Flora and Fauna Assessment

Rezoning Planning Proposal

Prepared for
Celestino

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Executive summary

Eco Logical Australia Pty Ltd was engaged by Celestino Pty Ltd to undertake a Flora and Fauna Assessment for the proposed rezoning of land associated with the Jacaranda Ponds residential subdivision. This Flora and Fauna Assessment report would accompany a planning proposal to Hawkesbury City Council. This report is a flora and fauna report for the proposed construction of residential housing, including large lot housing, recreational areas and associated infrastructure.

Extensive flora and fauna survey has been undertaken for the study area and identified a range of ecological values of Cumberland Plain Woodland in the Sydney Basin Bioregion, a critically endangered ecological community under the NSW *Biodiversity Conservation Act 1995* (BC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions, is also listed as an endangered ecological community under the BC Act. The study area included farm dams, hollow bearing trees and a riparian corridor. These habitat features as well as the native vegetation in the study area, resulted in the following six threatened fauna species either known or predicted as likely to occur:

- *Meridolum corneovirens* (Cumberland Plain Land Snail) – listed as vulnerable under the BC Act
- *Miniopterus australis* (Little Bent-wing Bat) – listed as vulnerable under the BC Act
- *Miniopterus schreibersii oceanensis* (Eastern Bentwing-bat) – listed as vulnerable under the BC Act
- *Mormopterus norfolkensis* (Eastern Freetail-bat) – listed as vulnerable under the BC Act
- *Myotis macropus* (Southern Myotis) – listed as vulnerable under the BC Act
- *Pteropus poliocephalus* (Grey-headed Flying-fox) – listed as vulnerable under the BC Act and EPBC Act.

The study area was found to contain potential Koala habitat, as per the State Environmental Planning Policy 44 – Koala Habitat Protection (SEPP 44) guidelines. No Koala individuals or signs of use on potential feed trees was identified during targeted field survey. Therefore, the site was not considered to contain core Koala habitat.

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1 Introduction

1.1 Project background

Eco Logical Australia was commission by Celestino Pty Ltd to undertake a Flora and Fauna Assessment for the Jacaranda Ponds Planning Proposal to Hawkesbury City Council. This report is a flora and fauna report for the proposed rezoning of the study area.

This report describes the existing ecological values in the study area including threatened species, populations and communities and associated habitat features as a result of the proposed construction. This assessment is based on the information gathered from data searches and field investigations. The report sets out the legislative context, methods used, potential impacts to the environment and recommendations to minimise these impacts.

This report addresses the requirements of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The study area is located within the Hawkesbury City Council, a Local Government Area (LGA).

1.2 Site description

The study area is located at Spinks Road, Glossodia in the Hawkesbury LGA (**Figure 1**). The study area is located north of Freemans Reach and is approximately 7 km north east of the Richmond CBD. The study area is bound by Currency Creek to the south, and a mix of low density residential and agricultural land to the north, east and west. The site covers approximately 185.3 ha.

The study area is zoned as RE1 Public Recreation, R2 Low Density Residential, R5 Large Lot Residential and SP2 Infrastructure. Parts of the study area is also covered by the Terrestrial Biodiversity Layer and the Bushfire Prone Land layer identified in the Hawkesbury Local Environment Plan 2012.

The study area is comprised of remnant native vegetation, farm dams and infrastructure associated with poultry farming. The majority of the site is comprised of exotic pasture grasses and shows signs of previous disturbance and ongoing management.

The *study area* refers to the current boundary at Jacaranda Ponds (**Figure 1**). The study area is comprised of the following lots:

- Lot 1 DP784300
- Lot 2 DP784300
- Lot 3 DP784300
- Lot 50 DP751637
- Lot 3 DP230943
- Lot 2 DP230943
- Lot 1 DP230943
- Lot 52 DP1104504
- Lot 2 DP533402.

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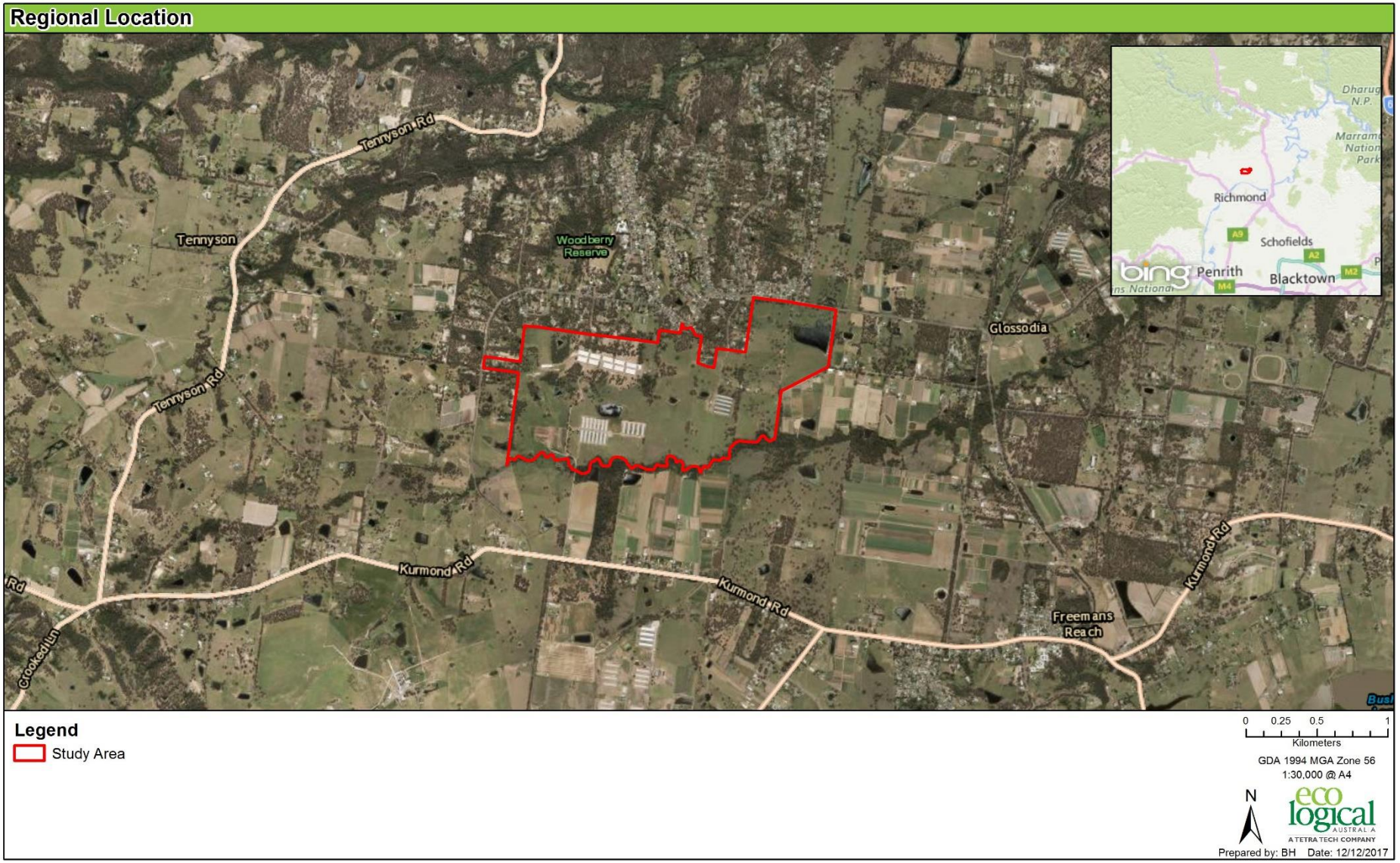

Figure 1: Regional location of the study area

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1.3 Community consultation and stakeholder engagement

The planning proposal to rezone the land at Jacaranda Ponds has undergone extensive community consultation. Celestino have been conducting monthly meetings with the community at Glossodia since 2015.

Celestino and Hawkesbury Council have been discussing the proposal for a number of months.

- Celestino met with Council on 10 December 2015, 14 July 2016 and 16 May
- Celestino, Council and ELA met with OEH on 18 March 2016 to discuss the project.

The planning proposal would be placed on public exhibition.

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2 Legislative context

Name	Relevance to the project	Section
Commonwealth		
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	Under the EPBC Act, proposed actions that have the potential to significantly impact on matters of Matters of National Environmental Significance (MNES) must be referred to the Commonwealth Department of Environment and Energy. MNES have been identified on or near the site. This report forms part of a planning proposal. Assessment under the EPBC Act is not required for Part 3 approvals.	4
State		
Environmental Planning and Assessment Act 1979 (EP&A Act)	The proposed rezoning requires consent under the Hawkesbury Shire Council LEP 2012 and is to be assessed under Part 3 of the EP&A Act.	4
Biodiversity Conservation Act 2016 (BC Act)	The proposal is to be assessed under Part 3 of the EP&A Act and impacts to threatened species and endangered ecological communities listed under the BC Act in accordance with s7.3 of the BC Act are not required at this stage.	4
Fisheries Management Act 1994 (FM Act)	The proposal does not involve harm to mangroves or other protected marine vegetation, dredging, reclamation or blocking of fish passage) and therefore a permit under the FM Act is not required.	N/A
Water Management Act 2000 (WM Act)	The project is a rezoning and the report considers matters subject to the WM Act.	4.3
Planning Instruments		
SEPP 44 – Koala Habitat Protection	The SEPP encourages the conservation and management of areas of natural vegetation providing habitat for koalas. The consent authority must determine whether the land contains potential koala habitat and core koala habitat. Schedule 1 of the SEPP lists local government areas to which the plan applies. SEPP 44 applies to the local government area in which the rezoning is proposed. While strictly not required for a planning proposal, an assessment of koala habitat has been made in accordance with Part 2 of the SEPP.	4.2.4
Hawkesbury Shire Council Local Environment Plan	The subject site is zoned RE1 Public Recreation, R2 Low Density Residential, R5 Large Lot Residential and SP2 Infrastructure under the Hawkesbury LEP and is partially covered by the Terrestrial Biodiversity overlay. The proposal aims to alter some of the zones.	N/A

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3 Methods

3.1 Literature and data review

The following information and data sources were reviewed prior to field survey:

- BioNet / Atlas of NSW Wildlife (OEH2017a)
- EPBC Act Protected Matters Search Tool (DotEE 2017)
- NSW Threatened Species Profiles (OEH 2017b)
- NSW NPWS Native Vegetation of the Cumberland Plain Vegetation Mapping (NPWS 2002)
- SEPP 44 – Koala Habitat Protection (SEPP 44)
- Hawkesbury Local Environment Plan 2012.

Aerial photography of the study area and surrounds were also used to investigate the extent of native vegetation cover and landscape features in the study area.

The BioNet / Atlas of NSW Wildlife (10 km radius) and Protected Matters Search Tool (5 km radius) was performed around the co-ordinates -33.54056, 150.77031 on 30 August 2017. The results of these searches were combined to produce a list of threatened flora, fauna and ecological communities considered likely to occur or utilise the study area. The likelihood of occurrence for each species was determined using recent records, the likely presence of suitable habitat and knowledge of the species ecology. A list of species (defined as “yes”, “likely” or having “potential”) was then used to inform the need for any targeted surveys. The terms for the likelihood of occurrence are listed in **Appendix A**.

3.2 Field survey

The field survey was undertaken by ELA Accredited Assessors Rebecca Dwyer, Enhua Lee and Meredith Henderson, with support from ELA field ecologists Alex Gorey and Nicole McVicar, over a 6 month period from November 2015 to April 2016. The study area was divided into two portions (east and west) due to quarantine restrictions between the existing poultry farm and egg farm. **Table 1** summarises the survey effort, locations and methods used. The entire study area was traversed on foot and focused on the following:

- validation of existing vegetation mapping determining the type, condition and extent
- biometric plots
- threatened flora targeted survey
- threatened fauna targeted survey
- hollow bearing tree search
- Koala habitat assessment
- opportunistic fauna sightings.

Table 1: summary of survey effort, method and location within the study area

Date	Location	Methodology
13 November 2015	Western side of Study Area	- One-day survey by two ecologists. - Vegetation mapping was undertaken using aerial photography and ground-truthing the Vegetation of the Cumberland Plain mapping (NPWS 2002).

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Date	Location	Methodology
		- A random meander of the whole study area was undertaken noting species that occurred in each area following Cropper (1993). - Vegetation was surveyed through one plot/transect (20 m x 20 m plots nested in 20 m x 50 m plots, plus 50 m transect)
16 November 2015	Eastern side of Study Area	- One-day survey by two ecologists. - Vegetation mapping was undertaken using aerial photography and ground-truthing the Vegetation of the Cumberland Plain mapping (NPWS 2002). - A random meander of the whole study area was undertaken noting species that occurred in each area following Cropper (1993). - Vegetation was surveyed through three plots/transects (20 m x 20 m plots nested in 20 m x 50 m plots, plus 50 m transect)
18 – 20 April 2016	Western side of Study Area	- Three-day survey by two ecologists. - Vegetation mapping was undertaken using aerial photography and ground-truthing the Vegetation mapping by ELA in 2015 - Vegetation was surveyed through three plots/transects (20 m x 20 m plots nested in 20 m x 50 m plots, plus 50 m transect) - One Anabat unit was placed adjacent to a dam and hollow bearing tree. The device was programmed to record through the entire night and left on site for two consecutive nights. - Targeted threatened flora species searches were undertaken for *Pimelea spicata, Acacia pubescens* and *Grevillea juniperina* subsp. *juniperina*. - *Pimelea spicata* was targeted during meanders. - Two nights of spotlighting and stag watching surveys were undertaken by two ecologists for 30 minutes prior to sunset and 60 minutes after sunset to identify the presence of Grey-headed Flying-fox (GHFF) within the study area. - Targeted surveys for Koala were undertaken over two consecutive nights, involving call-playback and spotlighting. The call of the target species was broadcast for up to five minutes, after which 10 minutes of listening and spotlighting was undertaken. This was repeated two times at each of four sites. - Active searches targeting Cumberland Plain Land Snail within leaf litter at the base of trees, under logs and

Date	Location	Methodology
		dumped rubbish, and near grass clumps in remnant patches of CPW in the study area (10 locations) over 15 person hours undertaken over two days.
26 – 28 April 2016	Eastern side of Study Area	- Three-day survey by two ecologists. - Vegetation mapping was undertaken using aerial photography and ground-truthing the Vegetation mapping by ELA in 2015 - Vegetation was surveyed through three quadrats (20 m x 20 m plots nested in 20 m x 50 m plots) - Two Anabat units were placed adjacent to dams with hollow bearing trees. The device was programmed to record through the entire night and left on site for two consecutive nights. - Targeted threatened flora species searches were undertaken for *Pimelea spicata, Acacia pubescens* and *Grevillea juniperina* subsp. *juniperina*. - *Pimelea spicata* was targeted during meanders. - Two nights of spotlighting and stag watching surveys were undertaken by two ecologists for 30 minutes prior to sunset and 60 minutes after sunset to identify the presence of GHFF within the study area. - Targeted surveys for Koala were undertaken over two consecutive nights, involving call-playback and spotlighting. The call of the target species was broadcast for up to five minutes, after which 10 minutes of listening and spotlighting was undertaken. This was undertaken twice at each of four sites. - Active searches targeting Cumberland Plain Land Snail within leaf litter at the base of trees, under logs and dumped rubbish, and near grass clumps in remnant patches of CPW in the study area (10 locations) over 15 person hours undertaken over two days.

3.2.1 Vegetation validation

Where the boundaries of vegetation communities differed from those mapped, they were modified using hard copy maps. A list of above ground vascular flora was collected and used to determine the vegetation community likely to be present, and its condition. During survey, the weather conditions were mild and mostly sunny (**Table 2**) (BOM 2017).

Biometric plots were undertaken within the study area. Biometric plots (20 m x 20 m plots nested in 20 m x 50 m plots, plus a 50 m transect) were carried out to ascertain the condition and extent of native species within the study area. Other ecological values such as leaf litter, woody debris and hollow bearing trees were also noted. All hollow bearing trees within the study area were marked using a handheld GPS unit.

Table 2: Weather conditions during field survey

Timing	Date	Minimum temperature (ºC)	Maximum temperature (ºC)	Rainfall (mm)	Relative humidity (%) at 9am	Relative humidity (%) at 3pm
November week prior to survey	6-13/11/2015	11.7-18.2	21.3-30.8	24.4	-	-
November 2015 survey	13/11/2015	15.6	29.9	4.4	-	-
	16/11/2015	12.8	24.2	7.4	-	-
April week prior to survey	11-17/04/2016	7.8-17.2	22.2-29.7	0-0.4	58-89	29-74
April 2016 survey	18/04/2016	13.6	24.7	0	80	76
	19/04/2016	15.7	25.8	0.4	81	46
	20/04/2016	14.1	27.4	0.2	95	49
	26/04/2016	8.2	25.0	0	91	50
	27/04/2016	9.2	27.0	0	99	45
	28/04/2016	10.3	27.7	0	98	47

Data from weather station located at RICHMOND RAAF ID: 067105

3.2.2 Targeted threatened flora survey

Targeted searches were performed on 1-20 April 2016 and 26 – 28 April 2016 for the following threatened flora:

- *Pimelea spicata* (Spiked Rice-flower)
- *Acacia pubescens*
- *Grevillea juniperina* subsp. *juniperina* (Juniper-leaved Grevillea).

Parallel transects approximately 3 m apart were walked throughout areas of native vegetation considered potential habitat for these species. Areas of potential habitat were generally defined as patches of moderate – good quality Cumberland Plain Woodland and River-flat Eucalypt Forest.

3.2.3 Targeted Cumberland Plain Land Snail survey

The Cumberland Plain Land Snail has specific habitat requirements. The species relies on a fungus that grows at the base of *Eucalyptus tereticornis* trees that have sufficient leaf litter and clumps of native grasses. The species are considered less likely to occur in areas where exotic grasses are present and leaf litter is largely absent. In addition to the base of *Eucalyptus tereticornis*, other Eucalypt species and logs surrounded by native grasses and clumps of leaf litter were also searched for the Cumberland Plain Land Snail.

Searches were made by lightly raking at the leaf litter and soil in areas of potential habitat. Where the soil was friable, it was raked to a few centimetres below the surface. This is because in dry conditions, the Snail is known to burrow into the ground in search of moisture.

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Where snails were positively identified their location was marked using a handheld GPS. Additional details including the number of individuals and their health status (live or deceased) was also noted.

3.2.4 Targeted Microchiropteran bat and Grey-headed Flying-fox survey

Targeted survey for threatened microchiropteran bats (micro bats) and Grey-headed Flying-fox survey included both nocturnal and diurnal survey effort.

Nocturnal survey involved the placement of one anabat echolocation recorder in close to a dam and hollow bearing trees to cover potential foraging and roosting resources. The anabat was left to record for two consecutive nights from 18-20 April 2016 and 26 – 27 April 2016. Anabats were also used to record any micro bats flying overhead or exiting hollows.

Bat calls were analysed by ELA ecologist Dr Rodney Armistead using the program AnalookW (Version 3.8 25 October 2012, written by Chris Corben, www.hoarybat.com). Call identifications were made using regional based guides to the echolocation calls of microbats in New South Wales and south-east Queensland and north-east New South Wales and the accompanying reference library of over 200 calls from north-eastern NSW (Reinhold et al. 2001; Pennay et al. 2004).

Bat calls are analysed using species-specific parameters of the call profile such as call shape, characteristic frequency, initial slope and time between calls (Rinehold et al. 2001). To ensure reliable and accurate results protocols were followed.

Spotlighting for the Grey-headed Flying-fox was performed by two ecologists over four nights. Survey started after dusk (7.30pm) for 1.5 hours, using high powered LED torches. Survey focused on patches of native vegetation within the study area. If individuals were identified their location was marked using a handheld GPS, along with their activity (foraging, flying).

3.2.5 Targeted Koala surveys

Koala surveys involved both diurnal and nocturnal survey effort. Nocturnal survey effort was conducted over four nights and involved call playback and spotlighting. The male Koala call was played three times at five minute intervals, followed by a 10-minute listening period at each survey location. This process was repeated three times per survey location. Spotlighting was undertaken throughout all native vegetation within the study area.

Diurnal survey involved searches for scats and scratches underneath / on feed trees in the study area. The location of any scats / scratches would be marked using a handheld GPS unit.

3.2.6 SEPP 44 – Koala Habitat Assessment

In addition to the targeted nocturnal survey for the Koala, an assessment of Koala habitat was undertaken to determine whether the study area constituted Potential or Core Koala Habitat as outlined in SEPP 44.

'Potential Koala Habitat' refers to:

> "an area of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower state of the tree component" (SEPP 44).

Core Koala Habitat refers to:

> "an area of land with a resident population of Koalas, evidenced by attributes such as breeding females and recent sightings of and historical records of a population" (SEPP 44).

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Feed tree species as identified in the SEPP in the study area were first identified then calculated as a percentage of the total number of canopy trees. Potential feed trees within the subject site were observed for signs of use, including scratches and scats. Where these features were present, the location of the tree was marked using a handheld GPS.

In addition to the feed trees outlined in SEPP 44, OEH has identified several feed trees specific to the Hawkesbury-Nepean region. Survey also noted the abundance of these trees within the study area.

3.3 Survey limitations

Typically, stag watching is conducted in conjunction with overnight anabat surveys. Stag watching was not conducted as part of the field survey. Determining the presence of microbats relied on the anabat data. The results of the data was used to extrapolate how the species were utilising the study area, including foraging or roosting. The anabat data cannot be used to determine whether the individuals are breeding within the study area.

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4 Existing environment

4.1 Literature and data review

The desktop data and literature review returned seven threatened ecological communities, 52 threatened fauna (including migratory species) and 22 threatened flora considered as likely or having potential to occur within a 10 km radius of the study area. Further ground-truthing was undertaken to detect the presence or absence of suitable habitat features within the study area for threatened flora and fauna.

Regional vegetation mapping by NPWS (2002) indicated that there were five vegetation types present (**Figure 2**):

- Alluvial Woodland
- Shale Plains Woodland
- Shale Sandstone Transition Forest (High Sandstone Influence)
- Western Sydney Dry Rainforest
- Unclassified vegetation.

4.2 Terrestrial ecological values

4.2.1 Field survey

Field survey identified a range of ecological values in the study area including the following vegetation communities (**Figure 3; Table 3**):

- Shale Plains Woodland
- Alluvial Woodland
- Exotic pasture
- Planted Natives.

Table 3: Vegetation communities and equivalent plant community types in the study area and relationship to threatened ecological communities

Vegetation community (ELA 2016)	Plant Community Type equivalent (OEH 2017)	BC / EPBC Acts	Approximate area in study area (ha)
Shale Plains Woodland	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	CEEC / CEEC	29.84
Alluvial Woodland	Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin	EEC / -	7.29
Cleared land	N/A	-	147.30
Planted natives	N/A	-	0.74

Key: EEC = endangered ecological community, CEEC = critically endangered ecological community

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4.2.2 Shale Plains Woodland

Shale Plains Woodland corresponds to *Cumberland Plain Woodland in the Sydney Basin Bioregion*, a critically endangered ecological community under the BC Act and as *Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest* under the EPBC Act. For the purpose of this report, Shale Plains Woodland will be referred to as Cumberland Plain Woodland.

Cumberland Plain Woodland is an open eucalypt forest with an open shrub later and grassy groundcover. It occurs in clay-loam soils derived from Wianamatta shale and is restricted to the Cumberland Plain, western Sydney. The canopy typically consists of *Eucalyptus moluccana* (Grey Box), *Eualyptus tereticornis* (Forest Red Gum), *Eucalyptus fibrosa* (Red Ironbark) and *Eucalyptus crebra* (Narrow-leaved Ironbark), with *Eucalyptus eugenioides* (Thin-leaved Stringybark) and *Corymbia maculata* (Spotted Gum) occurring less frequently. The midstorey contains *Acacia decurrens* (Black Wattle), *Acacia falcata* (Sally Wattle), *Acacia parramattensis* (Parramatta Wattle), *Melaleuca decora* (Paperbark), *Bursaria spinosa* (Blackthorn), *Dillwynia sieberi*, *Daviesia ulicifolia* (Gorse Bitter Pea), *Indigofera australis* (Native Indigo) and *Rubus parvifolius* (Native Raspberry). Typical groundcover species include *Aristida ramosa* (Three awn Speargrass), *Cymbopogon refractus* (Barbed Wire Grass), *Dichelachne micrantha* (Short-hair Plume Grass), *Microlaena stipoides* (Weeping Grass), *Themeda triandra* (Kangaroo Grass), *Cyperus gracilis* (Slender Flat-sedge), *Lomandra filiformis* subsp. *filiformis* (Wattle Mat-rush) and *Lomandra multiflora* subsp. *multiflora* (Many-flowered Mat-rush). *Brunoniella australis* (Blue Trumpet), *Dichondra repens* (Kidney Weed), *Glycine* spp., *Goodenia hederacea* subsp. *hederacea* (Ivy Goodenia) and *Oxalis perennans* (Wood Sorrel) are also known to occur.

Field survey confirmed the presence of Cumberland Plain Woodland in the study area in three condition states, good, moderate and scattered paddock trees.

The areas of Cumberland Plain Woodland in **good** condition were restricted to the western boundary of the study area and a small patch at the southern extent of the study area. The canopy was comprised of *Eucalyptus tereticornis* and *Eucalyptus crebra*. The midstorey contained *Bursaria spinosa*. The groundcover was comprised of a mix of native forbs and grasses including *Microlaena stipoides, Einadia trigonos, Oxalis perennans, Commelina cyanea, Desmodium varians, Oplismenus aemulus, Centella asiatica, Entolasia marginata* and *Pratia purpurascens*. Exotic groundcover species included *Sida rhombifolia, Plantago lanceolata, Ehrharta erecta, Senecio madagascariensis, Anagallis arvensis* and *Hypochaeris radicata*. Patches of the community in good condition met EPBC Act condition criteria. Each patch was >0.5 ha in size and contained >30% native perennial species in the groundcover layer.

The areas of Cumberland Plain Woodland in **moderate** condition were present along the eastern and southern extents of the study area. The canopy was comprised of *Eucalyptus tereticornis, Eucalyptus crebra* and *Eucalyptus eugenioides*. The midstorey contained one native shrub, *Bursaria spinosa*. The groundcover contained a mix of native grasses and forbs including *Dichondra repens, Desmodium varians, Oplismenus aemulus, Microlaena stipoides, Oxalis perennans, Entolasia stricta* and *Lomandra filiformis*. Exotic groundcover species included *Sporobolus africanus, Modiola caroliniana, Verbena bonariensis, Sida rhombifolia, Bidens pilosa, Cirsium vulgare* and *Solanum mauritianum*. Patches in moderate condition did not meet EPBC condition criteria due to the patch size either being too small or the groundcover layer containing <30% native perennial species. In some patches a native midstorey was absent and / or dominated by exotic species. Patches in moderate condition did not meet EPBC Act condition criteria because the patches were <5 ha, were not contiguous with larger patches of the community and did not contain at least 30% native groundcover species.

Areas of Cumberland Plain Woodland mapped as **scattered paddock trees** existed across the entire study area. Areas of scattered paddock trees contained a canopy of *Eucalyptus crebra*. The midstorey

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was absent and the groundcover was dominated by exotic pasture grasses including *Senecio madagascariensis, Pennisetum clandestinum, Paspalum dilatatum, Ehrharta erecta, Lepidium sp., Bromus sp.* and *Bidens pilosa*. Native groundcover species including *Oxalis perennans, Cyperus gracilis, Cynodon dactylon, Einadia trigonos* and *Commelina cyanea* were scattered throughout patches of the community. Scattered paddock trees did not meet EPBC condition criteria as they did not form part of a larger, contiguous patch. The midstorey layer was absent and the groundcover was dominated by exotic perennial species. Patches mapped as scattered paddock trees did not meet EPBC Act condition criteria because the patches were <5 ha, were not contiguous with larger patches of the community and did not contain at least 30% native groundcover species.

The patches in moderate condition lacked structural complexity and species diversity, often containing a thinned or in some cases absent midstorey layer with the groundcover comprised of <30% native species across the entire patch. Patches mapped as scattered paddock trees did not contain a native midstorey or groundcover layer. The groundcover was dominated by exotic species and the canopy cover was <10% over the patch. Patches of the community mapped as derived native shrubland contained an intact midstorey and groundcover layer dominated by native species, however did not contain a native canopy.

Patches mapped as moderate and scattered paddock trees did not meet the EPBC Act condition criteria of the community.

4.2.3 Alluvial Woodland

Alluvial Woodland corresponds to *River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions*, an endangered ecological community under the BC Act. For the purpose of this report, Alluvial Woodland will be referred to as River-flat Eucalypt Forest. The River-flat Eucalypt Forest in the study area was found to be in good condition and occurred along Currency Creek. The River-flat Eucalypt Forest in the study area contained native species in all structural layers.

River-flat Eucalypt Forest is an open forest woodland with an open shrub layer and continuous groundcover of grasses and forbs and is found on stream banks and alluvial flats draining soils derived from the Wianamatta Shale. River-flat Eucalypt Forest typically contains a canopy of *Eucalyptus tereticornis* (Forest Red Gum), *E. amplifolia* (Cabbage Gum), *Angophora floribunda* (Rough-barked Apple), *Angophora subvelutina* (Broad-leaved Apple) and *Casuarina glauca* (Swamp Oak). The midstorey contains *Acacia parramattensis* (Parramatta Wattle), *Bursaria spinosa* (Blackthorn) and *Sigesbeckia orientalis.* Typical groundcover species include *Microlaena stipoides* (Weeping Grass), *Oplismenus aemulus* (Basket Grass), *Dichondra spp., Entolasia marginata* (Bordered Panic), *Solanum prinophyllum* (Forest Nightshade), *Pratia purpurascens* (Whiteroot), *Echinopogon ovatus* (Forest Hedgehog Grass), *Desmodium gunnii* (Slender Tick Trefoil), *Commelina cyanea* and *Veronica plebeia* (Creeping speedwell) (OEH 2017).

River-flat Eucalypt Forest was present in good condition in the study area. The canopy was comprised of *Eucalyptus tereticornis. Bursaria spinosa* comprised the midstorey with *Lantana camara* and *Solanum mauritianum* occurring occasionally. The groundcover was diverse and included *Microlaena stipoides, Cynodon dactylon, Austrostipa ramosissima, Oxalis perennans, Commelina cyanea* and *Entolasia marginata*. In some areas, juvenile *Acacia decurrens* was identified in the groundcover layer. Exotic groundcover species were scattered through the community and included *Conyza bonariensis, Senecio madagascariensis, Pennisetum clandestinum, Modiola caroliniana* and *Paspalum dilatatum*

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4.2.4 Exotic pasture

Areas of exotic pasture comprised a majority of the study area and did not form part of any native vegetation community. The community showed signs of large scale clearing and management for cattle grazing. Areas of exotic pasture comprised a majority of the study area. Species in this vegetation type included *Pennisetum clandestinum, Senecio madagascariensis* and *Bromus sp.*

4.2.5 Planted natives

Planted native vegetation did not comprise a native vegetation community. Areas of planted native vegetation consisted of *Eucalyptus microcorys* (Tallowwood).

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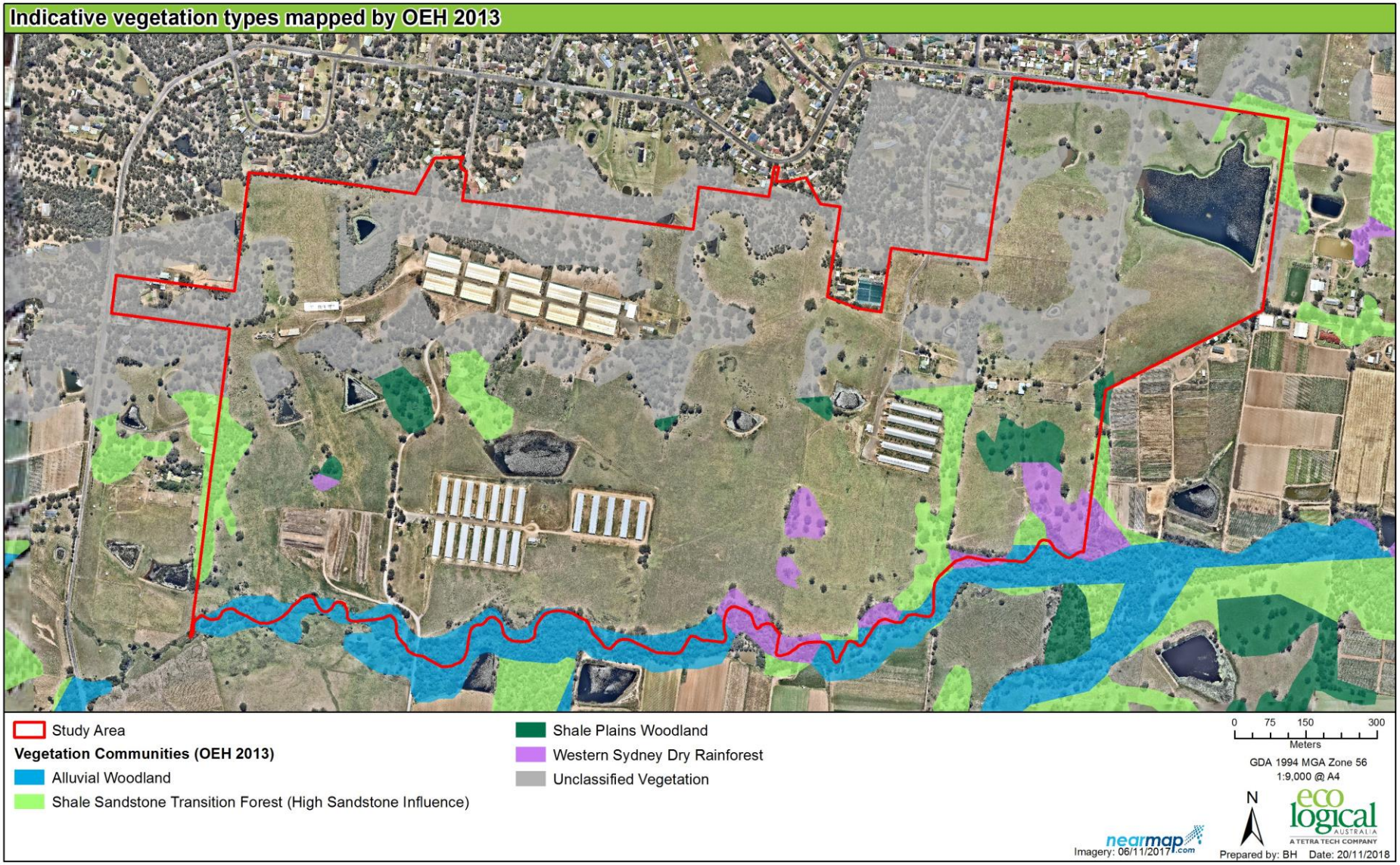

Figure 2: Vegetation mapping by OEH (2013) in the study area

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Figure 3: Validated vegetation types and condition classes in the study area

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4.2.6 Threatened fauna targeted survey

The following threatened fauna species were identified in the study area during survey:

- *Meridolum corneovirens* (Cumberland Plain Land Snail)
- *Miniopterus australis* (Little Bent-wing Bat)
- *Miniopterus schreibersii oceanensis* (Eastern Bentwing-bat)
- *Mormopterus norfolkensis* (Eastern Freetail-bat)
- *Myotis macropus* (Southern Myotis).

These species would likely utilise a range of habitat features present in the study area including hollow bearing trees, leaf litter and woody debris, Currency Creek and farm dams. The Koala and Grey-headed Flying-fox were not identified in the study area during survey.

Targeted survey for the Cumberland Plan Land Snail identified six living and four deceased Cumberland Plain Land Snail individuals in the study area. The species were identified at the bases of *Eucalyptus moluccana* and *E. tereticornis*. mainly occupying areas that contained native grasses and thick leaf litter.

The Grey-headed Flying-fox is still considered likely to occur given the availability of foraging resources, proximity of a known camp and the tendency for the species to forage widely.

4.2.7 Threatened flora habitat assessment

No threatened flora species were identified during the targeted flora survey. Due to the history of disturbance the study area is unlikely to provide habitat for any threatened flora species considered likely to occur.

4.2.8 SEPP 44 – Koala Habitat Assessment

Koala habitat has been delineated across the study area based on vegetation type, condition and extent. The subject site contained one feed tree species listed under SEPP 44, *Eucalyptus tereticornis* (Forest Red Gum). This tree species comprised approximately 40% of the canopy species in areas of Cumberland Plain Woodland and 10% in River-flat Eucalypt Forest.

During targeted survey, no Koalas were visually or aurally identified. Based on the presence of potential feed trees in the study area, the area was found to be potential Koala habitat. Given that no Koala or signs of Koala were identified during targeted survey the subject site is not considered core Koala habitat (as per the definition under SEPP44).

4.3 Aquatic ecological values

4.3.1 Riparian pre-amble

The usage of the riparian land within the study area will be guided by two key legislative requirements – the *Fisheries Management Act 1994* (FM Act) and the *Water Management Act 2000* (WM Act).

The FM Act lists threatened aquatic species which require consideration when addressing the potential impacts of a proposed development. If a proposed development is likely to significantly affect a threatened species, population, or their habitats, then a Species Impact Statement (SIS) is required to be prepared.

The NSW Department of Primary Industries (DPI Water) administers the WM Act and is required to assess activities carried out on waterfront land. Waterfront land includes the bed and bank of any river, lake or

estuary and all land within 40 m of the highest bank of the river, lake or estuary. Certain activity within this land is defined as a 'controlled activity' and requires approval from DPI Water.

DPI Water requires a Vegetated Riparian Zone (VRZ) adjacent to a creek channel to provide a protective buffer between catchment land uses and aquatic habitat. This not only helps improve water quality and aquatic habitat, but provides habitat for terrestrial and riparian flora and fauna. The VRZ plus the channel width constitute the 'riparian corridor' (**Figure 4**). The width of the VRZ within waterfront land is measured from the top of the highest bank on both sides of the watercourse (**Table 4**). The VRZ width has been predetermined and standardised for first, second, third and fourth order and greater watercourses (**Figure 5**).

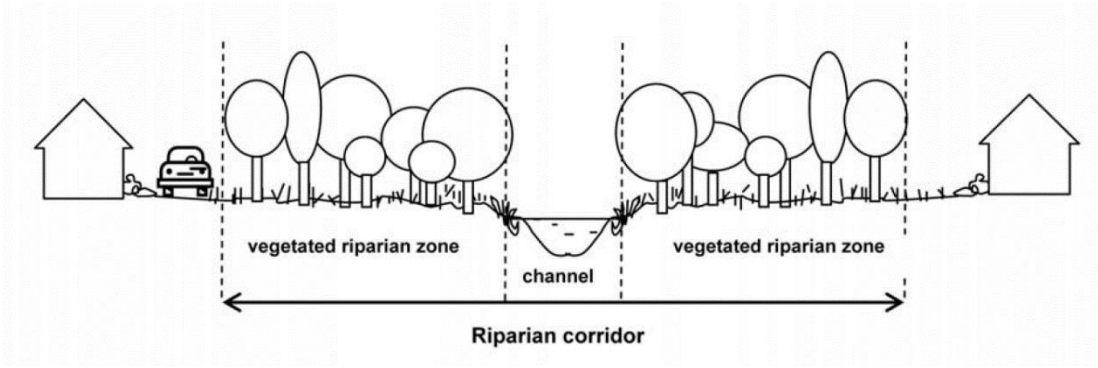

Figure 4: Riparian corridor showing the Vegetated Riparian Zone (VRZ) relative to the watercourse channel

The uses permitted in each watercourse type are defined by the Strahler stream order system of classification. The Strahler system numbers the smallest headwater streams as 1st Order, and stream order increases downstream through the catchment as streams merge and form larger streams (e.g. when two 1st Order streams join they become a 2nd Order).

Table 4: Recommended riparian corridor widths

Watercourse type	VRZ width (per side; (m))	Total Riparian Corridor Width
1st order	10	20 m + channel width
2nd order	20	40 m + channel width
3rd order	30	60 m +channel width
4th order and greater (Includes estuaries, wetlands and any parts of rivers influenced by tidal waters)	40	80m + channel width

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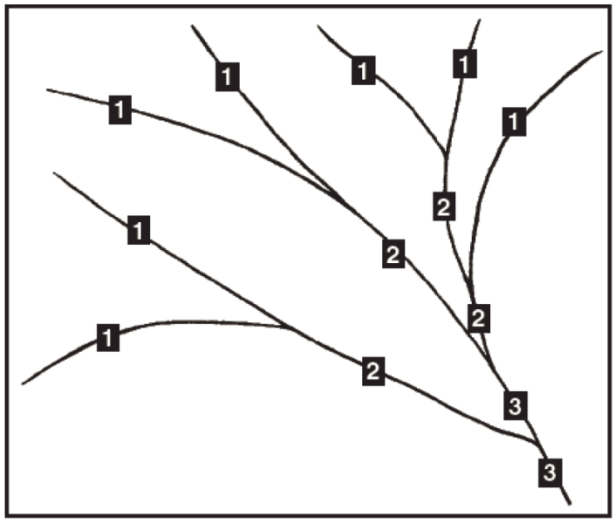

Figure 5: The Strahler system for classifying stream order (source: NSW Office of Water 2012)

Non-riparian corridor works may be authorised by DPI Water in the outer riparian corridor (outer 50%) as long as an equivalent area connected to the VRZ is offset (**Figure 6**). These works may include asset protection zones, roads, infrastructure and recreational areas. This process is often referred to as the averaging rule. The average width of the VRZ is achieved over the watercourse within the site. The inner 50% of the VRZ must be fully maintained as a functional riparian zone.

Watercourses are identified on 1:25,000 topographic maps published by NSW Government Spatial Services (maps.six.nsw.gov). The *Guidelines for riparian corridors on waterfront land* (NSW Office of Water 2012) also notes that "where a watercourse does not exhibit the features of a defined channel with beds and banks, the Office of Water may determine that the watercourse is not waterfront land for the purposes of the WM Act". However, removal of a watercourse from the existing hydroline mapping does not alter the downstream watercourse type (i.e. Strahler stream order is fixed).

Stream order	Vegetated Riparian Zone (VRZ)	RC off-setting for non RC uses	Cycleways and paths	Detention basins		Stormwater outlet structures and essential services	Stream realignment	Road crossings		
				Only within 50% outer VRZ	Online			Any	Culvert	Bridge
1st	10m	•	•	•	•	•	•	•		
2nd	20m	•	•	•	•	•		•		
3rd	30m	•	•	•		•			•	•
4th +	40m	•	•	•		•			•	•

Figure 6: Riparian corridor matrix showing works that can occur on waterfront land and riparian corridors (from NSW Office of Water 2012)

4.3.2 Riparian results

The Jacaranda Ponds study area is situated within the Hawkesbury River Catchment. The topography is undulating in cleared areas grading to flatter terrain around Currency Creek. Currency Creek runs along the southern boundary of the site and is mapped as a fourth order stream which requires an 80 m riparian

corridor. Three first order streams run north to south at the northern boundary of the study area and would require a 20 m riparian corridor. The streams are unnamed and are tributaries of Howes Creek.

Riparian corridors (VRZ + channel) for Currency Creek and the first order streams unnamed corridors are mapped in **Figure 7** The riparian corridor includes the channel between the top of each bank plus the required VRZ for its appropriate Strahler stream order.

4.3.3 Riparian outcome

The first order streams within the study area have been highly modified and are non-functioning. Currency Creek has retained its integrity due to the vegetation along a majority of its banks. Some portions of the corridor show signs of disturbance and previous clearing for agricultural purposes. Potential impacts from the proposed subdivision and subsequent development may include:

- altered flow regimes resulting in replacement of 'chain of ponds' ecosystems with permanent channels
- removal of riparian vegetation leading to significant creek and riverbank erosion and loss of habitat
- removal of instream vegetation and woody debris contributing to habitat loss
- road crossings, culvert and other flood mitigation structures, which alter watercourses and present barriers to fish passage
- run-off from residential land contributes high nutrient and debris loads to creeks and rivers (i.e. lawn clippings and leaves entering stormwater)
- presence and on-going proliferation of invasive species e.g. *Gambusia holbrooki* (Mosquito Fish).

Many of the above impacts are now considered to be Key Threatening Processes (KTPs) listed under the FM Act. The combined effect of these impacts presents a reduction in the ecological functioning of these systems and an associated loss of environmental values. Further impact assessments in accordance with the FM Act will be required during future stages of the approval process.

The preliminary masterplan provides for the retention of the majority of Currency Creek. A riparian corridor in accordance with the WM Act has been allowed for at Currency Creek. This will ensure that the waterways maintain their ecological function through the retention and enhancement of the vegetated riparian zone.

The majority of the first order streams are proposed to be removed and are likely to be replaced with concrete drainage infrastructure. It is noted that some streams have not been field validated, and may not exist with a defined channel and therefore not meet the definition of a stream under the WM Act.

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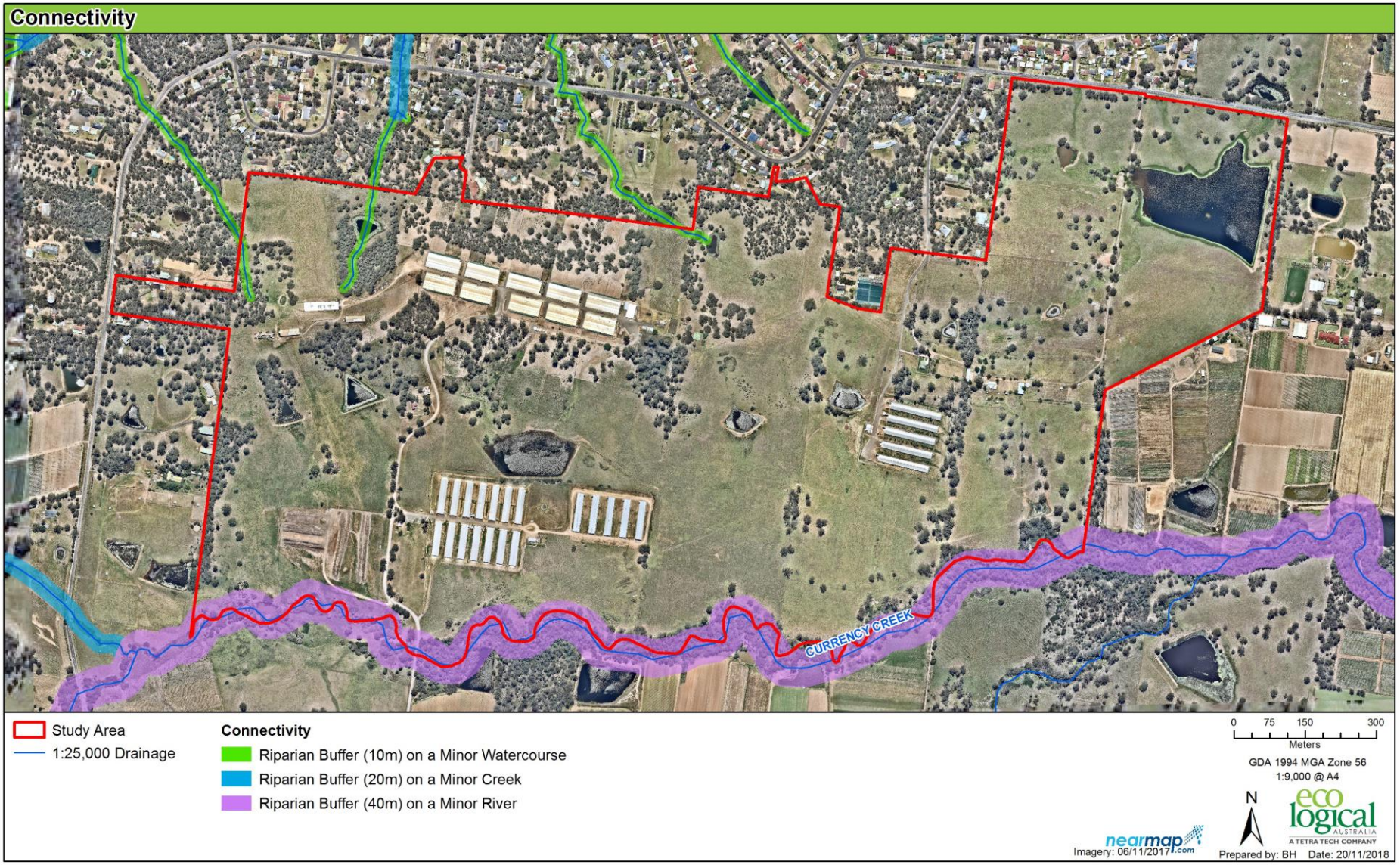

Figure 7: Strahler stream order of the watercourses within the study area

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5 Discussion

5.1 Terrestrial ecological constraints

The ecological constraints in the study area have been determined by assessing the native vegetation present, its condition, extent and whether it provides foraging or roosting resources for threatened species known or considered likely to occur in the study area (**Table 5**).

The minimum requirement for Cumberland Plain Woodland to meet EPBC Act condition criteria is a patch containing at least 30% native groundcover species. Although the patches of moderate condition Cumberland Plain Woodland did not meet EPBC Act condition, the contiguity of some patches with larger areas of native vegetation, presence of hollow bearing trees, potential habitat for Cumberland Plain Land Snail and it's listing as a critically endangered ecological community under the BC Act and EPBC Act meant these patches were still deemed very high ecological constraint.

Targeted survey for threatened microbats returned positive calls for the Little Bent-wing Bat, Eastern Bentwing-bat, Eastern Freetail-bat and Southern Myotis which would, on an occasional basis be likely to utilise the hollow bearing trees within the study area. In addition, the hollow bearing trees are in proximity to a number of farm dams and Currency Creek which would be used as foraging habitat for the Southern Myotis.

Targeted survey for the Cumberland Plain Land Snail identified live and deceased individuals in areas of moderate and good condition Cumberland Plain Woodland. The Cumberland Plain Land Snail has highly specific habitat requirements and relies upon Cumberland Plain Woodland containing native *Eucalyptus* sp. Little is known about the species home range. Some studies suggest the species can travel around 0.5 m per day (Ridgeway et al. 2014). The small home range of the species would indicate that the Cumberland Plain Land Snail could not easily relocate and colonise new habitat in the event of disturbance. Given this species relies on a critically endangered ecological community for habitat, the patches of moderate and good condition Cumberland Plain Woodland have been assigned a very high level of constraint.

The patches of cleared land are considered to be of low constraint as it would not provide habitat for threatened flora and fauna species and was dominated by exotic perennial grasses.

5.2 Aquatic / riparian ecological constraints

A majority of the dams within the study area contained poor quality water and have been subject to ongoing nutrient inputs from the surrounding farming and agriculture. There was minimal fringing vegetation that would be likely to provide roosting and foraging habitat for migratory birds or amphibians. The dams were considered to be of low ecological constraint, however they would still require de-watering under the supervision of a suitably qualified aquatic ecologist.

Currency Creek is mapped as a fourth order stream, requires an 80 m riparian corridor and is mapped as Key Fish Habitat under the FM Act. One of the aims of the FM Act is to protect waterways / bodies mapped as Key Fish Habitat. If Currency Creek were to be impacted, the 'avoid, minimise and offset' principle would need to be applied. If encroachment into the 80 m corridor were to occur, the encroachment would need to be offset elsewhere along the corridor. Currency Creek may provide foraging habit for the Southern Myotis. Its banks are vegetated with River-flat Eucalypt Forest which is

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an endangered ecological community under the BC Act. The patches of River-flat Eucalypt Forest are high constraint and the proposed rezoning is consistent with this constraint.

Table 5: Constraints in the study area

Constraint	Value	Justification
Very High	Cumberland Plain Woodland (good condition) and Cumberland Plain Land Snail habitat	• listed as critically endangered under the BC Act and EPBC Act • met EPBC Act condition criteria and contained native species in all structural layers • potential habitat for Cumberland Plain Land Snail • formed part of larger, contiguous patches • foraging and roosting habitat for threatened microbat species • covered by the terrestrial biodiversity overlay • potential Koala habitat under SEPP 44 • contiguous with native vegetation outside the study area • known habitat for Cumberland Plain Land Snail listed as endangered under the BC Act; specific habitat requirements living only in Cumberland Plain Woodland; small species range, does not respond well to disturbance and is unable to easily relocate
Very High	Cumberland Plain Woodland (moderate condition) and Cumberland Plain Land Snail habitat	• listed as critically endangered under the BC Act • in some areas contiguous with other patches of the community in good condition • foraging and roosting habitat for threatened microbat species • potential habitat for Cumberland Plain Land Snail • native species not present in all structural layers • covered by the terrestrial biodiversity overlay • potential Koala habitat under SEPP 44 • known habitat for Cumberland Plain Land Snail listed as endangered under the BC Act; specific habitat requirements living only in Cumberland Plain Woodland; small species range, does not respond well to disturbance and is unable to easily relocate
High	River-flat Eucalypt Forest	• listed as endangered under the BC Act • forms the riparian corridor along Currency Creek • is contiguous with other patches of native vegetation in the study area • foraging and roosting habitat for threatened microbats • covered by the terrestrial biodiversity overlay • mapped as a fourth order stream, requiring the retention of a 80 m riparian corridor (40 m each side) • covered by the terrestrial biodiversity overlay • may provide habitat for Cumberland Plain Land Snail • forms part of a native vegetation corridor extending to the east of the study area • mapped as Key Fish Habitat under the FM Act
Moderate	Cumberland Plain Woodland – Scattered Paddock Trees	• listed as critically endangered under the BC Act • lacked structural complexity and species diversity • marginal foraging habitat for threatened microbats • unlikely to provide habitat for Cumberland Plain Land Snail

Constraint	Value	Justification
		• did not contain a contiguous canopy (<10% cover)
Moderate	Cumberland Plain Woodland – regeneration	• listed as critically endangered under the BC Act • did not contain a native canopy • lacked structural complexity and species diversity • history of previous disturbance and clearing • not considered habitat for any threatened flora or fauna species
Moderate	Dam 1 (located in the north-west of the study area)	• potential foraging habitat for *Myotis macropus* – located adjacent to potential roost tree • good water quality • fringing vegetation present
Low	Exotic pasture	• dominated by exotic perennial grass species • did not contain any potential habitat for threatened flora or fauna species • long history of ongoing disturbance and maintenance for agricultural purposes
Low	Dams	• would not provide foraging habitat for any threatened microbat species • many agricultural and nutrient inputs • potentially poor water quality

5.3 Impact areas

A preliminary impact quantification was conducted based on the proposed masterplan and the results of the vegetation survey. **Table 6** identifies the areas of each vegetation community that would either be retained or removed, based on the proposed masterplan. The proposed masterplan has focussed retention on the north-south biodiversity corridors, as well as facilitating more native vegetation to be retained than the current zoning allows for. The site presents an opportunity to provide conservation of east-west corridor along Currency Creek and link it to other more expansive areas of native vegetation in the north.

Table 6: Indicative areas to be impacted and retained under the proposed rezoning

Shale Plains Woodland	Development impact (ha)	BioBank area (ha)	Retained land (ha)	**Total (ha)**
Good	4.02	8.51	0.00	**12.53**
Moderate	10.59	3.81	0.00	**14.40**
Regeneration	0.53	0.00	0.00	**0.53**
Scattered Paddock Tree	2.20	0.14	0.41	**2.75**
Total	**17.33**	**12.46**	**0.41**	**30.20**
Alluvial Woodland	Impact (ha)	BioBank area (ha)	Retained land (ha)	**Total (ha)**
Good	0.02	0.00	6.80	**6.82**
Total	**0.02**	**0.00**	**6.80**	**6.82**

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Grand Total	**17.35**	**12.46**	**7.21**	**37.02**

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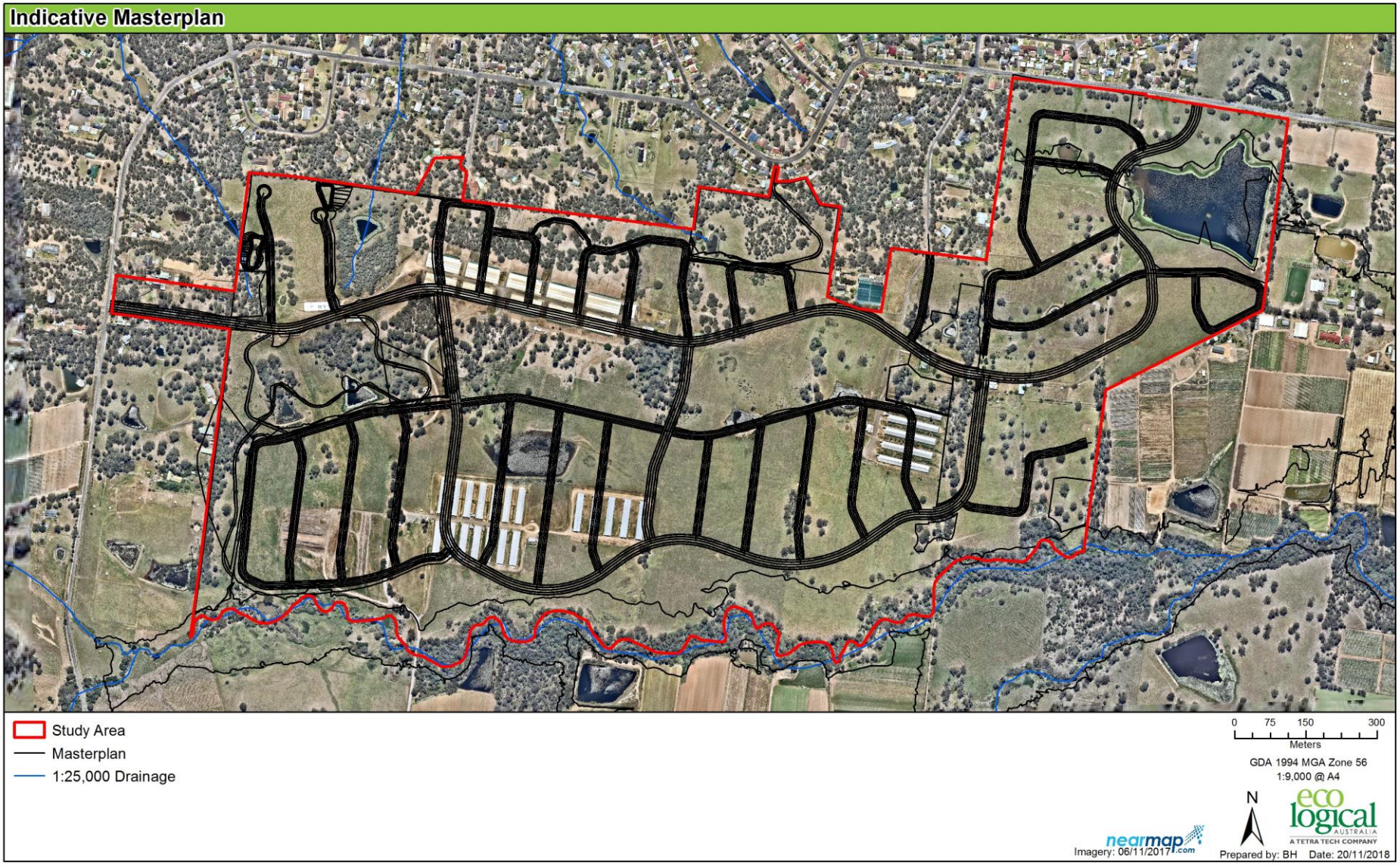

Figure 8: Proposed layout of the rezoned site

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6 Conservation and management recommendations

The following recommendations have been made for the planning proposal based on best practice principles to protect ecological and aquatic values in the study area. Some of the recommendations pertain to requirements for further targeted survey to determine the likely presence of threatened flora and fauna in the study area. The recommendations should continue to be followed through the design and planning phases.

6.1 Terrestrial ecology

-
- Any proposed development should avoid large patches of native vegetation, particularly those that are contiguous with other patches of native vegetation. This would avoid fragmentation and isolation of native vegetation communities and fauna species likely to be utilising the area.
- The likely planning approval at the development stage would be to obtain Biodiversity Certification of the entire site. This would allow for consideration of in-perpetuity management for some areas of vegetation. This would secure the lands for conservation and be funded. If this was pursued, consideration would be given to future uses such as recreation and road crossings to ensure the conservation site does not prevent other beneficial uses or infrastructure requirements.
- It is recommended that HBTs are retained where practicable, particularly those clustered in good quality vegetation. HBTs have ecological value for threatened microbat species and other hollow dependent fauna. Hollow bearing trees could be retained in open space areas such as pocket parks or as street trees.
- The management of weeds in the study area will need to be considered further. Areas proposed for retention would require varying levels of weed management.
- Vegetated buffers should be placed around patches of native vegetation to be retained to prevent the spread of exotic flora species.
- Where habitat features are to be cleared, removed or modified, compensatory habitat could be incorporated into the planning of the site.
- The number of infrastructure crossings should be minimised, but provide sufficient width in the infrastructure corridor so that minor alignment changes at the DA stage can be accommodated.
- Services and infrastructure should be located outside of the conservation areas or services co-located if the conservation areas cannot be avoided
- Local provenance species should be used in rehabilitation works and within street/neighbourhood landscaping.

6.2 Aquatic ecology

- The proposal should aim at retention of the higher order riparian corridors to protect associated patches of native vegetation. Where existing aquatic habitat features are to be removed or modified, compensatory habitat could be incorporated into the detailed planning of the site for example by rehabilitating cleared areas within riparian buffers.

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- The terrestrial and aquatic habitat linkages within and off site should aim to be retained, enhanced and protected in the design of riparian corridors, the Masterplan allows for this.
- It is possible some of the first order streams can be proposed for removal. These reaches may not meet the definition of a 'river' under the WM Act as they may not exhibit the features of a defined channel with bed and banks. This would extinguish the requirements under the WM Act for such areas. The desktop mapping will require field validation of the riparian corridor (VRZ + channel) using a GPS, or survey technique with an accuracy of <1 m to confirm the riparian extents. As development is permitted in the outer 50% VRZ if adequate offset compensation is applied (1:1 spatial extent), the development boundary does not necessarily have to mimic the natural shape of the channels. That is, encroachment may occur near outer bends if offsets are applied to inner bends. This is often undertaken to achieve a straighter development edge whilst keeping an average appropriate VRZ.
- Should future development of the site require roads to be constructed across streams impacting the Riparian Zone, it will be deemed a controlled activity under the WM Act and an approval will be required under Section 91 (2) of the WM Act. The preparation of a vegetation management plan would also be required.
- To further improve aquatic habitat, the removal of existing instream blockages including weirs and farm dams should occur and include appropriate use of large woody debris to reintroduce instream habitat.
- The proposal should consider fish passage requirements when designing future creek crossings, water detention and water quality features.
- The proposal should consider improvement of water quality through Water Sensitive Urban Design.
- Water design and siting should consider control of peak flows to reduce erosion impacts and improve water quality.
- The riparian corridor widths should be consistent with the Natural Resources Access Regulator Water Guidelines for the corresponding stream order.
- Wherever possible, development and subsequent bushfire asset protection zones (APZ) should not occur in areas designated as a Riparian Corridor.
- All first order streams including those determined not to be 'waterfront land' must be used in determination of stream ordering downstream.
- Riparian corridors should be maintained or rehabilitated with fully structured native vegetation in accordance with the riparian corridor matrix rules.
- Where existing dams are to be removed post development the riparian corridor should be measured from the top of bank of the proposed new constructed channel. The channel width should be consistent with the existing channel up or downstream.
- Cycleway and paths are permitted within the outer VRZ, however, the total disturbance footprint must not exceed 4 m. This impact does not require offsetting as used under the WM Act.
- Detention basins are permitted within the outer VRZ. However, an equivalent area connected to the riparian corridor is required to offset that part of the detention basin that occurs within the VRZ.
- Flora and fauna impact assessments are to consider listings under the FM Act.

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7 Conclusion

7.1 Biodiversity

Eco Logical Australia Pty Ltd was engaged by Celestino Pty Ltd to undertake a Flora and Fauna Assessment for the proposed rezoning of land associated with the proposed Jacaranda Ponds residential subdivision. This Flora and Fauna Assessment report would accompany a planning proposal to Hawkesbury City Council.

Extensive flora and fauna survey has been undertaken for the study area and identified a range of ecological values including Cumberland Plain Woodland, a critically endangered ecological community under the BC Act and the EPBC Act and River-Flat Eucalypt Forest, listed as an endangered ecological community under the BC Act. The study area included farm dams, hollow bearing trees and a riparian corridor. The Cumberland Plain Land Snail, Little Bent-wing Bat, Eastern Bentwing-bat, Eastern Freetail-bat and Southern Myotis were identified during field survey. The Grey-headed Flying-fox is also likely to utilise the study area for foraging purposes.

Impacts to areas of very high and high ecological constraint should be avoided with development more suitable in areas mapped as moderate to low ecological constraint. The areas of very high to high ecological constraint contained native vegetation listed as critically endangered or endangered under the BC Act or EPBC Act, provided habitat for threatened microbats and the Cumberland Plain Land Snail, were covered by the terrestrial biodiversity overlay or were mapped as Key Fish Habitat. The areas of exotic pasture and scattered paddock trees were considered more suitable for development.

7.2 Planning approvals

On 25 August 2017, the BC Act came into force. However, the *Biodiversity Conservation (Savings and Transitional) Regulation 2017* provides for a 12 month period in certain LGA where a Part 4 (EP&A Act) DA can be lodged under the previous legislation. This applies to Hawkesbury City LGA. This planning proposal is assessed under Part 3 of the EP&A Act.

OEH advised that within three months of the BC Act coming into force, the Minister for the Environment will reveal several Biodiversity Certification projects that may be submitted under the former provisions.

> *Within three months of 25 August 2017 the Minister for the Environment will identify, through a notice in the NSW Gazette, biodiversity certification proposals which can be submitted after 25 August 2017 and considered under the* Threatened Species Conservation Act 1995*. The deadline for submitting these applications will be set out in the order.*

The *Biodiversity Conservation (Savings and Transitional) Regulation 2017* allows for transition of certification projects. On 24 November 2017, the Minister published in the gazette a notification that the Jacaranda Ponds site may be assessed under the Biodiversity Certification provisions of the now repealed *Threatened Species Conservation Act 1995*.

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Appendix A - Likelihood of occurrence

An assessment of likelihood of occurrence was made for threatened and migratory species identified from the database search. Five terms for the likelihood of occurrence of species are used in this report. This assessment was based on database or other records, presence or absence of suitable habitat, features of the proposal site, results of the field survey and professional judgement. The terms for likelihood of occurrence are defined below:

- "yes" = the species was or has been observed on the site
- "likely" = a medium to high probability that a species uses the site
- "potential" = suitable habitat for a species occurs on the site, but there is insufficient information to categorise the species as likely to occur, or unlikely to occur
- "unlikely" = a very low to low probability that a species uses the study area, and
- "no" = habitat on site and in the vicinity is unsuitable for the species.

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Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution and Habitat	Likelihood of Occurrence
Castlereagh Scribbly Gum Agnes Banks Woodland in the Sydney Basin Bioregion		E	E	Occurs in western Sydney, now mostly near Agnes Banks on the east bank of the Hawkesbury River, in the Penrith local government area. Occurs within the local government areas of Bankstown, Blacktown, Campbelltown, Hawkesbury, Liverpool and Penrith. Mainly found in the Castlereagh area of the Cumberland Plain, with small patches occurring at Kemps Creek and Longneck Lagoon; also present around Holsworthy.	Potential
Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion		E	CE	Occurs in western Sydney, with the most extensive stands occurring in the Castlereagh and Holsworthy areas. Smaller remnants occur in the Kemps Creek area and in the eastern section of the Cumberland Plain. Mainly occurs on clay soils derived from the deposits of ancient river systems (alluvium), or on shale soils of the Wianamatta Shales.	Unlikely
Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest		CE	CE	Endemic to the shale hills and plains of the Sydney Basin Bioregion in NSW, occurring primarily in, but not limited to, the Cumberland Sub-region. Flat to undulating or hilly terrain, at elevations up to approximately 350 metres above sea level. Predominantly associated with clay soils, that are derived from Wianamatta Shale geology. Minor occurrences may be present on other soil groups, notably Holocene Alluvium and soils derived from the Mittagong Formation.	Known
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions		E	-	Found on the river flats of the coastal floodplains. Known from parts of the Local Government Areas of Port Stephens, Maitland, Singleton, Cessnock, Lake Macquarie, Wyong, Gosford, Hawkesbury, Baulkham Hills, Blacktown, Parramatta, Penrith, Blue Mountains, Fairfield, Holroyd, Liverpool, Bankstown, Wollondilly, Camden, Campbelltown, Sutherland, Wollongong, Shellharbour, Kiama, Shoalhaven, Palerang, Eurobodalla and Bega Valley. Associated with silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains.	Known
Shale/Sandstone Transition Forest of the Sydney Basin Bioregion		CE	CE	Occurs at the edges of the Cumberland Plain in western Sydney, most now occurs in the Hawkesbury, Baulkham Hills, Liverpool, Parramatta, Penrith, Campbelltown and Wollondilly local government areas. Intergrade between clay soils from the shale rock and earthy and sandy soils from sandstone, or where shale caps overlay sandstone.	Unlikely

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Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution and Habitat	Likelihood of Occurrence
Sydney Turpentine-Ironbark Forest in the Sydney Basin Bioregion		E	CE	Cumberland Lowlands, with remnants also occurring to the west on shale-capped ridges in the Blue Mountains. Restricted to areas with clay soil derived from Wianamatta Shale in an area that generally has an annual rainfall of more than 950 mm.	Potential
Western Sydney Dry Rainforest and Moist Woodland on Shale / Western Sydney Dry Rainforest / Moist Shale Woodland		E	CE	Cumberland Plain Sub-region of the Sydney Basin Bioregion. It generally occurs in rugged terrain and other patches may occur on undulating terrain, with dry rainforest patches typically occupying steep lower slopes and gullies, and moist woodland patches typically occupying upper sections of the slope Occurs almost exclusively on clay soils derived from Wiannamatta Group shales.	Unlikely
FAUNA					
Anthochaera phrygia	Regent Honeyeater	E4A	CE	Inland slopes of south-east Australia, and less frequently in coastal areas. In NSW, most records are from the North-West Plains, North-West and South-West Slopes, Northern Tablelands, Central Tablelands and Southern Tablelands regions; also recorded in the Central Coast and Hunter Valley regions. Eucalypt woodland and open forest, wooded farmland and urban areas with mature eucalypts, and riparian forests of *Casuarina cunninghamiana* (River Oak).	Unlikely
Apus pacificus	Fork-tailed Swift	-	M	Recorded in all regions of NSW. Riparian woodland, swamps, low scrub, heathland, saltmarsh, grassland, Spinifex sandplains, open farmland and inland and coastal sand-dunes.	Unlikely
Botaurus poiciloptilus	Australasian Bittern	E1	E	Found over most of NSW except for the far north-west. Permanent freshwater wetlands with tall, dense vegetation, particularly Typha spp. (bullrushes) and Eleocharis spp. (spikerushes).	Unlikely
Calidris ferruginea	Curlew Sandpiper	E1	M	Occurs along the entire coast of NSW, and sometimes in freshwater wetlands in the Murray-Darling Basin. Littoral and estuarine habitats, including intertidal mudflats, non-tidal swamps, lakes and lagoons on the coast and sometimes inland.	Unlikely
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	In NSW, distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes. Isolated records known from as far north as Coffs Harbour and as far west as Mudgee. Tall mountain forests and woodlands in	Unlikely

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Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution and Habitat	Likelihood of Occurrence
				summer; in winter, may occur at lower altitudes in open eucalypt forests and woodlands, and urban areas.	
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	In NSW, widespread along coast and inland to the southern tablelands and central western plains, with a small population in the Riverina. Open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur.	Potential
Cercartetus nanus	Eastern Pygmy-possum	V	-	In NSW it extends from the coast inland as far as the Pilliga, Dubbo, Parkes and Wagga Wagga on the western slopes. Rainforest, sclerophyll forest (including Box-Ironbark), woodland and heath.	No
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Recorded from Rockhampton in Qld south to Ulladulla in NSW. Largest concentrations of populations occur in the sandstone escarpments of the Sydney basin and the NSW north-west slopes. Wet and dry sclerophyll forests, Cyprus Pine dominated forest, woodland, sub-alpine woodland, edges of rainforests and sandstone outcrop country.	Potential
Circus assimilis	Spotted Harrier	V	-	Found throughout the Australian mainland, except in densely forested or wooded habitats, and rarely in Tasmania. Grassy open woodland, inland riparian woodland, grassland, shrub steppe, agricultural land and edges of inland wetlands.	Unlikely
Daphoenositta chrysoptera	Varied Sittella	V	-	Distribution in NSW is nearly continuous from the coast to the far west. Inhabits eucalypt forests and woodlands, mallee and Acacia woodland.	Potential
Dasyurus maculatus maculatus	Spotted-tailed Quoll	V	E	Found on the east coast of NSW, Tasmania, eastern Victoria and north-eastern Qld. Rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline.	Unlikely
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	South-east coast and ranges of Australia, from southern Qld to Victoria and Tasmania. In NSW, records extend to the western slopes of the Great Dividing Range. Tall (greater than 20m) moist habitats.	Potential
Gallinago hardwickii	Latham's Snipe	-	M	Migrant to east coast of Australia, extending inland west of the Great Dividing Range in NSW. Freshwater, saline or brackish wetlands up to 2000 m above sea-level; usually freshwater swamps, flooded grasslands or heathlands.	Potential

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Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution and Habitat	Likelihood of Occurrence
Glossopsitta pusilla	Little Lorikeet	V	-	In NSW, found from the coast westward as far as Dubbo and Albury. Dry, open eucalypt forests and woodlands, including remnant woodland patches and roadside vegetation.	Potential
Grantiella picta	Painted Honeyeater	V	-	Widely distributed in NSW, predominantly on the inland side of the Great Dividing Range but avoiding arid areas. Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests.	Unlikely
Haliaeetus leucogaster	White-bellied Sea-Eagle	-	M	Distributed along the coastline of mainland Australia and Tasmania, extending inland along some of the larger waterways, especially in eastern Australia. Freshwater swamps, rivers, lakes, reservoirs, billabongs, saltmarsh and sewage ponds and coastal waters. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, forest and urban areas.	Unlikely
Heleioporus australiacus	Giant Burrowing Frog	V	V	South eastern NSW and Victoria, in two distinct populations: a northern population in the sandstone geology of the Sydney Basin as far south as Ulladulla, and a southern population occurring from north of Narooma through to Walhalla, Victoria. Heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based.	No
Hieraaetus morphnoides	Little Eagle	V	-	Throughout the Australian mainland, with the exception of the most densely-forested parts of the Dividing Range escarpment. Open eucalypt forest, woodland or open woodland, including sheoak or Acacia woodlands and riparian woodlands of interior NSW.	Potential
Hirundapus caudacutus	White-throated Needletail	-	M	All coastal regions of NSW, inland to the western slopes and inland plains of the Great Divide. Occur most often over open forest and rainforest, as well as heathland, and remnant vegetation in farmland.	Potential
Hoplocephalus bungaroides	Broad-headed Snake	E1	V	Largely confined to Triassic and Permian sandstones within the coast and ranges in an area within approximately 250 km of Sydney. Dry and wet sclerophyll forests, riverine forests, coastal heath swamps, rocky outcrops, heaths, grassy woodlands.	No

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Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution and Habitat	Likelihood of Occurrence
Lathamus discolor	Swift Parrot	E1	CE	Migrates from Tasmania to mainland in Autumn-Winter. In NSW, the species mostly occurs on the coast and south west slopes. Box-ironbark forests and woodlands.	Unlikely
Limosa lapponica	Bar-tailed Godwit	-	M	Summer migrant to Australia. Widespread along the coast of NSW, including the offshore islands. Also numerous scattered inland records. Intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons, bays, seagrass beds, saltmarsh, sewage farms and saltworks, saltlakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats. Rarely inland wetlands, paddocks and airstrips.	Unlikely
Litoria aurea	Green and Golden Bell Frog	E1	V	Since 1990, recorded from ~50 scattered sites within its former range in NSW, from the north coast near Brunswick Heads, south along the coast to Victoria. Records exist west to Bathurst, Tumut and the ACT region. Marshes, dams and stream-sides, particularly those containing Typha spp. (bullrushes) or Eleocharis spp. (spikerushes). Some populations occur in highly disturbed areas.	Unlikely
Litoria littlejohni	Littlejohn's Tree Frog	V	V	Plateaus and eastern slopes of the Great Dividing Range from Watagan State Forest south to Buchan in Victoria. The species has not been recorded in southern NSW within the last decade. Breeding habitat is the upper reaches of permanent streams and perched swamps. Non-breeding habitat is heath-based forests and woodlands	Unlikely
Lophoictinia isura	Square-tailed Kite	V	-	In NSW, it is a regular resident in the north, north-east and along the major west-flowing river systems. It is a summer breeding migrant to the south-east, including the NSW south coast. Timbered habitats including dry woodlands and open forests, particularly timbered watercourses.	Unlikely
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V	-	Widespread in NSW from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. Also Richmond and Clarence River areas and a few scattered sites in the Hunter, Central Coast and Illawarra regions. Open forests or woodlands dominated by box and ironbark eucalypts, or by smooth-barked gums, stringybarks, river sheoaks and tea-trees.	Unlikely

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Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution and Habitat	Likelihood of Occurrence
Meridolum corneovirens	Cumberland Plain Land Snail	E1	-	Areas of the Cumberland Plain west of Sydney, from Richmond and Windsor south to Picton and from Liverpool, west to the Hawkesbury and Nepean Rivers at the base of the Blue Mountains. Primarily inhabits Cumberland Plain Woodland. Also known from Shale Gravel Transition Forests, Castlereagh Swamp Woodlands and the margins of River-flat Eucalypt Forest.	Known
Miniopterus australis	Little Bentwing-bat	V	-	East coast and ranges south to Wollongong in NSW. Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub.	Known
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-	In NSW it occurs on both sides of the Great Dividing Range, from the coast inland to Moree, Dubbo and Wagga Wagga. Rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grassland.	Known
Mixophyes balbus	Stuttering Frog	E1	V	Along the east coast of Australia from southern Qld to north-eastern Victoria. Rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range.	No
Monarcha melanopsis	Black-faced Monarch	-	M	In NSW, occurs around the eastern slopes and tablelands of the Great Divide, inland to Coutts Crossing, Armidale, Widden Valley, Wollemi National Park and Wombeyan Caves. It is rarely recorded farther inland. Rainforest, open eucalypt forests, dry sclerophyll forests and woodlands, gullies in mountain areas or coastal foothills, Brigalow scrub, coastal scrub, mangroves, parks and gardens.	Unlikely
Mormopterus norfolkensis	Eastern Freetail-bat	V	-	Found along the east coast from south Qld to southern NSW. Dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range.	Known
Motacilla flava	Yellow Wagtail	-	M	Regular summer migrant to mostly coastal Australia. In NSW recorded Sydney to Newcastle, the Hawkesbury and inland in the Bogan LGA. Swamp margins, sewage ponds, saltmarshes, playing fields, airfields, ploughed land, lawns.	Unlikely

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Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution and Habitat	Likelihood of Occurrence
Myiagra cyanoleuca	Satin Flycatcher	-	M	In NSW, widespread on and east of the Great Divide and sparsely scattered on the western slopes, with very occasional records on the western plains. Eucalypt-dominated forests, especially near wetlands, watercourses, and heavily-vegetated gullies.	Potential
Myotis macropus	Southern Myotis	V	-	In NSW, found in the coastal band. It is rarely found more than 100 km inland, except along major rivers. Foraging habitat is waterbodies (including streams, or lakes or reservoirs) and fringing areas of vegetation up to 20m.	Known
Neophema pulchella	Turquoise Parrot	V	-	Occurs along the length of NSW from the coastal plains to the western slopes of the Great Dividing Range. Eucalypt and cypress pine open forests and woodlands, ecotones between woodland and grassland, or coastal forest and heath.	No
Ninox connivens	Barking Owl	V	-	Wide but sparse distribution in NSW, avoiding the most central arid regions. Core populations exist on the western slopes and plains and in some northeast coastal and escarpment forests. Woodland and open forest, including fragmented remnants and partly cleared farmland, wetland and riverine forest.	Unikely
Ninox strenua	Powerful Owl	V	-	In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered records on the western slopes and plains. Woodland, open sclerophyll forest, tall open wet forest and rainforest.	Unlikely
Numenius madagascariensis	Eastern Curlew	-	CE, M	Summer migrant to Australia. Primarily coastal distribution in NSW, with some scattered inland records. Estuaries, bays, harbours, inlets and coastal lagoons, intertidal mudflats or sandflats, ocean beaches, coral reefs, rock platforms, saltmarsh, mangroves, freshwater/brackish lakes, saltworks and sewage farms.	No
Petaurus australis	Yellow-bellied Glider	V	-	Along the eastern coast to the western slopes of the Great Dividing Range, from southern Qld to Victoria. Tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils.	Unlikely
Petaurus norfolcensis	Squirrel Glider	V	-	Widely though sparsely distributed on both sides of the Great Dividing Range in eastern Australia, from northern Qld to western Victoria. Mature or old growth Box, Box-Ironbark	Unlikely

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Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution and Habitat	Likelihood of Occurrence
				woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas.	
Petrogale penicillata	Brush-tailed Rock-wallaby	E1	V	In NSW they occur from the Qld border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit. Rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges.	No
Petroica boodang	Scarlet Robin	V	-	In NSW, it occurs from the coast to the inland slopes. Dry eucalypt forests and woodlands, and occasionally in mallee, wet forest, wetlands and tea-tree swamps.	Unlikely
Phascolarctos cinereus	Koala	V	V	In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. There are sparse and possibly disjunct populations in the Bega District, and at several sites on the southern tablelands. Eucalypt woodlands and forests.	Potential
Plegadis falcinellus	Glossy Ibis	-	M	Recorded over much of NSW. Spring/summer breeding migrant to southern Murray-Darling region and Macquarie Marshes. Edges of lakes and rivers, lagoons, flood-plains, wet meadows, swamps, reservoirs, sewage ponds, rice-fields and cultivated areas under irrigation. Occasionally estuaries, deltas, saltmarshes and coastal lagoons.	Unlikely
Pseudomys novaehollandiae	New Holland Mouse	-	V	Fragmented distribution across eastern NSW. Open heathlands, woodlands and forests with a heathland understorey, vegetated sand dunes.	No
Pseudophryne australis	Red-crowned Toadlet	V	-	Confined to the Sydney Basin, from Pokolbin in the north, the Nowra area to the south, and west to Mt Victoria in the Blue Mountains. Open forests, mostly on Hawkesbury and Narrabeen Sandstones. Inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings.	Unlikely
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Along the eastern coast of Australia, from Bundaberg in Qld to Melbourne in Victoria. Subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops.	Likely

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Rhipidura rufifrons	Rufous Fantail	-	M	Coastal and near coastal districts of northern and eastern Australia, including on and east of the Great Divide in NSW. Wet sclerophyll forests, subtropical and temperate rainforests. Sometimes drier sclerophyll forests and woodlands.	No
Rostratula australis	Australian Painted Snipe	E1	E, M	In NSW most records are from the Murray-Darling Basin. Other recent records include wetlands on the Hawkesbury River and the Clarence and lower Hunter Valleys. Swamps, dams and nearby marshy areas.	Unlikely
Tringa nebularia	Common Greenshank	-	M	Summer migrant to Australia. Recorded in most coastal regions of NSW; also widespread west of the Great Dividing Range, especially between the Lachlan and Murray Rivers and the Darling River drainage basin, including the Macquarie Marshes, and north-west regions. Terrestrial wetlands (swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, claypans, saltflats, sewage farms and saltworks dams, inundated rice crops and bores) and sheltered coastal habitats (mudflats, saltmarsh, mangroves, embayments, harbours, river estuaries, deltas, lagoons, tidal pools, rock-flats and rock platforms).	Unlikely
Tyto novaehollandiae	Masked Owl	V	-	Recorded over approximately 90% of NSW, excluding the most arid north-western corner. Most abundant on the coast but extends to the western plains. Dry eucalypt forests and woodlands from sea level to 1100 m.	Unlikely
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Acacia bynoeana	Bynoe's Wattle	E1	V	Found in central eastern NSW, from the Hunter District (Morisset) south to the Southern Highlands and west to the Blue Mountains. Heath or dry sclerophyll forest on sandy soils.	Unlikely
Acacia pubescens	Downy Wattle	V	V	Restricted to the Sydney region around the Bankstown-Fairfield-Rookwood and Pitt Town area, with outliers occurring at Barden Ridge, Oakdale and Mountain Lagoon. Open woodland and forest, including Cooks River/Castlereagh Ironbark Forest, Shale/Gravel Transition Forest and Cumberland Plain Woodland. Occurs on alluviums, shales and at the intergrade between shales and sandstones.	Potential

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Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution and Habitat	Likelihood of Occurrence
Allocasuarina glareicola		E1	E	Primarily restricted to the Richmond (NW Cumberland Plain) district, but with an outlier population found at Voyager Point, Liverpool. Castlereagh woodland on lateritic soil. Found in open woodland with *Eucalyptus parramattensis*, *Eucalyptus fibrosa, Angophora bakeri*, *Eucalyptus sclerophylla* and *Melaleuca decora.*	Unlikely
Asterolasia elegans		E1	E	Occurs north of Sydney, in the Baulkham Hills, Hawkesbury and Hornsby local government areas. Also likely to occur in the western part of Gosford local government area. Hawkesbury sandstone. Found in sheltered forests on mid- to lower slopes and valleys.	Unlikely
Cryptostylis hunteriana	Leafless Tongue Orchid	V	V	In NSW, recorded mainly on coastal and near coastal ranges north from Victoria to near Forster, with two isolated occurrences inland north-west of Grafton. Coastal heathlands, margins of coastal swamps and sedgelands, coastal forest, dry woodland, and lowland forest.	No
Dillwynia tenuifolia		V	-	Mainly on the Cumberland Plain, but also Bulga Mountains at Yengo in the north, and Kurrajong Heights and Woodford in the Lower Blue Mountains. Scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest, transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland, and disturbed escarpment woodland on Narrabeen sandstone.	Potential
Genoplesium baueri	Bauer's Midge Orchid	E1	E	Has been recorded from locations between Nowra and Pittwater and may occur as far north as Port Stephens. Dry sclerophyll forest and moss gardens over sandstone.	No
Haloragis exalata subsp. *exalata*	Square Raspwort	V	V	Disjunct distribution in the Central Coast, South Coast and North Western Slopes botanical subdivisions of NSW. Protected and shaded damp situations in riparian habitats.	Unlikely
Melaleuca deanei	Deane's Paperbark	V	V	Ku-ring-gai/Berowra area, Holsworthy/Wedderburn area, Springwood (in the Blue Mountains), Wollemi National Park, Yalwal (west of Nowra) and Central Coast (Hawkesbury River) areas. Heath on sandstone.	No

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Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution and Habitat	Likelihood of Occurrence
Olearia cordata		V	V	A NSW endemic generally restricted to the south-western Hunter Plateau, eastern Colo Plateau, and the far north-west of the Hornsby Plateau near Wisemans Ferry east of Maroota. Open sclerophyll forest and open shrubland, on sandstone ridges.	No
Pelargonium sp. *striatellum*	Omeo Storksbill	E1	E	Known from only 3 locations in NSW, with two on lake-beds on the basalt plains of the Monaro and one at Lake Bathurst. Irregularly inundated or ephemeral lakes, in the transition zone between surrounding grasslands or pasture and wetland or aquatic communities.	No
Persoonia hirsuta	Hairy Geebung	E1	E	Scattered distribution around Sydney, from Singleton in the north, along the east coast to Bargo in the south and the Blue Mountains to the west. Sandy soils in dry sclerophyll open forest, woodland and heath on sandstone.	Unlikely
Pimelea curviflora var. *curviflora*		V	V	Confined to the coastal area of the Sydney and Illawarra regions between northern Sydney and Maroota in the north-west and Croom Reserve near Albion Park in the south. Woodland, mostly on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes.	Potential
Pimelea spicata	Spiked Rice-flower	E1	E	Two disjunct areas; the Cumberland Plain (Marayong and Prospect Reservoir south to Narellan and Douglas Park) and the Illawarra (Landsdowne to Shellharbour to northern Kiama). Well-structured clay soils. Eucalyptus moluccana (Grey Box) communities and in areas of ironbark on the Cumberland Plain. Coast Banksia open woodland or coastal grassland in the Illawarra.	Potential
Pomaderris brunnea	Brown Pomaderris	E	V	In NSW, found around the Colo, Nepean and Hawkesbury Rivers, including the Bargo area and near Camden. It also occurs near Walcha on the New England tablelands. Moist woodland or forest on clay and alluvial soils of flood plains and creek lines.	Unlikely
Pterostylis gibbosa	Illawarra Greenhood	E1	E	Known from a small number of populations in the Hunter region (Milbrodale), the Illawarra region (Albion Park and Yallah) and the Shoalhaven region (near Nowra). Open forest or woodland, on flat or gently sloping land with poor drainage.	No

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Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution and Habitat	Likelihood of Occurrence
Pterostylis saxicola	Sydney Plains Greenhood	E1	E	Restricted to western Sydney between Freemans Reach in the north and Picton in the south. Small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines, adjacent to sclerophyll forest or woodland on shale/sandstone transition soils or shale soils.	Unlikely
Pultenaea parviflora		E1	V	Endemic to the Cumberland Plain. Mainly from Windsor to Penrith and east to Dean Park, with outlier populations at Kemps Creek and Wilberforce. Dry sclerophyll forest, especially Castlereagh Ironbark Forest, Shale Gravel Transition Forest and transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland.	Potential
Rhizanthella slateri	Eastern Australian Underground Orchid	V	E	In NSW, currently known from fewer than 10 locations, including near Bulahdelah, the Watagan Mountains, the Blue Mountains, Wiseman's Ferry area, Agnes Banks and near Nowra. Sclerophyll forest in shallow to deep loams. Highly cryptic given that it grows almost completely below the soil surface, with flowers being the only part of the plant that can occur above ground. Therefore usually located only when the soil is disturbed. Flowers September to November.	No
Syzygium paniculatum	Magenta Lilly Pilly	E1	V	Only in NSW, in a narrow, linear coastal strip from Upper Lansdowne to Conjola State Forest. Subtropical and littoral rainforest on gravels, sands, silts and clays.	No
Tetratheca glandulosa		V	-	Found from Sampons Pass (Yengo NP) in the north to West Pymble (Lane Cove NP) in the south. The eastern limit is at Ingleside (Pittwater LGA) and the western limit is at East Kurrajong (Wollemi NP). Heath, scrub, woodlands and open forest on upper-slopes and mid-slope sandstone benches. Soils generally shallow, consisting of a yellow, clayey/sandy loam.	Potential
Thesium australe	Austral Toadflax	V	V	In eastern NSW it is found in very small populations scattered along the coast, and from the Northern to Southern Tablelands. Grassland on coastal headlands or grassland and grassy woodland away from the coast.	Unlikely

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