ATTACHMENT 4

ECOLOGICAL ASSESSMENT

Travers

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ecological assessment

REZONING OF
LOT 23 DP 1159704

76 BERKELEY ROAD,
FOUNTAINDALE

JULY 2011
(REF: A11049)

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File: A11049

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The mapping is indicative of available space and location of features which may prove critical in assessing the viability of the proposed works. Mapping has been produced on a map base with an inherent level of inaccuracy, the location of all mapped features are to be confirmed by a registered surveyor.

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Executive Summary

Travers bushfire & ecology have been engaged by *Hapido Pty Ltd* and *TSM Projects Pty Ltd* to prepare an updated ecological assessment in for the purposes of a revised planning proposal for the rezoning of Lot 23 DP 1159704 at 76 Berkeley Road, Fountaindale.

It is intended to transfer E2 zoned lands to Wyong Shire Council and the E4 zoned lands will be retained in private ownership to allow for a three (3) lot rural residential subdivision and associated asset protection zones for typical dwellings. The transfer of E2 lands to Wyong Shire Council will secure an important wildlife corridor in the locality.

Typical building envelopes have been identified on the concept subdivision plans which generally aim to keep the proposed dwellings out of the 1% AEP flood level. Building envelopes, asset protection zones, effluent management areas and retained vegetation areas have been identified for each of the three lots to ensure that the expected impacts are largely contained within cleared portions of the site.

The potential ecological impacts on this site relates to potential for tree removal, functioning of watercourses, construction and implementation of asset protection zones and wastewater management systems and the potential impacts on identified EEC's.

Legislative Requirements

Ecological survey and assessment has been undertaken in accordance with relevant legislation including the *Environmental Planning and Assessment Act 1979*, the *Threatened Species Conservation Act 1995*, the *Environment Protection and Biodiversity Conservation Act 1999* and the *Fisheries Management Act 1994*.

In respect of matters required to be considered under the *Environmental Planning and Assessment Act 1979* and relating to the species / provisions of the *Threatened Species Conservation Act 1995*, seven (7) threatened fauna species including Powerful Owl (*Ninox strenua*), Varied Sittella (*Daphoenositta chrysoptera*), Grey-headed Flying-fox (*Pteropus poliocephalus*), Little Bentwing-bat (*Miniopterus australis*), Eastern Bentwing-bat (*Miniopterus orianae oceansis*), Greater Broad-nosed Bat (*Scoteanax rueppellii*) and Yellow-bellied Glider (*Petaurus australis*), one (1) threatened flora species, *Melaleuca biconvexa* and three (3) endangered ecological communities, *Swamp Sclerophyll Forest on Coastal Floodplains, River-flat Eucalypt Forest on Coastal Floodplains* and *Lowland Rainforest* were recorded within or in close proximity to the subject site.

In accordance with Section 5A of the *Environmental Planning and Assessment Act 1979*, the 7 part test of significance concluded that the proposed subdivision and associated works, is not likely to have a significant impact on any threatened species, populations or endangered ecological communities. Therefore, a Species Impact Statement should not be required for the proposal.

In respect of matters required to be considered under the *Environment Protection and Biodiversity Conservation Act 1999*, one (1) threatened fauna species, Grey-headed Flying-fox (*Pteropus poliocephalus*) and one (1) threatened flora species, *Melaleuca biconvexa,* was recorded within the subject site. No endangered populations or endangered ecological communities listed under this Act were recorded within or in close proximity the subject site.

The proposed development will not impact on the population of *Melaleuca biconvexa* due to the strategic location of proposed development footprint and asset protection zones that avoid the habitat of this species. Additionally protection measures for the existing protection and enhancement will provide a positive outcome for the ongoing sustainability of the population.

In respect of matters relative to the *Fisheries Management Act 1994*, no suitable habitat for threatened marine or aquatic species was observed within the subject site and there are no matters requiring further consideration under this Act.

Ecological Impacts & Habitat Restoration

Wyong Shire Council in correspondence dated 27th October 2010, raised the following relevant ecological issues including:-

- Flora and fauna impacts
- Wetlands
- Wildlife corridors
- Proposed conservation offset

These issues are briefly addressed below.

Flora and Fauna Impacts

This flora and fauna reports identifies the presence of 3 new threatened species including:-

- Powerful Owl
- Varied Sittella
- Eastern Bentwing-bat

All dwellings can be constructed and asset protections implemented without further removal of vegetation or trees, and effluent zones can be located within cleared lands. Therefore the proposed E4 lands and subsequent subdivision will not significantly impact any of the recorded threatened species.

It is estimated that there are approximately 50 juvenile *Melaleuca biconvexa* within the northern portion of Lot 2. This area is not subject to any future development and the land area containing the juvenile species can be fenced off with title restrictions in a similar fashion that has occurred within the rural residential subdivision on the southern side of Berkeley Road within DP 1134328. Additionally given the large number (1000+) plants mainly occurring and regenerating within the proposed E2 lands, the retention and protection of these few juvenile plants is considered to represent an acceptable and consistent conservation outcome.

No *Eucalyptus robusta* trees recorded onsite are expected to be affected directly by construction of dwellings, access or the asset protection zones.

Wetlands

A SEPP 14 Wetland occurs approximately 600m to the north east of proposed Lot 2. The wetland is mapped in Wyong Council's DCP 30 immediately to the north-west of Lot 2 DP 1100181. The subject site is within land that is upstream of the wetland. Consequently development within the proposed subdivision has an influence on the quality of catchment runoff into the SEPP 14 Wetland.

However the low impact nature of the subdivision (rural residential) and the presence of significant vegetated lands between the site and the wetland, reduces the risk of nutrient or sediment pollution into the wetland to an insignificant level.

The implementation of standard controls over the construction and ongoing land management within the proposed rural residential lots will ensure that there is no significant deterioration in runoff from the proposed E4 lands. Such issues can adequately be addressed at the DA stage.

Wildlife corridors

The existing vegetation within the proposed E2 lands of the subject site, which is proposed to be transferred to Council, forms an important regional wildlife corridor linking the vegetated ridge top lands with the vegetated wetlands within the valley floor. The corridor through the site connects these northern and southern conservation areas which area currently owned by Council.

The transfer of this significant corridor link to Council will ensure a positive conservation outcome by protection of the corridor in perpetuity. The vegetation within the corridor is only broken by the existing Berkeley Road corridor which represents a greater threat to the movement of wildlife then the proposed subdivision. Future road works along Berkeley Road will need to consider the impact of road widening on habitat connectivity and the provision of appropriate crossing points. The implementation of crossing points is not the responsibility of the current land owners.

The proposed E2 lands provide a minimum 100 m wide corridor that is fully vegetated and is actively utilised by local fauna. Ongoing natural regeneration will continue to see the previously disturbed portions of the corridor mature. Weed control and strategic planting shrub, subcanopy and canopy species will enhance the quality of the existing wildlife corridor.

The proposed regeneration areas in Wyong Shire Councils correspondence on the northern portion of lot 2 and southern portion of lot 4 do not add significantly to the functioning of the corridor or to the amount of land conserved. The retention of trees within these areas will continue to provide canopy connectivity facilitating wildlife movement. Natural regeneration to the west of lot 4 is occurring rapidly with native and weed species. Therefore revegetation works should only supplement canopy species and aim to remove any existing weeds that may be competing with the regeneration of native plants.

Conservation Offset

As there is to be no clearing of vegetation, a conservation offset is not required for the loss of native vegetation. In combination with fencing, regeneration and protection of any *Melaleuca biconvexa* areas under title, the proposed E2 lands provide an offset for the loss of any affected *Melaleuca biconvexa*.

Conclusion

It is concluded that the proposed rezoning, future subdivision and associated development to create three (3) rural-residential allotments as well as a residual conservation lot at No. 76 Berkeley Road, Fountaindale is unlikely to result in a significant impact on any threatened species, populations or endangered ecological communities or their habitats.

The proposed rezoning conserves the most significant threatened flora, fauna habitat and recorded endangered ecological communities within the proposed E2 lands.

As such no further assessments are considered to be required under the *EP&A Act 1979, EPBC Act 1999 or FM Act 1994.*

List of abbreviations

APZ	asset protection zone
BPA	bushfire protection assessment
CLUMP	conservation land use management plan
DCP	Development Control Plan
DEC	NSW Department of Environment and Conservation (superseded by DECC from 4/07)
DECC	NSW Department of Environment and Climate Change (superseded by DECCW from 10/09)
DECCW	NSW Department of Environment, Climate Change and Water (superseded by OEH from 4/11)
DCP	NSW Department of Premier and Cabinet
EEC	endangered ecological community
EPA	Environmental Protection Agency
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ESMP	ecological site management plan
FF	flora and fauna assessment
FM Act	*Fisheries Management Act 1994*
FMP	fuel management plan
HTA	habitat tree assessment
IPA	inner protection area
LEP	Local Environment Plan
LGA	local government area
NES	national environmental significance
NPWS	NSW National Parks and Wildlife Service
NSW DPI	NSW Department of Industry and Investment
OEH	Office of Environment and Heritage (Part of the NSW Department of Premier and Cabinet)
OPA	outer protection area
PBP	*Planning for Bush Fire Protection 2006: A Guide for Councils, Planners, Fire Authorities and Developers*

POM	plan of management
RF Act	*Rural Fires Act*
RFS	NSW Rural Fire Service
ROTAP	rare or threatened Australian plants
SEPP 44	*State Environmental Protection Policy No 44 – Koala Habitat Protection*
SEWPAC	Federal Department of Sustainability, Environment, Water, Population and Communities
SIS	species impact statement
SULE	safe useful life expectancy
TPO	tree preservation order
TPZ	tree preservation zone
TRRP	tree retention and removal plan
TSC Act	*Threatened Species Conservation Act 1995*
VMP	vegetation management plan

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Tables

Travers bushfire & ecology have been engaged by *Hapido Pty Ltd* and *TSM Projects Pty Ltd* to prepare an updated ecological assessment in for the purposes of a revised planning proposal for the rezoning of Lot 23 DP 1159704 at 76 Berkeley Road, Fountaindale.

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The proposal encompasses an area of approximately 10.861ha of which 63.5% will be dedicated to conservation. Building envelopes have been identified on the development plans coupled with the relevant asset protection zones.

The following figures indicate the sites constraints and significant ecological features;

Figure 1 – proposed subdivision
Figure 2 – vegetation communities and threatened flora
Figure 3 – flora and fauna survey effort and results

1.1 Aims of the assessment

The aims of the flora and fauna assessment are to:

- Carry out a botanical survey to describe the vegetation communities and their conditions
- Carry out a fauna survey for the detection and assessment of fauna and their habitats
- Complete target surveys for threatened species, populations and ecological communities
- Prepare a flora and fauna impact assessment in accordance with the requirements of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), the *Threatened Species Conservation Act 1995* (TSC Act), the *Fisheries Management Act 1994* (FM Act) and guidelines issued by the Department of Environment and Conservation (DEC 2004 - now OEH)

1.2 Statutory requirements

1.2.1 Threatened Species Conservation Act 1995

The specific requirements of the *TSC Act* must be addressed in the assessment of flora and fauna matters. This requires the consideration of potential impacts on threatened species, populations and ecological communities. The factors to be taken into account in deciding whether there is a significant effect are set out in Section 5A of the *Environmental Planning*

and Assessment Act 1979 (EPA Act) and are based on a 7 part test of significance. Where a proposed activity is located in an area identified as critical habitat, or such that it is likely to significantly affect threatened species, populations, ecological communities, or their habitats, a Species Impact Statement (SIS) is required to be prepared.

1.2.2 Fisheries Management Act 1994

The *FM Act* provides a list of threatened aquatic species that require consideration when addressing the potential impacts of a proposed development. Where a proposed activity is located in an area identified as critical habitat, or such that it is likely to significantly affect threatened species, populations, ecological communities, or their habitats, an SIS is required to be prepared.

1.2.3 Environment Protection and Biodiversity Conservation Act 1999

The *EPBC Act* requires that Commonwealth approval be obtained for certain actions. It provides an assessment and approvals system for actions that have a significant impact on matters of *national environmental significance* (NES). These may include:

- World Heritage Properties and National Heritage Places
- Wetlands of International Importance protected by international treaty
- Nationally listed threatened species and ecological communities
- Nationally listed migratory species
- Commonwealth marine environment

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

Where a proposed activity is located in an area identified to be of NES, or such that it is likely to significantly affect threatened species, ecological communities, migratory species or their habitats, then the matter needs to be referred to the Department of Sustainability, Environment, Water, Population and Communities (SEWPAC) for assessment. In the case where no listed federal species are located on site then no referral is required. The onus is on the proponent to make the application and not the Council to make any referral.

A significant impact is regarded as being:

> *important, notable, or of consequence, having regard to its context or intensity and depends upon the sensitivity, value, and quality of the environment which is impacted and upon the duration, magnitude, and geographical extent of the impacts. A significant impact is likely when it is a real or not a remote chance or possibility.*
>
> *Source: EPBC Policy Statement*

Guidelines on the correct interpretation of the actions and assessment of significance are located on the department's web site http://www.environment.gov.au/epbc/publications.

1.3 Development proposal

This ecological assessment has been prepared to accompany a planning proposal for the rezoning of the land. Upon rezoning it is proposed to develop part of the land for three (3)

rural residential lots within the proposed E4 zoned land (Figure 1). The E2 lands will be set aside and transferred to public ownership.

Bushfire asset protection zones have been determined following bushfire assessment by *Travers bushfire & ecology 2011.* The proposed effluent disposal areas are illustrated on Figure 1.

1.4 Site description

Table 1.1 provides a summary of the planning, cadastral, topographical, and disturbance details of the subject site.

Table 1.1 – Site features

Location	The subject site is located on the northern, southern and south-western side of Berkeley Road, Fountaindale.
Area	10.861ha
Local government area	Wyong Shire Council
Grid reference	352500E 6310000N
Elevation	10-70m (AHD)
Topography	The subject site is situated on the lower slope/s and flats and feeds into Ourimbah Creek. Its topography consists of moderately steep hillsides in the southeast and west, grading to a relatively flat landscape. It is crossed by two intermittent drainage lines. Steeper hillsides occur immediately beyond the southern and western boundaries of the study area. Gradients are variable from approximately 5-30% with a generally north easterly aspect.
Geology and soils	The Gosford – Lake Macquarie 1:100,000 Soil Landscape map sheet (Murphy & Tille, 1993) identifies the subject site as being located within a combination of the Erina, Watagan and Wyong Soil Landscapes. The northern portion of the subject site is situated upon quaternary alluvium, gravel, sand, silt and clay. The southern portion of the subject site is situated on the confluence of the Terrigal Formation and Clifton Sub-group of the Narrabeen Series, which is part of the Triassic Period.
Catchment & drainage	Small un-named drainages that flow into the subject from the south widen into a floodplain basin within the subject site where constructed drainages and soaks continue towards a SEPP 14 wetland to the north-east. Road drainages in the area are also diverted towards Ourimbah Creek to the north which flows into the Tuggerah Lakes at Chittaway Point.
Vegetation	The natural vegetation of the subject site is comprised of natural forests, disturbed forest and cleared lands that arise from horse and cattle grazing. There are no nearby conservation reserves. A SEPP 14 Wetland occurs approximately 600m to the north east of proposed Lot 2. The wetland is mapped in Wyong Council's DCP 30 immediately to the north-west of Lot 2 DP 1100181.
Existing land use	Cleared areas are used for grazing of small numbers of cattle and

Table 1.1 – Site features

	horses. No dwellings are currently located on the subject site. No major earthworks have been conducted within the site although Wyong Shire Council is undertaking major earthworks on the widening the Berkeley Road corridor. Cleared portions of the southern lot were historically used as a market garden.
Clearing	Irregular areas of clearing occur within the subject site.

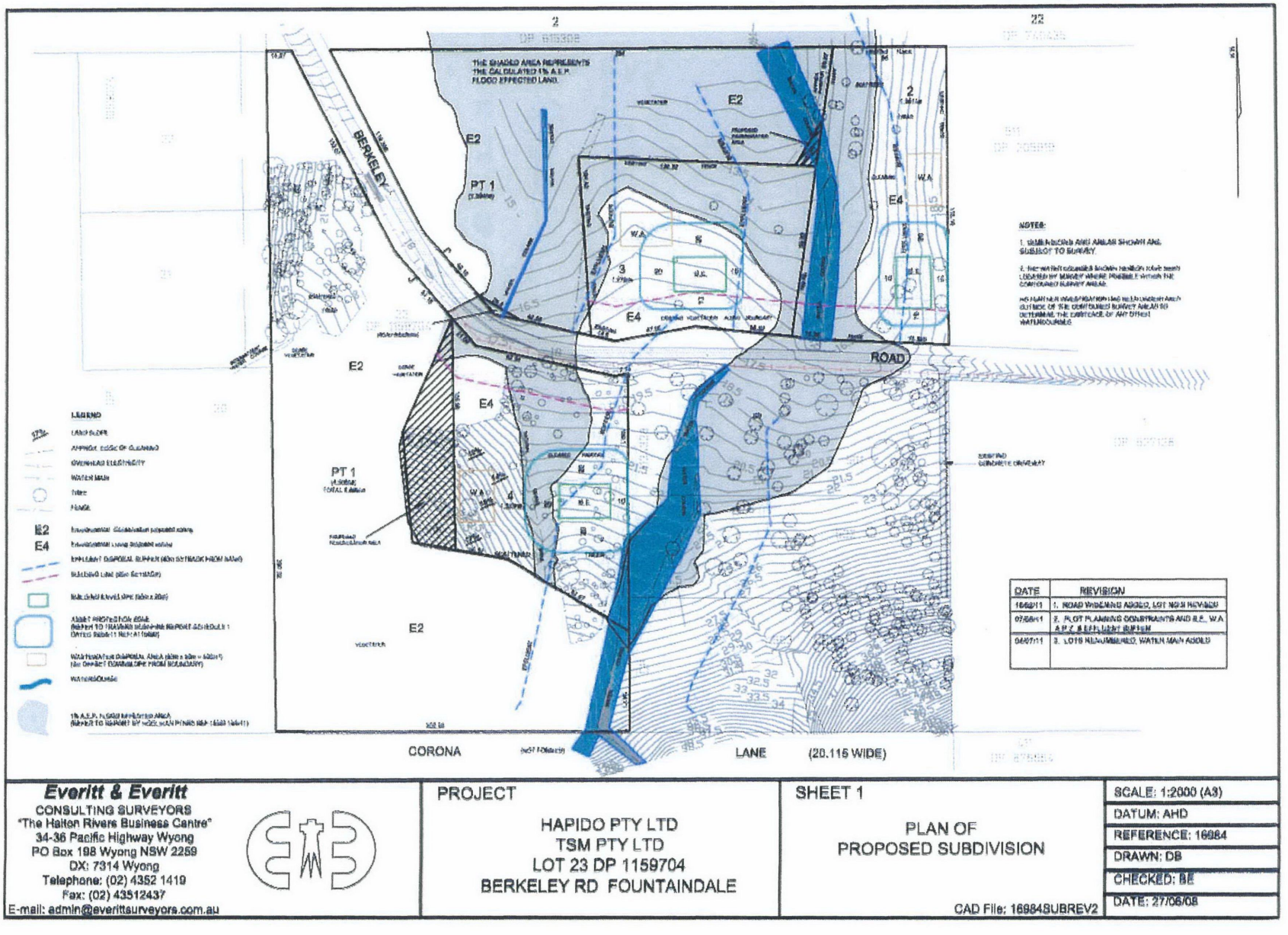


Figure 1 – Proposed Subdivision

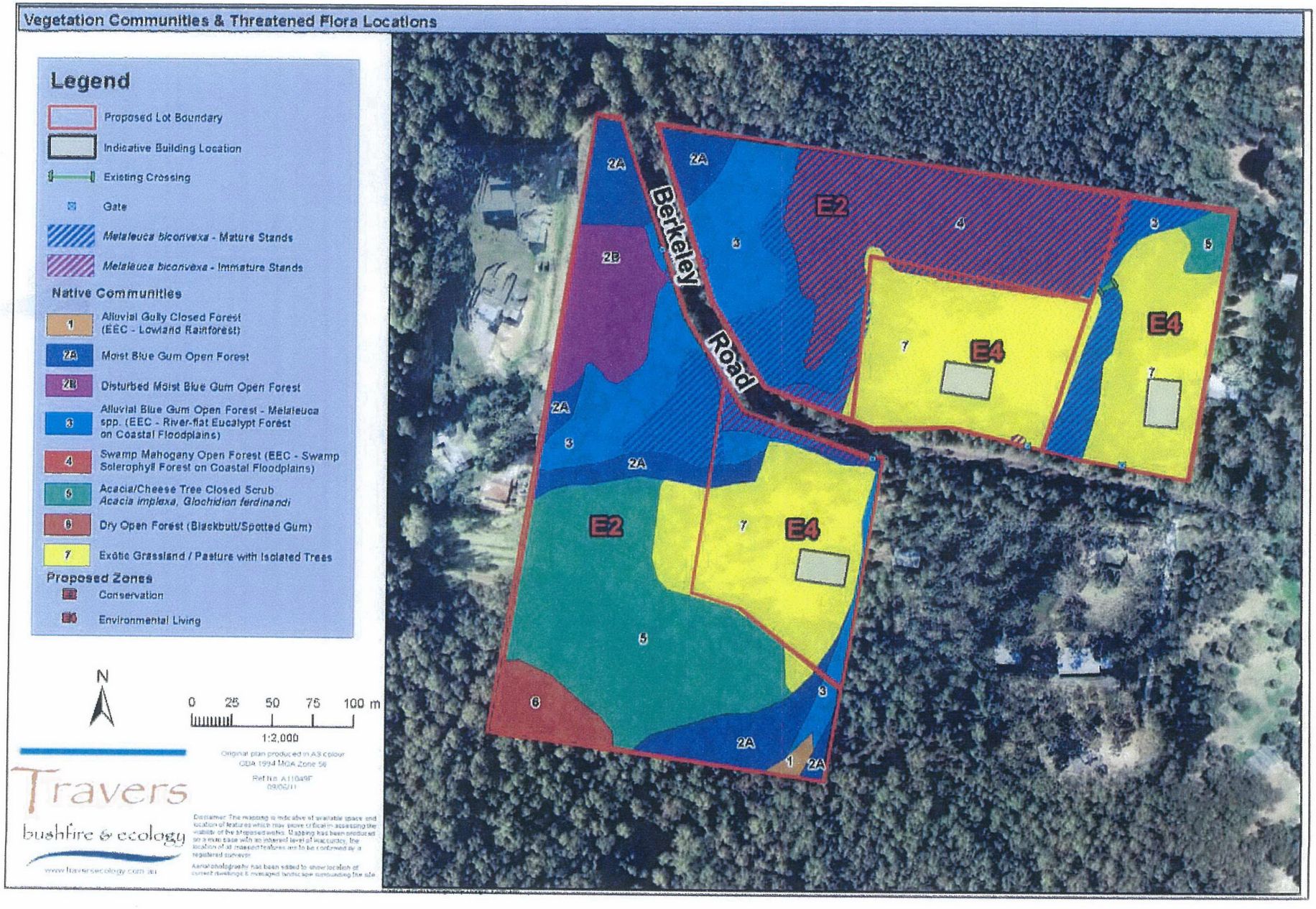


Figure 2 - Vegetation Communities & Threatened Flora Results

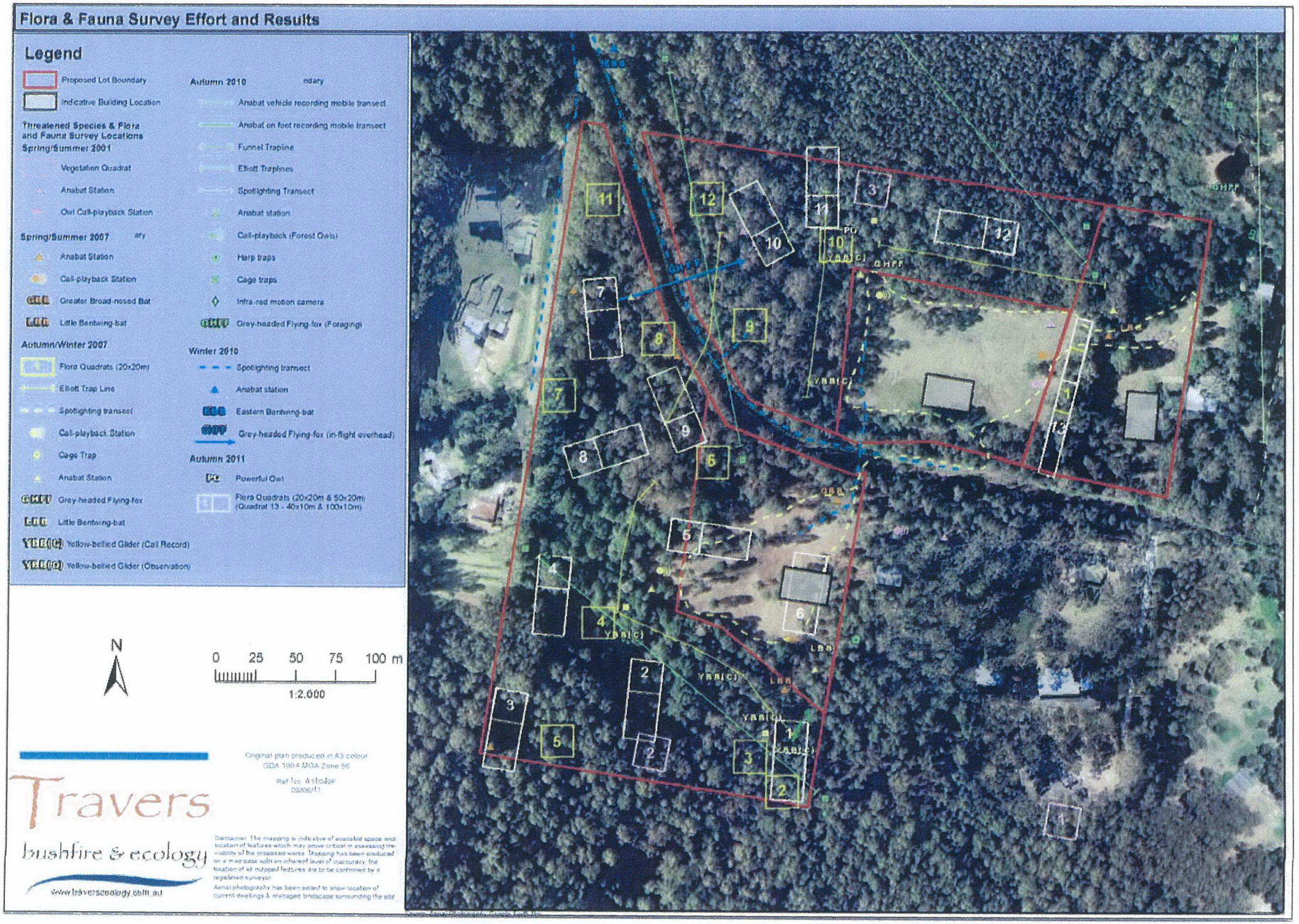


Figure 3 - Flora & Fauna Survey Effort & Results

2.1 Survey constraints

It is important to note that field survey data collected during the survey period is representative of species occurring within the subject site for that occasion. Due to effects of fire, breeding cycles, migratory patterns, camouflage, weather conditions, time of day, visibility, predatory and / or feeding patterns, increased species frequency or richness may be observed within the subject site outside the nominated survey period. Habitat assessments based on the identification of micro-habitat features for various species of interest, including regionally significant and threatened species, have been used to overcome this survey limitation.

2.2 Information collation

A review of the relevant information pertinent to the subject site was undertaken prior to the initiation of field surveys as background to the study. Information sources reviewed include the following:

Specialist advice:

- Onsite Wastewater Management Report *(2007) Whitehead & Associates 2007*
- *Edge of clearing survey and mapping* by *Everitt & Everitt 2007*
- Survey and mapping undertaken *by Everitt & Everitt May 2007/2011*
- Watercourse definition by *Everitt & Everitt May 2007/2011*
- Bushfire Protection Assessment *(2011) Travers Bushfire & Ecology*

Standard Technical Resources:

- *Flora and Fauna Guidelines for Development – Wyong Shire Council 1999*
- *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities 2004* (working draft), Department of Environment and Conservation (DEC)
- Aerial photographs (Google Earth Pro / Spatial Information Exchange / Nearmap)
- Topographical maps (scale 1:25,000)
- *Threatened Species Conservation Act 1995* (TSC Act)
- *Fisheries Management Act 1994* (FM Act)
- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- Rare or Threatened Australian Plants (ROTAP)
- The natural vegetation maps for the study area including Wyong local government area (LGA), Central Coast, New South Wales (Stephen Bell) and LHCCREMS Vegetation Mapping.

Conacher Travers Pty Ltd and *Travers Environmental Consultants have previously undertaken* field surveys on:

- 17-21 September and 5 October, 2001

- 11 & 21 March, 2002
- 9-13 July, 2007
- 20-21 November 2007

To determine the likely and actual occurrence of flora species, fauna species and plant communities on the subject site a variety of assessments were undertaken to supplement previous surveys of the area and literature reviews. The methods utilised included:

- ***Literature review*** – A review of readily available literature for the area was undertaken to obtain reference material and background information for this survey.

- ***Data search*** – A search of the *Atlas of NSW Wildlife* (OEH 2011) was undertaken to identify records of threatened flora and fauna species located within a 10km radius of the site. Searches were also undertaken on the SEWPAC – 'protected matters search tool' website to generate a report that will help determine whether matters of national environmental significance or other matters protected by the EPBC Act are likely to occur in the area of interest. The search was broadened to a 10km radius like the Atlas search. These two searches combined, enabled the preparation of a list of threatened flora and fauna species that could potentially occur within the habitats found on the site (Tables 4.1, 4.2 and 4.3).

- ***Accuracy of flora identification*** – Specimens of plants not readily discernible in the field were collected for identification. Structural descriptions of the vegetation were made according to Specht *et al* (1995).

- ***Licences*** – Individual staff members are licensed under Clause 20 of the *National Parks and Wildlife (Land Management) Regulation 1995* and Section 120 & 131 of the *National Parks and Wildlife Act 1974* to conduct flora and fauna surveys within service and non-service areas. NPWS Scientific Licence Numbers: S10359.

  The staff of *Travers bushfire & ecology* are licensed under an Animal Research Authority issued by the Department of Agriculture. This authority allows *Travers bushfire & ecology* staff to conduct various fauna surveys of native and introduced fauna for the purposes of environmental consulting throughout New South Wales.

2.3 Flora survey methodology

A flora survey using a systematic stratified sampling regime within each of the identified vegetation communities, incorporating the placement of 20x20 metre quadrats, was undertaken on 5 October 2001, 12 & 16 July 2007 and 20 & 21 November 2007. The flora survey targeted all vegetation communities present within the study area. The locations of flora survey quadrats are shown in Figure 3.

Targeted survey was undertaken on both 23 May and 20 November 2007 to determine the distribution of *Melaleuca biconvexa* within the site and local area.

Updated flora survey utilising a biometric quadrat style of assessment was undertaken across all parts of the site on 18 May 2011 to quantitatively determine the quality of vegetation with conserved areas.

2.4 Fauna survey methodology

Fauna survey was carried out for the subject site in spring 17-21st September 2001 (by *Conacher Travers*), winter 9-13th July 2007 and in late spring 20-21st November 2007 (by *Travers Environmental Consultants*) and May 21-24th 2010 and again on the 14-18th June 2010. Survey effort is provided on Figure 3.

All survey effort described below is consistent with all surveys unless described otherwise. Survey dates, times, weather conditions and methods employed are shown in Table 2.1.

2.4.1 Diurnal birds

Visual observation and call identification of birds was carried out during visits to the site.

Opportunistic bird counts are also made while undertaking other survey work and during spotlight surveys of the site.

Birds were observed and identified using binoculars. Calls were generally identified in the field by the observer. If an unknown call was heard it is recorded and identified using reference libraries.

2.4.2 Nocturnal birds

The presence of nocturnal birds is first determined by quiet listening after dusk for calls by individuals emerging from diurnal roosts. Following this and provided no calls were heard call-playback techniques are employed. This involves broadcasting recorded calls through a 15 watt Toa 'Faunatech' amplifier to evoke a response from species known to reply.

Given the suitability of habitat present Masked Owl (*Tyto novaehollandiae*), Powerful Owl (*Ninox strenua*), Barking Owl (*Ninox connivens*), Sooty Owl (*Tyto tenebricosa*), Grass Owl (*Tyto capensis*) and Bush Stone-curlew (*Burhinus grallarius*) were targeted. Each call was played for 5-minute periods with 5-minute intervals of quiet listening for a response. This was followed with spotlighting and periods of quiet listening throughout the nocturnal survey. Call-playback stations are shown on Figure 3.

Searches for evidence of Owl roosts and potential Owl roosting / breeding hollows were made during general surveys of the subject site. Any whitewash, or regurgitated pellets found were noted.

Flora survey recorded presence of a Powerful Owl roosting on the 19th May 2011. On this same afternoon, a brief search was undertaken for nearby potential nesting hollows. This was followed by night survey for one hour following dusk to attempt to locate any nearby nesting behaviour. No call-playback or spotlighting was undertaken at this time to prevent any nesting disturbance.

Travers bushfire & ecology has not undertaken comprehensive hollow bearing-tree survey within the subject site, given that the proposal will not be removing any open forest habitat. As such the locations of potential nesting hollows for Powerful Owl have not been determined.

2.4.3 Arboreal and terrestrial mammals

2001 & 2007 Surveys

Elliott Type A and B traps were used for trapping arboreal and terrestrial mammals. Trapping during 2001 surveys consisted of 60 arboreal trap nights and 60 terrestrial trap nights. Trapping during 2007 surveys consisted of 100 arboreal trap nights and 100 terrestrial trap nights.

Arboreal trap-lines using 10-20 metre separations were placed in the most suitable trees along approximately 80m transects. Elliott type A and B traps were placed onto platforms that were attached to the trunks of trees 2-3 m above the ground at an incline of 10 degrees to facilitate drainage during inclement weather. A mixture of honey and water was then sprayed onto the trunk 3-5 metres above the trap and around the platform as a lure.

Terrestrial trap-lines of type A and B Elliott traps using 10-20 metre separations were placed along the same line as the arboreal traps in the most suitable terrestrial habitats.

The traps were baited with a mixture of rolled oats, honey and peanut butter.

Three trap-lines were set on the nights of 17, 18, 19 & 20 September, 2001. Five trap-lines were set on the nights of 9, 10, 11 & 12 July 2007. The location of the trap-lines is shown in Figure 3. During 2001 surveys each trap-line consisted of 5 type A arboreal traps, 3 type B terrestrial traps and 2 type A terrestrial traps. During 2007 surveys three trap-lines consisted of 5 type A arboreal traps and 5 type A terrestrial traps and two trap-lines of 5 type A and 5 type B traps, alternating in size for both arboreal and terrestrial traps.

Cage trapping was conducted to target the threatened species, Southern Brown Bandicoot (*Isoodon obesulus*) and Spotted-tailed Quoll (*Dasyurus maculatus*). Cage traps were positioned along or adjacent to each of the Elliott trap lines in suitable in areas of dense shrub and ground cover. The standard cage traps used are 18cm x 18cm by 45cm long. Cage trapping consisted of a total of 8 trap nights during 2001 surveys and 12 trap nights during 2007 surveys. Cage traps were placed in suitable in areas of dense shrub and ground cover. The cage traps were baited with a mix of honey, oats and peanut butter and sardines. During 2007 surveys two traps were baited with ox's tongue with cat food smeared over traps and surrounding trees.

2010 Surveys

Autumn survey undertaken for lands to the east included three Elliott trap-lines within the subject site as well as one trap-line just outside the eastern boundary. Traps were placed in the same manner described above with all arboreal traps and one terrestrial trap-line consisting of five (5) Elliott type B traps and all remaining terrestrial trapline consisting of five (5) Elliott type A traps. This total effort consisted of 60 terrestrial and 60 arboreal Elliot trap nights.

Cage traps baited with chicken were placed at either end of each Elliott trap-line. A lure of Jellymeat catfood was smeared to nearby trees as a lure. An infra-red / motion detection and heat sensor surveillance camera was placed at one cage trap to capture trap shy fauna coming close but not entering traps. The trapping effort during 2010 was undertaken between May 21-24th and again on the 14-18th June 2010.

All surveys

The presence of Yellow-bellied Glider (*Petaurus australis*), Squirrel Glider (*Petaurus norfolcensis*) and Koala (*Phascolarctos cinereus*) were targeted by broadcasting taped calls through a 15 watt Toa 'Faunatech' amplifier. Calls were played for 5 minute periods at 5 minute intervals during each nocturnal survey, followed with quiet listening and spotlighting.

Assessment of 'found' scats, markings, diggings, runways and scratches during visits to the site is generally undertaken. Any scats or pellets not readily identifiable are collected and sent to an expert for identification of contents, hair or bone fragments. Habitat is also assessed to determine the likelihood of threatened native species of fauna occurring within the subject site.

Spotlighting for nocturnal mammalian fauna was carried out using a hand held lamp of 750,000 candlelight power (100W halogen globe). This technique involved walking amongst the forest edges of the subject site so that a maximum number of trees could be observed.

The subject area was assessed for activity by Koalas using the following method.

i. A search of the Atlas of NSW Wildlife (OEH 2011) databases.

ii. The site was surveyed on foot, with known Koala food trees being inspected for signs of use. Trees were inspected for characteristic scratch and claw marks on the trunk and scats around the base of each tree. The proportion of trees showing signs of Koala use was calculated. Additionally the location and density of droppings if found were documented.

iii. Identification and an assessment of the density of tree species listed as Koala feed trees in State Environmental Protection Policy No. 44 - Koala Habitat Protection was undertaken across the site. An estimate of the percentage density of each tree species across the site was determined by averaging the percentage of stems counted.

iv. Koalas were also targeted during spotlight surveys which included the use of call-playback techniques described above.

2.4.4 Bats

Micro-chiropteran bats were surveyed by echolocation using Anabat Mk 2 and SD-1 detectors in fixed passive monitoring positions throughout the subject site. Recording locations were determined in order to represent different available foraging structures for various micro-chiropteran bat species.

Fixed passive monitoring involves leaving the bat recorder in a position to record call-sequences of passing bats. Fixed monitoring positions were deployed during all nocturnal survey undertaken by *Conacher Travers* (2001), *Travers Environmental Consultants* (2007) and *Travers bushfire & ecology* (2010).

Bat call recordings were interpreted through Anabat V and Anabat CF Storage and Interface Module ZCAIM devices and analysed using Anabat 6 and Analook 3.3q computer software packages.

Mega-chiropteran bat species, such as Grey-headed Flying-fox (*Pteropus poliocephalus*), were surveyed by targeting flowering / fruiting trees during spotlighting activities.

2010 Surveys

One (1) Harp (Constantine) Trap was placed within the subject site as part of surveys for adjacent lands to the east. This trap was setup for the 19th, 20th, 24th & 25th May 2010 for a total of four (4) trap nights. This traps was placed along a suitable 'flyway' located along the drainage line that runs through the eastern portions of the subject site.

Anabat passive recording stations and harp trap locations are shown on Figure 3.

2.4.5 Amphibians

Amphibians were surveyed by vocal call identification and spotlighting. For similar calling species, male calls were compared to recorded calls from a field reference library for accuracy of identification. Amphibians were also surveyed by habitat searches.

Any amphibians found are visually identified and when required to be examined are handled with latex gloves and kept moist until release. Any tadpoles requiring capture are collected with a scoop net and placed within a snaplock clear plastic bag for analysis of colour and morphological features.

2.4.6 Reptiles

Searches for reptiles in likely localities such as under logs, rubbish debris, and in deep leaf litter were undertaken during diurnal visits to the site.

Spotlighting of terrestrial habitats suitable for reptiles occurred during nocturnal surveys.

2.5 Field survey effort

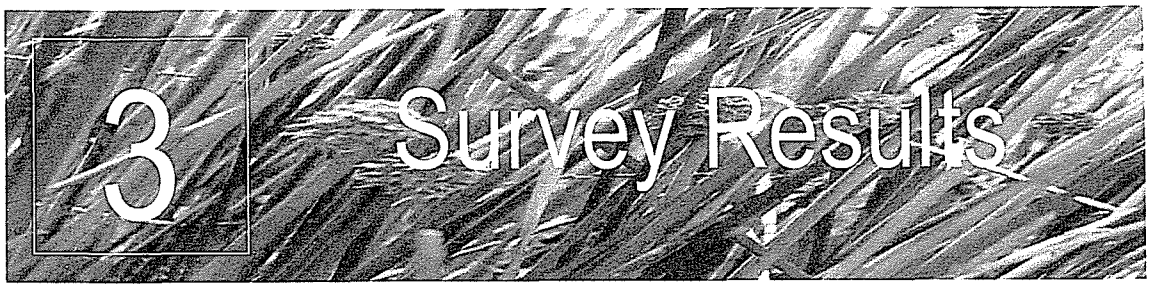
Table 2.1 below details the fauna survey effort undertaken for the subject site.

Table 2.1 – Fauna survey methodology and dates

Fauna group	Date	Weather conditions	Survey method	Survey effort / time (24hr)
Diurnal birds	17/09/01	Fine 21°C,2/8 cloud no rain, wind 5kmph	Bird census, Opportunistic observation	1hr 3.00-4.00pm
	18/09/01	Fine 21°C,0/8 cloud no rain, wind 5kmph	Bird census, Opportunistic observation	1hr 8.00-9.00am
	19/09/01	Fine 20°C,7/8 cloud no rain, wind 5kmph	Bird census, Opportunistic observation	1hr 8.00-9.00am
	20/09/01	Fine 19°C,0/8 cloud no rain, wind 5kmph	Bird census, Opportunistic observation	1hr 8.00-9.00am
	09/07/07	8/8 cloud, light SE wind, showers, 15°C	Opportunistic observation	4hrs 13:50 - 17:50
	10/07/07	0/8 cloud, light W wind, no rain, 12-16°C	Opportunistic observation	2hrs 15min 8:30 – 10:45
	11/07/07	0/8 cloud, no wind, no rain, 13-18°C	Opportunistic observation	2hrs 30min 8:35 – 11:05
	12/07/07	0/8 cloud, no wind, no rain, 9-14°C	Opportunistic observation	2hrs 20min 8:35 – 10:55
	13/07/07	0/8 cloud, no wind, no rain, 9.5-18°C	Opportunistic observation	2hrs 25min 8:40 – 11:05
	20/11/07	0/8 cloud, light NE wind, no rain, 26°C	Bird census, Opportunistic observation	2hrs 18:00 – 20:00
	21/11/07	8/8 cloud, Nil wind, nil, 24°C	Bird census, Opportunistic observation	1hrs 40min 18:20 – 20:00
	29/06/10	0/8 cloud, no wind, no rain, temp 13°C	Diurnal opportunistic	3hrs 25mins 1350 - 1715
Nocturnal birds	19/09/01	Fine 18°C,0/8 cloud, no rain, 5kmph wind	Spotlighting, Owl Call Playback	1hour 6.00pm-7.00pm.
	20/09/01	Fine 17° C, 5/8 cloud, no rain, no wind	Spotlighting, Owl Call Playback	1hour 6.00pm-7.00pm
	10/07/07	2/8 cloud, no wind, no rain, 10°C	Spotlighting, Owl Call Playback	2hrs 30min 17:30 – 20:00
	12/07/07	0/8 cloud, no wind, no rain, 10°C	Spotlighting, Owl Call Playback	3hrs 17:45 – 20:45
	20/11/07	0/8 cloud, light NE wind, no rain, 20°C	Owl and Bush Stone-Curlew Call Playback	40min 20:20 – 21:00
	21/11/07	8/8 cloud, Nil wind, nil (storm @ 21:00), 17°C	Owl Call Playback	45min 20:15 – 21:00
	17/06/10	0/8 cloud, no wind, no rain, 2/4 moon, temp 12°C-11°C	Call playback	2hrs 18.25 – 20.25
	29/06/10	0/8 cloud, no wind, no rain, late 4/4 moon, temp 9°C	Call playback (Section 2.4.2 species) & listening spotlighting	1hr 10mins 1740 - 1850 1hr 30mins 1720 - 1850
	19/05/11	0/8 cloud, no wind, no rain, late 4/4 moon, temp 15°C	Powerful Owl target searches	1hr 45mins 1645 - 1830
Arboreal mammals	17/09/01	Fine 21°C,2/8 cloud no rain, wind 5kmph	3 transects of 5 Elliot traps (5 type A)	15 trap nights
	18/09/01	Fine 21°C,0/8 cloud no rain, wind 5kmph	3 transects of 5 Elliot traps (5 type A)	15 trap nights
	19/09/01	Fine 20°C,7/8 cloud no rain, wind 5kmph	3 transects of 5 Elliot traps (5 type A) Spotlighting	15 trap nights Not sourced
	20/09/01	Fine 19°C,0/8 cloud no rain, wind 5kmph	3 transects of 5 Elliot traps (5 type A) Spotlighting.	15 trap nights Not sourced
	09/07/07	0/8 cloud, light W wind, no rain, 12°C	5 transects of 5 Elliot traps (3 type A, 2 type A & B)	25 trap nights
	10/07/07	0/8 cloud, no wind, no rain, 13°C	5 transects of 5 Elliot traps (3 type A, 2 type A & B)	25 trap nights
		2/8 cloud, no wind, no rain, 10°C	Spotlighting	2hrs 30min 17:30 – 20:00

Fauna group	Date	Weather conditions	Survey method	Survey effort / time (24hr)
	11/07/07	0/8 cloud, no wind, no rain, 9°C	5 transects of 5 Elliot traps (3 type A, 2 type A & B)	25 trap nights
	12/07/07	0/8 cloud, no wind, no rain, 9.5°C	5 transects of 5 Elliot traps (3 type A, 2 type A & B)	25 trap nights
		0/8 cloud, no wind, no rain, 10°C	Spotlighting	3hrs 17:45 – 20:45
	20/11/07	0/8 cloud, light NE wind, no rain, 26°C	Koala / Squirrel Glider / Yellow-bellied Spotlighting	2hrs 5min 20:05 – 22:10
	21/11/07	8/8 cloud, Nil wind, nil (storm @ 21:00), 17°C	Spotlighting	45min 20:15 – 21:00
	19/05/10	0-8/8 cloud, no wind, pos showers, 1/4 moon, 9°C min	Elliot B trapping: (3 lines)	15 trap nights
	20/05/10	0/8 cloud, no wind, no rain, 1/2 moon, 9°C min	Elliot B trapping: (3 lines)	15 trap nights
	24/05/10	8/8 cloud, no wind, later rain, 3/4 moon, 12°C min	Elliot B trapping: (3 lines)	15 trap nights
	25/05/10	8/8 cloud, no wind, later rain, 3/4 moon, 11°C min	Elliot B trapping: (3 lines)	15 trap nights
	29/06/10	0/8 cloud, no wind, no rain, late 4/4 moon, temp 9°C	Spotlighting	1hr 30mins 1720 - 1850
	29/06/10	0/8 cloud, no wind, no rain, late 4/4 moon, temp 9°C	Call playback (Section 2.4.3 species) & listening	1hr 10mins 1740 - 1850
	29/06/10	0/8 cloud, no wind, no rain, late 4/4 moon, temp 9°C	Stag-watching	25mins 1715 - 1740
Terrestrial mammals	17/09/01	Fine 21°C,2/8 cloud no rain, wind 5kmph	3 transects of 5 Elliot traps (5 type B)	15 trap nights
	18/09/01	Fine 21°C,0/8 cloud no rain, wind 5kmph	3 transects of 5 Elliot traps (5 type B)	15 trap nights
	19/09/01	Fine 20°C,7/8 cloud no rain, wind 5kmph	3 transects of 5 Elliot traps (5 type B)	15 trap nights
			Spotlighting	Not sourced
	20/09/01	Fine 19°C,0/8 cloud no rain, wind 5kmph	3 transects of 5 Elliot traps (5 type B)	15 trap nights
			Spotlighting.	Not sourced
	09/07/07	0/8 cloud, light W wind, no rain, 12°C	5 transects of 5 Elliot traps (3 type A, 2 type A & B)	25 trap nights
			3 cage traps	3 cage trap nights
	10/07/07	0/8 cloud, no wind, no rain, 13°C	5 transects of 5 Elliot traps (3 type A, 2 type A & B)	25 trap nights
			3 cage traps	3 cage trap nights
		2/8 cloud, no wind, no rain, 10°C	Spotlighting	2hrs 30min 17:30 – 20:00
	11/07/07	0/8 cloud, no wind, no rain, 9°C	5 transects of 5 Elliot traps (3 type A, 2 type A & B)	25 trap nights
			3 cage traps	3 cage trap nights
	12/07/07	0/8 cloud, no wind, no rain, 9.5°C	5 transects of 5 Elliot traps (3 type A, 2 type A & B)	25 trap nights
	19/05/10	0-8/8 cloud, no wind, pos showers, 1/4 moon, 9°C min	Elliot B trapping: (3 lines)	15 trap nights
			Surveillance Camera	1 camera night
	20/05/10	0/8 cloud, no wind, no rain, 1/2 moon, 9°C min	Elliot B trapping: (2 lines)	10 trap nights
			Elliot A trapping: (1 line)	5 trap nights
			Surveillance Camera	1 camera night
	24/05/10	8/8 cloud, no wind, later rain, 3/4 moon, 12°C min	Elliot B trapping: (2 lines)	10 trap nights
			Elliot A trapping: (1 line)	5 trap nights
			Surveillance Camera	1 camera night
	25/05/10	8/8 cloud, no wind, later rain, 3/4 moon, 11°C min	Elliot B trapping: (2 lines)	10 trap nights
			Elliot A trapping: (1 line)	5 trap nights
			Surveillance Camera	1 camera night
	29/06/10	0/8 cloud, no wind, no rain, late 4/4 moon, temp 9°C	Spotlighting	1hr 30mins 1720 - 1850
Bats	19/09/01	Fine 18°C,0/8 cloud, no rain, 5kmph wind	Anabat II Echolocation call detection	1hr 30mins 6.00pm-7.30pm
	20/09/01	Fine 17° C, 5/8 cloud, no rain, no wind	Anabat II Echolocation call detection	1hr 30mins 6.00pm-7.30pm

Fauna group	Date	Weather conditions	Survey method	Survey effort / time (24hr)
	10/07/07	2/8 cloud, no wind, no rain, 10°C	Anabat II Echolocation call detection	2hrs 40min 17:15 – 19:55
	12/07/07	0/8 cloud, no wind, no rain, 10°C	Anabat II Echolocation call detection	3hrs 15min 17:30 – 20:45
	20/11/07	0/8 cloud, light NE wind, no rain, 20°C	Anabat II Echolocation call detection	2hrs 25min 19:55 – 22:20
	21/11/07	8/8 cloud, Nil wind, nil (storm @ 21:00), 17°C	Anabat II Echolocation call detection	45min 20:15 – 21:00
	19/05/10	0-8/8 cloud, no wind, showers, 1/4 moon, 9°C min	Harp trap x1	1 Harp trap night
	20/05/10	0/8 cloud, no wind, no rain, 1/2 moon, 9°C min	Harp trap x1	1 Harp trap night
	24/05/10	8/8 cloud, no wind, later rain, 3/4 moon, 12°C min	Harp trap x1	1 Harp trap night
	25/05/10	8/8 cloud, no wind, late rain, 3/4 moon, 11°C min	Harp trap x1	1 Harp trap night
	29/06/10	0/8 cloud, no wind, no rain, late 4/4 moon, temp 9°C	Anabat II & SD-1 / Spotlighting	3hr 30mins 1700 - 1850
Reptiles	17/09/01	Fine 21°C,2/8 cloud no rain, wind 5kmph	Habitat Search	1hr 3.00--4.00pm
	18/09/01	Fine 21°C,0/8 cloud no rain, wind 5kmph	Habitat Search	1hr 8.00-9.00am
	19/09/01	Fine 20°C,7/8 cloud no rain, wind 5kmph	Habitat Search	1hr 8.00-9.00am
	20/09/01	Fine 19°C,0/8 cloud no rain, wind 5kmph	Habitat Search	1hr 8.00--9.00am
	09/07/07	8/8 cloud, light SE wind, showers, 15°C	Opportunistic observation / Habitat Search	4hrs 13:50 - 17:50
	10/07/07	0/8 cloud, light W wind, no rain, 12-16°C	Opportunistic observation / Habitat Search	2hrs 15min 8:30 – 10:45
	11/07/07	0/8 cloud, no wind, no rain, 13-18°C	Opportunistic observation / Habitat Search	2hrs 30min 8:35 – 11:05
	12/07/07	0/8 cloud, no wind, no rain, 9-14°C	Opportunistic observation / Habitat Search	2hrs 20min 8:35 – 10:55
	13/07/07	0/8 cloud, no wind, no rain, 9.5-18°C	Opportunistic observation / Habitat Search	2hrs 25min 8:40 – 11:05
	20/11/07	0/8 cloud, light NE wind, no rain, 26°C	Spotlighting	2hr 5min 20:05 – 22:10
	21/11/07	8/8 cloud, Nil wind, nil, 24°C	Spotlighting	45min 20:15 – 21:00
	29/06/10	0/8 cloud, no wind, no rain, temp 13°C	Habitat search, opportunistic	3hrs 25mins 1350 - 1715
Amphibians	17/09/01	Fine 21°C,2/8 cloud no rain, wind 5kmph	Call Detection and Habitat Search	1hr 3.00--4.00pm
	19/09/01	Fine 18°C,0/8 cloud, no rain, 5kmph wind	Call Detection and Habitat Search Spotlighting	2hrs, 5.00pm-7.00pm
	20/09/01	Fine 17° C, 5/8 cloud, no rain, no wind	Call Detection and Habitat Search Spotlighting	2hrs, 5.00pm-7.00pm
	10/07/07	2/8 cloud, no wind, no rain, 10°C	Spotlighting	2hrs 30min 17:30 – 20:00
	12/07/07	0/8 cloud, no wind, no rain, 10°C	Spotlighting	3hrs 17:45 – 20:45
	20/11/07	0/8 cloud, light NE wind, no rain, 26°C	Call Playback, Spotlighting	2hr 5min 20:05 – 22:10
	21/11/07	8/8 cloud, Nil wind, nil, 24°C	Spotlighting	45min 20:15 – 21:00
	29/06/10	0/8 cloud, no wind, no rain, late 4/4 moon, temp 9°C	Call detection & spotlighting	1hr 30mins 1720 - 1850



3.1 Flora results

Seven (7) vegetation communities were identified within the subject site through ground-truthing. The Moist Blue Gum Open Forest has been divided into two (2) sub-communities based upon the level of disturbance and past clearing/management. Vegetation communities have been identified through aerial photographic interpretations and extensive ground-truthing. Details of the vegetation communities are provided in section 4.2.

A total of two hundred and fifty (250) plant species have been observed within the subject site. The plants observed within the vegetation communities of the subject site are listed in Table 3.1 below.

Table 3.1 – Flora observations for the subject site

Family	Scientific Name	Common Name
TREES		
Arecaceae	*Archontophoenix cunninghamiana*	Bangalow Palm
Arecaceae	*Livistona australis*	Cabbage Tree Palm
Bignoniaceae	*Jacaranda mimosifolia**	Jacaranda
Casuarinaceae	*Allocasuarina littoralis*	Black She-oak
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak
Ebenaceae	*Diospyros australis*	Black Plum
Eleocarpaceae	*Elaeocarpus reticulatus*	Blueberry Ash
Euphorbiaceae	*Claoxylon australe*	Brittlewood
Euphorbiaceae	*Glochidion ferdinandi*	Cheese Tree
Fabaceae	*Erythrina X sykesii**	Coral Tree
Lauraceae	*Cinnamomum camphora**	Camphor Laurel
Lauraceae	*Cryptocarya glaucescens*	Jackwood
Lauraceae	*Cryptocarya microneura*	Murrogun
Malaceae	*Eriobotrya japonica**	Loquat
Meliaceae	*Melia azedarach* var. *australasica*	White Cedar
Mimosaceae	*Acacia implexa*	Hickory
Mimosaceae	*Acacia schinoides*	-
Moraceae	*Ficus coronata*	Sandpaper Fig
Myrtaceae	*Acmena smithii*	Lilly Pilly
Myrtaceae	*Angophora floribunda*	Rough-barked Apple
Myrtaceae	*Backhousia myrtifolia*	Grey Myrtle
Myrtaceae	*Corymbia maculata*	Spotted Gum
Myrtaceae	*Eucalyptus acmenoides*	White Mahogany
Myrtaceae	*Eucalyptus deanei*	Blue Gum

Table 3.1 – Flora observations for the subject site

Family	Scientific Name	Common Name
Myrtaceae	*Eucalyptus paniculata* subsp. *paniculata*	Grey Ironbark
Myrtaceae	*Eucalyptus pilularis*	Blackbutt
Myrtaceae	*Eucalyptus resinifera* subsp. *resinifera*	Red Mahogany
Myrtaceae	*Eucalyptus robusta*	Swamp Mahogany
Myrtaceae	*Eucalyptus saligna*	Sydney Blue Gum
Myrtaceae	*Eucalyptus umbra* subsp. *umbra*	Broad-leaved White Mahogany
Myrtaceae	*Melaleuca biconvexa TS*	-
Myrtaceae	*Melaleuca linariifolia*	Snow in Summer
Myrtaceae	*Melaleuca styphelioides*	Prickly-leaved Tea Tree
Myrtaceae	*Syncarpia glomulifera*	Turpentine
Myrtaceae	*Synoum glandulosum*	Scentless Rosewood
Myrtaceae	*Syzigium oleosum*	Blue Lilly Pilly
Pinaceae	*Pinus elliottii**	Slash Pine
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum
Rhamnaceae	*Alphitonia excelsa*	Red Ash
Rutaceae	*Melicope micrococca*	White Euodia
Sapindaceae	*Diploglottis australis*	Native Tamarind
Sapindaceae	*Guioa semiglauca*	Guioa
SHRUBS		
Araliaceae	*Polyscias sambucifolia*	Elderberry Panax
Asteraceae	*Ozothamnus diosmifolius*	Ball Everlasting
Celastraceae	*Cassine australis*	Red-fruited Olive Plum
Celastraceae	*Maytenus silvestris*	-
Dilleniaceae	*Hibbertia aspera*	-
Dilleniaceae	*Hibbertia scandens*	Climbing Guinea Flower
Epacridaceae	*Leucopogon juniperinus*	Bearded Heath
Epacridaceae	*Leucopogon lanceolatus*	Lance-leaf Beard-heath
Epacridaceae	*Monotoca scoparia*	Prickly Broom-heath
Euphorbiaceae	*Breynia oblongifolia*	Coffee Bush
Euphorbiaceae	*Croton verreauxii*	Native Cascarilla
Euphorbiaceae	*Phyllanthus gunnii*	Spurge
Euphorbiaceae	*Phyllanthus hirtellus*	Thyme Spurge
Eupomatiaceae	*Eupomatia laurina*	Bolwarra
Fabaceae	*Bossiaea obcordata*	Spiny Bossiaea
Fabaceae	*Daviesia ulicifolia*	Gorse Bitter-pea
Fabaceae	*Gompholobium latifolium*	Golden Glory Pea
Fabaceae	*Gompholobium minus*	Dwarf Wedge-pea
Fabaceae	*Indigofera australis*	Native Indigo
Fabaceae	*Podolobium ilicifolium*	Native Holly
Fabaceae	*Senna pendula* var. *glabrata**	-
Lamiaceae	*Clerodendrum tomentosum*	Hairy Clerodendrum
Mimosaceae	*Acacia falcata*	Sickle Wattle
Mimosaceae	*Acacia irrorata*	-

Table 3.1 – Flora observations for the subject site

Family	Scientific Name	Common Name
Mimosaceae	*Acacia maidenii*	Maiden's Wattle
Monimiaceae	*Wilkiea huegeliana*	Wilkiea
Myrsinaceae	*Myrsine variabilis*	Muttonwood
Myrtaceae	*Callistemon salignus*	Willow Bottlebrush
Myrtaceae	*Kunzea ambigua*	Tick Bush
Myrtaceae	*Leptospermum polygalifolium*	Yellow Tea Tree
Myrtaceae	*Melaleuca sieberi*	-
Myrtaceae	*Rhodamnia rubescens*	Brush Turpentine
Ochnaceae	*Ochna serrulata**	Mickey Mouse Plant
Oleaceae	*Ligustrum sinense**	Small-leaved Privet
Oleaceae	*Notelaea longifolia*	Mock Olive
Phytolaccaceae	*Phytolacca octandra**	Inkweed
Pittosporaceae	*Pittosporum multiflorum*	Orange Thorn
Pittosporaceae	*Pittosporum revolutum*	Yellow Pittosporum
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum
Proteaceae	*Persoonia linearis*	Narrow-leaved Geebung
Rhamnaceae	*Pomaderris ferruginea*	-
Rhamnaceae	*Pomaderris lanigera*	-
Rosaceae	*Rubus fruticosus* spp. Agg.*	Blackberry
Rosaceae	*Rubus moluccanus*	Broad-leaf Bramble
Rosaceae	*Rubus parvifolius*	Native Raspberry
Rosaceae	*Rubus rosifolius*	Forest Bramble
Solanaceae	*Physalis peruviana**	Cape Gooseberry
Solanaceae	*Solanum mauritianum**	Wild Tobacco
Sterculiaceae	*Rulingia dasyphylla*	Kerrawang
Ulmaceae	*Trema tomentosa* var. *viridis*	Native Peach
Verbenaceae	*Lantana camara**	Lantana
Winteraceae	*Tasmannia insipida*	-
Zamiaceae	*Maclura cochinchinensis*	-
GROUNDCOVERS		
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower
Adiantaceae	*Adiantum aethiopicum*	Common Maidenhair
Adiantaceae	*Adiantum formosum*	Tall Maidenhair
Adiantaceae	*Adiantum hispidulum*	Rough Maidenhair
Amaryllidaceae	*Crinum pedunculatum*	Swamp Lily
Apiaceae	*Centella asiatica*	Swamp Pennywort
Apiaceae	*Daucus glochidiatus*	Native Carrot
Apiaceae	*Hydrocotyle bonariensis**	Kurnell Curse / Pennywort
Apiaceae	*Hydrocotyle peduncularis*	Pennywort
Apiaceae	*Hydrocotyle tripartita*	Pennywort
Araceae	*Gymnostachys anceps*	Settlers Flax
Asparagaceae	*Asparagus aethiopicus**	Asparagus Fern
Aspleniaceae	*Asplenium australasicum*	Bird's Nest Fern

Table 3.1 – Flora observations for the subject site

Family	Scientific Name	Common Name
Asteraceae	*Ageratina adenophora**	Crofton Weed
Asteraceae	*Ambrosia artemisifolia**	Annual Ragweed
Asteraceae	*Bidens pilosa**	Cobbler's Pegs
Asteraceae	*Bidens subalternans**	Greater Beggar's Tick
Asteraceae	*Billardiera scandens*	Apple Dumplings
Asteraceae	*Conyza bonariensis**	Flax-leaf Fleabane
Asteraceae	*Conyza sumatrensis**	Fleabane
Asteraceae	*Coreopsis lanceolata**	-
Asteraceae	*Erechtites valerianifolia**	Brazilian Fireweed
Asteraceae	*Galinsoga parviflora**	Potato Weed
Asteraceae	*Gamochaeta spicata**	Cudweed
Asteraceae	*Hypochaeris radicata**	Flatweed
Asteraceae	*Senecio madagascariensis**	Fireweed
Asteraceae	*Sigesbeckia orientalis*	Indian Weed
Asteraceae	*Soliva sessilis**	Jojo
Asteraceae	*Tagetes minuta**	Stinking Roger
Asteraceae	*Taraxacum officinale**	Dandelion
Asteraceae	*Vernonia cinerea* var. *cinerea*	-
Blechnaceae	*Blechnum cartilagineum*	Gristle Fern
Blechnaceae	*Doodia aspera*	Rasp Fern
Brassicaceae	*Sisyrinchium iridifolium**	Pigroot
Carophyllaceae	*Cerastium glomeratum**	Mouse-ear Chickweed
Caryophyllaceae	*Stellaria media**	Common Chickweed
Commelinaceae	*Commelina cyanea*	Scurvy Weed
Commelinaceae	*Tradescantia fluminensis**	Wandering Jew
Convolvulaceae	*Dichondra repens*	Kidney Weed
Cyperaceae	*Carex appressa*	Tussock Sedge
Cyperaceae	*Carex longibrachiata*	-
Cyperaceae	*Cyperus congestus**	-
Cyperaceae	*Cyperus eragrostis**	Umbrella Sedge
Cyperaceae	*Gahnia radula*	Saw Sedge
Cyperaceae	*Gahnia sieberiana*	Red-fruited Saw-sedge
Cyperaceae	*Lepidosperma elatius*	-
Cyperaceae	*Lepidosperma laterale*	Variable Sword-sedge
Cyperaceae	*Schoenus melanostachys*	Black Bog Rush
Davalliaceae	*Nephrolepis cordifolia**	Fish-bone Fern
Dennstaedtiaceae	*Hypolepis muelleri*	Harsh Ground Fern
Dennstaedtiaceae	*Pteridium esculentum*	Bracken Fern
Dicksoniaceae	*Calochilus sp.*	Bearded Orchid
Dicksoniaceae	*Calochlaena dubia*	Common Ground Fern
Dryopteridaceae	*Lastreopsis acuminata*	Shiny Shield-fern
Euphorbiaceae	*Phyllanthus gasstroemii*	-
Fabaceae	*Trifolium repens**	White Clover

Table 3.1 – Flora observations for the subject site

Family	Scientific Name	Common Name
Fumariaceae	*Fumaria muralis**	Wall Fumitory
Geraniaceae	*Geranium homeanum*	-
Gleicheniaceae	*Sticherus flabellatus*	Umbrella Fern
Goodeniaceae	*Goodenia heterophylla*	-
Iridaceae	*Crocosmia* X *crocosmiiflora**	Montbretia
Iridaceae	*Libertia paniculata*	Branching Grass-flag
Iridaceae	*Watsonia meriana**	Wild Watsonia
Juncaceae	*Juncus subsecundus*	-
Juncaceae	*Juncus usitatus*	Common Rush
Lindsaeaceae	*Lindsaea microphylla*	Lacy Wedge-fern
Lobeliaceae	*Pratia purpurascens*	Whiteroot
Lomandraceae	*Lomandra longifolia*	Spiky-headed Mat-rush
Lomandraceae	*Lomandra multiflora*	Many-flowered Mat-rush
Malvaceae	*Sida rhombifolia**	Paddy's Lucerne
Orchidaceae	*Acianthus fornicatus*	Pixie Caps
Orchidaceae	*Dipodium sp.*	Hyacinth Orchid
Orchidaceae	*Pterostylis nutans*	Nodding Greenhood
Orchidaceae	*Thelymitra pauciflora*	Sun Orchid
Oxalidaceae	*Oxalis perennans*	-
Phormiaceae	*Dianella caerulea*	Flax Lily
Plantaginaceae	*Plantago lanceolata**	Ribwort
Poaceae	*Andropogon virginicus**	Whisky Grass
Poaceae	*Austrodanthonia sp.*	Wallaby Grass
Poaceae	*Axonopus affinis**	Narrow-leaved Carpet Grass
Poaceae	*Briza maxima**	Quaking Grass
Poaceae	*Briza minor**	Shivery Grass
Poaceae	*Bromus cartharticus**	Prairie Grass
Poaceae	*Bromus diandrus*	-
Poaceae	*Chloris gayana**	Rhodes Grass
Poaceae	*Cynodon dactylon*	Common Couch
Poaceae	*Dichelachne micrantha*	Short-hair Plume Grass
Poaceae	*Digitaria sanguinalis**	Crab Grass
Poaceae	*Echinopogon caespitosus* var. *caespitosus*	Tufted Hedgehog Grass
Poaceae	*Echinopogon ovatus*	Forest Hedgehog Grass
Poaceae	*Ehrharta erecta**	Panic Veldtgrass
Poaceae	*Entolasia marginata*	Bordered Panic
Poaceae	*Entolasia stricta*	Wiry Panic
Poaceae	*Eriochloa pseudoacrotricha*	Early Spring Grass
Poaceae	*Imperata cylindrica* var. *major*	Blady Grass
Poaceae	*Joycea pallida*	Silvertop Wallaby Grass
Poaceae	*Microlaena stipoides*	Weeping Grass
Poaceae	*Oplismenus aemulus*	-
Poaceae	*Oplismenus imbecillis*	-

Table 3.1 – Flora observations for the subject site

Family	Scientific Name	Common Name
Poaceae	*Panicum simile*	Two Colour Panic
Poaceae	*Paspalum dilatatum**	Paspalum
Poaceae	*Paspalum urvillei**	Vasey Grass
Poaceae	*Pennisetum clandestinum**	Kikuyu
Poaceae	*Poa annua**	Winter Grass
Poaceae	*Poa labillardieri*	-
Poaceae	*Setaria palmifolia**	Palm Grass
Poaceae	*Setaria parviflora**	-
Poaceae	*Sporobolus africanus**	Parramatta Grass
Poaceae	*Sporobolus creber*	Slender Rat's Tail Grass
Poaceae	*Themeda australis*	Kangaroo Grass
Poaceae	*Vulpia myuros**	Rat's Tail Fescue
Polygonaceae	*Acetosella vulgaris**	Sheep Sorrel
Polygonaceae	*Persicaria hydropiper*	Water Pepper
Polygonaceae	*Rumex brownii*	Swamp Dock
Polygonaceae	*Rumex crispus**	Curled Dock
Primulaceae	*Anagallis arvensis**	Scarlet Pimpernel
Rubiaceae	*Pomax umbellata*	Pomax
Scrophulariaceae	*Verbascum virgatum**	Twiggy Mullein
Scrophulariaceae	*Veronica plebeia*	Creeping Speedwell
Sinopteridaceae	*Pellaea falcata*	Sickle Fern
Solanaceae	*Solanum nigrum**	Black Nightshade
Solanaceae	*Solanum prinophyllum*	Forest Nightshade
Thymelaeaceae	*Pimelea linifolia* subsp. *linifolia*	Slender Rice Flower
Verbenaceae	*Verbena bonariensis**	Purpletop
Violaceae	*Viola hederacea*	Ivy-leaved Violet
Zingiberaceae	*Alpinia caerulea*	Native Ginger
EPIPHYTES		
Polypodiaceae	*Platycerium bifurcatum* subsp. *bifurcatum*	Elkhorn
VINES		
Apocnyaceae	*Araujia sericifera**	Mothvine
Apocynaceae	*Parsonsia straminea*	Common Silkpod
Asclepiadaceae	*Marsdenia rostrata*	Common Milk Vine
Bignoniaceae	*Pandorea pandorana*	Wonga Vine
Caprifoliaceae	*Lonicera japonica**	Japanese Honeysuckle
Dilleniaceae	*Hibbertia dentata*	Twining Guinea Flower
Dilleniaceae	*Hibbertia scandens*	Climbing Guinea-flower
Dioscoreaceae	*Dioscorea transversa*	Native Yam
Fabaceae	*Desmodium rhytidophyllum*	Rusty Tick-trefoil
Fabaceae	*Desmodium varians*	-
Fabaceae	*Glycine clandestina*	Twining Glycine
Fabaceae	*Glycine tabacina*	Twining Glycine
Fabaceae	*Hardenbergia violacea*	False Sarsparilla

Table 3.1 – Flora observations for the subject site

Family	Scientific Name	Common Name
Fabaceae	*Kennedia rubicunda*	Dusky Coral Pea
Lauraceae	*Cassytha pubescens*	Devil's Twine
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry
Luzuriagaceae	*Geitonoplesium cymosum*	Scrambling Lily
Menispermaceae	*Sarcopetalum harveyanum*	Pearl Vine
Menispermiaceae	*Stephania japonica* var. *discolor*	Snake Vine
Passifloraceae	*Passiflora edulis**	Common Passionfruit
Ranunculaceae	*Clematis aristata*	Clematis
Ranunculaceae	*Clematis glycinoides* var. *glycinoides*	Clematis
Rubiaceae	*Morinda jasminoides*	-
Smilacaceae	*Smilax australis*	Lawyer Vine
Smilacaceae	*Smilax glyciphylla*	Sarsaparilla
Vitaceae	*Cayratia clematidea*	Slender Grape
Vitaceae	*Cissus antarctica*	Native Grape
Vitaceae	*Cissus hypoglauca*	Water Vine
Species name^{TS} = Threatened Species * = Introduced Species		

3.2 Fauna results

Fauna species observed throughout the duration of fauna surveys are listed in Table 3.2 below.

Table 3.2 – Fauna observations for the subject site

Scientific name	Common name	Observation Method			
		Sept 2001	July 2007	November 2007	May / June 2010
BIRDS					
Alectura lathami	Australian Brush Turkey			SC	
Afsterus scapularis	Australian King-Parrot	OC	OC	OC	
Gymnorhina tibicen	Australian Magpie	O	OC	OC	OC
Pelecanus conspicillatus	Australian Pelican				O
Corvus coronoides	Australian Raven	O	OC	OC	
Chenonetta jubata	Australian Wood Duck	OC	OC		
Manorina melanophrys	Bell Miner	OC	OC	OC	OC
Coracina novaehollandiae	Black-faced Cuckoo-shrike	OC	OC		
Monarcha melanopsis	Black-faced Monarch			C	
Macropygia amboinensis	Brown Cuckoo-Dove		O		O
Gerygone mouki	Brown Gerygone		OC	C	OC
Acanthiza pusilla	Brown Thornbill	OC	OC	OC	OC
Cacomantis variolosus	Brush Cuckoo		C		
Ardea ibis	Cattle Egret	O			

Table 3.2 – Fauna observations for the subject site

Scientific name	Common name	Observation Method			
		Sept 2001	July 2007	November 2007	May / June 2010
Acridotheres tristis	Common Myna *				OC
Ocyphaps lophotes	Crested Pigeon	OC	C		OC
Eurystomus orientalis	Dollarbird			OC	
Platycercus eximinus	Eastern Rosella	O			
Acanthorhynchus tenuirostris	Eastern Spinebill			OC	
Psophodes olivaceus	Eastern Whipbird	OC	OC	C	C
Eopsaltria australis	Eastern Yellow Robin	OC	OC	O	C
Cacomantis flabelliformis	Fan-tailed Cuckoo	OC	C		C
Cacatua roseicapilla	Galah	OC	C		
Pachycephala pectoralis	Golden Whistler		O	C	
Ailuroedus crassirostris	Green Catbird	OC	O	C	T
Cracticus torquatus	Grey Butcherbird	OC	OC	C	C
Rhipidura fuliginosa	Grey Fantail	OC	OC	C	OC
Accipiter novaehollandiae	Grey Goshawk		O		
Colluricincla harmonica	Grey Shrike-thrush		C		
Sericornis magnirostris	Large-billed Scrub Wren			OC	
Dacello novaeguinea	Laughing Kookaburra	OC	OC	OC	C
Melaphiga lewinii	Lewins Honeyeater	OC	OC	OC	OC
Anthochaera chrysoptera	Little Wattlebird	OC	OC	C	
Cacatua tenuirostris	Long-billed Corella	OC			
Grallina cyanoleuca	Magpie-lark	OC			
Vanellus miles	Masked Lapwing		C		
Philemon corniculatus	Noisy Friar bird	OC	OC	OC	
Manorina melanocephala	Noisy Miner	OC			
Oriolus sagittatus	Olive-backed Oriole			OC	
Aviceda subcristata	Pacific Baza		C		
Centropus phasianinus	Pheasant Coucal	OC			
Strepera gracullina	Pied Currawong	OC	OC	OC	
Ninox strenua	Powerful Owl [TS]	Observed onsite May 2011			
Trichoglossus haematodus	Rainbow Lorikeet		OC	OC	C
Anthochaera carunculate	Red Wattlebird		OC		
Neochmia temporalis	Red-browed Finch	OC	OC		OC
Petroica rosea	Rose Robin		C		
Rhipidura rufifrons	Rufous Fantail	OC			
Pachycephala rufiventris	Rufous Whistler	OC	C		
Todiramphus sanctus	Sacred Kingfisher	OC			
Ptilonorhynchus violaceus	Satin Bowerbird	OC	O	OC	
Myzomela sanguinolenta	Scarlet Honeyeater			C	
Chrysococcyx lucidus	Shining Bronze-Cuckoo		C		
Zosterops lateralis	Silvereye		OC		

Table 3.2 – Fauna observations for the subject site

Scientific name	Common name	Observation Method			
		Sept 2001	July 2007	November 2007	May / June 2010
Pardalotus punctatus	Spotted Pardalote		O		
Streptopelia chinensis *	Spotted Turtle-Dove	OC	C		
Cacatua galerita	Sulphur-crested Cockatoo	OC	OC	OC	
Malurus cyaneus	Superb Fairy-wren	O	OC	OC	OC
Daphoenositta chrysoptera	Varied Sittella [TS]		O		
Malurus lamberti	Variegated Fairy Wren			OC	
Sericornis frontalis	White-browed Scrubwren	OC	C		
Columba leucomela	**White-headed Pigeon**				**O**
Gerygone olivacea	White-throated Gerygone	OC			
Cormobates leucophaeus	White-throated Treecreeper		OC		C
Rhipidura leucophrys	Willie Wagtail	OC			
Leucosarcia melanoleuca	Wonga Pigeon	OC	OC		
Lichenostomus chrysops	Yellow-faced Honeyeater	OC	C		OC
Calyptorhynchus funereus	Yellow-tailed Black-Cockatoo	OC	OC		
Acanthiza nana	Yellow Thornbill				OC
Sericornis citreogularis	Yellow-throated Scrub Wren	OC			
MAMMALS					
Rattus rattus *	Black Rat	T	T		
Antechinus stuartii	Brown Antechinus	T	T		T
Rattus fuscipes	Bush Rat	T	T		T
Trichosurus vulpecula	Common Brushtail Possum			S	S
Pseudocheirus peregrinnis	Common Ringtail Possum	S	S	S	S
Bos taurus	Cow		S		O
Canis familiaris *	Dog	O	S		C
Miniopterus orianae oceansis	Eastern Bentwing-bat [TS]				A [PR]
Scotorepens orion	Eastern Broad-nosed Bat			A	
Vespadelus pumilus	Eastern Forest Bat		A	A [PO]	
Vulpes vulpes	Fox			S	
Chalinolobus gouldii	Goulds Wattle bat			A	A
Scoteanax ruepelli	Greater Broad-nosed Bat			A	
Pteropus poliocephalus	Grey-headed Flying-fox [TS]		S		O
Nyctophilus sp	Long-eared Bat			A [PR]	
Miniopterus australis	Little Bentwing-bat [TS]		A	A	
Vespadelus vulturnus	Little Forest Bat			A [PR]	
Pteropus scapulatus	Little Red Flying-fox		S		O
Perameles nasuta	Long-nosed Bandicoot	R			
Isoodon macrourus	Northern Brown Bandicoot		T		
Oryctolagus cuniculus *	Rabbit	I	S		
Petaurus breviceps	Sugar Glider		T		T
Rattus lutreolus	Swamp Rat	T	T		
Wallabia bicolor	Swamp Wallaby		S		

Table 3.2 – Fauna observations for the subject site

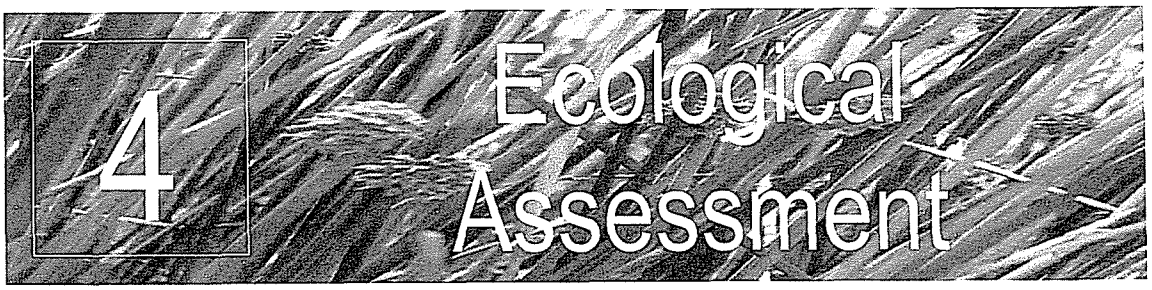
Scientific name	Common name	Observation Method			
		Sept 2001	July 2007	November 2007	May / June 2010
Petaurus australis	Yellow-bellied Glider[TS]		S C		
Macropus sp.		I			
AMPHIBIANS					
Litoria fallax	Dwarf Tree Frog	C		C	
Litoria phyllochroa	Green Leaf Tree Frog	C			
Litoria peronii	Peron's Tree Frog	C		C	
Limnodynastes peronii	Striped Marsh Frog	C			
Litoria tyleri	Tyler's Tree Frog			C	
Litoria verreauxii	Whistling Tree Frog		C		C
REPTILES					
Lamprophilis delicata	Garden Skink	O			
Pseudechis porphyriacus	Red-bellied Black Snake	O			

Note: * indicates introduced species
[TS] indicates threatened species

All species listed are identified to a high level of certainty unless otherwise noted as:

[PR] indicates species identified to a 'probable' level of certainty
[PO] indicates species identified to a 'possible' level of certainty

A	-	Anabat II/SD-1	C	-	Call Identification
O	-	Observation	P	-	Call-playback Response
T	-	Trap (Elliott, cage, etc)	H	-	Habitat Search
S	-	Spotlight	I	-	Scat, Track or Sign Identification
R	-	Roadkill			



4.1 Previous surveys reviewed

Lower Hunter and Central Coast Regional Environment Management Strategy Vegetation Survey, Classification and Mapping; Lower Hunter and Central Coast Region (LHCCREMS) (NPWS 2003)

An extensive vegetation mapping survey of the Lower Hunter and Central coast in which the vegetation within the subject site was identified as a combination of Coastal Narrabeen Moist Forest, Alluvial Tall Moist Forest, Coastal Wet Gully Forest and Coastal Narrabeen Shrub Forest.

Field inspections indicate that the mapping within the vicinity of the subject site is not accurate. Apart from differences in the boundaries of the communities, there was no mention of a forest containing Swamp Mahogany, yet it was quite extensive to the north of the study area. No vegetation similar to Coastal Narrabeen Shrub Forest was observed within the study area. It appeared to occur further north of the subject site along Berkeley Rd and again further east.

The Natural Vegetation of the Wyong Local Government Area, Central Coast, New South Wales (Bell 2002)

An extensive vegetation mapping survey of the Wyong LGA in which the vegetation within the subject site was identified as a combination of Map Units.

- Map Unit 16 Coastal Alluvial Bluegum–Paperbark Mesic Palm Forest
- Map Unit 35 Coastal Ranges Moist Layered Forest
- Map Unit 27 Alluvial Narrabeen Coastal Blackbutt Shrubby Forest
- Map Unit 20 Alluvial Floodplain Shrub Swamp Forest

4.2 Flora species

A total of two hundred and fifty (250) flora species were observed within the subject site during the survey. One of the species, *Melaleuca biconvexa* is listed as a threatened species under the TSC Act (1995) and EPBC Act (1999).

All species are listed in Table 3.1.

4.3 Vegetation communities

Seven (7) vegetation communities were identified within the subject site through ground-truthing. The Moist Blue Gum Open Forest has been divided into two (2) sub-communities based upon the level of disturbance and past clearing/management. The vegetation communities observed includes;

- Vegetation Community 1 - Alluvial Gully Closed Forest
- Vegetation Community 2a - Moist Blue Gum Open Forest
- Vegetation Community 2b - Disturbed Moist Blue Gum Open Forest
- Vegetation Community 3 - Alluvial Blue Gum Open Forest
- Vegetation Community 4 - Swamp Mahogany Open Forest
- Vegetation Community 5 - Acacia / Cheese Tree Closed Scrub
- Vegetation Community 6 - Dry Open Forest
- Vegetation Community 7 - Exotic Grassland Pasture with Isolated Trees

A brief description of each of these communities is provided below;

Vegetation Community 1 - Alluvial Gully Closed Forest

Occurrence – This community is restricted to an isolated patch within an incised gully on the subject site southern boundary. It has been mapped as occupying approximately 0.035ha. This vegetation community is equivalent to the EEC – Lowland Rainforest.

Structure – Closed forest with an emergent eucalypt layer. The canopy cover is approximately 80% and height of approximately 20-30 metres. The understorey consists of a moderate to dense shrublayer to 5 metres high and a moderate to sparse groundcover of ferns and sedges.

Disturbances - This vegetation community is severely impacted by incursions of *Lantana camara* (Lantana) and *Ligustrum sinense* (Small-leaved Privet).

Common Species

Emergent Trees: *Eucalyptus saligna* (Blue Gum) and *Eucalyptus deanei* (Blue Gum).

Trees: *Acmena smithii* (Lilly Pilly), *Archontophoenix cunninghamiana* (Bangalow Palm), *Cryptocarya microneura* (Murrogun) *Diospyros australis* (Black Plum), *Elaeocarpus reticulatus* (Blueberry Ash), *Glochidion ferdinandi* (Cheese Tree) and *Livistona australis* (Cabbage Tree Palm).

Shrubs: *Claoxylon australe* (Brittlewood), *Ficus coronata* (Sandpaper Fig), *Lantana camara* (Lantana) and *Ligustrum sinense* (Small-leaved Privet).

Groundcovers: *Adiantum formosum* (Tall Maidenhair) *Blechnum cartilagineum* (Gristle Fern), *Carex longibrachiata*, *Doodia aspera* (Rasp Fern), *Gymnostachys anceps* (Settlers Flax), *Hypolepis muelleri* (Harsh Fern) and *Lastreopsis acuminata* (Shiny Shield-fern).

Vines: *Cissus antarctica* (Native Grape), *Cissus hypoglauca* (Water Vine), *Dioscorea transversa* (Native Yam), *Morinda jasminoides, Parsonsia straminea* (Common Silkpod) and *Stephania japonica* var. *discolor* (Snake Vine).

Vegetation Community 2A - Moist Blue Gum Open Forest - *Eucalyptus deanei – Syncarpia glomulifera - E. pilularis*

Occurrence - This vegetation community occupies the sheltered lower to mid slopes above the alluvial floodplains and drainage lines of the subject site and has been mapped as occupying approximately 0.94ha. This is not EEC vegetation.

Structure - Tall Open Forest with a eucalypt canopy cover of approximately 30-50% and a height of approximately 20-30 metres. A secondary tree layer dominated by Mesophilic rainforest species provided *a* dense canopy of up to 75% and a height of 10-15 metres. The understorey consists of a moderate shrublayer to 5 metres high and a moderate groundcover of dominated by ferns and vines.

Disturbances - This vegetation community is impacted by moderate incursions of *Lantana camara* (Lantana) and *Ligustrum sinense* (Small-leaved Privet).

Common Species

Trees: *Cinnamomum camphora* (Camphor Laurel), *Corymbia maculata* (Spotted Gum), *Eucalyptus deanei* (Blue Gum), *Eucalyptus paniculata* subsp. *paniculata* (Grey Ironbark), *Eucalyptus pilularis* (Blackbutt), *Eucalyptus saligna* (Sydney Blue Gum) and *Syncarpia glomulifera* (Turpentine).

Secondary Trees: *Acacia schinoides, Acacia implexa* (Hickory), *Backhousia myrtifolia* (Grey Myrtle), *Glochidion ferdinandi* (Cheese Tree), *Livistona australis* (Cabbage Tree Palm), *Melaleuca styphelioides* (Prickly-leaved Tea Tree), *Notelaea longifolia* (Mock Olive) and *Pittosporum undulatum* (Sweet Pittosporum).

Photo 1 – Moist Blue Gum Forest in the far north-west of the subject site

Shrubs: *Acacia irrorata, Clerodendrum tomentosum* (Hairy Clerodendrum), *Lantana camara* (Lantana) and *Ligustrum sinense* (Small-leaved Privet) *Maytenus silvestris, Ochna serrulata* (Mickey Mouse Plant) *Myrsine variabilis* (Muttonwood), *Rhodamnia rubescens* (Tree Heath) *Solanum mauritianum* (Wild Tobacco) and *Wilkiea huegeliana* (Wilkea).

Groundcovers: *Adiantum aethiopicum* (Common Maidenhair), *Blechnum cartilagineum* (Gristle Fern), *Dichondra repens* (Kidney Weed), *Entolasia marginata* (Bordered Panic), *Hypolepis muelleri* (Harsh Fern) *Lomandra longifolia* (Spiky-headed Mat-rush), *Oplismenus aemulus,* and *Sigesbeckia orientalis* (Indian Weed).

Vines: *Cissus antarctica* (Native Grape), *Marsdenia rostrata* (Common Milk Vine), *Morinda jasminoides, Parsonsia straminea* (Common Silkpod) and *Smilax australis* (Lawyer Vine).

Vegetation Community 2B – Disturbed Moist Blue Gum Open Forest:

Occurrence - This vegetation community occurs within the western clearing of the subject site and occupies approximately 0.53ha. This is not EEC vegetation.

Structure - Grasslands and herb-fields with scattered trees and regrowth shrubs.

Disturbances - This vegetation community has been affected by past weed control management and under-scrubbing.

Common Species

Trees: *Alphitonia excelsa* (Red Ash), *Eucalyptus deanei* (Blue Gum), *Eucalyptus pilularis* (Blackbutt), *Eucalyptus saligna* (Sydney Blue Gum) and *Melaleuca styphelioides* (Prickly-leaved Tea Tree).

Shrubs: *Acacia irrorata*, *Acacia schinoides*, *Glochidion ferdinandi* (Cheese Tree), *Lantana camara* (Lantana) and *Ligustrum sinense* (Small-leaved Privet).

Groundcovers: *Andropogon virginicus* (Whisky Grass), *Axonopus affinis* (Narrow-leaved Carpet Grass), *Bidens pilosa* (Cobbler's Pegs), *Cynodon dactylon* (Common Couch), *Dichondra repens* (Kidney Weed), *Plantago lanceolata* (Ribwort), *Paspalum dilatatum* (Paspalum), *Pteridium esculentum* (Bracken Fern) *Senecio madagascariensis* (Fireweed) *Sida rhombifolia* (Paddy's Lucerne), *Stellaria media* (Chickweed), *Trifolium repens* (Clover), *Veronica plebeia* (Creeping Speedwell).

Vegetation Community 3 - Alluvial Blue Gum Open Forest – *Eucalyptus saligna/deanei - Melaleuca* spp

Occurrence - This community is restricted to the alluvial flats and minor creek lines within the subject site and has a broad transition zone to the north of the site with the Swamp Open Forest – *Eucalyptus robusta* vegetation community (identified as the EEC, Swamp Sclerophyll Forest on Coastal Floodplains). This community has been mapped as occupying 2.21ha within the subject site. This vegetation community is equivalent to the EEC – River-flat Eucalypt Forest on Coastal Floodplains.

Structure - Tall Open Forest with a eucalypt canopy cover of approximately 45 % and a height of approximately 20-30 metres. A secondary tree layer dominated by *Melaleuca sp.* has a dense canopy of 60-75% and a height of 10-15 metres. The understorey consists of a moderate shrublayer to 8 metres high and a moderate groundcover of herbs, ferns and grasses.

Disturbances - This vegetation community is impacted by moderate incursions of *Lantana camara* (Lantana) and *Ligustrum sinense* (Small-leaved Privet).

Photo 2 – Alluvial Blue Gum Open Forest. Roadside vegetation near the road bend on the south-western side of Berkeley Road

Common Species

Trees: *Cinnamomum camphora* (Camphor Laurel), *Eucalyptus deanei* (Blue Gum), and *Eucalyptus saligna* (Blue Gum).

Secondary Trees: *Acacia schinoides, Acacia implexa* (Hickory), *Acmena smithii* (Lilly Pilly), *Callistemon salignus* (Willow Bottlebrush), *Glochidion ferdinandi* (Cheese Tree), *Livistona australis* (Cabbage Tree Palm), *Melaleuca biconvexa, Melaleuca linariifolia* (Snow in Summer) and *Melaleuca styphelioides* (Prickly-leaved Tea Tree).

Shrubs: *Acacia irrorata, Ficus coronata* (Sandpaper Fig), *Lantana camara* (Lantana), *Ligustrum sinense* (Small-leaved Privet) *Phyllanthus gunnii* (Spurge), *Ochna serrulata* (Mickey Mouse Plant) and *Rhodamnia rubescens* (Tree Heath).

Groundcovers: *Blechnum cartilagineum* (Gristle Fern), *Dianella caerulea var. producta* (Blue Flax Lily), *Dichondra repens* (Kidney Weed), *Doodia aspera* (Rasp Fern), *Entolasia marginata* (Bordered Panic), *Hypolepis muelleri* (Harsh Fern) *Lomandra longifolia* (Spiky-headed Mat-rush), *Microlaena stipoides* (Weeping Grass), *Oplismenus aemulus, Sida rhombifolia* (Paddy's Lucerne) and *Sigesbeckia orientalis* (Indian Weed).

Vines: *Clematis aristata* (Clematis), *Morinda jasminoides, Parsonsia straminea* (Common Silkpod) and *Stephania japonica* var. *discolor* (Snake Vine).

Vegetation Community 4 - Swamp Mahogany Open Forest

Occurrence - This community occupies the poorly drained alluvial flats in the north of the subject site and has a broad transition zone with the Alluvial Blue Gum Open Forest community. Within the subject site this community has been mapped as occupying approximately 1.54ha. This vegetation community corresponds to the EEC Swamp Sclerophyll Forest on Coastal Floodplains.

Structure - Open Forest with a eucalypt canopy cover of approximately 45% and a height of approximately 20 metres. A secondary tree layer dominated by *Melaleuca* spp. has a dense canopy of 40-75% and a height of 10-15 metres. The understorey consists of a dense groundcover of sedges, herbs and ferns.

Disturbances - This vegetation community is impacted on the outer periphery by low incursions of *Lantana camara* (Lantana) and *Ligustrum sinense* (Small-leaved Privet).

Common Species

Trees: *Eucalyptus robusta* (Swamp Mahogany).

Secondary Trees: *Callistemon salignus* (Willow Bottlebrush), *Glochidion ferdinandi* (Cheese Tree), *Livistona australis* (Cabbage Tree Palm), *Melaleuca biconvexa, Melaleuca linariifolia* (Snow in Summer) and *Melaleuca styphelioides* (Prickly-leaved Tea Tree).

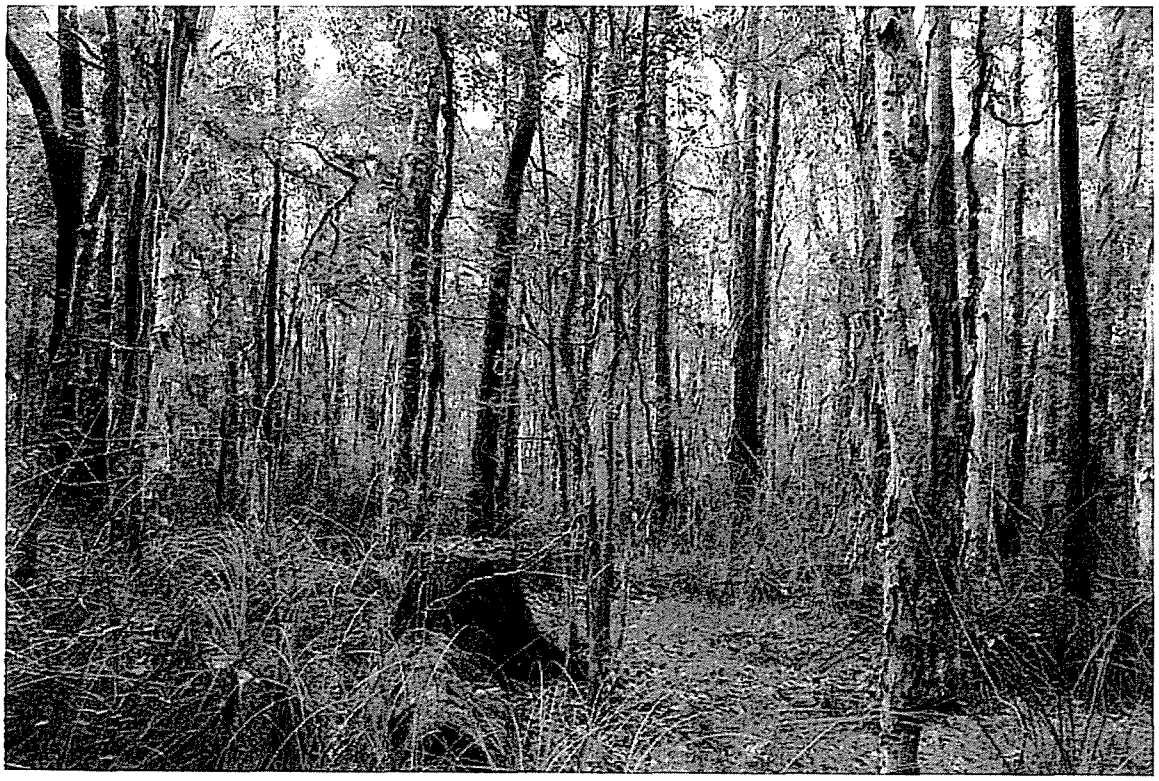


Photo 3 – Swamp Forest vegetation in the north of the subject site containing scattered Swamp Mahoganies, Melaleucas and Callistemon

Shrubs: *Lantana camara* (Lantana), *Ligustrum sinense* (Small-leaved Privet) and *Notelaea longifolia* (Mock Olive).

Groundcovers: *Blechnum cartilagineum* (Gristle Fern), *Carex appressa* (Tussock Sedge), *Dichondra repens* (Kidney Weed), *Entolasia marginata* (Bordered Panic), *Gahnia sieberiana* (Red-fruited Saw-sedge), *Hydrocotyle tripartita* (Pennywort), *Hypolepis muelleri* (Harsh Fern), *Juncus usitatus* (Common Rush) *Oplismenus aemulus* and *Pratia purpurascens* (White Root).

Vines: *Morinda jasminoides, Parsonsia straminea* (Common Silkpod) and *Stephania japonica* var. *discolor* (Snake Vine).

Vegetation Community 5 - Acacia/Cheese Tree Closed Scrub – *Acacia implexa – Glochidion ferdinandi*

Occurrence - This disturbed regrowth vegetation community is located on the mid-slopes of the south-western corner and in the north-east of the site associated with areas of past clearing. This community has been mapped as occupying approximately 1.88ha.

Structure - Tall closed scrub with a canopy cover of approximately 60-80% and height of approximately 10-15 metres, occasionally up to 20 metres. The understorey consists of a moderate shrublayer mostly of younger Privet and occasional Lantana, and a sparse groundcover of herbs, ferns and grasses.

Disturbances - This is a disturbed regrowth community associated with past clearing. It is significantly impacted by incursions of *Lantana camara* (Lantana) and *Ligustrum sinense* (Small-leaved Privet).

Common Species

Trees: *Acacia implexa* (Hickory), *Alphitonia excelsa* (Red Ash) and *Glochidion ferdinandi* (Cheese Tree)

Shrubs: *Lantana camara* (Lantana), *Ligustrum sinense* (Small-leaved Privet) and *Notelaea longifolia* (Mock Olive).

Groundcovers: *Dichondra repens* (Kidney Weed), *Entolasia marginata* (Bordered Panic), *Lepidosperma elatius* and *Pellaea falcata* (Sickle Fern).

Vines: *Cissus antarctica* (Native Grape), *Cissus hypoglauca* (Water Vine), *Parsonsia straminea* (Common Silkpod) and *Smilax australis* (Lawyer Vine).

Vegetation Community 6 - Dry Open Forest (Blackbutt / Spotted Gum)

Occurrence - This vegetation community is restricted to the more exposed upper slopes of the very south-western corner of the subject site and has been mapped as occupying approximately 0.26ha.

Structure - Open Forest with a canopy cover of approximately 30-40% and height of approximately 20-30 metres. The understorey consists of a sparse to moderate shrublayer to 5 metres high and a moderate groundcover of herbs and grasses.

Disturbances - This vegetation community is relatively undisturbed although minor incursions of weeds occur in the downhill edges.

Common Species

Trees: *Alphitonia excelsa* (Red Ash), *Corymbia maculata* (Spotted Gum), *Eucalyptus acmenoides* (White Mahogany) and *Eucalyptus pilularis* (Blackbutt).

Shrubs: *Acacia schinoides, Allocasuarina torulosa* (Forest Oak), *Breynia oblongifolia*, *Lantana camara* (Lantana), *Leucopogon juniperinus* (Bearded Heath), *Maytenus silvestris, Persoonia linearis* (Narrow-leaved Geebung) and *Podolobium ilicifolium* (Native Holly).

Groundcovers: *Desmodium rhytidophyllum* (Rusty Tick-trefoil), *Dianella caerulea* (Flax Lily), *Imperata cylindrica* var. *major* (Blady Grass), *Entolasia stricta* (Wiry Panic), *Lomandra longifolia* (Spiky-headed Mat-rush), *Microlaena stipoides* (Weeping Grass) and *Themeda australis* (Kangaroo Grass).

Vine: *Cissus antarctica* (Native Grape), *Cissus hypoglauca* (Water Vine), *Hardenbergia violacea* (False Sarsparilla), *Hibbertia scandens* (Climbing Guinea-flower), *Kennedia rubicunda* (Dusky Coral Pea) and *Morinda jasminoides.*

Vegetation Community 7 – Exotic Grassland Pasture with Isolated Trees:

Occurrence - This vegetation community occurs within two large clearings within the subject site and occupies approximately 3.47ha.

Structure - Grasslands and herb-fields with isolated trees and scattered shrubs.

Photo 4 – Managed pasture area with isolated trees within the cleared portion on the northern side of Berkeley Road

Disturbances - This vegetation community is the result of clearing, cultivation of pasture, grazing and under-scrubbing of the open forest.

Common Species

Trees: *Corymbia maculata* (Spotted Gum), *Eucalyptus acmenoides* (White Mahogany) *Eucalyptus deanei* (Blue Gum) and *Eucalyptus pilularis* (Blackbutt).

Shrubs: *Acacia irrorata*, *Acacia schinoides*, *Glochidion ferdinandi* (Cheese Tree), *Lantana camara* (Lantana), *Ligustrum sinense* (Small-leaved Privet) and *Melaleuca biconvexa.*

Groundcovers: *Andropogon virginicus* (Whisky Grass), *Axonopus affinis* (Narrow-leaved Carpet Grass), *Bidens pilosa* (Cobbler's Pegs), *Cynodon dactylon* (Common Couch), *Dichondra repens* (Kidney Weed), *Plantago lanceolata* (Ribwort), *Paspalum dilatatum* (Paspalum), *Pteridium esculentum* (Bracken Fern) *Senecio madagascariensis* (Fireweed) *Sida rhombifolia* (Paddy's Lucerne), *Stellaria media* (Chickweed), *Trifolium repens* (Clover), *Veronica plebeia* (Creeping Speedwell).

4.4 Local / Regional flora matters

A number of specimens of *Eucalyptus robusta,* which is classed as a regionally significant species by Wyong Council, were observed during the survey. The proposed dwelling footprints and asset protection zones are not likely to require the removal of any specimens of Swamp Mahogany.

The following species, listed as Keystone Species in Development Control Plan (DCP) 14 Tree Management, were observed within the study area:

Botanical Name	Common Name	Potential Schedule 1 or 2 Fauna
Acacia irrorata and other 'gum' producing *Acacia* species	Wattle	Squirrel Glider
Allocasuarina torulosa	Forest Oak	Glossy Black-Cockatoo
Corymbia maculata	Spotted Gum	Squirrel Glider / Yellow-bellied Glider
Eucalyptus acmenoides	White Mahogany	Squirrel Glider
Eucalyptus deanei	Deanes Gum	Yellow-bellied Glider
Eucalyptus pilularis	Blackbutt	Koala / Greater Glider
Eucalyptus robusta	Swamp Mahogany	Yellow-bellied Glider / Squirrel Glider / Koala / Regent Honeyeater
Melaleuca biconvexa and other local *Melaleuca* species	Paperbark	Ringtail Possum

4.5 State legislative flora matters

4.5.1 Threatened species

One threatened flora species, *Melaleuca biconvexa*, was observed during the survey and will be discussed further in Sections 4.6 and 5 of this report.

TSC Act – A search of the *Atlas of NSW Wildlife* (OEH 2011) database indicated that eighteen (18) species have been recorded within a 10 km radius of the study area. Those species are listed in Table 4.1.

TSC Act – A search of the *Atlas of NSW Wildlife* (OEH 2011) database indicated that eighteen (18) species have been recorded within a 10 km radius of the study area. Those species are listed in Table 4.1.

Of those eighteen (18) threatened flora species, five (5) have the potential to occur within the subject site. Those species are *Dendrobium melaleucaphilum*, *Melaleuca biconvexa, Prostanthera, Senna acclinis* and *Syzygium paniculatum.* Of these, one (1), *Melaleuca biconvexa,* was observed within the subject site.

4.5.2 Endangered populations

There are two (2) known endangered populations within Wyong Shire. *Eucalyptus parramattensis* subsp. *parramattensis* in the Wyong and Lake Macquarie LGAs *Eucalyptus oblonga* at Bateau Bay.

They are not represented within the study area.

4.5.3 Endangered ecological communities

Three (3) endangered ecological communities (EECs) – Lowland Rainforest, Swamp Sclerophyll Forest and Eucalypt Riverflat Forest on Coastal Floodplains – were observed within the subject site.

Three (3) EECs were located onsite, namely;

- River-flat Eucalypt Forest on Coastal Floodplains (Alluvial Blue Gum Open Forest)
- Swamp Sclerophyll Forest on Coastal Floodplains (Swamp Open Forest)
- Lowland Rainforest on Coastal Floodplains (Alluvial Gully Closed Forest)

4.6 National environmental significance - flora

4.6.1 Threatened species

A review of the schedules of the *EPBC Act* indicated the potential for thirteen (13) threatened flora species to occur within a 10km radius of the site (Table 4.1).

Of those thirteen (13) threatened flora species, three (3) have the potential to occur within the subject site. Those species are *Melaleuca biconvexa, Prostanthera askania* and *Syzygium paniculatum.* Of these, one (1), *Melaleuca biconvexa,* was observed within the study area.

Melaleuca biconvexa assessment

The population of *Melaleuca biconvexa* recorded within the subject site will not be directly impacted by the proposal and furthermore, the majority will be within proposed E2 zones to be conserved in perpetuity.

It is estimated that there are approximately 50 juvenile *Melaleuca biconvexa* within the northern portion of Lot 2. This area is not subject to any future development and the land area containing the juvenile species can be fenced off with title restrictions in a similar fashion that has occurred within the rural residential subdivision on the southern side of Berkeley Road within DP 1134328. Additionally given the large number (1000+) plants mainly occurring and regenerating within the proposed E2 lands, the retention and protection

of these few juvenile plants is considered to represent an acceptable and consistent conservation outcome.

The proposal was not considered to have a significant impact on the population of *Melaleuca biconvexa* within the subject site due to the strategic location of proposed development footprints to avoid this species. As such, a referral to SEWPAC should not be required.

Importance of population within the subject site

An *important population* is one that is necessary for a species' long term survival and recovery. This may include populations 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

It is considered that any presence of this species would be regarded as being an important population in terms of the legislation simply because it contains many specimens, however the proposed development has been specifically designed to ensure that the building envelopes, including the bushfire asset protection zones will be located predominately within the cleared areas and avoided the need to remove and/or impact *Melaleuca biconvexa* on the site.

Potential impact of development on Melaleuca biconvexa

Criteria identified within the *EPBC Act Administrative Guidelines on Significance July 2000* are addressed below in order to determine the significance of the impact upon the *Melaleuca biconvexa* and whether the development is subsequently classed as a controlled action. If in the event the activity (proposed development) is a controlled action, it must be referred to SEWPAC.

Comments are provided on each of the criteria (as identified within the guidelines) below.

An action has, will have, or is likely to have a significant impact on a vulnerable species if it does, will, or is likely to:

- *Lead to a long-term decrease in the size of an important population of a species; or*
- *Reduce the area of occupancy of an important population; or*
- *Fragment an existing important population into two or more populations; or*
- *Adversely affect habitat critical to survival of the species; or*
- *Disrupt the breeding cycle of an important population; or*
- *Modify, destroy, remove or isolate or decrease the availability of quality habitat to the extent that the species is likely to decline; or*
- *Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat; or*
- *Interferes substantially with the recovery of the species.*

The proposed development has been specifically designed to ensure that the building envelopes, including the bushfire asset protection zones, will be located within the cleared areas and have avoided the removal of *Melaleuca biconvexa* on the site. Furthermore, the majority of potential habitat for this species within the subject site will be completely retained within the conservation zoned lands, or protected under title and regenerated.

Background to Species: *Melaleuca biconvexa* is a shrub or small tree which occurs as dense stands along watercourses or as understorey in wet forests. It occurs from Jervis Bay to Port Macquarie with most populations in the Gosford / Wyong area.

Local Observations: The occurrence of *Melaleuca biconvexa* within the subject site may be considered to constitute an important population however the definition of important population is difficult to theorise due to the fact that this species forms a significant portion of communities across the whole of the central coast region and forms linear components to riparian zones. Thus its importance is difficult to quantify.

During the targeted survey of the subject site, numerous (1000+) specimens of *Melaleuca biconvexa* were observed. A search of the Atlas of NSW Wildlife (OEH 2011) records revealed between 250-300 records of *Melaleuca biconvexa* within 10km of the subject site. Many of these populations are large in size (1000+), for example, those located within bushland areas adjoining Corella Close approximately 750-1500m to the north. Numerous specimens of mostly regenerating *Melaleuca biconvexa* were also observed within the Berkeley Road reserve. An estimated 150 specimens have been observed on adjacent land within 250m to the east of the subject site. Between Corona Lane and Tuggerah Lakes Secondary College (Berkeley Vale Campus) along Berkeley Road there are numerous specimens on the roadside and within the riparian reserve, approximately 850m east south-east of the subject site.

Observations by *Travers bushfire & ecology* indicate that *M. biconvexa* is common in dense bushland on the banks of creeks which rise in Terrigal Formation geology.

This species occurs within the subject site along the minor drainage lines and alluvial flats, which are divided by Berkeley Road.

Figure 2 depicts the location of the population within the subject site. Within the drainage line to the south of Berkeley Road the density of this species increases in a northerly direction.

Small scattered examples also occur along the eastern boundary of the subject site. Large numbers of *Melaleuca biconvexa* were recorded particularly north of Berkeley Road within the Swamp Mahogany Open Forest vegetation community. There were less specimens on the southern side of the road and there were many immature specimens.

The proposed concept subdivision layout and future dwelling footprints avoid disturbance of any occurrences of this species within those lots.

Local Populations: In terms of the local population of *Melaleuca biconvexa*, observations by *Travers bushfire & ecology* reveal that the local area includes significant stands of *M. biconvexa* within the following locations:

- Large numbers of this species (within the same population) occur immediately to the north of the areas proposed for dwellings / disposal areas (within the study area).
- This population continues outside of the subject site to the north into the adjoining swamp vegetation.
- Other larger populations also occur along Berkeley Creek (Berkeley Vale), to the east and west of Catamaran Drive and Manns Road (Fountaindale), along Enterprise Drive (Fountaindale), to the north along Corella Close and to the east and west of Glenning Road (Glenning Valley). These sites are all within 1-2 kilometres of the study area.

Photo 5 – Melaleuca biconvexa within the drainage line in the eastern portion of the subject site, north of Berkeley Road.

Habitat Preferences: The specific habitat types of *Melaleuca biconvexa* within the subject site were described and mapped by Bell (2002) as Map Unit 17 Alluvial Robusta Paperbark Sedge Palm Forest and Map unit 16 Alluvial Bluegum – Paperbark Mesic Palm Forest.

Melaleuca biconvexa was identified as a key positive indicator species within high frequency of occurrence within both of these communities (Bell 2002). These two communities have been mapped as occurring over 272ha and 153ha respectively within the Wyong local Government Area.

Melaleuca biconvexa is also known to be found within Map Unit 15 Alluvial Redgum Footslopes Forest which occupies a further 145ha. Therefore, within the Wyong LGA there is approximately 570ha of known *Melaleuca biconvexa* habitat similar to that which occurs within the subject site.

The subject site already contains significant incursions of exotic weed species, particularly *Lantana camara, Ligustrum sinense* and *Cinnamomum camphora* within the ground, shrub and canopy layers.

Conclusion: It is considered that the rezoning of the site and the proposed concept subdivision will not have a significant impact upon the *Melaleuca biconvexa*, in terms of the *EPBC Act 1999*. As such it is considered that a referral to SEWPAC for this species is not required.

4.6.2 Endangered ecological communities

The actions associated with the development are not likely to significantly affect any nationally listed threatened ecological communities.

Conclusion: A referral to SEWPAC is not required.

4.7 Threatened flora species habitat assessment

Table 4.1 below provides an assessment of threatened flora species habitat likely to occur within the subject site.

Table 4.1 – Threatened flora habitat assessment

Scientific name	Growth form and habitat requirements	Conservation status	Comments	TSC Act	EPBC Act
Acacia bynoeana EPBC	Erect or spreading shrub to 0.3 m high growing in heath and dry sclerophyll open forest on sandy soils. Often associated with disturbed areas such as roadsides. Distribution limits N-Newcastle S-Berrima.	Blue Mountains NP, Royal NP, Castlereagh NR, Agnes Banks NR, Lake Macquarie SRA, Dharawal NR, Marramarra NP, Parr SRA	There are no records of this species within 10km. No suitable vegetation communities present within the subject site.	E1	V
Angophora inopina OEH EPBC	Small tree in open sclerophyll forest growing on deep sandy soils with associated lateritic outcrops. Distribution limits N-Wyee S-Gorokan.	Lake Macquarie SRA, Karuah NR	Nearest record is 10km away. Outside of known local range.	V	V
Apatophyllum constablei EPBC	A small shrub up to 40cm tall that grows in dry sclerophyll forest on slopes with a north to north-westerly aspect usually near cliffs. It flowers from August to December. Most populations are restricted to Wollemi National Park near the town of Glen Davis. The species has been removed from the TSA Act since 2007.	Wollemi NP	No records within 10km. Outside of known local range.	-	E
Caladenia tessellata OEH EPBC	Terrestrial orchid. Clay-loam or sandy soils. Distribution limits N-Swansea S-south of Eden.	Munmorah SRA, Popran NP, Wyrrabalong NP	Nearest record is 7km away. No suitable habitat present.	E1	V
Callistemon linearifolius OTHER	Shrub to 4 m high. Dry sclerophyll forest on coast and adjacent ranges. Distribution limits N-Nelson Bay S-Georges River.	Ku-ring-gai Chase NP Lion Island NR Spectacle Island Nature Reserve Yengo NP, Brisbane Water NP, Munmorah SRA, Werakata NP	No records within 10km. Marginal habitat present within riparian lines. Not observed.	V	-
Chamaesyce psammogeton OEH	Prostrate herb. Coastal dunes. Distribution limits N-Tweed Heads S-Jervis Bay	Wamberal Lagoon NR Myall Lakes NP Booti Booti NP	Nearest record is 9km away. No suitable habitat present.	E1	-

Table 4.1 – Threatened flora habitat assessment

Scientific name	Growth form and habitat requirements	Conservation status	Comments	TSC Act	EPBC Act
Cryptostylis hunteriana EPBC	Saprophytic orchid. Grows in swamp heath on sandy soils. Distribution limits N-Gibraltar Range S-south of Eden.	Gibraltar Range NP, Ku-ring-gai Chase NP, Ben Boyd NP	No records within 10km. No suitable vegetation types present.	V	V
Darwinia glaucophylla OEH	Spreading prostrate shrub with ascending branchlets to 0.15 m high. Grows in heath on shallow soils. Distribution limits Gosford district.	Brisbane Water NP	Nearest record is 10km away. No suitable habitat present.	V	-
Dendrobium melaleucaphilum OEH	Epiphytic orchid which usually occurs on the bark of *Melaleuca styphelioides* in coastal swamps. Distribution N-Border Ranges S-Blue Mountains.	Not currently known from conservation reserves.	Nearest record is 10km away. Suitable habitat present. Low likelihood of occurrence given lack of nearby records. Not observed.	E1	-
Diuris praecox OEH EPBC	Terrestrial orchid. Grows in sclerophyll forest near the coast. Distribution limits N-Nelson Bay S-Ourimbah.	Glenrock SRA, Munmorah SRA, Tomaree NP, Wyrrabalong NP	Nearest record is 6.5km away. No suitable vegetation types present.	V	V
Epacris purpurascens var. purpurascens OEH	Erect shrub to 1.5m high growing in sclerophyll forest and scrub and near creeks and swamps on Sandstone. Distribution limits N-Gosford S-Blue Mountains.	Ku-ring-gai Chase NP Muogamarra NR Brisbane Water NP Berowra Valley RP Bents Basin SRA	Nearest record is 4km away which is the only record within 10km. No suitable habitat present.	V	-
Eucalyptus camfieldii OEH EPBC	Stringybark to 10 m high. Grows on coastal shrub heath and woodlands on sandy soils derived from alluviums and Hawkesbury sandstone. Distribution limits N-Norah Head S-Royal NP.	Brisbane Water NP, Ku-ring-gai Chase NP, Royal NP, Sydney Harbour NP, Awabakal NR, Popran NP, Berowra Valley RP	Nearest record is 6km away. No suitable habitat present.	V	V
Grevillea parviflora subsp parviflora OEH	Open to erect shrub to 1 metre. Grows in woodland on light clayey soils Distribution limits N-Cessnock S-Appin.	Werakata NP	Nearest record is 10km away. No suitable vegetation types present/	V	V
Hibbertia procumbens OEH	Prostrate shrub with linear leaves which occurs in heath on sandy soils but is only known from Mangrove Mountain.	Not currently known from conservation reserves.	Nearest record is 8.5km away. No suitable habitat present.	E1	-

Table 4.1 – Threatened flora habitat assessment

Scientific name	Growth form and habitat requirements	Conservation status	Comments	TSC Act	EPBC Act
Maundia triglochinoides OEH	A reed-like herb which grows in swamps and shallow fresh water on clay. Distribution Limits N-Qld border S-Wyong.	Unknown	Nearest record is 2km away. No suitable habitat present.	V	-
Melaleuca biconvexa OEH EPBC	Tall shrub. Grows in wetlands adjoining perennial streams and on the banks of those streams, generally within the geological series known as the Terrigal Formation. Distribution limits N-Port Macquarie S-Jervis Bay.	Bouddi NP, Wyrrabalong NP	Several records on adjacent and nearby lots. Suitable habitat present. Numerous specimens observed.	V	V
Prostanthera askania OEH EPBC	Erect shrub. Grows in sclerophyll forest on ridges in or adjacent to Rainforest. Distribution limits Strickland SF region.	Not currently known from conservation reserves.	Nearest record just over 0.5km away. Limited habitat present. Not observed.	E1	E
Prostanthera junonis EPBC	Small shrub. Grows in sclerophyll forest and heath in shallow soil on sandstone. Distribution limits Somersby region.	Brisbane Water NP	No records within 10km. Outside of known local geographic range.	E1	E
Rhizanthella slateri EPBC	Underground orchid that is poorly known. Grows in sclerophyll forests. Usually only seen if the soil is disturbed. Flowers in Oct – Nov.	Unknown	No records within 10km and only 1 record on the Gosford 1:100,000 map sheet. Not likely to occur given lack of records.	V	E
Rutidosis heterogama OEH	Erect herb to 30cm. Grows mostly in heath, often along roadsides. Distribution limits N-Maclean S-Hunter Valley.	Werakata NP	Nearest record is 9km away. No suitable habitat present.	V	V
Senecio spathulatus	A low growing daisy that prefers primary dunes. Known to occur at Cape Howe and between Kurnell north to Myall Lakes National Park. Also occurs in coastal locations in eastern Victoria.	Nadgee NP	Nearest record is 9km away. No suitable habitat present.	E	-
Senna acclinis OEH	Shrub to 3 metres high which occurs in subtropical rainforest. Distribution limits N-Border Ranges S-Illawarra.	Darawank NR	Nearest record is 6.5km away. The lowland rainforest area may provide marginal habitat. Not recorded.	E1	-

Table 4.1 – Threatened flora habitat assessment

Scientific name	Growth form and habitat requirements	Conservation status	Comments	TSC Act	EPBC Act
Syzygium paniculatum OEH EPBC	Small tree. Subtropical and littoral rainforest on sandy soil. Distribution limits N-Forster S-Jervis Bay.	Booti Booti NP, Myall Lakes NP, Wamberal Lagoon NR, Wyrrabalong NP, Captain Cooks Landing Place HS, Jervis Bay NP, Munmorah SRA, Glenrock SRA	Nearest record is 9km away. No suitable habitat present.	V	V
Tetratheca juncea OEH EPBC	Prostrate shrub to 1 m high. Dry sclerophyll forest and heath. Distribution limits N-Bulahdelah S-Port Jackson.	Glenrock SRA, Awabakal NR, Munmorah SRA, Lake Macquarie SRA, Karuah NR, Wallaroo NR	Nearest record is 9km away. No suitable habitat present.	V	V

OEH	- Denotes species listed within 10km of the subject site on the *Atlas of NSW Wildlife* database
EPBC	- Denotes species listed within 10km of the subject site in the *EPBC Act* habitat search
OTHER	- Denoted a species not listed within 10km of the subject site in either of the above searches but considered to have some potential habitat present.
V	- Denotes vulnerable listed species under the relevant Act
E or E1	- Denotes endangered listed species under the relevant Act

4.8 Fauna species

A total of one-hundred and four (104) fauna species were observed within or in close proximity to the subject site during the survey. This number constitutes as a high number of biodiversity occurring within the site with 70 species of bird, 26 species of mammal, 2 species of reptile and 6 species of amphibian recorded.

All species are listed in Table 3.2.

4.9 Fauna Habitat

The fauna habitats present throughout the site include:

- Vegetated areas of open forest
- Nectar producing tree species, principally *Melaleuca, Eucalyptus, Corymbia* and *Acacia*
- Stands of the winter flowering Swamp Mahogany
- Seed producing trees, notably *Allocasuarina*
- Sap flows, particularly on *Eucalyptus* and *Acacia* trees
- Moderate to dense shrublayers
- Sparse to moderate density ground cover
- Large, medium and small hollows of varying quality in the greater subject site area
- Fallen logs, hollow sections and branches

- Loose soil suitable for foraging
- Perennial creek with moderate to dense riparian vegetation along the margins
- Small farm dam with fringing vegetation
- Melaleuca swamp with depressions close to the water table providing soaks
- Sparse to moderate litter layers
- Exfoliated bark on trunks and piles at the base of smooth-barked *Eucalyptus* species
- Artificial debris and refuse

The seven (7) vegetation communities present within the subject site provide a diverse array of habitat. The habitat attributes of each vegetation community are described below.

Alluvial Gully Closed Forest vegetation community

The Alluvial Gully Closed Forest vegetation community occurs as an isolated patch within the south-eastern corner of the southern portion of the subject site. This community continues as a larger representation beyond the subject site. Remnant tall eucalypts within this community provide foraging habitat and protective foliage cover for birds, bats and arboreal mammals. A moderate to dense shrublayer to 5 metres high provides protective and foraging habitat for birds, arboreal mammals, and terrestrial mammal species.

The drainage line supplementing this community with pooling locations and adjacent foliage provide protective, breeding and foraging habitat for amphibians, small mammals, passerine birds and waterfowl. A moderate to sparse groundcover of ferns and sedges combined with tree litter and fallen moist logs provides habitat for small terrestrial mammals, reptiles and amphibians.

The Moist Blue Gum Open Forest Community

The Moist Blue Gum Open Forest occurs as narrow representations within the southern portion of the subject site and along the north-western boundary generally along the outer fringes of the Alluvial Gully Forest community. Tree species within the upper and mid-strata levels of this tall open forest community provide breeding and roosting habitat for a variety of bird and arboreal species. The diversity of these species provide a year-round foraging resource for bird, arboreal mammal and bat species. *Corymbia maculata* (Spotted Gum) and *Eucalyptus paniculata* subsp. *paniculata* (Grey Ironbark) are capable of flowering through the winter period providing subsequent potential habitat for threatened migratory bird species, Swift Parrot and Regent Honeyeater. A moderate shrublayer to 5 metres high and a moderate groundcover of dominated by ferns and vines provides suitable habitat for birds, small arboreal and terrestrial mammals, reptiles and amphibians.

The Disturbed Blue Gum Open Forest vegetation community

The Acacia / Cheese Tree Closed Scrub vegetation community is located on the mid-slopes within the south-western portion of the subject site. Current small to medium sized tree species within this community provide foraging habitat for birds, bats and arboreal mammals. A small roosting colony of Little Red Flying-foxes was found in this community during trapping surveys in 2010.

A moderate to dense shrub layer provides protective, breeding and foraging habitat for small to medium sized birds, arboreal mammals and terrestrial mammal species. A sparse groundcover of herbs, ferns and grasses as well as tree litter provides potential habitat for small terrestrial mammals and reptiles.

The Disturbed Land with Scattered Trees vegetation community occurs in separate large portions adjacent to Berkeley Road, which traverses the subject site from the north-west to the central-east. The fauna habitat opportunities that occur within this community are generally the result of human disturbance. Isolated and scatted trees provide outlook roosts and breeding habitat for medium to large and predator bird species.

Deposited mulch refuse and stacked mounds of branches provides habitat for terrestrial reptile and small mammal species. Depressions and an ephemeral drainage line within this community provide habitat for amphibians, waterfowl and wading birds. The representation to the north of Berkeley Road is currently grazed by cows. The value of native fauna habitat within this community is limited due to the disturbed and exposed nature of the site.

The Alluvial Blue Gum Open Forest Community

The Alluvial Blue Gum Open Forest is restricted to the alluvial flats and minor creek lines within the north-western portion of the subject site. Tree species within the upper and mid-strata levels of this tall open forest community provide breeding and dense protective roosting habitat for a variety of bird species, megachiropteran bats and other arboreal species. Exfoliating bark on Melaleuca tree species provide protective habitat for amphibian and small reptile species. A moderate shrub layer to 8 metres high and a moderate groundcover of herbs, ferns and grasses as well as tree litter provides suitable habitat for suitable habitat for birds, small arboreal and terrestrial mammals, reptiles and amphibians.

Much of this community has notably been affected by dieback as a result of Bell Miners. The thinning of foliage in the upper strata levels would subsequently have a detrimental impact on the way in which fauna species may utilise the canopy within these areas.

The Swamp Open Forest – *Eucalyptus robusta* vegetation community

The Swamp Open Forest – *Eucalyptus robusta* vegetation community occupies the poorly drained alluvial flats in the central northern portion of the subject site. Tree species within the upper and mid-strata levels of this open forest community provide foraging, breeding and roosting habitat for a variety of bird species and roosting habitat for megachiropteran bats. This community is dominated by the winter flowering *Eucalyptus robusta* (Swamp Mahogany). This provides foraging habitat for birds, bats and arboreal mammals. Also this winter foraging source provides suitable foraging habitat for threatened migratory bird species, Swift Parrot and Regent Honeyeater.

Exfoliating bark on Melaleuca tree species provide protective habitat for amphibian and small reptile species. This community occurs within a topographical depression and drainage line resulting in periodic water flows, pooling and potential inundation after heavy rainfalls. This characteristic provides an ephemeral breeding resource for amphibians and foraging habitat for passerine birds, waterfowl, terrestrial mammals, and invertebrate and fungi feeders. A groundcover of sedges, herbs and ferns as well as tree litter provides suitable habitat for small terrestrial mammals, reptiles and amphibians.

The Acacia / Cheese Tree Closed Scrub vegetation community

The Acacia / Cheese Tree Closed Scrub vegetation community is located on the mid-slopes within the south-western portion of the subject site. Current small to medium sized tree species within this community provide foraging habitat for birds, bats and arboreal mammals. A small roosting colony of Little Red Flying-foxes was found in this community during trapping surveys in 2010.

A moderate to dense shrub layer provides protective, breeding and foraging habitat for small to medium sized birds, arboreal mammals and terrestrial mammal species. A sparse groundcover of herbs, ferns and grasses as well as tree litter provides potential habitat for small terrestrial mammals and reptiles.

The Dry Open Forest *Corymbia maculata – Eucalyptus pilularis* vegetation community

The Dry Open Forest *Corymbia maculata – Eucalyptus pilularis* vegetation community is restricted to the more exposed upper slopes of the very south-western corner of the subject site. Mature tree species within this community provide breeding and roosting habitat for a variety of birds, bats and arboreal species. Sugar Gliders have been recorded in this portion of the site. The winter flowering *Corymbia maculata* (Spotted Gum) provides potential foraging habitat for threatened migratory bird species, Swift Parrot and Regent Honeyeater. A sparse shrublayer to 5 metres high provided potential habitat for birds, small arboreal mammals and reptiles. A sparse groundcover of herbs and grasses provides limited habitat for small mammal and reptile species. Rock outcrops within this community provides potential supplementary habitat for terrestrial mammal and reptile species.

4.10 Habitat trees

A tree assessment undertaken as part of flora surveys within the subject site identified no hollow bearing trees within proposed dwelling locations or asset protection zones (*Travers Environmental Consultants* 2007). Habitat trees are likely to be present within the proposed E2 zones.

The subject site appeared to have been subjected to clearing and logging in the past with the current open forest areas being predominantly regrowth. This is considered likely to have contributed to this limitation of habitat trees within the study area.

4.11 Local fauna matters

4.11.1 Squirrel Glider habitat assessment

There are several records of Squirrel Glider within 10km of the study area, of these the closest record was 1.8km to the north-east in 1995 (OEH 2011). Four (4) Sugar Gliders were captured and identification confirmed. Two (2) specimens were observed whilst spotlighting within the subject site during recent surveys.

Squirrel Glider habitat on the subject site was assessed according to the document '*Wyong Shire Council Interim Ecological Assessment Information Required to Assess Clearing Impacts within Squirrel Glider Habitat in Wyong Shire' (2000)*. The assessment includes the following:

(a) Habitat quality (vegetation type);
(b) Remnant patch size;
(c) Density of habitat trees;
(d) Abundance of food plants;
(e) Habitat vulnerability;
(f) Disturbance factors.

The vegetation within the subject site is a combination of three open forest vegetation communities and clearings. The open forest occupies approximately 75% of the study area.

(a) Habitat Quality

The open vegetation communities have been significantly impacted by invasive weeds, particularly by Small-leaved Privet and Lantana, but in other respects are considered to be in good condition.

Prominent trees are *Eucalyptus pilularis* (Blackbutt), *Eucalyptus deanei* (Blue Gum), *Eucalyptus robusta* (Swamp Mahogany), *Eucalyptus saligna, Eucalyptus acmenoides* (White Mahogany) and *Corymbia maculata* (Spotted Gum). Prominent shrubs are *Acacia implexa, Acacia irrorata, Acacia schinoides, Callistemon salignus* (Willow Bottlebrush), *Glochidion ferdinandi, Melaleuca biconvexa* and *Melaleuca stypheloides* (Prickly-leaved Tea Tree).

(b) Remnant Patch Size

The remnant patch size is approximately 7.8 ha.

(c) Density Habitat Trees

The density of habitat trees within the Open Forest remnant is less than 1 per hectare.

(d) Abundance of Food Plants of Squirrel Glider

The abundance of Squirrel Glider food resources is provided in Table 6 for the open forest vegetation communities.

Table 4.2 – Squirrel Glider food resource abundance within the subject site

		Estimated Avg No of Plants / hectare in					
Food Plants	**Food Item**	Alluvial Gully Closed Forest	Alluvial Blue Gum Open Forest	Moist Blue Gum Open Forest	Dry Open Forest	Swamp Mahogany Open Forest	Acacia Cheese Tree Closed Scrub
Eucalyptus robusta	Sap, nectar & pollen	0	5	0	0	100	0
Eucalyptus siderophloia	Sap, nectar & pollen	0	0	0	0	0	0
Eucalyptus paniculata	Sap, nectar & pollen	0	5	10	50	0	0
Eucalyptus fibrosa	Sap, nectar & pollen	0	0	0	0	0	0
Corymbia maculata	Nectar & pollen	25	10	25	100	0	0
Melaleuca spp	Nectar & insects	10	250	25	0	250	0
Acacia spp.	Seeds & gum	25	50	25	25	5	100
Xanthorrhoea spp.	Nectar & gum	0	0	0	5	0	0

(e) Edge to Width Ratio

The Open forest remnants are impacted by irregularly shaped clearings and thus contain a relatively high edge: area ratio. Higher quality habitat areas in the northern portions of the site however, have a higher degree of connectivity to the north with only one combined large edge clearing, resulting in a lower edge to width ratio.

(f) Habitat Disturbance

The remnant vegetation communities have been severely impacted by incursions of weeds, principally *Lantana camara* (Lantana).

(g) Proximity to Existing or Future Residential Development

The subject site is bounded by open forest with rural residential development along the full length of the eastern boundary.

Conclusion of Squirrel Glider Assessment

No Squirrel Gliders have been recorded within the subject site. Habitat for this species does exist and is considered generally of good quality, particularly in the northern portions, with a notable limitation of low hollow tree densities. Habitat will be conserved within the subject site for this species and as such the proposed development is unlikely to have a significant impact on Squirrel Gliders.

4.12 State legislative fauna matters

4.12.1 Threatened species

Seven (7) threatened fauna species including Powerful Owl (*Ninox strenua*), Varied Sittella (*Daphoenositta chrysoptera*), Grey-headed Flying-fox (*Pteropus poliocephalus*), Little Bentwing-bat (*Miniopterus australis*), Eastern Bentwing-bat (*Miniopterus orianae oceansis*), Yellow-bellied Glider (*Petaurus australis*) and Greater Broad-nosed Bat (*Scoteanax rueppellii*) – were recorded within the subject site. The Greater Broad-nosed Bat was recorded only to a 'possible' level of certainty given the lack of recorded Anabat call sequences.

It is considered that the subject site provides suitable habitat (except the cleared areas) for the following threatened fauna species previously recorded within 10km (see Table 4.4 for likelihood of each species presence based on available habitat and records):

- Wallum Froglet
- Green-thighed Frog
- Pale-headed Snake
- Stephens' Banded Snake
- Wompoo Fruit-dove
- Superb Fruit-dove
- Black-necked Stork
- Little Eagle
- Square-tailed Kite
- Gang-gang Cockatoo
- Glossy Black-Cockatoo
- Little Lorikeet
- Swift Parrot
- Barking Owl
- Powerful Owl *
- Masked Owl
- Sooty Owl
- Regent Honeyeater
- Varied Sittella *
- Flame Robin
- Spotted-tailed Quoll
- Eastern Pygmy Possum
- Yellow-bellied Glider *
- Squirrel Glider
- Long-nosed Potoroo
- Grey-headed Flying-fox *
- Yellow-bellied Sheathtail-bat
- East-coast Freetail Bat
- Eastern Falsistrelle
- Golden-tipped Bat
- Little Bentwing-bat *
- Eastern Bentwing-bat *
- Large-footed Myotis
- Greater Broad-nosed Bat *

Not: Species annotated by an asterix (*) are listed threatened species that have been recorded on the site.

TSC Act – A search of the *Atlas of NSW Wildlife* (OEH, 2011) database for threatened species resulted in records of fifty-six (56) threatened fauna species within a 10km radius of

the subject site. These species are listed in Table 4.4 and are considered for potential habitat within the subject site.

Strictly coastal and oceanic threatened species found within 10km have not been included.

FM Act – No habitats suitable for threatened aquatic species were observed within the subject site and as such the provisions of this act do not require any further consideration.

4.12.2 Endangered populations

There are no identified endangered fauna populations within the Wyong LGA.

4.12.3 SEPP 44 Koala Habitat Protection

SEPP 44 Koala Habitat Protection applies to land within Local Government Areas (LGAs) listed under Schedule 1 of the Policy. In addition, Part 2 of the Policy outlines a three (3) step process to assess the likelihood of the land in question being potential or core koala habitat. Part 2 applies to land which has an area of greater than 1 hectare or has, together with any adjoining land in the same ownership, an area of more than 1 hectare.

The subject site is required to be considered under SEPP 44 as it falls within the Wyong LGA, which is listed on Schedule 1 of this Policy. In addition, the total area of the subject site is greater than 1 hectare, hence Part 2 – Development Control of Koala Habitats, of the Policy applies.

Potential Koala Habitat (PKH) is defined as land where at least 15% of the total number of trees in the upper or lower strata constitutes any of the tree species listed in Schedule 2 of the policy.

Core Koala Habitat (CKH) is defined as an area of land with a resident population of koalas, evidenced by attributes such as breeding females (i.e. females with young) and recent sightings of and historical records of a population.

Step 1 – Is the land PKH?

One Koala food tree species (*Eucalyptus robusta*) listed on Schedule 2 of State Environmental Planning Policy No. 44 - Koala Habitat Protection was recorded within the subject site. This species made up approximately 10% of trees within the Swamp Mahogany Open Forest vegetation community. This is less than the 15% indicated by SEPP 44, therefore the subject site is not considered to be PKH and no further assessment under this policy is required.

No Koalas were directly recorded at the time of fauna survey, which included diurnal searches of trees and spotlighting. In addition, there was no secondary evidence of Koala habitation in the area. Searches for secondary indications of Koalas included observations for scratchings on trees and scats beneath trees.

A search of the Atlas of NSW Wildlife (OEH 2011) database found seventeen (17) records of Koala habitation within a 10 km radius of the subject site. The record closest to the subject site was approximately 1.2 km to the south-east in 2007. This was also the most recent record. *Travers bushfire & ecology* was involved in the survey of lands where this record is located. Koala experts Biolink were engaged to undertake survey in the surrounding area (which did not include this subject site) and found no Koala activity. Biolink concluded that the previous record was likely an individual in dispersal or placed there. CKH is therefore not known in the immediate locality.

4.13 National environmental significance - fauna

4.13.1 Threatened species

EPBC Act – A review of the schedules of the *EPBC Act* identified the presence of sixteen (16) threatened fauna species or species habitat likely to occur within a 10km radius of the subject site.

These species have been listed in Table 4.4, and those with potential to utilise the subject site will be considered in the seven-part test within Section 5.

Of those sixteen (16) species, 5 were considered to have potential habitat within the subject site. Of these, one (1) nationally listed threatened fauna species, Grey-headed Flying-fox (*Pteropus poliocephalus*), was recorded foraging within the subject site.

Grey-headed Flying-fox assessment

Flying-foxes were heard foraging on flowering *Eucalyptus robusta* (Swamp Mahogany) trees during survey on the night of July 10th 2007. One individual was identified as Grey-headed Flying-fox by spotlight and binoculars. Whilst this species is the most commonly recorded Flying-fox in the region, a camp of the non-threatened Little Red Flying-fox (*Pteropus scapulatus*) was recorded roosting by day from within the site during these surveys.

The subject site does provide suitable roosting and subsequent breeding habitat for the Grey-headed Flying-fox. Both flying-fox species are known to roost together, which is often Little Red Flying-foxes joining the more permanent Grey-headed Flying-fox colonies as part of seasonal migrations. No Grey-headed Flying-foxes were present on the two occasions a small colony of Little Red Flying-foxes have been recorded roosting diurnally within the subject site.

The available roosting and subsequent breeding habitat for both species will be retained as part of the concept subdivision application and development proposal. Foraging habitat will also remain mostley unchanged with a large portion of the site particularly being proposed for conservation management.

It is therefore considered that a referral to SEWPAC in respect to the Grey-headed Flying-fox is not required.

4.13.2 Protected migratory species

The EPBC Act Protected Matters Report provides additionally listed terrestrial, wetland and marine migratory species of national significance likely to occur, or with habitat for these species likely to occur, within a 10km radius of the subject site. These migratory species are assessed in Table 4.3.

Table 4.3 - Migratory fauna habitat assessment

COMMON NAME *Scientific Name*	PREFERRED HABITAT	COMMENTS
White-bellied Sea Eagle (*Haliaeetus leucogaster*)	Coasts, islands, estuaries, inlets, large rivers, inland lakes, reservoirs. *Sedentary; dispersive.*	Sub-optimal foraging habitat. Not recorded during survey however a known nesting site was recorded by *Travers bushfire & ecology* approximately 450m to the north-east during 2010 surveys on a neighbouring site.
White-throated Needletail (*Hirundapus caudacutus*)	Airspace over forests, woodlands, farmlands, plains, lakes, coasts, towns; companies forage often along favoured hilltops and timbered ranges. *Breeds Siberia, Himilayas, east to Japan. Summer migrant to eastern Australia.*	Suitable foraging habitat present. Not recorded during surveys.
Rainbow Bee-eater (*Merops ornatus*)	Open woodlands with sandy, loamy soil; sandridges, sandspits, riverbanks, road cuttings, beaches, dunes, cliffs, mangroves, rainforest, woodlands, golf courses. *Breeding resident in northern Australia. Summer breeding migrant to south-east & south-west Australia.*	No suitable habitat present.
Black-faced Monarch (*Monarcha melanopsis*)	Rainforests, eucalypt woodlands; coastal scrubs; damp gullies in rainforest, eucalypt forest; more open woodland when migrating. *Summer breeding migrant to coastal south-east Australia, otherwise uncommon.*	Suitable roosting, breeding and foraging habitat present. Recorded present by call during 2007 surveys (location not documented). The most suitable areas of breeding roosting and foraging habitat for this species are proposed for retention within conservation areas.
Satin Flycatcher (*Myiagra cyanoleuca*)	Heavily vegetated gullies in forests, taller woodlands, usually above shrub-layer; during migration, coastal forests, woodlands, mangroves, trees in open country, gardens. *Breeds mostly south-east Australia & Tasmania over warmer months, winters in north-east Qld.*	Suitable breeding, roosting and foraging habitat present. Not recorded during surveys.
Rufous Fantail (*Rhipidura rufifrons*)	Undergrowth of rainforests/wetter eucalypt forests/gullies; monsoon forests, paperbarks, sub-inland and coastal scrubs; mangroves, watercourses; parks, gardens. On migration, farms, streets buildings. *Breeding migrant to south-east Australia over warmer months. Altitudinal migrant in north-east NSW in mountain forests during warmer months.*	Suitable roosting, breeding and foraging habitat present. Recorded during 2001 surveys (location not provided). The most suitable areas of breeding roosting and foraging habitat for this species are proposed for retention within conservation areas.

Table 4.3 - Migratory fauna habitat assessment

COMMON NAME *Scientific Name*	PREFERRED HABITAT	COMMENTS
Great Egret (*Ardea alba*)	Shallows of rivers, estuaries; tidal mudflats, freshwater wetlands; sewerage ponds, irrigation areas, larger dams, etc. *Dispersive; cosmopolitan.*	No suitable habitat present.
Cattle Egret (*Ardea ibis*)	Stock paddocks, pastures, croplands, garbage tips, wetlands, tidal mudflats, drains. *Breeds in summer in warmer parts of range including NSW.*	Suitable foraging habitat present. Recorded present during 2001 surveys (location not provided). This recording was probably of a few individuals foraging with cattle as a host within open paddocks. Cattle grazing will likely end as a result of the proposal and the potential for Cattle Egret to occur will be subsequently reduced. As there is no likely breeding habitat for this species and foraging opportunities are still well represented in the locality, there will not be any likely significant impact on this species as a result of the subdivision.
Latham's Snipe (*Gallinago hardwickii*)	Soft wet ground or shallow water with tussocks and other green or dead growth; wet parts of paddocks; seepage below dams; irrigated areas; scrub or open woodland from sea-level to alpine bogs over 2000m; samphire on saltmarshes; mangrove fringes. *Breeds Japan. Regular summer migrant to Australia. Some overwinter.*	No suitable habitat present.
Fork-tailed Swift (*Apus pacificus*)	Aerial: over open country, from semi-arid deserts to coasts, islands; sometimes over forests, cities. *Breeds Siberia, Himilayas, east to Japan south-east Asia. Summer migrant to east Australia. Mass movements associated with late summer low pressure systems into east Australia. Otherwise uncommon.*	Suitable foraging habitat present. Not recorded during surveys.

The actions associated with the development are not likely to significantly affect any nationally listed threatened fauna species or nationally listed migratory fauna species.

Conclusion: A referral to SEWPAC should not be required.

4.14 Threatened fauna species habitat assessment

Table 4.4 provides an assessment of state and nationally listed threatened fauna species habitat likely to occur within the subject site.

Table 4.4 - Threatened fauna habitat assessment

COMMON NAME *Scientific Name*	PREFERRED HABITAT	COMMENTS	TSC Act	EPBC Act
Wallum Froglet *Crinia tinnula* OEH	Found in acidic paperbark swamps and wallum country with dense groundcover. Breeds in temporary and permanent pools and ponds of high acidity. Distribution Limit: N-Tweed Heads S-Kurnell.	Sub-optimal habitat present. Not recorded during surveys. 9 records within 10km, the only record within 6 km is located 830m away to the north-east in 1997. *Travers bushfire & ecology* again recorded this species in the same location in 2010. Not likely to occur within the subject site.	V	-
Giant Burrowing Frog *Heleioporus australiacus* OEH EPBC	Inhabits open forests and riparian forests along non-perennial streams, digging burrows into sandy creek banks. Distribution Limit: N-Near Singleton S-South of Eden.	No suitable habitat present.	V	V
Stuttering Frog *Mixophyes balbus* OEH EPBC	Terrestrial inhabitant of rainforest and wet sclerophyll forests. Distribution Limit: N-near Tenterfield S-South of Bombala.	No suitable habitat present.	E	V
Giant Barred Frog *Mixophyes iteratus* OEH EPBC	Terrestrial inhabitant of rainforest and open forests. Distribution Limit: N-Border Ranges National Park. S-Narooma.	No suitable habitat present.	E	E
Red-crowned Toadlet *Pseudophryne australis* OEH	Prefers sandstone areas, breeds in grass and debris beside non-perennial creeks or gutters. Individuals can also be found under logs and rocks in non-breeding periods. Distribution Limit: N-Pokolbin. S-near Wollongong.	No suitable habitat present.	V	-
Green and Golden Bell Frog *Litoria aurea* OEH EPBC	Prefers the edges of permanent water, streams, swamps, creeks, lagoons, farm dams and ornamental ponds. Often found under debris. Distribution Limit: N-Byron Bay S-South of Eden.	No suitable habitat present.	E	V

Table 4.4 - Threatened fauna habitat assessment

COMMON NAME *Scientific Name*	PREFERRED HABITAT	COMMENTS	TSC Act	EPBC Act
Green-thighed Frog *Litoria brevipalmata* OEH	Found in rainforests and open forests within or at the edge of streams, swamps, lagoons, dams and ponds. Distribution Limit: N-Border Ranges National Park. S-Near Gosford.	Suitable habitat present. Not recorded during surveys. 10 records within 10km, the only record within 5 km is located 1.8km away to the north-west in 1995. No records since1997. Not likely to occur.	V	-
Littlejohn's Tree Frog *Litoria littlejohnii* OEH EPBC	Found in wet and dry sclerophyll forest associated with sandstone outcrops at altitudes 280-1000m on eastern slopes of Great Dividing Range. Prefers flowing rocky streams. Distribution Limit: N-Hunter River S-Eden.	No suitable habitat present.	V	V
Rosenberg's Goanna *Varanus rosenbergi* OEH	Hawkesbury sandstone outcrop specialist. Inhabits woodlands, dry open forests and heathland sheltering in burrows, hollow logs, rock crevices and outcrops. Distribution Limit: N-Nr Broke. S-Nowra Located in scattered patches near Sydney, Nowra and Goulburn.	No suitable habitat present.	V	-
Pale-headed Snake *Hoplocephalus bitorquatus* OEH	Occurs in a range of habitats from rainforest to open woodland. Usually occurs in hollow trees and beneath loose bark along watercourses. Partly arboreal and may use hollows in trees. Distribution Limit: N-Border Ranges National Park. S-Sydney.	Suitable habitat present. Not recorded during surveys. 1 record within 10km located 6km to the south in 1997. Not likely to occur.	V	-
Broad-headed Snake *Hoplocephalus bungaroides* EPBC	Sandstone outcrops, exfoliated rock slabs and tree hollows in coastal and near coastal areas. Distribution Limit: N-Mudgee Park. S-Nowra.	No suitable habitat present.	E	V
Stephens' Banded Snake *Hoplocephalus stephensii* OEH	A nocturnal and partly arboreal species that inhabits open and closed forest communities sheltering under bark, in hollows and under exfoliating slabs of granite. Distribution Limit: N-Border Ranges National Park. S-Gosford.	Suitable habitat present. Not recorded during surveys. 1 record within 10km located 6km to the south in 2000. Not likely to occur.	V	-

Table 4.4 - Threatened fauna habitat assessment

COMMON NAME *Scientific Name*	PREFERRED HABITAT	COMMENTS	TSC Act	EPBC Act
Wompoo Fruit-dove *Ptilinopus magnificus* OEH	Inhabits large undisturbed patches of lowland and adjacent highland rainforest and moist eucalypt forests where it feeds on fruit. Distribution Limit: N-Tweed Heads. S-Sydney.	Sub-optimal foraging habitat present. Not recorded during surveys. 1 record within 10km located 1km to the south in 1996. Not likely to occur.	V	-
Superb Fruit-dove *Ptilinopus superbus* OEH	Rainforests, adjacent mangroves, eucalypt forests, scrubland with native fruits. Distribution Limit: N-Border Ranges National Park. S-Bateman's Bay.	Sub-optimal foraging habitat present. Not recorded during surveys. 3 records within 10km, the closest located 4.6km to the south-west in 1995. Not likely to occur.	V	-
Black-necked Stork *Ephippiorhynchus asiaticus* OEH	Occurs in tropical to warm temperate terrestrial wetlands, estuarine and littoral habitats such as mangroves, tidal mudflats, floodplains, open woodlands, irrigated lands, bore drains, sub-artesian pools, farm dams and sewerage ponds. Distribution Limit: N-Tweed Heads. S-Nowra.	Limited and sub-optimal foraging habitat present. Not recorded during surveys. 30 records within 10km, the closest located 2km north in 1994. Not likely to occur.	E	-
Australasian Bittern *Botaurus poiciloptilus* OEH	Found in or over water of shallow freshwater or brackish wetlands with tall reedbeds, sedges, rushes, cumbungi, lignum and also in ricefields, drains in tussocky paddocks, occasionally saltmarsh, brackish wetlands. Distribution Limit: N-North of Lismore. S- Eden.	No suitable habitat present.	V	-
Black Bittern *Ixobrychus flavicollis* OEH	Found in shadowy, leafy waterside trees such as callistemons, casuarinas, paperbarks, eucalypts, mangroves and willows along tidal creeks, freshwater & brackish streams & ponds, sheltered mudflats and oyster slats. Distribution Limit: N-Tweed Heads. S-South of Eden.	No suitable habitat present.	V	-

Table 4.4 - Threatened fauna habitat assessment

COMMON NAME *Scientific Name*	PREFERRED HABITAT	COMMENTS	TSC Act	EPBC Act
Little Eagle *Hieraaetus morphnoides* OEH	Utilises plains, foothills, open forests, woodlands and scrublands; river red gums on watercourses and lakes. Distribution Limit - N-Tweed Heads. S-South of Eden.	Suitable foraging, roosting and nesting habitat present. Not recorded during surveys. 6 records within 10km, the closest two located 2km to the south-east in 1989. Low potential to occur.	V	-
Square-tailed Kite *Lophoictinia isura* OEH	Utilises mostly coastal and sub-coastal open forest, woodland or lightly timbered habitats and inland habitats along watercourses and mallee that are rich in passerine birds. Distribution Limit: N-Goondiwindi. S-South of Eden.	Suitable foraging, roosting and nesting habitat present. Not recorded during surveys. 1 record within 10km located 6km to the south-west in 2007. Low potential to occur.	V	-
Osprey *Pandion haliaetus* OEH	Utilises water bodies including coastal waters, inlets, lakes, estuaries and offshore islands with a dead tree for perching and feeding. Distribution Limit: N-Tweed Heads. S-South of Eden.	No suitable habitat present.	V	-
Bush Stone-curlew *Burhinus grallarius* OEH	Utilises open forests and savannah woodlands, sometimes dune scrub, savannah and mangrove fringes. Distribution Limit: N-Border Ranges National Park. S-Near Nowra.	No suitable habitat present.	E	-
Sooty Oystercatcher *Haematopus fuliginosus* OEH	Exclusively coastal in distribution foraging along rocky coastlines and estuaries. Distribution Limit: N-Tweed Heads. S-South of Eden.	No suitable habitat present.	V	-
Pied Oystercatcher *Haematopus longirostris* OEH	Inhabits coastal beaches and estuarine flats. Distribution Limit: N-Tweed Heads. S-South of Eden.	No suitable habitat present.	V	-
Comb-crested Jacana *Irediparra gallinacean* OEH	Floating vegetation of deep and permanent vegetation-choked tropical and warm temperate wetlands and dams. Occasionally feeds along muddy wetland margins. Distribution Limit: N-Tweed Heads. S-Ku-ring-gai Chase National Park.	No suitable habitat present.	V	-

Table 4.4 - Threatened fauna habitat assessment

COMMON NAME *Scientific Name*	PREFERRED HABITAT	COMMENTS	TSC Act	EPBC Act
Australian Painted Snipe *Rostratula australis* EPBC	Most numerous within the Murray-Darling basin and inland Australia within marshes and freshwater wetlands with swampy vegetation. Distribution Limit: N-Tweed Heads. S-South of Eden.	No suitable habitat present.	V	V
Gang-gang Cockatoo *Callocephalon fimbriatum* OEH	Prefers wetter forests and woodlands from sea level to > 2000m on Divide, timbered foothills and valleys, timbered watercourses, coastal scrubs, farmlands and suburban gardens. Distribution Limit: mid north coast of NSW to western Victoria.	Suitable foraging, roosting and possible nesting habitat present. Not recorded during surveys. 9 records within 10km, no records within 6km. The closest record at 6.7km north-west in 2002. Not likely to occur.	V	-
Glossy Black-Cockatoo *Calyptorhynchus lathami* OEH	Open forests with *Allocasuarina* species and hollows for nesting. Distribution Limit: N-Tweed Heads. S-South of Eden.	Sub-optimal foraging, roosting and possible nesting habitat present. Not recorded during surveys. Over 60 records within 10km, most of these beyond 5km. The closest record at 500m to the west in 2004. Potential to occur.	V	-
Little Lorikeet *Glossopsitta pusilla* OEH	Inhabits forests, woodlands; large trees in open country; timbered watercourses, shelterbeds, and street trees. Distribution Limit: N-Tweed Heads. S-South of Eden.	Suitable foraging, roosting and nesting habitat present. Not recorded during surveys. 25 records within 10km, the closest record taken by *Travers bushfire & ecology* at 350m to the south-east in 2006. Potential to occur.	V	-

Table 4.4 - Threatened fauna habitat assessment

COMMON NAME *Scientific Name*	PREFERRED HABITAT	COMMENTS	TSC Act	EPBC Act
Swift Parrot *Lathamus discolour* OEH EPBC	Inhabits eucalypt forests and woodlands with winter flowering eucalypts. Distribution Limit: N-Border Ranges National Park. S-South of Eden.	Suitable foraging and roosting habitat present. Not recorded during surveys. Over 50 records within 10km, only three of these from within 5km. The closest record at 1.2km to the south in 2002. Potential to occur.	E	E
Barking Owl *Ninox connivens* OEH	Inhabits principally woodlands but also open forests and partially cleared land and utilises hollows for nesting. Distribution Limits: N-Border Ranges National Park. S-Eden.	Sub-optimal foraging, roosting and nesting habitat present. Not recorded during surveys. 9 records within 10km, none within 7km. Low potential to occur.	V	-
Powerful Owl *Ninox strenua* OEH	Forests containing mature trees for shelter or breeding & densely vegetated gullies for roosting. Distribution Limits: N-Border Ranges National Park. S-Eden.	Suitable foraging, roosting and possible nesting habitat present. Recorded foraging within the northern part of the subject site in May 2011, 100 metres from a proposed dwelling in proposed Lot 3. 99 records within 10km, the closest record was 850m to the north-east in 2009.	V	-
Masked Owl *Tyto novaehollandiae* OEH	Open forest & woodlands with cleared areas for hunting and hollow trees or dense vegetation for roosting. Distribution Limit: N-Border Ranges National Park. S-Eden.	Suitable foraging and possible roosting and nesting habitat present. Not recorded during surveys. 27 records within 10km, the closest record at 3.4km to the north-west in 1991. Potential to occur.	V	-

Table 4.4 - Threatened fauna habitat assessment

COMMON NAME *Scientific Name*	PREFERRED HABITAT	COMMENTS	TSC Act	EPBC Act
Sooty Owl *Tyto tenebricosa* OEH	Tall, dense, wet forests containing trees with very large hollows. Distribution Limit: N-Border Ranges National Park. S-South of Eden.	Suitable foraging and possible roosting and nesting habitat present. Not recorded during surveys. Over 130 records within 10km, with only 6 of these located within 5km. The closest record at 2.1km south in 1998. Low potential to occur.	V	-
Speckled Warbler *Chthonicola sagittata* OEH	Found in temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts. Distribution Limit: N-Urbanville. S-Eden.	No suitable habitat present.	V	-
Painted Honeyeater *Grantiella picta* OEH	A nomadic bird occurring in low densities within open forest, woodland and scrubland feeding on mistletoe fruits. Inhabits primarily Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. Distribution Limit: N-Boggabilla. S-Albury with greatest occurrences on the inland slopes of the Great Dividing Range.	Sub-optimal habitat present. Not recorded during surveys. 3 records within 10km all beyond 6km in 1982. Not likely to occur and not considered any further.	V	-
Regent Honeyeater *Xanthomyza Phrygia* OEH EPBC	Found in temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts. Distribution Limit: N-Urbanville. S-Eden.	Suitable foraging and roosting habitat present. Not recorded during surveys. 16 records within 10km, the closest records at 2.1km to the north in 1991. No records within 5km since 1991. Not likely to occur.	E	E
Grey-crowned Babbler *Pomatostoomus temporalis temporalis* OEH	Found in dry open forests, woodland scrubland, farmland with isolated trees. Distribution Limit mostly west of Great Divide except Hunter Valley. Distribution Limit: N-Qld widespread. S-Mornington pen. E-se SA.	No suitable habitat present.	V	-

Table 4.4 - Threatened fauna habitat assessment

COMMON NAME *Scientific Name*	PREFERRED HABITAT	COMMENTS	TSC Act	EPBC Act
Varied Sittella *Daphoenositta chrysoptera* OEH	Open eucalypt woodlands/forests (except heavier rainforests); mallee, inland acacia, coastal tea-tree scrubs; golf courses, shelterbelts, orchards, parks, scrubby gardens. N-Border Ranges National Park. S-South of Eden.	Suitable foraging, roosting and nesting habitat present. Recorded present during July 2007 surveys by *Travers Environmental Consultants.*	V	-
Flame Robin *Petroica phoenicea* OEH	Summer: forests, woodlands, scrubs, from sea-level to *c.* 1800 m. Autumn-winter: open woodlands, plains, paddocks, golf courses, parks, orchards. Distribution Limit: N northern NSW tablelands. S-South of Eden.	Suitable summer breeding habitat present. Not recorded during surveys. 1 record within 10km, at 6.5km to the north in 1999. Not likely to occur.	V	-
Spotted-tailed Quoll *Dasyurus maculatus* OEH EPBC	Dry and moist open forests containing rock caves, hollow logs or trees. Distribution Limit: N-Mt Warning National Park. S-South of Eden.	Suitable foraging, denning and breeding habitat present. Not recorded during target trapping surveys. 25 records within 10km, the closest record at 600m to the north-east in 2001. Likely to have utilised the subject site on occasion given records.	V	E
Southern Brown Bandicoot *Isoodon obesulus* OEH	Utilises a range of habitats containing thick ground cover - open forest, woodland, heath, cleared land, urbanised areas and regenerating bushland. Distribution Limit: N-Kempsey. S-South of Eden.	No suitable habitat present.	E	E
Koala *Phascolarctos cinereus* OEH	Inhabits both wet & dry eucalypt forest on high nutrient soils containing preferred feed trees. Distribution Limit: N-Tweed Heads. S-South of Eden.	No suitable habitat present.	V	-

Table 4.4 - Threatened fauna habitat assessment

COMMON NAME *Scientific Name*	PREFERRED HABITAT	COMMENTS	TSC Act	EPBC Act
Eastern Pygmy Possum *Cercatetus nanus* OEH	Found in a variety of habitats from rainforest through open forest to heath. Feeds on insects but also gathers pollen from banksias, eucalypts and bottlebrushes. Nests in banksias and myrtaceous shrubs. Distribution Limit: N-Tweed Heads. S-Eden.	Suitable habitat present. Not recorded during surveys. 2 records within 10km, the closest record at 7.5km to the south in 1998. Low potential to occur.	V	-
Yellow-bellied Glider *Petaurus australis* OEH	Tall mature eucalypt forests with high nectar producing species and hollow bearing trees. Distribution Limit- N-Border Ranges National Park. S-South of Eden.	Suitable foraging, denning and breeding habitat present. Recorded during surveys.	V	-
Squirrel Glider *Petaurus norfolcensis* OEH	Mixed aged stands of eucalypt forest & woodlands including gum barked & high nectar producing species & hollow bearing trees. Distribution Limit: N-Tweed Heads. S-Albury.	Suitable foraging, denning and breeding habitat present. Not recorded during trapping surveys. 45 records within 10km, only 2 records within 4km, the closest record at 1.8km to the north-east in 1995. Not expected to occur following extensive trapping efforts within the subject site and adjacent lands to date.	V	-
Long-nosed Potoroo *Potorous tridactylus* OEH EPBC	Coastal heath and dry and wet sclerophyll forests with a dense understorey. Distribution Limit: N-Mt Warning National Park. S-South of Eden.	Suitable foraging, denning and breeding habitat present. Not recorded during surveys. 45 records within 10km, only 2 records within 4km, the closest record at 1.8km to the north-east in 1995. Not expected to occur following extensive trapping efforts within the subject site and adjacent lands to date.	V	V

Table 4.4 - Threatened fauna habitat assessment

COMMON NAME *Scientific Name*	PREFERRED HABITAT	COMMENTS	TSC Act	EPBC Act
Parma Wallaby *Macropus parma* OEH	Inhabits rainforests and wet and dry sclerophyll forests with a dense understorey and associated grassy patches. Distribution Limit: N-Border Ranges National Park. S-Morton National Park.	Suitable foraging, denning and breeding habitat present. Not recorded during surveys. 1 record within 10km, at 8.5km to the south in 1995. Not likely to occur and not considered any further.	V	-
Brush-tailed Rock-wallaby *Petrogale penicillata* EPBC	Found in rocky gorges with a vegetation of rainforest or open forests to isolated rocky outcrops in semi-arid woodland country. Distribution Limit: N-North of Tenterfield. S-Bombala.	No suitable habitat present.	E	V
Grey-headed Flying-fox *Pteropus poliocephalus* OEH EPBC	Found in a variety of habitats including rainforest, mangroves, paperbark swamp, wet and dry open forest and cultivated areas. Forms camps commonly found in gullies and in vegetation with a dense canopy. Distribution Limit: N-Tweed Heads. S-Eden.	Suitable foraging, roosting and breeding habitat present. Recorded foraging during surveys.	V	V
Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris* OEH	Rainforests, sclerophyll forests and woodlands. Distribution Limit: N-North of Walgett. S-Sydney.	Suitable foraging, roosting and breeding habitat present. Not recorded during surveys. 3 records within 10km, the closest at 7km to the south in 1992. Low potential to occur.	V	-
East-coast Freetail Bat *Micronomus norfolkensis* OEH	Inhabits open forests and woodlands foraging above the canopy and along the edge of forests. Roosts in tree hollows, under bark and buildings. Distribution Limit: N-Woodenbong. S-Pambula.	Suitable foraging, roosting and breeding habitat present. Not recorded during surveys. 18 records within 10km, the closest recorded by *Travers bushfire & ecology* on neighbouring lands 600m to the north-east in 2009 & 10. High potential to occur.	V	-

Table 4.4 - Threatened fauna habitat assessment

COMMON NAME *Scientific Name*	PREFERRED HABITAT	COMMENTS	TSC Act	EPBC Act
Large-eared Pied Bat *Chalinolobus dwyeri* EPBC	Warm-temperate to subtropical dry sclerophyll forest and woodland. Roosts in caves, tunnels and tree hollows in colonies of up to 30 animals. Distribution Limit: N-Border Ranges Nation Park. S-Wollongong.	No suitable habitat present.	V	V
Eastern Falsistrelle *Falsistrellus tasmaniensis* OEH	Recorded roosting in caves, old buildings and tree hollows. Distribution Limit: N-Border Ranges National Park. S-Pambula.	Suitable foraging, roosting and breeding habitat present. Previously identified in 2007 from a single recorded call sequence. A review of this and other recorded calls from 2007 has determined that this species was likely misidentified. 21 records from within 10km, the closest at 300m to the north-east in 2006. Potential to occur.	V	-
Golden-tipped Bat *Kerivoula papuensis* OEH	Rainforest and adjoining moist open forest habitats, roosting in tree hollows and dense vegetation. Distribution Limit: N-Border Ranges Nation Park. S-South of Eden.	Sub-optimal roosting, foraging and breeding habitat present. Not recorded during surveys. 12 records within 10km, the closest at 5.2km west in 2009. Not likely to occur.	V	-
Little Bentwing-bat *Miniopterus australis* OEH	Roosts in caves, old buildings and structures in the higher rainfall forests along the south coast of Australia. Distribution Limit: N-Border Ranges National Park. S-Sydney.	Suitable foraging habitat present. Recorded present during 2007 surveys.	V	-
Eastern Bentwing-bat *Miniopterus orianae oceansis* OEH	Prefers areas where there are caves, old mines, old buildings, stormwater drains & well-timbered areas. Distribution Limit: N-Border Ranges National Park. S-South of Eden.	Suitable foraging habitat present. Recorded present during 2010 surveys along Berkeley Road.	V	-

Table 4.4 - Threatened fauna habitat assessment

COMMON NAME *Scientific Name*	PREFERRED HABITAT	COMMENTS	TSC Act	EPBC Act
Large-footed Myotis *Myotis macropus* OEH	Roosts in caves, mines, tunnels, buildings, tree hollows and under bridges. Forages over open water. Distribution limits: N-Border Ranges National Park. S-South of Eden.	Marginal foraging habitat present. Low potential subsequent roosting and breeding habitat present. Not recorded during surveys. 14 records within 10km, the closest 2km to the north-east in 1998. Not likely to occur.	V	-
Greater Broad-nosed Bat *Scoteanax rueppellii* OEH	Inhabits areas containing moist river & creek systems especially tree lined creeks. Distribution Limit: N-Border Ranges National Park. S-Pambula.	Suitable foraging, roosting and breeding habitat present. Recorded to a 'possible' level of certainty during 2007 surveys.	V	-
Eastern Chestnut Mouse *Pseudomys gracilicaudatus* OEH	Inhabits heathland including dense wet heath and swampy areas, occasionally in woodland with grassy understorey. Distribution Limit: N-Border Ranges National Park. S-Brisbane Water National Park.	No suitable habitat present.	V	-
Giant Dragonfly *Petalura gigantean* OEH	Inhabits large relatively deep permanent swamps and bogs with high water quality and moss or other soft vegetation along the edge for egg laying. It occurs in the far NE NSW, south to Kempsey, & in a patch between Gosford & Nowra.	No suitable habitat present.	E	-
Macquarie Perch *Macquaria australasica* EPBC	Occurs in south east Australia at moderate to high altitudes in rivers and reservoirs. Historical records show the species was widespread and abundant in the upper reaches of the Lachlan, Murrumbidgee and Murray Rivers and their tributaries. Allen (1989) states that introduced populations are present in Nepean River and water supply dams in the Sydney area. Occurs in lakes and flowing streams, usually in deep holes.	No suitable habitat present.	V	E

Table 4.4 - Threatened fauna habitat assessment

COMMON NAME *Scientific Name*	PREFERRED HABITAT	COMMENTS	TSC Act	EPBC Act
Australian Greyling *Prototroctes maraena* EPBC	Clear, moderate to fast flowing water in the upper reaches of rivers (sometimes to altitudes above 1000m). Typically found in gravel bottom pools. Often forming aggregations below barriers to upstream movement (eg weirs, waterfalls).	No suitable habitat present.	Part 2, Section 19 – Protected Fish	V

OEH	-	Denotes species listed within 10km of the subject site on the *Atlas of NSW Wildlife* database
EPBC	-	Denotes species listed within 10km of the subject site in the *EPBC Act* habitat search
TBE	-	Denotes additional species not listed within 10km searches but considered by *Travers bushfire & ecology* to have potential habitat based on regional knowledge and other records
NOTE:	-	'records' refer to those provided by the *Atlas of NSW Wildlife* database. Updated 1:100,000 database mapsheet requests to OEH are undertaken every 3 months as recommended.

A detailed assessment in accordance with Section 5A of the *EPA Act* will be completed for these species in Section 5 of this report.

4.15 Vegetation connectivity and wildlife corridors

The natural vegetation within the subject site is part of an extensive area of forest which is partially fragmented in the immediate locality and has major roads acting as the main barrier to more extensive forest to the west into Ourimbah State Forest and beyond. Connectivity to the north towards Ourimbah Creek and its surrounds has the nearby barrier of Enterprise Drive providing a limitation to some species. To the south and west of the study area open forest continues towards Holgate and Katandra Reserve, with these areas between predominantly being privately owned land.

The subject site is predominantly Open Forest of Spotted Gum, Blue Gum and Blackbutts, with sections of disturbed land in the central and western areas which are highly weed infested. Subject to future dwelling applications, the concept subdivision of the lots is unlikely to significantly impact on the overall connectivity of the local vegetation corridors.

Wyong Shire Council has been in the process of widening Berkeley Road that runs through the subject site, that will in-turn increase open forest separation distances on either side. The proposed E2 zoned lands provide connectivity between the ridgeline to the south of the site and the low swamp forest to the north. The proposed E2 zone also provides one of the few linkages to natural habitat that remains to the east. The proposed E2 zone therefore comprises an important part of the habitat connectivity within the locality with recorded corridor values for a number of species including the threatened Yellow-bellied Glider.

The proposed building envelopes and APZ's are entirely within existing cleared areas. The entire residual open forest habitats within the southern, western and northern portions of the subject site are offered for conservation zoning. The proposed restoration of existing cleared areas within the proposed southern conservation lot will facilitate a north-south corridor at a minimum width of greater than 100m within the site. This will ensure that the existing options

for fauna passage will be retained and enhanced to provide a more direct route for fauna able to negotiate Berkeley Road.

The proposed E2 conservation area, whilst crossing Berkeley Road within the site, will provide a local habitat corridor. This corridor will provide valued function for the following reasons:

- Threatened species – During 2007 surveys the Yellow-bellied Glider was heard calling at intervals initially to the south and then later to the north of Berkeley Road. This species only calls in flight with movements suggesting that this species utilises the site as a corridor between various seasonal foraging opportunities that occurs on both sides of Berkeley Road.

  During surveys within the site and also the surrounding locality this species is often first heard to the south. Surveys for a separate site in 2010 found a Yellow-bellied Glider den tree (also a sap feed tree) located on the ridgetop to the immediate south of the subject site. 2007 surveys indicated that this species is likely making utilisation of winter flowering Eucalyptus robusta to the north which was flowering at the time. Scars on a Blue Gum to the immediate north of Berkeley Road suggest that sap flows may be pursued in these lower elevations also.

  The corridor also provides recorded roosting (and possible nesting) value for the Powerful Owl.

- Connectivity to adjacent remnant – The site acts as the most direct natural route in habitat connectivity between areas to the north-east / north and south / south-east.

- Ecosystem variation – The site acts as the most direct route in community transition between ridge-line open forest community to the immediate south and floodplain forest commencing within the site and extending to the north.

4.16 Potential for better environmental outcomes

As further tree clearance is not proposed canopy connectivity across the site will be maintained. This will ensure that fauna movement is not impeded.

The three EEC's, *Swamp Sclerophyll Forest on Coastal Floodplains, River-flat Eucalypt Forest on Coastal Floodplains* and Lowland Rainforest are to be retained and protected within the proposed E2 zone. The retention and protection of these three EEC's will require the removal of any animals grazing within the EEC's and provide long term protection for the recorded threatened species - *Melaleuca biconvexa*, Yellow-bellied Glider and Powerful Owl.

The proposed transfer of lands into E2 Environmental Conservation, will result in a significant habitat corridor maintaining important linkages between larger remnants of native vegetation.

Council is required to consider the impact upon threatened species, populations and / or EECs from any development or activity via the process of a 7 part test of significance. The significance of the assessment is then used to determine the need for a more detailed species impact statement (SIS).

The following 7 part test of significance relies on the ecological assessment provided in Sections 3 and 4 of this report and should be read as such.

The 7 part test of significance is as follows.

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

Detailed flora and fauna investigations of the subject site, together with habitat assessments, have resulted in the identification of potential habitat for a variety of threatened species. An assessment of these species is as follows:

Threatened flora

- *Callistemon linearifolius*
- *Dendrobium melaleucaphilum*
- *Melaleuca biconvexa**
- *Prostanthera askania*
- *Senna acclinis*
- *Syzygium paniculatum*

Endangered ecological communities

- *Swamp Sclerophyll Forest on Coastal Floodplains**
- *River-Flat Eucalypt Forest on Coastal Floodplains**
- *Lowland Rainforest**

Threatened fauna

- Wallum Froglet
- Green-thighed Frog
- Pale-headed Snake
- Stephens' Banded Snake
- Wompoo Fruit-dove
- Superb Fruit-dove
- Black-necked Stork
- Little Eagle
- Square-tailed Kite
- Regent Honeyeater
- Varied Sittella *
- Flame Robin
- Spotted-tailed Quoll
- Eastern Pygmy Possum
- Yellow-bellied Glider *
- Squirrel Glider
- Long-nosed Potoroo
- Grey-headed Flying-fox *

- Gang-gang Cockatoo
- Glossy Black-Cockatoo
- Little Lorikeet
- Swift Parrot
- Barking Owl
- Powerful Owl *
- Masked Owl
- Sooty Owl
- Yellow-bellied Sheathtail-bat
- East-coast Freetail Bat
- Eastern Falsistrelle
- Golden-tipped Bat
- Little Bentwing-bat *
- Eastern Bentwing-bat *
- Large-footed Myotis
- Greater Broad-nosed Bat *

Endangered populations

- No endangered fauna population to consider

Species indicated with a "*" were recorded within the subject site during surveys. Despite the presence of potential habitat, the remaining listed species were not recorded during the flora and fauna survey. It is considered that the proposal is unlikely to disrupt the life cycle for any of these listed species such that a viable local population would be placed at risk of extinction.

Summary of threatened species recorded

Melaleuca biconvexa

Melaleuca biconvexa is an erect shrub or small tree to 10 metres high. It occurs in dense stands along perennial watercourses which pass through or rise in Terrigal Formation geology and as dense stands or scattered specimens in wetlands on flood plains and along those streams. In Terrigal Formation geology, it also occurs on sheltered hillsides.

Throughout the duration of the flora survey of the subject site it was identified that the Alluvial Open forest and Swamp forest vegetation communities provide habitat for this species. During the survey of the subject site, numerous (1000+) specimens of *Melaleuca biconvexa* were observed within the subject site. One 20x20 (400m^2) quadrat located in this species preferred habitat on site identified approximately 30 mature specimens and >50 juvenile samplings.

A search of the Atlas of NSW Wildlife (OEH 2011) revealed 250-300 recorded populations of *Melaleuca biconvexa* within 10km of the subject site. Many of these populations are significant in size (1000+), for example, those located within bushland areas adjoining Corella Close. Numerous specimens of *Melaleuca biconvexa* were also observed within surrounding vegetation of the subject site.

The specific habitat types *Melaleuca biconvexa* was observed in the subject site were described and mapped by Bell (2002) as Map Unit 17 Alluvial Robusta Paperbark Sedge Palm Forest and Map unit 16 Alluvial Bluegum – Paperbark Mesic Palm Forest. *Melaleuca biconvexa* was identified as a key positive indicator species within high frequency of occurrence within both of these communities (Bell 2002).

These two communities have been mapped as occurring over 272ha and 153 ha respectively within the Wyong local Government Area. *Melaleuca biconvexa* is also known to be found within Map unit 15 Alluvial Redgum Footslopes Forest which occupies a further 145ha. Therefore, within the Wyong LGA there is approximately 570ha of known *Melaleuca biconvexa* habitat similar to that which occurs within the subject site.

The proposed development has been specifically designed to ensure that the building envelopes, including the bushfire asset protection zones, will be located predominately

within the cleared areas and have avoided the removal of any *Melaleuca biconvexa* on the site. Furthermore, the majority of potential habitat for this species will be mostly retained within the conservation zoned lands of the site with particular areas nominated for regeneration.

In 2010-2011, the proponent has installed protective fencing around the cleared areas to ensure limited impacts upon threatened species by the small number of cattle and horse grazing on site.

It is estimated that there are approximately 50 juvenile *Melaleuca biconvexa* within the northern portion of Lot 2. However this area is not subject to any future development and the land area containing the juvenile species can be fenced off with title restrictions in a similar fashion that has occurred within the rural residential subdivision on the southern side of Berkeley Road within DP 1134328.

Despite the presence of numerous *Melaleuca biconvexa* within the subject site, it is considered that the proposal is unlikely to have an adverse effect on the life cycle of this species such that a viable local population of the species is likely to be placed at risk of extinction.

Powerful Owl *(Ninox strenua)*

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

The Powerful Owl inhabits mature rainforest and wet and dry eucalypt forest. Optimal habitat includes a tall shrub layer and abundant hollows supporting high densities of arboreal mammals. Roosting is generally within dense foliage of mid-canopy trees in sheltered gullies. Large trees with hollows at least 45cm in diameter and 100cm deep are required for nesting. Mated pairs of Powerful Owl roost together or separately, maintaining several roost sites throughout their territory, which are used in rotation (Lindsey 1992), shifting with the availability of prey. A pair is generally faithful to a traditional nesting hollow. Powerful Owls form pairs for life, and are strongly territorial. Estimates of the home range of this species vary greatly, but territories are thought to range from 800 to 1500 hectares (Kavanagh 1997).

It is considered that the subject site provides suitable foraging, roosting and potential nesting habitat for the Powerful Owl. This species was observed roosting on the edges of the Swamp Open Forest during 2011 botanical surveys (see Figure 3 for location). At this time one individual was observed clutching a Common Ringtail Possum, a preferred food item. Following this observation fauna survey was undertaken on the same night to determine any nearby calling that would suggest nesting activity within the site. No activity was heard. Given the time of year (mid-May), individuals are usually paired up and roosting close to nesting locations.

Whilst it is considered that the Powerful Owl may be foraging within the subject site, the proposed development envelopes and APZ's are located within existing cleared areas. The development footprints are located approximately 30-50m from the edge of open forest within the site. No large hollows were observed within the fringes of these open forest areas and as such the setback from any nesting location will be higher.

As there will be no removal of foraging, roosting and nesting habitat for the Powerful Owl and nesting habitat will not likely be disturbed during development activity it is considered there will be no likely significant impact on Powerful Owl as a result of the proposal.

Little Bentwing-bat *(Miniopterus australis)*

The Little Bentwing-bat forages below the canopy within open forests and woodlands, feeding on small insects (Dwyer 1995b). This species roosts in caves, tunnels, tree hollows and occasionally old buildings (Dwyer 1995b). Caves are an important resource for this species, particularly for breeding where maternity caves must have suitable temperature, humidity and physical dimensions to permit breeding (Dwyer 1995b). One record exists of this species utilising a tree hollow however hollows are not currently considered as preferred habitat for this species (pers. com. Brad Law).

It is considered that the subject site provides suitable foraging habitat for the Little Bentwing-bat. This species was recorded foraging within the subject site during surveys undertaken in 2001 and 2007 (see Figure 3 for locations).

The proposed concept subdivision and associated development will not impact on any roosting or breeding habitat for this species. Foraging habitat will remain almost unchanged. It is therefore considered that the proposed concept subdivision and associated development envelopes will not significantly impact on the Little Bentwing-bat such that a local population would be placed at risk of extinction.

Eastern Bentwing-bat *(Miniopterus orianae oceanensis)*

The Eastern Bentwing-bat forages above and below the canopy within open forests and woodlands, feeding on small flying insects, predominantly moths (Dwyer 1995). The Eastern Bentwing-bat is known to roost in a range of habitats including stormwater channels, under bridges, occasionally in buildings, old mines and, in particular, caves (Dwyer 1995). Caves are an important resource for this species, particularly for breeding where maternity caves must have suitable temperature, humidity and physical dimensions to permit breeding (Dwyer 1995). Roost sites in tree hollows have not been reported within the literature reviewed.

This species has not been identified as utilising culverts for maternity roosts. Maternity roosts rather are occupied by up to 100 000 females with only 12 maternity roosts known throughout the complete range (Hoy & Hall 2008).

The assessment for this species is the same as for the Little Bentwing-bat given the similar habitat requirements. It is considered that the subject site provides suitable foraging habitat for the Eastern Bentwing-bat. This species was recorded foraging to the nearby north of the subject site during surveys undertaken in 2010 (see Figure 3 for location).

The proposed concept subdivision and associated development will not impact on any roosting or breeding habitat for this species. Foraging habitat will remain almost unchanged. It is therefore considered that the proposed concept subdivision and associated development envelopes will not significantly impact on the Eastern Bentwing-bat such that a local population would be placed at risk of extinction.

Greater Broad-nosed Bat *(Scoteanax rueppellii)*

The Greater Broad-nosed Bat inhabits a variety of habitats including moist gullies in mature coastal forest, rainforest, open woodland, *Melaleuca* swamp woodland, wet and dry

sclerophyll forests, cleared paddocks with remnant trees and tree lined creeks in open areas (Churchill 2008). The Greater Broad-nosed Bat predominantly forages within open forest, woodlands, along vegetated creeklines and small river systems (Hoye and Richards 1995). This species roost in tree hollows, cracks and fissures in trunks and dead branches, under exfoliating bark as well as the roof of old buildings (Chuchill 2008, Hoye & Richards 1995).

It is considered that the subject site provides suitable foraging, roosting and breeding habitat for the Greater Broad-nosed Bat. This species was recorded only to a 'possible' level of certainty, foraging within the subject site during surveys undertaken in 2007 (see Figure 3 for location).

The proposed concept subdivision and associated development will retain almost all naturally vegetated areas within the subject site and as such potential roosting, roosting and breeding habitat will remain almost unchanged for this species. It is therefore considered that the proposed concept subdivision and associated development envelopes will not significantly impact on the Greater Broad-nosed Bat such that a local population would be placed at risk of extinction.

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

Grey-Headed Flying-foxes are canopy feeding frugivores and nectarivores, inhabiting a wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests and cultivated areas. This species roosts in camps, which may contain tens of thousands of individuals.

Camps are commonly formed in gullies, typically not far from water and usually in vegetation with a dense canopy (Tidemann 1998). Camps can be found in riparian rainforest patches, Melaleuca stands, mangroves, riparian woodland or modified vegetation in urban areas. Loyalty to a site is high and some camps in NSW have been used for over a century (NSW NPWS 2001). Some camps are used at the same time every year by hundreds of thousands of flying-foxes while others are used sporadically by a few hundred individuals (Strahan 1995). Generally foraging is within 20km of camps but individuals are known to commute up to 50km to a productive food source.

It is considered that the subject site provides suitable foraging, roosting and subsequent breeding habitat for the Grey-headed Flying-fox. This species was recorded foraging within the subject site during surveys undertaken in 2007 and 2010 (see Figure 3 for locations).

The proposed concept subdivision and associated development will have minimal impact on available foraging habitat for this species. Whilst roosting by this species has not been recorded within the site, Little Red Flying-foxes have been recorded roosting at two separate locations. The two species are known to roost together however as the Grey-headed Flying-fox is more loyal to long-term roosting locations, where the two occur is typically where Little Red Flying-foxes have temporarily joined Grey-headed Flying-fox roost camps. Available roosting habitat will be retained within proposed conservation areas.

It is therefore considered that the proposed concept subdivision and associated development envelopes will not significantly impact on the Grey-headed Flying-fox such that a local population would be placed at risk of extinction.

Varied Sittella (*Daphoenositta chrysoptera*)

Varied Sittellas inhabit open eucalypt woodlands/forests (except heavier rainforests), mallee, inland acacia, coastal tea-tree scrubs, golf courses, shelterbelts, orchards, parks, scrubby gardens (Pizzey & Knight 1999).

Varied Sittella's feed mainly by gleaning arthropods from crevices on tree trunks or small branches and twigs in the tree canopy, moving downwards or along branches, searching for insects. They prefer rough or decorticating bark barked trees like stringybarks and ironbarks, standing dead trees, or mature trees with hollows or dead branches. It builds a cup-shaped nest of plant fibres and cobweb in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.

It is considered that the subject site provides suitable foraging, roosting and nesting habitat for the Varied Sittella. This species was recorded foraging within the subject site during surveys undertaken in 2007. The location of this recording was not documented as the species was not listed as threatened at this time. This species was also recorded along the ridge to the immediate south of the subject site during separate site surveys in 2010.

All available quality areas of habitat for the Varied Sittella will be retained within the proposed conservation areas. It is therefore considered that the proposed concept subdivision and associated development envelopes will not significantly impact on the Varied Sittella such that a local population would be placed at risk of extinction.

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

There are no endangered fauna populations within the Wyong LGA.

There are two endangered flora populations within the Wyong LGA, These are:

- *Eucalyptus parramattensis* subsp. *parramattensis* in the Wyong and Lake Macquarie LGAs
- *Eucalyptus oblonga* at Bateau Bay

Despite searches undertaken for both of these species within the subject site, no specimens were located.

Therefore it is considered that the action proposed is not likely to have an adverse effect on the life cycle of these species that constitute the endangered populations such that a viable local population of these species is likely to be placed at risk of extinction.

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

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

Three (3) Endangered Ecological Communities, Swamp Sclerophyll Forest on Coastal Floodplains, River-Flat Eucalypt Forest on Coastal Floodplains and Lowland Rainforest were observed within the subject site.

The *Swamp Sclerophyll Forest on Coastal Floodplains* occurs within the northern portion of the subject site associated with the Swamp Mahogany Open Forest vegetation community. This community occupies approximately 1.54ha of the site. Within the locality this vegetation community corresponds with Bells (2002), Map Unit 17 - Alluvial Robusta Paperbark Sedge Palm Forest, which has been mapped as occupying approximately 272ha. The proposed development will not impact upon any of this community's extent within the subject site.

The *River-Flat Eucalypt Forest on Coastal Floodplains* is restricted to the alluvial flats and minor creek lines within the subject site associated with the Alluvial Blue Gum Open Forest vegetation community. This shares a broad transition zone to the north of the site with the Swamp Open Forest – *Eucalyptus robusta* community but has been mapped as occupying approximately 2.21ha.

Within the locality this vegetation community corresponds with Bells (2002), Map Unit 16 - Alluvial Bluegum – Paperbark Mesic Palm Forest, which has been mapped as occupying approximately 153ha. While the proposal is unlikely to require the direct removal of this community, the proposed development will require the modification of approximately 0.04ha for the management of bushfire asset protection zones within the site.

Given the retention of this community's extent within the conservation zoned lands of the site exceeds (99%), and the proposed impact of only a small proportion for improved access onto the southern proposed lot (less than 0.02ha), the proposed development is unlikely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

The *Lowland Rainforest* is restricted to the small remnant of Gully Closed Forest within the upper reaches of the main drainage line located on the subject sites southern boundary. This community is mapped as occupying approximately 0.035ha. The proposed development will not impact upon any of this community's extent within the subject site.

It is therefore considered that the proposed development is unlikely to have an adverse effect on the extent of any ecological community such that its local occurrence is likely to be placed at risk of extinction.

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

The *River-Flat Eucalypt Forest on Coastal Floodplains* and to a lesser extent *Swamp Sclerophyll Forest on Coastal Floodplains* vegetation communities already contain moderate to high degrees of exotic weed incursions within the ground shrub and tree layers.

Within the locality, these communities have been mapped as occupying 153ha and 272ha respectively (Bell 2002). Given the moderate to high levels of modification already present within these communities, occurrence within the subject site and the presence of much greater areas of similar or better condition EECs within the subject site and locality, it is unlikely that the proposed development will substantially and adversely modify the composition of these communities such that their local occurrence is likely to be placed at risk of extinction.

The Lowland Rainforest will be securely conserved and buffered with natural vegetation upstream of any of the proposed development. It is unlikely that the proposed development will adversely modify the composition of this community such that its local occurrence is likely to be placed at risk of extinction.

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

It is considered that the habitat attributes of the subject site provide known or potential habitat for *Callistemon linearifolius, Dendrobium melaleucaphilum, Melaleuca biconvexa, Prostanthera askania, Senna acclinis, Syzygium paniculatum,* River-flat Eucalypt Forest on Coastal Floodplains, Swamp Sclerophyll Forest on Coastal Floodplains, Wallum Froglet,

Green-thighed Frog, Pale-headed Snake, Stephens' Banded Snake, Wompoo Fruit-dove, Superb Fruit-dove, Black-necked Stork, Little Eagle, Square-tailed Kite, Gang-gang Cockatoo, Glossy Black-Cockatoo, Little Lorikeet, Swift Parrot, Barking Owl, Powerful Owl, Masked Owl, Sooty Owl, Regent Honeyeater, Varied Sittella, Flame Robin, Spotted-tailed Quoll, Eastern Pygmy Possum, Yellow-bellied Glider, Squirrel Glider, Long-nosed Potoroo, Grey-headed Flying-fox, Yellow-bellied Sheathtail-bat, East-coast Freetail Bat, Eastern Falsistrelle, Golden-tipped Bat, Little Bentwing-bat, Eastern Bentwing-bat, Large-footed Myotis and Greater Broad-nosed Bat.

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

The subject site has an area of 10.86ha, which is comprised of approximately 7.39ha of natural vegetation and is connected to a large patch of similar native vegetation greater than 500ha. The proposed development footprints and APZ's associated with the concept subdivision are all centred on existing cleared areas. The proposal is only likely to require removal of roadside fringing vegetation at the entry into the southern proposed lot totalling an area of less than 0.02ha (less than 0.2% of the natural vegetation within the subject site). Furthermore the proposal aims to restore approximately 0.3ha within the conservation lot on offer.

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

As the proposed development footprints and APZ's associated with the concept subdivision are all centred on existing cleared areas the proposal will not further fragment or isolate currently connected areas of habitat. In contrast the proposal aims to restore approximately 0.3ha of open forest habitat so that the connectivity to the north and south will be increased to just over 100m in width along the narrowest extent.

Therefore, it is considered that known habitat for a threatened species, population or ecological community within the local area and region is unlikely to become isolated or fragmented as a result of the proposal.

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

The proposed development is likely to impact on less than 0.1ha (less than 1%) of the site's existing natural habitats. This area of habitat is not considered of any unique or otherwise important value to threatened fauna species.

The proposal will not impact on the EECs Swamp Sclerophyll Forest on Coastal Floodplains or Lowland Rainforest. In regards to the EEC River-Flat Eucalypt Forest on Coastal Floodplains, >99% of this community's extent within the site will be retained.

Given the occurrence of at least 500ha of similar vegetation adjoining the subject site and the retention of >99% of the exiting habitats within the site, the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population and ecological communities in the locality is considered to be minimal.

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

The site has not been identified as critical habitat within the provisions of the TSC Act. Therefore this matter does not require any further consideration at this time.

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

Draft recovery plans have been prepared for the following threatened species with potential habitat within the subject site:

- Barking Owl (*Ninox connivens*) (NPWS 2003)
- *Prostanthera askania* (DEC 2004)

Approved recovery plans have been prepared for the following threatened species with potential habitat within the subject site:

- Large Forest Owls ((Powerful Owl (*Ninox strenua*), Sooty Owl (*Tyto tenebricosa*) and Masked Owl (*Tyto novaehollandiae*)) (DEC 2006)
- Yellow-bellied Glider (*Petaurus australis*) (NPWS 2003)

It is considered that the proposed development is generally consistent with the objectives or actions of the above-mentioned draft and approved recovery plans.

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

A key threatening process is defined in the *TSC Act* as a process that threatens, or could threaten, the survival or evolutionary development of species, populations or ecological communities.

The current list of key threatening processes under the *TSC Act*, and whether the proposed activity is recognised as a threatening process, is shown below.

Listed key threatening process (as described in the final determination of the Scientific Committee to list the threatening process)	**Is the development or activity proposed of a class of development or activity that is recognised as a threatening process?**		
	Likely	**Possible**	**Unlikely**
Alteration of habitat following subsidence due to longwall mining			✓
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands		✓	
Anthropogenic Climate Change			✓
Bushrock removal			✓
Clearing of native vegetation			✓
Competition and habitat degradation by feral goats			✓
Competition and grazing by the feral European Rabbit (*Oryctolagus cuniculus*)			✓
Competition from feral honeybees			✓
Death or injury to marine species following capture in shark control programs on ocean beaches			✓
Entanglement in, or ingestion of anthropogenic debris in marine and estuarine environments			✓

Listed key threatening process (as described in the final determination of the Scientific Committee to list the threatening process)	Is the development or activity proposed of a class of development or activity that is recognised as a threatening process?		
	Likely	Possible	Unlikely
Forest Eucalypt dieback associated with over-abundant psyllids and bell miners		✓	
High frequency fire resulting in the disruption of life-cycle processes in plants and animals and loss of vegetation structure and composition			✓
Herbivory and environmental degradation caused by feral deer			✓
Importation of red imported fire ants into NSW			✓
Infection by *Psittacine circoviral* (beak and feather) disease affecting endangered psittacine species and populations			✓
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis			✓
Infection of native plants by *Phytophthora cinnamomi*		✓	
Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae		✓	
Introduction of the large earth bumblebee (*Bombus terrestris*)			✓
Invasion and establishment of exotic vines and scramblers		✓	
Invasion and establishment of Scotch Broom (*Cytisus scoparius*)			✓
Invasion and establishment of the Cane Toad (*Bufo marinus*)			✓
Invasion, establishment and spread of *Lantana camara*		✓	
Invasion of native plant communities by bitou bush & boneseed *Chrysanthemoides monilifera*			✓
Invasion of native plant communities by exotic perennial grasses		✓	
Invasion of native plant communities by African Olive *Olea europaea* subsp. *cuspidata*			✓
Invasion of the Yellow Crazy Ant (*Anoplolepis gracilipes*)			✓
Loss of Hollow-bearing trees			✓
Loss and/or degradation of sites used for hill-topping by butterflies			✓
Predation and hybridisation by feral dogs (*Canis lupus familiaris*)			✓
Predation by the European Red Fox (*Vulpes vulpes*)			✓
Predation by the Feral Cat (*Felis catus*)		✓	
Predation by Plague Minnow or Mosquito Fish (*Gambusia holbrooki*)			✓
Predation by the Ship Rat (*Rattus rattus*) on Lord Howe Island			✓
Predation, habitat degradation, competition & disease transmission from Feral pigs (*Sus scofa*)			✓
Removal of dead wood and dead trees		✓	

Summary of "likely" or "possible" Key Threatening Processes

Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands

In accordance with the Water Management Act, consideration is to be given to the impact of the proposed action on local watercourses and native vegetation riparian buffers. Effluent mitigative measures as proposed by Whitehead and Associates (2007) should be incorporated in the management of the site to protect any adjacent waterway. Revegetation works and fencing around riparian areas will assist in long term management of waterways.

Clearing of native vegetation

The proposed subdivision is not likely to result in the removal of any trees. Future removal of native vegetation may be required in association with future dwelling applications. The removal of native vegetation on the subject site is not likely to significantly affect the biodiversity of the local area due to the extent of better quality natural vegetation within the proposed E2 zoned lands and surrounding landscape.

Infection of native plants by Phytophthora cinnamomi

The proposal may temporarily increase the risk of fungal infection on site as it may be spread via vehicular movement and relocation of soil and vegetation. Consequently standard *Phytophthora cinnamomi* protocol applies to the cleaning of all plant, equipment, hand tools and work boots prior to delivery onsite to ensure that there is no loose soil or vegetation material caught under or on the equipment and within the tread of vehicle tyres. Any equipment found to contain soil or vegetation material is to be cleaned in a quarantined work area or wash station and treated with anti-fungal pesticides.

Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae

The 'Myrtle Rust' may be spread via machinery, animals and humans as well as by environmental factors such as wind. The presence of machinery and construction works is likely to slightly increase the potential for spread of this newly listed key threatening process. Similar protocols as to *Phytophthora cinnamomi* should be applied.

Invasion of native plant communities by exotic perennial grasses

The proposal is of a class of development recognised as a threatening process due to possible incursions of grasses such as *Pennisetum clandestinum* (Kikuyu). However the vegetation within the cleared areas where development will occur is of a degraded nature and the proposed development is not expected to significantly increase the prevalence of exotic perennial grasses.

Invasion, establishment and spread of Lantana camara

The site currently contains this species, however it is expected that weed control work within the E2 lands will reduce the prevalence of all weed invasions within the conserved lands.

Invasion and establishment of exotic vines and scramblers

The proposal is of a class of development recognised as a threatening process due to the presence of exotic vines and scramblers within the site and the potential for these species to invade any sensitive vegetation particularly within conserved lands. However it is expected

that that weed control work within the E2 lands will reduce the prevalence of all weed invasions within the conserved lands.

Predation by feral cat (Felis catus)

The proposed development may alter impacts on adjoining lands by increasing the numbers of domestic cat ownership and as such the action proposed may increase the impact of this threatening process.

Forest Eucalypt dieback associated with over-abundant psyllids and bell miners

The subject site is currently impacted upon by the presence of Bell Miners. Dieback within the site's Bluegum vegetation communities is currently minor. The arrival of Bell Miners may be attributed to previous forest clearing on the fringes of wet forest for local farms and residences. The proposal is however not considered likely to enhance the existing effect of Bell Miners but rather highlight that continued presence may have long-term effect on the existing fragmented remnant and some management may be warranted.

Removal of dead wood and dead trees

Future dwelling applications may require the removal of deadwood and / or dead trees and as such would be of a class of development recognised as a threatening process. Given that potential dwellings and asset protection zones can be located in cleared areas, there is unlikely to be any removal of dead wood and dead trees.

The document forms the basis of assessment required under Section 5A of the *EPA Act*. This assessment determines if future development of the site is likely to have a significant effect on threatened species, populations and / or EECs.

EPA Act and TSC Act

In respect of matters required to be considered under the *EPA Act* and relating to the species / provisions of the *TSC Act*.

- Seven (7) threatened fauna species – Powerful Owl (*Ninox strenua*), Varied Sittella (*Daphoenositta chrysoptera*), Grey-headed Flying-fox (*Pteropus poliocephalus*), Little Bentwing-bat (*Miniopterus australis*), Eastern Bentwing-bat (*Miniopterus orianae oceansis*), Yellow-bellied Glider (*Petaurus australis*) and Greater Broad-nosed Bat (*Scoteanax rueppellii*) – were recorded within or in close proximity to the subject site.

- One (1) threatened flora species, *Melaleuca biconvexa* – was recorded within the subject site

- Three (3) EECs, *Swamp Sclerophyll Forest on Coastal Floodplains, River-flat Eucalypt Forest on Coastal Floodplains* and *Lowland Rainforest* were recorded within the subject site

- No endangered populations have been observed

The 7 part test of significance (Section 5 of this report) has concluded that the proposed concept subdivision and associated development will not have a significant impact on any threatened species, populations or EECs. Therefore, an SIS should not be required for the proposed development.

EPBC Act

In respect of matters required to be considered under the *EPBC Act:*

- One (1) threatened fauna species, Grey-headed Flying-fox (*Pteropus poliocephalus*), was recorded within the subject site

- Three (3) protected migratory fauna species listed under the *EPBC Act* – Cattle Egret (*Ardea ibis*), Black-faced Monarch (*Monarcha melanopsis*) and Rufous Fantail (*Rhipidura rufifrons*) – were recorded within the subject site

- One (1) threatened flora species, *Melaleuca biconvexa* was recorded within the subject site

- No endangered populations or EECs listed under the *EPBC Act* were recorded within or in close proximity the subject site

Assessment of these species within Section 4 of this report concluded that the proposed development was not considered to have a significant impact on matters of NES. As such a referral to SEWPAC should not be required.

FM Act

In respect of matters relative to the *FM Act,* no suitable habitat for threatened aquatic species was observed within the subject site, and there are no matters requiring further consideration under this Act.

Conclusion

It is concluded that the proposed rezoning, future subdivision and associated development to create three (3) rural-residential allotments as well as a residual conservation lot at No. 76 Berkeley Road, Fountaindale is unlikely to result in a significant impact on any threatened species, populations or endangered ecological communities or their habitats.

As such no further assessments are considered to be required under the *EP&A Act 1979, EPBC Act 1999 or FM Act 1994.*

Recommendations

For the protection of *Melaleuca biconvexa*, it is recommended that the north portion of lot 2 and the riparian zone is fenced off with title restrictions in a similar fashion that has occurred within the rural residential subdivision on the southern side of Berkeley Road within DP 1134328.

Regeneration and planting of native vegetation may be required within the protected *Melaleuca biconvexa* areas to maintain control over weed species and to promote regeneration of juvenile seedlings.

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