs; Anthropogenic climate change; High frequency fire; and Removal of dead wood and dead trees are listed as Key Threatening Processes under the Threatened Species Conservation Act (1995).

12. Very few examples of River-Flat Eucalypt Forest on Coastal Floodplains remain unaffected by weeds. The causes of weed invasion include physical disturbance to the vegetation structure of the community, dumping of landfill rubbish and garden refuse, polluted runoff from urban and agricultural areas, construction of roads and other utilities, and grazing by domestic livestock. The principal weed species affecting River-Flat Eucalypt Forest on Coastal Floodplains include *Anredera cordifolia* (madeira vine), *Araujia sericiflora* (moth plant), *Asparagus asparagoides* (bridal creeper), *Axonopus fissifolius* (narrow-leaved carpet grass), *Bidens pilosa* (cobbler's peg), *Cardiospermum grandiflorum* (balloon vine), *Cirsium vulgare* (spear thistle), *Conyza bonariensis* (flaxleaf fleabane), *C. sumatrensis* (tall fleabane), *Gleditsea triacanthos* (honey locust), *Hypochaeris radicata* (catsear), *Ipomoea* spp. (morning glories), *Lantana camara* (lantana), *Ligustrum lucidum* (large-leaved privet), *L. sinense* (small-leaved privet), *Lonicera japonica* (Japanese honeysuckle), *Macfaydyena unguis-cati* (cat's claw creeper), *Olea europea* subsp. *cuspidata* (African olive), *Plantago lanceolata* (plantain), *Rubus* fruticosis agg. (blackberries), *Senecio madagascariensis* (fireweed), *Senna pendula* var. *glabrata, Setaria parviflora* (slender pigeon grass), *Sida rhombifolia* (paddy's lucerne), *Sonchus oleraceus* (common sowthistle), *Tradescantia fluminensis* (wandering jew), *Verbena bonariensis* (purpletop), *Paspalum dilatatum* (paspalum), *P. urvillei* and *Pennisetum clandestinum* (kikuyu) (Tozer 2003, Keith and Scott 2005, J. R. Hosking, pers. comm.).

13. Small areas of River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions are contained within existing conservation reserves, including Blue Mountains, Cattai, Dharug, Georges River, Marramarra, Morton, Deua and Wadbilliga National Parks, and Gulguer and Mulgoa Nature Reserves, and these are unevenly distributed throughout the range and unlikely to represent the full diversity of the community. The reserved examples are on

localised, sheltered river flats between hills, rather than the large open floodplains that comprised the majority of the original habitat (Keith 2004).

14. In view of the above the Scientific Committee is of the opinion that River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is likely to become extinct in nature in New South Wales unless the circumstances and factors threatening its survival or evolutionary development cease to operate.

Associate Professor Paul Adam
Chairperson
Scientific Committee

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NSW Scientific Committee - Final Determination

The Scientific Committee, established by the Threatened Species Conservation Act, has made a Final Determination to list Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions, as an ENDANGERED ECOLOGICAL COMMUNITY in Part 3 of Schedule 1 of the Act. Listing of endangered ecological communities is provided for by Part 2 of the Act. The Scientific Committee has found that:

1. Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is the name given to the ecological community associated with periodic or semi-permanent inundation by freshwater, although there may be minor saline influence in some wetlands. They typically occur on silts, muds or humic loams in depressions, flats, drainage lines, backswamps, lagoons and lakes associated with coastal floodplains. Floodplains are level landform patterns on which there may be active erosion and aggradation by channelled and overbank stream flow with an average recurrence interval of 100 years or less (adapted from Speight 1990). Freshwater Wetlands on Coastal Floodplains generally occur below 20 m elevation in the NSW North Coast, Sydney Basin and South East Corner bioregions. The structure of the community may vary from sedgelands and reedlands to herbfields, and woody species of plants are generally scarce. Typically these wetlands form mosaics with other floodplain communities, and often they include or are associated with ephemeral or semi-permanent standing water (e.g. Goodrick 1970).

The composition of Freshwater Wetlands on Coastal Floodplains is primarily determined by the frequency, duration and depth of waterlogging and may be influenced by the level of nutrients and salinity in the water and substrate. The community is characterised by the following assemblage of species:

Alisma plantago-aquatica	*Azolla filiculoides* var. *rubra*
Azolla pinnata	*Baumea articulata*
Baumea rubiginosa	*Bolboschoenus caldwellii*
Bolboschoenus fluviatilis	*Brasenia schreiberi*
Carex appressa	*Centipeda minima*
Ceratophyllum demersum	*Cyperus lucidus*
Eclipta platyglossa	*Eclipta prostrata*
Eleocharis acuta	*Eleocharis equisetina*
Eleocharis minuta	*Eleocharis sphacelata*
Fimbristylis dichotoma	*Gratiola pedunculata*
Hemarthria uncinata	*Hydrilla verticillata*
Hydrocharis dubia	*Juncus polyanthemos*
Juncus usitatus	*Leersia hexandra*
Lemna spp.	*Lepironia articulata*
Ludwigia peploides subsp. *montevidensis*	*Marsilea mutica*
Maundia triglochinoides	*Myriophyllum crispatum*
Myriophyllum latifolium	*Myriophyllum propinquum*
Myriophyllum variifolium	*Najas marina*
Najas tenuifolia	*Nymphaea gigantea*
Nymphoides geminata	*Nymphoides indica*
Ottelia ovalifolia	*Panicum obseptum*
Panicum vaginatum	*Paspalum distichum*
Persicaria attenuata	*Persicaria decipiens*
Persicaria hydropiper	*Persicaria lapathifolia*
Persicaria strigosa	*Philydrum lanuginosum*
Phragmites australis	*Potamogeton crispus*
Potamogeton ochreatus	*Potamogeton perfoliatus*
Potamogeton tricarinatus	*Pseudoraphis spinescens*
Ranunculus inundatus	*Schoenoplectus litoralis*
Schoenoplectus mucronatus	*Schoenoplectus validus*
Spirodella spp.	*Triglochin procera* sensu lato
Typha orientalis	*Utricularia australis*
Vallisneria spp.	*Wolffia* spp.

2. The total species list of the community is considerably larger than that given above, with many species present at only one or two sites or in low abundance. The species composition of a site will be influenced

by the size of the site, recent rainfall or drought conditions and by its disturbance history (including grazing, flooding, land clearing and pollution in the catchment). The number and relative abundance of species will change with time since flooding or significant rainfall, and may also change in response to changes in grazing regimes and land use in the catchment. At any one time, above-ground individuals of some species may be absent, but the species may be represented below ground in the soil seed banks or as dormant structures such as bulbs, corms, rhizomes, rootstocks or lignotubers. The list of species given above is of vascular plant species, the community also includes micro-organisms, fungi, cryptogamic plants and a diverse fauna, both vertebrate and invertebrate. These components of the community are poorly documented.

3. Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is known from parts of the Local Government Areas of Tweed, Byron, Lismore, Ballina, Richmond Valley, Clarence Valley, Coffs Harbour, Bellingen, Nambucca, Kempsey, Hastings, Greater Taree, Great Lakes, Port Stephens, Maitland, Newcastle, Cessnock, Lake Macquarie, Wyong, Gosford, Hawkesbury, Baulkham Hills, Blacktown, Penrith, Fairfield, Liverpool, Wollondilly, Camden, Campbelltown, Wollongong, Shellharbour, Kiama, Shoalhaven, Eurobodalla and Bega Valley but may occur elsewhere in these bioregions. Bioregions are defined in Thackway and Creswell (1995). Examples include Swan Bay, Gundurimba wetland, Bungawalbin Swamp, Dyraaba Creek and Tuckean Swamp on the Richmond floodplain; Southgate wetlands and Trenayr Swamp on the Clarence floodplain; Seven Oaks Swamp, Swan Pool, Kinchela Creek and Upper Belmore Swamp on the Macleay floodplain; Great Swamp on the Manning floodplain; Wentworth Swamp, Hexham Swamp, Wallis Creek and Ellalong Lagoon on the Hunter floodplain; Bushells, Pitt Town, Long Neck and Broadwater Lagoons on the Hawkesbury floodplain; Coomonderry Swamp on the Shoalhaven floodplain; Pedro and Old Man Bed Swamps on the Moruya floodplain; and Jellat Jellat Swamp on the Bega floodplain (Goodrick 1970).

4. Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is dominated by herbaceous plants and have very few woody species. The structure and composition of the community varies both spatially and temporally depending on the water regime (Yen and Myerscough 1989, Boulton and Brock 1999). Wetlands or parts of wetlands that lack standing water most of the time are usually dominated by dense grassland or sedgeland vegetation, often forming a turf less than 0.5 metre tall and dominated by amphibious plants including *Paspalum distichum* (water couch), *Leersia hexandra* (swamp rice-grass), *Pseudoraphis spinescens* (mud grass) and *Carex appressa* (tussock sedge). Wetlands or parts of wetlands subject to regular inundation and drying may include large emergent sedges over 1 metre tall, such as *Baumea articulata, Eleocharis equisetina* and *Lepironia articulata*, as well as emergent or floating herbs such as *Hydrocharis dubia* (frogbit), *Philydrum lanuginosum* (frogsmouth), *Ludwigia peploides* subsp. *montevidensis* (water primrose), *Marsilea mutica* (nardoo) and *Myriophyllum* spp. (milfoils). As standing water becomes deeper or more permanent, amphibious and emergent plants become less abundant, while floating and submerged aquatic herbs become more abundant. These latter species include *Azolla filiculoides* var. *rubra*, *Ceratophyllum demersum* (hornwort), *Hydrilla verticillata* (water thyme), *Lemna* spp. (duckweeds), *Nymphaea gigantea* (giant waterlily), *Nymphoides indica* (water snowflake), *Ottelia ovalifolia* (swamp lily) and *Potamageton* spp. (pondweeds). The threatened aquatic plants, *Aldrovanda vesiculosa* and *Najas marina*, also occur within this community. The composition and structure of the vegetation is also influenced by grazing history, changes to hydrology and soil salinity, catchment runoff and disturbance, and may have a substantial component of exotic grasses and forbs. Artificial wetlands created on previously dry land specifically for purposes such as sewerage treatment, stormwater management and farm production, are not regarded as part of this community, although they may provide habitat for threatened species.

5. Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions has a distinctive fauna that includes frogs, fish, freshwater tortoises, waterbirds and a diversity of micro- and macro-invertebrates. The frog families represented are Myobatrachidae (southern frogs) and Hylidae (tree frogs), including the threatened Green and Golden Bell Frog (*Litoria aurea*). Waterbirds include Black Swan (*Cygnus atratus*), Pacific Black Duck (*Anas superciliosa*), Australian Grey Teal (*Anas gracilis*), Pacific Heron (*Ardea pacifica*), White-faced Heron (*Ardea novaehollandiae*), Great Egret (*Ardea alba*), Intermediate Egret (*Ardea intermedia*), Little Egret (Ardea garzetta), Straw-necked Ibis (*Threskiornis spinicollis*), Sacred Ibis (*Threskiornis aethiopica*), Black-necked Stork (*Ephippiorhynchus asiaticus*), Royal Spoonbill (*Platalea regia*), Yellow-billed Spoonbill (*Platalea flavipes*), Japanese Snipe (*Gallinago hardwickii*), Black-winged Stilt (*Himantopus himantopus*), Dusky Moorhen (*Gallinula tenebrosa*), Comb-crested jacana (*Jacana gallinacea*) and Purple swamphen (*Porphyrio porphyrio*).

6. Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions forms part of a complex of forested wetland and treeless wetland communities found

throughout the coastal floodplains of NSW. A recent analysis of available quadrat data from these habitats identified several types of forested wetlands that are distinct from this treeless wetland community (Keith and Scott 2005). The combination of features that distinguish Freshwater Wetlands on Coastal Floodplains from other endangered ecological communities on the coastal floodplains include its scarcity or complete absence of woody plant species and the presence of amphibious, emergent, floating or submerged aquatic forbs, grasses or sedges. It generally occupies low-lying parts of floodplains, alluvial flats, depressions, drainage lines, backswamps, lagoons and lakes; habitats where flooding is periodic and standing fresh water persists for at least part of the year in most years. The community also occurs in backbarrier landforms where floodplains adjoin coastal sandplains (e.g. Pressey and Griffith 1992). However, it is distinct from Sydney Freshwater Wetlands, which may include a component of woody plant species and are associated with sandplains in the Sydney Basin bioregion.

7. Freshwater Wetlands on Coastal Floodplains may adjoin or intergrade with several other endangered ecological communities, which collectively cover all remaining native vegetation on the coastal floodplains of New South Wales. These include Lowland Rainforest on Floodplain in the NSW North Coast bioregion, Subtropical Floodplain Forest of the NSW North Coast bioregion, River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (including the formerly listed Sydney Coastal River-flat Forest in the Sydney Basin bioregion), Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (including the formerly listed Sydney Coastal Estuary Swamp Forest Complex in the Sydney Basin bioregion) and Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions. For example, Freshwater Wetlands on Coastal Floodplains are sometimes fringed by trees, such as *Casuarina glauca* (swamp oak) and *Melaleuca quinquenervia* (paperbark), indicating transitional zones to forested communities of the floodplains. The boundaries between these communities are dynamic and may shift in response to changes in hydrological regimes, fire regimes or land management practices (e.g. Johnston *et al.* 2003, Stevenson 2003). In addition, Freshwater Wetlands on Coastal Floodplains may adjoin or intergrade with Coastal Saltmarsh of the NSW North Coast, Sydney Basin and South East Corner bioregions and Sydney Freshwater Wetlands of the Sydney Basin bioregion. The Determinations for these communities collectively encompass the full range of intermediate assemblages.

8. A number of vegetation surveys and mapping studies have been conducted across the range of Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions. This community includes 'Fresh meadows', Seasonal fresh swamps', 'Semi-permanent fresh swamps', and 'Open fresh waters' in the general coastal wetlands classification of Goodrick (1970). In the Tweed valley lowlands, this community includes '*Eleocharis equisetina* tall closed sedgeland' (E2) and '*Triglochin procera* tall forbland to tall open forbland' (E3) of Pressey and Griffith (1992) and parts of the 'Floodplain Wetland Complex' (FL) that are dominated by herbaceous plants (Pressey and Griffith 1992). In the lower Hunter valley, 'Freshwater Wetland Complex' (map unit 46) of NPWS (2000) falls within this community. In the Sydney region, this community includes 'Freshwater wetlands on the floodplains' of Benson and Howell (1990); 'Freshwater reed swamps' (map unit 28a) of Benson (1992) and Ryan *et al.* (1996) in the Penrith-St Albans district; '*Lepironia* freshwater swamp' (map unit 75 and part of map unit 79) of NPWS (2002a) in the Warragamba area; and 'Freshwater wetlands' (map unit 36) of Tozer (2003) on the Cumberland Plain. On the Illawarra plain, this community includes 'Floodplain Wetland' (map unit 54) of NPWS (2002b). In the Comprehensive Regional Assessment of southern New South Wales (Thomas et al. 2000), this community includes 'Coastal alluvial valley floor wetlands' (map unit 189). This community also includes those parts of 'Coastal freshwater lagoon' (map unit 313) of Tindall et al. (2004), on the south coast of NSW, and parts of 'Floodplain Wetlands' (map unit 60) of Keith and Bedward (1999), in the Eden region, that are dominated by herbaceous aquatic plants. Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is included within the 'Coastal Freshwater Lagoons' vegetation class of Keith (2002, 2004). There may be additional or unmapped occurrences of Freshwater Wetlands on Coastal Floodplains within and beyond these surveyed areas.

9. The extent of the Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions prior to European settlement has not been mapped across its entire range. Estimates of wetland area also vary, depending on the scale of mapping (coarse scale maps may exclude many small wetlands), wetland definition and the occurrence of recent flooding. Mapping carried out by Kingsford *et al.* (2004), for example, focused on areas of open water and thus excluded many wetlands attributable to this community. One estimate based on a compilation of regional vegetation maps suggests that Coastal Freshwater Lagoons, which include Freshwater Wetlands on Coastal Floodplains, currently cover 90-160 km2, representing less than 60-90% of the original extent of this broadly defined vegetation class (Keith 2004). However, the remaining area of Freshwater Wetlands on

Coastal Floodplains is likely to represent much less than 60-90% of its original range, because this combined estimate for the Coastal Freshwater Wetlands class (Keith 2004) is likely to include a considerable area of freshwater wetlands on coastal sandplains, which are excluded from this Determination. Goodrick (1970) estimated that approximately 21 700 ha of 'Fresh meadows', 'Seasonal fresh swamps', 'Semi-permanent fresh swamps', and 'Open fresh waters' remained on NSW coastal floodplains in 1969, representing less than 39% of their original area. Continued clearing and drainage works in the 35 years since Goodrick's (1970) survey are likely to have resulted in a substantial diminution of Freshwater Wetlands on Coastal Floodplains. More detailed surveys have identified the following areas attributable to Freshwater Wetlands on Coastal Floodplains: less than 150 ha on the Tweed lowlands in 1985 (Pressey and Griffith 1992); about 10 600 ha on the lower Clarence floodplain in 1982 (Pressey 1989a); about 11 200 ha on the lower Macleay floodplain in 1983 (Pressey 1989b); about 3500 ha in the lower Hunter – central Hunter region in 1990s (NPWS 2000); less than 2700 ha on the NSW south coast from Sydney to Moruya in the mid 1990s (Tindall *et al*. 2004), including about 660 ha on the Cumberland Plain in 1998 (Tozer 2003) and about 100 ha on the Illawarra Plain in 2001 (NPWS 2002); and less than 1000 ha in the Eden region in 1990 (Keith and Bedward 1999). The wetlands included in these estimates exist in various states of modification.

10. Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions has been extensively cleared and modified. Large areas that formerly supported this community are occupied by exotic pastures grazed by cattle, market gardens, other cropping enterprises (e.g. sorghum, corn, poplars, etc.) and, on the far north coast, canefields. On the Tweed lowlands, Pressey and Griffith (1992) estimated that less than 3% of the original Floodplain Wetlands remained in 1985. Similar estimates are likely to apply to Freshwater Wetlands on Coastal Floodplains in other parts of the NSW North Coast bioregion (Pressey 1989a, 1989b). In the lower Hunter – central coast region, about two-thirds was estimated to have remained during the 1990s (NPWS 2000), while approximately 40% remained on the Cumberland Plain in 1998 (Tozer 2003). In the Sydney – South Coast region, about 70% was estimated to remain in the mid 1990s (Tindall *et al*. 2004), in the Eden region about 30% was estimated to remain during the 1990s (Keith and Bedward 1999).

11. Land clearing continues to threaten Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions. A small minority of the remaining area occurs on public land (e.g. Pressey 1989a, b; Pressey and Griffith 1992), with most occurring on productive agricultural land or in close proximity to rural centres. The remaining stands are severely fragmented by past clearing and are further threatened by continuing fragmentation and degradation, flood mitigation and drainage works, filling associated with urban and industrial development, pollution and eutrophication from urban and agricultural runoff, weed invasion, overgrazing, trampling by livestock, soil disturbance by pigs, activation of 'acid sulfate soils' and rubbish dumping (e.g. Goodrick 1970; Pressey 1989a, b; Pressey and Griffith 1992; Boulton and Brock 1999, Johnston *et al*. 2003). The native fauna of Freshwater Wetlands on Coastal Floodplains is threatened by predation, particularly by mosquito fish and cane toads. Anthropogenic climate change may also threaten Freshwater Wetlands on Coastal Floodplains if sea levels rise and future flooding regimes change as predicted (IPCC 2001; Hughes 2003). Clearing of native vegetation; Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands; Invasion of native plant communities by exotic perennial grasses; Predation, habitat destruction, competition and disease transmission by feral pigs; and Anthropogenic climate change are listed as Key Threatening Processes under the Threatened Species Conservation Act (1995).

12. Large areas of habitat formerly occupied by Freshwater Wetlands on Coastal Floodplains have been directly drained by construction of artificial channels (e.g. Pressey 1989a, Boulton and Brock 1999). By the early 1900s, drainage unions or trusts were formed on the major floodplains to enable adjacent landholders to arrange for co-ordinated drainage systems, which were designed and constructed by the former NSW Department of Public Works. Additional areas that have not been directly drained may have been altered hydrologically by changed patterns of flooding and drainage following flood mitigation works, particularly the construction of drains, levees and floodgates (Pressey and Griffith 1992). On the north coast of NSW, expansion of *Melaleuca quinquenervia* and *Casuarina glauca* into open floodplain swamps has been attributed to artificial drainage and shortening of the hydroperiod (Johnston *et al*. 2003, Stevenson 2003). These changes appear to be closely associated with enhanced acidity, altered ionic ratios, increased dissolved organic carbon and sulfide oxidation in the soil profile (Johnston *et al*. 2003). Conversely, alteration of tidal flows may have led to decreased soil salinity and localised expansion of Freshwater Wetland into areas that previously supported Coastal Saltmarsh or mangroves (Stevenson 2003). Re-instatement of tidal flows and other natural hydrological processes may therefore lead to contraction of Freshwater Wetlands. In addition, sedimentation and eutrophication of wetlands is associated with development of their catchments for intensive agriculture or urban or industrial infrastructure. Harmful runoff from developed catchments may include herbicides, pesticides, fertilisers,

sewerage, industrial waste and polluted stormwater. The widespread degradation of Freshwater Wetlands on Coastal Floodplains has led to regional declines in their dependent fauna including Magpie Geese (*Anseranas semipalmata*), Cotton Pygmy Geese (*Nettapus coromandelianus*), Hardhead (*Aythya australis*), Black-necked Stork (*Ephippiorhynchus asiaticus*), and Wandering Whistling Duck (*Dendrocygna arcuata*).

13. Very few examples of Freshwater Wetlands on Coastal Floodplains remain unaffected by weeds. The causes of weed invasion include physical disturbance to the vegetation structure of the community; the dumping of landfill, rubbish and garden refuse; eutrophication and polluted runoff from urban and agricultural areas; construction of roads and other utilities; soil disturbance by feral pigs and grazing by domestic livestock. In addition, mechanical and chemical methods of controlling aquatic weeds may threaten native components of the flora. The principal weed species affecting Freshwater Wetlands on Coastal Floodplains include *Alternanthera philoxeroides* (alligatorweed), *Baccharis halimifolia* (groundsel bush), *Echinochloa crus-galli* (barnyard grass), *Eichhornia crassipes* (water hyacinth), *Hygrophila costata* (glush weed), *Ludwigia longifolia, L. peruviana*, *Nymphaea capensis* (Cape waterlily), *Panicum repens* (torpedo grass), *Pennisetum clandestinum* (kikuyu) and *Salvinia molesta,* (Sainty and Jacobs 1981).

14. Small areas of Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions are contained within existing conservation reserves, including Ukerebagh, Tuckean, Tabbimoble Swamp, Hexham Swamp, Pambalong and Pitt Town Nature Reserves and Bungawalbin, Scheyville and Seven Mile Beach National Parks, although these are unevenly distributed throughout the range and unlikely to represent the full diversity of the community. In addition, wetlands within protected areas are exposed to hydrological changes that were, and continue to be initiated outside their boundaries. Some Freshwater Wetlands on Coastal Floodplains are protected by State Environmental Planning Policy 14, although this has not always precluded impacts on wetlands from the development of major infrastructure.
15. Given the dynamic hydrological relationship between Freshwater Wetlands on Coastal Floodplains, Coastal Saltmarsh and other endangered ecological communities on coastal floodplains, future management of water and tidal flows may result in the expansion of some communities at the expense of others. Proposals for the restoration of natural hydrological regimes and for the rehabilitation of acid sulfate soils may also result in changes to the distribution and composition of floodplain communities. Co-ordinated planning and management approaches across whole catchments will be required to address and resolve priorities between different management objectives.
16. In view of the above the Scientific Committee is of the opinion that Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is likely to become extinct in nature in New South Wales unless the circumstances and factors threatening its survival or evolutionary development cease to operate.

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Chairperson
Scientific Committee

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An assessment is undertaken below for each threatened species recorded in the study, employing the method outlined in Appendix 3 in the Part 3A *Guidelines* prepared by DEC and DPI (2005). The words in italics below are from the above appendix in the *Guidelines*. Note that no listed threatened plants are known or likely to occur in the area of the development.

Yellow-bellied Glider

Identifying potential effects of the proposal on threatened species, populations or ecological communities, or their habitats.
How is the proposal likely to affect the lifecycle of a threatened species or population?
Displaces or disturbs threatened species and/or populations;
The forest impacted by the development contains some Red Bloodwood and Spotted Gum trees, both local food trees for the glider. Despite many hours of spotlighting in the area, the glider was not found in the study area; the only record is of calls heard to the northeast of the old pine plantation, in state forest land. There are Grey Gums *Eucalyptus punctata* in that area, but this important local food tree species was not found on the Comberton Grange property. The glider appears not to inhabit the area proposed for the development, so it is unlikely that the development would disturb this species.

Disturbs the breeding cycle;
The removal of hollow-bearing trees used by the species has the potential to impact on this species, which could disturb breeding activity. The glider was not found in the study area, including the forest/woodland proposed to be impacted, so it is unlikely that the development could impact breeding activity.

Disturbs the dormancy period;
Not relevant to this species.

Disturbs roosting behaviour;
The glider uses tree hollows for denning; as noted above, the species seems not to inhabit the area of forest/woodland to be impacted.

Changes foraging behaviour;
The species appears not to occur in the area of impact; therefore, there would be no impact on foraging.

Affects migration and dispersal ability;
The area of forest to be removed is part of an identified wildlife corridor. The record of the glider was not in this area of the corridor. The corridor affected is not a 'pinch point' in the mapped corridor as there is a very large area of forest further to the east, so that dispersal of gliders would not be impacted.

Disturbs pollination cycle;
Not relevant to this species.

Disturbs seed banks;
Not relevant to this species.

Disturbs recruitment (i.e. germination and establishment of plants);
As noted above, breeding is not likely to be impacted.

Affects the interaction between threatened species and other species in the community (e.g. pollinators, host species, mychorrizal associations).
Not relevant to this species.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?
Disturbs any permanent, semi-permanent or ephemeral water bodies;
Not relevant to this species.

Degrades soil quality;
Not relevant to this species.

Clears or modifies native vegetation;
The proposal results in the removal of 34.5 hectares of native vegetation; the Yellow-bellied Glider was not recorded in this vegetation.

Introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;
The Conservation and Landscape Management Plan will discuss the issue of pest species and outline the required control programs.

Removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;
The key habitat features associated with this species are the presence of tree hollows and the food tree Grey Gum within its home range. Since the species was not recorded in the development area or on land owned by the proponent, it is not likely that there would be a significant impact on these key habitat features.

Affects natural revegetation and recolonisation of existing species following disturbance;
Various parts of the site will be rehabilitated, such as the watercourse corridors in the old pine plantation and the wetlands on the Currambine Creek floodplain. These areas and the methods to be employed will be covered in the Conservation and Landscape Management Plan.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?
Not relevant to this species, which occurs well to the north and south of the site.

How is the proposal likely to affect current disturbance regimes?
Modifies the intensity and frequency of fires;
There is no reason to suspect that bushfire intensity or frequency will change in the area. The surrounding land managers, i.e. State Forests and NPWS, currently carry out hazard reduction burning and this will continue. Bushfire management on the subject land would be in accordance with the fire management plan, which will be approved by the RFS.

Modifies flooding flows.
Not relevant to this species.

How is the proposal likely to affect habitat connectivity?
Creates a barrier to fauna movement;
Removes remnant vegetation or wildlife corridors;
Modifies remnant vegetation or wildlife corridors
The proposal results in the removal of 34.5 hectares of native vegetation that is located in a designated habitat corridor.

How is the proposal likely to affect critical habitat?
Removes or modifies key habitat features;
Affects natural revegetation or recolonisation of existing species following disturbance;
Introduces weeds, vermin or feral species;
Generates or disposes of solid, liquid or gaseous waste;
Uses pesticides, herbicides, other chemicals.

Not relevant; there is no critical habitat in the study area or nearby.

Gang-gang Cockatoo

Identifying potential effects of the proposal on threatened species, populations or ecological communities, or their habitats.
How is the proposal likely to affect the lifecycle of a threatened species or population?
Displaces or disturbs threatened species and/or populations;
The forest impacted by the development conations some feeding habitat, but this is not particularly special and there are huge areas of feeding habitat within protected public land in the locality. The cockatoo breeds in tree hollows, but the forest/woodland to be removed is mostly of small trees that are not likely to be sued by this species. There are large areas of forest more suitable for breeding in the locality.

Disturbs the breeding cycle;
The removal of a hollow-bearing trees used by the species has the potential to impact on this species, which could disturb breeding activity. The area of forest/woodland proposed to be impacted does contain some hollows. Given the large extent of surrounding forest, it is unlikely that the loss of these hollows could seriously impact breeding.

Disturbs the dormancy period;
Not relevant to this species.

Disturbs roosting behaviour;
The cockatoo roosts in trees, but given the huge number of trees locally, the loss of the trees in this development could not seriously impact on roosting sites.

Changes foraging behaviour;
The cockatoo feeds in eucalypt trees, but given the huge number of trees locally, the loss of the trees in this development could not seriously impact on foraging sites.

Affects migration and dispersal ability;
The removal of the bushland will not impact upon potential movement corridors for this species, as they will readily fly over cleared land, and in any case, there are still bushland links in all directions from the subject land.

Disturbs pollination cycle;
Not relevant to this species.

Disturbs seed banks;
Not relevant to this species.

Disturbs recruitment (i.e. germination and establishment of plants);
As noted above, breeding is not likely to be impacted.

Affects the interaction between threatened species and other species in the community (e.g. pollinators, host species, mychorrizal associations).
Not relevant to this species.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?
Disturbs any permanent, semi-permanent or ephemeral water bodies;
Not relevant to this species.

Degrades soil quality;
Not relevant to this species.

Clears or modifies native vegetation;
The development will result in the removal of 34.5 hectares of forest/woodland; this is minor compared to the large areas of forest and woodland on the public land surrounding the site.

Introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;
The Landscape Plan of Management will discuss the issue of pest species and outline the required control programs.

Removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;
Tree hollows are a key habitat component for this species. Given the large extent of surrounding forest, it is unlikely that the loss of these hollows could seriously impact breeding.

Affects natural revegetation and recolonisation of existing species following disturbance; and
Various parts of the site will be rehabilitated, such as the watercourse corridors in the old pine plantation and the wetlands on the Currambine Creek floodplain. These areas and the methods to be employed will be covered in the Conservation and Landscape Management Plan.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Not relevant to this species, which occurs well to the north and south of the site.

How is the proposal likely to affect current disturbance regimes?
Modifies the intensity and frequency of fires;
There is no reason to suspect that bushfire intensity or frequency will change in the area. The surrounding land managers, i.e. State Forests and NPWS, currently carry out hazard reduction burning and this will continue. Bushfire management on the subject land would be in accordance with the fire management plan which will be approved by the RFS.

Modifies flooding flows.
Not relevant to this species.

How is the proposal likely to affect habitat connectivity?
Creates a barrier to fauna movement;
Removes remnant vegetation or wildlife corridors;
Modifies remnant vegetation or wildlife corridors
The proposal results in the removal of 34.5 hectares of native vegetation that is located in a designated habitat corridor. The Gang-Gang Cockatoo crosses cleared and even urbanised land (e.g. Nowra and Canberra), so the proposal to remove a relatively small area of bushland within a mosaic of cleared and forested land is not likely to impact on the ability of this species to move about the locality.

How is the proposal likely to affect critical habitat?
Removes or modifies key habitat features;
Affects natural revegetation or recolonisation of existing species following disturbance;
Introduces weeds, vermin or feral species;
Generates or disposes of solid, liquid or gaseous waste;
Uses pesticides, herbicides, other chemicals.

Not relevant; there is no critical habitat in the study area or nearby.

Glossy Black-Cockatoo

Identifying potential effects of the proposal on threatened species, populations or ecological communities, or their habitats.
How is the proposal likely to affect the lifecycle of a threatened species or population?
Displaces or disturbs threatened species and/or populations;
The forest impacted by the development contains scattered *Allocasuarina littoralis* trees that may be used for foraging by the cockatoo. The Because of the very large area of habitat in the locality, the loss of a few food trees is not likely to seriously impact on this cockatoo.

Disturbs the breeding cycle;
The removal of a hollow-bearing trees has the potential to impact on this species, which could disturb breeding activity. There are more likely breeding sites in the taller forest in the locality, rather than the area impacted by the development could seriously impact breeding.

Disturbs the dormancy period;
Not relevant to this species.

Disturbs roosting behaviour;
The cockatoo roosts in trees; there is no shortage of suitable trees in the locality; the development could not seriously impact upon roosting sites.

Changes foraging behaviour;
The species feeds primarily on the cones of the tree *Allocasuarina littoralis*. Some of these trees will be removed, but this tree is abundant in the locality, so the development could not seriously impact upon the foraging activity of the species.

Affects migration and dispersal ability;
The removal of the bushland will not impact upon potential movement corridors for this species, as they will readily fly over cleared land, and in any case, there are still bushland links in all directions from the subject land.

Disturbs pollination cycle;

Not relevant to this species.

Disturbs seed banks;
Not relevant to this species.

Disturbs recruitment (i.e. germination and establishment of plants);
As noted above, breeding is not likely to be impacted.

Affects the interaction between threatened species and other species in the community (e.g. pollinators, host species, mychorrizal associations).
Not relevant to this species.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?
Disturbs any permanent, semi-permanent or ephemeral water bodies;
Not relevant to this species.

Degrades soil quality;
Not relevant to this species.

Clears or modifies native vegetation;
The proposal results in the removal of 34.5 hectares of native vegetation; the Glossy Black-Cockatoo was recorded in this vegetation, but there are only scattered *Allocasuarina littoralis* trees..

Introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;
The Landscape Plan of Management will discuss the issue of pest species and outline the required control programs.

Removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;
The key habitat features for the cockatoo are *Allocasuarina* trees and tree hollows. As noted above, nether feature is likely to be seriously compromised by the development.

Affects natural revegetation and recolonisation of existing species following disturbance; and
Various parts of the site will be rehabilitated, such as the watercourse corridors in the old pine plantation and the wetlands on the Currambine Creek floodplain. These areas and the methods to be employed will be covered in the Conservation and Landscape Management Plan.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?
Not relevant to this species, which occurs well to the north and south of the site.

How is the proposal likely to affect current disturbance regimes?
Modifies the intensity and frequency of fires;
There is no reason to suspect that bushfire intensity or frequency will change in the area. The surrounding land managers, i.e. State Forests and NPWS, currently carry out hazard reduction burning and this will continue. Bushfire management on the subject land would be in accordance with the fire management plan which will be approved by the RFS.

Modifies flooding flows.
Not relevant to this species.

How is the proposal likely to affect habitat connectivity?
Creates a barrier to fauna movement;
Removes remnant vegetation or wildlife corridors;
Modifies remnant vegetation or wildlife corridors
The proposal results in the removal of 34.5 hectares of native vegetation that is located in a designated habitat corridor. The Cockatoo will cross cleared land so that the development is not likely to seriously impact upon the cockatoo.

How is the proposal likely to affect critical habitat?
Removes or modifies key habitat features;
Affects natural revegetation or recolonisation of existing species following disturbance;

Introduces weeds, vermin or feral species;
Generates or disposes of solid, liquid or gaseous waste;
Uses pesticides, herbicides, other chemicals.

Not relevant; there is no critical habitat in the study area or nearby.

Masked Owl

Identifying potential effects of the proposal on threatened species, populations or ecological communities, or their habitats.
How is the proposal likely to affect the lifecycle of a threatened species or population?
Displaces or disturbs threatened species and/or populations;
The forest impacted by the development is potential foraging habitat for the owl, but is a tiny part of its total foraging range (home territory) which would be several hundred hectares. The potential impact on the owl is very slight, given the large area of surrounding forest that will not be impacted and which is in public ownership.

Disturbs the breeding cycle;
The removal of a hollow-bearing trees has the potential to impact on this species, which could disturb breeding activity. The owl was not found in the area of forest/woodland proposed to be impacted, although it could occur there from time to time. Given the large areas of forest in the locality that contain abundant tree hollows, it is unlikely that the development could seriously impact breeding.

Disturbs the dormancy period;
Not relevant to this species.

Disturbs roosting behaviour;
The Masked owl roost in trees; there is no shortage of suitable trees in the locality; the development could not seriously impact upon roosting sites.

Changes foraging behaviour;
The owl forages in forests and along the edges of forest. The small area of forest removed is unlikely to seriously impact this species foraging activities because it is tiny compared to the home range of the species and the abundance of forest in the locality.

Affects migration and dispersal ability;
The owl can readily disperse throughout the locality and is not likely to be hindered by the loss of a small area of bushland.

Disturbs pollination cycle;
Not relevant to this species.

Disturbs seed banks;
Not relevant to this species.

Disturbs recruitment (i.e. germination and establishment of plants);
The impact on breeding, as noted above, is not likely to be serious.

Affects the interaction between threatened species and other species in the community (e.g. pollinators, host species, mychorrizal associations).
Not relevant to this species.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?
Disturbs any permanent, semi-permanent or ephemeral water bodies;
Not relevant to this species.

Degrades soil quality;
Not relevant to this species.

Clears or modifies native vegetation;
The proposal results in the removal of 34.5 hectares of native vegetation; the Masked Owl was not recorded in this vegetation but could conceivably visit the area to forage.

Introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;
The Conservation and Landscape Management Plan will discuss the issue of pest species and outline the required control programs.

Removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;
The key habitat components for this owl are tree hollows, required for nesting. Although some tree hollows in forest will be removed, there are abundant hollows in the large areas of surrounding forest, so that the development is unlikely to impact seriously on this owl.

Affects natural revegetation and recolonisation of existing species following disturbance; and
Various parts of the site will be rehabilitated, such as the watercourse corridors in the old pine plantation and the wetlands on the Currambine Creek floodplain. These areas and the methods to be employed will be covered in the Conservation and Landscape Management Plan.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?
Not relevant to this species, which occurs well to the north and south of the site.

How is the proposal likely to affect current disturbance regimes?
Modifies the intensity and frequency of fires;
There is no reason to suspect that bushfire intensity or frequency will change in the area. The surrounding land managers, i.e. State Forests and NPWS, currently carry out hazard reduction burning and this will continue. Bushfire management on the subject land would be in accordance with the fire management plan which will be approved by the RFS.

Modifies flooding flows.
Not relevant to this species.

How is the proposal likely to affect habitat connectivity?
Creates a barrier to fauna movement;
Removes remnant vegetation or wildlife corridors;
Modifies remnant vegetation or wildlife corridors
The proposal results in the removal of 34.5 hectares of native vegetation that is located in a designated habitat corridor.

How is the proposal likely to affect critical habitat?
Removes or modifies key habitat features;
Affects natural revegetation or recolonisation of existing species following disturbance;
Introduces weeds, vermin or feral species;
Generates or disposes of solid, liquid or gaseous waste;
Uses pesticides, herbicides, other chemicals.

Not relevant; there is no critical habitat in the study area or nearby.

Powerful Owl

Identifying potential effects of the proposal on threatened species, populations or ecological communities, or their habitats.
How is the proposal likely to affect the lifecycle of a threatened species or population?
Displaces or disturbs threatened species and/or populations;
The forest impacted by the development is potential foraging habitat for the owl, but is a tiny part of its total foraging range (home territory) which would be several hundred hectares. The potential impact on the owl is very slight, given the large area of surrounding forest that will not be impacted and which is in public ownership.

Disturbs the breeding cycle;
The removal of a hollow-bearing trees has the potential to impact on this species, which could disturb breeding activity. The owl was not found in the area of forest/woodland proposed to be impacted, although it could occur there from time to time. Given the large areas of forest in the locality that contain abundant tree hollows, it is unlikely that the development could seriously impact breeding.

Disturbs the dormancy period;
Not relevant to this species.

Disturbs roosting behaviour;
The owl roosts in trees; there is no shortage of suitable trees in the locality and the development could not seriously impact upon roosting sites.

Changes foraging behaviour;
The owl forages in forests and along the edges of forest. The small area of forest removed is unlikely to seriously impact this species foraging activities because it is tiny compared to the home range of the species and the abundance of forest in the locality.

Affects migration and dispersal ability;
The owl can readily disperse throughout the locality and is not likely to be hindered by the loss of a small area of bushland.

Disturbs pollination cycle;
Not relevant to this species.

Disturbs seed banks;
Not relevant to this species.

Disturbs recruitment (i.e. germination and establishment of plants);
The impact on breeding, as noted above, is not likely to be serious.

Affects the interaction between threatened species and other species in the community (e.g. pollinators, host species, mychorrizal associations).
Not relevant to this species.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?
Disturbs any permanent, semi-permanent or ephemeral water bodies;
Not relevant to this species.

Degrades soil quality;
Not relevant to this species.

Clears or modifies native vegetation;
The proposal results in the removal of 34.5 hectares of native vegetation; the Powerful Owl was recorded in this vegetation, but it forms a small part of its local home range.

Introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;
The Landscape Plan of Management will discuss the issue of pest species and outline the required control programs.

Removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;
The key habitat components for this owl are tree hollows, required for nesting. Although some tree hollows in forest will be removed, there are abundant hollows in the large areas of surrounding forest, so that the development is unlikely to impact seriously on this owl.

Affects natural revegetation and recolonisation of existing species following disturbance; and
Various parts of the site will be rehabilitated, such as the watercourse corridors in the old pine plantation and the wetlands on the Currambine Creek floodplain. These areas and the methods to be employed will be covered in the Conservation and Landscape Management Plan.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?
Not relevant to this species, which occurs well to the north and south of the site.

How is the proposal likely to affect current disturbance regimes?
Modifies the intensity and frequency of fires;

There is no reason to suspect that bushfire intensity or frequency will change in the area. The surrounding land managers, i.e. State Forests and NPWS, currently carry out hazard reduction burning and this will continue. Bushfire management on the subject land would be in accordance with the fire management plan which will be approved by the RFS.

Modifies flooding flows.
Not relevant to this species.

How is the proposal likely to affect habitat connectivity?
Creates a barrier to fauna movement;
Removes remnant vegetation or wildlife corridors;
Modifies remnant vegetation or wildlife corridors
The proposal results in the removal of 34.5 hectares of native vegetation that is located in a designated habitat corridor.

How is the proposal likely to affect critical habitat?
Removes or modifies key habitat features;
Affects natural revegetation or recolonisation of existing species following disturbance;
Introduces weeds, vermin or feral species;
Generates or disposes of solid, liquid or gaseous waste;
Uses pesticides, herbicides, other chemicals.

Not relevant; there is no critical habitat in the study area or nearby.

Black Bittern
Identifying potential effects of the proposal on threatened species, populations or ecological communities, or their habitats.
How is the proposal likely to affect the lifecycle of a threatened species or population?
Displaces or disturbs threatened species and/or populations;
The Black Bittern would only be found along Currambine Creek and its immediate tributaries. None of these areas are anywhere near the proposed developments., so it unlikey that the proposal would disturb or displace this species.

Disturbs the breeding cycle;
As noted above, the species would not occur on or near the proposal so there would be no impact upon breeding activities.

Disturbs the dormancy period;
Not relevant to this species.

Disturbs roosting behaviour;
Changes foraging behaviour;
Affects migration and dispersal ability;
The habitat of the Black Bittern in not on or near the proposed development; so the proposal would not have any of the above impacts on this species.

Disturbs pollination cycle;
Not relevant to this species.

Disturbs seed banks;
Not relevant to this species.

Disturbs recruitment (i.e. germination and establishment of plants);
The habitat of the Black Bittern in not on or near the proposed development; so the proposal would not have any impact on breeding.

Affects the interaction between threatened species and other species in the community (e.g. pollinators, host species, mychorrizal associations).
Not relevant to this species.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?
Disturbs any permanent, semi-permanent or ephemeral water bodies;

The wetland habitat potentially utilised by this species is well away from any component of the development.

Degrades soil quality;
Not relevant to this species.

Clears or modifies native vegetation;
The proposal results in the removal of 34.5 hectares of native vegetation; but this is not potential habitat for the Black Bittern, not is it close to that habitat.

Introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;
The Landscape Plan of Management will discuss the issue of pest species and outline the required control programs.

Removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;
The habitat of this species will not be disturbed, including the key areas along the banks of Currambene Creek.

Affects natural revegetation and recolonisation of existing species following disturbance; and
Various parts of the site will be rehabilitated, such as the watercourse corridors in the old pine plantation and the wetlands on the Currambine Creek floodplain. These areas and the methods to be employed will be covered in the Conservation and Landscape Management Plan.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?
Not relevant to this species, which occurs well to the north and south of the site.

How is the proposal likely to affect current disturbance regimes?
Modifies the intensity and frequency of fires;
There is no reason to suspect that bushfire intensity or frequency will change in the area. The surrounding land managers, i.e. State Forests and NPWS, currently carry out hazard reduction burning and this will continue. Bushfire management on the subject land would be in accordance with the fire management plan which will be approved by the RFS.

Modifies flooding flows.
Not relevant to this species.

How is the proposal likely to affect habitat connectivity?
creates a barrier to fauna movement;
Removes remnant vegetation or wildlife corridors;
Modifies remnant vegetation or wildlife corridors
The proposal results in the removal of 34.5 hectares of native vegetation that is located in a designated habitat corridor.

How is the proposal likely to affect critical habitat?
Removes or modifies key habitat features;
Affects natural revegetation or recolonisation of existing species following disturbance;
Introduces weeds, vermin or feral species;
Generates or disposes of solid, liquid or gaseous waste;
Uses pesticides, herbicides, other chemicals.

Not relevant; there is no critical habitat in the study area or nearby.

Square-tailed Kite
Identifying potential effects of the proposal on threatened species, populations or ecological communities, or their habitats.
How is the proposal likely to affect the lifecycle of a threatened species or population?
Displaces or disturbs threatened species and/or populations;
The forest impacted by the development offers a very small area of foraging habitat for the kite, which ranges over a very large foraging area of many square kilometres. The species could not be seriously impacted by the development.

Disturbs the breeding cycle;
The bushland proposed for removal contains mostly relatively small trees that are unlikely to be used for nesting by this species, as the kite prefers tall forest trees for nesting. In any case, there are very large areas of more suitable forest in the locality, if this rare summer visitor to the region was to breed in the area.

Disturbs the dormancy period;
Not relevant to this species.

Disturbs roosting behaviour;
The kite roosts in trees; there is no shortage of suitable trees in the locality and the development could not seriously impact upon roosting sites.

Changes foraging behaviour;
The kite forages in forests and woodland, as well as cleared land. The small area of forest removed is unlikely to seriously impact this species foraging activities because it is tiny compared to the very large home range of the species.

Affects migration and dispersal ability;
The Square-tailed Kite migrates to the south coast of NSW in summer and is occasionally found breeding, but it is not very common. The development, including the removal of the bushland, is very unlikely to impact upon the movement of this species, which has a very large foraging area and is not deterred from dispersing by cleared land.

Disturbs pollination cycle;
Not relevant to this species.

Disturbs seed banks;
Not relevant to this species.

Disturbs recruitment (i.e. germination and establishment of plants);
As noted above, there is not likely to be a serious impact upon breeding.

Affects the interaction between threatened species and other species in the community (e.g. pollinators, host species, mychorrizal associations).
Not relevant to this species.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?
Disturbs any permanent, semi-permanent or ephemeral water bodies;
Not relevant to this species.

Degrades soil quality;
Not relevant to this species.

Clears or modifies native vegetation;
The proposal results in the removal of 34.5 hectares of native vegetation; the Square-tailed Kite was not recorded in this vegetation but it would be a part of its large home range used for foraging.

Introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;
The Landscape Plan of Management will discuss the issue of pest species and outline the required control programs.

Removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat
There are no key habitat features in the area for the kite; nesting is in tall trees, which are abundant locally, while foraging is carried out across most of the landscape.

Affects natural revegetation and recolonisation of existing species following disturbance; and
Various parts of the site will be rehabilitated, such as the watercourse corridors in the old pine plantation and the wetlands on the Currambine Creek floodplain. These areas and the methods to be employed will be covered in the Conservation and Landscape Management Plan.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?
Not relevant to this species, which occurs well to the north and south of the site.

How is the proposal likely to affect current disturbance regimes?
Modifies the intensity and frequency of fires;
There is no reason to suspect that bushfire intensity or frequency will change in the area. The surrounding land managers, i.e. State Forests and NPWS, currently carry out hazard reduction burning and this will continue. Bushfire management on the subject land would be in accordance with the fire management plan which will be approved by the RFS.

Modifies flooding flows.
Not relevant to this species.

How is the proposal likely to affect habitat connectivity?
Creates a barrier to fauna movement;
Removes remnant vegetation or wildlife corridors;
Modifies remnant vegetation or wildlife corridors
The proposal results in the removal of 34.5 hectares of native vegetation that is located in a designated habitat corridor.

How is the proposal likely to affect critical habitat?
Removes or modifies key habitat features;
Affects natural revegetation or recolonisation of existing species following disturbance;
Introduces weeds, vermin or feral species;
Generates or disposes of solid, liquid or gaseous waste;
Uses pesticides, herbicides, other chemicals.

Not relevant; there is no critical habitat in the study area or nearby.

Varied Sittella
Identifying potential effects of the proposal on threatened species, populations or ecological communities, or their habitats.
How is the proposal likely to affect the lifecycle of a threatened species or population?
Displaces or disturbs threatened species and/or populations;
The forest and woodland impacted by the development contains foraging habitat, but this is abundant locally so the development is unlikely to impact seriously on this bird.

Disturbs the breeding cycle;
The bird builds small nest in trees, which are abundant in the locality, so it is unlikely that the development could seriously impact breeding.

Disturbs the dormancy period;
Not relevant to this species.

Disturbs roosting behaviour;
Changes foraging behaviour;
The Varied Sittella forages and roosts in trees; there is an abundance of trees in the locality and the removal of the trees for this proposal is not likely to seriously affect the lifecycle of this bird.

Affects migration and dispersal ability;
The removal of the bushland in the proposal is unlikely to seriously disrupt movement of the species, which could still readily move throughout the locality.

Disturbs pollination cycle;
Not relevant to this species.

Disturbs seed banks;
Not relevant to this species.

Disturbs recruitment (i.e. germination and establishment of plants);
The species nests in trees; the scale of tree removal in comparison with the very large area of forest and woodland in the vicinity of the site is not likely to impact on the breeding activities of the species.

Affects the interaction between threatened species and other species in the community (e.g. pollinators, host species, mychorrizal associations).
Not relevant to this species.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?
Disturbs any permanent, semi-permanent or ephemeral water bodies;
Not relevant to this species.

Degrades soil quality;
Not relevant to this species.

Clears or modifies native vegetation;
The proposal results in the removal of 34.5 hectares of native vegetation; the Varied Sittella was not recorded in this vegetation, but this species may well occur there from time to time. The scale of the loss of potential habit is tiny compared to the large local areas of forest and woodland in the locality.

Introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;
The Landscape Plan of Management will discuss the issue of pest species and outline the required control programs.

Removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;
There are no special habitats in the area for the species, which uses forest and woodland generally for foraging and nesting.

Affects natural revegetation and recolonisation of existing species following disturbance; and
Various parts of the site will be rehabilitated, such as the watercourse corridors in the old pine plantation and the wetlands on the Currambine Creek floodplain. These areas and the methods to be employed will be covered in the Conservation and Landscape Management Plan.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?
Not relevant to this species, which occurs well to the north and south of the site.

How is the proposal likely to affect current disturbance regimes?
Modifies the intensity and frequency of fires;
There is no reason to suspect that bushfire intensity or frequency will change in the area. The surrounding land managers, i.e. State Forests and NPWS, currently carry out hazard reduction burning and this will continue. Bushfire management on the subject land would be in accordance with the fire management plan which will be approved by the RFS.

Modifies flooding flows.
Not relevant to this species.

How is the proposal likely to affect habitat connectivity?
Creates a barrier to fauna movement;
Removes remnant vegetation or wildlife corridors;
Modifies remnant vegetation or wildlife corridors
The proposal results in the removal of 34.5 hectares of native vegetation that is located in a designated habitat corridor.

How is the proposal likely to affect critical habitat?
Removes or modifies key habitat features;
Affects natural revegetation or recolonisation of existing species following disturbance;
Introduces weeds, vermin or feral species;
Generates or disposes of solid, liquid or gaseous waste;
Uses pesticides, herbicides, other chemicals.

Not relevant; there is no critical habitat in the study area or nearby.

Cave-utilising Bats

Eastern Bentwing-bat
Large-footed Myotis

There are no caves or overhangs that could be used as roosting sites in the development, nor are there any nearby. There is no potential for the development to impact upon roosting sites for these bats. The bats could forage in the area, as they do across much of the region, but the development will not seriously impact upon the ability of the bats to forage in the area. These species readily cross large expanses of cleared land.

Tree Hollow-utilising Bats
East-coast Freetail Bat
Eastern Falsistrelle
Greater Broad-nosed Bat
Golden-tipped Bat

Identifying potential effects of the proposal on threatened species, populations or ecological communities, or their habitats.
How is the proposal likely to affect the lifecycle of a threatened species or population?
Displaces or disturbs threatened species and/or populations;
The forest and woodland impacted by the development could contain some foraging and roosting habitat, although this vegetation is abundant in the locality son that the removal of some of the forest and woodland is not likely to seriously impact these species.

Disturbs the breeding cycle;
The removal of a hollow-bearing trees used by the species has the potential to impact on this species, which could disturb breeding activity. However, tree hollows are abundant in the surrounding bushland so that it is unlikely that the development could seriously impact breeding.

Disturbs the dormancy period;
Disturbs roosting behaviour;
These bats aestivate at their roosting sites for part of winter. The first three bats primarily roost in tree hollows while the Golden-tipped Bat, a rainforest bat, roosts in birds nest and occasionally elsewhere. Some hollow-bearing trees will be removed, but this is an abundant habitat feature in the locality.

Changes foraging behaviour;
The first three bats forage widely in forest and other habitats, while the Golden-tipped Bat is primarily a rainforest bat and would find little suitable habitat in the project area. Given the very large area of natural bushland in the locality, the removal of 34.5 hectares of this is not likely to seriously impact upon these foraging behaviour of these bats.

Affects migration and dispersal ability;
The removal of the bushland will not impact upon the ability of these bats to disperse or migrate, as they readily fly over all types or terrain.

Disturbs pollination cycle;
Not relevant to this species.

Disturbs seed banks;
Not relevant to this species.

Disturbs recruitment (i.e. germination and establishment of plants);
As noted above, breeding is not likely to be seriously impacted by the development, primarily because of the very large area of habitat remaining in the locality.

Affects the interaction between threatened species and other species in the community (e.g. pollinators, host species, mychorrizal associations).
Not relevant to this species.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?
Disturbs any permanent, semi-permanent or ephemeral water bodies;
Not relevant to this species.

Degrades soil quality;
Not relevant to this species.

Clears or modifies native vegetation;
The proposal results in the removal of 34.5 hectares of native vegetation; these bats probably forage in this vegetation, but the area is tiny compared to the large area of forests and woodlands locally.

Introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;
The Landscape Plan of Management will discuss the issue of pest species and outline the required control programs.

Removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;
The only key habitat components for the first three bats are tree hollows, which are abundant in the locality. The habitat, including roosting habitat, of the Golden-tipped Bat is rainforest and this will not be impacted by the devleopment.

Affects natural revegetation and recolonisation of existing species following disturbance; and
Various parts of the site will be rehabilitated, such as the watercourse corridors in the old pine plantation and the wetlands on the Currambine Creek floodplain. These areas and the methods to be employed will be covered in the Conservation and Landscape Management Plan.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?
Not relevant to these species, which occur well to the north and south of the site.

How is the proposal likely to affect current disturbance regimes?
Modifies the intensity and frequency of fires;
There is no reason to suspect that bushfire intensity or frequency will change in the area. The surrounding land managers, i.e. State Forests and NPWS, currently carry out hazard reduction burning and this will continue. Bushfire management on the subject land would be in accordance with the fire management plan which will be approved by the RFS.

Modifies flooding flows.
Not relevant to these species.

How is the proposal likely to affect habitat connectivity?
Creates a barrier to fauna movement;
Removes remnant vegetation or wildlife corridors;
Modifies remnant vegetation or wildlife corridors
The proposal results in the removal of 34.5 hectares of native vegetation that is located in a designated habitat corridor.

How is the proposal likely to affect critical habitat?
Removes or modifies key habitat features;
Affects natural revegetation or recolonisation of existing species following disturbance;
Introduces weeds, vermin or feral species;
Generates or disposes of solid, liquid or gaseous waste;
Uses pesticides, herbicides, other chemicals.

Not relevant; there is no critical habitat in the study area or nearby.