Gerringong to Bomaderry
Princes Highway upgrade

ROUTE OPTIONS DEVELOPMENT
APPENDIX G - PRELIMINARY BIOLOGICAL REPORT (TERRESTRIAL FLORA AND FAUNA)
NOVEMBER 2007
Gerringong to Bomaderry
Princes Highway Upgrade

Preliminary Biological Report - Terrestrial Flora and Fauna

The Roads and Traffic Authority NSW
October 2007
Gerringong to Bomaderry Princes Highway Upgrade

Prepared for
The Roads and Traffic Authority NSW

Prepared by
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26 October 2007

DEV06/04-FF-BI-Flora and Fauna

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Abbreviations

DECC  Department of Environment and Climate Change (includes DNR, previously DIPNR)
DEWR  Department of the Environment and Water Resources (previously DEH)
EEC   Endangered Ecological Communities
EIS   Environmental Impact Statement
EP&A Act  *Environmental Planning and Assessment Act 1979*
EPBC Act  *Environment Protection and Biodiversity Conservation Act 1999*
LGA   Local Government Area
MNES  Matter of National Environmental Significance
NPWS  National Parks and Wildlife Service (now part of DECC)
REF   Review of Environmental Factors
ROTAP Rare or Threatened Australian Plant as listed by Briggs and Leigh (1995)
SIS   Species Impact Statement
SEPP  State Environmental Planning Policy
TSC Act  *Threatened Species Conservation Act 1995*
sp.   Species (singular)
spp.  Species (plural)
ssp.  Subspecies
var.  Variety
1.0 Background

Maunsell was engaged by the RTA in December 2006 to carry out an Options and Route Selection Study, Concept Development and Environmental Assessment (EA) for upgrading the Princes Highway between 42.6 km to 74.6 km south of Wollongong. Maunsell has engaged a number of prominent sub-consultants to contribute to the delivery of this project.

The work includes development of route options and concept development based on the identified preferred route, environmental assessment, public displays and handover period to allow for finalisation of all activities and reports following the announcement and display of the Preferred Route, the Environmental Assessment and the Conditions of Approval.

The project will provide a bypass of Berry. The northern extremity of the project is in the vicinity of the Mount Pleasant Lookout (north of Gerringong at the termination of the four lane configuration) and the southern extremity of the project is the intersection (roundabout) of the Princes Highway with Cambewarra and Moss Vale Roads at Bomaderry.

Community involvement is a key aspect of this project and will afford the broader community the opportunity to make a demonstrable input to the process and to ensure that the requirements and aspirations of the community will be adequately and appropriately addressed. This is particularly relevant to:

a) Any potential impacts on rural and residential areas within the study area;
b) Social and economic impacts;
c) Accessibility of the road network for local and through traffic;
d) Potential impacts on water quality;
e) Potential impacts on wetlands;
f) Potential impact on flooding;
g) Potential impacts on land uses;
h) Threatened flora and fauna species;
i) Indigenous and non-indigenous heritage;
j) Visual impact;
k) Noise; and
l) Air quality.

Several studies have been undertaken since the early 1990s to identify a preferred route to upgrade sections of the Princes Highway between Kiama and Nowra including a bypass around the town of Berry.

These studies include:

m) The 1991 Gerringong to Berry Route Study;

n) 1998 North Street Berry Bypass Corridor; and

o) 2004/05 Quantm Study from Kiama to Nowra.

Sections of the highway between Gerringong and Bomaderry have a poor accident record and limited safe overtaking opportunities.

Due to the significant changes in traffic, land use and population since 1991, the NSW state government, in March 2006 committed to investigating an area where it is likely a preferred route would be located to upgrade the Princes Highway between Mount Pleasant at Gerringong and Moss Vale/Cambewarra Road at Bomaderry to meet current road standards.
2.0 Objective of report

Biosis Research Pty. Limited. (Biosis) was engaged to investigate potential terrestrial flora and fauna issues in relation to the proposed upgrade of the Princes Highway between 42.6 km and 74.6 km south of Wollongong. The terrestrial flora and fauna study is expected to involve two major components:

a) Preliminary investigations to assist the process of selecting a preferred route option; and
b) Detailed investigations of the selected route.

This report forms part of the preliminary investigations component of the study.

The overall objective of this report is to present the results of the preliminary investigations and an assessment of “opportunities and constraints” in relation to terrestrial flora and fauna. Its purpose is to provide information that will assist the selection of the most appropriate route. The focus of this component is to gather information regarding the flora and fauna of the study area, assess relative ecological values and rank lands within the study area in terms of conservation significance.

The specific objectives of this component of the study are to:

c) Gather existing information regarding terrestrial flora and fauna within and surrounding the study area, focusing on threatened species, populations and ecological communities;
d) Examine the nature, extent and condition of fauna habitats and vegetation associations within the study area, through a combination of desktop and field studies;
e) Determine areas supporting vegetation associations that are, or are likely to be, of conservation significance, or support resources that may be utilised by species or populations of conservation significance;
f) Assess the potential occurrence of flora and fauna species or populations of conservation significance, in particular, threatened species and populations;
g) Determine areas that may be of importance as habitat corridors;
h) Develop and apply criteria to rank the relative conservation significance of land across the study area; and
i) Determine areas that are considered to be of high, low or medium constraint to the construction of a highway upgrade.
3.0 Methods

3.1 Approach

The location and extent of the study area is shown on Figure 1. The study involved three key stages: a desktop examination; field surveys; and constraints mapping. The desktop study involved gathering and reviewing existing information regarding the flora and fauna of the study area. Field surveys were undertaken for the purpose of ground-truthing information obtained during the desktop examination and to gather additional data from parts of the study area selected for further investigation. The combined information from field and desktop studies was then used to assess relative conservation significance across the study area.

3.2 Desk top study

Existing information regarding the flora and fauna of the study area was obtained from a range of sources, including: databases; aerial photographs and maps; previous studies carried out in the vicinity of the study area; and consultation with experts, government agencies, land owners and land managers, local volunteer organisations and natural heritage clubs. A list of documents cited in this report is located in the Section 10.

Database records were obtained for the study area and the landscape within a 10 km radius of the perimeter of the study area. Database searches included:

a) Records of threatened flora and fauna species listed on the schedules of the NSW Threatened Species Conservation Act 1995 (TSC Act) obtained from the then NSW Department of Environment and Conservation (now DECC) Atlas of NSW Wildlife in February 2007;

b) Records of matters of national environmental significance listed under the provisions of the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) obtained from the Commonwealth Department of the Environment and Water Resources (DEWR) Protected Matters Database in February 2007; and


Spatial information from previous studies carried out in the vicinity of the study area that was examined included:

d) Aerial photographs of the study area and surrounds, sourced by Maunsell;

e) Topographic and orthophoto maps (Department of Lands 1:25,000 maps of Berry, Gerroa, Kiama and Kangaroo Valley);

f) Cadastral information, sourced by Maunsell;

g) Native Vegetation Map Report Series. No. 4 (DEC 2005q);

h) Shoalhaven City Council on-line vegetation maps;

i) Draft Remnant Vegetation Management Strategy for the Shoalhaven (RVMC 2005);

j) Roadside Environment Management Plan (Shoalhaven City Council 2000);

k) Vegetation and Fauna Survey and Assessment prepared for the 1991 Gerringong to Berry route selection study (Muston & Associates 1991);

l) Kiama Municipal Council Local Environment Plan;

m) Illawarra Regional Environment Plan;

n) The Fauna of Kiama (Kevin Mills & Associates 2005);

o) The Natural Vegetation in the Municipality of Kiama New South Wales (Kevin Mills & Associates 2005);
p) Threatened Fauna of the Shoalhaven (NPWS 2000);
q) Mammal Survey of Seven Mile Beach National Park and Comerong Island Nature Reserve on the South Coast of New South Wales (Murphy 1998);
r) Mammals of the National Parks and Nature Reserves between Port Hacking and the Shoalhaven River (Robinson 1987);
s) Bats of the Illawarra Region (Robinson 1985);
t) Mammals of the Metropolitan Water, Sewerage and Drainage Board Catchments (Robinson 1985); and
u) Illawarra Wildlife Studies No 3 – Animals killed by motor vehicles adjacent to Seven Mile Beach National Park and in the Illawarra Region (Kevin Mills 2004).

Additional data or information was provided by Mark Tozer, Ann Goeth, NANA, the Berry & District Historical Society Inc., Kerry Withers, Dr Arthur White and Gary Daly. A number of residents provided information regarding flora and fauna observed on their properties or in the area and some land owners provided species lists, including Phil Bragg and Caroline Ridge, Deborah Wordsworth, Chris Hallahan and Tracey Wood.

3.3 Site selection

A number of sites within the study area were selected for possible further field investigation following an examination of aerial photographs, topographic maps, existing vegetation maps and threatened species records. Potential survey sites included locations containing stands of native vegetation, riparian vegetation along creeks and farm dams. Reconnaissance surveys of the study area were carried out on 15 January 2007 and 5 February 2007 to obtain a preliminary assessment of the nature and condition of the vegetation and identify locations likely to contain potential habitat or resources for threatened species.

Potential survey sites were then ranked according to size, condition, location, type of plant community present and presence of known or potential habitat for threatened species. Sites containing larger areas of native vegetation in relatively good condition were assessed in preference to those that did not, and sites that enabled sampling of a range of plant communities across a broad geographic spread were assessed in preference to those that did not. In addition, sites considered to have higher potential to require consideration during the process of route selection were assessed in preference to those of low potential; for example, survey sites were not located in steeply sloping areas amongst the foothills of the Illawarra escarpment at the western periphery of the study area, whereas a number of sites were located in representative vegetation remnants across the broad area of Toolijooa and Broughton Village (Figure 2a, b, c, d and e).

The location of field survey sites is shown on Figure 2a, b, c, d and e. Field survey effort was not consistent across all sites; rather, survey effort was guided by the site assessment process described above, focussing on larger areas of vegetation within the study area. Site selection and survey effort was also influenced by site access limitations, as some land owners could not be contacted, were unwilling to allow access or unwilling to allow sufficient access for detailed surveys.
3.4 Flora surveys

3.4.1 Survey techniques

Flora surveys were carried out by two botanists over 10 days between 12 February 2007 and 23 February 2007. Surveys involved targeted searches for threatened plant species using random meander techniques and/or ground-truthing of the plant communities mapped by DECC (DEC 2005q) using plot-based surveys. An assessment of plant community condition was conducted at all survey sites.

Surveys were conducted in accordance with the draft DECC publication, Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (DEC 2005q). Survey effort was most rigorous within areas identified as known or potential habitat for threatened plant species and areas identified as Endangered Ecological Communities (EEC). A description of each of the survey methods is provided below.

3.4.2 Target searches

Targeted searches for threatened plant species involved random meander transects as described by (Cropper 1993), carried out in selected areas of known or potential habitat. Random meander transects were undertaken in pairs traversing each site. The locations of random meander transects are shown on Figure 3a, b and c.

During the random meander surveys, an inventory of all observed plant species was recorded at each site. Where threatened plants were detected, the number of individuals present was counted and the extent and geographic location of each population recorded using a hand-held non differential Global Positioning Systems (GPS). Where plant species could not be identified in the field, a representative sample was collected and preserved for later identification by the Royal Botanic Gardens, Sydney Herbarium.

3.4.3 Plot-based surveys (quadrats)

In order to comprehensively describe the structure and floristics of each sampled plant community, plot-based surveys were used. Plot-based surveys also provided a concentrated search area for the detection of inconspicuous plant species that may be present at a particular site. The structure and floristics exhibited by each plant community present in the study area was sampled using one or more 400m$^2$ quadrats. A modified Braun-Blanquet cover abundance scale was assigned to each of the species collected within any one quadrat. For this assessment a seven-division cover abundance scale was used (Table 1).

Table 1 Modified Braun blanquet cover abundance scale

<table>
<thead>
<tr>
<th>Cover abundance score</th>
<th>Cover abundance estimate (% cover of any species within each quadrat)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>&lt;5% - 3 or less individuals</td>
</tr>
<tr>
<td>2</td>
<td>&lt;5% - more than 3 individuals but sparsely scattered consistent throughout plot</td>
</tr>
<tr>
<td>3</td>
<td>&lt;5% - many individuals throughout plot and any number less than 5% cover abundance</td>
</tr>
<tr>
<td>4</td>
<td>Species covers between 5% and 25% of the plot</td>
</tr>
<tr>
<td>5</td>
<td>Species covers between 25% and 50% of the plot</td>
</tr>
<tr>
<td>6</td>
<td>Species covers between 50% and 75% of the plot</td>
</tr>
<tr>
<td>7</td>
<td>Species covers between 75% and 100% of the plot</td>
</tr>
</tbody>
</table>
Figure 3c: Flora survey effort.

Legend
- Survey effort
  - Quadrat
  - Random meander location
  - Transect
  - Study Area

Topography
- Road
- Railway
- Drainage

Acknowledgements:
This product incorporates Data which is copyright to the Commonwealth of Australia (c.2003.)
Survey data was compared with existing vegetation maps of the study area (DEC 2005q) in order to confirm the identification and extent of plant communities, particularly those that correspond to EEC. Any inconsistencies identified in the DECC vegetation mapping were checked using the results of both random meander transects and plot-based surveys.

3.4.4 Condition assessments

Habitat condition assessments collected data regarding the plant communities present at each survey site, including the dominant species within each stratum, the degree of cover and the relative quality or condition of the plant community. The condition of the vegetation was assessed according to the degree to which it resembled relatively natural, undisturbed vegetation using the following criteria:

a) Species composition (species richness, extent of weed invasion); and
b) Structure (representation of each of the original layers of vegetation).

Plant community condition was categorised as follows:

**Good**: containing a high number of indigenous species; no weeds present or weed invasion restricted to edges and track margins; vegetation community contains original layers of vegetation; vegetation layers (ground, shrub, canopy etc.) are intact.

**Moderate**: containing a moderate number of indigenous species; moderate level of weed invasion; weeds occurring in isolated patches or scattered throughout; one or more of original layers of vegetation are modified; vegetation layers (ground, shrub, canopy etc.) are largely intact.

**Poor**: containing a low number of indigenous species; high level of weed invasion; weeds occurring in dense patches or scattered throughout; one or more of the original layers of vegetation are highly modified; one or more original vegetation layers (ground, shrub, canopy etc) are modified or missing.

**Unnatural landscape**: highly modified landscape containing few or no indigenous species; exotic species dominant; original native vegetation layers removed; natural soil profile disturbed; unable to be regenerated to natural condition; high input intervention required to revegetate.
3.4.5 Flora survey effort

The details of the flora survey effort are shown in Tables 2 and 3.

Table 2 Flora survey details – targeted searches and habitat condition assessments

<table>
<thead>
<tr>
<th>Task</th>
<th>Details</th>
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<tbody>
<tr>
<td>Aim: to determine presence of threatened plant species and assess habitat condition</td>
<td></td>
</tr>
<tr>
<td>Targeted subject species</td>
<td>Cynanchum elegans, Daphnandra sp. 'Illawarra', Eucalyptus langleyi, Galium australe, Genoplesium baueri, Grevillea parviflora, Grevillea rivularis, Irenepharsus trypherus, Pomaderris parrisiae, Pterostylis gibbosa, Pterostylis pulchella, Solanum celatum, Syzygium paniculatum, Thesium australe, Zieria baueuerlenii, Zieria granulata</td>
</tr>
<tr>
<td>Survey technique</td>
<td>Random meander transects</td>
</tr>
<tr>
<td>Time invested in each survey technique</td>
<td>91.5 person hours</td>
</tr>
<tr>
<td>Dates of surveys</td>
<td>13/02/07 to 16/02/07 and 19/02/07 to 23/02/07</td>
</tr>
<tr>
<td>Survey point or transect marked on a map</td>
<td>See Figure 3a, b and c.</td>
</tr>
<tr>
<td>Size, orientation and dimensions of quadrat or length of transect for each survey technique</td>
<td>Targeted searches (random meanders) carried out within the study area. This included two persons walking in parallel lines approximately 20 m apart and traversing the sample site.</td>
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<tr>
<td>Survey start times and finish times</td>
<td>Between 8.00 am and 6.00 pm each day</td>
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Table 3 Flora survey details – plot-based sampling

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<tr>
<td>Aim: to describe structure and floristics of each plant community, identify EEC and search for inconspicuous plant species</td>
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<tr>
<td>Targeted subject species</td>
<td>All plant species and communities</td>
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<tr>
<td>Survey technique</td>
<td>Quadrats</td>
</tr>
<tr>
<td>Time invested in each survey technique</td>
<td>9 person hours</td>
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<tr>
<td>Dates of surveys</td>
<td>13/02/07 to 16/02/07 and 19/02/07 to 23/02/07</td>
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<tr>
<td>Description of site location</td>
<td>Stratified within each of the different plant communities.</td>
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<tr>
<td>Survey point marked on a map</td>
<td>See Figure 3a, b and c.</td>
</tr>
<tr>
<td>Size, orientation and dimensions of quadrat or length of transect for each survey technique</td>
<td>Eight quadrats each measuring 20 x 20 m (400 m²)</td>
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<tr>
<td>Survey start times and finish times</td>
<td>8.30 am to 4.30 pm per day.</td>
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3.5  Fauna surveys

3.5.1  Survey techniques

Elliot traps
Elliot traps targeting small, ground-dwelling mammals were deployed at three Sites (1, 3 and 15). Both small (size A) and large (size B) traps were used. Traps were placed along a transect with Elliot A and Elliot B traps alternating every five metres (thus, the distance between traps of the same size was approximately 10 m). Alternate baits (dog food and a mixture of rolled oats, peanut butter, honey and vanilla essence) were used for both trap sizes. Traps were opened before dusk each night for four consecutive nights and checked each following morning.

Cage traps
Cage traps targeting medium-sized ground-dwelling mammals were deployed at three Sites (1, 3 and 15). Traps were placed along a transect and were spaced between 20 m and 50 m apart. Traps were baited with chicken necks and a mixture of rolled oats, peanut butter, honey and vanilla essence. Traps were opened before dusk each night for four consecutive nights and checked each following morning.

Harp traps
Harp traps targeting microchiropteran bats were deployed at three Sites (3, 10 and 15). Traps were set along potential “flyways” for a maximum of two consecutive nights and checked each following morning.

Ultrasonic call recording
Ultrasonic call detectors targeting microchiropteran bats were deployed at five of the forest remnants (Sites 3, 10, 13, 15 and 17), three dams and beneath two road bridges.

Spotlighting
Spotlighting for nocturnal mammals and birds was carried out at four Sites (3, 10, 15 and 28) with repeated surveys carried out at two Sites (3 and 15). Spotlighting was either undertaken by two observers traversing through a site on foot or by driving slowly along tracks and examining the vegetation using a 50-watt spotlight. Spotlighting from a vehicle was also carried out in roadside vegetation along several minor roads and tracks within the study area.

Nocturnal frog survey
Frog surveys were undertaken by spotlight searches, aural surveys, and call playback, all of which were conducted at night within three to four hours of dusk. Spotlight searches targeted dams within the study area and one section of Broughton Creek. Aural surveys involved quietly listening for calling frogs for a period of five to six minutes at each site. Aural surveys were carried out at each spotlighting location (before the spotlight search) and were also carried out after rain at numerous dams and creeks adjacent to the Princes Highway south of Berry and Toolijooa and Beach Roads east of Berry. Call playback for the green and golden bell frog Litoria aurea was also undertaken at sites where it was considered they might occur.

Diurnal bird survey
Diurnal bird surveys were carried out in patches of native vegetation scattered throughout the study area and also at numerous farm dams. Surveys involved one or two observers traversing forest or woodland patches or scanning the area around a dam with binoculars. Birds were identified by direct observation with binoculars or by call.
Call playback

Call playback techniques were used at two Sites (3 and 28) to survey for owl species. Call playback involved repeating recorded calls of owls through a megaphone for a period of at least three minutes, followed by a five minute listening period and spotlighting.

Reptile survey

Habitat for threatened reptile species does not occur within the study area and no systematic searches for reptiles were carried out as part of this study. Reptiles were recorded by opportunistic identification when observed during other surveys or by occasional hand searches under rocks or fallen timber where suitable habitat was present.

3.5.2 Fauna habitat assessment

Fauna habitats within the study area were assessed on the basis of a variety of criteria, including: plant community structure; level of disturbance; existence of threatening processes; and potential value as a habitat corridor. The presence of particular habitat features was examined, including: potential food, nesting or roosting resources; ground shelter such as logs and litter; and water sources. The presence of potential resources for habitat specialists, such as feed trees for the glossy black-cockatoo, was also examined.

3.5.3 Survey effort

Fauna surveys were carried out by two zoologists between 12 and 21 February 2007, inclusive. Total survey effort for the techniques described above (except habitat assessment) is shown in Table 4 and Table 5. The location of fauna survey sites is shown on Figure 4a, b and c.

Table 4  Trapping survey effort

<table>
<thead>
<tr>
<th>Technique</th>
<th>No. trap nights</th>
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<tr>
<td>Elliot A traps</td>
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<td>Elliot B traps</td>
<td>220</td>
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<tr>
<td>Cage traps</td>
<td>72</td>
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<tr>
<td>Harp trap</td>
<td>7</td>
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<tr>
<td>Anabat detector</td>
<td>14</td>
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Table 5  Fauna survey effort

<table>
<thead>
<tr>
<th>Technique</th>
<th>No. hours</th>
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<tr>
<td>Nocturnal frog survey</td>
<td>5.7</td>
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<tr>
<td>Spotlighting (mammals)</td>
<td>8.5</td>
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<tr>
<td>Owl call playback</td>
<td>1.4</td>
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<tr>
<td>Diurnal bird survey</td>
<td>17.2</td>
</tr>
</tbody>
</table>
Figure 4a: Fauna survey effort.

Legend

Survey sites
- Anabat
- Anabat/Harp Trap
- Anabat/Owl Call Playback
- Bird Survey

Transects
- Bird Survey
- Bird Survey/Spotlighting
- Cage Trap
- Elliot Trap
- Elliot Trap/Cage Trap/Bird Survey
- Elliot Trap/Cage Trap/Bird Survey/Spotlighting
- Spotlighting

Survey effort
- Study Area

Topography
- Road
- Railway
- Drainage

Acknowledgements:
This product incorporates Data which is copyright to the Commonwealth of Australia (c.2003-).
Figure 4b: Fauna survey effort.
Figure 4c: Fauna survey effort.
### 3.6 Conservation significance assessment

The conservation significance of flora and fauna within the study area was primarily assessed according to Commonwealth (EPBC Act) and NSW (TSC Act) legislation and other relevant policies. In this report the term “threatened species” refers to species listed as vulnerable, endangered or critically endangered on either or both of the acts.

Plant communities were considered to be of national conservation significance if they comprised part of an EEC listed on the EPBC Act and of state significance if they comprised part of an EEC listed on the TSC Act. Areas containing vegetation associations defined by a State Environmental Planning Policy (SEPP) were also considered to be of state significance: these included coastal wetlands listed under SEPP 14, littoral rainforest as defined by SEPP 26 and core koala habitat as defined by SEPP 44.

Plant and animal species listed as threatened on the EPBC Act were considered to be of national conservation significance and of state significance if listed on the TSC Act. Within this categorisation, threatened species listed as endangered or critically endangered are of greater conservation significance than species listed as vulnerable. Threatened species were also considered to be of greater conservation significance if they were at or close to the edge of their known range. Other flora and fauna considered to be of conservation significance included listed migratory species on the EPBC Act.

Areas of known and potential habitat for threatened flora and fauna species were also considered to be of conservation significance. Areas listed as critical habitat on the EPBC or TSC Acts were given national or state significance accordingly. Areas that could be regarded as “important habitat” (as defined by the EPBC Act) for listed migratory species were also considered to be of national significance. In order to provide some distinction between areas not listed as critical habitat, known habitats for threatened species were assessed according to the number and significance of the threatened species they were likely to support and the extent and nature of the resources present. Areas that contained potential habitat for threatened species were assessed in the same way; however, these areas were also assessed according to the likelihood that threatened species would occur.

Areas that were considered to be part of a regional or local habitat corridor were considered to be of regional or local significance respectively.

All of the factors were combined to rank sections of the study area in terms of relative conservation significance, from “very high” to “very low”. The system used for ranking overall conservation significance is described in Section 5.  

### 3.7 Limitations

Field investigations for this study were carried out over a single sampling period. Given that some species are likely to occur (or be readily detected) seasonally, occasionally, or use different areas periodically it is highly unlikely that the field surveys would have detected all of the species likely to occur within the sample sites or the study area as a whole. In addition, sampling effort within the study was targeted, with some sample sites receiving more survey effort than others.

Other limitations to the field investigations included site access. Whilst the majority of land owners able to be contacted assisted the field investigations and the study was able to apply recognised sampling techniques to most of the habitat types present within the study area, surveys of some sites were limited by various constraints. These included limitations imposed by land owners on survey techniques or survey times and duration or, in some cases, a refusal of access.
The limitations of the study were taken into consideration in the analysis of results. First, the conclusions of this study are drawn from a variety of data in addition to the field data collected during this investigation. Second, the fact that a particular species was not detected during the survey was not, in itself, considered a sufficient basis to exclude that species from consideration. Finally, assessments of conservation significance were made, wherever possible, on criteria for which information was available across the study area or could be reasonably assumed.

3.8 Taxonomy

Plant taxonomy (method of classification) used in this report follows (Harden 1990, 1991, 1992, 1993); (Brooker and Kleinig 1999) or subsequent advice from the National Herbarium of NSW. Plant species are referred to using their scientific names in this report with all scientific and common names listed in the appendices.

Names of vertebrates follow the Census of Australian Vertebrates (CAV) maintained by the Commonwealth Department of the Environment and Water Resources. In the body of this report vertebrates are referred to by both their common and scientific names when first mentioned. Subsequent references to these species cite the common name only.