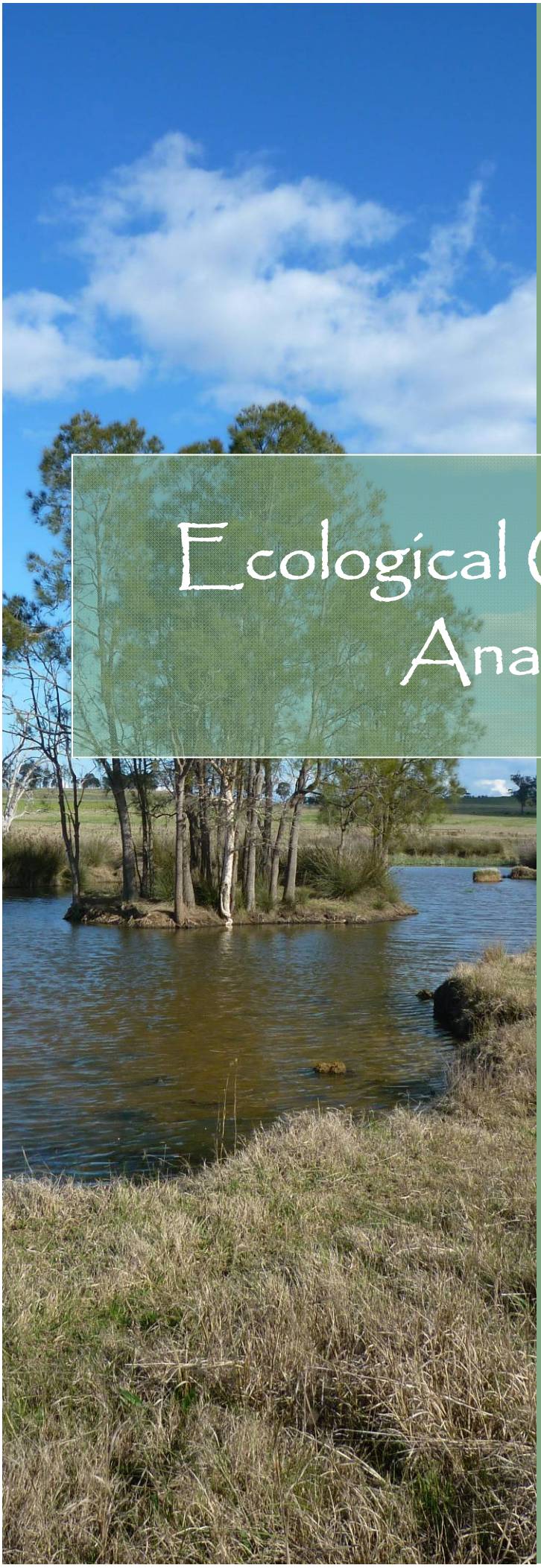

Travers
bushfire & ecology

Ecological Constraints Analysis

LOTS 201-203 DP 1152191
565 LUDDENHAM ROAD, LUDDENHAM

NOVEMBER 2010
(REF: A10094F)

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FLORA AND FAUNA ASSESSMENT

LOTS 201-203 DP 1152191
565 LUDDENHAM ROAD, LUDDENHAM

NOVEMBER 2010

Report Authors: John Travers, Lindsay Holmes, Corey Mead
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Checked by:
Date: 8 November 2010
File: A10094F

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EXECUTIVE SUMMARY

This analysis report has been prepared by *Travers bushfire & ecology* to identify the ecological characteristics and development constraints at 565 Luddenham Road, Luddenham.

The subject site, upon which development is considered, includes Lots 201-203 DP 1152191 Luddenham.

Legislative Requirements

Ecological survey 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 the Large-footed Myotis (*Myotis macropus*) and East-coast Freetail Bat (*Micronomus norfolkensis*), no threatened flora species, and two (2) Endangered Ecological Communities (EECs), *Cumberland Plain Woodland* and *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, two (2) migratory bird species Great Egret (*Ardea alba*) and Cattle Egret (*Ardea ibis*), no threatened flora species, and one (1) highly disturbed, poor condition EEC, *Cumberland Plain Shale Woodland and Shale-Gravel Transition Forest* listed under this Act were recorded within or in close proximity to the subject site.

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.

Conclusion

With respect to the threatened flora, there were no threatened flora species identified within Lots 201-203 DP 1152191 Luddenham. The far eastern remnant of Cumberland Plain Woodland provides marginal habitat for the threatened plant *Pimelea spicata* however all other remnants are unlikely to provide any habitat for this species. Given the separation between remnants of vegetation, lack of connective value and current land use as grazing / pastoral, it is very unlikely for the species to occur.

There is also marginal habitat for the threatened species *Hypsela sessiflora* which has potential to occur around the no inundated areas adjacent to dams, creek lines and the Swamp Oak Woodland / Forest. Again, given the lack of connectivity, the fragmentation of remnants and the current land use, it is unlikely to occur.

In terms of the EECs, all but one remnant was less than 0.25ha which means they could be classed as ‘low condition’ under a Biometric assessment and thus could be removed. One remnant of Cumberland Plain Woodland along the southern boundary in the western portion of the subject site, whilst highly degraded, does not lend itself to being classed as low condition because it is more than 0.25ha and has a higher canopy than a benchmark figure that would trigger a low condition remnant.

Given this larger remnant is of poor condition with 80% or more weed coverage in the ground layer, an absent shrub layer and no direct connective value to other Cumberland Plain Woodland, the remnant provides very little value except for the fauna hollows within the trees. Removal of this remnant can be considered provided that there is compensation with a conserved area of the subject site. For example, the loss of this 2ha (approximate) remnant should trigger a restoration area of equivalent size or greater within the central riparian corridor.

Vegetatively, the main constraint to future development is to avoid clearing of the larger CPW remnant. The removal of all other smaller patches across the subject site less than 0.25ha is allowable under the Biometric assessment.

From an ecological perspective, this remnant plays little role in providing connectivity for fauna. Its main value is that is contains several hollows which may provide roosting habitat for microbats, small mammals, lizards or birds for example. For future planning purposes, the need to retain this patch for its ecological value alone is not really warranted.

Compensatory measures should be encouraged into future planning to provide a revegetated corridor along the riparian line which runs north-east to south-west through the centre of the subject site adjacent to or near the overhead transmission wires. This revegetated corridor should contain at least the equivalent amount of vegetation lost from the proposal. For example, if there is 20ha of remnant EEC vegetation across the site, the riparian conservation corridor should restore and revegetate a minimum of 20ha in one consolidated unit (to include both EECs). This would be a good ecological outcome as it will link with vegetation to the north and south of the subject site. Even if that habitat is partly fragmented outside of the subject site, it would be a better outcome than what is present and more likely to be approved by the authority determining a future land-use proposal.

As mentioned within individual species discussions, the threatened fauna values within the subject site include open water resources, fringing vegetation to water areas, woodland trees and hollow resources. These are all important for both of the threatened microchiropteran bats recorded however values increase for each of these habitat types by the way they combine together.

For example vegetated fringes to water bodies and soaks in the form of sedges and rushes provide invertebrate breeding areas that combine with water habitat for higher invertebrate presence and subsequent foraging on prey species. Hollows proximate to open water areas are more likely to be utilised by the Large-footed Myotis and hollows within or close to remnants are more likely to be utilised by microbats in general.

The collective retention of the central drainage, natural vegetated fringes, nearby connective remnants and nearby hollows therefore provides a far higher value to threatened fauna species than the alternate retention of similar amounts of isolated habitats. Whilst the nearby locality is highly fragmented, the limited connectivity to the subject site is best where the central drainage continues both to the north and south. The central drainage area should be enhanced through restoration and revegetation of both EECs within.

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Licences

Individual staff members are licensed under Clause 20 of the *National Parks and Wildlife (Land Management) Regulation 1995* and Section 120 & 131 of the *National Parks and Wildlife Act 1974* to conduct flora and fauna surveys within service and non-service areas. NPWS Scientific Licence Numbers: S10359. The staff of *Travers bushfire & ecology* are licensed under an Animal Research Authority issued by the Department of Agriculture. This authority allows *Travers bushfire & ecology* staff to conduct various fauna surveys of native and introduced fauna for the purposes of environmental consulting throughout New South Wales.

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
DEWHA	Federal Department of the Environment, Water, Heritage and the Arts
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
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*
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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FIGURES

TABLES

1 INTRODUCTION

Travers bushfire & ecology has been engaged by *EG Property Group* to carry out a constraints assessment upon the flora and fauna within Lots 201-203 DP 1152191 (565 Luddenham Road) Luddenham, hereafter referred to as the subject site.

Figure 1 provides an aerial appraisal of the subject site and provides the ecological survey effort undertaken inclusive of habitat trees within 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 in accordance with the guidelines adopted by Penrith City Council
- Carry out a fauna survey for the detection and assessment of fauna and their habitats in accordance with the guidelines adopted by Penrith City Council
- Complete target surveys for threatened species, populations and ecological communities
- Assess the conservation value of the site
- Prepare a flora and fauna impact assessment in accordance with the requirements of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), the *Threatened Species Conservation Act 1995* (TSC Act), the *Fisheries Management Act 1994* (FM Act) and guidelines issued by the National Parks and Wildlife Service (NPWS).

1.2 Information collation

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

Standard Technical Resources:

- *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities 2004* (working draft), Department of Environment and Conservation (DEC)
- Aerial photographs (scale 1:25,000) and topographical maps (scale 1:25,000)
- *Atlas of NSW Wildlife 2010* (DECCW) 1:100,000 scale map sheet
- The schedules of the *TSC Act*
- The schedules of the *FM Act*
- Lists of threatened species and communities in the *EPBC Act*
- Rare or Threatened Australian Plants (ROTAP)
- Vegetation Mapping of the Cumberland Plain (NPWS, 2003)

1.3 Statutory requirements

1.3.1 Threatened Species Conservation Act 1995

The specific requirements of the *TSC Act* must be addressed in the assessment of flora and fauna matters. This requires the consideration of potential impacts on threatened species, populations and ecological communities. The factors to be taken into account in deciding whether there is a significant effect are set out in Section 5A of the *Environmental Planning and Assessment Act 1979* (EPA Act) and are based on a 7 part test of significance. Where a proposed activity is located in an area identified as critical habitat, or such that it is likely to significantly affect threatened species, populations, ecological communities, or their habitats, a Species Impact Statement (SIS) is required to be prepared.

1.3.2 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.

1.3.3 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 the Environment, Water, Heritage and the Arts (DEWHA) for assessment. In the case where no listed federal species are located on site then no referral is required. The onus is on the proponent to make the application and not the Council to make any referral.

A significant impact is regarded as being:

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

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

1.4 Development concept

Currently there is no development concept. This report is being prepared more so to advise on the ecological constraints such that a potentially achievable development concept and plan can be put forward.

1.5 Site description

The planning and cadastral details of the subject site are provided in Table 1.1, while Table 1.2 summarises the geographical characteristics of the site.

Table 1.1 – Site details

Location	Lots 201-203 DP 1152191 – 565 Luddenham Road, Luddenham
Description of location	Lots 201-203 are located to the west side of Luddenham road, east of Gates Road (which runs of The Northern Road), and immediately south of large above-ground Sydney water supply pipelines. The Luddenham Road entries are located approximately 5.5km from the intersection with Mamre Road.
Area	Approximately 455ha
Topographic map	Penrith 1:25,000
Grid reference	289150E and 6253300N
Local government area	Penrith City Council
Existing land use	Pastoral/grazing

Table 1.2 – Site characteristics

Elevation	Approximately 50-92m AHD
Topography	Situated on gentle slopes, mostly less than 5% gradients
Aspect	Various
Geology and soils	Bringelly Shale Geology which covers a large proportion of the Cumberland Plain. There may be some Quaternary Geology in association with the riparian areas which is usually fine grained sand, silt and clay. Soils are mostly Blacktown Soil Landscape (residual) – shallow to moderately deep hard-setting mottled texture contrast soils. Soils in the riparian areas are South Creek Soil Landscape (fluvial) – often deep layered sediments in floodplain areas and valley flats.
Catchment	Hawkesbury / Nepean River
Drainage	Soaks and drainages linking dams flow north into both the Blaxland and Cosgrove Creeks which both flow into south creek. This creek runs into the Windsor reach of the Hawkesbury approximately 27kms north of the site (direct distance).
Vegetation	Predominately cleared pastoral landscape with some small remnant low quality disturbed patches of Cumberland Plain Woodland and River-flat Eucalypt Forest.

The subject site has been affected by the following impacts:

Table 1.3 – Site disturbance

Clearing	The entire subject site has been managed in some form through clearing of vegetation, construction of dams and structures, and through grazing.
Agriculture / Pastoral	Some paddocks are currently occupied by cattle and horses
Earthworks	Dams have been constructed along the central drainage line and in various other locations within open paddocks. A graded road has been constructed from east to west across the entire site with other access roads to houses within the far eastern portions.
Introduced weeds	Almost the entire vegetation on site contains a dominance of exotic annual herbs and grasses in the understorey. There were very few invasive species or noxious weeds present. Within the aquatic areas, there were few to no weed species present.
Evidence of feral, introduced or domestic fauna	Domestic Dogs, Cattle and Horse are currently present within the site. Feral European Red Foxes, Hares, Common Mynas, Common Starlings, Rock Doves, Spotted Turtle-doves, Carp, and Mosquito Fish have also been recorded and likely impact on native fauna species. Foxes are present in high numbers.

2 SURVEY TECHNIQUES

2.1 Background

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.

2.2 Survey techniques

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

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

- ***Data search*** – A search of the *Atlas of NSW Wildlife* (DECCW, 2010) 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 Department of Environment and Heritage – 'protected matters search tool' website to generate a report that will help determine whether matters of national environmental significance or other matters protected by the EPBC Act are likely to occur in the area of interest. The search was broadened to a 10km radius like the Atlas search. These two searches combined enabled the preparation of a list of threatened flora and fauna species that could potentially occur within the habitats found on the site (Tables 4.2, 4.4 and 4.5).

- ***Aerial photograph interpretation*** – Aerial photography via Google Earth, Bing Images and Spatial Information Exchanged were utilised to identify the extent of vegetation with respect to the site and surrounding areas.

- ***Accuracy of identification*** – Specimens of plants not readily discernible in the field were collected for identification. Those which are potentially threatened species are sent to the Royal Botanic Gardens for confirmation. Structural descriptions of the vegetation were made according to Specht *et al* (1995). Scat and hair samples collected are sent to Barbara Triggs for identification. Invertebrates are sent to Michael Shea at the Malacology Section of the Australian Museum.

2.3 Fauna survey methodology

2.3.1 Diurnal birds

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

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

Remnant woodland patches were focus areas of woodland bird survey. Several open water bodies including all of the large dams were observed for wading birds and waterfowl by the use of a spotting scope mounted on a tripod from a distance so that there would be no disturbance to foraging activity. Spotting scope points are shown on figure 1.

Birds were otherwise observed and identified using handheld binoculars. Calls were generally identified in the field by the observer. If an unknown call was heard it is cross-matched to bird call reference libraries taken into the field.

2.3.2 Nocturnal birds

The presence of nocturnal birds is first determined by quiet listening after dusk for calls by individuals emerging from diurnal roosts. This was undertaken from the highest point of the site on both nights of survey. Following this and provided no calls were heard call-playback techniques are employed. This involves broadcasting recorded calls through a 15 watt Toa 'Faunatech' amplifier to evoke a response from species known to reply. Call-playback was undertaken near to mature remnant trees so that owls may use perches on approach.

Given the low suitability of habitat present Masked Owl (*Tyto novaehollandiae*), Barking Owl (*Ninox connivens*), Australian Bittern (*Botaurus poiciloptilus*) and Bush Stone-curlew (*Burhinus grallarius*) were targeted. Each call was played for 5-minute periods with 5-minute intervals of quiet listening for a response. This was followed with spotlighting and periods of quiet listening throughout the nocturnal survey. Owls and the Bush Stone-curlew were each broadcast only once during survey, whilst the Australasian Bittern was broadcast at a number of locations along the central drainage area.

Call-playback stations are shown on Figure 1.

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

2.3.3 Arboreal and terrestrial mammals

Spotlighting within the subject site

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

Secondary indications within the subject site

Assessment was made of 'found' scats, markings, diggings, runways and scratches during visits to the site. Any scats or pellets not readily identifiable were collected and sent to Barbara Triggs for identification of contents, hair or bone fragments. Habitat was also assessed to determine the likelihood of threatened native species of fauna occurring within the subject site.

Koala assessment

The subject area was assessed for activity by Koalas using the following methods:

- A search of the *Atlas of NSW Wildlife* (DECCW 2010) databases.

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

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

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

2.3.4 Bats

Micro-chiropteran bats were surveyed by echolocation using Anabat Mk 2 and SD-1 detectors in fixed passive monitoring positions at various stations throughout the subject site. Recording locations were generally determined in order to represent different available foraging structures for various micro-chiropteran bat species. Given the absence of large connective areas of forest / woodland remnants, the various water bodies were particularly targeted to record drinking bats and also given the nearby previous recordings of Large-footed Myotis. This species forages predominantly over the water surface.

Fixed passive monitoring involves leaving the bat recorder in a position to record call-sequences of passing bats. Three (3) fixed monitoring positions were employed on both nights of survey undertaken on the 7th & 8th September 2010.

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

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

2.3.5 Amphibians

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

The presence of Green & Golden Bell Frog was considered unlikely at this site given the presence of cattle which encourages the chytrid fungus that attacks this species. Nonetheless this species was targeted by broadcasting recorded calls through a 15 watt Toa 'Faunatech' amplifier. The call was played for a 1-minute periods at various suitable habitat locations along the central drainage line with 2-minutes of quiet listening for response. Call-playback stations are shown on Figure 1.

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

2.3.6 Reptiles

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

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

2.3.7 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, target surveys were undertaken. Searches were undertaken within the best quality remaining remnant in the south-western portions of the site which was considered unsuitable for the species given the degree of understorey disturbance. Nonetheless, tree stumps were turned throughout this patch to find snails in moist substrates below. The search area is shown on Figure 1.

2.3.8 Habitat trees

Hollow-bearing trees were identified and recorded within the subject site on a *Trimble* handheld GPS unit during surveys. All data such as hollow types, hollow size, tree species, diameter at breast height, canopy spread and overall height were collected and a metal tag with the tree number placed on the trunk for field relocation purposes. Other habitat features such as nests and significant sized mistletoe for foraging were also noted.

A summary of hollow-bearing tree results is provided in Table 4.5.

Field survey method

Tables 2.1 and 2.2 below detail the flora and fauna survey effort undertaken for the subject site.

Table 2.1 – Flora survey methodology and dates

Flora survey	Method	Dates
Vegetation communities	Survey of the boundaries of vegetation communities (GPS and aerial photographic interpretation)	10/09/10 & 13/09/10
Stratified sampling	20x20 metre quadrats in all some vegetation remnants and across cleared areas – biometric methodology used. Additional transects also undertaken	10/09/10 & 13/09/10
Target searches	Target searches in suitable habitats	10/09/10 & 13/09/10
Hollow-bearing trees	GPS location and note tree dimensions, species, health and size of hollows present	08/09/10 & 13/09/10

Table 2.2 – Fauna survey methodology and dates

Fauna group	Date	Weather conditions	Survey method	Survey effort / time (24hr)
Diurnal birds	7/09/10 8/09/10	3/8 cloud, light SE wind, no rain, temp 20-9^{o}C 0/8 cloud, nil-light SE wind, no rain, temp 23-10^{o}C	Diurnal opportunistic Diurnal opportunistic	5hrs 20min 1230 - 1750 4hrs 40min 1320 - 1800
Nocturnal birds	7/09/10 8/09/10	1/8 cloud, light SE wind, no rain, temp 9^{o}C 0/8 cloud, nil-light SE wind, no rain, temp 10.5-9^{o}C	Call playback (Section 2.3.2 species) & spotlighting Call playback (Section 2.3.2 species) & spotlighting	1hr 20min 1830 - 1950 2hrs 10min 1830 - 2040
Arboreal mammals	7/09/10 8/09/10	1/8 cloud, light SE wind, no rain, temp 9^{o}C 0/8 cloud, nil-light SE wind, no rain, temp 10.5-9^{o}C	Spotlighting Spotlighting	1hr 40min 1810 - 1950 2hrs 30min 1810 - 2040
Terrestrial mammals	7/09/10 8/09/10	1/8 cloud, light SE wind, no rain, temp 9^{o}C 0/8 cloud, nil-light SE wind, no rain, temp 10.5-9^{o}C	Spotlighting Spotlighting	1hr 40min 1810 - 1950 2hrs 30min 1810 - 2040

Fauna group	Date	Weather conditions	Survey method	Survey effort / time (24hr)
Bats	7/09/10 8/09/10	1/8 cloud, light SE wind, no rain, temp 9^{o}C 0/8 cloud, nil-light SE wind, no rain, temp 10.5-9^{o}C	Anabat II x2 & SD-1 / Spotlighting Anabat II x2 & SD-1 / Spotlighting	1745 – o'night 7hrs 1945 - 2030
Reptiles	7/09/10 8/09/10	3/8 cloud, light SE wind, no rain, temp 20-9^{o}C 0/8 cloud, nil-light SE wind, no rain, temp 23-10^{o}C	Habitat search, opportunistic Habitat search, opportunistic	5hrs 20min 1230 - 1750 4hrs 40min 1320 - 1800
Amphibians	7/09/10 8/09/10	1/8 cloud, light SE wind, no rain, temp 9^{o}C 0/8 cloud, nil-light SE wind, no rain, temp 10.5-9^{o}C	Spotlighting, call identification & call-playback (Green and Golden Bell Frog) Spotlighting, call identification & call-playback (Green and Golden Bell Frog)	1hr 40min 1810 - 1950 2hrs 30min 1810 - 2040

3 SURVEY RESULTS

3.1 Flora results

Four (4) vegetation communities were identified within the subject site through aerial photographic interpretations and extensive ground truthing. These include;

- Cleared / Pastoral
- Disturbed Grey Box / Forest Red Gum Open Woodland (EEC – Cumberland Plain Woodland)
- Disturbed Swamp Oak Woodland - Forest (EEC – River-flat Eucalypt Forest on Coastal Floodplains)
- Dams and Creeks with Fringing Vegetation

Note 1 – planted vegetation such as lines of trees have been lumped into the Cleared / Pastoral vegetation community

Note 2 – some landscaping shrubs around the dwelling structures were not surveyed and therefore do not appear in Table 3.1.

Descriptions of the vegetation communities are in Section 4.

The plants observed within the vegetation communities of the subject site are listed in the Table 3.1 below.

Table 3.1 – Flora observations for the subject site

Family	Scientific Name	Common Name
TREES		
Casuarinaceae	*Casuarina glauca*	Swamp Oak
Myrtaceae	*Eucalyptus crebra*	Narrow-leaved Ironbark
Myrtaceae	*Eucalyptus microcorys* (planted)	Tallowwood
Myrtaceae	*Eucalyptus moluccana*	Grey Box
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum
Proteaceae	*Grevillea robusta* (planted)	Silky Oak
Myrtaceae	*Melaleuca stypheloides*	Prickly-leaved Tea Tree
Moraceae	*Morus alba**	Mulberry
Salicaceae	*Salix babylonica**	Weeping Willow
SHRUBS		
Pittosporaceae	*Bursaria spinosa* var. *spinosa*	Blackthorn
Solanaceae	*Lycium ferocissimum**	African Boxthorn
Myrtaceae	*Melaleuca armillaris* (planted)	Bracelet Honey Myrtle
Myrtaceae	*Melaleuca nodosa* (planted)	Ball Honey Myrtle
Myrtaceae	*Melaleuca sieberi*	-
Oleaceae	*Olea europaea* subsp. *cuspidata**	Common Olive
GROUNDCOVERS		
Asteraceae	*Ambrosia artemisifolia**	Annual Ragweed

Table 3.1 – Flora observations for the subject site

Family	Scientific Name	Common Name
Asteraceae	*Ambrosia tenuifolia**	Lacy Ragweed
Primulaceae	*Anagallis arvensis var. caerulea**	Blue Pimpernel
Primulaceae	*Anagallis arvensis**	Scarlet Pimpernel
Poaceae	*Austrodanthonia tenuior*	Wallaby Grass
Poaceae	*Axonopus fissifolius**	Narrow-leaf Carpet Grass
Azollaceae	*Azolla pinnata*	Ferny Azolla
Poaceae	*Bothriochloa macra*	Red Grass
Brassicaceae	*Brassica juncea**	Indian Mustard
Brassicaceae	*Brassica rapa**	Wild Turnip
Poaceae	*Bromus cartharticus**	Prairie Grass
Brassicaceae	*Capsella bursa-pastoris**	Shepherds purse
Gentianaceae	*Centaurium erythraea**	Pink Stars
Apiaceae	*Centella asiatica*	Swamp Pennywort
Carophyllaceae	*Cerastium glomeratum**	Mouse-ear Chickweed
Chenopodiaceae	*Chenopodium album**	Fat Hen
Poaceae	*Chloris gayana**	Rhodes Grass
Poaceae	*Chloris truncata*	Windmill Grass
Poaceae	*Chloris virgata**	Feathertop Rhodes Grass
Asteraceae	*Cirsium vulgare**	Spear Thistle
Asteraceae	*Conyza bonariensis**	Flax-leaf Fleabane
Asteraceae	*Conyza sumatrensis**	Fleabane
Apiaceae	*Cyclospermum leptophyllum**	Slender Celery
Poaceae	*Cynodon dactylon*	Common Couch
Cyperaceae	*Cyperus brevifolius**	Mullumbimby Couch
Cyperaceae	*Cyperus gracilis*	-
Poaceae	*Dichelachne micrantha*	Short-hair Plume Grass
Convolvulaceae	*Dichondra repens*	Kidney Weed
Chenopodiaceae	*Einadia hastata*	Berry Saltbush
Chenopodiaceae	*Einadia trigonos*	Fishweed
Asteraceae	*Euchiton involucratus*	Star Cudweed
Euphorbiaceae	*Euphorbia peplus**	Spurge
Cyperaceae	*Fimbristylis dichotoma*	Common Fringe-rush
Apiaceae	*Foeniculum vulgare**	Fennel
Asteraceae	*Galinsoga parviflora**	Potato Weed
Rubiaceae	*Galium proquinquum*	Bedstraw
Asteraceae	*Gamochaeta spicata**	Cudweed
Geraniaceae	*Geranium homeanum*	Northern Cranesbill
Clusiaceae	*Hypericum gramineum*	Small St Johns Wort
Asteraceae	*Hypochaeris radicata**	Flatweed
Poaceae	*Imperata cylindrica* var. *major*	Blady Grass
Lobeliaceae	*Stoma fluviatilis*	Swamp Isotome
Juncaceae	*Juncus acutus* subsp. *acutus**	Sharp Rush
Juncaceae	*Juncus subsecundus*	Finger Rush
Juncaceae	*Juncus usitatus*	Common Rush
Brassicaceae	*Lepidium africanum**	Common Peppercress
Brassicaceae	*Lepidium didymum**	Lesser Swinecress
Poaceae	*Lolium perrenne**	Perennial Ryegrass
Lomandraceae	*Lomandra multiflora* subsp. *multiflora*	Many-flowered Mat-rush
Fabaceae	*Lotus suaveolans**	Hairy Bird's Foot Trefoil
Malvaceae	*Malva parviflora**	Small-flowered Mallow
Malvaceae	*Malva sylvestris**	Tall Mallow

Table 3.1 – Flora observations for the subject site

Family	Scientific Name	Common Name
Fabaceae	*Medicago polymorpha**	Burr Medic
Lamiaceae	*Mentha satureioides*	Native Pennyroyal
Poaceae	*Microlaena stipoides* var. *stipoides*	Weeping Rice Grass
Malvaceae	*Modiola caroliniana**	Red-flowered Mallow
Oxalidaceae	*Oxalis corniculata**	Yellow Wood Sorrel
Oxalidaceae	*Oxalis perrenans*	-
Poaceae	*Paspalum dilatatum**	Paspalum
Poaceae	*Paspalum distichum*	Water Couch
Poaceae	*Pennisetum clandestinum**	Kikuyu
Polygonaceae	*Persicaria decipiens*	Slender Knotweed
Euphorbiaceae	*Phyllanthus virgatus*	-
Plantaginaceae	*Plantago lanceolata**	Lamb's Tongues
Poaceae	*Poa annua**	Winter Grass
Euphorbiaceae	*Poranthera microphylla*	
Portulacaceae	*Portulaca oleracea*	Purslane
Asteraceae	*Pseudognaphalium luteo-album*	Cudweed
Ranunculaceae	*Ranunculus muricatus**	Sharp Buttercup
Ranunculaceae	*Ranunculus plebeius*	Hairy Buttercup
Iridaceae	*Romulea rosea* var. *australis**	Onion Grass
Polygonaceae	*Rumex crispus**	Curled Dock
Asteraceae	*Senecio madagascariensis**	Fireweed
Asteraceae	*Senecio quadridentatus*	Cotton Fireweed
Malvaceae	*Sida rhombifolia**	Paddy's Lucerne
Brassicaceae	*Sisymbrium orientale**	Indian Hedge Mustard
Solanaceae	*Solanum linnaeanum**	Apple of Sodom
Solanaceae	*Solanum nigrum**	Black Nightshade
Solanaceae	*Solanum prinophyllum*	Forest Nightshade
Asteraceae	*Soliva sessilis**	Bindyi
Asteraceae	*Sonchus oleraceus**	Common Sow-thistle
Poaceae	*Sporobolus africanus**	Parramatta Grass
Asteraceae	*Taraxacum officinale**	Dandelion
Poaceae	*Themeda australis*	Kangaroo Grass
Fabaceae	*Trifolium campestre**	Hop Clover
Fabaceae	*Trifolium repens**	White Clover
Juncaginaceae	*Triglochin procera*	Water Ribbons
Typhaceae	*Typha domingensis*	Narrow-leaved Cumbungi
Typhaceae	*Typha orientalis*	Broad-leaved Cumbungi
Urticaceae	*Urtica urens**	Small Nettle
Verbenaceae	*Verbena bonariensis**	Purpletop
VINES		
Apocnyaceae	*Araujia sericifera**	Mothvine
Asteraceae	*Delairea odorata**	Cape Ivy
Fabaceae	*Glycine clandestina*	Twining Glycine
Convolvulaceae	*Polymeria calycina*	Bindweed
Fabaceae	*Vicia sativa* subsp. *sativa**	Common Vetch
Species name^{TS} = Threatened Species * = Introduced Species		

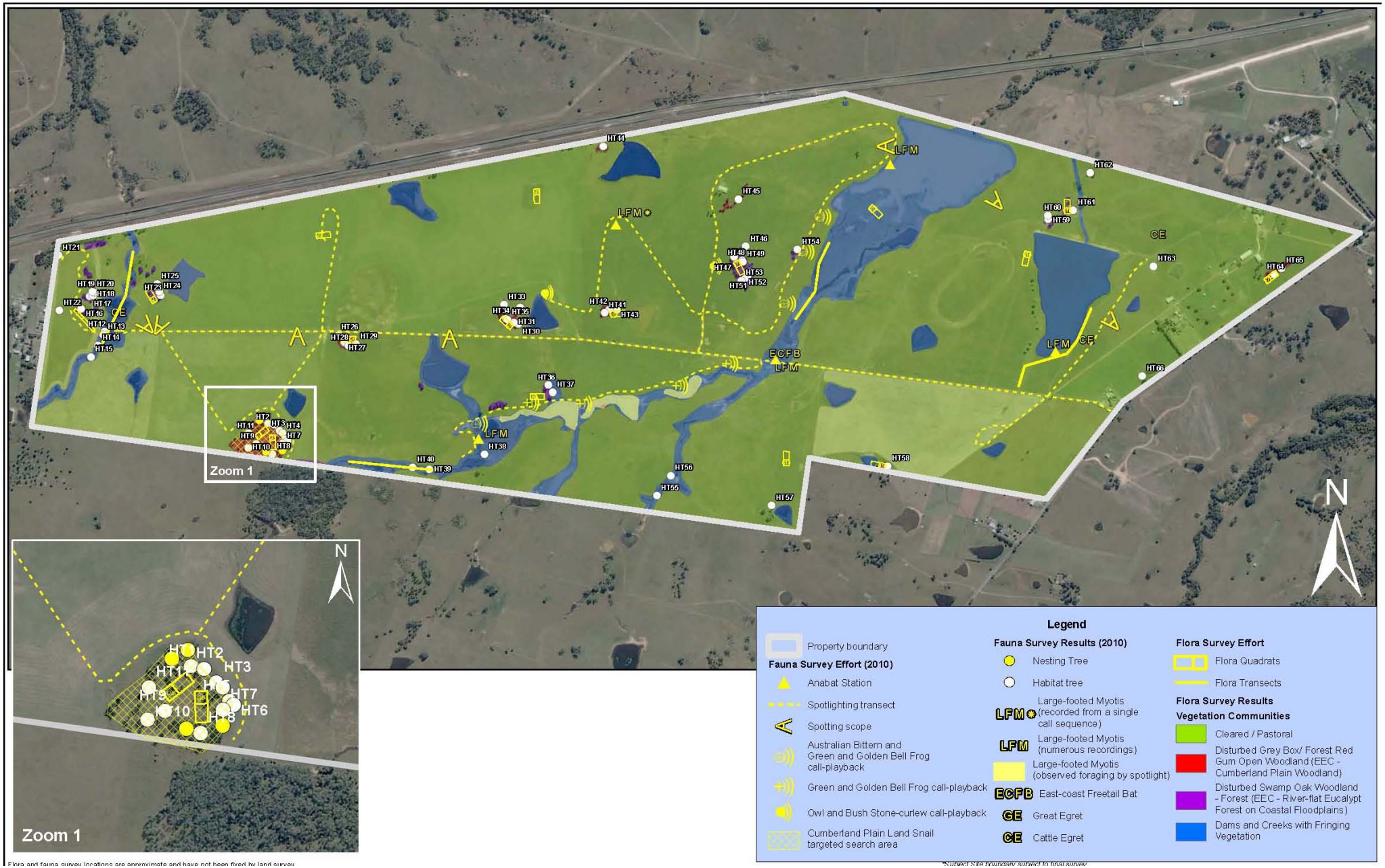

Figure 1 Flora and Fauna Survey Effort & Results

3.2 Fauna results

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

Table 3.2 – Fauna observations for the study area

Common name	Scientific name	Method observed
Birds		**Sept 2010**
Australasian Grebe	*Tachybaptus novaehollandiae*	O C
Australian Hobby	*Falco longipennis*	O C
Australian Magpie	*Gymnorhina tibicen*	O C
Australian Pelican	*Pelecanus conspicillatus*	O
Australian Raven	*Corvus coronoides*	O C
Australian Wood Duck	*Chenonetta jubata*	O Sp
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	O C
Black-fronted Dotterel	*Elseyornis melanops*	O C
Black Swan	*Cygnus atratus*	O Sp
Brown Falcon	*Falco berigora*	O C
Brown Quail	*Coturnix ypsilophora*	O C
Chestnut Teal	*Anas castanea*	O
Common Myna *	*Acridotheres tristis*	O C
Common Starling *	*Sturnus vulgaris*	O C
Crested Pigeon	*Ocyphaps lophotes*	O C
Eastern Rosella	*Platycercus eximius*	O C
Fairy Martin	*Hirundo ariel*	O C
Galah	*Cacatua roseicapilla*	O C
Golden-headed Cisticola	*Cisticola exilis*	O C
Great Cormorant	*Phalacrocorax carbo*	O
Great Egret	*Ardea alba*	O C
Grey Fantail	*Rhipidura fuliginosa*	O C
Little Corella	*Cacatua sanguinea*	O C
Little Pied Cormorant	*Phalacrocorax melanoleucos*	O C Sp
Magpie-lark	*Grallina cyanoleuca*	O C
Masked Lapwing	*Vanellus miles*	O C Sp
Nankeen Kestrel	*Falco cenchroides*	O
Noisy Miner	*Manorina melanocephala*	O C
Pacific Black Duck	*Anas superciliosa*	O Sp
Purple Swamphen	*Porphyrio porphyrio*	O C
Red-rumped Parrot	*Psephotus haematonotus*	O C
Richard's Pipit	*Anthus novaeseelandiae*	O C
Rock Dove *	*Columba livia*	O
Spotted Turtle-Dove *	*Streptopelia chinensis*	O C
Superb Fairy-wren	*Malurus cyaneus*	O C
Willie Wagtail	*Rhipidura leucophrys*	O C
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	O C
Yellow-billed Spoonbill	*Platalea flavipes*	O
Mammals		
Brown Hare *	*Lepus lepus*	Sp
Chocolate Wattled Bat	*Chalinolobus morio*	A
Domesticated Cattle *	*Bos taurus*	O
Domesticated Dog *	*Canis familiaris*	O
Domesticated Sheep	*Ovis aries*	O
East-coast Freetail-bat [TS]	*Micronomus norfolkensis*	A
Eastern Freetail-bat	*Mormopterus ridei*	A

Table 3.2 – Fauna observations for the study area

Common name	Scientific name	Method observed
Eastern Grey Kangaroo	*Macropus giganteus*	Sp
European Red Fox *	*Vulpes vulpes*	Sp
Gould's Wattled Bat	*Chalinolobus gouldii*	A
Horse *	*Equus caballus*	O
Large-footed Myotis[TS]	*Myotis macropus*	A
White-striped Mastiff-bat	*Austronomus australis*	A [PR]
Reptiles		
Bar-sided Skink	*Eulamprus tenius*	O
Cream-striped Shining Skink	*Cryptoblepharus virgatus*	O
Red-bellied Black Snake	*Pseudechis porphyriacus*	O
Amphibians		
Common Eastern Froglet	*Crinia signifera*	C
Dusky Toadlet	*Uperoleia fusca*	C
Dwarf Tree Frog	*Litoria fallax*	C
Striped Marsh Frog	*Limnodynastes peronii*	C
Spotted Marsh Frog	*Limnodynastes tasmaniensis*	C
Whistling Tree Frog	*Litoria verreauxii*	C
Fish		
Mosquitofish *	*Gambusia holbrooki*	O
Common Carp *	*Cyprinus carpio*	O
Mollusc		
Common Garden Snail *	*Helix aspersa*	S

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
E	-	Trap (Elliott, cage, etc)	S	-	Habitat Search
Sp	-	Spotlight	Sc	-	Scat, Track or Sign Identification

4 ECOLOGICAL ASSESSMENT

4.1 Previous surveys reviewed

Vegetation of the Cumberland Plain (NPWS 2003)

An extensive survey was undertaken across the Cumberland Plain and released in 2003. This vegetation mapping shows some remnant low quality Shale Plains Woodland and low quality Alluvial Woodland.

Botanical survey undertaken by *Travers bushfire & ecology* would agree that these vegetation communities exist within the subject site. Given the extensive clearing and pastoral activities, remnant vegetation is generally low condition.

Natural Vegetation of the Penrith area 1:100,000 Vegetation Series (Benson, 1992).

This map shows the subject site as cleared. The vegetation mapping is quite course and does not pick up small remnants of say less than 2ha. Larger remnants in the Orchard Hills area 1-2km north were noted as Grey Box Woodland.

4.2 Flora species

A total of one hundred and eleven (111) flora species were observed within the subject site during the survey. Of these, fifty species (50) were native, including those species which have been planted, for example some of the Melaleuca species and *Grevillea robusta* (Silky Oak).

It should be noted that some of the landscaping species in close proximity to the dwellings have not been surveyed and thus added to the count of species present on site.

All species are listed in Table 3.1.

4.3 Vegetation communities

Four (4) vegetation communities were identified within the subject site through aerial photographic interpretations and extensive ground truthing. These include;

- Cleared / Pastoral
- Disturbed Grey Box / Forest Red Gum Open Woodland (EEC – Cumberland Plain Woodland)
- Disturbed Swamp Oak Woodland - Forest (EEC – River-flat Eucalypt Forest on Coastal Floodplains)
- Dams and Creeks with Fringing Vegetation

Note 1 – planted vegetation such as lines of trees have been lumped into the Cleared / Pastoral vegetation community

Cleared / Pastoral

This vegetation community covers the majority of the subject site (393.40 ha – 86.46 %) and consists of a grassed landscape with a very occasional tree to less than 2% canopy cover overall. This vegetation community takes into account the planted vegetation and tree lines in the far eastern portion of the subject site.

Due to the pastoral nature of the vegetation, the projected foliage cover of exotic species was on average around 90%, compared to approximately 10% native foliage cover.

Common Species

Some common planted trees or shrubs include *Eucalyptus microcorys* (Tallowwood), *Melaleuca armillaris* (Bracelet Honey Myrtle) and *Melaleuca nodosa* (Ball Honey Myrtle).

Common native understorey species include *Chloris truncata* (Windmill Grass), *Microlaena stipoides* var. *stipoides* (Weeping Grass), *Cynodon dactylon* (Common Couch), *Phyllanthus virgatus* (Wiry Spurge) and *Hypericum gramineum* (Small St Johns Wort).

Common exotic understorey species include *Pennisetum clandestinum* (Kikuyu), *Senecio madagascariensis* (Fireweed), *Cerastrium glomeratum* (Mouse-ear Chickweed), *Axonopus fissifolius* (Narrow-leaf Carpet Grass), *Sonchus oleraceus* (Common Sow-thistle), *Plantago lanceolata* (Ribwort), *Romulea rosea* var. *australis* (Onion Weed), *Lepidium africanum* (Common Peppercress), *Malva parviflora* (Small-flowered Mallow), *Trifolium repens* (White Clover) and *Modiola caroliniana* (Red-flowered Mallow).

Photo 1 – An example of pastoral lands in the central-western portion of the subject site

Photo 2 – A line of planted Tallowwood trees in the far east of the subject site. Photo looking into the site off Luddenham Road.

Disturbed Grey Box / Forest Red Gum Open Woodland (EEC – Cumberland Plain Woodland)

This vegetation community of predominantly planted trees covers approximately 3.3 ha – 0.73 % of the subject site and occurs as small, isolated and fragmented patches of open woodland throughout the subject site, outside of any flood prone lands. There has been clearing amongst remnant patches, being that the entire shrub layer has been removed and some canopy has been thinned such that the density of trees is quite low. Remnant trees, on the whole are in a poor to moderate condition whereby the upper portion appears to suffering some form of dieback.

All patches of vegetation would be regarded as 'low condition' under the Biometric assessment except one (1) remnant along the southern boundary in the western portion of the subject site. Refer to Section 4.5 for further explanation on the EECs.

Common Species

Canopy
Eucalyptus moluccana (Grey Box) and *Eucalyptus tereticornis* (Forest Red Gum) with a projected foliage cover of up to 15% however more likely to be closer to 5-10%. Canopy height typically varies from 15-25m.

Midstorey
The midstorey is absent except for the very occasional noxious weed (class 4) *Lycium ferocissimum* (African Boxthorn).

Ground Layer
The majority of the ground layer of vegetation is pastoral and is grazed upon by cattle, with a percent foliage cover of >95%. Having grazing animals within these small fragmented remnants, the percentage of exotic species far outweighs that of native species.

Common species include *Chloris truncata* (Windmill Grass), *Microlaena stipoides* var. *stipoides* (Weeping Grass), *Phyllanthus virgatus* (Wiry Spurge), *Solanum prinophyllum* (Forest Nightshade), *Hypericum gramineum* (Small St Johns Wort), *Plantago lanceolata** (Lamb's Tongues), *Malva parviflora** (Small-flowered Mallow), *Senecio madagascariensis**

(Fireweed), *Trifolium repens** (White Clover), *Modiola caroliniana** (Red-flowered Mallow), *Cirsium vulgare** (Spear Thistle), *Chloris gayana** (Rhodes Grass), *Soliva sessilis** (Bindyi), *Taraxacum officinale** (Dandelion), *Axonopous fissifolius** (Narrow-leaved Carpet Grass) and *Cerastrium glomeratum** (Mouse-ear Chickweed).

Photo 3 – The largest of the Cumberland Plain Woodland remnants along the southern boundary in the west of the subject site.

Disturbed Swamp Oak Woodland - Forest (EEC – River-flat Eucalypt Forest on Coastal Floodplains)

This vegetation community occurs as small fragments of woodland or forest in association with riparian areas. They typically occur as small remnants of a River-flat Eucalypt Forest without the Eucalypt presence, possibly due to previous clearance and are mostly 0.02-0.15ha in size. All remnants fall below the 0.25ha biometric assessment threshold therefore would be classed as 'low condition'. This vegetation community covers approximately 2.3 ha – 0.51 % of the subject site.

All remnants have an absent shrub layer, and the ground layer is dominated by pastoral grasses, annual and perennial exotic species of between 80-100%.

Common Species

Canopy
Casuarina glauca (Swamp Oak) with a variable PFC of between 8-40%, however usually 10-15%. Only one or two remnants have a handful of *Eucalyptus tereticornis* (Forest Red Gum). The canopy height typically varies between 12-18m.

Midstorey
The midstorey is absent except for the very occasional noxious weed (class 4) *Lycium ferocissimum* (African Boxthorn).

Ground Layer

The ground layer is dominated by exotic species typically greater than 80% cover. Common species include *Malva parviflora** (Small-flowered Mallow), *Malva sylvestris** (Tall Mallow), *Senecio madagascariensis** (Fireweed), *Ambrosia tenuifolia** (Lacy Ragweed), *Rumex crispus** (Curled Dock), *Cirsium vulgare** (Spear Thistle), *Lepidium africanum** (Common Peppercress), *Trifolium repens** (White Clover), *Modiola caroliniana** (Red-flowered Mallow), *Cirsium vulgare** (Spear Thistle), *Soliva sessilis** (Bindyi) and *Cerastrium glomeratum** (Mouse-ear Chickweed).

Photo 4 – A remnant of Swamp Oak trees in the centre of the subject site adjacent to the overhead transmission wires

Dams and Creeks with Fringing Vegetation

This vegetation community exists in association with the dams, creeks, drainage lines and soak areas within the subject site. There are many constructed dams across the site, several of which are along creek and drainage lines. This vegetation community covers approximately 56 ha – 12.31 % of the subject site.

Photo 5 – One of the dams in the central portion of the subject site with fringing rushes

The vegetation within these areas is typically sparse within the inundated areas consisting of sedge species such as *Typha domingensis* (Narrow-leaved Cumbungi), *Typha orientalis* (Broad-leaved Cumbungi), *Triglochin procera* (Water Ribbons), *Juncus acutus* subsp. *acutus** (Sharp Rush), *Juncus usitatus, Juncus subsecundus* (Finger Rush), *Paspalum distichum* (Water Couch), *Fimbristylis dichotoma* (Common Fringe-sedge), *Isotoma fluviatilis* (Swamp Isotome) and *Azolla pinnata* (Ferny Azolla).

Groundcovers immediately adjacent to inundated areas may include *Centella asiatica* (Indian Pennywort), *Dichondra repens* (Kidney Weed), *Microlaena stipoides* var. *stipoides* (Weeping Grass), *Malva parviflora** (Small-flowered Mallow), *Senecio madagascariensis** (Fireweed), *Rumex crispus** (Curled Dock), *Cirsium vulgare** (Spear Thistle), *Lepidium africanum** (Common Peppercress), *Trifolium repens** (White Clover), *Modiola caroliniana** (Red-flowered Mallow), *Cirsium vulgare** (Spear Thistle), *Soliva sessilis** (Bindyi) and *Cerastrium glomeratum** (Mouse-ear Chickweed).

4.4 Threatened flora legislation

No threatened flora species were observed within the subject site over the two-day field survey.

Two (2) endangered ecological communities (EECs) – Cumberland Plain Woodland and River-flat Eucalypt Forest on Coastal Floodplains – were observed within the subject site.

Cumberland Plain Woodland is listed under state legislation as a *critically endangered ecological community.* Under national legislation it is referred to as *Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest.*

No ROTAP species were observed within the subject site.

4.4.1 State legislative matters

TSC Act – A search of the *Atlas of NSW Wildlife* (DECCW 2010) database indicated that ten (10) species have been recorded within a 10 km radius of the study area. Those species are listed in Table 4.2.

Of those ten (10) threatened flora species, two (2) have the potential to occur within the subject site. Those species are *Pimelea spicata* and *Hypsela sessiflora.* Neither species was observed during field surveys.

Pimelea spicata habitat exists only as marginal potential and only within the far eastern remnant of Cumberland Plain Woodland.

Hypsela sessiflora may have potential habitat around the drainage line / dam areas or within remnants of the Swamp Oak vegetation community but it would be marginal at most given the current grazing activities.

4.4.2 Endangered populations

There are two (2) known endangered populations within the Penrith LGA or within 10km, they are;

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

- *Dillwynia tenuifolia*, Kemps Creek

Neither species are represented within the subject site.

4.4.3 National legislative matters

A review of the schedules of the *EPBC Act* indicated the potential for eleven (11) threatened flora species to occur within a 10km radius of the site (Table 4.2).

Of those twelve (12) threatened flora species, one (1) has the potential to occur within the subject site, *Pimelea spicata.* No nationally threatened or endangered listed species were observed within the subject site.

Pimelea spicata habitat exists only as marginal potential and only within the far eastern remnant of Cumberland Plain Woodland.

Future actions upon the subject site are not likely to significantly affect any nationally listed threatened species therefore a referral to DEWHA should not be required. Even though the larger remnant of Cumberland Plain Woodland appears to be in poor condition (near the southern boundary in the western portion of the subject site), it does not satisfy the criteria under the biometric assessment to be classed as low condition (see section 4.5) and may require referral to DEWHA.

The remnant should be assessed again at the development application stage given the current condition of trees within the remnant – poor quality with many dead limbs and upper portions. If these trees were to senesce more, it is possible that the overstorey foliage cover may satisfy a low condition under a biometric assessment.

4.5 Endangered ecological communities

Two (2) EECs were located onsite, namely;

- River-flat Eucalypt Forest on Coastal Floodplains
- Cumberland Plain Woodland

A biometric style assessment was undertaken to determine the condition of vegetation across the subject site. Figure 1 shows the location of remnant patches.

Cumberland Plain Woodland and River-flat Eucalypt Forest on Coastal Floodplains was located in several places across the subject site and all patches were less than 0.25ha (except one) which meant they fall into a *low condition* in accordance with the Biometric assessment.

When applying the Biometric assessment a number of conditions apply. To be called *low condition,* the vegetation within the assessed quadrat must conform to the following;

- The over-storey per cent foliage cover is <25% of the lower value of the over-storey per cent foliage cover benchmark for that vegetation type and

- <50% of vegetation in the ground layer is indigenous species or >90% is ploughed or fallow or

- Polygons or remnants of vegetation are less than 0.25ha.

Table 4.1 – Biometric assessment

Quadrat	Vegetation Community	Native Over-storey % foliage cover	Total % of Native Ground Covers foliage cover	Exotic Plants % foliage cover	Native Species Richness	Exotic Species Richness	Satisfies Criteria for Low Condition?
1	RFEF	40	2	95	3	19	Yes – remnant is under 0.25ha
2	RFEF	10	6	90	3	18	Yes – remnant is under 0.25ha
3	Cleared	0	8	90	3	9	Not part of an EEC
4	CPW	8	11	85	6	17	No – remnant is over 0.25ha and the foliage cover in the overstorey exceeds 5%
5	CPW	7	20	80	9	19	No – remnant is over 0.25ha and the foliage cover in the overstorey exceeds 5%
6	CPW	4	13	85	6	16	Yes – remnant is under 0.25ha
7	RFEF	20	13	85	5	18	Yes – remnant is under 0.25ha
8	CPW	10	14	65	9	15	Yes – remnant is under 0.25ha
9	Cleared	0	11	80	3	14	Not part of an EEC
10	CPW	5	15	85	3	15	Yes – remnant is under 0.25ha
11	RFEF	8	8	90	3	12	Yes – remnant is under 0.25ha
12	Dam	0	75	25	6	7	Not part of an EEC
13	Cleared	0	9	90	2	12	Not part of an EEC
14	Cleared	0	10	90	2	10	Not part of an EEC
15	CPW	3	4	95	3	13	Yes – remnant is under 0.25ha
16	RFEF	5	5	90	3	13	Yes – remnant is under 0.25ha
17	CPW	7	22	70	10	19	Yes – remnant is under 0.25ha

CPW – Cumberland Plain Woodland
RFEF – River-flat Eucalypt Forest

Benchmark for CPW is 20.5-25.5% foliage cover for native overstorey species
Benchmark for RFEF is 27.5-32.5% foliage cover for native overstorey species

To be in low condition;

the native overstorey needs to be no greater than 5% for CPW and 7% for RFEF and exotic species comprise more than 50% of the combined foliage cover with native species in the understorey.

OR

The remnant must not exceed 0.25ha.

Quadrats 4 and 5 were undertaken in a remnant patch of Cumberland Plain Woodland of approximately 2ha. The average foliage cover exceeds the benchmark figure for a 'low condition' status under the Biometric assessment.

Vegetation classified as low condition under a Biometric assessment may be removed. That classified otherwise will require any one of the following;

- EPBC referral
- Negotiation with Council
- Vegetation management plan

- Maintain or improve test – that which is removed can be restored to the same quantity or more on site.

4.6 Threatened flora species habitat assessment

Table 4.2 below provides an assessment of threatened flora species habitat likely to occur within the subject site.

Table 4.2 – Threatened flora habitat assessment

Scientific name	Growth form and habitat requirements	Conservation status	Comments	TSC Act	EPBC Act
Acacia pubescens DECCW EPBC	Spreading shrub 1-4 m high open sclerophyll growing in open forest and woodlands on clay soils. Distribution limits N-Bilpin S-Georges River.	Wollemi NP, Scheyville NP	All records within 10km occur to the south-east of the subject site. Nearest record is 8km away. No potential habitat given the current pastoral activities. Not observed.	V	V
Cryptostylis hunteriana EPBC	Saprophytic orchid. Grows in swamp heath on sandy soils. Distribution limits N-Gibraltar Range S-south of Eden.	Gibraltar Range NP, Ku-ring-gai Chase NP, Ben Boyd NP	No records within 10km. No potential habitat present. Not observed.	V	V
Cynanchum elegans EPBC	Climber or twiner to 1 m. Grows in rainforest gullies, scrub & scree slopes. Distribution limits N-Gloucester S-Wollongong.	Camel's Hump NR, Woko NP, Booti Booti NP, Oxley Wild Rivers NP, Goulburn River NP, Glenrock SRA, Kooragang Island NR, Camels Hump NR, New England NP, Sea Acres NR, Wollemi NR Darawank NR Khappingaht NR	No records within 10km. No potential habitat present. Not observed.	E1	E
Dillwynia tenuifolia DECCW	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.	Blue Mountains NP, Windsor Downs NR, Yengo NP, Agnes Banks NR, Scheyville NP, Castlereagh NR, Mulgoa NR	Nearest record is 1km away to the north within existing better quality bushland. Potential habitat would exist if the site was not grazed upon like current practices allow. Not observed.	V	V
Eucalyptus benthamii DECCW EPBC	Blue gum to 40 m high. Wet forest on sandy alluvial soils. Distribution limits N-Yarramundi S-Bents Basin.	Blue Mountains NP, Bents Basin SRA	Nearest record is 7km away. No potential habitat present. Not observed.	V	V

Table 4.2 – Threatened flora habitat assessment

Scientific name	Growth form and habitat requirements	Conservation status	Comments	TSC Act	EPBC Act
Grevillea juniperina subsp. Juniperina DECCW	Erect to spreading shrub 0.5-1.5 metres tall. Grows on laterite and Tertiary alluvium. Distribution limits St Marys-Londonderry-Prospect.	Castlereagh NR	Nearest record is 1km away to the north within existing better quality bushland. Potential habitat would exist if the site was not grazed upon like current practices allow. Not observed.	V	-
Grevillea parviflora subsp parviflora DECCW EPBC	Open to erect shrub to 1 metre. Grows in woodland on light clayey soils Distribution limits N-Cessnock S-Appin.	Werakata NP	Nearest record is 7km away. No potential habitat present. Not observed.	V	V
Hypsela sessiliflora DECCW	Prostrate herb, rooting at nodes, growing in damp places on the Cumberland Plain. Only known from 2 sites in Erskine Park, but once occurred more extensively.	Not currently known from conservation reserves	Nearest record is 5km away. Marginal habitat is present. Not observed.	E1	Extinct
Micromyrtus minutiflora DECCW	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.	Castlereagh NR	Nearest record is 9km away. Only one record within 10km. No potential habitat present. Not observed.	E1	V
Persoonia nutans DECCW EPBC	Erect to spreading shrub. Grows in dry sclerophyll forest and woodland on laterite and alluvial sands. Distribution limits Cumberland Plain.	Agnes Banks NR, Windsor Downs NR, Castlereagh NR	Nearest record is 5km away. No potential habitat present. Not observed.	E1	E
Pimelea curviflora var. curviflora EPBC	Woody herb or sub-shrub to 0.2-1.2 m high. Grows on Hawkesbury sandstone near shale outcrops. Distribution Sydney.	Not currently known from conservation reserves.	No records within 10km. No potential habitat present. Not observed.	V	V
Pimelea spicata DECCW EPBC	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.	Killalea SRA	Nearest record is 3km away. Only 4 records within 10km. Marginal habitat present only within the far eastern remnant of Cumberland Plain Woodland. Not observed.	E1	E

Table 4.2 – Threatened flora habitat assessment

Scientific name	Growth form and habitat requirements	Conservation status	Comments	TSC Act	EPBC Act
Pomaderris brunnea EPBC	Shrub to 3 metres high. Confined to Upper Nepean and Colo Rivers where it grows in open forest.	Wollemi NP	No records within 10km. No potential habitat present. Not observed.	V	V
Pultenaea parviflora DECCW EPBC	Erect shrub. Grows in dry sclerophyll forest at the intergrade between Tertiary Alluviums and Wianamatta Shales. Distribution limits Cumberland Plain.	Scheyville NP, Windsor Downs NR, Castlereagh NR	Nearest record is 1km away to the north within existing better quality bushland. Potential habitat would exist if the site was not grazed upon like current practices allow. Not observed.	E1	V
Thelymitra sp. 'Kangaloon' EPBC	A terrestrial orchid with dark blue flowers, presented in mid-late spring. Only known from the Robertson area in the Southern Highlands. Often in association with the endangered ecological community *Temperate Highland Peat Swamps on Sandstone.*	Unknown	Outside of geographic range. No potential habitat present. Not observed.	-	Critic. E

DECCW	- 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

4.7 Fauna species

A total of sixty-three (63) fauna species were observed within or in close proximity to the subject site during the survey. This number comprised 38 species of bird, 13 species of mammal, 3 species of reptile, 6 species of amphibian, 2 exotic species of fish and 1 mollusc.

All species are listed in Table 3.2.

Of interest to note, three (3) separate species of falcon were observed actively foraging within subject site. These include the Nankeen Kestrel (*Falco cenchroides*), Australian Hobby (*Falco longipennis*) and Brown Falcon (*Falco berigora*). Falcons do not build nests but typically use nests of other raptors or crows. Nesting by these species, particularly given the time of year of survey may be taking place within or near to the subject site. Large nests located within the subject site were therefore also noted during hollow tree surveys (see Figure 1).

4.8 Threatened fauna legislation

Two (2) threatened fauna species – Large-footed Myotis (*Myotis macropus*) and East-coast Freetail Bat (*Micronomus norfolkensis*) – were recorded within the subject site.

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

- Green and Golden Bell Frog
- Black-necked Stork
- Australasian Bittern
- Little Eagle
- Bush Stone-curlew
- Australian Painted Snipe
- Swift Parrot
- Barking Owl
- Masked Owl
- Speckled Warbler
- Black-chinned Honeyeater
- Regent Honeyeater
- Varied Sittella
- Scarlet Robin
- Flame Robin
- Grey-headed Flying-fox
- East-coast Freetail Bat *
- Eastern Bentwing-bat
- Large-footed Myotis *
- Greater Broad-nosed Bat

Species indicated with a "*" were recorded within the subject site during surveys. The site generally provides only sub-optimal or low potential habitat for the majority of the remaining listed species.

4.8.1 State legislative matters

TSC Act – A search of the *Atlas of NSW Wildlife* (DECCW, 2010) database for threatened species resulted in records of thirty-six (36) threatened fauna species within a 10km radius of the subject site. These species are listed in Table 4.4 and are considered for potential habitat within the subject site.

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

4.8.2 Endangered populations

There is one listed endangered fauna population that has a considered range extending into the Penrith LGA. This is the White-fronted Chat (*Epthianura albifrons*) in the Sydney Metropolitan Catchment Management Authority area. Whilst there is suitable habitat for this species along the soaks and rushes of the central drainage line, it was not recorded during survey or previously within 10km of the site and thus is not expected to occur and provide a constraint to development.

4.8.3 National legislative matters

EPBC Act – A review of the schedules of the *EPBC Act* identified the presence of seventeen (17) threatened fauna species or species habitat likely to occur within a 10km radius of the subject site. These species have been listed in Table 4.4 and assessed for habitat suitability and potential to occur.

Of those seventeen (17) species, five (5) were considered to have potential habitat within the subject site. No nationally listed threatened fauna species were recorded within the subject site during survey.

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 are assessed in Table 4.3.

Table 4.3 - Migratory fauna habitat assessment

COMMON NAME ***Scientific Name***	PREFERRED HABITAT	COMMENTS
White-bellied Sea Eagle (*Haliaeetus leucogaster*)	Coasts, islands, estuaries, inlets, large rivers, inland lakes, reservoirs. *Sedentary; dispersive.*	Sub-optimal roosting, foraging and nesting habitat present. Not recorded during surveys. 5 records within 10km, the closest and most recent located 3km to the SE in 2008. Potential to occur. This species is easy to detect during survey in such open country. No nesting is definitely occurring within the subject site. No likely significant impact based on survey results.
White-throated Needletail (*Hirundapus caudacutus*)	Airspace over forests, woodlands, farmlands, plains, lakes, coasts, towns; companies forage often along favoured hilltops and timbered ranges. *Breeds Siberia, Himilayas, east to Japan. Summer migrant to eastern Australia.*	Suitable roosting and foraging habitat present. Not recorded during surveys. No records within 10km. Potential to occur but not likely to utilise the site for any ecological value.
Rainbow Bee-eater (*Merops ornatus*)	Open woodlands with sandy, loamy soil; sandridges, sandspits, riverbanks, road cuttings, beaches, dunes, cliffs, mangroves, rainforest, woodlands, golf courses. *Breeding resident in northern Australia. Summer breeding migrant to south-east & south-west Australia.*	No suitable habitat present.
Black-faced Monarch (*Monarcha melanopsis*)	Rainforests, eucalypt woodlands; coastal scrubs; damp gullies in rainforest, eucalypt forest; more open woodland when migrating. *Summer breeding migrant to coastal south-east Australia, otherwise uncommon*.	No suitable habitat present.
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.*	Marginally suitable habitat on migration present. Not recorded during surveys. 3 records within 10km all prior to 2005. No records within 8km. Not expected to occur. No likely impacts.

Table 4.3 - Migratory fauna habitat assessment

COMMON NAME ***Scientific Name***	PREFERRED HABITAT	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.*	Marginally suitable habitat on migration present. Not recorded during surveys. 8 records within 10km all prior to 2007. No records within 7km. Not expected to occur. No likely impacts.
Great Egret (*Ardea alba*)	Shallows of rivers, estuaries; tidal mudflats, freshwater wetlands; sewerage ponds, irrigation areas, larger dams, etc. *Dispersive; cosmopolitan.*	Suitable roosting and foraging habitat present. Suitable nesting habitat is not considered to be present. Recorded foraging within the far western dam during surveys. Given the locality provides extensive areas of similar foraging and host species habitat, removal of habitat within the site is not considered likely to cause any significant impact on this species. Retention of the central drainage soaks will likely be a usable foraging resource for this species following surrounding development. Retention of the central drainage soaks is recommended for this species.
Cattle Egret (*Ardea ibis*)	Stock paddocks, pastures, croplands, garbage tips, wetlands, tidal mudflats, drains. *Breeds in summer in warmer parts of range including NSW*.	Suitable roosting and foraging habitat present. Suitable nesting habitat is not considered to be present. 6 individuals were recorded foraging with cattle as a host during surveys. Given the locality provides extensive areas of similar foraging and host species habitat, removal of habitat within the site is not considered likely to cause any significant impact on this species. Retention of the central drainage soaks will likely be a usable foraging resource for this species following surrounding development.

Table 4.3 - Migratory fauna habitat assessment

COMMON NAME ***Scientific Name***	PREFERRED HABITAT	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.*	Suitable foraging habitat along the central drainage line, dam fringes and associated seepages/shallows. Not recorded during surveys. 3 records within 10km, the most recent and closest recorded by *Travers bushfire & ecology* approximately 1.5km to the NNE in 2009 in less suitable habitat. Potential to occur. Retention of the central drainage and associated shallow soaks is recommended given that there is potential for this species to visit on migration.
Fork-tailed Swift (*Apus pacificus*)	Aerial: over open country, from semi-arid deserts to coasts, islands; sometimes over forests, cities. *Breeds Siberia, Himilayas, east to Japan south-east Asia. Summer migrant to east Australia. Mass movements associated with late summer low pressure systems into east Australia. Otherwise uncommon.*	Suitable roosting and foraging habitat present. Not recorded during surveys. 3 records within 10km prior to 2006. All of these further than 7km away. Potential to occur but not likely to utilise the site for any ecological value.

Conclusion: In respect to migratory birds, a referral to DEWHA would not be required for habitat removal within the subject site. However, retention of the central drainage and associated wetlands is recommended for species recorded and with potential to occur.

4.9 Threatened fauna species habitat assessment

Table 4.4 below provides an assessment of threatened fauna species habitat likely to occur within the subject site.

Table 4.4 - Threatened fauna habitat assessment

COMMON NAME ***Scientific Name***	PREFERRED HABITAT	COMMENTS	TSC Act	EPBC Act
Giant Burrowing Frog *Heleioporus australiacus* DECCW EPBC	Inhabits open forests and riparian forests along non-perennial streams, digging burrows into sandy creek banks. Distribution Limit: N-Near Singleton S-South of Eden.	No suitable habitat present.	V	V
Stuttering Frog *Mixophyes balbus* EPBC	Terrestrial inhabitant of rainforest and wet sclerophyll forests. Distribution Limit: N-near Tenterfield S-South of Bombala.	No suitable habitat present.	E	V

Table 4.4 - Threatened fauna habitat assessment

COMMON NAME ***Scientific Name***	PREFERRED HABITAT	COMMENTS	TSC Act	EPBC Act
Giant Barred Frog *Mixophyes iteratus* EPBC	Terrestrial inhabitant of rainforest and open forests. Distribution Limit: N-Border Ranges National Park. S-Narooma.	No suitable habitat present.	E	E
Red-crowned Toadlet *Pseudophryne australis* DECCW	Prefers sandstone areas, breeds in grass and debris beside non-perennial creeks or gutters. Individuals can also be found under logs and rocks in non breeding periods. Distribution Limit: N-Pokolbin. S-near Wollongong.	No suitable habitat present.	V	-
Green and Golden Bell Frog *Litoria aurea* DECCW EPBC	Prefers the edges of permanent water, streams, swamps, creeks, lagoons, farm dams and ornamental ponds. Often found under debris. Distribution Limit: N-Byron Bay S-South of Eden.	Suitable habitat present. Not recorded during surveys. 4 records within 10km, none since 1999 and none within 4km. Low potential to occur.	E	V
Littlejohn's Tree Frog *Litoria littlejohnii* EPBC	Found in wet and dry sclerophyll forest associated with sandstone outcrops at altitudes 280-1000m on eastern slopes of Great Dividing Range. Prefers flowing rocky streams. Distribution Limit: N-Hunter River S-Eden.	No suitable habitat present.	V	V
Broad-headed Snake *Hoplocephalus bungaroides* EPBC	Sandstone outcrops, exfoliated rock slabs and tree hollows in coastal and near coastal areas. Distribution Limit: N-Mudgee Park. S-Nowra.	No suitable habitat present.	E	V
Black-necked Stork *Ephippiorhynchus asiaticus* DECCW	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.	Suitable foraging habitat present. Not recorded during surveys. 3 records within 10km, none within 4km. No records within 6km since 1978. Low potential to occur.	E	-
Australasian Bittern *Botaurus poiciloptilus* DECCW	Found in or over water of shallow freshwater or brackish wetlands with tall reed beds, sedges, rushes, cumbungi, lignum and also in rice fields, drains in tussocky paddocks, occasionally saltmarsh, brackish wetlands. Distribution Limit: N-North of Lismore. S- Eden.	Suitable foraging habitat present. Not recorded during surveys. 1 record within 10km, recorded 7km to the NW in 2003. Low potential to occur.	V	-

Table 4.4 - Threatened fauna habitat assessment

COMMON NAME ***Scientific Name***	PREFERRED HABITAT	COMMENTS	TSC Act	EPBC Act
Little Eagle *Hieraaetus morphnoides* DECCW	Utilises plains, foothills, open forests, woodlands and scrublands; river red gums on watercourses and lakes. Distribution Limit - N-Tweed Heads. S-South of Eden.	Suitable foraging, roosting and nesting habitat present. Not recorded during surveys. 2 records within 10km, the closest and most recent located 6km east in 2008. Low potential to occur.	V	-
Square-tailed Kite *Lophoictinia isura* DECCW	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.	No suitable habitat present.	V	-
Bush Stone-curlew *Burhinus grallarius* DECCW	Utilises open forests and savannah woodlands, sometimes dune scrub, savannah and mangrove fringes. Distribution Limit: N-Border Ranges National Park. S-Near Nowra.	Marginal suitable habitat present given the large presence of foxes within the subject site. Not recorded during surveys. 2 records within 10km, both at 3km north in 1996. Not likely to occur.	E	-
Australian Painted Snipe *Rostratula australis* EPBC	Most numerous within the Murray-Darling basin and inland Australia within marshes and freshwater wetlands with swampy vegetation. Distribution Limit: N-Tweed Heads. S-South of Eden.	Sub-optimal habitat present. Not recorded during surveys. No records within 10km. Not likely to occur.	V	V
Black-tailed Godwit *Limosa limosa* DECCW	A mainly coastal species feeding along estuarine mudflats, beaches, mangroves and lagoons. Distribution Limit: N-Tweed Heads. S-South of Eden.	No suitable habitat present.	V	-
Gang-gang Cockatoo *Callocephalon fimbriatum* DECCW	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.	No suitable habitat present.	V	-

Table 4.4 - Threatened fauna habitat assessment

COMMON NAME ***Scientific Name***	**PREFERRED HABITAT**	**COMMENTS**	**TSC Act**	**EPBC Act**
Glossy Black-Cockatoo *Calyptorhynchus lathami* DECCW	Open forests with *Allocasuarina* species and hollows for nesting. Distribution Limit: N-Tweed Heads. S-South of Eden.	No suitable habitat present.	V	-
Swift Parrot *Lathamus discolour* DECCW EPBC	Inhabits eucalypt forests and woodlands with winter flowering eucalypts. Distribution Limit: N-Border Ranges National Park. S-South of Eden.	Suitable foraging habitat present. Not recorded during surveys. 7 records within 10km, none within 5km or since 2003. Low potential to occur.	E	E
Barking Owl *Ninox connivens* DECCW	Inhabits principally woodlands but also open forests and partially cleared land and utilises hollows for nesting. Distribution Limits: N-Border Ranges National Park. S-Eden.	Sub-optimal foraging habitat present. Not recorded during surveys. 1 record within 10km, recorded 7km to the NW in 2002. Low potential to occur.	V	-
Powerful Owl *Ninox strenua* DECCW	Forests containing mature trees for shelter or breeding & densely vegetated gullies for roosting. Distribution Limits: N-Border Ranges National Park. S-Eden.	No suitable habitat present.	V	-
Masked Owl *Tyto novaehollandiae* DECCW	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 foraging habitat present. Not recorded during surveys. 11 records within 10km, none within 5km or since 2004. Low potential to occur.	V	-
Sooty Owl *Tyto tenebricosa* DECCW	Tall, dense, wet forests containing trees with very large hollows. Distribution Limit: N-Border Ranges National Park. S-South of Eden.	No suitable habitat present.	V	-
Speckled Warbler *Chthonicola sagittata* DECCW	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.	Marginally suitable habitat present. Not recorded during surveys. 12 records within 10km, the closest & most recent located 2.5km north in 2006. Low potential to occur.	V	-

Table 4.4 - Threatened fauna habitat assessment

COMMON NAME ***Scientific Name***	PREFERRED HABITAT	COMMENTS	TSC Act	EPBC Act
Black-chinned Honeyeater *Melithreptus gularis gularis* DECCW	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.	Sub-optimal habitat present. Not recorded during surveys. 1 record just beyond 10km in 2007. Low potential to occur.	V	-
Regent Honeyeater *Xanthomyza Phrygia* DECCW EPBC	Found in temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts. Distribution Limit: N-Urbanville. S-Eden.	Suitable foraging habitat present. Not recorded during surveys. 3 records within 10km, none within 9km or since 1980. Not likely to occur.	E	E
Varied Sittella *Daphoenositta chrysoptera* DECCW	Open eucalypt woodlands/forests (except heavier rainforests); mallee, inland acacia, coastal tea-tree scrubs; golf courses, shelterbelts, orchards, parks, scrubby gardens. N-Border Ranges National Park. S-South of Eden.	Marginally suitable habitat present. Not recorded during surveys. 23 records within 10km, the closest & most recent located 2km SE in 2009. Low potential to occur.	V	-
Hooded Robin *Melanodryas cucullata cucullata* DECCW	Found in Eucalypt woodlands, *Acacia* scrubland, open forest, and open areas adjoining large woodland blocks, with areas of dead timber. Distribution Limit: N-Central Qld. S-Spencer Gulf SA.	No suitable habitat present.	V	-
Scarlet Robin *Petroica boodang* DECCW	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.	Suitable dispersal habitat present. Not recorded during surveys. 2 records within 10km, the closest located 3km north in 1990 and the most recent 8km west in 2006. Low potential to occur.	V	-
Flame Robin *Petroica phoenicea* DECCW	Summer: forests, woodlands, scrubs, from sea-level to *c.* 1800 m. Autumn-winter: open woodlands, plains, paddocks, golf courses, parks, orchards. Distribution Limit: N northern NSW tablelands. S-South of Eden.	Suitable dispersal habitat present. Not recorded during surveys. 5 records within 10km, none within 7km. Low potential to occur.	V	-

Table 4.4 - Threatened fauna habitat assessment

COMMON NAME ***Scientific Name***	PREFERRED HABITAT	COMMENTS	TSC Act	EPBC Act
Diamond Firetail *Stagonopleura guttata* DECCW	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.	No suitable habitat present.	V	-
Spotted-tailed Quoll *Dasyurus maculatus* DECCW EPBC	Dry and moist open forests containing rock caves, hollow logs or trees. Distribution Limit: N-Mt Warning National Park. S-South of Eden.	No suitable habitat present.	V	E
Koala *Phascolarctos cinereus* DECCW	Inhabits both wet & dry eucalypt forest on high nutrient soils containing preferred feed trees. Distribution Limit: N-Tweed Heads. S-South of Eden.	No suitable habitat present.	V	-
Yellow-bellied Glider *Petaurus australis* DECCW	Tall mature eucalypt forests with high nectar producing species and hollow bearing trees. Distribution Limit- N-Border Ranges National Park. S-South of Eden.	No suitable habitat present.	V	-
Long-nosed Potoroo *Potorous tridactylus* EPBC	Coastal heath and dry and wet sclerophyll forests with a dense understorey. Distribution Limit: N-Mt Warning National Park. S-South of Eden.	No suitable habitat present.	V	V
Brush-tailed Rock-wallaby *Petrogale penicillata* DECCW EPBC	Found in rocky gorges with a vegetation of rainforest or open forests to isolated rocky outcrops in semi-arid woodland country. Distribution Limit: N-North of Tenterfield. S-Bombala.	No suitable habitat present.	E	V
Grey-headed Flying-fox *Pteropus poliocephalus* DECCW EPBC	Found in a variety of habitats including rainforest, mangroves, paperbark swamp, wet and dry open forest and cultivated areas. Forms camps commonly found in gullies and in vegetation with a dense canopy. Distribution Limit: N-Tweed Heads. S-Eden.	Suitable foraging habitat present. Not recorded during surveys. 20 records within 10km, with only 1 record within 5km at 3km north in 2006 suggesting there are no nearby camps in the locality. Potential to occur seasonally within the subject site when flowering trees permit.	V	V

Table 4.4 - Threatened fauna habitat assessment

COMMON NAME ***Scientific Name***	PREFERRED HABITAT	COMMENTS	TSC Act	EPBC Act
East-coast Freetail Bat *Micronomus norfolkensis* DECCW	Inhabits open forests and woodlands foraging above the canopy and along the edge of forests. Roosts in tree hollows, under bark and buildings. Distribution Limit: N-Woodenbong. S-Pambula.	Suitable roosting, foraging and breeding habitat present. Recorded foraging during surveys, located over the dam where the central road bisects the central drainage line.	V	-
Large-eared Pied Bat *Chalinolobus dwyeri* DECCW EPBC	Warm-temperate to subtropical dry sclerophyll forest and woodland. Roosts in caves, tunnels and tree hollows in colonies of up to 30 animals. Distribution Limit: N-Border Ranges Nation Park. S-Wollongong.	No suitable habitat present.	V	V
Eastern Falsistrelle *Falsistrellus tasmaniensis* DECCW	Recorded roosting in caves, old buildings and tree hollows. Distribution Limit: N-Border Ranges National Park. S-Pambula.	No suitable habitat present.	V	-
Eastern Bentwing-bat *Miniopterus orianae oceansis* DECCW	Prefers areas where there are caves, old mines, old buildings, stormwater drains & well timbered areas. Distribution Limit: N-Border Ranges National Park. S-South of Eden.	Suitable foraging and possible roosting habitat within old sheds & buildings. No suitable maternity sites. Not recorded during surveys. 18 records within 10km, none within 5km. Potential to occur given the species high mobility.	V	-
Large-footed Myotis *Myotis macropus* DECCW	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.	Suitable foraging, roosting and breeding habitat present. Recorded foraging over a number of open water bodies within the subject site during survey, including spotlighting individuals hawking the water surface along the central drainage line.	V	-

Table 4.4 - Threatened fauna habitat assessment

COMMON NAME ***Scientific Name***	PREFERRED HABITAT	COMMENTS	TSC Act	EPBC Act
Greater Broad-nosed Bat *Scoteanax rueppellii* DECCW	Inhabits areas containing moist river & creek systems especially tree lined creeks. Distribution Limit: N-Border Ranges National Park. S-Pambula.	Sub-optimal roosting, breeding and foraging habitat present. Not recorded during surveys. 6 records within 10km, none within 5km. Low potential to occur.	V	-
New Holland Mouse *Pseudomys novaehollandiae* EPBC	Occurs in heathlands, woodlands, open forest 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.	No suitable habitat present.	-	V
Cumberland Plain Land Snail *Meridolum corneovirens* DECCW	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.	No suitable habitat present.	E	-
Macquarie Perch *Macquaria australasica* EPBC	Occurs in south east Australia at moderate to high altitudes in rivers and reservoirs. Historical records show the species was widespread and abundant in the upper reaches of the Lachlan, Murrumbidgee and Murray Rivers and their tributaries. Allen (1989) states that introduced populations are present in Nepean River and water supply dams in the Sydney area. Occurs in lakes and flowing streams, usually in deep holes.	No suitable habitat present.	V	E
Australian Greyling *Prototroctes maraena* EPBC	Clear, moderate to fast flowing water in the upper reaches of rivers (sometimes to altitudes above 1000m). Typically found in gravel bottom pools. Often forming aggregations below barriers to upstream movement (eg weirs, waterfalls).	No suitable habitat present.	Part 2, Section 19 – Protected Fish	V

DECCW	-	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

Table 4.4 - Threatened fauna habitat assessment

COMMON NAME *Scientific Name*	PREFERRED HABITAT	COMMENTS	TSC Act	EPBC Act
TBE	- Denotes additional species not listed within 10km searches but considered by *Travers bushfire & ecology* to have potential habitat based on regional knowledge and other records			
NOTE:	- 'records' refer to those provided by the *Atlas of NSW Wildlife* database. Updated 1:100,000 database mapsheet requests to DECCW are undertaken every 3 months as recommended. - 'close proximity' refers to distances within 2km from the subject site.			

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

4.10 Habitat assessment

The fauna habitats present throughout the site include:

- Small remnant patches of Swamp Oak forest and Cumberland Plain Woodland trees
- Nectar producing tree species, principally *Eucalyptus*
- Sparse to absent shrublayers
- Moderate to dense areas of sedges and rushes fringing waterways
- Sparse to dense ground covers (predominantly grasses)
- Medium and small hollows of varying quality
- Fallen logs, and branches
- Loose soil suitable for foraging
- Perennial drainage line with dam sections, soaks, runs and wetlands
- Sparse to dense riparian vegetation along the margins of open water-bodies
- Farm dams with surface and fringing vegetation
- Sparse litter layers
- Exfoliated bark on trunks and piles at the base of smooth-barked *Eucalyptus* species
- Farm sheds
- Artificial debris and refuse

4.10.1 Habitat trees

A complete assessment of the location of habitat trees and the size of hollows within was undertaken as part of surveys undertaken. No large hollows suitable for owls were recorded as all hollows found were less than 20cm in size. Table 4.5 below provides hollow-bearing tree data and other habitat features recorded. Figure 1 provides locations of habitat trees.

Table 4.5 – Habitat tree data

Tree No	Common Name	Scientific Name	DBH (cm)	Height (m)	Spread (m)	Hollows & Other Habitat Features Recorded
HT01	Grey Box	E moluccana	70	21	11	2x 5-10cm branch (1 good quality)
HT02	Grey Box	E moluccana	55	23	8	1x 0-5cm split (good quality)
HT03	Grey Box	E moluccana	85	24	13	1x 0-5cm branch, 1x 5-10cm branch
HT04	Grey Box	E moluccana	60	21	11	2x 5-10cm branch
HT05	Grey Box	E moluccana	55	18	10	1x 5-10cm trunk (good quality)
HT06	Grey Box	E moluccana	45	20	5	5x 0-5cm cracked bark
HT07	Grey Box	E moluccana	45	18	6	1x 0-5cm branch, 1x 5-10cm branch
HT08	Grey Box	E moluccana	60	25	9	1x 15-20cm trunk (good quality), wear at base

Table 4.5 – Habitat tree data

Tree No	Common Name	Scientific Name	DBH (cm)	Height (m)	Spread (m)	Hollows & Other Habitat Features Recorded
						of hollow
HT09	Grey Box	E moluccana	60	25	9	1x 0-5cm trunk (good quality & wear around), 1x 0-5cm branch
HT10	Grey Box	E moluccana	60	26	13	2x 5-10cm branch spout
HT11	Grey Box	E moluccana	55	18	12	1x 0-5cm trunk
HT12	stag	stag	40	15	2	6x 0-5cm cracked bark
HT13	Grey Box	E moluccana	60	19	9	1x 0-5cm branch
HT14	Forest Red Gum	E tereticornis	85	17	14	2x 10-15cm broken trunk
HT15	Grey Box	E moluccana	90	14	12	2x 0-5cm branch
HT16	stag	stag	20	9	2	1x 0-5cm trunk, 1x 0-5cm branch
HT17	stag	stag	25	10	1	1x 0-5cm trunk
HT18	Swamp Oak	C glauca	45	17	6	1x 0-5cm trunk
HT19	stag	stag	30	18	5	4x 0-5cm cracked bark
HT20	Swamp Oak	C glauca	45	14	5	1x 5-10cm trunk (Bar-sided Skink)
HT21	stag	stag	65	18	9	2x 0-5cm branch, 1x 10-15cm trunk (good quality & nest material inside), 1x 15-20cm trunk
HT22	Grey Box	E moluccana	35	8	7	1x 0-5cm branch, 1x 5-10cm branch
HT23	stag	stag	25	8	1	1x 10-15cm broken trunk
HT24	Swamp Oak	C glauca	50	10	5	1x 0-5cm branch
HT25	Swamp Oak	C glauca	55	18	6	1x 10-15cm trunk, burrow @ base
HT26	Grey Box	E moluccana	100	18	9	1x 0-5cm branch, 1x 5-10cm branch
HT27	stag	stag	70	22	12	1x 0-5cm cracked bark, 1x 0-5cm branch
HT28	stag	stag	100	25	10	2x 0-5cm branch, 2x 5-10cm branch
HT29	Grey Box	E moluccana	60	19	9	1x 0-5cm branch, 1x 10-15cm branch (good quality)
HT30	Grey Box	E moluccana	70	20	9	1x 5-10cm trunk split
HT31	Grey Box	E moluccana	45	19	6	1x 5-10cm trunk (good quality)
HT32	Grey Box	E moluccana	65	18	8	1x 0-5cm branch
HT33	Grey Box	E moluccana	40	20	5	1x 5-10cm trunk (good quality)
HT34	Grey Box	E moluccana	60	22	5	1x 5-10cm trunk (good quality)
HT35	Grey Box	E moluccana	60,45	21	12	1x 10-15cm trunk (good quality & wear around)
HT36	Grey Box	E moluccana	40	25	6	1x 10-15cm trunk (good quality)
HT37	Grey Box	E moluccana	65	26	7	2x 0-5cm branch, 1x 5-10cm branch
HT38	Grey Box	E moluccana	70	14	14	1x 10-15cm branch
HT39	Forest Red Gum	E tereticornis	115	26	14	1x 5-10cm trunk (good quality)
HT40	stag	stag	55	17	3	1x 0-5cm branch, 2x 5-10cm branch, 1x 10-15cm branch, 1x 15-20 broken trunk
HT41	Grey Box	E moluccana	50	16	7	1x 0-5cm branch , 1x 10-15cm trunk
HT42	stag	stag	45	17	1	2x 0-5cm branch , 1x 10-15cm trunk, 1x 15-20cm trunk
HT43	stag	stag	55	15	5	3x 0-5cm branch , 1x 10-15cm trunk
HT44	Forest Red Gum	E tereticornis	70	16	7	1x 0-5cm branch, 1x 5-10cm trunk
HT45	Grey Box	E moluccana	50	14	4	1x 5-10cm branch
HT46	Swamp Oak	C glauca	55	14	5	1x 5-10cm branch
HT47	Swamp Oak	C glauca	65	14	5	1x 10-15cm trunk
HT48	Swamp Oak	C glauca	60	14	7	1x 10-15cm trunk
HT49	Swamp Oak	C glauca	75	15	4	1x 5-10cm trunk
HT50	stag	stag	40	11	1	1x 15-20 broken trunk
HT51	Swamp Oak	C glauca	45	12	4	1x 5-10cm broken trunk
HT52	stag	stag	45	13	3	1x 0-5cm trunk
HT53	stag	stag	55	5	1	1x 0-5cm split
HT54	Swamp Oak	C glauca	40	9	6	1x 5-10cm branch

Table 4.5 – Habitat tree data

Tree No	Common Name	Scientific Name	DBH (cm)	Height (m)	Spread (m)	Hollows & Other Habitat Features Recorded
HT55	stag	stag	60,45	19	7	1x 0-5cm branch, 1x 5-10cm trunk
HT56	Forest Red Gum	E tereticornis	65	15	6	2x 0-5cm branch, 1x 5-10cm branch 1x 10-15cm trunk
HT57	stag	stag	65	13	2	2x 0-5cm trunk, 1x 0-5cm branch
HT58	Grey Box	E moluccana	55	16	5	1x 5-10cm trunk
HT59	Swamp Oak	C glauca	50	16	5	1x 5-10cm trunk
HT60	Swamp Oak	C glauca	40	14	4	2x 0-5cm trunk
HT61	stag	stag	45	16	3	1x 5-10cm split
HT62	stag	stag	65	16	4	1x 5-10cm branch, 1x 5-10cm trunk
HT63	Grey Box	E moluccana	90	15	9	2x 0-5cm branch, 1x 5-10cm branch, 1x 5-10cm trunk
HT64	Forest Red Gum	E tereticornis	65	20	12	1x 5-10cm trunk, 1x 10-15cm trunk
HT65	Forest Red Gum	E tereticornis	55,40	22	7	1x 10-15cm trunk
HT66	stag	stag	75	13	9	2x 0-5cm branch

4.10.2 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 Penrith LGA is not listed under schedule 1 of SEPP 44 and therefore this policy is not required for consideration for ecological assessments undertaken within the subject site.

4.11 Vegetation connectivity

The existing vegetation within the subject site is highly fragmented and isolated particularly the woodland portions. Small woodland portions contain only mature trees as previous clearing and ongoing grazing have reduced the surface logs, native covers, regrowth and scrub vegetation.

There is a further degree of internal connectivity along the central drainage line that runs through the site from the south to the north-east, whilst this is also modified and non-continual. The immediate surrounding habitats to the subject are also highly modified and fragmented with the continuation of the central drainage being the only true continuation of the internal habitats.

To the south an approximately 6.9ha remnant of Swamp Oak Forest occurs immediately outside of the subject site boundary which continues from the upper reaches of the central drainage line. This remnant is itself somewhat isolated due to clearing further south. To the north the drainage continues with narrowly lined trees which widen to more extensive woodland areas further north. Therefore the central drainage provides the only true connective values from within the site to adjacent habitats.

4.12 Riparian constraints

The site is mapped by the NSW Office of Water (DECCW) as containing numerous category 2 and category 3 watercourses (Figure 2 & 3). Given the current condition of the site a review of the existing watercourses is warranted.

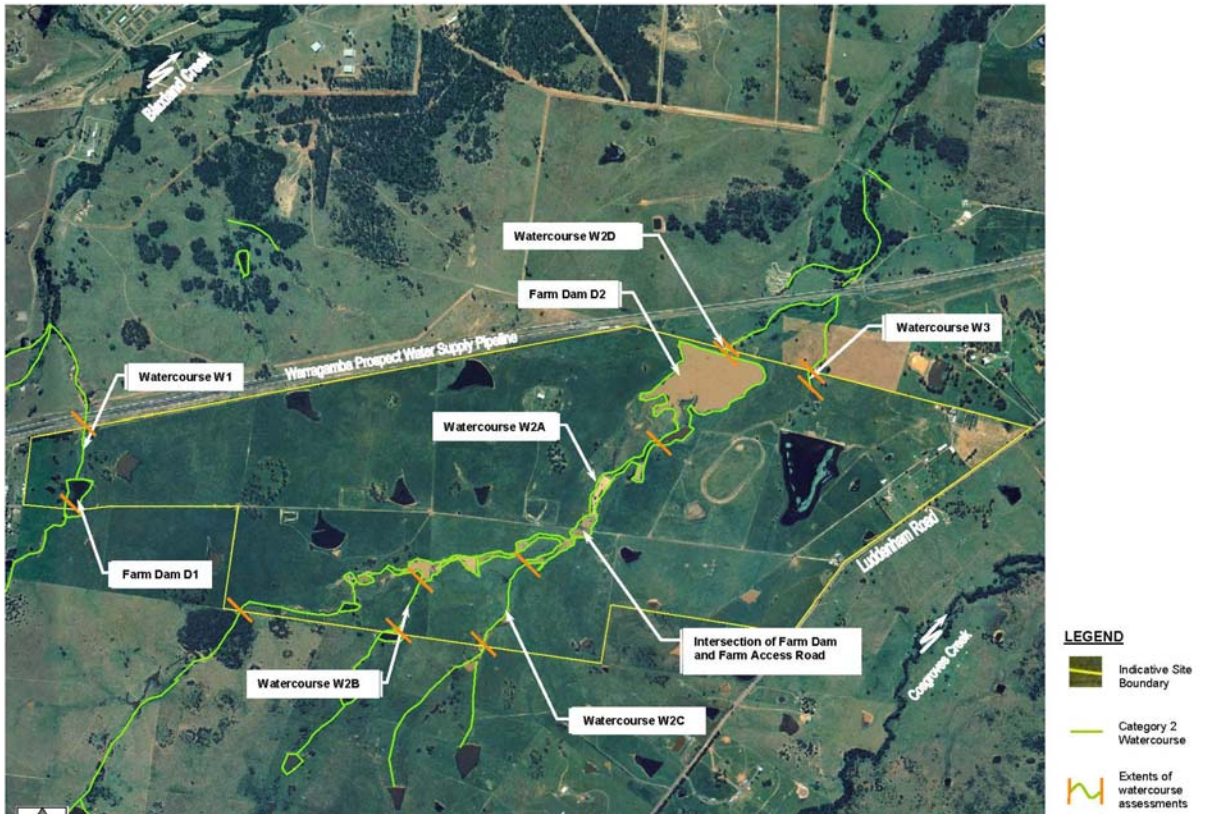

Figure 2 – Category 2 watercourses as mapped by NSW Office of Water (DECCW)
(Source: Worley Parsons - Stream Classification and Site Flood Assessment 2010)

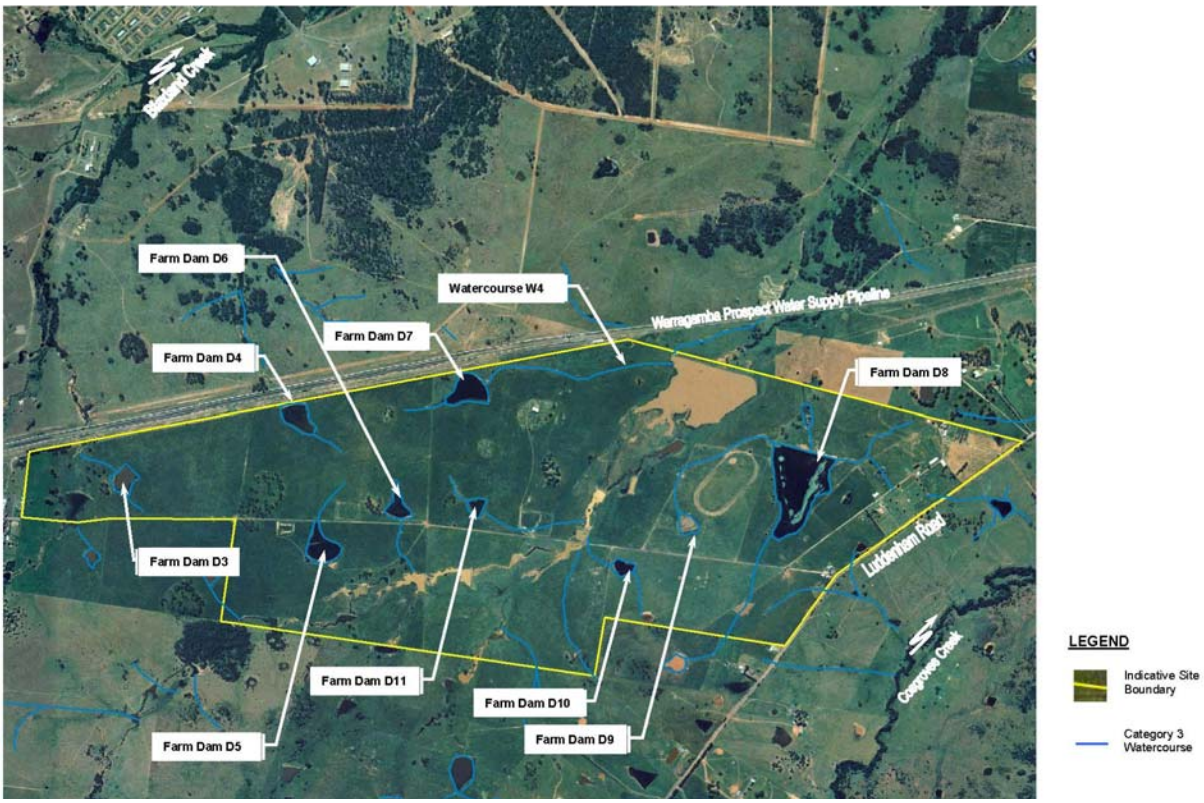

Figure 3 – Category 3 watercourses as mapped by NSW Office of Water (DECCW)
(Source: Worley Parsons - Stream Classification and Site Flood Assessment 2010)

A Stream Classification and Site Flood Assessment (Worley Parsons 2010) identified one main watercourse and associated dams as Category 3 Watercourses (Figure 4). The reclassification of the existing streams is based on the generally poor condition of each mapped watercourse; presence of man made dams that could be removed, lack of any supporting vegetation, and disconnected nature of any channels onsite.

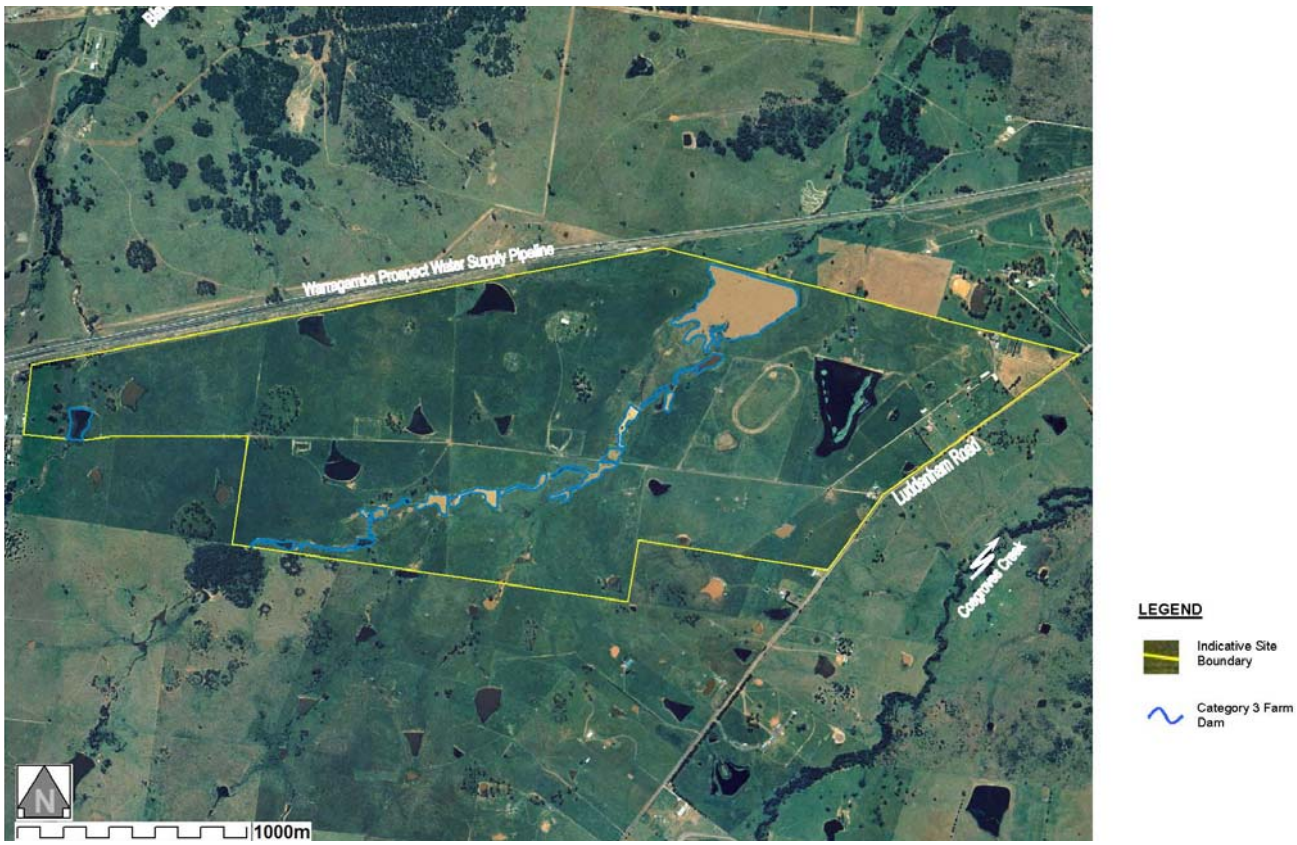

Figure 4 – Category 3 watercourses as recommended by Worley Parsons (DECCW)
(Source: Worley Parsons - Stream Classification and Site Flood Assessment 2010)

The recommended watercourse has significant foraging value for threatened microbat species. Any proposal to restore the riparian vegetation with retention of the larger open water bodies would significantly enhance foraging habitat onsite.

5 7 PART TEST OF SIGNIFICANCE CONSIDERATIONS

Penrith City Council is required to consider the impact upon threatened species, populations and or endangered ecological communities 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).

There is currently no development proposal formulated for the subject site. A combined development layout will be produced for assessment and application purposes at a later date. A seven part test of significance can therefore not be assessed to a specific proposal. The following are points to consider relevant to future seven part test assessment.

5.1 Flora assessment

In summary and following the field habitat assessment it is considered that the subject site provides marginal habitat for the following threatened flora species:

- *Pimelea spicata*
- *Hypsela sessiflora*

Travers bushfire & ecology did not locate either of these threatened species during field investigations. These species are not cryptic in nature such that survey is required to be done at a specific time of the year.

Pimelea spicata habitat exists only as marginal potential and only within the far eastern remnant of Cumberland Plain Woodland.

Hypsela sessiflora may have potential habitat around the drainage line / dam areas or within remnants of the Swamp Oak vegetation community but it would be marginal at most given the current grazing activities. In addition, the EPBC Act status regards the species as extinct despite records since 2000. There are 2 known locations of this species which are adjacent to each other in Erskine Park approximately 5km away. There have been past records in other places across the Cumberland Plain. Given a) the distance to a known population, b) the current grazing activities, c) the previous vegetation clearance and dominance of exotic species, whilst there may be marginal habitat for the species to occur in some selective locations across the subject site, the likelihood of occurrence is extremely low. As such, any removal or modification of vegetation within those areas would not cause a significant impact on either species' potential habitat.

The seven part test of assessment (Part 5A assessment under the EP&A Act) requires consideration to the amount of habitat removed, the impact of isolation and further fragmentation and the importance of habitat removed.

Because of the grazed nature of the majority of the subject site and previous large-scale clearing, the potential habitat and likelihood of occurrence is greatly reduced or considered no potential habitat within those cleared / grazed areas.

The remnant patches of vegetation are all poor condition because of grazing and weed invasion. Nonetheless, this does not preclude that the vegetation would be classed as low condition under a biometric assessment.

Several flora quadrats were undertaken within the small remnants to determine the condition of vegetation under the biometric assessment. It was found that despite the exotic foliage cover content in the ground layer of vegetation, the canopy overstorey may exceed that which would regard it as a low condition remnant. Not withstanding this, the remnant must be 0.25ha or more (or say 50x50m) in order to be considered a 'remnant' that requires assessment. All remnants were under 0.25ha except for one Cumberland Plain Woodland remnant along the southern site boundary in the western portion which was around 2ha.

Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest is listed under the EPBC Act (nationally recognised EEC). Removal of this vegetation community may trigger a referral to DEWHA for consideration.

Vegetatively, the main constraint to future development is to avoid clearing of the larger CPW remnant. The removal of all other smaller patches across the subject site less than 0.25ha is allowable under the Biometric assessment.

From an ecological perspective, this remnant plays little role in providing connectivity for fauna. Its main value is that is contains several hollows which may provide roosting habitat for microbats, small mammals, lizards or birds for example. For future planning purposes, the need to retain this patch for its ecological value alone is not really warranted.

Compensatory measures should be encouraged into future planning to provide a revegetated corridor along the riparian line which runs north-east to south-west through the centre of the subject site adjacent to or near the overhead transmission wires. This revegetated corridor should contain at least the equivalent amount of vegetation lost from the proposal. For example, if there is 20ha of remnant EEC vegetation across the site, the riparian conservation corridor should restore and revegetate a minimum of 20ha in one consolidated unit (to include both EECs). This would be a good ecological outcome as it will link with vegetation to the north and south of the subject site. Even if that habitat is partly fragmented outside of the subject site, it would be a better outcome than what is present and more likely to be approved by the authority determining a future land-use proposal.

There are two (2) known endangered populations within the Penrith LGA or within 10km, they are;

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

- *Dillwynia tenuifolia*, Kemps Creek

Neither species are represented within the subject site.

Given the grazed and cleared nature of the subject site, there would be no suitable habitat for either species.

The subject site does not constitute 'Critical Habitat' as listed by the TSC Act (1995) for any threatened species (flora or fauna) or community.

A 7 part test of significance (Part 5A of the EP&A Act) will also require consideration as to whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

There is an approved recovery plan for *Pimelea spicata* (DEC 2006). To be consistant with the recovery plan, a future proposal would have to conserve the species habitat. The only suitable habitat which is marginal only, is the Cumberland Plain Woodland remnant in the far eastern portion of the subject site close to Luddenham Road.

Our opinion based upon the two (2) day survey undertaken by this firm is that the vegetation and flora characteristics are unlikely to constrain a future development proposal. Consideration for the loss of EEC vegetation can be compensated in some form through restoration of the central riparian channel as previously discussed, and this will tie in with the recommendations from the fauna assessment.

5.2 Fauna assessment

It is considered that the subject site provides habitat for the following threatened fauna species:

- Green and Golden Bell Frog
- Black-necked Stork
- Australasian Bittern
- Little Eagle
- Bush Stone-curlew
- Australian Painted Snipe
- Swift Parrot
- Barking Owl
- Masked Owl
- Speckled Warbler
- Black-chinned Honeyeater
- Regent Honeyeater
- Varied Sittella
- Scarlet Robin
- Flame Robin
- Grey-headed Flying-fox
- East-coast Freetail Bat *
- Eastern Bentwing-bat
- Large-footed Myotis *
- Greater Broad-nosed Bat

Species indicated with a "*" were recorded within the subject site during surveys. The site generally provides only sub-optimal or low potential habitat for the majority of the remaining listed species.

An assessment of individual threatened species with available habitat present should consider if a proposed development is likely to place a local population at risk of extinction. Furthermore, in the assessment of these species, the seven part test requires consideration to the amount of habitat removed, the impact of isolation and further fragmentation and the importance of habitat removed. Refer to Section 5.2.1 below for a preliminary assessment of threatened fauna species recorded and with potential to occur.

In regard to other fauna related considerations within the 7 part test:

- There is one listed endangered fauna population that has a considered range extending into the Penrith LGA. This is the White-fronted Chat (*Epthianura albifrons*) in the Sydney Metropolitan Catchment Management Authority area. Whilst there is suitable habitat for this species along the soaks and rushes of the central drainage line, it was not recorded during survey or previously within 10km of the site and thus is not expected to occur and provide a constraint to development;

- The subject site does not constitute as 'Critical Habitat' as listed by the TSC Act (1995) for any threatened species (flora or fauna) or community; and

- A seven-part test of significance will also require consideration as to whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

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

  - Barking Owl *(Ninox connivens)* (DECC, 2003)
  - Green and Golden Bell Frog *(Litoria aurea)* (DECC, 2005)

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

  - Bush Stone Curlew (*Burhinus grallarius*) (DECC 2006)
  - Large Forest Owls (Powerful Owl (*Ninox strenua*), Sooty Owl (*Tyto tenebricosa*) and Masked Owl (*Tyto novaehollandiae*) (DECC 2006))

  No species with a recovery plan have been recorded within the subject site or have high potential to occur. The policies and actions associated with recovery plans are not likely to constrain development.

5.2.1 Summary of threatened species recorded

5.2.1.1 Large-footed Myotis (*Myotis adversus*)

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 water bodies 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).

It is considered that the subject site provides suitable foraging, roosting and breeding habitat for the Large-footed Myotis. This species was recorded by Anabat foraging over most open water bodies where recorders were placed at various locations throughout the subject site. A number of recordings at each of these sites indicated numerous passes and frequent use for foraging.

In addition to this three (3) individuals were observed by spotlight hawking the water's surfaces along the southern portion of the central drainage line for the complete 45 minute spotlighting transect in this area. Anabat and spotlighting results confirm the subject site as providing an important foraging resource for this species. Furthermore, given this high presence, the potential for roosting and subsequent breeding habitat within the site also becomes high.

Given this species unique foraging behaviour in comparison to other microbats, it would be correct in assuming that foraging is concentrated over all open water areas present particularly the larger surfaces and where fringing vegetation occurs which is crucial habitat for the life-cycle of numerous prey species. Anabat recordings away from water bodies also reflected this.

This species will utilise a range of roosting habitats from natural through to artificial, however it is generally regarded that roosting is more likely within close proximity to foraging areas. Given this it is considered that if the species is roosting/breeding within the subject site this is more likely to be taking place within hollows located near to open water areas and also possibly within nearby remnant clumps. A hollow-bearing tree survey has been conducted across the entire site and these are depicted on Figure 1.

In order to avoid a significant impact on this species it is recommended that future development proposals provide adequate representation of open water areas for foraging and nearby hollows for roosting/breeding. The proposed retention of the central drainage and nearby hollows and remnants is considered sufficient in respect to adequate conservation of habitat within the subject site for this species. These areas of conservation value aim to keep suitable habitat 'together' and continue the existing linkage to adjacent and depleted habitat.

This recommendation is considered to similarly provide adequate habitat areas for remaining threatened and protected fauna species recorded or with potential to occur.

5.2.1.2 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). All known natural roosts have 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). Post graduate student Anna McConvill from the University of Newcastle recently recorded a roost of this species within mangroves which re-iterates the lack of knowledge on the true habitat requirements of this species.

It is considered that the subject site provides suitable foraging, roosting and breeding habitat for the East-coast Freetail Bat. This species was recorded at one of six Anabat recording stations during surveys. An individual was recorded where the open water of the central drainage line bisects the main central east to west unsealed access road (see Figure 1). Typical call characteristics of this species are unique and definitive however the Eastern Freetail Bat (*Mormopterus ridei*) which was recorded extensively within the site also has similar call characteristics. The identification was based on a single call sequence however features were considered enough to be identified to a reliable level of certainty.

The low recorded presence of this species may be a reflection that the subject site is not central or near to main roosting and activity areas. The single recording sequence (pass) was after 8:30pm suggesting that there was sufficient time for this individual to fly far from the roost location following dusk. This is a highly mobile species and local habitat would not be exclusive to the subject site. Hoy et. al (2008) suggests that despite a female recorded 6km from its roost, this species generally forages within a few kilometres of roosts.

As foraging use of the site is almost certain, roosting and breeding within the subject site should not be ruled out. At this stage it is considered that the conservation measures outlined above for the Large-footed Myotis would be sufficient for this species also given the low recorded presence and the location. As this species is known for its utilisation of paddock trees in disturbed landscapes where nearby forest and woodland habitats occur, retention of other hollows located away from identified areas of conservation value would provide a more reliable assessment outcome. This would benefit the assessment for both threatened microbat species recorded.

5.2.2 Summary of threatened species with potential to occur

Tables 4.2 and 4.4 of this report detail the potential for various threatened flora and fauna species to occur within the subject site based on suitable habitat present and local records.

It should be noted here that there appears to be a limitation of Atlas database records within the nearby locality (out to 3km) which may be a reflection of limited local surveys and therefore should not be regarded as an accurate or independent measure of potential to occur. For example, the Large-footed Myotis was recorded quite extensively across the subject site however there has only been 1 previous record of this species within 5km of the site, which was recorded by this company 2.3 km to the north in 2009.

In respect to threatened fauna species there is generally limited or absent habitat for most species previously recorded within 10km, despite the large size of the site. The numerous dams, soaks and water bodies along the central drainage do provide potential habitat for wading birds however only the Black-necked Stork and Australasian Bittern are such threatened birds previously recorded out to 10km. The paucity of records suggests there is low potential for both of these birds to occur.

The dams, soaks and water bodies also provide good foraging and drinking habitat for microchiropteran bats. The Eastern Bentwing-bat is the only additional threatened microbat to those already recorded that has a reasonable potential to occur within the site and is therefore considered further below.

An SIS prepared by *Conacher Travers* (2002) for a proposed golf course at the Twin Creeks development across Luddenham Road to the east listed the Green and Golden Bell Frog as an effected species. There is suitable habitat for this species also throughout the vegetated areas of the central drainage line of the subject site given the fringing rushes and sedges combining with open shallows and open basking areas. This species has not been previously recorded within the locality on the Atlas of NSW Wildlife database (DECCW 2010) and is not expected to occur due to the presence of nutrient enriched conditions associated with cattle use. Such conditions promote the chytrid fungus that attacks this and other frog species. Remaining Green and Golden Bell Frog populations tend to be located in areas where saline or other water conditions are less favourable for chytrid. The reasons for this species listing as an effected species nearby is unknown; if there are other known local records of the species then late spring or summer survey following rainfall would be recommended.

In conclusion to this, the open water areas particularly those along the central drainage line provide the best threatened fauna species habitat. The loss of dams, both small and large, outside of the central drainage line would then not be considered significant for any threatened fauna species recorded or with potential to occur provided that the central drainages and associated open water areas are retained.

The small and degraded remnant woodland patches within the subject site provide sub-optimal habitat for woodland birds such as the Speckled Warbler, Black-chinned Honeyeater Varied Sittella and birds in dispersal such as the Scarlet Robin and Flame Robin. The low potential for these birds to occur is based on either local records or the mature eucalypts present for foraging. These mature trees also provide potential for seasonal foraging from the Grey-headed Flying-fox.

Although potential woodland species are not expected to offer a constraint to development based on survey results thus far, it would be recommended that mature remnant trees are retained with a degree of connectivity to the central drainage line where they occur in

patches close to this drainage or adjacent remnant patches. This would ensure that habitat is retained and enhanced if utilised by these species.

5.2.2.1 Eastern Bentwing-bat (*Miniopterus orianae oceanensis*)

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

The subject site provides suitable foraging habitat for the Eastern Bentwing-bat along the central drainage and to a far lesser extent through the remaining open areas. There is no suitable natural roosting and subsequent breeding habitat for this species present. Roosting habitat may be present within artificial structures such as within the buildings and sheds present provided that these contain small openings to ceiling or wall cavities.

As the Eastern Bentwing-bat was not recorded during surveys and there is no likely habitat of importance this species is not likely to offer a constraint to development.

5.3 Other considerations under the 7-part test

Another ecological consideration of a seven-part test of significance is the potential for 'key threatening processes' listed under the TSC Act (1995). The following threatening processes are considered potentially relevant to a development proposal within the subject site:-

- Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands
- Clearing of native vegetation
- Infection of frogs by amphibian *chytrid* causing the disease *chytridiomycosis*
- Infection of native plants by *Phytophthora cinnamomi*
- Invasion of native plant communities by exotic perennial grasses
- Loss of hollow-bearing trees
- Predation by Plague Minnow or Mosquito Fish (*Gambusia holbrooki)*
- Predation by the Feral Cat (*Felis catus*)
- Removal of dead wood and dead trees

Alteration to natural flow regimes, clearing of native vegetation (particularly riparian) and loss of hollow-bearing trees are particularly relevant to the high presence of Large-footed Myotis within the site.

Isolation and fragmentation need to be considered under the 7-part test assessment. Development throughout the site will isolate open water areas (dams) that the large-footed Myotis currently utilises for foraging. This will not be considered significant if connective and high quality open water areas are sufficiently retained within the site. This provides further argument for retention of the central drainage line for this species.

6 CONCLUSION AND RECOMMENDATIONS

6.1 Legislative conclusion

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

EPA Act and TSC Act

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

- Two (2) threatened fauna species – Large-footed Myotis (*Myotis macropus*) and East-coast Freetail Bat (*Micronomus norfolkensis*) – were recorded within the subject site,
- No threatened flora species were recorded within the subject site,
- Two (2) EECs – *River-flat Eucalypt Forest on Coastal Floodplains* and *Cumberland Plain Woodland* – were recorded within the subject site, and
- 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 the subject site,
- Two (2) migratory fauna species listed under the *EPBC Act* – Cattle Egret (*Ardea ibis*) and Great Egret (*Ardea alba*) – were recorded within the subject site,
- No threatened flora species were recorded within the subject site,
- No endangered populations were recorded within the subject site, and
- One EEC – *Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest* 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.

6.2 Constraints conclusion

The collective retention and restoration of connectivity between the central drainage, the natural vegetated fringes to this drainage, nearby remnants and nearby hollows provides a far higher value to threatened and protected fauna species than the alternate retention of similar amounts of combined isolated habitats. The area in reference is the drainage line which runs from north-east to south-west through the centre of the subject site near the overhead transmission wires. This would therefore keep quality habitat types 'together'. This will also continue the existing linkage to the best available adjacent habitat areas, which is again a positive outcome for the threatened species assessment. Restoration activities within this central corridor would include revegetation of the EECs which occur on site to compensate for their removal to allow future development.

Provided that these central drainages and associated open water areas are retained, the loss of other isolated dams, both small and large, would not be considered a likely significant loss for any threatened fauna species recorded or with potential to occur.

This is particularly the case for the open water dependent Large-footed Myotis which was recorded foraging to a high level of activity over various open water bodies within the site. Nearby hollows to water bodies therefore also provide high potential roosting and breeding habitat. The retention of these areas will avoid a likely significant impact on this species by providing adequate representation of open water areas and nearby hollows.

6.3 Recommendations

The following general recommendations are made to minimise ecological impacts, address threatening processes and to create a positive ecological outcome for threatened species and their associated habitats.

- It is recommended that a formal conservation plan be prepared at the development application stage to highlight the areas for future conservation and restoration of EECs along the central riparian corridor. The conservation plan shall identify the ongoing management of habitat resources, weeds, future landscaping and site works to retain mature trees and habitat movement corridors to ensure the access options to foraging resources are maintained for the local population of Large-footed Myotis in addition to enhancing vegetative habitat. This plan should incorporate a fox control program as the numbers of foxes on site were high.

- In respect to threatened fauna species the collective retention of the central drainage, the natural vegetated fringes to this drainage, nearby connective remnants and nearby hollows is recommended. Disturbed areas within the conservation limits may be restored to offset habitat loss in remaining locations of the site. Bat boxes could also be provided within the conservation areas to offset the loss of hollows elsewhere within the site.

- Any restoration of the central drainage line should be so that open water areas will not be consumed by aquatic vegetation. Outlier areas (not inundated) should be revegetated as River-flat Eucalypt Forest or Cumberland Plain Woodland.

- 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 onsite found to contain soil or vegetation material is to

be cleaned in a quarantined work area or wash station and treated with anti-fungal herbicides.

- Erosion control measures are to be in place to reduce temporary erosion and sedimentation risks to adjacent EEC vegetation and any nearby drainage channel.

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