Travers

bushfire & ecology

flora & fauna assessment

Lot 1672 DP 855001
Capitol Hill,
Mount Vernon, NSW

April 2013
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Flora & Fauna Assessment

Proposed Rural-Residential Subdivision
Capitol Hill, Mount Vernon, NSW

APRIL 2013

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Executive Summary

Travers bushfire & ecology has been engaged by *Rapedo Pty Ltd* to assess the ecological impacts of a proposed rural-residential subdivision within Lot 1672 DP 855001 Capitol Hill, Mount Vernon, NSW. Lot 1672 will hereafter be referred to as the 'subject site'.

Record threatened flora, fauna & EEC's

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*, two (2) threatened fauna species including Large-footed Myotis (*Myotis macropus*) and East-coast Freetail Bat (*Micronomus norfolkensis*), no threatened flora species, and one (1) EEC, River-flat Eucalypt Forest on Coastal Floodplains were recorded within the subject site.

In respect of matters required to be considered under the *Environment Protection and Biodiversity Conservation Act 1999*, no threatened fauna species, no protected migratory bird species, no threatened flora species, and no EEC's were recorded within the subject site. Two protected migratory bird species Great Egret (*Ardea alba*) and Cattle Egret (*Ardea ibis*) were recorded nearby to the south of the subject site and are expected to occur within the site on occasion.

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.

Potential Ecological impacts

The potential ecological impacts include:

- Removal or isolation of hollow-bearing trees utilised by microbats, particularly recorded hollow dependent - threatened species
- Removal of dams utilised by microbats for foraging, particularly recorded threatened species, as well as water birds
- Removal of foraging habitat for birds and mega chiropteran bats from the removal of dead trees and mature flowering tree resources
- Indirect impacts on the drainage line EEC vegetation through changes to hydrological regimes or improved access

Mitigation measures

The proposed subdivision does not currently propose any works that will directly impact on the EEC – River-flat Eucalypt Forest on Coastal Floodplains.

Riparian setbacks have been provided for in the proposed subdivision in accordance with NSW Office of Water Controlled Activity Guidelines 2012. As there are no works being proposed within the riparian corridor, the corridor will not be directly impacted and is expected to be allowed to naturally regenerate. A high voltage electrical easement is present which places a significant limitation on the restoration of the riparian corridor which must be maintained on a regular basis as an infrastructure corridor. Any services, stormwater works or creek crossings required for the subdivision (if any) would be expected to comply with NSW Office of Water Controlled Activity Guidelines 2012 in accordance with General Terms of Approval and any site specific requirements stipulated by the NSW Office of Water.

The EEC vegetation occurs within flood prone areas which is not suitable for development. As such the proposed subdivision does not intend to cause any direct impacts. There is limited to no potential threatened flora habitat within the proposed subdivision area given the existing level of management, clearing and lack of native vegetation.

The large constructed dam within the subject site provides secondary habitat for such species with high foraging use by Large-footed Myotis observed during survey. This large dam will be removed as part of the proposal.

Trees are only sparsely located through the subdivision landscape and many of these may be retained within lots subject to their condition. Where any trees are likely to be removed, these trees may contain hollows or other habitat feature utilised by threatened species. Although the subdivision does not propose the direct removal of any trees, it is expected that some trees will be removed. Given their size, they may contain hollows suitable for hollow dependent threatened fauna.

A tree that is destroyed containing a microbat colony will either kill the colony or flush them out during the daylight period. Microbats flying during the day are at high risk of stress and predation. Furthermore, destroying a threatened microbat breeding colony is considered a significant impact on the local population of that species.

The following mitigation measures are recommended to avoid, minimise and mitigate potential impacts on the sites EEC – River-flat Eucalypt Forest on Coastal Floodplains and any hollow dependent threatened fauna habitat:

- The riparian corridor is to be protected and allowed to regenerate with exception to those areas impacted by the existing high voltage electrical easement;
- Prior to the removal of any trees, an inspection for hollows and hollow dependent threatened fauna is to be undertaken under the supervision of a fauna ecologist and allow for the relocation of the impacted fauna. Should juveniles be contained within the affected tree then clearing is to be delayed until juveniles have vacated;
- Artificial nest boxes are to be installed within the riparian corridor of appropriate locations to replace all affected hollows with every second nest box designed as a microbat box. The hollow inspection, removal and placement of hollows/boxes is to be under the direction of a fauna ecologist; and
- Proposed road works and future DA's should avoid the removal of existing trees.

Conclusion

It is concluded that the proposed subdivision and development of the subject site (Lot 1672 DP 855001) Capitol Hill, Mount Vernon, is unlikely to result in a significant impact on any threatened species, populations or EECs or their habitats.

Implementing the recommended mitigation measures are an integral component of this assessment conclusion that will protect existing EEC vegetation remnants, protect the local water catchment and avoid or mitigate impacts on hollow dependent threatened fauna species. Existing infrastructure onsite limits the restoration of habitat within the riparian corridor which has a significant impact on future restoration within the locality.

As such no further assessments are considered to be required under the *Environmental Planning and Assessment Act 1979*, the *Environment Protection and Biodiversity Conservation Act 1999* or the *Fisheries Management 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)
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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Introduction 1

Travers bushfire & ecology has been engaged by *Rapedo Pty Ltd* to assess the ecological impacts of a proposed rural residential subdivision development within Lot 1672 DP 855001 Capitol Hill, Mount Vernon, NSW. Lot 1672 will hereafter be referred to as the 'subject site'.

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; and
- 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 Threatened species assessment guidelines, the assessment of significance (DECC 2007).

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 impacts on threatened flora and fauna, 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 departments web site http://www.environment.gov.au/epbc/publications.

1.3 Proposed works

It is proposed to subdivide Lot 1672 into a 36 lot rural residential subdivision as part of the Capitol Hill Stage 2 development (see Figure 1). Rocks Creek with churs generally along the south-western site boundary is a category 3 stream with a 30m setback from the top of bank proposed. APZ's according to different construction levels are also shown on Figure 1.

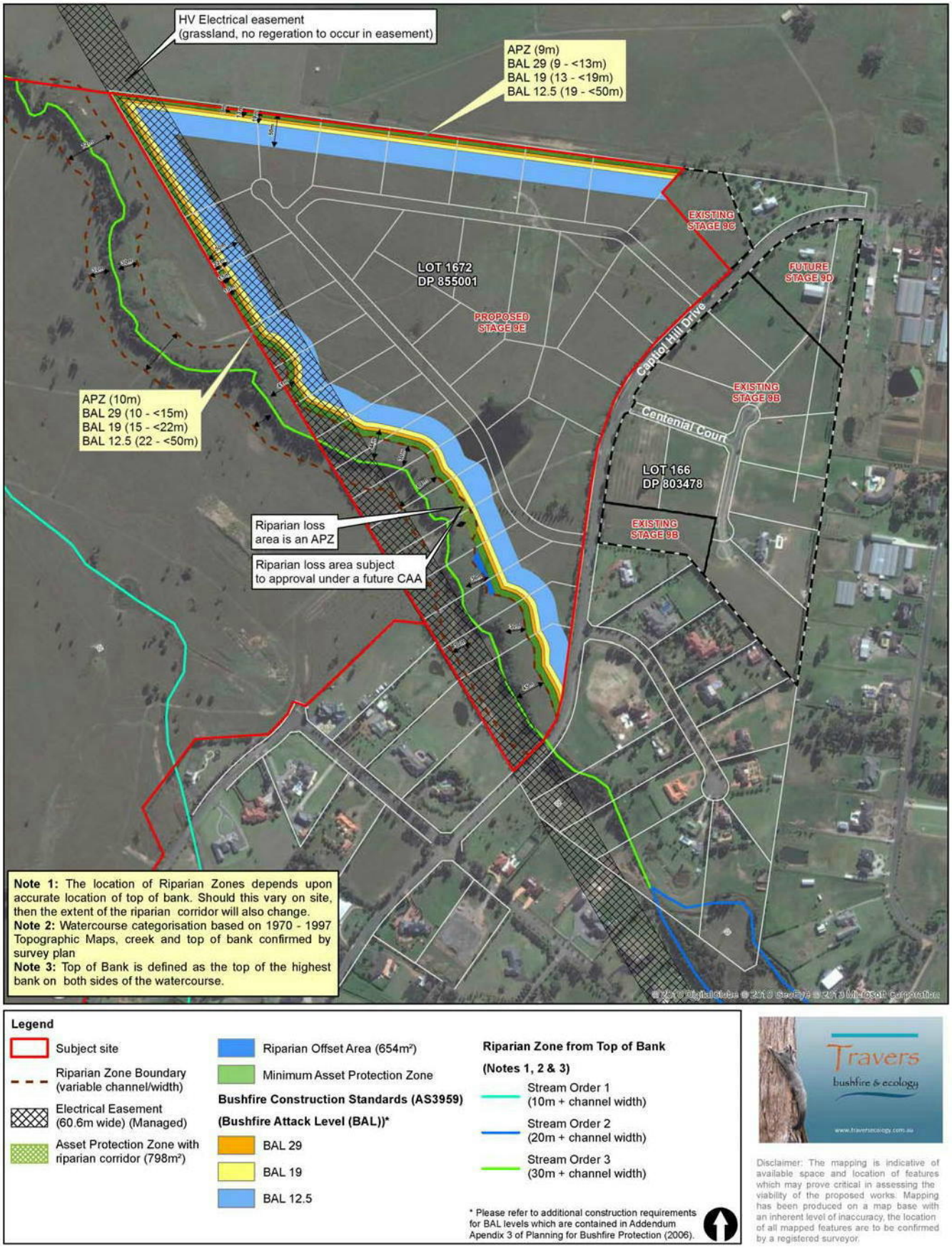

Figure 1 - Proposed lot layout with bushfire protection measures

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	Capitol Hill, Mount Vernon.
Local government area	Penrith
Grid reference	297000E 6252000N
Elevation	70-80m AMSL
Topography	Gently undulating away from creeks and relatively flat around the creek lines.
Geology and soils	Geology; Wianamatta Shales of the Triassic Period, Tertiary Alluvium and Quaternary Sediments. Soils; A combination of Blacktown, Luddenham and South Creek Soil Landscapes.
Catchment & drainage	Ropes Creek
Vegetation	Riparian woodland within the creek lines and a managed grassland landscape.
Existing land use	The subject site appears to have a long history of agricultural pursuits including grazing and vegetable farming. Some cattle grazing at the time of the 2012 survey.
Clearing	The subject site has been cleared for agricultural purposes with the retention of a small number of trees.

Survey Methodology 2

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, technical resources, desktop assessments, specialist identification and licences

A review of the relevant information pertinent to the subject site was undertaken.

Standard Technical Resources utilised:

- *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/ Near Map)
- 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 subject site including Vegetation Mapping of the Cumberland Plain (NPWS 2002)

Desktop Assessment:

To determine the likely and actual occurrence of flora species, fauna species and plant communities on the subject site, desktop assessments were undertaken to including:

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

- ***A data search*** – A search of the *Atlas of NSW Wildlife* (OEH 2013) 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 A2.1, A2.2 and A2.3).

Accuracy of identification:

Specimens of plants not readily observable 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: S10888.

The business of Travers bushfire & ecology is 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

The following surveys have been undertaken within an area incorporating the subject site as well as Lot 4132 DP 857038. Subsequent methodology and results explained are for this study area.

22 February 2011

A flora survey using a systematic stratified sampling regime within each of the identified vegetation communities was undertaken by Cumberland Travers. The flora survey targeted all vegetation communities present within the study area.

8 February 2012

Flora survey was undertaken over approximately a 3hr time frame on which included a random meander in accordance with Cropper (1993) around the existing dams, creek lines and patches of native vegetation to undertake a species list.

Twelve (12) 20x20m or 4Ox10m floristic quadrats were assessed in relatively naturally vegetated portions of the study area and a target search for threatened species was undertaken for particular species where applicable. Two (2) additional transects were undertaken along the creek line vegetation in the north-western corner of the study area. Searches for threatened species were also undertaken during the initial random meander prior to the stratified sampling. All quadrat sampling has been undertaken utilising Bionetrics assessment methodology.

Specific methodology for Lot 1672 includes a random meander and also inspection of dams and specific quadrat of 4Ox10m within the creek line and a target search for threatened flora species.

A review of the Atlas of NSW Wildlife database (OEH 2013) was undertaken prior to the botanical survey to identify threatened species previously recorded within approximately 10km of the subject site and determine whether target searches were needed to be undertaken.

2.4 Fauna survey methodology

Detailed fauna survey was undertaken within an area incorporating the subject site as well as Lot 4182 DP 857038 by Conacher Travers in 1998. Subsequent methodology and results explained are for this study area. Conacher Travers undertook brief additional survey associated with a habitat assessment in 2001. More recent updated survey has been undertaken by Travers bushfire & ecology in 2012.

1998

Information of weather conditions and timing of fauna survey in 1998 has not been sourced. Locations of survey have also not been sourced and are not shown on the current survey effort figure. Subsequently the following text account is provided.

Survey in 1998 included visual observation of birds, Elliott trapping along Ropes Creek including the use of 20 Elliott type A and type B traps for trapping small mammals (September 24th 1998). The traps were baited with a mixture of rolled oats, honey and peanut butter. Trapping consisted of a total of 20 terrestrial trap nights.

Spotlighting for nocturnal fauna was carried out on the night of September 30th 1998 using a hand held lamp of 750,000 candle light power (100W halogen globe), with a motorcycle battery for power. Spotlighting was limited to Ropes Creek due to lack of suitable habitat in other parts of the study area. This activity was carried out for 1 hour. This survey technique was utilised only in the 1998 survey.

Amphibians were surveyed on the night of September 30th by vocal call identification and by using a tape recorder to record male calls in suitable places and comparing these to known reference calls. Dams, creek lines and 'soaks' were surveyed for amphibians for a total of 2.5 hours on September 30th, 1998.

Microchiropteran bats were surveyed by echolocation using an Anabat MK 2 detector on the night of September 30th 1998 in both fixed and mobile positions at various sites across the study area. Recordings were made for a total of 3 hours.

The presence of the threatened owls Sooty Owl *Tyto tenebricosa*, Masked Owl *Tyto novaehollandiae*, Powerful Owl *Ninox strenua*, Barking Owl *Ninox connivens* and the threatened Marbled Frogmouth *Podargus ocellatus* was investigated by broadcasting taped calls through a 15 watt Toa Faunatech amplifier. This was done for 5-minute periods at 5-minute intervals on the night of September 30th with a listening period of 30 minutes after call playback being followed by spotlighting.

Searches for reptiles, amphibians and the threatened Cumberland Plain Land Snail were undertaken in likely localities such as amongst sandstone piles and along the creek lines.

2001

Fauna survey was limited to five diurnal hours on the 27th February 2001. This was indicated due to the lack of natural fauna habitat within the study area. This was not a formal fauna survey but rather an update site inspection for threatened species habitat. Subsequently, no survey effort has been shown on the current survey effort figure. Timing and weather conditions are noted in Table 2.1. Three bird species not previously recorded were noted. Areas of actual habitat were assessed for potential amphibian habitat. This aquatic assessment has not been incorporated into the recent habitat assessment.

2012

Site survey effort accounting for techniques deployed, duration and weather conditions are outlined in Table 2.1 and shown on Figure 2.

Current standard fauna survey techniques employed by Trevena Cuthbertson & Ecology in line with relevant survey guidelines as well as current survey knowledge are provided in Appendix 1. Fauna survey techniques that have been tailored to the site are provided in Section 2.3

2.5 Field survey effort

Tables 2.1 and 2.2 below detail the flora and fauna survey effort undertaken for the study area.

Table 2.1 – Fauna survey effort

Fauna group	Date	Weather conditions	Survey technique(s)	Survey effort / time (24hr)
Diurnal birds	27/2/01 7/2/12 8/2/12	8/8 cloud, 6-11kph wind from E, temp 33°C 8/8 cloud, no wind, showers, temp 20-24°C 1/8 cloud, no wind, no rain, temp 18°C	Diurnal opportunistic Diurnal opportunistic Diurnal bird census points x8 (>15min each) spotting scope outlook station x8 (>5min each) Diurnal opportunistic	5hrs 1200 - 1700 7hrs 5min 1310 - 2015 Minimum of 2hrs Minimum of 40min 40min 1005 - 1045
Nocturnal birds	7/2/12	8/8 cloud, no wind, no rain, 4/4 moon, temp 20-24°C	Spotlighting Call playback (Section 2.6 species)	2hrs 2030 - 2230 Commenced @ 2050
Arboreal mammals	7/2/12	8/8 cloud, no wind, no rain, 4/4 moon, temp 20-24°C	Spotlighting Call playback (Section 2.6 species)	2hrs 2030 - 2230 Commenced @ 2105
Terrestrial mammals	7/2/12	8/8 cloud, no wind, no rain, 4/4 moon, temp 20-24°C	Spotlighting	2hrs 2030 - 2230
Bats	7/2/12	8/8 cloud, no wind, no rain, 4/4 moon, temp 20-24°C	Spotlighting Anabat II & SD-1 (Passive monitoring) x2	2hrs 2030 - 2230 Overnight from 2015
Reptiles	27/2/01 7/2/12 8/2/12	8/8 cloud, 6-11kph wind from E, temp 33°C 8/8 cloud, no wind, showers, temp 20-24°C 1/8 cloud, no wind, no rain, temp 18°C	Opportunistic Habitat search, opportunistic Habitat search, opportunistic	5hrs 1200 - 1700 7hrs 5min 1310 - 2015 40min 1005 - 1045
Amphibians	27/2/01 7/2/12	1/8 cloud, 6-11kph from E, temp 33°C 8/8 cloud, no wind, no rain, 4/4 moon, temp 20-24°C	Habitat search / Call detection Spotlighting & call identification	5hrs 1200 - 1700 2hrs 2030 - 2230
Molluscs	7/2/12	8/8 cloud, no wind, showers, temp 20-24°C	Isolated opportunistic habitat searches	7hrs 5min 1310 - 2015

Table 2.2 – Flora survey effort

Flora survey	Survey technique(s)	Dates
Vegetation communities	Survey of the boundaries of all communities – field verification and aerial photographic interpretation	22/2/01, 6/2/12
	Vegetation condition assessment – Biometric field method	6/2/12
Stratified sampling	20x20 or 40x10 metre quadrats in all existing bushland or remnant areas	22/2/01, 6/2/12
	Transects	6/2/12
Target searches	Target searches in known habitats	22/2/01, 6/2/12

2.6 Site specific survey techniques

Diurnal birds

Eight (8) diurnal bird census points were undertaken within the study area. A minimum of 15 minutes of survey was undertaken at each census point in an area radiating out to between 50-100m. Bird census points were selected to give an even spread and representation across the site and its communities (see Figure 2). Census points were undertaken evenly along Ropes Creek given suitability of habitat. Census points were also commenced in locations where bird activity was apparent, as often different small bird species are found foraging together. Opportunistic diurnal bird survey was conducted between census points and whilst undertaking other diurnal surveys.

Eight (8) spotting scope outlook stations were undertaken to identify wetland birds from different vantage points. The spotting scope to x47 magnification is placed on a tripod for stable long-distance views. The scope is setup at a distance from water-bodies to prevent disturbance of roosting waterbirds. See Figure 2 for spotting scope outlook station locations.

Nocturnal birds

Given the suitability of habitat present Masked Owl (*Tyto novaehollandiae*) Barking Owl (*Ninox connivens*) Black Bittern (*Ixobrychus flavicollis*) Australian Bittern (*Botaurus poiciloptilus*) and Bush Stone-curlew (*Burhinus grallarius*) were targeted by call-playback techniques.

Invertebrates

Given the proximity to previous Atlas of NSW Wildlife Database records of Cumberland Plain Land Snail (*Meridolum corneovirens*) and the recorded presence of its typical host community, an assessment of habitat suitability was undertaken. As habitat was found to be suppressed in the understorey as a result of long term grazing, habitat was found to be limited. Habitat searches were undertaken where logs, stumps, artificial refuse and rocks were found.

Significant habitat trees

Significant habitat trees are defined as trees containing large hollows suitable for use by owls and/or containing a number of good quality hollows typically consisting of more than one medium (10-30cm) sized hollow. A tree may also be considered significant where evidence of use by select fauna is found such as Yellow-bellied Glider sap feed tree, raptor nest, or owl roost.

Data such as the number of hollows present in each size category (or other reason for selection), tree species, diameter at breast height, canopy spread and overall height were collected. A summary of significant habitat tree results is provided in Table 4.3.

2.7 Survey limitations

Given the limited potential for threatened species to occur on site because of the heavily disturbed (and removed understorey), it is unlikely that there are any significant limitations of this study.

Whilst some flora species are difficult to identify unless flowering, the presence of some species on site may have been overlooked. Care has been taken to target any area where native vegetation was present traversing in a zig-zag pattern.

Flora survey limitations

Even though flora survey has been limited to summer only, this should not be considered a deficiency in the survey effort for threatened species as *Rhaphea* spicata and *Grevillea juniperina* subsp. *juniperina* can be identified outside of its flowering time. The subject site was unlikely to host any other potential threatened flora species that are cryptic.

Fauna survey limitations

A complete hollow-bearing tree survey has not been undertaken. This is considered necessary in light of recording two hollow-dependent threatened microbat species during survey. A complete hollow-bearing tree survey will ensure that hollows suitable for use by threatened species as well as total hollow numbers can be accounted for. This is considered important during tree removal to ensure an ecologist is present for removal of hollow-bearing trees to ensure appropriate animal welfare considerations, particularly for any threatened bat colonies recovered. Furthermore, the numbers of hollows removed may ensure that appropriate re-location or replacement of hollows is provided within the non-developable areas such that habitat resources for hollow-dependent species remains consistent through the landscape following development.

The wetland area of Ropes Creek and to the south-west of the subject site is considered of high quality foraging habitat for migratory wading birds and water fowl. It is considered likely that this wetland is utilised by notably additional bird species to those identified at the time of survey due to seasonal and condition changes.

The locations of Anabat recorders during surveys are selected based on most suitable areas of habitat where microbats may have higher foraging activity. Other smaller dams and waterbodies are expected to be utilised also by the recorded threatened bat species to relative proportions.

Survey Results 3

3.1 Flora results

3.1.1 Flora species

The plants observed within the vegetation communities of the study area are listed in the Table 3.1 (native) and 3.2 (exotic) below.

Table 3.1 – Native flora observations for the study area

Common Name	Scientific Name
Trees	
Swamp Oak	*Casuarina glauca*
Beyer's Ironbark	*Eucalyptus beyeriana*
Bangalay	*Eucalyptus botryoides*
Thin-leaved Stringybark	*Eucalyptus eugenioides*
Grey Box	*Eucalyptus moluccana*
Forest Red Gum	*Eucalyptus tereticornis*
Snow in Summer	*Melaleuca linariifolia*
Prickly-leaved Tea Tree	*Melaleuca stypheliodes*
Shrubs	
Coast Myall	*Acacia binervia*
Flax Wattle	*Acacia linifolia*
Sydney Golden Wattle	*Acacia longifolia*
Prickly Moses	*Acacia ulicifolia*
Blackthorn	*Bursaria spinosa*
Bleeding Heart	*Homalanthus populifolius*
Tick Bush	*Kunzea ambigua*
Thyme Spurge	*Phyllanthus hirtellus*
Vines	
-	*Desmodium varians*
Twining Glycine	*Glycine clandestina*
Twining Glycine	*Glycine tabacina*
Herbs	
Water Plantain	*Alisma plantago-aquatica*
Lesser Joyweed	*Alternanthera denticulata*
Wire Grass	*Aristida jerichoensis*
Wire Grass	*Aristida vagans*

Table 3.1 – Native flora observations for the study area	
Common Name	**Scientific Name**
Common Woodruff	*Asperula conferta*
Short Wallaby Grass	*Austrodanthonia carphoides*
Wallaby Grass	*Austrodanthonia racemosa*
Slender Bamboo Grass	*Austrostipa verticillata*
Redleg Grass	*Bothriochloa macra*
Blue Trumpet	*Brunoniella australis*
Boganflea	*Calotis cuneifolia*
Swamp Pennywort	*Centella asiatica*
Windmill Grass	*Chloris truncata*
Tall Chloris	*Chloris ventricosa*
Native Wandering Jew	*Commelina cyanea*
Common Couch	*Cynodon dactylon*
-	*Cyperus mirus*
Star-fruit	*Damasonium minus*
Long-hair Plume Grass	*Dichelachne crinita*
Kidney Weed	*Dichondra repens*
Nodding Chocolate Lily	*Dichopogon fimbriatus*
Tufted Hedgehog Grass	*Echinopogon caespitosus var. caespitosus*
Berry Saltbush	*Einadia hastata*
Climbing Saltbush	*Einadia nutans*
-	*Eleocharis pusilla*
Tall Spike-rush	*Eleocharis sphacelata*
Paddock Lovegrass	*Eragrostis leptostachya*
Early Spring Grass	*Ericophorum pseudocyperinum*
Cudweed	*Euchiton sphaericus*
Common Fringe-rush	*Fimbristylis dichotoma*
Rough Bedstraw	*Galium gaudichaudii*
-	*Geranium solanderi*
-	*Goodenia hederacea*
Little St Johns Wort	*Hypericum gramineum*
Golden Star	*Hypoxis hygrometrica*
-	*Juncus subsecundus*
Common Rush	*Juncus usitatus*
Common Lagenifera	*Lagenifera stipitata*
-	*Lotus australis*
Water Primrose	*Ludwigia peploides*
-	*Marsilea mutica*
Weeping Grass	*Microlaena stipoides*
Swamp Lily	*Ottelia ovalifolia*
-	*Oxalis perennans*
-	*Paspalidium aversum*

Table 3.1 – Native flora observations for the study area	
Common Name	**Scientific Name**
Water Couch	*Paspalum distichum*
Slender Knotweed	*Persicaria decipiens*
-	*Persicaria lapathifolia*
Woolly Frogmouth	*Philyrum lanuginosum*
Common Reed	*Phragmites australis*
-	*Plantago varia*
-	*Pterantherа microphylla*
Purslane	*Portulaca oleracea*
Floating Pondweed	*Potamogeton tricarinatus*
Whiteroot	*Pratia purpurascens*
River Buttercup	*Ranunculus inundatus*
-	*Rumex brownii*
Duckweed	*Spirodela pusilla*
Slender Rat's Tail Grass	*Sporobolus creber*
-	*Stackhousia viminea*
Kangaroo Grass	*Themeda australis*
Water Ribbons	*Triglochin procerum*
Striated Arrow-grass	*Triglochin striatum*
Narrow-leaved Cumbungi	*Typha domingensis*
Broad-leaved Cumbungi	*Typha orientalis*
-	*Vernonia cinerea var. cinerea*
Australian Bluebell	*Wahlenbergia gracilis*
Early Nancy	*Wurmbea dioica*
Ferns	
Ferny Azolla	*Azolla pinnata*
Rock Fern	*Cheilanthes sieberi*

Table 3.2 – Exotic flora observations for the study area	
Common Name	**Common Name**
Exotic Palm	-
Turkey Rhubarb	*Acetosa sagittata*
Green Amaranth	*Amaranthus viridis*
Scarlet Pimpernel	*Anagallis arvensis*
Moth Plant	*Araujia sericifera*
Wild Aster	*Aster subulatus*
Saltbush	*Atriplex prostrata*
Narrowleaf Carpet Grass	*Axonopus affinis*
Cobblers Pegs	*Bidens pilosa*
Indian Mustard	*Brassica juncea*
Shivery Grass	*Briza minor*

Table 3.2 – Exotic flora observations for the study area	
Common Name	**Common Name**
-	*Briza subaristata*
Prairie Grass	*Bromus carthaticus*
Soft Brome	*Bromus molliformis*
Common Starwort	*Callitriche stagnalis*
Shepherd's Purse	*Capsella bursa-pastoris*
Pink Stars	*Centaurium erythraea*
Mouse-ear Chickweed	*Cerastium glomeratum*
Nettle-leaf Goosefoot	*Chenopodium murale*
Chilean Cestrum	*Cestrum parqui*
Rhodes Grass	*Chloris gayana*
Bitou Bush	*Chrysanthemoides monilifera*
Chicory	*Cichorium intybus*
Spear Thistle	*Cirsium vulgare*
Flaxleaf Fleabane	*Conyza bonariensis*
Tall Fleabane	*Conyza sumatrensis*
-	*Coronopus didymus*
Grey-leaved Cotoneaster	*Cotoneaster glaucophyllus*
Water Buttons	*Cotula coronopifolia*
Cypress	*Cupressus sp.*
Slender Celery	*Cyclospermum leptophyllum*
Umbrella Sedge	*Cyperus eragrostis*
-	*Cyperus sesquiflorus*
Summer Grass	*Digitaria sanguinalis*
Barnyard Grass	*Echinochloa crus-galli*
Panic Veldtgrass	*Ehrharta erecta*
Goosegrass	*Eleusine tristachya*
African Lovegrass	*Eragrostis curvula*
Coskspur Coral Tree	*Erythrina crista-galli*
Coral Tree	*Erythrina sykesii*
Fennel	*Foeniculum vulgare*
Wall Fumitory	*Fumaria muralis*
Potato Weed	*Galinsoga parviflora*
Cudweed	*Gamochaeta spicata*
St John's Wort	*Hypericum perforatum*
White Flatweed	*Hypochaeris microcephala*
Flatweed	*Hypochaeris radicata*
-	*Juncus acutus*
Prickly Lettuce	*Lactuca serricla*
Crepe Myrtle	*Lagerstroemia indica*

Table 3.2 – Exotic flora observations for the study area	
Common Name	**Common Name**
Common Peppercress	*Lepidium africanum*
Liquid Amber	*Liquidambar styraciflua*
African Boxthorn	*Lycium ferocissimum*
Tall Mallow	*Malva sylvestris*
Spotted Burr Medic	*Medicago arabica*
Red-flowered Mallow	*Modiola caroliniana*
Brazilian Water Milfoil	*Myriophyllum aquaticum*
Paspalum	*Paspalum dilatatum*
Kikuyu	*Pennisetum clandestinum*
-	*Persicaria capitata*
-	*Pinus sp.*(Cultivar)
Ribwort	*Plantago lanceolata*
Plane Tree	*Platanus sp.*
Wire Weed	*Polygonum arenastrum*
Wire Weed	*Polygonum aviculare*
Castor Oil Plant	*Ricinis communis*
Onion Grass	*Romulea rosea*
Blackberries	*Rubus fruticosus*
Clustered Dock	*Rumex conglomeratus*
Curled Dock	*Rumex crispus*
Fireweed	*Senecio madagascariensis*
Slender Pigeon Grass	*Setaria parviflora*
Paddy's Lucerne	*Sida rhombifolia*
Tobacco Bush	*Solanum mauritianum*
Black Nightshade	*Solanum nigrum*
-	*Solanum physalifolium*
-	*Solanum pseudocapsicum*
Jojo	*Soliva anthemifolia*
Common Sowthistle	*Sonchus oleraceus*
Parramatta Grass	*Sporobolus iraicus var. capensis*
Dandelion	*Taraxacum officinale*
White Clover	*Trifolium repens*
Purple Top	*Verbena bonariensis*
Flaxleaf Fleabane	*Verbena litoralis*
Common Vetch	*Vicia sativa*

3.1.2 Vegetation communities

Specifically within the subject site, five (5) vegetation communities are present. The description of all vegetation communities present are detailed below.

Within the subject site the areas represented by each vegetation type are;

- Alluvial Woodland – 1.47ha (3.6%)
- Alluvial Woodland (Low Condition) – 0.44ha (1.1%)
- Aquatic Sedges and Herbs (Creeks and Dams) – 1.37ha (3.3%)
- Exotic Herbs and Shrubs – 0.32ha (0.8%)
- Grassland with Occasional Trees – 37.68ha (91.3%)

Alluvial Woodland

Occurrence - This vegetation community occurs in the bed of Ropes Creek and on the sides of its banks.

Structure – Woodland to open forest with a canopy cover of approximately 20-60% and height of approximately 10-20 metres. The understorey consists of a very sparse shrub layer to 6 metres high and sparse to moderate groundcover of aquatic and terrestrial herbs and grasses.

Disturbances - This vegetation community has been disturbed by clearing of the floodplain and water borne pollutants and nutrients.

Common Species

Trees: Swamp Oak *Casuarina glauca*.

Shrubs: Blackthorn *Bursaria spinosa* and Prickly-leaved Tea Tree *Melaleuca styphelioides*.

Groundcovers: Common Couch *Cynodon dactylon*, Common Rush *Juncus usitatus,* Common Reed *Phragmites australis*, Duckweed *Spirodela pusilla,* Streaked Arrow-grass *Triglochin striatum,* Kidney Weed *Dichondra repens,* Indian Pennywort *Centella asiatica,* Weeping Grass *Microlaena stipoides* and Cumbungi *Typha domingensis*.

Weeds: *Juncus acutus.*

Photo 1 – Remnant Alluvial Woodland near quadrat 12

Alluvial Woodland (Low Condition)

As per vegetation community 5 however these remnants are classed as low condition based upon either having a) a canopy coverage of less than 5% and an understorey comprising of more than 50% exotics, or b) the remnant is under 0.25ha.

This vegetation community occurs as a few small remnants along the Ropes Creek floodplain.

Photo 2 – A small remnant of low condition vegetation (quadrat 2) just to the west of this current stage of development

Aquatic Sedges and Herbs (Creeks and Dams)

Occurrence - This vegetation community occurs on the fringes of the dams and in damp depressions which occur generally within the floodplain area of Ropes Creek or as scattered man-made individuals.

Structure – Moderate to dense herbfield to a height of approximately 0.5 metres.

Disturbances – This vegetation community is relatively undisturbed, but only occurs in highly disturbed sites.

Common Species

Groundcovers: Tall Spike-rush, *Eleocharis sphacelata*, Common Rush *Juncus usitatus*, Water Primrose *Ludwigia peploides*, *Marsilea mutica,* Water Couch *Paspalum distichum*, *Persicaria lapathifolia*, Wooly Frogmouth *Philydrum lanuginosum*, Water Ribbons *Triglochin procerum* and Cumbungi *Typha orientalis*.

Weeds: *Juncus acutus* and Brazilian Water Milfoil *Myriophyllum aquaticum*.

Photo 3 – An example of one dam within the locality

Exotic Herbs and Shrubs

Occurrence - This vegetation community occurs on the mounds of fill on the site.

Structure – Moderate to sparse groundcover of herbs and grasses with occasional shrubs.

Disturbances - This vegetation community is the result of weed growth over the mounds of fill.

Common Species

Groundcovers: Wallaby Grass *Austrodanthonia racemosa*, Redleg Grass *Bothriochloa macra*, Windmill Grass *Chloris truncata* and Common Couch *Cynodon dactylon*.

Weeds: Turkey Rhubarb *Acetosa sagittaria*, Cobblers Pegs *Bidens pilosa*, Rhodes Grass *Chloris gayana*, Fleabane *Conyza sumatrensis*, African Lovegrass *Eragrostis curvula*, Flatweed *Hypochaeris radicata*, Paspalum *Paspalum dilatatum*, Ribwort *Plantago lanceolata*, *Setaria parviflora*, Paddy's Lucerne *Sida rhombifolia* and *Solanum physalifolium*.

Grassland with Occasional Trees

Occurrence - This vegetation community occurs over the majority of the subject site.

Structure – Moderate to dense groundcover of herbs and grasses with occasional trees and shrubs.

Disturbances - This vegetation community is the result of agricultural activities. There has been some occasional planting of exotic trees or shrubs also.

Common Species

Groundcovers: Common Woodruff *Asperula conferta,* Redleg Grass *Bothriochloa macra*, Common Couch *Cynodon dactylon*, Paddock Lovegrass *Eragrostis leptostachya*, Common Fringe-rush *Fimbristylis dichotoma*, Weeping Grass *Microlaena stipoides*, *Oxalis perennans* and Kangaroo Grass *Themeda australis*.

Weeds: Narrow-leaf Carpet Grass *Axonopus affinis*, *Briza subaristata*, Flatweed *Hypochaeris radicata*, Paspalum *Paspalum dilatatum*, Ribwort *Plantago lanceolata* and *Setaria parviflora*.

3.2 Fauna results

Fauna species observed throughout the duration of fauna surveys are listed in Table 3.3.

Table 3.3 – Fauna observations for the study area

Common name	Scientific name	Method Observed	
Birds		**1998/2001**	**2012**
Australian Magpie	*Gymnorhina tibicen*	✓	O C
Australian Raven	*Corvus coronoides*	✓	O C
Australian White Ibis	*Threskiornis molucca*	✓	O
Australian Wood Duck	*Chenonetta jubata*	✓	O C
Black Swan	*Cygnus atratus*	✓	O
Cattle Egret	*Ardea ibis*		O
Clamorous Reed-Warbler	*Acrocephalus stentoreus*		O C
Common Bronzewing	*Phaps chalcoptera*		O C
Common Myna *	*Acridotheres tristis*	✓	O C
Common Starling *	*Sturnus vulgaris*	✓	
Crested Pigeon	*Ocyphaps lophotes*	✓	O C
Darter	*Anhinga melanogaster*		O C
Dollarbird	*Eurystomus orientalis*		O C
Domestic Goose	*Anser sp.*	✓	
Dusky Moorhen	*Gallinula tenebrosa*		O C

Common name	Scientific name	Method Observed	
Eastern Rosella	*Platycercus eximius*	✓	O C
Eurasian Coot	*Fulica atra*		O
Galah	*Cacatua roseicapilla*	✓	O C
Golden-headed Cisticola	*Cisticola exilis*		C
Great Cormorant	*Phalacrocorax carbo*	✓	O
Great Egret	*Ardea alba*	✓	O
Grey Butcherbird	*Cracticus torquatus*	✓	O C
Grey Fantail	*Rhipidura fuliginosa*	✓	
Hardhead	*Aythya australis*		O
Intermediate Egret	*Ardea intermedia*	✓	
Little Black Cormorant	*Phalacrocorax sulcirostris*	✓	O
Little Pied Cormorant	*Phalacrocorax melanoleucos*		O
Magpie-lark	*Grallina cyanoleuca*	✓	O C
Masked Lapwing	*Vanellus miles*	✓	O C
Nankeen Kestrel	*Falco cenchroides*		O
Noisy Miner	*Manorina melanocephala*	✓	O C
Pacific Black Duck	*Anas superciliosa*	✓	O C
Pied Cormorant	*Phalacrocorax varius*	✓	
Purple Swamphen	*Porphyrio porphyrio*	✓	O C
Red-rumped Parrot	*Psephotus haematonotus*	✓	O C
Richard's Pipit	*Anthus novaeseelandiae*		C
Royal Spoonbill	*Platalea regia*	✓	
Rufous Songlark	*Cincloramphus mathewsi*	✓	
Spotted Pardalote	*Pardalotus punctatus*	✓	
Spotted Turtle-Dove *	*Streptopelia chinensis*	✓	C
Straw-necked Ibis	*Threskiornis spinicollis*	✓	O
Superb Fairy-wren	*Malurus cyaneus*		O C
Tawny Frogmouth	*Podargus strigoides*	✓	
Welcome Swallow	*Hirundo neoxena*	✓	O C
Whistling Kite	*Haliastur sphenerus*	✓	
White-faced Heron	*Egretta novaehollandiae*	✓	O C
Willie Wagtail	*Rhipidura leucophrys*	✓	O C
Yellow-billed Spoonbill	*Platalea flavipes*	✓	O
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	✓	
Yellow Thornbill	*Acanthiza nana*		O C
Mammals			
Brown Hare *	*Lepus lepus*		S O
Domesticated Cattle *	*Bos taurus*	✓	O
Domesticated Dog *	*Canis familiaris*	✓	C
East-coast Freetail Bat [TS]	*Micronomus norfolkensis*		A
Eastern Grey Kangaroo	*Macropus giganteus*		O
European Red Fox *	*Vulpes vulpes*		S
Gould's Wattled Bat	*Chalinolobus gouldii*		A
Horse *	*Equus caballus*	✓	O
Large-footed Myotis [TS]	*Myotis macropus*		A
Little Forest Bat	*Vespadelus vulturnus*		A [PR]
Reptiles			
Delicate Skink	*Lampropholis delicata*	✓	
Eastern Water Dragon	*Physignathus lesueurii*	✓	O
Eastern Water Skink	*Eulamprus quoyii*	✓	H
Grass Skink	*Lampropholis guichenoti*		H
Red-Bellied Black Snake	*Pseudechis porphyriacus*	✓	H

Common name	Scientific name	Method Observed	
Amphibians			
Brown Toadlet	*Pseudophryne bibronii*		C[PR]
Common Eastern Froglet	*Crinia signifera*	✓	C
Dwarf Tree Frog	*Litoria fallax*	✓	C
Peron's Tree Frog	*Litoria peronii*	✓	C
Smooth Toadlet	*Uperoleia laevigata*	✓	C
Striped Marsh Frog	*Limnodynastes peronii*	✓	C
Spotted Marsh Frog	*Limnodynastes tasmaniensis*		C

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

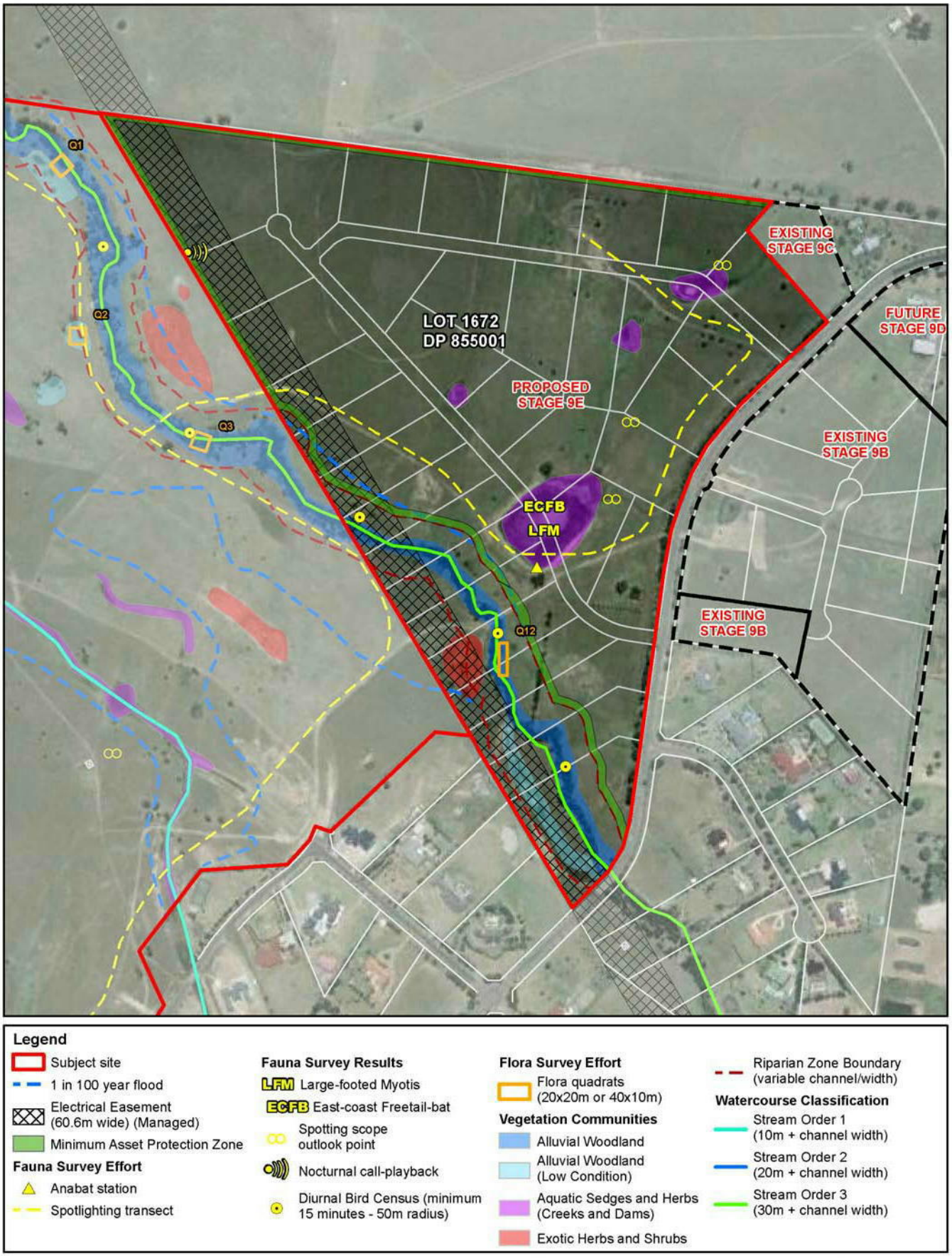

Figure 2 - Flora and fauna survey effort and results

Ecological Assessment 4

4.1 Previous surveys reviewed

The following regional vegetation mapping was examined to identify the potential vegetation communities' onsite.

NPWS (2002) Vegetation Mapping of the Cumberland Plain - shows that vegetated portions of the study area are Map Unit 10, Shale Plains Woodland and Shale Hills Woodland in various conditions. This community conforms to the EEC – Cumberland Plain Woodland under state legislation. Vegetation along Ropes Creek and associated floodplain areas has been partly mapped as Map Unit 11, Alluvial Woodland which conforms to the EEC – River-flat Eucalypt Forest on Coastal Floodplains. No Cumberland Plain Woodland has been previously mapped within the subject site.

Flora and Fauna Assessment at Lot 4132 DP 857093, Bowood Way, Mt Vernon (*Conacher Travers* 2002) - This report accounted for field survey undertaken in 1998 and 2001 in which no threatened species were recorded within the study area and Cumberland Plain Woodland was recorded. The 2001 field assessments also previously considered Lot 166 DP 803478 and Lot 1672 DP 855001. Lot 166 is no longer valid and has been subdivided to the north-east. An eight part test assessment was undertaken for a proposed subdivision. It was concluded that the remnants of Cumberland Plain Woodland were not viable. In relation to the proposed subdivision, the Grey Box Woodland and Red Gum Woodland were to be retained within large proposed allotments and as such no impact was considered likely to occur upon these two remnants.

4.2 Flora

No threatened flora species were observed in the 2001 or 2012 field survey. Vegetation descriptions are listed in section 3 of this report.

All species are listed in Table 3.1 or 3.2.

4.2.1 Local / Regional flora matters

Urban Bushland Bio-diversity Study – Stage 1 Western Sydney (NPWS, 1997)

Almost 500 taxa or 50% of the total number of significant species within western Sydney are considered to be of particular regional significance (NPWS, 1997). Most of these species are rare in western Sydney due to their low abundance records during the targeted bio-diversity survey or are restricted in their distributions (ie representations within three or less LGA). One conclusion forwarded from the results of the UBBS (NPWS, 1997) is that these species should be conserved where practicable.

Almost 72% of the total number of plant species recorded from western Sydney are considered to be either inadequately reserved or are vulnerable. Due to the large number of

vulnerable species it was considered that a priority rating should be afforded to each species of significance.

In accordance with the Urban Bushland Biodiversity Survey of Western Sydney, the following listed species are considered to be regionally significant within the Penrith LGA:

• *Alisma plantago-aquatica*	Water Plantain	V3
• *Austrodanthonia racemosa*	Wallaby Grass	V3
• *Azolla pinnata*	Ferny Azolla	V2
• *Bothriochloa macra*	-	V3
• *Calotis dentex*	Boganflea	V2
• *Chloris truncata*	Windmill Grass	V3
• *Chloris ventricosa*	Tall Chloris	V3
• *Eriochloa pseudoacrotricha*	Early Summer Grass	V3
• *Eucalyptus beyeriana*	Beyer's Ironbark	V2
• *Euchiton sphaericus*	Cudweed	V3
• *Juncus subsecundus*	Finger Rush	V3
• *Oxalis perennans*	-	V3
• *Rumex brownii*	Swamp Dock	V3
• *Sporobolus creber*	Slender Rats Tail Grass	V3
• *Typha domingensis*	Cumbungi	V2

V1, V2 or V3 has been assigned to a large number of species where any v rating means that the taxa occurs in less than 3 reserves in western Sydney.

V1 – vulnerable taxa which are also ROTAP/TSA Act listings, regionally significant or rare.
V2 – vulnerable taxa which are uncommon. These taxa will move into the v1 classification in the near future if not adequately protected in the short term.
V3 – vulnerable taxa which are relatively common to widespread and are unlikely to become regionally extinct in the near future.

Water Plantain *Alisma plantago-aquatica* was found during the survey and is considered to be a category V3 species in western Sydney (NPWS 1997). Records of this species within the study area are restricted to some small clumps within Ropes Creek or within the dams. This species is common and widespread throughout the Sydney Basin Bio-region. This species is unlikely to become regionally extinct in the near future.

Wallaby Grass *Austrodanthonia racemosa* was found during the survey and is considered to be a category V3 species in western Sydney (NPWS 1997). Records of this species within the study area are restricted to occasional specimens on piles of fill. This species is common and widespread throughout the Sydney Basin Bio-region and most of eastern Australia. This species is unlikely to become regionally extinct in the near future.

Ferny Azolla *Azolla pinnata* was found during the survey and is considered to be a category V2 species in western Sydney (NPWS 1997). Records of this species within the study area are restricted to mats on some of the dams. This species is common and widespread on still water, particularly farm dams throughout the Sydney Basin Bio-region and most of eastern Australia. This species is unlikely to become regionally extinct in the near future.

Redleg Grass *Bothriochloa macra* was found during the survey and is considered to be a category V3 species in western Sydney (NPWS 1997). Records of this species within the study area are in grassland throughout the site. This species is common and widespread,

especially in overgrazed pasture throughout the Sydney Basin Bio-region and all eastern states. This species is unlikely to become regionally extinct in the near future.

Eganflea *Calotis scabiosifolia* was found during the survey and is considered to be a category V2 species in western Sydney (NPWS 1997). Records of this species within the study area are in small remnant patches of Cumberland Plain Woodland. This species is common and widespread across the Cumberland Plain and adjacent sandstone areas. The species is considered to be amongst the most common *Calotis* species locally. This species is unlikely to become regionally extinct in the near future.

Windmill Grass *Chloris truncata* was found during the survey and is considered to be a category V3 species in western Sydney (NPWS 1997). Records of this species within the study area are in grassland and piles of fill. This species is relatively common and widespread throughout the Sydney Basin Bio-region and all Australian states except Tasmania and Northern Territory. This species and is unlikely to become regionally extinct in the near future.

Tall Chloris *Chloris ventricosa* was found during the survey and is considered to be a category V3 species in western Sydney (NPWS 1997). Records of this species within the study area are numerous with specimens in most woodland vegetation communities. This species is common and widespread throughout the Sydney Basin Bio-region and all eastern states. This species is unlikely to become regionally extinct in the near future.

Early Spring Grass *Entolasia pseudoadpressiflora* was found during the survey and is considered to be a category V3 species in western Sydney (NPWS 1997). Records of this species within the study area are of numerous specimens in the grassland vegetation community. This species is relatively common to widespread in native grassland throughout the Sydney Basin Bio-region and all Australian states. This species is unlikely to become regionally extinct in the near future.

Beyer's Ironbark *Eucalyptus beyeriana* was found during the survey and is considered to be a category V2 species in western Sydney (NPWS 1997). Records of this species within the study area are of several specimens in the grassland vegetation community in the northern portion. This species is relatively widespread occurring from Narrabri to Nowra in open dry woodland on sandy infertile soils. This species is unlikely to become regionally extinct in the near future.

Cudweed *Euchiton sphaericus* was found during the survey and is considered to be a category V3 species in western Sydney (NPWS 1997). Records of this species within the study area are of numerous specimens in the grassland and woodland vegetation communities. This species is relatively common to widespread across the Cumberland Plain and is known to occur in all states and territories except NT. This species is unlikely to become regionally extinct in the near future.

Finger Rush *Juncus subsecundus* was found during the survey and is considered to be a category V3 species in western Sydney (NPWS 1997). Records of this species within the study area are of numerous specimens within the aquatic sedges and reeds vegetation community. This species is relatively common to widespread in floodplain environments of the Sydney Basin Bio-region including the Cumberland Plain, Castlereagh Woodlands and Sandstone areas. It occurs in all states as well as New Zealand. This species is unlikely to become regionally extinct in the near future.

Oxalis perennans was found during the survey and is considered to be a category V3 species in western Sydney (NPWS 1997). Records of this species within the study area are of numerous specimens occurring in all non-water inundated vegetation communities. This

species is widespread in native grassland and woodland throughout the Sydney Basin Bio-region. Occurs widely scattered in coastal locations, ranges and some inland areas, also in New Zealand. This species is unlikely to become regionally extinct in the near future.

Swamp Dock *Rumex brownii* was found during the survey and is considered to be a category V3 species in western Sydney (NPWS 1997). Records of this species within the study area are of numerous specimens in damp areas, largely within the grassland community. This species is relatively common to widespread in native grassland throughout the Sydney Basin Bio-region and all Australian states. This species is unlikely to become regionally extinct in the near future.

Slender Rat's Tail Grass *Sporobolus creber* was found during the survey and is considered to be a category V3 species in western Sydney (NPWS 1997). Records of this species within the study area are from most grassland areas throughout the site. This species is common and widespread throughout the Sydney Basin Bio-region, all except the arid areas of NSW, Victoria and Queensland. This species is unlikely to become regionally extinct in the near future.

Cumbungi *Typha domingensis* was found during the survey and is considered to be a category V3 species in western Sydney (NPWS 1997). Records of this species within the study area are of numerous specimens within the creek line of Ropes Creek. This species is widespread throughout NSW, especially inland districts. This species is unlikely to become regionally extinct in the near future.

The regional significance of the vegetation within the study area is considered to be relatively low.

4.2.2 State legislative flora matters

(a) Threatened flora species (NSW)

TSC Act – A search of the *Atlas of NSW Wildlife* (OEH 2013) database indicated a list of species that have been recorded within a 10 km radius of the subject site. Those species are considered for suitable habitat and potential to occur in Table A2.1 (Appendix 2).

Based on the habitat assessment within Appendix 2, it is considered that the subject site provides varying levels of potential habitat for the following state listed threatened flora species:

- *Grevillea juniperina* subsp. *juniperina* (low-moderate potential)
- *Pimelea spicata* (low potential)

Note: Full habitat descriptions for these species are provided in Appendix 2

No state listed threatened flora species were observed during survey(s) undertaken.

(b) Endangered flora populations (NSW)

There are two (2) known endangered populations within the Penrith LGA:

- Dillwynia tenuifolia, Kemps Creek
- *Marsdenia viridiflora* subsp. *viridiflora* population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas

They are not represented within the subject site.

(c) Endangered ecological communities (NSW)

One (1) EEC was identified within the subject site, namely;

- River-flat Eucalypt Forest on Coastal Floodplains

The vegetation within the floodplain area of Ropes Creek is largely comprised of Swamp Oak trees, indicative of Alluvial Woodland in accordance with NPWS 2002 and equivalent to the EEC River-flat Eucalypt Forest on Coastal Floodplains.

Within the floodplain areas, there are heavy limitations as to what may be developed, particularly in terms of rural residential development which occurs surrounding the study area. It is thus unlikely that future development would have a significant impact upon EEC.

4.2.3 Matters of national environmental significance - flora

(a) Threatened flora species (National)

A review of the schedules of the *EPBC Act* indicated the potential for a list of threatened flora species to occur within a 10km radius of the site.

These species have been considered for habitat presence and potential to occur within Appendix 2.1.

Based on the habitat assessment within Appendix 2.1, it is considered that the subject site provides varying levels of potential habitat for the following nationally listed threatened flora species:

- *Pimelea spicata* (low potential)

No nationally listed threatened flora species were observed within the subject site.

(b) Endangered ecological communities (National)

River-flat Eucalypt Forest on Coastal Floodplains is not a nationally listed EEC.

4.2.4 Flora and EEC assessment conclusions

Almost all remnant vegetation within the subject site could not be regarded as *low condition* in accordance with the Biometric Assessment methodology as their patch size is above 0.25ha and they do not satisfy other quantitative criteria of either canopy coverage or exotic understorey measurements.

All remnants not regarded as low condition could be retained in situ and protected thus requiring no offsetting. Any loss of moderate-good quality vegetation would require an offset. There is ample space within the floodplain area of Ropes Creek for an internal offset should one be required.

Under a 7 part test of significance, a not significant impact upon the EECs would not require a Species Impact Statement to be prepared for flora. This is the likely scenario.

A referral to *Department of Sustainability, Environment, Water, Populations and Communities* is not required as there will be no direct impacts or impacts causing a potential significant impact upon matters of national significance.

4.3 Fauna

All fauna species recorded during survey(s) are listed in Table 3.3.

4.3.1 Fauna habitat

The fauna habitats present within the site are identified within Table 4.1.

Table 4.1 – Observed fauna habitat

Topography				
Flat ✓	Gentle ✓	Moderate	Steep	Drop-offs
Vegetation structure				
Closed Forest	Open Forest	Woodland ✓	Heath	Grassland ✓
Disturbance History				
Fire	Underscrubbing ✓	Cut & fill works		
Tree clearing ✓	Grazing ✓			
Soil Landscape				
DEPTH:	Deep ✓	Moderate ✓	Shallow	Skeletal
TYPE:	Clay/shales ✓	Loam	Sand	Organic
VALUE:	Foraging	Denning	Roosting	Digging
WATER RETENTION:	Well Drained ✓	Damp / Moist ✓	Water logged ✓	Swamp / Soak ✓
Rock Habitat				
CAVES:	Large	Small	Deep	Shallow
CREVACES:	Large	Small	Deep	Shallow
ESCARPMENTS:	Winter / late sunny aspects		Shaded winter / late aspects	
OUTCROPS:	High Surface Area Hides	Med. Surface Area Hides	Low Surface Area Hides	
SCATTERED/ISOLATED:	High Surface Area Hides	Med. Surface Area Hides	Low Surface Area Hides	
Feed Resources				
FLOWERING TREES:	Eucalypts ✓	Corymbias	Melaleucas ✓	
	Banksias	Acacias ✓		
SEEDING TREES:	Allocasuarinas	Conifers		
WINTER FLOWERING EUCALYPTS:	C. maculata	E. crebra	E. globoidea	E. sideroxylon
	E. squamosa	E. grandis	E. multicaulis	E. scias
	E. robusta	E. tereticornis ✓	E. agglomerata	E. siderophloia
FLOWERING PERIODS:	Autumn ✓	Winter ✓	Spring ✓	Summer ✓

OTHER:	Mistletoe ✓	Figs / Fruit	Sap / Manna	Termites ✓
Foliage Protection				
UPPER STRATA:	Dense	Moderate	Sparse ✓	
MID STRATA:	Dense	Moderate	Sparse	
PLANT / SHRUB LAYER:	Dense	Moderate	Sparse ✓	
GROUNDCOVERS:	Dense	Moderate ✓	Sparse ✓	
Hollows / Logs				
TREE HOLLOWS:	Large	Medium ✓	Small ✓	
GROUND HOLLOWS:	Large	Medium	Small ✓	
Vegetation Debris				
FALLEN TREES:	Large ✓	Medium ✓	Small ✓	
FALLEN BRANCHES:	Large ✓	Medium ✓	Small ✓	
LITTER:	Deep	Moderate	Shallow ✓	
HUMUS:	Deep	Moderate	Shallow ✓	
Drainage Catchment				
WATER BODIES	Soak(s) ✓	Dam(s) ✓	Drainage line(s) ✓	Creek(s) ✓ River(s)
RATE OF FLOW:	Still ✓	Slow ✓	Rapid	
CONSISTENCY:	Permanent ✓	Perennial ✓	Ephemeral	
RUNOFF SOURCE:	Urban / Industrial	Parkland	Grazing ✓	Natural
RIPARIAN HABITAT:	High quality	Moderate quality ✓	Low quality ✓	Poor quality ✓
Artificial Habitat				
STRUCTURES:	Sheds	Infrastructure	Equipment	
SUB-SURFACE	Pipe / Culvert(s) ✓	Tunnel(s)	Shaft(s)	
FORREIGN MATERIALS:	Sheet	Pile / Refuse ✓		

4.3.2 Habitat trees

A complete assessment of the location of habitat trees and the size of hollows within was not conducted as part of surveys undertaken. The available size range and quality of hollows were noted during site visits.

Searches for significant habitat trees were however undertaken during the fauna survey. These are trees containing large hollows suitable for use by owls and/or containing a number of good quality hollows typically consisting of more than one medium (10-30cm) sized hollow. A tree may also be considered significant where evidence of use by select fauna is found such as Yellow-bellied Glider sap feed tree, raptor nest, or owl roost. No significant habitat trees were recorded within the subject site.

Hollows observed overall were found to be very few and generally only small (and rarely medium) in size across the subject site.

4.3.3 Local fauna matters

The Penrith City Council website does not mention any locally significant fauna.

4.3.4 State legislative fauna matters

(a) Threatened species (NSW)

TSC Act – A search of the *Atlas of NSW Wildlife* (OEH, 2013) database provided a list of threatened fauna species previously recorded within a 10km radius of the subject site. These

species are listed in Table A2.2 (Appendix 2) and are considered for potential habitat within the subject site.

Based on the habitat assessment within Appendix 2, it is considered that the subject site provides varying levels of potential habitat for the following state listed threatened fauna species:

COMMON NAME	TSC Act	Nearby and/or high number of record(s)	Record(s) from recent years	Potential to occur
East-coast Freetail Bat	V	-	-	recorded
Large-footed Myotis	V	-	-	recorded
Little Eagle	V	✓	✓	✓
Grey-headed Flying-fox	V	✓	✓	✓
Eastern Bentwing-bat	V	✓	✓	✓
Greater Broad-nosed Bat	V	✓	✓	✓
Square-tailed Kite	V	×	✓	low
Little Bentwing-bat	V	✓	✓	✓
Green and Golden Bell Frog	E	×	×	unlikely
Black-necked Stork	E	×	×	unlikely
Australasian Bittern	E	×	×	unlikely
Spotted Harrier	V	×	×	unlikely
Bush Stone-curlew	E	×	×	unlikely
Gang-gang Cockatoo	V	×	×	unlikely
Little Lorikeet	V	×	×	unlikely
Swift Parrot	E	×	×	unlikely
Masked Owl	V	×	✓	unlikely
Black-chinned Honeyeater	V	×	×	unlikely
Regent Honeyeater	E4A	×	×	unlikely
Varied Sittella	V	×	×	unlikely
Scarlet Robin	V	×	×	unlikely
Flame Robin	V	×	×	unlikely
Diamond Firetail	V	×	×	unlikely
Koala	V	×	×	unlikely
Eastern Falsistrelle	V	×	×	unlikely
Cumberland Plain Land Snail	E	×	×	unlikely

Note: Full habitat descriptions for these species are provided in Appendix 2

Two (2) state listed threatened fauna species – Large-footed Myotis (*Myotis macropus*) and East-coast Freetail Bat (*Micronomus norfolkensis*) – were recorded within the subject site during surveys. These two species are assessed in detail within the 7 part test (Appendix 3).

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.

(b) Endangered populations (NSW)

There are no endangered fauna populations within the Penrith LGA.

(c) 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 not required to be considered under SEPP 44 as the Penrith LGA is not listed on Schedule 1 of this Policy.

4.3.5 National environmental significance - fauna

(a) Threatened species (National)

EPBC Act – A review of the schedules of the *EPBC Act* identified a list of threatened fauna species or species habitat likely to occur within a 10km radius of the subject site. These species have been listed in Table A2.2 (Appendix 2), and those with potential habitat within the subject site are considered in the seven-part test within Appendix 3.

Based on the habitat assessment within Appendix 2, it is considered that the subject site provides varying levels of potential habitat for the following nationally listed threatened fauna species:

COMMON NAME	EPBC Act	Nearby and/or high number of record(s)	Record(s) from recent years	Potential to occur
Grey-headed Flying-fox	V	✓	✓	✓
Green and Golden Bell Frog	V	×	×	unlikely
Australasian Bittern	E	×	×	unlikely
Swift Parrot	E	×	×	unlikely
Regent Honeyeater	E	×	×	unlikely

No nationally listed threatened fauna species were recorded within the subject site during surveys undertaken.

(b) Protected migratory species (National)

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 considered in Table A2.3 (Appendix 2). Threatened migratory species are assessed in Table A2.2 (Appendix 2).

4.3.6 Fauna assessment conclusions

In accordance with Section 5A of the *EPA Act 1979*, the 7 part test of significance (Appendix 3) concluded that the proposed development will not have a significant impact on any state listed threatened fauna species or threatened fauna populations. This is provided that the mitigation measures in regard to tree hollows, outlined with the recommendations of this report are undertaken. Therefore, a Species Impact Statement should not be required for the proposed development in respect to fauna. This conclusion also considers that the remaining area within the riparian and flood affected lands of the subject site and nearby maintains suitable vegetation structure, hollow resources and open water foraging areas for threatened microbat species recorded.

The proposed development was not considered to have a significant impact on threatened or migratory fauna species listed as matters of national environmental significance under the

EPBC Act 1999. As such a referral to Department of Sustainability, Environment, Water, Populations and Communities should not be required in respect to fauna.

4.4 Vegetation connectivity and wildlife corridors

The Alluvial Woodland vegetation along the fringes of Ropes Creek provides the only connective habitat between the subject site and similar habitat extending to the south-east and north-west. In its current form this vegetation acts as a narrow corridor for movement of small to medium sized birds, reptiles, amphibians and small mammals particularly as it is a drainage channel. This corridor is also associated with peripheral parks and wetlands. Subsequently this corridor comprises an important part of the habitat connectivity within the locality.

The corridor in its current state is however represented by trees lining the immediate banks of Ropes Creek and as a result is made up of almost complete dominance by Casuarina glauca (Swamp Oak), resulting in a deficiency of hollows for nectarivorous birds and mammals and hollows. This has had a bearing on the low recorded biodiversity within the study area, as the Ropes Creek and nearby parks and gardens provide the best consolidated habitat available to fauna.

By way of explanation, a corridor is used to ensure wildlife can move between vegetation parcels that contain habitat characteristics suitable for each taxa and foraging opportunities for those taxa. In other words they need protection and food. They also need mating opportunity and for some wildlife movement opportunity is quite small, as they are territorial, whilst others are more opportunistic and migrate over larger areas.

For some wildlife the dispersal (home) range is quite small, whilst others migrate over larger areas. Where wildlife numbers, particularly some populations, and diversity are in large quantities and require movement to and from large areas (ecosystems) then a suitable large corridor linkage should be provided. Likewise if a small quantity of wildlife is known to be present then a smaller corridor may accommodate these species / populations adequately.

The riparian buffers and the 1:100 year flood constrained lands within the subject site are indicated on Figure 2. The resultant area of flood affected land fringing Ropes Creek and the parallel drainage soak to the south allows opportunity to enrich the corridor values through the subject site. Whilst it is anticipated that not all of the flood affected land will be rehabilitated either as an offset or as a riparian corridor, any additional rehabilitation would prove beneficial for the future threatened species habitat. Such rehabilitation should also consider habitat suitability for threatened microbat species recorded as outlined in Section 4.3.4a. An improved outcome for fauna habitat quality and movement through the subject site is likely to result from any consolidated rehabilitation of the central corridor.

4.5 Potential ecological impact

The potential ecological impact from rezoning for subdivision in respect to fauna includes:

- Potential removal or isolation of hollow-bearing trees utilised by microbats particularly recorded threatened species.
- Removal of dams utilised by microbats for foraging, particularly recorded threatened species, as well as water birds.
- Potential removal of foraging habitat for birds and mega chiropteran bats from the removal of dead trees and mature flowering tree resources.
- Potential indirect impacts on the drainage line EEC vegetation through changes to hydrological regimes.

4.6 Mitigation measures

The proposed subdivision does not currently propose any works that will directly impact on the EEC – River-flat Eucalypt Forest on Coastal Floodplains.

Riparian setbacks have been provided for in the proposed subdivision in accordance with NSW Office of Water Controlled Activity Guidelines 2012. As there are no works being proposed within the riparian corridor, the corridor will not be directly impacted and is expected to be allowed to naturally regenerate. A high voltage electrical easement is present which places a significant limitation on the restoration of the riparian corridor which must be maintained on a regular basis as an infrastructure corridor. Any services, stormwater works or creek crossings required for the subdivision (if any) would be expected to comply with NSW Office of Water Controlled Activity Guidelines 2012 in accordance with General Terms of Approval and any site specific requirements stipulated by the NSW Office of Water.

The EEC vegetation occurs within flood prone areas which is not suitable for development. As such the proposed subdivision does not intend to cause any direct impacts. There is limited to no potential threatened flora habitat within the proposed subdivision area given the existing level of management, clearing and lack of native vegetation.

The large constructed dam within the subject site provides secondary habitat for such species with high foraging use by Large-footed Myotis observed during survey. This large dam will be removed as part of the proposal.

Trees are only sparsely located through the subdivision landscape and many of these may be retained within lots subject to their condition. Where any trees are likely to be removed, these trees may contain hollows or other habitat feature utilised by threatened species. Although the subdivision does not propose the direct removal of any trees, it is expected that some trees will be removed. Given their size, they may contain hollows suitable for hollow dependent threatened fauna.

A tree that is destroyed containing a microbat colony will either kill the colony or flush them out during the daylight period. Microbats flying during the day are at high risk of stress and predation. Furthermore, destroying a threatened microbat breeding colony is considered a significant impact on the local population of that species.

The following mitigation measures are recommended to avoid, minimise and mitigate potential impacts on the sites EEC – River-flat Eucalypt Forest on Coastal Floodplains and any hollow dependent threatened fauna habitat:

- The riparian corridor is to be protected and allowed to regenerate with exception to those areas impacted by the existing high voltage electrical easement;
- Prior to the removal of any trees, an inspection for hollows and hollow dependent threatened fauna is to be undertaken under the supervision of a fauna ecologist and allow for the relocation of the impacted fauna. Should juveniles be contained within the affected tree then clearing is to be delayed until juveniles have vacated;
- Artificial nest boxes are to be installed within the riparian corridor of appropriate locations to replace all affected hollows with every second nest box designed as a microbat box. The hollow inspection, removal and placement of hollows/boxes is to be under the direction of a fauna ecologist; and
- Proposed road works and future DA's should avoid the removal of existing trees.

Conclusions & Recommendations 5

5.1 Conclusions

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.*

- Two (2) threatened fauna species including Large-footed Myotis (*Myotis macropus*) and East-coast Freetail Bat (*Micronomus norfolkensis*) were recorded within and in close proximity to the subject site
- No threatened flora species was recorded within the subject site
- One (1) EECs – *River-flat Eucalypt Forest on Coastal Floodplains* was recorded within the subject site
- No endangered populations have been observed

EPBC Act

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

- No threatened fauna species were recorded within or in close proximity to the subject site
- Two (2) protected migratory fauna species listed under the *EPBC Act* – Cattle Egret (*Ardea ibis*) and Great Egret (*Ardea alba*) – were recorded within close proximity to the subject site
- No threatened flora species was recorded within the subject site
- No EEC was recorded within the subject site

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 subdivision and development of the subject site (Lot 1672 DP 855001) Capitol Hill, Mount Vernon, is unlikely to result in a significant impact on any threatened species, populations or EECs or their habitats.

As such no further assessments are considered to be required under the *Environmental Planning and Assessment Act 1979*, the *Environment Protection and Biodiversity Conservation Act 1999* or the *Fisheries Management Act 1994*.

5.2 Recommendations

This report has identified the following ecological issues, threatening processes and potential ecological impacts as a result of the proposed works:

- Potential removal or isolation of hollow-bearing trees utilised by microbats, particularly recorded threatened species
- Removal of dams utilised by microbats for foraging, particularly recorded threatened species, as well as water birds
- Potential removal of foraging habitat for birds and mega chiropteran bats from the removal of dead trees and mature flowering tree resources
- Potential indirect impacts on the drainage line EEC vegetation through changes to hydrological regimes

Recommendations for the management of flora and fauna habitat onsite include:-

Flora

- Retain existing alluvial woodland vegetation along the creek line and allow regeneration to the width of a Class 1 riparian corridor.
- Where possible revegetation using locally occurring native plant species should be re-established within clear areas of the riparian corridor to maintain native vegetation cover.
- Target weed control should be undertaken within all areas of retained vegetation.

Fauna

- Hollows should be identified in trees to be removed. Any hollow that is required to be removed should be replaced with a nest box of similar size entry within any bushland area being conserved. Boxes should be constructed all of weatherproof timber (marine ply), fasteners and external paint.
- The felling of all hollow-bearing trees is to be conducted under the supervision of a fauna ecologist to ensure appropriate animal welfare procedures are taken, particularly for threatened species. Hollows of high quality or with fauna recorded residing within should be sectionally dismantled and all hollows should be inspected for occupation, activity and potential for reuse. Re-used hollows or those with likely occupation are to be relocated to natural areas within close proximity to the site.

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Standard Survey Methodology

A1

The survey methods outlined within this Appendix are standard techniques employed by *Travers bushfire & ecology*. The fauna survey techniques deployed for each specific site are outlined within the survey effort table in the main body of this report. The techniques selected will depend upon the site characteristics extent of available habitat as well as restrictions such as available survey time and weather conditions.

If any additional or target survey techniques for fauna species are undertaken, beyond the standard methods outline within this Appendix, the details of these will be described within the main body of this report.

1 Standard survey techniques

1.1 Diurnal birds

Diurnal birds are typically identified visually and/or by calls during diurnal surveys. Habitat searches to identify nests, feathers, eggs, or signs of foraging may be utilised more specifically for identifying threatened diurnal bird species.

Visual observations are made more accurate with the use of binoculars and where necessary or practical, with the use of a spotting scope. Binoculars are carried by the fauna surveyor at all times during nocturnal and diurnal fauna surveys. A birding field guide is always available in the field when required for verifications.

Calls are identified in the field by the fauna surveyor. If an unknown call is heard it is cross-matched to comprehensive bird call reference libraries taken into the field. A call library of birds occupying the NSW coastal areas is also stored into a mobile phone for a quick reference. This phone is carried into the field at all times and may be used for call-playback methods and recording calls for later analysis.

Diurnal bird census points may be undertaken at large sites where the total area may not be effectively covered during the survey period or as a measure to ensure focused bird only survey.

1.2 Nocturnal birds

Searches for evidence of owl roosts, key perches and potential owl roosting / breeding hollows are made during diurnal site searches. Whitewash, feathers or regurgitated pellets give key information. Pellets are sent for analysis of contents to assist in identification where necessary.

The presence of nocturnal birds during the nocturnal period is first determined by quiet listening after dusk for calls by individuals emerging from diurnal roosts. Following this and provided no calls are heard call-playback techniques are employed for threatened species that have suitable habitat present.

Threatened nocturnal birds known to provide response to call-playback techniques include Masked Owl (*Tyto novaehollandiae*), Powerful Owl (*Ninox strenua*), Barking Owl (*Ninox connivens*), Sooty Owl (*Tyto tenebricosa*), Grass Owl (*Tyto capensis*), Black Bittern (*Ixobrychus flavicollis*), Australian Bittern (*Botaurus poiciloptilus*) and Bush Stone-curlew (*Burhinus grallarius*).

Each call is typically played for 5-minute periods with 5-minute intervals of quiet listening for a response. This is followed with spotlighting and periods of quiet listening throughout the nocturnal survey.

Separation distances between broadcasting stations during a single night of survey are advised for different species within survey guidelines. These include 1km between owl calls and 3km between Bush Stone-curlew calls. Subsequent to this separate broadcasting stations will be deployed on the same night where sites of significant size are surveyed. Separations for bitterns are not advised and these may be broadcast at a number of stations along suitable habitat areas.

Stag-watching will be undertaken where suitable large hollows for owl nesting/roosting show signs of activity or are located within development areas. Stag-watching of nesting trees should be undertaken during the recognised nesting period for owls with potential to occur.

1.3 Arboreal mammals

Arboreal mammals may be surveyed using Elliott type A, B and/or C traps (small and/or large), hair tubes, spotlighting, call-playback techniques, scat searches or searches for other signs of activity.

Baiting and layout for Elliott trapping and hair tubing are typically incorporated into terrestrial trapping and hair tubing effort unless where target survey is undertaken. Standard baiting and layout is therefore described in Section A1.8.2 below within terrestrial survey methods. Where gliders are targeted the standard bait mix may be additionally laced with nectar/honey powder mix used for feeding by native birds. Where Brush-tailed Phascogales are targeted the standard bait mix may be additionally laced with an insectivore powder mix. Where Eastern Pygmy Possum is targeted the bait mix will be more heavily laced with honey.

Elliott traps for arboreal captures are placed onto tree-mounted platforms that are attached to the trunk 2-3 m above the ground at an incline to facilitate drainage during inclement weather. Plastic sleeves are placed around or over traps when there is a possibility of wet weather in the forecast. Arboreal hair tubes are attached to the trunk of trees using rubber bands with the tube entry facing down preventing water entry.

For all arboreal traps and hair tubes a mixture of honey and water is sprayed onto the trunk up to 6 metres above the trap and around the trap as a lure. Where Eastern Pygmy Possum is targeted a high concentrate honey-water mix is also sprayed from the base of trunk up and along connective branches.

Arboreal traps and hair tubes are placed in trees selected to be as target species. These are often flowering or sap flow trees for gliders, rough-barked trees for the Brush-tailed Phascogale and Banksias for the Eastern Pygmy possum.

Where habitat is suitable, the presences of Koala (*Phascolarctos cinereus*), Yellow-bellied Glider (*Petaurus australis*) and Squirrel Glider (*Petaurus norfolcensis*) may be targeted by call-playback techniques. Calls are played for 5-minute periods during nocturnal surveys. This is followed by quiet listening and spotlighting.

1.3.1 Koala survey

Koala survey is undertaken where the site is considered to provide potential habitat under the definitions of SEPP 44 - Koala Habitat Protection or in the presence of feed trees listed in Appendix 1 of the Recovery Plan for the Koala. Habitat may also be defined according to locally prepared Koala Plans of Management.

SEPP 44 is applied to land within Local Government Areas (LGAs) listed under Schedule 1 of the Policy. Part 2 is applied 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.

To determine Potential Koala Habitat (PKH) under the definitions of SEPP 44 an estimate of the percentage density of each tree species within vegetation communities is determined by averaging the percentage of stems counted. 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.

Where Koala habitat is considered to be present the site will be surveyed on foot, with known Koala food trees being inspected for signs of use. Trees are inspected for characteristic scratch and claw marks on the trunk and scats around the base of each tree. Koalas may also be targeted during nocturnal survey involving call-playback techniques and spotlighting.

For large sites Koala search quadrats may be employed within portions of communities where feed trees are present at suitable densities. All Koala feed trees within quadrats are searched for signs of activity including characteristic claw marks on the trunk and faecal pellets around the base. Pellet searches are undertaken according to the tree base search methods described in *Phillips & Callaghan (2008)*. Search quadrats are less labour intensive than the SAT techniques described below but may only be an initial survey effort to determine presence/absence.

Where any Koala activity is recorded the complete Spot Assessment Technique (SAT), described by *Phillips & Callaghan (2008)* may be undertaken as a measure of Koala 'activity'. This technique may also be employed in the first instance as an indicator of presence/absence particularly where a site has potential Koala activity based on previous records.

For any survey technique the location and density of Koala droppings, if found, are documented.

1.4 Terrestrial mammals

Various traps may be used to survey for the presence of terrestrial mammals. These include Elliott trapping, medium and large cage trapping, small and large hair tubing and pitfall traps. Other survey methods for terrestrial mammals include the use of camera surveillance, spotlighting and activity searches.

Arboreal and terrestrial Elliott traps and hair tubes are placed in grids or more commonly along trap-lines of 5-10 traps separated by distances of 20-50m depending on site size and variation of habitat. Trap or hair tube sizes selected at each trap station may alternate or may have an emphasis on certain sizes according to target species.

Selection of terrestrial Elliott trap, cage trap, hair tube or pitfall trap locations have an emphasis on nearby fallen logs, runways, shelters and signs of activity.

Standard bait mix for all Elliott traps, medium cage traps and harp traps is a mixture of rolled oats, honey and peanut butter. Standard bait mix may be supplemented with sardines in large hair tubes or cage traps to simultaneously target Spotted-tailed Quoll. Cage traps may also be baited solely with meat or roadkill to target Spotted-tailed Quoll. Where Potoroos or Bandicoots are targeted, truffle oil may be used to bait the standard bait mix or used on its own.

Where difficult to access sensitive or extended trapping periods are undertaken, surveillance cameras can be used in terrestrial mammal surveys. The surveillance camera is mounted on a tree and directed towards a closed baited cage trap. Surveillance cameras may also be used to detect use or monitor activity at burrows, hollows, nests, etc.

During diurnal site searches, assessment is made of 'found' scats, markings, diggings, runways and scratchings located. Any scats or pellets not readily identifiable (particularly predator scats) may be collected and sent to Barbara Triggs for identification of contents, hair or bone fragments.

1.5 Bats

Micro-chiropteran bats are surveyed by echolocation using Anabat detectors or trapped using harp (Constantine) traps, mist nets or trip lines. Microchiropteran bats are also surveyed by searches of subterranean habitats such as caves, tunnels or shafts where present, or by searching structures such as under bridges and abandoned buildings or walls/ceilings/caves where entry is possible.

Anabat Mk 2 and SD-1 detectors are used in fixed passive monitoring positions and/or during active nocturnal monitoring. Active monitoring is used in conjunction with spotlighting or during stag-watching for greater accuracy of recorded call identification.

Bat call recordings are interpreted through Anabat 6 and Anabat CF Storage and Interface Module ZCAIM devices and analysed using Anabat 6 and Analook 6.3q computer software packages.

Harp traps and mist nets are placed along suitable 'flyways' such as along open narrow roads/water corridors to maximise the likelihood of captures. Traps may be purpose set to capture bats emerging from roosts by being placed at the entry of tunnels/caves or draped over the edge of bridges. Trip lines are placed over water to trip bats flying or hanging into the water. These bats are collected as they swim to the water's edge.

Harp traps are checked during early nocturnal survey as well as each morning. Mist nets and trip lines require constant monitoring. Captured bats are identified using field identification guides. Bats are released at the point of capture after dusk or placed under trunk bark/scats of nearby trees.

Mega-chiropteran bat species, such as Grey-headed Flying-fox, are surveyed by targeting flowering/fruiting trees during spotlighting activities and by listening to distinctive vocalisations. Suitable roosting habitat is searched for presence of small or large established camps during diurnal survey periods.

1.6 Amphibians

Amphibians are surveyed by vocal call identification, call-playback, spotlighting along the edge of water-bodies, pitfall trapping, funnel trapping, by driving along sealed roads near waterways, habitat searches and collection of tadpoles.

Calls are identified in the field by the fauna surveyor. For similar calling species or if an unknown male call is heard it is cross-matched to frog call reference libraries taken into the field. A call library of frogs occupying the NSW coastal areas is also stored into a mobile phone for a quick reference. This ensures is carried into the field at all times and may be used for call-playback methods and recording calls for later analysis.

All threatened frog species may be targeted by use of call-playback techniques where suitable habitat exists, with some species more reliable than others in providing a response. Red-crowned Toadlet may also be targeted by clapping and cupped torch along suitable habitat drainages in order to evoke a call response.

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 snap-lock clear plastic bag for analysis of colour and morphological features.

Amphibian survey yields best results during or following wet periods with seasonal breeding and subsequent male calling varying according each species. Targeted survey is thus undertaken in appropriate seasons.

1.7 Reptiles

Reptiles are surveyed opportunistically during diurnal site visit(s), but also by habitat searches, pitfall trapping, funnel trapping, by driving along roads on humid nights and by camera surveillance at burrows.

Habitat searches for reptiles are undertaken in likely localities such as under logs, rocky slopes or rock surfaces, under sheet debris, under bark exfoliations and leaf litter at the base of trees and along the edge of wetlands. Aspect and land surface thermal properties are considered to determine best search locations particularly along rocky escarpments.

During warmer months spotlighting may assist survey effort particularly during humid conditions.

1.8 Invertebrates

Target survey is undertaken for the Cumberland Plain Land Snail (*Meridolum corneovirens*) within proximity to previous Atlas of NSW Wildlife Database records and particularly where its typical host vegetation community is present. The most appropriate areas of observed habitat are searched. Dense areas of leaf litter with likely moisture retaining properties are scraped using a three pronged rake. Logs, stumps, artificial refuse and rocks are also turned over. In large survey areas searches (quadrats) are undertaken evenly across highest quality habitat areas to estimate population size.

The top (spiral side), side (showing aperture) and underside (showing umbilicus) of snail specimens found are photographed and sent to Michael Shea of the Australian Museum Malacology Unit for confirmation of identification.

2 Habitat Trees

Hollow-bearing tree surveys use a Trimble handheld GPS unit to log both field reference location as well as tree data. Data such as hollow types, hollow size, tree species, diameter at breast height, canopy spread and overall height are documented. A metal tag with the tree number is placed on the trunk for field relocation purposes. Other habitat features such as nests and significant sized limb/stag for foraging are also noted.

3 Survey Effort Table Descriptors:

Target - Where effort is specifically concentrated towards an individual species. Selected target species will be identified within the survey effort table and where necessary described within the report.

Opportunistic - Where birds are identified by observation, call or indirect methods as the opportunity arises.

Habitat search - Where suitable areas of habitat for selected fauna groups such as frogs, reptiles and invertebrates are specifically searched.

Diurnal Bird Census Point(s) - Are bird surveys undertaken within a specified area surrounding a point (or in a quadrat) for a specified amount of time. Size and time will be specified in the survey effort table. These are more typically undertaken across larger sites where the total area cannot be effectively covered during the survey period. Subsequently census points are selected to adequately represent each of the habitat areas present and particularly areas designated for proposed development. Often census points are commenced at locations where bird activity is noted early in the morning.

Spotting-scope Outlook - A Nikon spotting scope with 16-47 zoom at x30 magnification on a mounted tripod is used for distant inspections of diurnal birds. This is undertaken at wetlands for viewing waterfowl and waders but also other difficult to access areas. It may also be used for inspecting activity at nests, hollows and combined with spotlight for a panoramic search in open areas.

Call-playback - This involves broadcasting recorded calls through a 15 watt Toa Equalised amplifier to evoke a response from species known to reply. Species selected for call-playback will be indicated in the survey effort table.

Spotlighting - is carried out using a hand held 55 watt spotlight powered by a 12 volt rechargeable battery. This technique involves walking amongst the wooded areas, forest fringes, along roads, trails and fence lines so that a maximum number of trees can be observed. Spotlighting around water-bodies and particularly along the shallow fringes is used for finding frogs. Spotlighting is used in combination with binoculars or spotting scope for observing nocturnal inspections.

Stag-watching - involves watching hollows in the dusk period, approximately 15 minutes prior to dark until 30 minutes following dark. Placement of the observer on the ground allows for a silhouette of any emerging fauna to be seen against the lighter sky background such that a spotlight is not required, which would likely disrupt emergence behaviour. Where any movement is observed a spotlight may then be used for identification purposes.

Search Quadrats - are undertaken within a specified area surrounding a point (or in a quadrat) for a specified amount of time. These are more typically undertaken across larger sites where the total area cannot be effectively covered during the survey period. Subsequently quadrats are selected to adequately represent each of the suitable habitat areas present and particularly areas designated for proposed development. The use of this technique simply as an initial time-effective suitable indicator of presence/absence of Koalas has been discussed with Koala expert Stephen Phillips.

Koala Spot Assessment Technique (SAT) - Method outlined by Phillips & Callaghan (2008) and accepted by the Australian Koala Foundation to determine Koala activity levels. Activity levels are calculated from the proportion of trees showing signs of Koala use as indicated by the presence of scats as well as site location within the state.

Elliott trapping - using Elliott type A (38x 9x 9 cm) and Type B (45x 8x 5 cm), B and/or Type C traps for trapping small sized mammals. Trapping nights effort will be indicated in the survey effort table. Trapping layout, trap sizes, baiting and trapping period will be outlined within the site specific methodology section.

Medium Cage trapping - using medium sized cage traps (17x17x45 cm fold out cages with tread-plate mechanism or 22x28x63 cm rigid cage with tread-plate mechanism) for trapping up to cat/bandicoot sized mammals. Trapping layout, target species, baiting and trapping period will be outlined within the site specific methodology section.

Large Cage trapping - using large sized cage traps (25x25x50 cm fold out cages with pull lever (meat) mechanism, 28x28x60 cm fold out cages with tread-plate mechanism or 30x30x70cm rigid cage with tread-plate mechanism) for trapping up to quoll sized mammals. Trapping layout, target species, baiting and trapping period will be outlined within the site specific methodology section.

Hair tubing - using small (40mm diameter x 120mm long) and/or large (80mm diameter x 200mm long) PVC pipe sections for collecting mammal hair samples. At one end of each tube is an enclosed chamber where the bait is placed and capped. Small holes in the inside face of the chamber allow the smell of the bait to permeate out through the tube without allowing access to the bait. At the other open entry end double-sided tape is attached around the inner rim so hair samples of animals entering the tube are collected. Hair samples collected are sent to Barbara Triggs for identification. Trapping layout, tube sizes, baiting and trapping period will be outlined within the site specific methodology section.

Pitfall trapping - is used to survey for small terrestrial mammals, frogs, reptiles and invertebrates. Pitfall trapping involves the use of 15cm diameter and 60 cm long PVC stormwater pipe sections placed vertically into pre-dug holes. The pipes are placed and set firm with surrounding soil so that the top rim is level with the ground surface. Drift fences made of camo-and-scrim 270mm wide are held tight and upright by wooden and steel pegs and run along the length of each trap-line. Drift fences are run over the middle of each pit in the trap line ensuring at least 5m of fencing is run along each side of each pit. Ground fauna passing beyond the pitfall transect are diverted towards the pits along the fence line.

Funnel trapping - is used to survey mainly for frogs and reptiles. Funnel traps are 130cm x 18cm x 75cm long and constructed of shade cloth with an internal spring and wire frame in a similar design to yabby traps. At each end an inward facing funnel directs fauna through a 4cm hole and into the trap. Herpetofauna search the walls and corners for an exit and discover it difficult to re-find the internal exit hole. As with pitfall traps, funnel traps are used with drift fences that divert fauna towards the trap entry. At least 5m of fencing is run between each funnel trap which may be placed on either side of the fence. Trapping layout, target species, fence lengths and trapping period will be outlined within the site specific methodology section.

Passive Anabat monitoring - involves leaving the bat recorder in a fixed mounted position to record bat-sequences of passing bats. Recording locations are determined in order to represent different available foraging structures for various micro-chiropteran bat species. Dams, cleared flyways, high insect activity areas, forest edges and ecotones are particularly targeted.

Active Anabat monitoring - is a method of active microbat recording during stag-watching or during complete nocturnal survey. Active monitoring involves an SD1 recorder paired with a PDA for viewing call-sequences in real-time. When calls are heard the transducer microphone is actively directed towards the calling animal with the aid of a spotlight, so longer and clearer call sequences may be recorded. When calls of a potential threatened species are observed on the PDA screen a view by spotlight of the bat size and wing morphology is attempted for greater identification accuracy.

Active vehicle Anabat monitoring - is a method of active microbat recording deployed when large distances need to be covered in a nocturnal survey period. A 5m mic extension cable allows the transducer microphone to be placed on a bracket on the roof of a traveling vehicle so calls may be viewed whilst driving. The vehicle travels at no more than 40km/h to

prevent wind interference. When calls of a potential threatened species are observed on the dash mounted PDA screen active spotlighting is undertaken.

Harp trapping - is used to capture microchiropteran bats. Harp traps have an aluminium frame with a two-bank 4.2m^2 area and calico capture bag set along the base area.

Mist netting - is used to capture microchiropteran bats. The mist net capture area is 2.4m high and 9m wide and supported by two 3.5m poles which are braced with ropes and pegs. Design is a 0.08mm ultrafine nylon monofilament thread arranged in a 14x14mm mesh, with four horizontal capture pockets. These features are specific for the use to capture micro-chiropteran bat species and are provided from the only known supplier in Poland.

Trip lining - is used to capture microchiropteran bats. Fishing line is strung tight on pegs in a zig-zag pattern across open water-bodies just above the water surface to trip drinking bats into the water.

Camera surveillance - is used to monitor activity at burrows, hollows, etc. or to survey for species presence at baited stations. A Reconyx Hyperfire digital weatherproof camera is used with a passive infrared motion detector and a night-time infrared illuminator. The camera is mounted on a tree or tripod and takes three consecutive photo frames on the detection of movement up to 30m away or the detection of a heat/cold source different to the ambient temperature.

Weather conditions - Survey effort for each fauna group accounting for methods undertaken, duration, and weather conditions are provided in the survey effort table. Weather details are documented for all survey techniques and include:

- Air temperature;
- Cloud cover;
- Rain (eg none, light drizzle, heavy drizzle, heavy rain);
- Recent rain events (where relevant);
- Wind Strength eg calm, light (leaves rustle), moderate (moves branches), strong (moves tree crowns);
- Wind direction; and
- Moon (where relevant) (eg none, 1/4 moon, 1/2 moon, 3/4 moon, full moon).

Threatened & Migratory Species Habitat Assessment

A2

Table A2.1 below provides an assessment of potential habitat within the subject site for state and nationally listed threatened flora species recorded within 10km on the Atlas of NSW Wildlife Database (OEH) or indicated to have potential habitat present within 10km on the EPBC Protected Matters Tool.

Table A2.1 – Threatened flora habitat assessment

Scientific Name DATABASE SOURCE	**TSC Act**	**EPBC Act**	**GROWTH FORM AND HABITAT REQUIREMENTS**	**RECORDED ON SITE (✓)**	**IF NOT RECORDED ON-SITE**				**SHOULD BE CONSIDERED IN FUTURE 7 PART TEST (✓)**
					Suitable Habitat Present (✓)	**Nearby and/or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Acacia pubescens OEH EPBC	V	V	Spreading shrub 1-4 m high open sclerophyll growing in open forest and woodlands on clay soils. Distribution limits N-Bilpin S-Georges River.	x	x	-	-	x	x
Allocasuarina glareicola EPBC	E1	E	Small shrub 1-2m high growing in open sclerophyll forest on lateritic soils derived from tertiary alluviums. Distribution limits Castlereagh NR region.	x	x	-	-	x	x
Cynanchum elegans OEH EPBC	E1	E	Climber or twiner to 1 m. Grows in rainforest gullies, scrub & scree slopes. Distribution limits N-Gloucester S-Wollongong.	x	x	-	-	x	x

Scientific Name DATABASE SOURCE	TSC Act	EPBC Act	GROWTH FORM AND HABITAT REQUIREMENTS	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				SHOULD BE CONSIDERED IN FUTURE 7 PART TEST (✓)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Dillwynia tenuifolia OEH	V	-	Erect shrub 0.6-1 m high. Grows in Woodlands and Open Forest on sandstone shale or laterite. Distribution limits N-Howes Valley S-Cumberland Plain.	×	×	-	-	×	×
Eucalyptus scoparia OEH	E1	V	Smooth-barked tree only known from vicinity of Bald Rock.	×	×	-	-	×	×
Grevillea juniperina subsp. *juniperina* OEH	V	-	Erect to spreading shrub 0.5-1.5 metres tall. Grows on laterite and Tertiary alluvium. Distribution limits St Marys-Londonderry-Prospect.	×	marginal	-	-	low	✓
Grevillea parviflora subsp *parviflora* OEH EPBC	V	V	Open to erect shrub to 1 metre. Grows in woodland on light clayey soils Distribution limits N-Cessnock S-Appin.	×	×	-	-	×	×
Hypsela sessiliflora OEH	E1	Extinct	Prostrate herb, rooting at nodes, growing in damp places on the Cumberland Plain.	×	×	-	-	×	×
Micromyrtus minutiflora OEH	E1	V	Spreading shrub to 2 m high. Grows in dry sclerophyll forest dominated by Scribbly gums and Ironbarks on Tertiary Alluviums. Distribution limits Western part of Cumberland Plain.	×	×	-	-	×	×
Persoonia nutans OEH EPBC	E1	E	Erect to spreading shrub. Grows in dry sclerophyll forest and woodland on laterite and alluvial sands. Distribution limits Cumberland Plain.	×	×	-	-	×	×

Scientific Name DATABASE SOURCE	TSC Act	EPBC Act	GROWTH FORM AND HABITAT REQUIREMENTS	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				SHOULD BE CONSIDERED IN FUTURE 7 PART TEST (✓)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Pilularia novae-hollandiae OEH	E1	-	Widespread but not common in seasonally dry depressions and margins of marshes; may grow submerged.	×	×	-	-	×	×
Pimelea curviflora var. *curviflora* OEH EPBC	V	V	Woody herb or sub-shrub to 0.2-1.2m high. Grows on Hawkesbury sandstone near shale outcrops. Distribution Sydney.	×	×	-	-	×	×
Pimelea spicata OEH EPBC	E1	E	Decumbent or erect shrub to 0.5 m high. Occurs principally in woodland on soils derived from Wianamatta Shales. Distribution limits N-Lansdowne S-Shellharbour.	×	✓	✓	✓	Low	✓
Pomaderris brunnea EPBC	V	V	Shrub to 3 metres high. Confined to Upper Nepean and Colo Rivers where it grows in open forest.	×	×	-	-	×	×
Pterostylis gibbosa EPBC	E1	E	Terrestrial orchid which occurs near Wollongong and in Hunter Valley in sclerophyll forest, sometimes with paperbarks.	×	×	-	-	×	×
Pterostylis saxicola OEH EPBC	E1	E	Terrestrial orchid. Grows in shallow sandy soil above rock shelves, usually near Wianamatta / Hawkesbury transition. Distribution limits N-Hawkesbury River S-Campbelltown.	×	×	-	-	×	×
Pultenaea parviflora OEH EPBC	E1	V	Erect shrub. Grows in dry sclerophyll forest at the intergrade between Tertiary Alluviums and Wianamatta Shales. Distribution limits Cumberland Plain.	×	×	-	-	×	×

Scientific Name DATABASE SOURCE	TSC Act	EPBC Act	GROWTH FORM AND HABITAT REQUIREMENTS	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				SHOULD BE CONSIDERED IN FUTURE 7 PART TEST (✓)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Streblus pendulinus EPBC	-	E	Tree or large shrub to 6m tall. Coastal species along watercourses in warmer rainforest area.	x	x	-	-	x	x

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
V	- Denotes vulnerable listed species under the relevant Act
E or E1	- Denotes endangered listed species under the relevant Act
NOTE:	1. This field is not considered if no suitable habitat is present within the subject site 2. '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. 3. 'nearby' or 'recent' records are species specific accounting for home range, dispersal ability and life cycle.

Table A2.2 below provides an assessment of potential habitat within the subject site for state and nationally listed threatened fauna species recorded within 10km on the Atlas of NSW Wildlife Database (OEH) or indicated to have potential habitat present within 10km on the EPBC Protected Matters Tool.

Table A2.2 – Threatened fauna habitat assessment

COMMON NAME ***Scientific Name*** DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT ***Distribution Limit***	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				SHOULD BE CONSIDERED IN FUTURE 7 PART TEST (✓)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Giant Burrowing Frog *Heleioporus australiacus* EPBC	V	V	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.*	×	×	-	-	×	×
Giant Barred Frog *Mixophyes iteratus* EPBC	E	E	Terrestrial inhabitant of rainforest and open forests. *Distribution Limit: N-Border Ranges National Park. S-Narooma.*	×	×	-	-	×	×
Green and Golden Bell Frog *Litoria aurea* OEH EPBC	E	V	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.*	×	✓	×	×	unlikely	✓
Southern Bell Frog *Litoria raniformis* EPBC	E	V	Prefers the edges of permanent water, streams, swamps, creeks, lagoons, farm dams and ornamental ponds. Often found under debris. *Distribution Limit: N-ACT Bay. S-Albury.*	×	×	-	-	×	×

COMMON NAME *Scientific Name* DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT *Distribution Limit*	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				SHOULD BE CONSIDERED IN FUTURE 7 PART TEST (✓)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Broad-headed Snake *Hoplocephalus bungaroides* EPBC	E	V	Sandstone outcrops, exfoliated rock slabs and tree hollows in coastal and near coastal areas. *Distribution Limit: N-Mudgee Park. S-Nowra.*	×	×	-	-	×	×
Black-necked Stork *Ephippiorhynchus asiaticus* OEH	E	-	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.*	×	✓	×	×	unlikely	✓
Australasian Bittern *Botaurus poiciloptilus* EPBC	E	E	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.*	×	✓	×	×	unlikely	✓
Spotted Harrier *Circus assimilis* OEH	V	-	Utilises grassy plains, crops and stubblefields; saltbush, spinifex associations; scrublands, mallee, heathlands; open grassy woodlands. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	×	✓	×	×	unlikely	✓

COMMON NAME *Scientific Name* DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT *Distribution Limit*	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				SHOULD BE CONSIDERED IN FUTURE 7 PART TEST (✓)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Little Eagle *Hieraaetus morphnoides* OEH	V	-	Utilises plains, foothills, open forests, woodlands and scrublands; river red gums on watercourses and lakes. *Distribution Limit - N-Tweed Heads. S-South of Eden.*	×	✓	✓	✓	✓	✓
Square-tailed Kite *Lophoictinia isura* OEH	V	-	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.*	×	✓	×	✓	low	✓
Red Goshawk *Erythrotriorchis radiatus* OEH EPBC	E	V	Inhabits tall open forests and woodlands. Breeds in tall trees adjacent to watercourses of wetlands. *Distribution Limit: N-Border Ranges National Park. S-Foster.*	×	×	-	-	×	×
Bush Stone-curlew *Burhinus grallarius* OEH	E	-	Utilises open forests and savannah woodlands, sometimes dune scrub, savannah and mangrove fringes. *Distribution Limit: N-Border Ranges National Park. S-Near Nowra.*	×	✓	×	×	unlikely	✓
Australian Painted Snipe *Rostratula australis* EPBC	V	V	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.*	×	✓	×	×	Not likely	×

COMMON NAME *Scientific Name* DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT *Distribution Limit*	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				SHOULD BE CONSIDERED IN FUTURE 7 PART TEST (✓)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1.2 & 3*	Record(s) from recent years (✓) *Notes 1.2 & 3*	Potential to occur	
Gang-gang Cockatoo *Callocephalon fimbriatum* OEH	V	-	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.*	×	marginal	×	×	unlikely	✓
Glossy Black-Cockatoo *Calyptorhynchus lathami* OEH	V	-	Open forests with *Allocasuarina* species and hollows for nesting. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	×	×	-	-	×	×
Little Lorikeet *Glossopsitta pusilla* OEH	V	-	Inhabits forests, woodlands; large trees in open country; timbered watercourses, shelterbeds, and street trees. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	×	limited	×	×	unlikely	✓
Swift Parrot *Lathamus discolour* OEH EPBC	E	E	Inhabits eucalypt forests and woodlands with winter flowering eucalypts. *Distribution Limit: N-Border Ranges National Park. S-South of Eden.*	×	✓	×	×	unlikely	✓
Masked Owl *Tyto novaehollandiae* OEH	V	-	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.*	×	Sub-optimal	×	✓	unlikely	✓

COMMON NAME *Scientific Name* DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT *Distribution Limit*	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				SHOULD BE CONSIDERED IN FUTURE 7 PART TEST (✓)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Eastern Bristlebird *Dasyornis brachypterus* EPBC	E	E	Coastal woodlands, dense scrubs and heathlands, especially where low heathland borders taller woodland or dense tall tea-tree. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	×	×	-	-	×	×
Speckled Warbler *Chthonicola sagittata* OEH	V	-	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.*	×	×	-	-	×	×
Black-chinned Honeyeater *Melithreptus gularis gularis* OEH	V	-	Found in woodlands containing box-ironbark associations and River Red Gums, also drier coastal woodlands of the Cumberland Plain and Hunter Richmond and Clarence. *Distribution Limit: N-Cape York pen. Qld. S-Victor H. Mt Lofty Ra & Flinders Ra. SA.*	×	limited	×	×	unlikely	✓
Regent Honeyeater *Xanthomyza Phrygia* OEH EPBC	E4A	E	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.*	×	✓	×	×	unlikely	✓
Varied Sittella *Daphoenositta chrysoptera* OEH	V	-	Open eucalypt woodlands/forests (except heavier rainforests); mallee, inland acacia, coastal tea-tree scrubs; golfcourses, shelterbelts, orchards, parks, scrubby gardens. *Distribution Limit: N-Border Ranges National Park. S-South of Eden.*	×	limited	×	×	unlikely	✓

COMMON NAME *Scientific Name* DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT *Distribution Limit*	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				SHOULD BE CONSIDERED IN FUTURE 7 PART TEST (✓)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Scarlet Robin *Petroica boodang* OEH	V	-	Found in foothill forests, woodlands, watercourses; in autumn-winter, more open habitats: river red gum woodlands, golf courses, parks, orchards, gardens. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	×	limited	×	×	unlikely	✓
Flame Robin *Petroica phoenicea* OEH	V	-	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.*	×	limited	×	×	unlikely	✓
Diamond Firetail *Stagonopleura guttata* OEH	V	-	Found in Eucalypt woodlands, forests and mallee where there is grassy understorey west of the Great Div. also drier coastal woodlands of the Cumberland Plain and Hunter Richmond and Clarence River Valleys. *Distribution Limit: N-Rockhampton Q. S-Eyre Pen Kangaroo Is. SA.*	×	limited	×	×	unlikely	✓
Spotted-tailed Quoll *Dasyurus maculatus* OEH EPBC	V	E	Dry and moist open forests containing rock caves, hollow logs or trees. *Distribution Limit: N-Mt Warning National Park. S-South of Eden.*	×	×	-	-	×	×

COMMON NAME *Scientific Name* DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT *Distribution Limit*	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				SHOULD BE CONSIDERED IN FUTURE 7 PART TEST (✓)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Koala *Phascolarctos cinereus* OEH EPBC	V	-	Inhabits both wet & dry eucalypt forest on high nutrient soils containing preferred feed trees. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	×	✓	×	×	unlikely	✓
Long-nosed Potoroo *Potorous tridactylus* EPBC	V	V	Coastal heath and dry and wet sclerophyll forests with a dense understorey. *Distribution Limit: N-Mt Warning National Park. S-South of Eden.*	×	×	-	-	×	×
Brush-tailed Rock-wallaby *Petrogale penicillata* EPBC	E	V	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.*	×	×	-	-	×	×
Grey-headed Flying-fox *Pteropus poliocephalus* OEH EPBC	V	V	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.*	×	✓	✓	✓	✓	✓

COMMON NAME *Scientific Name* DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT *Distribution Limit*	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				SHOULD BE CONSIDERED IN FUTURE 7 PART TEST (✓)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
East-coast Freetail Bat *Micronomus norfolkensis* OEH	V	-	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.*	✓	-	-	-	-	✓
Large-eared Pied Bat *Chalinolobus dwyeri* EPBC	V	V	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.*	×	×	-	-	×	×
Eastern Falsistrelle *Falsistrellus tasmaniensis* OEH	V	-	Recorded roosting in caves, old buildings and tree hollows. *Distribution Limit: N-Border Ranges National Park. S-Pambula.*	×	limited	×	×	unlikely	✓
Eastern Bentwing-bat *Miniopterus orianae oceansis* OEH	V	-	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.*	×	✓	✓	✓	✓	✓
Little Bentwing-bat *Miniopterus australis* OEH	V	-	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.*	×	✓	×	-	low	✓

COMMON NAME *Scientific Name* DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT *Distribution Limit*	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				SHOULD BE CONSIDERED IN FUTURE 7 PART TEST (✓)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Large-footed Myotis *Myotis macropus* OEH	V	-	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.*	✓	-	-	-	-	✓
Greater Broad-nosed Bat *Scoteanax rueppellii* OEH	V	-	Inhabits areas containing moist river & creek systems especially tree lined creeks. *Distribution Limit: N-Border Ranges National Park. S-Pambula.*	×	✓	✓	✓	✓	✓
New Holland Mouse *Pseudomys novaehollandiae* EPBC	-	V	Occurs in heathlands, woodlands, openforest and paperbark swamps and on sandy, loamy or rocky soils. Coastal populations have a marked preference for sandy substrates, a heathy understorey of leguminous shrubs less than 1m high and sparse ground litter. Recolonise of regenerating burnt areas. *Distribution Limit: N-Border Ranges National Park. S-South of Eden.*	×	×	-	-	×	×
Cumberland Plain Land Snail *Meridolum corneovirens* OEH	E	-	Inhabits remnant eucalypt woodland of the Cumberland Plan. Shelters under logs, debris, clumps of grass, around base of trees and burrowing into loose soil. *Distribution Limit: Cumberland Plain of Sydney Basin Region.*	×	limited	×	×	unlikely	✓

COMMON NAME *Scientific Name* DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT *Distribution Limit*	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				SHOULD BE CONSIDERED IN FUTURE 7 PART TEST (✓)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Macquarie Perch *Macquaria australasica* EPBC	V	E	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.*	x	x	-	-	x	x
Australian Greyling *Prototroctes maraena* EPBC	Part 2, Section 19 – Protected Fish	V	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).	x	x	-	-	x	x

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
V	-	Denotes vulnerable listed species under the relevant Act
E	-	Denotes endangered listed species under the relevant Act
NOTE:	1.	This field is not considered if no suitable habitat is present within the subject site
	2.	'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.
	3.	'nearby' or 'recent' records are species specific accounting for home range, dispersal ability and life cycle.

A detailed assessment in accordance with Section 5A of the *EPA Act* will be completed for these species in Appendix 3 of this report.

Table A2.3 below provides an assessment of potential habitat within the subject site for nationally *protected* migratory fauna species recorded within 10km on the EPBC Protected Matters Tool. Nationally *threatened* migratory species are considered in Table A2.2 above.

Table A2.3 – Migratory fauna habitat assessment

COMMON NAME ***Scientific Name***	**PREFERRED HABITAT** ***Migratory Breeding***	**Suitable Habitat Present (✓)**	**Recorded on Site (✓)**	**COMMENTS**
White-bellied Sea Eagle (*Haliaeetus leucogaster*)	Coasts, islands, estuaries, inlets, large rivers, inland lakes, reservoirs. *Sedentary; dispersive.*	✓	×	-
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.*	✓	×	-
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.*	×	-	-
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.*	×	-	-
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.*	×	-	-

COMMON NAME *Scientific Name*	PREFERRED HABITAT *Migratory Breeding*	Suitable Habitat Present (✓)	Recorded on Site (✓)	COMMENTS
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.*	✓	×	-
Great Egret (*Ardea alba*)	Shallows of rivers, estuaries; tidal mudflats, freshwater wetlands; sewerage ponds, irrigation areas, larger dams, etc. *Dispersive; cosmopolitan.*	✓	✓	A single Great Egret was observed foraging along the fringes of the wetland area to the south-west of the subject site. This wetland and most suitable foraging habitat is contained within the flood affected areas. Low potential nesting habitat is only contained within this flood affected area also. Maintaining flood affected lands as non-developable lands will retain sufficient areas of habitat such that this species would not likely be significantly impacted by the proposed subdivision.

COMMON NAME *Scientific Name*	PREFERRED HABITAT *Migratory Breeding*	Suitable Habitat Present (✓)	Recorded on Site (✓)	COMMENTS
Cattle Egret (*Ardea ibis*)	Stock paddocks, pastures, croplands, garbage tips, wetlands, tidal mudflats, drains. *Breeds in summer in warmer parts of range including NSW.*	✓	✓	Cattle Egrets were initially observed as a flock of approximately 15 individuals foraging together along the fringes of the wetland strip located to the south-west of the subject site. At this location they were foraging alongside cattle as a host. This wetland and surrounding trees, particularly on the neighbouring property to the west, provides the most suitable nearby nesting habitat and will be retained within the riparian habitat area. A flock were later observed roosting at night within these trees on neighbouring land. Foraging habitat is likely to be anywhere within the site where cattle is present or otherwise along the riparian habitats. There will be less potential for this species to occur following the removal of cattle from the subject site. Regardless of this, there is much suitable foraging habitat and alternate host species options in the nearby locality. Therefore, the Cattle Egret is not likely to be significantly impacted by the proposed subdivision provided that it can be demonstrated that the riparian habitats will be improved and protected as part of the proposal.

COMMON NAME *Scientific Name*	PREFERRED HABITAT *Migratory Breeding*	Suitable Habitat Present (✓)	Recorded on Site (✓)	COMMENTS
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.*	✓	×	-
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.*	✓	×	-

7 Part Test of Significance

A3

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

- *Grevillea juniperina* subsp. *juniperina*
- *Pimelea spicata*

Endangered ecological communities

- *River-Flat Eucalypt Forest on Coastal Floodplains**

Threatened fauna

- Green and Golden Bell Frog
- Black-necked Stork
- Australasian Bittern
- Little Eagle
- Square-tailed Kite
- Spotted Harrier
- Bush Stone-curlew
- Gang-gang Cockatoo
- Little Lorikeet
- Swift Parrot
- Masked Owl
- Black-chinned Honeyeater
- Regent Honeyeater
- Varied Sittella
- Scarlet Robin
- Flame Robin
- Diamond Firetail
- Koala
- Grey-headed Flying-fox
- East-coast Freetail Bat*
- Eastern Falsistrelle
- Little Bentwing-bat
- Eastern Bentwing-bat
- Large-footed Myotis*
- Greater Broad-nosed Bat
- Cumberland Plain Land Snail

Endangered populations

- None for fauna

- Dillwynia tenuifolia, Kemps Creek
- *Marsdenia viridiflora* subsp. *viridiflora* population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas

Species indicated with a "*" were recorded within and/or in close proximity to 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

Large-footed Myotis *(Myotis macropus)*

The Large-footed Myotis inhabits rainforests and open forests containing creeks and lakes over which it feeds and roosts in tree hollows, caves, mines, under bridges, in tunnels and occasionally buildings (Richards 1995). The Large-footed Myotis predominantly forages along creek lines and over waterbodies where it takes insects and small fish from on and just below the water surface (Richards 1995).

This species has a strong association with streams and permanent waterways, most frequently at low elevations and in flat or undulating country and usually in areas that are vegetated rather than cleared. They will live in most habitat types as long as it is near water (Churchill 2008).

The Large-footed Myotis was recorded by Anabat foraging over the two large open water areas within the subject site and nearby during survey. This includes the large dam located within the subject site and the large wetland area to the south-west that extends into neighbouring property further west. Up to three individuals were spotlighted continually foraging over the large dam within the subject site following dusk during nocturnal survey on the 7th February 2012, confirming the value of this open water resource.

Whilst Ropes Creek provides foraging sections for this species, the narrow vegetated nature of this drainage does not provide as likely value for foraging as the two large open water areas where the species was recorded. The large wetland area is located within the non-developable riparian and 1:100 year flood affected lands however the large north-eastern dam is located outside of this and will be removed as part of the proposal. This removal will impact on the species but will not likely be significant given the extent of other similar dams in the locality.

This species is expected to be utilising a bridge or culvert in the locality for roosting but may be using hollows also within the subject site.

Assessment conclusion for hollow-dependent threatened microbats

The removal of a hollow utilised as a roosting site and possibly a breeding colony is considered likely to significantly impact on the local population. Therefore, this assessment may conclude a not significant outcome on the assumption that no trees of habitat value are removed with the development landscape. Mitigation measures have been proposed in the event that trees are removed.

Any trees required for removal should be first inspected for habitat potential by a fauna ecologist. The removal of any tree containing identified hollows or quality habitat features should then be supervised by a fauna ecologist to ensure appropriate welfare and relocation procedures for residing fauna, particularly threatened microbats.

Any hollow that is found to be utilised by threatened fauna or of high quality should be relocated into trees along the riparian protection areas under the direction of the fauna ecologist. All other hollows should be replaced with nest boxes and installed within the riparian protection areas, with every second nest box designed for microbat species.

Based on the presence of very few trees through the development landscape it is likely that very few, if any trees, will be required for removal as part of development within the subdivision. Based on a low density of available hollows there is low potential for any trees to be removed to require the above precautionary process.

East-coast Freetail-bat *(Micronomus norfolkensis)*

The East-coast Freetail Bat forages above the canopy of open forests and woodlands and in clearings at forest edges, feeding on small insects (Allison, Hoye & Law 2008). This species is thought to roost predominantly in tree hollows but also under loose bark and occasionally in houses and outbuildings (Allison, Hoye & Law 2008). Until recent findings of a roost within mangroves, all known natural roosts had occurred within hollow spouts of large mature eucalypts. The species is often found close to dams and waterholes. The East-coast Freetail Bat species will utilize paddock trees and isolated remnant vegetation when in proximity to larger forest remnants (Allison, Hoye & Law 2008).

This is a highly mobile species and local habitat would not be exclusive to the subject site. Hoy *et. al* (2008) suggest that despite a female recorded 6km from its roost, this species generally forages within a few kilometres of roosts.

PhD student Anna McConvill from the University of Newcastle recently has undertaken a more formal and detailed analysis to investigate landscape habitat use by this species. She found that cleared and semi-cleared landscapes were found to have higher activity levels than urban or forested landscapes. Riparian sites were also found to have high activity levels. Prior to McConvill's work, this species was known for its utilisation of paddock trees in disturbed landscapes where nearby forest and woodland habitats occur (Hoy et. al 2008).

The East-coast Freetail Bat was recorded foraging by Anabat over the large dam within the subject site during survey. It is considered that the subject site provides suitable foraging, roosting and breeding habitat for this species. The removal of a hollow utilised as a roosting site and possibly a breeding colony is considered likely to significantly impact on the local population. Therefore this species has the same assessment conclusion and mitigation measures as the Large-footed Myotis above.

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 recorded within 10km of the subject site.

There are two endangered flora populations within locality, these are:

- Dillwynia tenuifolia, Kemps Creek
- *Marsdenia viridiflora* subsp. *viridiflora* population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas

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

The River-Flat Eucalypt Forest on Coastal Floodplains is restricted to the alluvial flats within the subject site and occupies an area of approximately 1.31ha.

A portion of the EEC vegetation is within a 30m wide electrical easement and may be partly managed on a regular basis.

As the vegetation is within a riparian corridor the NSW Office of Water have issued guidelines for protection of watercourses. In this instance the watercourse is a 3rd order stream and will require setbacks of a minimum of 30m plus the channel width. Effectively this would see retention of all existing vegetation within the riparian corridor and thus the proposal 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.

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 proposal will not require any changes to the composition of the existing remnant vegetation and asset protection zones will be outside of the riparian corridor.

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 Grevillea juniperina subsp. juniperina, Pimelea spicata, River-flat Eucalypt Forest on Coastal Floodplains, Green and Golden Bell Frog, Black-necked Stork, Australasian Bittern, Little Eagle, Square-tailed Kite, Spotted Harrier, Bush Stone-curlew, Gang-gang Cockatoo, Little Lorikeet, Swift Parrot, Masked Owl, Black-chinned Honeyeater, Regent Honeyeater, Varied Sittella, Scarlet Robin, Flame Robin, Diamond Firetail, Koala, Grey-headed Flying-fox, East-coast Freetail Bat, Eastern False-pipistrelle, Little Bentwing-bat, Eastern Bentwing-bat, Large-footed Myotis, Greater Broad-nosed Bat and Cumberland Plain Land Snail.

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 approximately 41ha, of which 3% is cleared. Cleared areas have very limited value to any threatened species potential or known habitat. EEC vegetation will be fully retained (4.7% of the site) however most dams and subsequent fringing vegetation will likely be lost (3.8% of the site).

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

The proposed subdivision landscape does not contain any quality habitat patches but rather scattered trees within a mostly cleared landscape. The only habitats within the subject site with connective values are along Ropes Creek. Riparian buffers have been applied to Ropes Creek and rehabilitation of vegetation will occur along it extent within the subject site. This outcome will not further fragment and isolate habitat but will instead improve the current connective values within the subject site.

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

In respect to threatened fauna species, the habitat to be removed is not likely to be of importance or central to habitat requirements. The exception is if any hollow within trees to be removed provide roosting and maternity values for microbat species. There may be no tree removal as part of the proposal however, if tree removal is to occur, appropriate mitigation measures have been identified to prevent significant impacts on threatened microbats.

The proposal will not have any direct impacts on any EEC vegetation and in considering the habitats that may be impacted by the proposal, they have little potential for hosting threatened flora habitat due to the level of clearing and grazing.

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

- Green and Golden Bell Frog (*Litoria aurea*) (DEC 2005)

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

- Bush Stone Curlew (*Burhinus grallarius*) (DEC 2006)
- Koala (*Phascolarctos cinereus*) (DEC 2008)
- Large Forest Owls ((Powerful Owl (*Ninox strenua*), Sooty Owl (*Tyto tenebricosa*) and Masked Owl (*Tyto novaehollandiae*)) (DEC 2006).
- *Pimelea spicata* (DEC 2004)

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			✓
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			✓
Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae		✓	
Infection of native plants by *Phytophthora cinnamomi*		✓	
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*			✓

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
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

Clearing of native vegetation

The proposal may require the removal of some remnant trees within the managed paddocks and as such will contribute to the key threatening process even though only incrementally.

Whilst there is no proposed removal of EEC vegetation, there will be setbacks from the watercourses in line with the 2012 guidelines for controlled activities (NSW Office of Water) that will give effective protection to existing EEC vegetation and will provide an opportunity to restore the vegetation within the riparian corridor of 60+ metres width. Part of the riparian corridor may provide some opportunity for offsetting the loss of Cumberland Plain Woodland within the adjoining stage also.

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 subject site is of a degraded nature and the proposed development is not expected to significantly increase the prevalence of exotic perennial grasses. The application of a vegetation management plan upon conserved lands will assist in the spread of such grasses.

Loss of Hollow-bearing Trees

Hollow-bearing tree surveys have not been undertaken within the subject site. Observations for significant habitat trees found that hollows are generally of small size and very low density through the site. The proposal may require the removal some isolated trees through the landscape and such trees may contain hollows. Given that two hollow-dependent threatened microbat species were recorded present during survey, mitigation measures have been proposed to prevent significant impacts. These measures include the identification of hollows where any trees are required for removal and a hollow removal process.

Removal of dead wood and dead trees

The proposal may require the removal of deadwood and / or dead trees within the development landscape and in this case would be a class of development recognised as a threatening process. Threatened fauna species with potential habitat within the subject site and likely dependent on dead wood or dead trees include Bush Stone-curlew, Varied Sittella, Flame Robin, Scarlet Robin and Cumberland Plain Land Snail. These species have not been recorded to date within the subject site. These species are also considered unlikely to occur based on regional records and habitat suitability. Given the low quality habitat present within the development areas, the removal of dead wood and dead trees is not considered likely to impact on threatened species or the biodiversity of the local area.

National - Significant Impact Criteria

A4

Under the EPBC Act an action will require approval from the Australian Government Environment Minister if the action has, will have, or is likely to have, a significant impact on a matter of national environmental significance. The following significant impact criteria were sourced from the EPBC Act Policy Statement 1.1 (May 2006):

CRITICALLY ENDANGERED AND ENDANGERED SPECIES

Significant impact criteria

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

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

>> What is a population of a species?

A 'population of a species' is defined under the EPBC Act as an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to:

- a geographically distinct regional population, or collection of local populations; or
- a population, or collection of local populations, that occurs within a particular bioregion.

>> What is habitat critical to the survival of a species or ecological community?

'Habitat critical to the survival of a species or ecological community' refers to areas that are necessary:

- For activities such as foraging, breeding, roosting, or dispersal;
- For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators);
- To maintain genetic diversity and long term evolutionary development; or
- For the reintroduction of populations or recovery of the species or ecological community.

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

VULNERABLE SPECIES

Significant impact criteria

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

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

>> What is an important population of a species?

An 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- Key source populations either for breeding or dispersal;
- Populations that are necessary for maintaining genetic diversity; and/or
- Populations that are near the limit of the species range.

CRITICALLY ENDANGERED AND ENDANGERED ECOLOGICAL COMMUNITIES

Significant impact criteria

An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

- Reduce the extent of an ecological community;
- Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines;
- Adversely affect habitat critical to the survival of an ecological community;
- Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns;
- Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting;
- Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:
  - assisting invasive species, that are harmful to the listed ecological community, to become established; or
  - causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community; or
- Interfere with the recovery of an ecological community.

MIGRATORY SPECIES

Significant impact criteria

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

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

>> What is important habitat for a migratory species?

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

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

>> What is an ecologically significant proportion?

Listed migratory species cover a broad range of species with different life cycles and population sizes. Therefore, what is an 'ecologically significant proportion' of the population varies with the species (each circumstance will need to be evaluated). Some factors that should be considered include the species' population status, genetic distinctiveness and species specific behavioural patterns (for example, site fidelity and dispersal rates).

>> What is the population of a migratory species?

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