

Area 20 Biodiversity Assessment

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Abbreviations

ABBREVIATION	DESCRIPTION
CEEC	Critically Endangered Ecological Community
CPW	Cumberland Plain Woodland
CLS	Cumberland Land Snail
DECCW	Department of the Environment Climate Change and Water
DEWHA	Department of Environment Water, Heritage and the Arts (now SEWPAC)
DoP	Department of Planning
EEC	Endangered Ecological Community
ELA	Eco Logical Australia
ENV	Existing Native Vegetation
EPBC	Environment Protection and Biodiversity Conservation Act
ILP	Indicative Layout Plan
NES	Matters of National Environmental Significance
SEPP	State Environmental Planning Policy
SEWPAC	Department of Sustainability, Environment, Water, Population and Communities (formerly DEWHA)
TSC	Threatened Species Conservation Act

1 Introduction

1.1 DESCRIPTION OF PROJECT

Eco Logical Australia Pty Ltd (ELA) was engaged by the NSW Department of Planning (DoP) to undertake an ecological assessment of approximately 245ha that forms the Area 20 precinct in Rouse Hill. The aim of the assessment is to identify key ecological constraints, assess the impact of the Indicative Layout Plan (ILP) for the Area 20 Precinct and provide recommendations with respect to terrestrial and aquatic ecosystem management.

Specific objectives of this project are to:

- Undertake a strategic biodiversity assessment including a flora and fauna study, an analysis of ecological values and identification and high-quality mapping of areas of high, moderate and low ecological value.
- Achieve innovative management frameworks for ecological and biodiversity issues which enable long term conservation and management, while facilitating the development outcomes for the precincts (as identified in the structure plan).
- Ensure the statutory requirements for the protection, restoration and enhancement of threatened species, populations, ecological communities and their habitats are met.
- Ensure protection of biodiversity values within areas identified by the Growth Centres SEPP.
- Ensure that precinct planning is consistent with the terms of any biodiversity certification granted to the SEPP.

This report demonstrates the objectives are achieved through:

- Methodology that includes a literature review of previous work, terrestrial aquatic and geomorphic field assessment, and ecological constraints analysis.
- Consideration of statutory requirements, including; Growth Centres Commission Development Code, Threatened Species Conservation Act (TSC Act), Environment Protection and Biodiversity Conservation Act (EPBC Act), TSC Act SEPP Biocertification, Water Management Act, Fisheries Management Act.

1.2 STUDY AREA

The Area 20 precinct in Rouse Hill, within the eastern portion of the North West Growth Centre, has been identified as suitable for higher density housing. The proposed North West Rail Link traverses the precinct in the south. Planning for the precinct is underway and involves the preparation of numerous planning documents, including a Development Control Plan and an amendment of the SEPP (Sydney Regional Growth Centres) to facilitate the formal rezoning of the site.

The study area includes approximately 245ha of land that is bounded to the east by Windsor Road and Schofields Road to the south with Second Ponds Creek flowing north-east through the centre of the site. Figure 1 illustrates the broad location of the study area. The study area incorporates a number of landowners, including Blacktown City Council, Department of the Environment Climate Change and Water (DECCW) (Rouse Hill Regional Parklands), Sydney Water and numerous private landowners.



Figure 1: Study area

1.3 METHODOLOGY OVERVIEW

An overview of the methodology is provided below, full details can be found in Appendix B;

- Database search for threatened species, populations and ecological communities under the TSC Act and Matters of National Environmental Significance (NES) under the EPBC Act
- Assessment of State and Federal statutory requirements
- Detailed field validation of existing vegetation, threatened species and aquatic/riverine habitat condition mapping and assessments
- Analysis and identification of ecological constraints
- Impact assessment for the Indicative Layout Plan
- Recommendations for the development of the Indicative Layout Plan

2 Statutory Framework

A substantial array of legislation, policies and guidelines apply to the assessment, planning and management of biodiversity values within the Area 20 Precinct. This information was reviewed and will be used to identify priority constraints and opportunities within the study area (Refer to Appendix A). Legislation and policies reviewed include:

2.1 INTERNATIONAL

- Japan – Australia Migratory Bird Agreement (JAMBA)
- China – Australia Migratory Bird Agreement (CAMBA)
- Republic of Korea – Australia Migratory Bird Agreement (ROKAMBA)

2.2 COMMONWEALTH

- Environment Protection & Biodiversity Conservation Act 1999 (EPBC Act)

2.3 STATE

- Environmental Planning and Assessment Act 1979 (EP&A Act)
- Threatened Species Conservation Act 1995 (TSC Act)
- Threatened Species Conservation Amendment (Special Provisions) Act 2008
- National Parks and Wildlife Act 1974
- Fisheries Management Act 1994 (FM Act)
- Noxious Weeds Act 1993
- Protection of the Environment Operations Act 1997
- State Environmental Planning Policy (Sydney Region Growth Centres) 2006
- State Environmental Planning Policy No.19 – Bushland In Urban Areas
- Sydney Regional Environmental Plan No 20 – Hawkesbury-Nepean River (No 2 – 1997)
- NSW Biodiversity Strategy 1999
- Growth Centres Development Code 2006
- Draft Growth Centres Conservation Plan 2007

2.4 LOCAL

- Blacktown City Council Local Environmental Plan 1988
- Blacktown City Council Growth Centre Precincts Development Control Plan 2010

2.5 LITERATURE REVIEW

A desktop literature review was undertaken by ELA to determine the location and extent of previous surveys, identify the constraints within the study area and evaluate the presence of any threatened species, populations and ecological communities listed under the TSC Act and the Commonwealth EPBC Act that could potentially occur within the study area. To this end, the following documentation and mapping was reviewed:

- Topographic maps, digital elevation models and aerial photography of the study area;
- A search of the NSW DECCW Wildlife Atlas database
- EPBC online Protected Matters Database Search
- 'Rouse Hill Infrastructure Project, Water, Sewerage and Trunk Drainage Flora and Fauna Assessments prepared by Gunninah Environmental Consultants (2002 and 2003)
- 'Draft Growth Centres Conservation Plan' prepared by Eco Logical Australia (2007) for NSW Growth Centres Commission;
- Western Sydney Vegetation Mapping (NPWS 2002a);
- Western Sydney Condition and Conservation Significance Mapping (NPWS 2002b).
- 'Species Impact Statement Riverstone Integrated Water Services Cudgegong Road Reservoir Site' prepared by ELA (2007) for Sydney Water Corporation
- 'Remnant Bushland Reserve, Reserve 260 Cudgegong Road Rouse Hill – Draft Plan of Management' (2002) prepared by Earth Work Australia Pty Ltd for Blacktown City Council.

3 Terrestrial Biodiversity Assessment

3.1 BIODIVERSITY CERTIFICATION

The Sydney Region Growth Centres State Environmental Planning Policy (SEPP) (referred to as the 'Growth Centres SEPP') has been 'bio-certified' by order of the Minister for the Environment under s.126G of the *TSC Act*. The mechanism for achieving this is outlined in the *Draft Growth Centres Conservation Plan* (Eco Logical Australia, 2007) and the conditions for bio-certification are documented in the Ministers order for consent¹. Bio-certification negates the requirement for impact assessment under s.5A of the *Environmental Planning and Assessment Act, 1979* thus turning off the requirements for seven part tests or species impact statements. Any subsequent development applications within certified areas in the precinct will be considered biodiversity compliant development removing the need to undertake assessments of significance under the EP&A Act.

The *Draft Growth Centres Conservation Plan* assessed native vegetation across the entire Growth Centres area and identified areas of Existing Native Vegetation (ENV) as shown in Figure 2 and Figure 3 below. By definition (TSC Act 1995 biodiversity certification conditions) ENV means areas of indigenous trees (including saplings) that:

- a) had 10 % or greater over-storey canopy cover present
- b) were equal to or greater than 0.5 ha in area, and
- c) were identified as "vegetation" on maps 4 and 5 of the draft Growth Centres Conservation Plan, at the time the biodiversity certification order took effect, subject to condition 13.

Condition 13 of the Certification details the ground-truthing requirements for existing native vegetation namely, if new information becomes available after the biodiversity certification order took effect that demonstrates that the vegetation within an areas does not otherwise meet the definition of existing native vegetation, then for the purposes of conditions 7-8 and 11-12 only the area of confirmed existing native vegetation shall be considered. As such the field validation of vegetation across the site has updated the extent of ENV within the precinct.

Under the *Draft Growth centres Conservation Plan* mapping, 11.3ha of ENV has been mapped within the non-certified lands within the Area 20 Precinct (excluding Rouse Hill Regional Park). To maintain parity with the Area 20 contribution to protecting 2000 ha across the Growth Centres, a minimum of 11.3 ha of ENV should therefore be protected with the precinct.

¹ <http://www.environment.nsw.gov.au/resources/nature/biocertordwsgcentres.pdf>

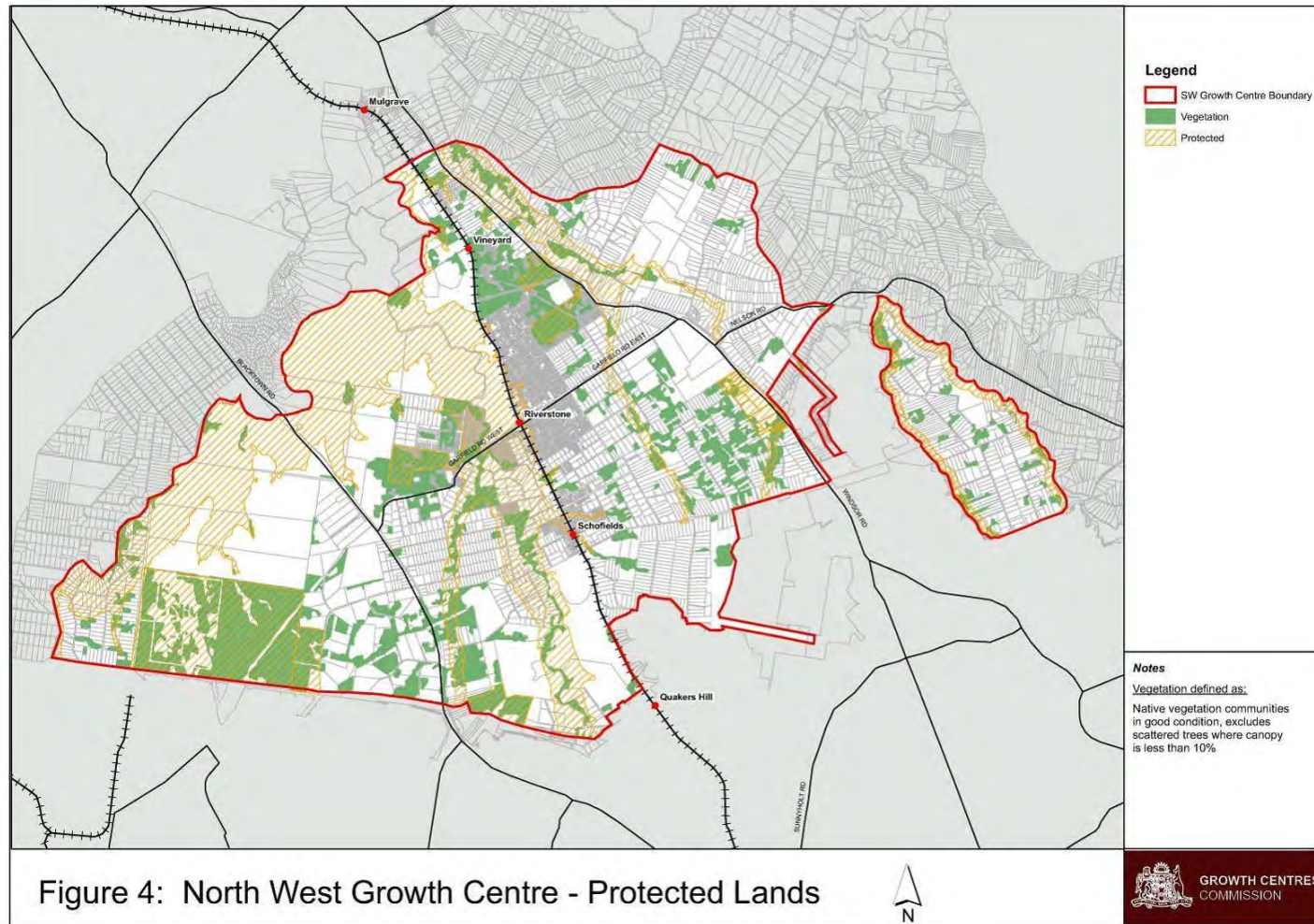


Figure 2: Figure 4 from the Draft Growth Centres Conservation Plan

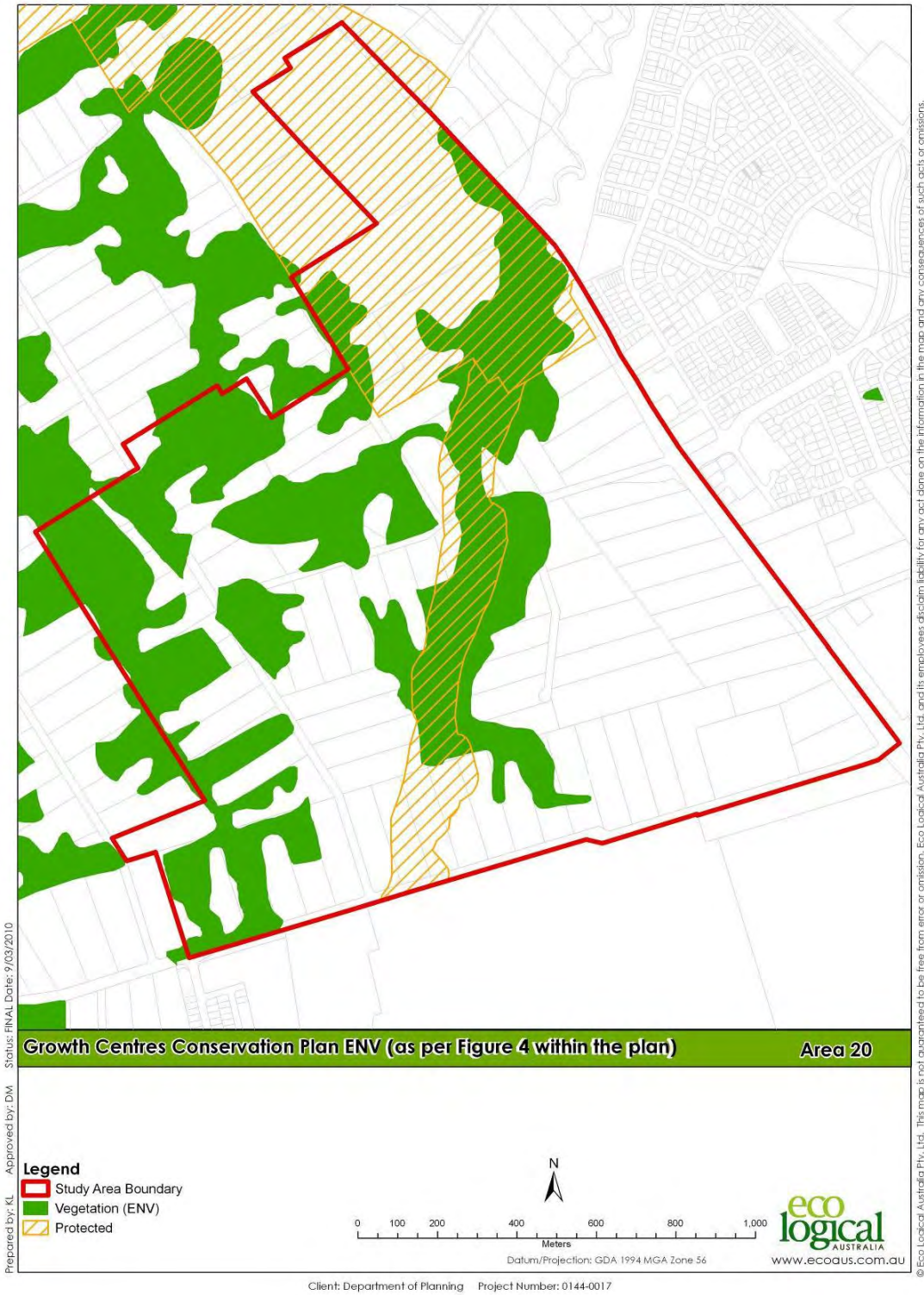


Figure 3: ENV as per Figure 4 of the Growth Centres Conservation Plan within the Area 20 Precinct

3.2 METHODS

A full floristic survey of the precinct was undertaken to confirm the vegetation communities present. This survey included classification of native vegetation communities in accordance with the DECCW profiles. Full floristic quadrats were also taken out to allow for the identification of vegetation communities to EPBC Act level.

Additional flora and fauna targeted surveys were also undertaken and included, random meander targeted flora searches, evening bird census, anabat detection, frog census and spotlighting.

Detailed methodology can be found in Appendix B.

3.3 VEGETATION COMMUNITIES & CONDITION

Two vegetation communities were identified within the study area. The characteristics of each vegetation community, their conservation significance and ecological condition are summarised below in Table 1 and presented in Figure 4 and Figure 5.

3.3.1 Shale Plains Woodland

Shale Plains Woodland (SPW) is part of the Cumberland Plain Woodland Critically Endangered Ecological Community, listed under both the TSC and EPBC Acts. SPW is the most widely distributed community on the Cumberland Plain, predominantly occurring on soils derived from Wianamatta Shale.

SPW within the study area consists of a mixture of poor, moderate and good condition vegetation. The canopy is dominated by grey box (*Eucalyptus moluccana*) and forest red gum (*Eucalyptus tereticornis*), with narrow-leaved ironbark (*Eucalyptus crebra*), and broad-leaved ironbark (*Eucalyptus fibrosa*) occurring less frequently.

The shrub layer over a large proportion of the study area has been and is currently subject to under scrubbing and grazing. In areas of natural growth and regrowth, the shrub layer is dominated by native blackthorn (*Bursaria spinosa*).

Groundcover vegetation is typically dominated by a mixture of native and exotic grasses and herbs. Native groundcover species include kangaroo grass (*Themeda australis*), threeawn speargrass (*Aristida vagans*), weeping rye grass (*Microlaena stipoides*), two-colour panic (*Panicum simile*), and couch (*Cynodon dactylon*). Exotic groundcovers include African lovegrass (*Eragrostis curvula*), Rhodes grass (*Chloris gayana*), slender pigeon grass (*Setaria gracilis*), fireweed (*Senecio madagascariensis*), and spear thistle (*Cirsium vulgare*).

The Commonwealth and State have recently 'up-listed' Cumberland Plain Woodland (CPW) to a Critically Endangered Ecological Community (CEEC) under the EPBC Act and TSC Act. The criterion that must be met for vegetation to be captured by the new CEEC listing has changed under both the EPBC Act and TSC Act. Under the EPBC Act, changes to both the vegetation characteristics and the assigning of condition classes have been introduced, whilst smaller scale changes such as the inclusion of derived native grassland in areas of CPW, have been made under the TSC Act. Consequently, vegetation mapping to represent areas that meet the TSC Act criteria and areas that meet the EPBC Act criteria has been included separately (refer to Figure 4 and Figure 5 respectively). Condition classes have also been assigned based on the relevant criteria.

3.3.2 Alluvial Woodland

The Alluvial Woodland (AW) within the study area comprises the endangered ecological community *River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions* (River-Flat Forest), which is listed on Schedule 1 of the TSC Act. AW occurs exclusively along, or in close proximity to Second Ponds Creek, through the centre of the study area (refer to Figure 4).

The most common canopy species found within AW is cabbage gum (*Eucalyptus amplifolia*), with forest red gum, rough-barked apple (*Angophora floribunda*), and grey box occurring less frequently.

The shrub layer is usually dominated by native blackthorn, and Parramatta wattle (*Acacia parramattensis*), with *Melaleuca decora*, and white sally (*Acacia floribunda*) occurring less frequently.

Groundcover vegetation is typically dominated by a mixture of native and exotic grasses and herbs. Native groundcover species include threeawn speargrass, weeping rye grass, and couch. Exotic groundcovers include kikuyu, Rhodes grass, paddy’s lucerne (*Sida rhombifolia*), fireweed, and lamb’s tongues (*Plantago lanceolata*).

The stands of AW within the study area consists of approximately 21.9ha of good condition vegetation (ABC condition), and approximately 2ha of poor condition vegetation (TX Condition).

3.3.3 Vegetation Community and Condition Assessment Area Calculations

Area calculations of each vegetation community within the study area are provided in Table 1. The study area is dominated by grassland (exotic dominated).

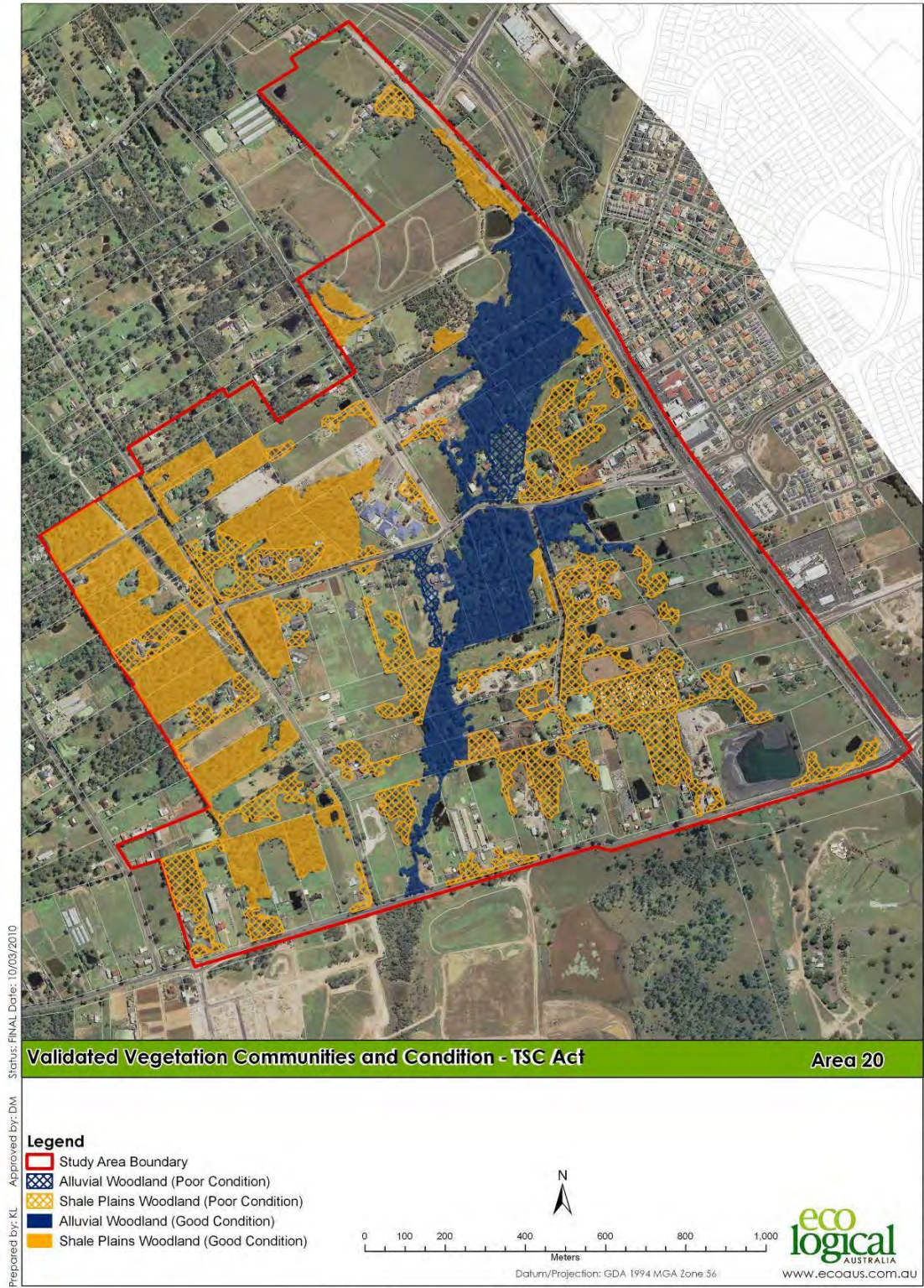
The stands of SPW within the study area constitute approximately 58.6 ha under the TSC Act and 27.84 ha under the EPBC Act. Table 1 summarises the amount of each vegetation type, for each condition, currently existing within the precinct. The majority of the Shale Plains Woodland was determined to be condition A or B, accounting for 11.8% of the study area or 28.8ha.

Alluvial Woodland, recorded within the study area, along Second Ponds Creek occupies an area of approximately 23.9ha.

Table 1: A summary of area occupied by vegetation communities and their condition.

Vegetation Community	TSC Act (ha)			EPBC Act (ha)	
	ABC (good)	Tx (poor)	Total	A	Total
Shale Plains Woodland	28.8	29.8	58.6	27.84	27.84
Alluvial Woodland	21.9	2.0	23.9	n/a	n/a
Total	50.7	31.8	82.5	27.84	27.84

NB. Appendix B provides an explanation of the condition codes assigned.



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Figure 4: TSCA vegetation communities and condition



Figure 5: EPBC Act vegetation communities

3.3.4 Validated ENV Area Calculations

The original area of ENV (65.8 ha) within the Area 20 precinct excluding Rouse Hill Regional Park consisted of three vegetation communities Shale Sandstone Transition Forest, Shale Plains Woodland and Alluvial Woodland, as mapped by NSW National Parks and Wildlife Service (NPWS) Cumberland Plain Vegetation Mapping Project (2002). Field validation undertaken by ELA for this report found that Shale Sandstone Transition Forest was not a community that currently existed on site.

Figure 6 shows the combined areas of ENV as mapped in the conservation plan overlain with the validated vegetation community boundaries which fit the definition of ENV. The total area of validated ENV is 36.1 ha (excluding Rouse Hill Regional Park), which is 29.7 ha less than the original ENV mapping indicated as present within the precinct. An additional 4.1 ha of additional native vegetation meeting the definition of ENV but not mapped within the Growth Centres Conservation Plan was recorded within the precinct.

The ENV mapped within the Western Sydney Growth Centres Conservation Plan was based on desktop analysis of the NPWS Western Sydney Mapping Project (2002). As such discrepancy between the Draft Conservation Plan ENV and the Field Validated ENV has occurred due to a number of reasons including:

- Clearing for approved development and agriculture since the mapping was undertaken;
- Changes in vegetation condition due to regrowth, clearing or disturbance since the mapping was undertaken; and
- Changes in boundaries due to increased accuracy of mapping from ground truthing compared to desktop analysis at a broad scale.

Tables 2, 3 and 4 below show the amount of ENV within Area 20 excluding Rouse Hill Regional Park, the amount of ENV within the Area 20 Precinct including Rouse Hill Regional Park, and the amount of ENV within Rouse Hill Regional Park.

The current ILP proposes to retain 8.1 ha of validated ENV within non certified lands and an additional 4.8 ha in reserves and parks (3.2 ha in Cudgegong reserve). In addition, 1.4 ha of ENV that meets the definition of ENV but is not mapped in the Growth Centres Conservation Plan will be protected in non-certified lands. 0.2 ha of validated ENV will be removed for the upgrade of Rouse Road Bridge and for the North West Rail Link in non-certified lands.

Table 2: Amount of ENV in Area 20 Precinct excluding Rouse Hill Regional Park

Area 20 Precinct excluding Rouse Hill Regional Park	Total in Area 20 Precinct	Total in Non-Certified lands (ha)			Total in Certified Lands (ha)				Loss**	Total
		Protected*	Loss (from Bridges)	Total	Protected*					
					Cudgegong reserve	Other parks	1 in 100 year flood	Total		
ENV as mapped in GC Conservation Plan	65.8	11.0	0.3	11.3	3.3	3.9	1.1	8.3	46.2	54.5
Field Validated Conservation Plan ENV	36.1	8.1	0.2	8.3	3.2	1.1	0.5	4.8	23.0	27.8
Additional Native Vegetation meeting ENV description (but not mapped in Conservation Plan)	4.1	1.4	0.2	1.6	0.1	0.3	0.0	0.4	2.1	2.5

*Protected non-certified land, areas within the 1-in-100-year flood line and parks

**Loss includes all development, detention basins and drainage zones which are outside non-certified areas and the 1-in-100-year flood line

Table 3: Amount of ENV in Area 20 Precinct including Rouse Hill Regional Park

Area 20 Precinct including Rouse Hill Regional Park	Total in Area 20 Precinct	Total in Non-Certified lands (ha)			Total in Certified Lands (ha)				Loss**	Total
		Protected*	Loss (from Bridges)	Total	Protected*					
					Cudgegong reserve	Other parks	1 in 100 year flood	Total		
ENV as mapped in GC Conservation Plan	78.0	23.2	0.3	23.5	3.3	3.9	1.1	8.3	46.2	54.5
Field Validated Conservation Plan ENV	45.4	17.4	0.2	17.6	3.2	1.1	0.5	4.8	23.0	27.8
Additional Native Vegetation meeting ENV description (but not mapped in Conservation Plan)	5.2	2.5	0.2	2.7	0.1	0.3	0.0	0.4	2.1	2.5

*Protected non-certified land, areas within the 1-in-100-year flood line and parks

**Loss includes all development, detention basins and drainage zones which are outside non-certified areas and the 1-in-100-year flood line

Table 4: Amount of ENV in Rouse Hill Regional Park

Rouse Hill Regional Park	Total in Rouse Hill Regional Park (Non Certified)
ENV as mapped in GC Conservation Plan	12.3
Field Validated Conservation Plan ENV	9.3
Additional Native Vegetation meeting ENV description (but not mapped in Conservation Plan)	1.2



Figure 6: Validated ENV areas

3.4 FLORA

The field survey undertaken within the study area identified 173 flora species. These species included 127 native species and 46 exotic species. A flora list for the study area is presented in Appendix C. This is not a comprehensive list of flora species likely to be present within the study area.

A list of threatened flora species known to occur within a 10 km radius of the study area has been collated (Appendix D). During the field survey, no threatened flora species listed under the TSC or EPBC Acts were recorded. There are a number of threatened flora species that have been previously recorded within close proximity to the study area including, *Micromyrtus minutiflora*, *Persoonia hirsuta*, *Grevillea juniperina subsp. juniperina*, *Epacris purpurascens var purpurascens*, and *Pimelea spicata*.

Five plant species identified within the study area are listed as noxious weeds within the Blacktown Local Government Area. These noxious weeds include:

- African Boxthorn (*Lycium ferocissimum*) - Noxious Class 4
- Blackberry (*Rubus fruticosus* aggregate) - Noxious Class 4
- Bridal creeper (*Asparagus asparagoides*) - Noxious Class 5
- Broad-leaved Privet (*Ligustrum lucidum*) - Noxious Class 4
- Narrow-leaved Privet (*Ligustrum sinense*) - Noxious Class 4

3.5 FAUNA

The field survey identified 55 fauna species. These species included 39 birds, 5 mammals, 4 amphibians, 5 reptiles and 2 gastropods. A fauna list for the study area is presented in Appendix C.

A list of threatened fauna species known to occur within a 10 km radius of the study area has been collated (Appendix D).

The field survey identified 3 species listed under either the TSC Act or the EPBC Act. These species included:

- Eastern bent-wing bat (*Miniopterus schreibersii oceanensis*) - (TSC Act);
- Eastern free-tail bat (*Mormopterus nofolkensis*) - (TSC Act); and
- Yellow-bellied sheath-tail bat (*Saccolaimus flaviventris*) - (TSC Act).

Based on the Appendix D the following threatened fauna species are known, likely or have the potential to occur on site;

Species	TSC Act	EPBC Act
• Green and golden bell frog (<i>Litoria aurea</i>);	x	x
• Speckled warbler (<i>Pyrrholaemus sagittatus</i>);	x	
• Square-tailed Kite (<i>Lophoictinia isura</i>)	x	x
• Regent honeyeater (<i>Xanthomyza phrygia</i>);	x	x
• Hooded Robin (<i>Melanodryas cucullata</i>)	x	
• Swift parrot (<i>Lathamus discolor</i>);	x	x

• Yellow-bellied Sheath-tail-bat (<i>Saccolaimus flaviventris</i>);	x	
• Eastern Freetail-bat (<i>Mormopterus norfolkensis</i>);	x	
• Grey-headed Flying-fox (<i>Pteropus poliocephalus</i>);	x	x
• Eastern false pipistrelle (<i>Falsistrellus tasmaniensis</i>);	x	
• Eastern Bentwing-bat (<i>Miniopterus schreibersii</i>);	x	
• Large-footed Myotis (<i>Myotis adversus</i>);	x	
• Large-eared Pied Bat (<i>Chalinolobus dwyeri</i>);	x	x
• Greater Broad-nosed Bat (<i>Scoteanax rueppellii</i>); and	x	
• Cumberland Plain Land Snail (<i>Meridolum corneovirens</i>)	x	
• Great Egret (<i>Ardea alba</i>)		x
• Cattle Egret (<i>Ardea ibis</i>)		x
• Fork-tailed Swift (<i>Apus pacificus</i>)		x

3.6 ECOLOGICAL CONSTRAINTS

An ecological constraint ranking was derived applying an amended methodology that has been used elsewhere in Western Sydney (see Appendix B of this report) which combines size, condition, connectivity and recovery potential into a single ecological constraint value. This relates to the ecological value of remnants within the study area without taking into account planning controls. The results of this analysis can be seen in Table 5 and Figure 7. Broadly the rankings are as follows:

- High constraint = high ecological value, relatively large areas of good quality, well connected vegetation,;
- Moderate constraint = moderate ecological value, smaller areas of good quality vegetation or large areas of poorer quality vegetation;
- Low constraint = low ecological value, all other native vegetated areas, generally isolated and small in size, with a low recovery potential.

Table 5: Constraints summary within the study area

Ecological Constraints	Area (ha)	% of Site
High	82.1	32.4%
Moderate	0	0%
Low	3.1	1.3%

Highly constrained areas occupy 32.4% of the study area. These areas represent all areas of Shale Plains Woodland as well as Alluvial Woodland remnants of good condition and a high recovery potential. They also provide potential habitat for threatened flora and fauna species.

Areas of low constraint have little habitat value and are generally dominated by exotic grass species and are highly disturbed by current land use (grazing, horse/vehicle trails). These areas cover approximately 1.3% of the study area.

Section 5 includes discussion on land constraint categories that incorporates ecological constraints with planning and legislative controls throughout the precinct.

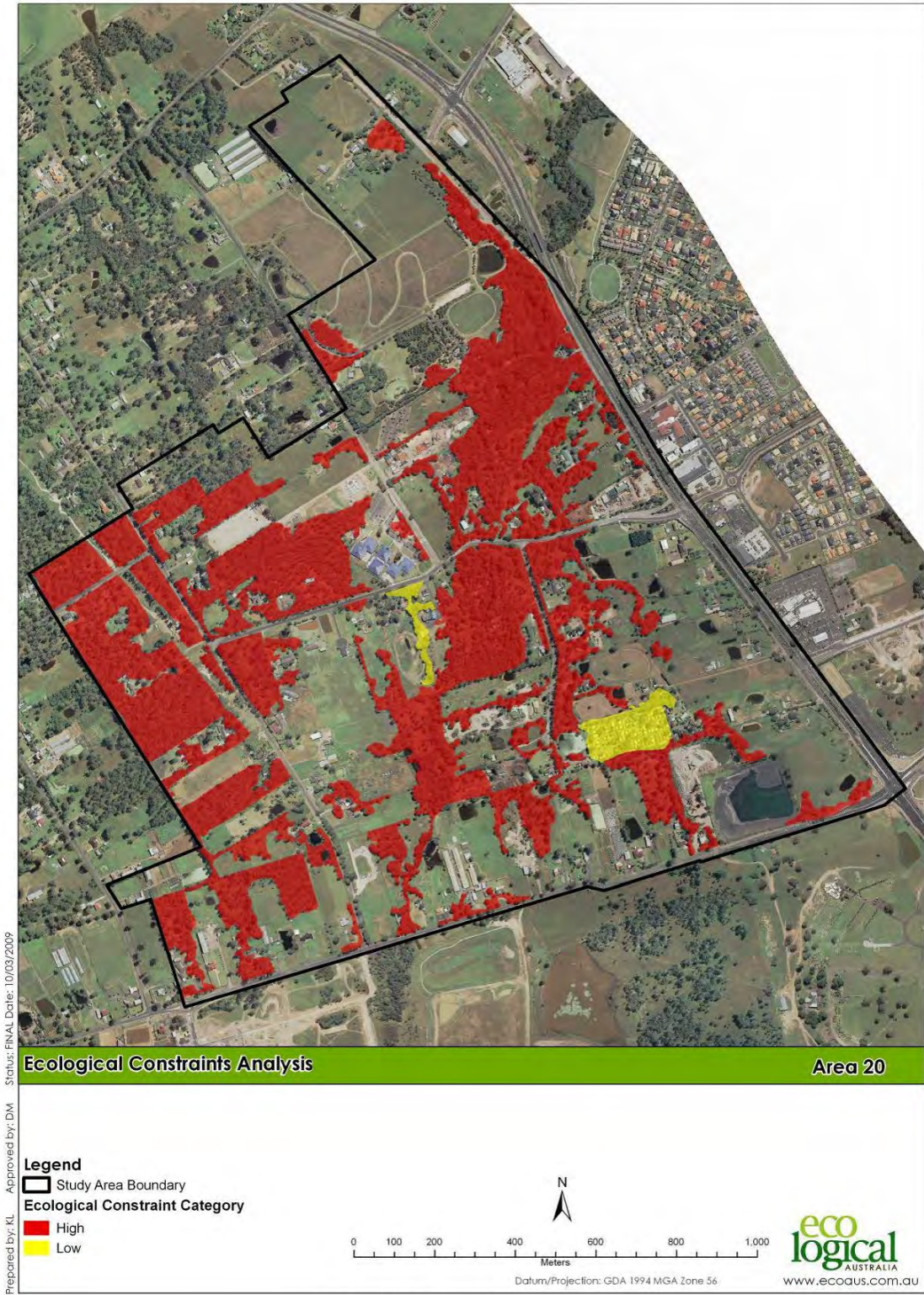


Figure 7: Ecological constraints analysis

3.7 IMPACT ASSESSMENT

Due to the biocertification of the Growth Centres SEPP, there is no further requirement under the TSC Act to consider threatened species issues in certified areas. Subsequent DAs within certified lands within the precinct would be considered biodiversity compliant development under the *Environmental Planning and Assessment Regulation 2000*, thereby negating the requirement to undertake impact assessment under the EP&A Act. Table 6 provides figures on the amount of vegetation protected and lost within the certified areas.

ENV within the non-certified areas will be largely retained. Only a small area (0.2 ha) of vegetation is proposed to be removed for the upgrade of the Rouse Road Bridge and the construction of the North West Rail Link. Clause 11 of the Biocertification Order acknowledges that clearing ENV in non-certified areas may occur where there is essential infrastructure required. The clause requires that an offset be provided of an equal or greater area of existing vegetation elsewhere in the Cumberland Plain. Within the Area 20 Precinct an additional 4.8ha of ENV will be protected in local parks. This more than adequately offsets the 0.2ha of loss for the upgrade of Rouse Road Bridge and construction of the North West Rail Link.

Detailed area calculations for loss and retention can be found in Tables 2, 3 and 4, (ENV) and Tables 6 and 7(communities). In accordance with clause 11 of the biodiversity certification order, the precinct exceeds the offset requirement for the construction of Rouse Road Bridge and the North West Rail Link through the retention of 8.1 ha of ENV within non certified lands, and 4.3 ha of ENV in parks and 0.5 ha within the 1 in 100yr flood line within certified lands. Revegetation along the riparian corridor is also proposed to be undertaken by Sydney Water within the 1 in 100yr flood line in areas zoned SP2 (drainage) constituting approximately 6.3 ha.

Specifically, land uses surrounding non-certified areas and parks will need to be carefully managed so as not to adversely impact on the ecological integrity of the protected area. A management plan is currently being prepared which will be put in place for all areas to be retained for biodiversity conservation.

With respect to the EPBC Act, it is understood that a referral to the Department of Sustainability, Environment, Water, Population and Communities (SEWPAC) will not be made at this stage, rather DoP are in ongoing negotiations with SEWPAC regarding a Growth Centres wide EPBC Act strategic assessment / referral process similar to that undertaken for the Biodiversity Certification Order.

Full EPBC Act tests of significance for those listed species or communities which are known to have the potential to occur on site have not been carried out at this time, pending the findings of the strategic assessment process. At this stage there will be a potentially significant level of vegetation loss across the site primarily involving the clearing of Cumberland Plain Woodland (at least 14.2 ha) which for the purposes of this report is considered critically endangered. Refer to Table 6 and Table 7 for detailed areas of loss.

The specific referral requirements for CPW will be dependent on the staging of DA's across the precinct and will need to be reviewed post rezoning of the site and in accordance with the ongoing negotiations between SEWPAC and DoP.

In light of the potential impact of CPW clearing across the site, it is recommended that all CPW be retained within non-certified areas and that CPW in certified areas also be retained and protected wherever possible. Priority for retention should be areas of CPW which are of high constraint (Figure 7) and good condition (Figure 4 and Figure 5).

Table 6: TSC Act vegetation loss and retention under the Indicative Layout Plan

Vegetation Community and Condition	Status	Loss* (Ha)	Parks (Ha)	Very Low Density Residential (Ha)	Protected** (Ha)	Rouse Hill Regional Park
<i>Cumberland Plain Woodland</i>	<i>CEEC TSC Act</i>					
Shale Plains Woodland - ABC		17.3	3.8	7.6		2.8
Shale Plains Woodland - TX		24.5	2.6	1.2	1.0	0.5
Total		41.8	6.4	8.8	1.0	3.3
<i>River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions</i>	<i>EEC TSC Act</i>					
Alluvial Woodland - ABC		3.2	1.0		10.0	7.7
Alluvial Woodland - TX		0.5	0.5		1.0	
Total		3.7	1.5		11.0	7.7
Cleared		112.6	8.0	2.8	6.3	30.5
Grand Total		158.1	15.9	11.6	18.3	41.5

*Loss includes all development, detention basins and drainage zones which are outside non-certified areas and the 1-in-100-year flood line

**Protected includes non-certified land and areas within the 1-in-100-year flood line

Table 7: EPBC Act vegetation loss and retention under the Indicative Layout Plan

Vegetation Community and Condition	Status	Loss* (Ha)	Parks (Ha)	Very Low Density Residential (Ha)	Protected** (Ha)	Rouse Hill Regional Park
<i>Cumberland Plain Woodland</i>	<i>CEEC EPBC Act</i>					
Shale Plains Woodland - A		14.2	3.8	7.7		2.2
Total		14.2	3.8	7.7		2.2

*Loss includes all development, detention basins and drainage zones which are outside non-certified areas and the 1-in-100-year flood line

**Protected includes non-certified land and areas within the 1-in-100-year floodline

4 Aquatic Assessment

4.1 METHODS

The aquatic habitat assessment and search for Ground Water Dependant Ecosystems (GDE's) involved a preliminary field assessment, followed by stream categorisation and condition assessment. Full details of the methodology can be found in Appendix B and further riparian assessment details can be found in the ELA Riparian Assessment Report.

4.2 RESULTS

4.2.1 Threatened Species

A review of listed threatened species dependant on instream habitat revealed that no threatened species are likely to occur within the aquatic habitats present in the study area

4.2.2 Groundwater Dependant Ecosystems

Inspections of the site did not reveal the presence of any groundwater dependant ecosystems. There are no known cave systems within the study area and nor are there ground water dependant wetlands. The base flow of streams across the study area are likely to be fed to some degree by groundwater, however the majority of the waterways across the precinct would be primarily fed by surface and subsurface flows after rain periods .

4.2.3 Condition Assessment

Second Ponds Creek within the study area has been much altered from its natural state due to previous structural works along the creek (e.g. to provide for watering points and crossings for local land holders), removal of riparian vegetation, increases in sediment and nutrient transport through the system due to high pollutant loads, and various other factors.

Nonetheless, the creek has value as a component of riparian corridors that exist in the region and that are important in the movement of local flora and fauna. The creek also provides instream habitat for local fish species, aquatic macrophytes and aquatic macroinvertebrates all of which contribute to local ecosystem health. Programs that encourage improvements in these ecosystem values by restoring condition of environments such as Second Ponds Creek will be crucial to improving the condition of downstream environments such as the Hawkesbury Nepean River that contribute to valuable fisheries resources.

Notes on the condition indicators and final condition score for each reach is tabled below (Table 8). The location of each reach is shown in Figure 8. Boundaries between reaches reflected changes in condition primarily brought about by different land management practices between properties

Table 8: Condition of reaches of Second Ponds Creek

Reach No.	Hydrology	Streamside Vegetation	Physical Form	Water Quality and Aquatic Habitat	Overall Rating
1	Regionally modified. Some points of the watercourse have been modified historically these appear to have a moderate effect on flow regime.	Moderate condition: Predominant ground cover is introduced <i>Tradescantia albiflora</i> however natives also present. Good native canopy cover and frequent current and past recruitment of <i>Casuarina glauca</i> but not <i>Eucalyptus amplifolia</i> . Mixed age community. Some developed tracks from recreation activities causing disturbance. Good longitudinal connectivity of canopy.	Previous historic erosion has occurred throughout site. Some continuing erosion of banks around bridge over Windsor Rd. Generally, however, only low to moderate active erosion of muddy banks which are supported by tree roots. Sandstone works have been implemented to prevent erosion along Windsor Rd.	High sediment loads from local and upstream erosion, consistent with other reaches. Bike tracks contributing to sediment loads locally. Presence of native and exotic aquatic macrophytes. Some occasional medium to large native wood offering habitat.	Moderate
2	Regionally modified. Gravel/concrete causeway road crossing affecting flow regime within reach and acting as barrier to low/medium flows.	Thin riparian strip only (approx 5m) and degraded and fragmented by road crossing. Some regeneration of <i>C.glauca</i> . Various weeds at different strata levels including Small and Large-leaved Privet and African Olive.	Previous historic erosion has occurred throughout site. Some continuing erosion of banks around road crossing. Generally, however, only low to moderate active erosion of muddy banks which are supported by tree roots.	High sediment loads from local and upstream erosion, consistent with other reaches. Some local erosion around road crossing. Limited large wood.	Moderate
3	Regionally modified. Concrete causeway downstream causing permanent pooling immediately upstream leading to thick aquatic plant growth. Concrete blocks contributing to local hydrology interruption further upstream.	Mostly poor condition of riparian vegetation however good width and extent. Weeds present at various strata levels and some thick and prolific problematic weeds limiting future canopy development in these areas.	Banks well consolidated with vegetation providing stabilisation. Good diversity of instream bed and bank features such as bars and benches.	Occasional instream large/moderate sized wood. Mixture of native and introduced aquatic macrophytes contributing to habitat availability.	Moderate

Reach No.	Hydrology	Streamside Vegetation	Physical Form	Water Quality and Aquatic Habitat	Overall Rating
4	Regionally modified. Introduced concrete pipes interrupting flow.	Thin strip of riparian vegetation on both sides with low canopy cover. Poor condition of vegetation at all strata levels with numerous weeds dominant including <i>Salix</i> spp. Some native <i>Bursaria spinosa</i> present.	Previous bank modifications have occurred throughout reach though appear moderately stable now.	Thick growth of introduced <i>Typha orientalis</i> causing degradation of instream habitat. No large wood.	Degraded
5	Regionally modified. No major barriers to flow within site though there may have been historical modifications.	Relatively thin but continuous strip of riparian vegetation. Better recruitment of canopy species in this reach compared with upstream. Highly weedy ground cover.	Near vertical banks with some undercutting occurring. Generally however banks are well vegetated.	Frequent instream large wood and snags offering good habitat. Occasional aquatic macrophytes present.	Moderate
6	Regionally modified. Some barriers to flow apparently introduced to maintain water levels along sections.	High density of weeds on ground and within other strata. <i>Cardiospermum grandiflorum</i> (Balloon Vine) prolific and causing significant damage to canopy and prevention of future condition improvements. Some recruitment outside of weedy areas.	Moderate bank stability. Relatively homogenous structure within reach.	Large wood and snags present though some of these used to change flow regime. Occasional aquatic macrophytes.	Degraded
7	Regionally modified. Piped culvert upstream but does not appear to significantly influence hydrology. Causeway downstream in reach causes unnatural ponding with flow-on effects.	Thin and discontinuous strip of riparian vegetation. Various weed species present but not prolific. Some recent recruitment of <i>Casuarina glauca</i> . Mowing occurring adjacent to riparian zone.	Stream channel showing moderate erosion in sections and constriction in others as a result of modified flow and clearing. Erosion somewhat controlled by remaining trees.	Inputs and deposition of sediments and roadwork materials from nearby table drains. Area has been exposed to nearby agricultural runoff with no vegetated buffer.	Degraded

Reach No.	Hydrology	Streamside Vegetation	Physical Form	Water Quality and Aquatic Habitat	Overall Rating
8	Regional modification. Derivation of current drainage line and nearby ponded area unknown.	Weedy vegetation with little canopy cover.	Banks consolidated by thick plant cover, mainly weeds.	Occasional aquatic macrophytes including native species. Growth of filamentous algae and surface scum indicating poor water quality, however this feature acts as a natural sediment basin for downstream.	Degraded.

4.2.4 Impact Assessment

ELA have carried out a separate Riparian Corridor Constraints Assessment (ELA 2009 report). The key riparian corridor identified as part of the riparian assessment spans the length of Second Ponds Creek, 50m either side of the Top of Bank. Figure 9 shows the proposed riparian corridors as contained within the riparian report and the entire riparian corridor is proposed to be protected.

The aquatic habitat of Second Ponds Creek will be enhanced by the provision of a category 1 riparian corridor along its length and associated management and protection that this will provide for the in-stream habitat. A category 1 stream is designated as a key environmental corridor and requires a 40m core riparian zone and 10m vegetated buffer which together form a vegetated riparian corridor. Bed and bank stabilisation works will need to focus on minimising harm and maximising water quality and aquatic habitat condition.

Water quality and watercourse condition form core objectives for the ongoing management of the Second Ponds Creek riparian corridor, specific controls for the riparian corridor including fish passage are further detailed within the ELA Riparian Assessment Report.

Core Riparian Zones (CRZ's) such as Second Ponds Creek which flow through the precinct have a number of guidelines that need consideration in regard to their management under the Water Management Act 2000. For example, DECCW will seek to ensure that the CRZ remains, or becomes vegetated, with fully structured native vegetation (including groundcovers, shrubs and trees). The width of the CRZ from the banks of the stream is determined by assessing the importance and riparian functionality of the watercourse, merits of the site and long-term use of the land.

It is currently proposed that Sydney Water Corporation (SWC) will acquire the riparian corridor along the length of Second Ponds Creek (to the 1:100 year flood line) and it is understood that SWC is committed to managing the watercourse as a natural asset. The majority of the balance outside the corridor will be managed by Blacktown Council as part of the open space/drainage network and the riparian areas within the regional park will continue to be managed by DECCW (former NPWS) under the current zoning.

Refer to the ELA Riparian Assessment Report for further detailed discussion regarding suitable uses, potential planning controls and management options for the riparian corridor areas within the site. Blacktown City Council Growth Centre Precincts Development Control Plan 2010 (BCC 2010), hereafter referred to as the BCC Growth Centre DCP, provides a set of outcomes and planning controls for the riparian protection area within the growth centres precincts that are located in Blacktown LGA. This DCP only applies to precincts that have been completed, however, it is considered that Area 20 will have a schedule within this DCP and as such it is considered that the planning controls contained within the BCC Growth Centre DCP will be applicable to Area 20 once the precinct is completed.

Relevant guidelines regarding water crossings in particular for Rouse Road Bridge and the North West Rail Link and fish passage will also need to be taken into consideration during the detailed design phases of future development of the site.

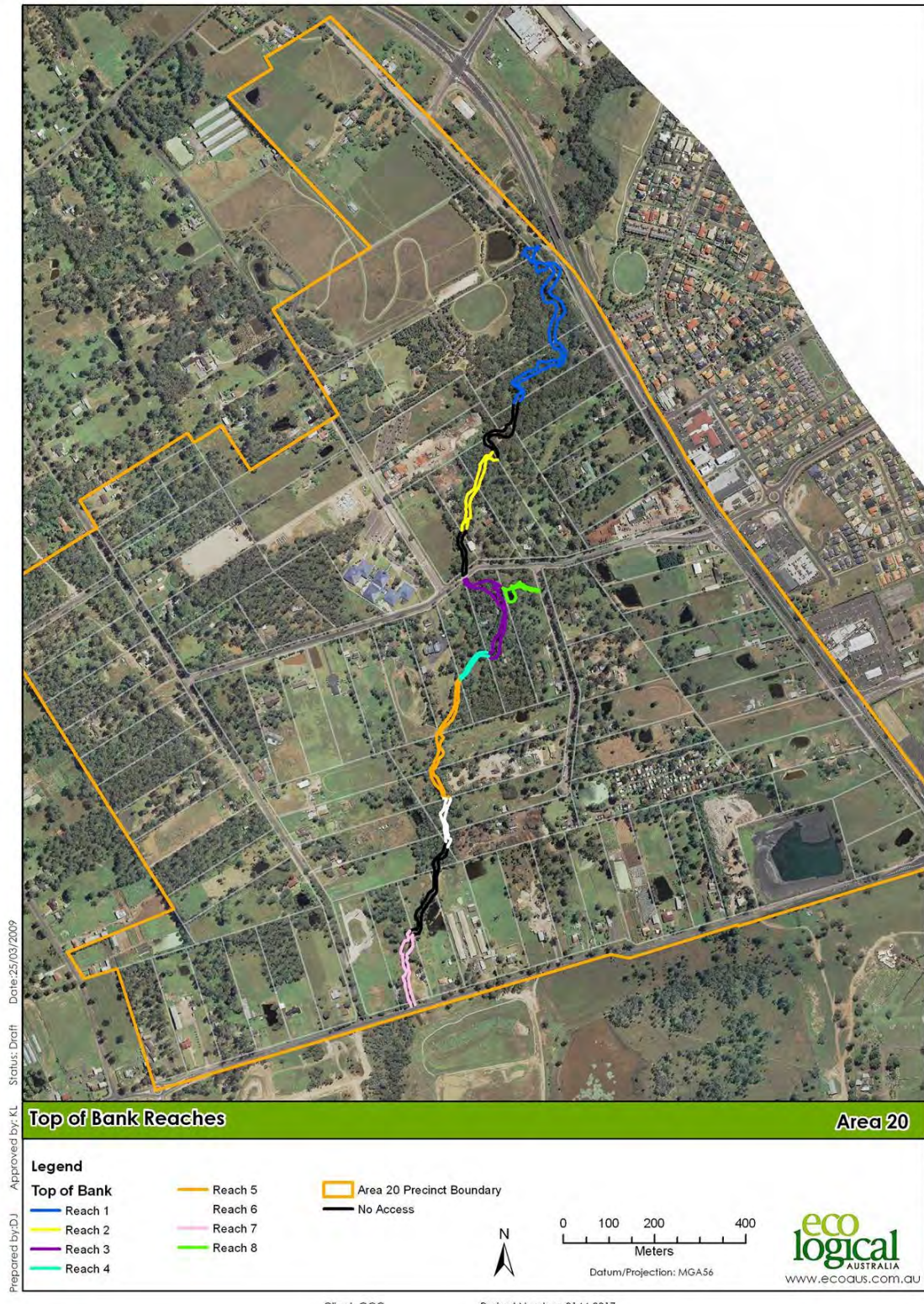


Figure 8: Survey reaches of Second Ponds Creek

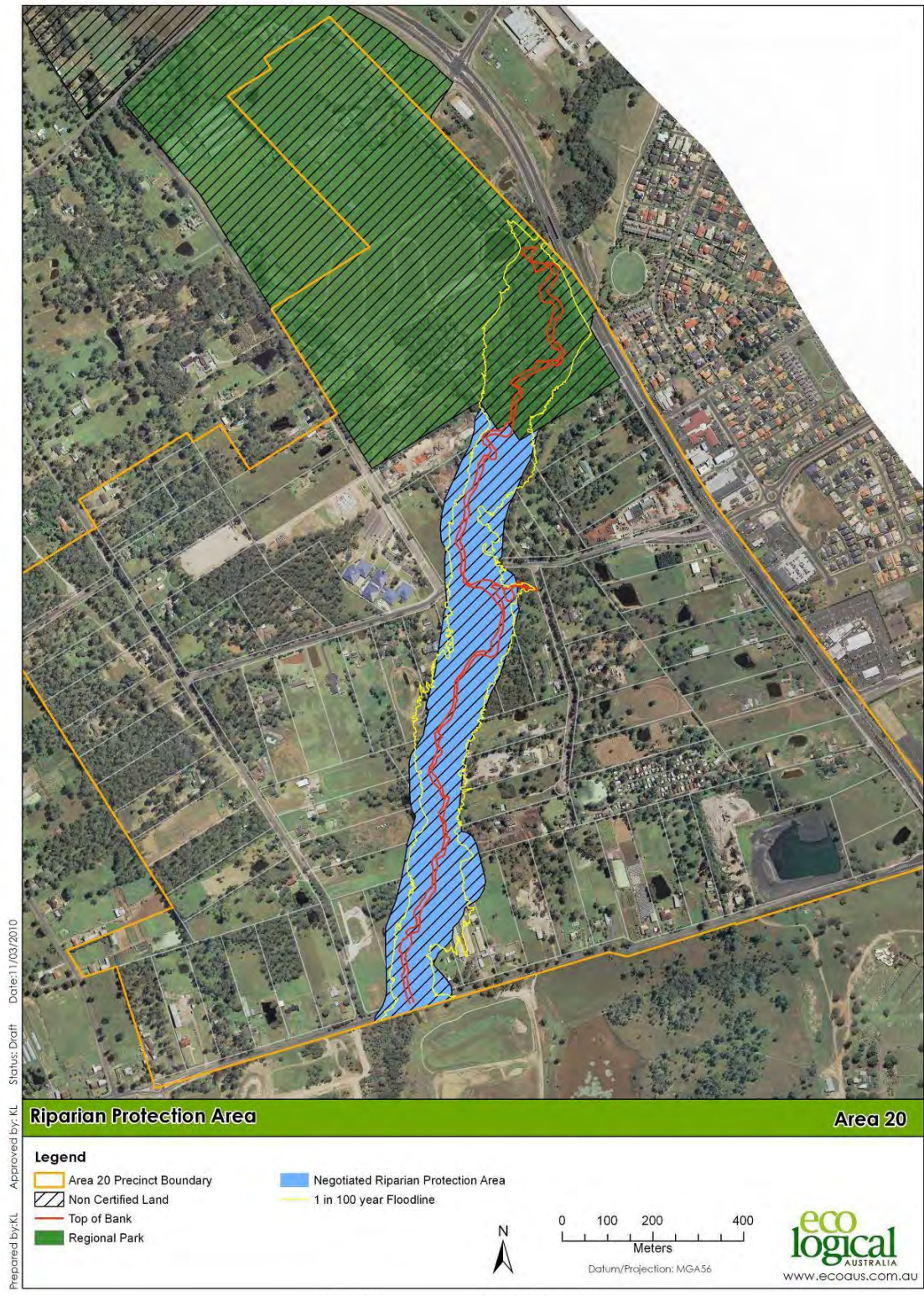


Figure 9: Riparian corridors as proposed by the Draft ILP

5 Conservation and Management Recommendations for Indicative Layout Plan

All preliminary site constraints have been combined to create 4 constraint categories for the Area 20 Precinct, each of which are linked to specific recommendations for the design of the Indicative Layout Plan (ILP).

Figure 10 illustrates the layout of each of these categories across the site, being;

1. Lands specified in the GC SEPP as non-certified areas. These lands are not covered by the Biocertification Order and form offsetting sites for the development of all Growth Centres Precincts. These lands should not be developed or impacted upon. Any clearing of vegetation within these areas will incur at least a 3:1 offset ratio of like for like vegetation within the site.
 - a. Non-certified and contains existing native vegetation (as per the GCC ENV definition)
 - b. Non-certified and not currently ENV (cleared or poor condition vegetation)
2. Shale Plains Woodlands (EPBC listed community). These areas are certified under the SEPP and are therefore potentially available for development because the impacts have been offset both within non-certified areas and conservation offsetting outside the GC precincts; however this community is also federally protected under the EPBC Act and any clearing at this stage may require a referral to SEWPAC and potentially be called in as a controlled action.
 - a. Shale Plains Woodland in good condition. These areas should be targeted as a priority for retention through location of conservation areas, open space, visual buffers and other such passive land uses.
 - b. Shale Plains Woodland in poor condition. These areas should also be retained where possible within open space, visual buffers and other such passive land uses.
3. Other remnant vegetation. These areas of remnant Alluvial Woodland (TSC Act EEC) provide additional habitat and corridor connectivity across the site and should be retained where possible. These areas are, however, also suitable for development as they are certified under the SEPP and their loss has been offset elsewhere.
4. Existing cleared lands. These lands do not hold any specific environmental value at this stage and would be the best suited for development.

In addition to these constraint categories it is recommended that open space areas, water quality and flood detention devices etc, are located in existing areas of high ecological constraint, to minimise habitat loss across the site and minimise potential impact under the EPBC Act.

There are no significant existing aquatic habitat constraints that should impact upon the ILP design, as none of the dams on site presented important habitat values and the rivers (Second Ponds Creek and

one tributary) were of moderate to degraded condition. Specific aquatic design considerations include;

- Incorporate areas of higher aquatic habitat quality into passive open space where possible, or create new habitat to replace losses;
- Restore the aquatic habitat of Second Ponds Creek as part of the riparian corridor management plan;
- Use local provenance wetland species for detention basin design with specific consideration of establishing suitable wetland/aquatic habitat.

The key constraints to rezoning of the site, in addition to the constraint categories above are the corresponding riparian corridors either side of the rivers on site (Figure 9). The categorisation of Second Ponds Creek as a Category 1 river will result in the need to ensure that all crossings are in accordance with DECCW specifications for this level of river. It is understood that the current ILP has restricted creek crossings to the existing crossing at Rouse Road and the proposed crossing of the North West Rail Link. The river categorisation requirements and riparian corridor management implications are further discussed in the riparian assessment report.

Environmental objectives and planning controls for Area 20 Precinct are outlined in Section 2.3.4 of the BCC Growth Centre DCP. These controls aim to:

- Conserve and rehabilitate the remaining native vegetation within the precinct;
- Ensure native vegetation contributes to the character and amenity of the precinct; and
- Preserve and enhance ecological values within the precinct and ecological links to surrounding areas.

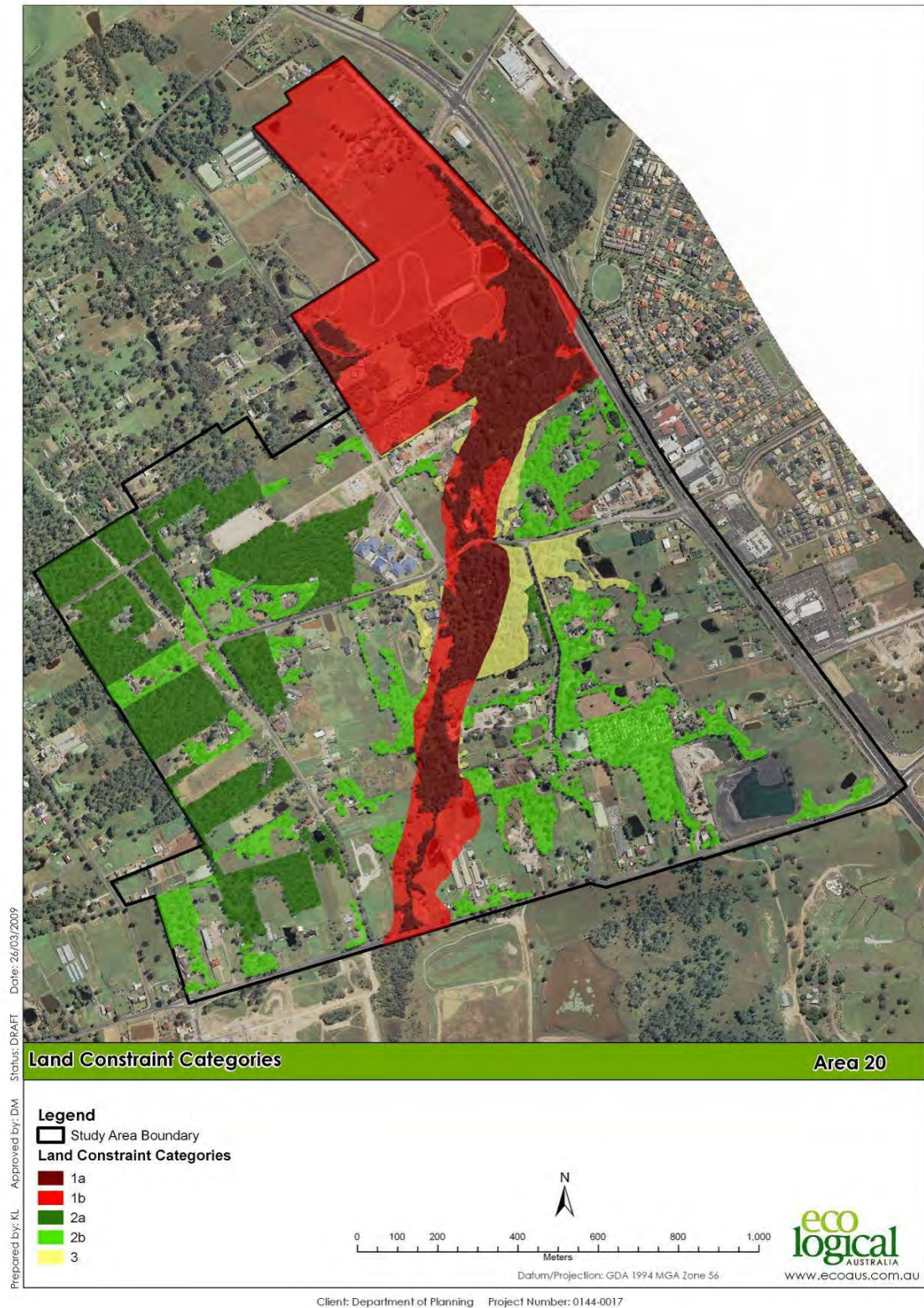


Figure 10: Land constraint categories

6 Indicative Layout Plan Assessment

The zoning layout for the Area 20 ILP can be seen in Figure 11. The ILP in its current form will conform to the biodiversity certification order, through the retention of vegetation within non-certified areas and additionally Cudgegong Reserve and drainage areas within the 1 in 100yr flood line. These areas will be protected by inclusion in the Native Vegetation Retention Map in the Growth Centres SEPP Amendment for Area 20.

The ILP proposes retention of vegetation on site primarily within the central riparian corridor along Second Ponds Creek, the majority of which will be taken into public ownership (SWC and Blacktown City Council) and managed as a natural feature into the future. The riparian corridor currently contains primarily Alluvial Woodland.

The ILP also proposes a number of parks to combine vegetation retention and passive recreational uses such as Cudgegong Reserve which will continue to be managed by Blacktown City Council as per the existing Plan of Management for biodiversity conservation.

The Rouse Hill Regional Park will continue to be managed as per current planning controls, and will see retention and protection of native vegetation therein.

Native vegetation along the ridgeline within the very low density residential zoning will be retained through additional controls for canopy tree retention requirements within the lots. This will provide habitat connectivity for mobile species with the surrounding lands outside the precinct and within the precinct through to the riparian corridor and Regional Park as well as preserving the historic viewshed of the site.

However, the ILP does propose significant onsite clearing of Cumberland Plain Woodland, a critically endangered EPBC Act listed community.

It is understood that the DoP are currently in negotiations with SEWPAC regarding a Growth Centres wide EPBC strategic assessment with the aim of achieving an EPBC Act sign-off similar to the biodiversity certification under the TSC Act. This would remove the referral requirements from future complying DA's. Any DA's which are to be lodged prior to the conclusion of these negotiations and require clearing of CPW, will likely require referral to SEWPAC.

There are two major crossings (Rouse Road Bridge and the North West Rail Link) proposed over Second Ponds Creek, the design of crossings will need to be in accordance with Category 1 requirements and ensure potential fish passage is not impeded. This is further discussed in the riparian assessment report.

With respect to drainage basins on site, these have been primarily located adjacent to the riparian corridor which will provide a buffer from the adjacent residential development. It is understood that these will be bioretention basins which offer a good opportunity to increase the biodiversity onsite. As such it is recommended that bioretention basins be placed in such a manner as to maximise vegetation retention, particularly in areas of CPW and that they be planted out with native species to reflect the native vegetation communities.

A report has been prepared providing an assessment between the Relevant Biodiversity Measures of the Biodiversity Certification Order and the Area 20 Precinct. This report highlighted the following key points:

- Areas of ENV are to be protected within non-certified and certified areas in excess of the contribution required for the precinct to maintain parity with the 2000 hectares of ENV to be protected across the Growth Centres (11.3 ha required excluding Rouse Hill Regional Park).
- 8.1 ha of existing native vegetation will be retained in non-certified areas and protected through the SEPP. The subject land will be owned by public authorities and the existing native vegetation conserved and rehabilitated.
- An additional 4.8 ha of validated existing native vegetation will be protected in certified areas within Cudgegong Reserve (3.2 ha), certified areas within the 1 in 100yr flood line (0.5 ha) and pocket parks (1.1 ha). These areas will be retained in Public ownership and included in the Native Vegetation Retention Map which will subsequently protect ENV through the Growth Centres SEPP.
- As such a total of 12.9 ha of existing native vegetation will be retained and protected across the precinct which is 1.6 ha more than that required within the Precinct.
- In addition to the above, 1.8 ha of vegetation recorded on site meeting the definition of ENV but which was not mapped in the Growth Centres Conservation Plan will be protected in non-certified lands and pocket parks.
- 0.2 ha of non-certified ENV in the Precinct is anticipated to be cleared due to the Rouse Road Bridge upgrade and North West Rail Link Bridge construction. This will be offset by the protection of 0.2 ha of the protected ENV onsite within certified lands that lie within the 1 in 100 year flood line.
- ENV protected in the creek corridor (8.1ha non certified lands and 0.5 ha in certified areas within the 1 in 100 year flood line) in addition to ENV protected in Cudgegong Reserve (3.2ha) totals 11.8 ha. This figure exceeds the amount required to meet the 2000ha in parity (11.3ha) and the offset required for the Rouse Hill Bridge upgrade and construction of the North West Rail Link (0.2ha).
- Cumberland Plain Woodland which is present in the Area 20 Precinct was assessed as a critically endangered community in the Ecological Report.
- Provisions are included in the Precinct Plan that prohibits clearing of ENV. The Department may also amend the boundaries of the certified lands to include all ENV that is to be protected in Cudgegong reserve and the 1 in 100 year flood line.

As such, the Area 20 precinct is considered to be consistent with the biodiversity certification of the Growth Centres SEPP.

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Appendix A: Detailed Statutory Framework

COMMONWEALTH

Environment Protection & Biodiversity Conservation Act 1999

The Commonwealth *Environment Protection & Biodiversity Conservation Act 1999* (EPBC Act) establishes a process for assessing the environmental impact of activities and developments where 'matters of national environmental significance' (MNES) may be affected. The EPBC Act lists endangered ecological communities, threatened and migratory species that have the potential to occur, or are known to occur on a site.

Given the presence of MNES (in particular Cumberland Plain Woodland) within Area 20 precinct, it is expected that the action would normally require assessment and referral under the EPBC Act. In this instance, however, there are a number of factors that suggest an alternative course of action may be available. It is understood that the Department of Planning (DoP) and other relevant NSW Government agencies are currently in discussions with the Federal Department of Sustainability, Environment, Water, Population and Communities (SEWPAC) (formerly DEWHA) regarding the possibility of a strategic assessment of the Growth Centres SEPP.

The strategic assessment should remove the need for individual referrals under the EPBC Act for agreed development areas within the Growth Centres. If a strategic assessment is not undertaken then referral of the Area 20 precinct development will be necessary for DA's that will involve any impact on CPW, this should be initiated at the master planning stage.

At this time it is recommended that a decision on when to refer the development to the Federal Government be delayed until it is clear what Federal Government assessment and approval process is to occur for the Growth Centres SEPP.

STATE

Environmental Planning and Assessment Act 1979 (EP&A Act)

The NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) is the principal planning legislation for the state, providing a framework for the overall environmental planning and assessment of development proposals. Various legislative instruments, such as the NSW *Threatened Species Conservation Act 1995* (TSC Act), are integrated with EP&A Act and have been reviewed separately.

In determining a development application, the consent authority is required to take into consideration the matters listed under Section 79C of the EP&A Act that are relevant to the application. Key considerations include:

- Any environmental planning instrument, including drafts
- The likely impacts of the development
- The suitability of the site for the development
- Any submissions made in accordance with the EP&A Act or regulations
- The public interest

Threatened Species Conservation Act 1995 (TSC Act)

The *Threatened Species Conservation Act 1995* (TSC Act) aims to protect and encourage the recovery of threatened species, populations and communities listed under the Act. The TSC Act is integrated with the EP&A Act and requires consideration of whether a development (Part 4 of the EP&A Act 1974) or an activity (Part 5 of the EP&A Act) is likely to significantly affect threatened species, populations and ecological communities or their habitat.

The schedules of the Act list species, populations and communities as endangered or vulnerable. New species, populations and communities are continually being added to the schedules of the TSC Act. All developments, land use changes or activities need to be assessed to determine if they will have the potential to significantly impact on species, populations or communities listed under the Act.

Bio-certification was introduced under the TSC Act (s.126G) to confer certification on an environmental planning instrument if the Minister is satisfied that it will lead to the overall improvement or maintenance of biodiversity values – typically at a landscape scale. The effect of granting certification is that any development or activity requiring consent (Under Part 4 and 5 of the EP&A Act respectively) is automatically - development that is not likely to significantly affect threatened species. This certification removes the need to address threatened species considerations and the assessment of significance or seven part tests (s.5A of the EP&A Act), including the prepare species impact statements (SIS).

Where Parts 3A, 4 or 5 are not applicable, a licence under s.91 of the TSC Act from Department of Environment and Climate Change (DECC) must be obtained for actions (such as bush regeneration) that have the potential impact on threatened species.

The Growth Centres SEPP (see below) impacts the application of the TSC Act within Area 20 precinct, which is discussed further below.

Threatened Species Conservation Amendment (Special Provisions) Act 2008

This Act passed by NSW Parliament on 24 June 2008 confirms bio-certification of the Growth Centres SEPP by amending the TSC Act. The Act also amends the Local Government Act 1993 with respect to rates payable on land subject to conservation agreements within the Growth Centres.

State Environmental Planning Policy (Sydney Region Growth Centres) 2006 (Growth Centres SEPP)

The Growth Centres State Environmental Planning Policy (SEPP) (referred to as the 'Growth Centres SEPP') has been 'bio-certified' by order of the Minister for the Environment under s.126G of the *TSC Act*. The mechanism for achieving this is outlined in the *Growth Centres Conservation Plan* (Eco Logical Australia, 2007) and the conditions for bio-certification are documented in the Ministers order for consent². Bio-certification negates the requirement for impact assessment under s.5A of the *Environmental Planning and Assessment Act, 1979* thus turning off the requirements for seven part tests or species impact statements.

² <http://www.environment.nsw.gov.au/resources/nature/biocertordwsgcentres.pdf>

Areas within Area 20 that are non-certified are shown in of the report. They comprise of a riparian area delineated by the 1 in 100 year flood lines and Rouse Hill Regional Park (protected under the NPW Act). Each precinct needs to be assessed against the conditions of the Biodiversity Conservation Order to ensure that the planned rezoning and subsequent development of the precinct complies.

Fisheries Management Act 1994 (FM Act)

The *Fisheries Management Act 1994* (FM Act) aims to conserve, develop and share the fishery resources of NSW for the benefit of present and future generations. The FM Act defines 'fish' as any marine, estuarine or freshwater fish or other aquatic animal life at any stage of their life history. This includes insects, molluscs (eg. oysters), crustaceans, echinoderms, and aquatic polychaetes (eg. beachworms), but does not include whales, mammals, reptiles, birds, amphibians or species specifically excluded (eg. some dragonflies are protected under the TSC Act instead of the FM Act). Under this act, if any activity occurs that will block fish passage, then a permit under this Act will be required.

Water Management Act 2000

The NSW *Water Management Act 2000* has replaced the provisions of the *Rivers and Foreshores Improvement Act 1948*. The *Water Management Act 2000* and *Water Act 1912* control the extraction of water, the use of water, the construction of works such as dams and weirs and the carrying out of activities in or near water sources in New South Wales. 'Water sources' are defined very broadly and include any river, lake, estuary, place where water occurs naturally on or below the surface of the ground and coastal waters.

If a 'controlled activity' is proposed on 'waterfront land', an approval is required under the Water Management Act (s91). 'Controlled activities' include:

- the construction of buildings or carrying out of works;
- the removal of material or vegetation from land by excavation or any other means;
- the deposition of material on land by landfill or otherwise; or
- any activity that affects the quantity or flow of water in a water source.

'Waterfront land' is defined as the bed of any river or lake, and any land lying between the river or lake and a line drawn parallel to and forty metres (40m) inland from either the highest bank or shore (in relation to non-tidal waters) or the mean high water mark (in relation to tidal waters). It is an offence to carry out a controlled activity on waterfront land except in accordance with an approval.

Similar to biodiversity certification, it is the intention that an 'order' under the WM Act will be obtained for the precinct that exempts future development assessment from controlled activity approval (CAA), providing the development is consistent with the strategic framework and planning controls identified in an appropriate Waterfront Land Strategy. A Waterfront Land Strategy for the Area 20 precinct would formally identify the Riparian Protection Areas to which it will apply and contain specific activities, objectives and controls to which works must comply if they are to be considered exempt from CAA. For all complying works, the requirement to refer the development application to DECCW is removed and the approval authority remains with the local council.

Guidelines have been provided for the protection of core riparian areas (CRZs) as illustrated in the table below.

Water Management Act CRZ Widths

Types of Watercourses	CRZ Width
Any first order ¹ watercourse and where there is a defined channel where water flows intermittently	10 metres
Any permanent flowing first order watercourse, or any second order ¹ watercourse where there is a defined channel where water flows intermittently or permanently	20 metres
Any third order ¹ or greater watercourse and where there is a defined channel where water flows intermittently or permanently. Includes estuaries, wetlands and any parts of rivers influenced by tidal waters.	20 – 40 metres ²

¹ as classified under the Strahler System of ordering watercourses and based on current 1:25,000 topographic maps.

² merit assessment based on riparian functionality of the river, lake or estuary, the site and long-term land use.

The riparian corridors that exist within Area 20 precinct have been mapped according to their watercourse classification and are dealt with separately in the Riparian Assessment Report (ELA).

Noxious Weed Act 1993

The objectives of the NSW *Noxious Weeds Act 1993* are to identify which noxious weeds require control measures, identify control measures suitable to those species and to specify the responsibilities of both public and private landholders for noxious weed control.

Rural Fires Act 1997

The objectives of the NSW *Rural Fires Act 1997* (RF Act) are to provide for:

- The prevention, mitigation and suppression of fires
- Coordination of bushfire fighting and prevention
- Protection of people and property from fires
- Protection of the environment

Section 100B of the RF Act provides for the Commissioner to issue a bushfire safety authority for subdivision of bushfire prone land that could lawfully be used for residential or rural residential purposes or for development of bushfire prone land for a special fire protection purpose.

A Bushfire Safety Authority permits development to the extent that it complies with bushfire protection standards. Application for a Bushfire Safety Authority must be lodged as part of the development application process and must demonstrate compliance with the Planning for Bushfire Protection Guidelines (RFS 2006).

The RF Act also outlines the responsibilities of land owners to manage their land for bushfire protection and provides a mechanism for the approval of hazard reduction works, through the issue of a bushfire hazard reduction certificate.

Rural Fires and Environmental Assessment Legislation Amendment Act 2002

The NSW *Rural Fires and Environmental Assessment Legislation Amendment Act 2002* amends the RF Act and the EP&A Act with respect to bushfire prone lands, bushfire hazards and bushfire emergencies.

Planning for Bushfire Protection 2006

This guide (*Planning for Bushfire Protection: a Guide for Councils, Planners, Fire Authorities, Developers and Home Owners, NSW Rural Fire Service 2006*) is the key bushfire planning document for the state. The document identifies requirements and strategies for new developments to help protect from bushfire hazards. It details the location and depth of asset protection zones, fire trails and perimeter roads, water supply and building standards in bushfire risk areas. This document is given legal force through the *Rural Fires and Environmental Assessment Legislation Amendment Act 2002*.

State Environmental Planning Policy No.19 – Bushland in Urban Areas

This NSW State Environmental Planning Policy (SEPP) aims to protect and preserve bushland within selected local government areas. The policy recognises the recreational, educational and scientific significance of such bushland and aims to protect the flora, fauna, significant geological features, landforms and archaeological relics in such areas. It encourages management to protect and enhance the quality of the bushland and facilitate public enjoyment, compatible with its conservation. The policy states that a person shall not disturb bushland zoned or reserved for public open space purposes without the consent of the council.

Growth Centres Development Code 2006

The Growth Centres Development Code was produced by the former Growth Centres Commission (GCC) in 2006. The Development Code was produced to guide the planning and urban design in the North West and South West Growth Centres.

The Development Code includes objectives and provisions that support the retention of as much native vegetation, habitat and riparian areas within the precinct through incorporation into land use planning outcomes such as lower density development in these areas, subdivision patterns, road design, local parks, and other areas required to be set aside for community uses without adversely affecting the development yield of areas.

As a requirement under the Development Code, the Area 20 precinct will need to demonstrate how the biodiversity and other values of areas identified by the SEPP will be protected, maintained and enhanced. Key issues will include boundary management (eg. buffers to surrounding development), bush fire and water sensitive urban design (WSUD) (GCC 2006).

The riparian areas within the Growth Centres Precincts are assessed according to methodology included in the Growth Centres Development Code (ie: Category 1, 2 and 3 which was based on the Riparian Corridor Management Study (DIPNR, March 2004). produced for the Wollongong LGA and Calderwood Valley in the Shellharbour LGA). The Growth Centres Development Code methodology has been used for this study. The riparian corridors that exist within the Area 20 have been mapped according to their watercourse classification and riparian corridor boundaries negotiated with DECCW.

Growth Centres Commission Conservation Plan 2007

Under the GCC Conservation Plan (January 2007), the vegetation within Area 20 precinct has been identified as 'Lower Long Term Management Viability (LMV)' and has already been considered for offset as part of the Improve or Maintain test (i.e. is not designated for conservation as part of the larger regional plan for Western Sydney). It should be noted however that while the Improve or Maintain test has already been considered, it can and should be supplemented by other relevant considerations as recommended by the Conservation Plan. By applying the precautionary principle, the Conservation Plan recommends that some residual areas identified as LMV should be further examined and addressed, for any potential for habitat conservation to contribute to the broader habitat values of the area at the planning stage.

Blacktown City Council Growth Centre Precinct Development Control Plan 2010

This DCP only applies to precincts that have been completed, however, it is considered that Area 20 will have a schedule within this DCP and as such it is considered that the planning controls contained within the BCC Growth Centre DCP will be applicable to Area 20 once the precinct is completed. The purpose of the plan is

- to communicate planning design and environmental objectives and controls against which to assess DAs;
- consolidate and simplify planning controls;
- Ensure orderly efficient and environmentally sensitive design; and
- Promote high quality urban design outcomes.

Blacktown City Council Growth Centre Precincts Development Control Plan 2010 provides a set of outcomes and planning controls for the riparian protection area (DCP Appendix B) within the growth centres precincts that are located in Blacktown LGA.

Appendix B: Methodology

Literature Review

A desktop literature review was undertaken by ELA to determine the location and extent of previous surveys, identify the representative spectrum of flora and fauna within the study area and identify the presence of any threatened species, populations and ecological communities listed under the TSC Act and the Commonwealth EPBC Act that could potentially occur within the study area. To this end, the following documentation and mapping was reviewed:

- Topographic maps and aerial photography of the study area;
- A search of the NSW DECC Wildlife Atlas database
- EPBC online Protected Matters Database Search
- Rouse Hill Infrastructure Project, Water, Sewerage and Trunk Drainage Flora and Fauna Assessments prepared by Gunninah Environmental Consultants (2002 and 2003)
- 'Growth Centres Conservation Plan' prepared by Eco Logical Australia (2007) for NSW Growth Centres Commission;
- Western Sydney Vegetation Mapping (NPWS 2002a); and
- Western Sydney Condition and Conservation Significance Mapping (NPWS 2002b).

Likelihood of Occurrence

Appendix D identifies the threatened species returned by the NSW DECCW Wildlife Atlas database and EPBC online Protected Matters database searches (based on a 10km radius from the study area) together with an assessment of the likelihood of occurrence for each species. Each species likely occurrence was determined by records in the area, habitat availability and knowledge of the species' ecology.

Five terms for the likelihood of occurrence of species are used in this report. 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 site.
- "no" = habitat on site and in the vicinity is unsuitable for the species.

Terrestrial Biodiversity Assessment

METHODS

Field survey across the study area was conducted on the 23rd, 24th, 25th, 26th of February, and 2nd of March 2009. Field survey consisted of validating vegetation communities and their condition, and opportunistic fauna sightings. The field survey was undertaken by Liz Norris, Tammy Haslehurst, and Daniel Magdi of Eco Logical Australia. Approximately 110 person hours were utilised in completing the survey.

Matters of National Environmental Significance (MNES) listed under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC) were targeted during this survey period. The entire study area was inspected to assess the broad range of vegetation and habitat types occurring within the study area.

Table 9: Weather conditions during field surveys

Date	Min Temp (°C)	Max Temp (°C)	Rainfall (mm)
23 rd February 2009	19.5	31.6	0.2
24 th February 2009	18	32.5	8.2
25 th February 2009	19.2	30	0.2
26 th February 2009	18.8	25.5	0
2 nd March 2009	18.3	27.8	0

Weather observations were taken from www.bom.gov.au

The survey involved validating vegetation communities, and searching for threatened flora and fauna. Six survey techniques were used during the field surveys. These techniques included:

1. Floristic quadrats
2. Random meander targeted flora searches
3. Evening Bird Census
4. Anabat detection; and
5. Frog census and Spotlighting.

The survey techniques were based on those outlined within the *Threatened Biodiversity Survey and Assessment: Guidelines for Development and Activities (Working Draft)* by DEC (2004).

Figure 12 over the page illustrates the types and locations of the additional detailed survey work.

Vegetation Community and Condition Assessment

Using a combination of the NPWS Western Sydney Mapping Project and aerial photograph interpretation, vegetation community information, canopy density and understorey condition were assigned to each vegetation polygon. Field surveys were carried out to assess the accuracy of the mapped boundaries and attributed information.

NSW Cumberland Plain Condition Criteria

Table below outlines the classification rules used to determine canopy and understorey condition. This table is a modification of Table 4 in the Interpretation Guidelines for the Native Vegetation Maps of the Cumberland Plain, Western Sydney (NPWS 2002). Each area of remnant vegetation was given a condition rating according to the rule-set identified in the table below.

Table 10: Canopy and condition codes.

Code	Canopy Density	Description
A	>10%	Relatively intact native tree canopy
B	<10%	Larger areas of remnant vegetation with a low or discontinuous canopy. Often found on the disturbed edges of larger remnants.
C	<10%	Areas of native vegetation that do not have a Eucalypt canopy cover.
TX	<10%	Areas of native trees with very discontinuous canopy cover.
TXr	<10%	Areas of Tx (as above) located in areas where there is a combination of urban and rural activities such as rural residential development.
TXu	<10%	Areas of Tx (as above) located where the dominant land use is urban (residential/industrial etc).

Source: Table 4 in the Interpretation Guidelines for the Native Vegetation Maps of the Cumberland Plain Western Sydney (NPWS 2002).

Commonwealth Cumberland Plain Woodland and Shale Gravel Transition Forest Condition Criteria

The condition assessment criteria under the EPBC Act differs from that of the TSC Act. Condition is assigned based on patch size and perennial understorey cover. Table 11 below outlines the EPBC Act condition criteria which were applied to vegetation within the study area to determine the condition code.

Table 11: Condition Thresholds for Patches that meet the description for the Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community.

Category and rationale	Thresholds
A. Core thresholds that apply under most circumstances: patches with an understorey dominated by natives and a minimum size that is functional and consistent with the minimum mapping unit size applied	Minimum patch ³ size is ≥0.5ha; AND ≥50% of the perennial understorey vegetation cover ⁴ is made up of native species.

Category and rationale	Thresholds
in NSW.	
OR	
B. Larger patches which are inherently valuable due to their rarity.	The patch size is ≥5ha; AND ≥30% of the perennial understorey vegetation cover is made up of native species.
OR	
C. Patches with connectivity to other large native vegetation remnants in the landscape.	The patch size is ≥0.5 ha; AND ≥30% of the perennial understorey vegetation cover is made up of native species; AND The patch is contiguous ⁵ with a native vegetation remnant (any native vegetation where cover in each layer present is dominated by native species) that is ≥5ha in area.
OR	
D. Patches that have large mature trees or trees with hollows (habitat) that are very scarce on the Cumberland Plain.	The patch size is ≥0.5 ha in size; AND ≥30% of the perennial understorey vegetation cover is made up of native species; AND The patch has at least one tree with hollows per hectare or at least one large tree (≥80 cm dbh) per hectare from the upper tree layer species outlined in the Description and Appendix A.
³ A <i>patch</i> is defined as a discrete and continuous area that comprises the ecological community, outlined in the Description. Patches should be assessed at a scale of 0.04 ha or equivalent (e.g. 20m x 20m plot). The number of plots (or quadrats or survey transects) per patch must take into consideration the size, shape and condition across the site. Permanent man-made structures, such as roads and buildings, are typically excluded from a patch but a patch may include small-scale disturbances, such as tracks or breaks or other small-scale variations in native vegetation that do not significantly alter the overall functionality of the ecological community, for instance the easy movement of wildlife or dispersal of spores, seeds and other plant propagules. ⁴ Perennial understorey vegetation cover includes vascular plant species of the ground and shrub layers (as outlined in the Description and Appendix A) with a life-cycle of more than two growing seasons (Australian Biological Resources Study, 2007). Measurements of perennial understorey vegetation cover exclude annuals, cryptogams, leaf litter or exposed soil (although these are included in a patch of the ecological community when they do no alter functionality as per footnote 3 and the Description and Condition Thresholds are met). ⁵ Contiguous means the woodland patch is continuous with, or in close proximity (within 100 m), of another patch of vegetation that is dominated by native species in each vegetation layer present.	

Source: DEWHA (2009a) Advice to the Minister for the Environment, Heritage and the Arts from the Threatened Species Scientific Committee (the Committee) on an Amendment to the List of Threatened Ecological Communities under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

Quadrats

Floristic quadrats (20m x 20m) were conducted within vegetation community remnants identified from the NSW National Parks and Wildlife Service (NPWS) Cumberland Plain Vegetation Mapping Project (2002), were visited during the field survey.

Vegetation community remnants were targeted to validate and determine the floristic structure of the vegetation community. A full floristic list was compiled within each quadrat (Appendix C). Floristic quadrat locations are shown in Figure 12.

For each quadrat, diagnostic species for each community were identified and compared against the minimum number of diagnostic species expected to occur in a 20 x 20m quadrat for that community. Consideration was also given to those more disturbed sites where weed species were common and

native species were low in abundance making the classification process more difficult as those sites containing fewer native species are less likely to contain high numbers of diagnostic species.

Threatened Flora Surveys

Random meander surveys were conducted within the vegetation communities located within the site, and other areas of potential habitat for threatened flora species. MNES flora species that were targeted during the field survey included:

- *Micromyrtus minutiflora*
- *Persoonia nutans*
- *Pimelea curviflora* var. *curviflora*
- *Pimelea spicata*
- *Pultenaea parviflora*

Threatened Fauna Surveys

Threatened fauna surveys were undertaken within the study area to determine whether any MNES species were found within the Area 20. Three methods were utilised during the surveys, including:

- **Bird Census** - A bird census was undertaken at dusk within the study area to target MNES woodland birds and migratory bird species. The census was conducted for a 1 hour period over four consecutive evenings. The afternoon census was undertaken between 1900hrs and 2000hrs. All birds were identified either by sight or call recognition and were recorded. The location of the wetland bird census is presented in Figure 12.
- **Anabat Detection** - An Anabat detector equipped with ZCAIM recording device was used to record resident microchiropteran bat species on four consecutive nights. On each night of survey the Anabat was tuned to record from 1900hours to 0800 the following morning. Anabat calls were downloaded and sent to Anna Lloyd for identification. Anabat locations are presented in Figure 12. Certainty of bat identifications are recorded confident (C), probable (P) and possible (Po).
- **Call Playback and Spotlighting** - Call play back and census techniques were used to undertake targeted surveys for Green and Golden Bell Frogs. These surveys were undertaken along second ponds creek and a number of dams within the precinct. Water body side census was undertaken at four sites where suitable habitat for green and golden bell frog existed. This survey method involved listening for calls for a period of 10 minutes. Call playback was then utilised at these sites to attract response from the species. The green and golden bell frog call was played for a period of 5 minutes followed by a period of 5 minutes listening, then by 10min of spotlighting. Green and golden bell frog survey locations are presented in Figure 12. Spotlighting was also undertaken to identify megachiropteran bat species within the study area over four consecutive nights.

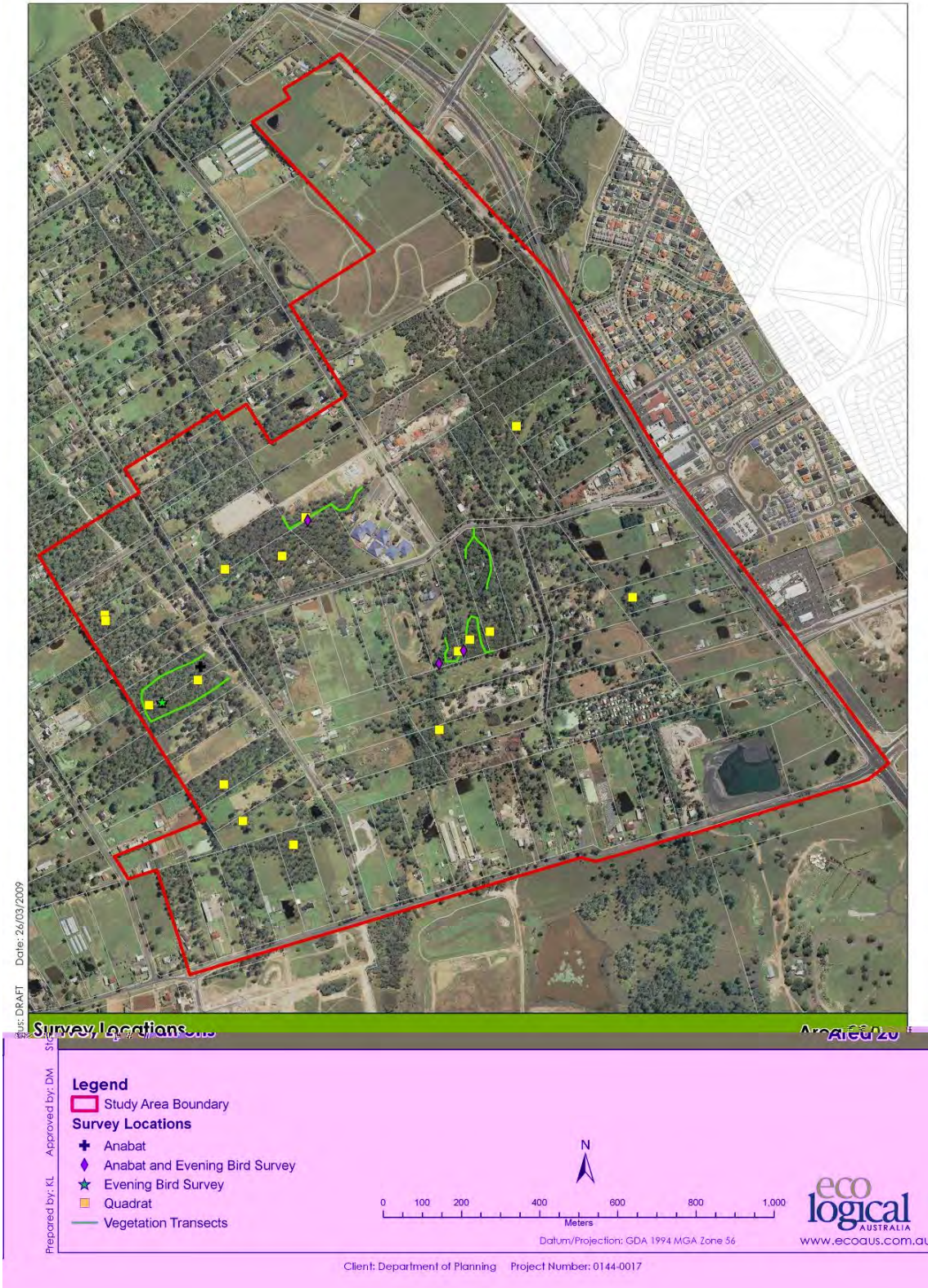


Figure 12: Survey types and locations

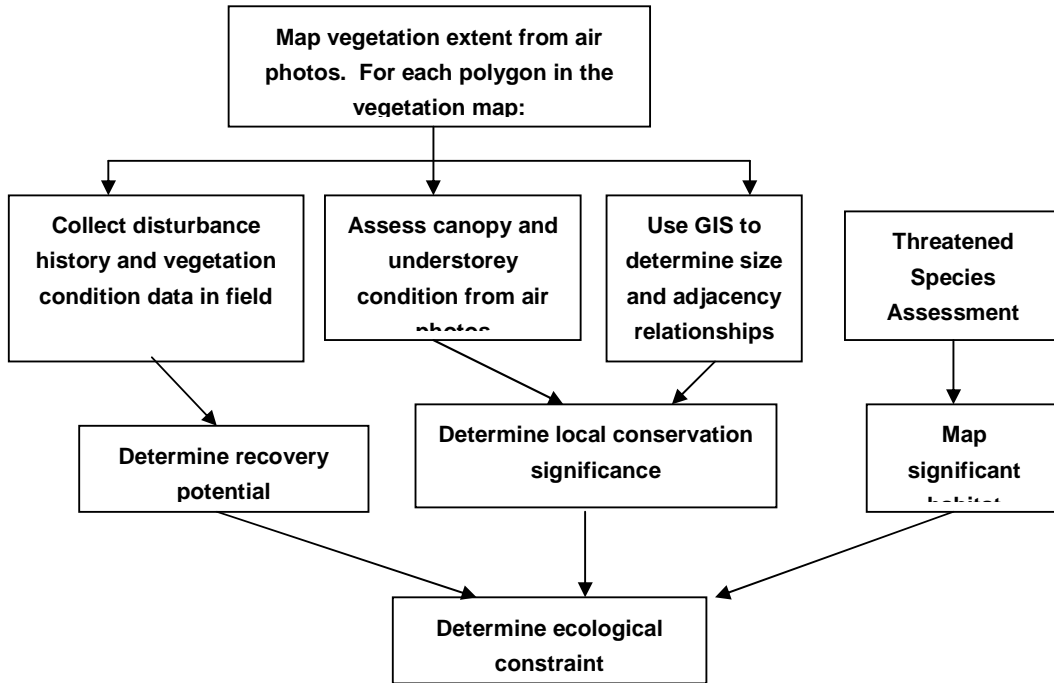
Ecological Constraints

An ecological constraints analysis, based on a methodology used elsewhere in Western Sydney (Eco Logical Australia 2003) was applied across the study area. An ecological constraints analysis is a stepped analysis of the environmental values of an area. It provides a combined measure of ecological values, and is increasingly used as a basis for negotiations over locations, types and densities of land development. It includes measurement of:

- the conservation significance of vegetation communities (including legislative status);
- the structural condition of vegetation remnants;
- type and severity of disturbance and associated recovery potential;
- connectivity between remnants on and off site;
- the size of the vegetation remnant; and
- the value of the remnant as threatened species habitat.

The steps involved in this type of ecological constraints analysis are illustrated in the flowchart in the Figure below. Vegetation mapping is combined with field survey work, threatened species assessment, recovery potential and the NPWS (2002) conservation significance assessment methodology to determine the relative level of ecological value or constraint across a site.

Ecological Constraints Flowchart



Recovery Potential

Using information collected in the field ‘recovery potential’ is determined for each area of vegetation. This is defined as “...the anticipated capacity of (an) area to recover to a state representative of its condition prior to the most recent disturbance event” (IPC & AES, 2002).

The table over the page outlines the decision rules used in this step, resulting in a ranking of High, Moderate, Low or Very Low recovery potential for each vegetation remnant.

Conservation Significance

As part of the recovery planning process for Cumberland Plain vegetation communities, NPWS (2001) have classified remnant vegetation across the Plain into significance categories to assist Councils and other land use planners in making decisions about land use. Remnant woodland and forest vegetation has been ranked as one of four categories:

- ‘Core Habitat’; defined as “areas that constitute the backbone of a viable conservation network across the landscape; or areas where the endangered ecological communities are at imminent risk of extinction”
- ‘Support for Core Habitat’; “areas that provide a range of support values to the Core Habitat, including increasing remnant size, buffering from edge effects, and providing corridor connections”
- ‘Other Remnant Vegetation’; “all native vegetation that does not fall within the above significance categories”

These decision criteria are outlined in the tables over the page.

NPWS (2002) conservation significance attribute information was assigned to the vegetation polygons mapped within Area 20. Where the classification no longer matched, changes were made.

Threatened Species Assessment

Threatened species information and field observations of habitat value were then collated for the study area and used to determine significant threatened species habitat. Each remnant vegetation patch is classed as having either Known, Likely or Nil chance of supporting threatened species.

The following criteria were adopted for categorisation;

- Known/High
 - Known occurrence of threatened flora or fauna
 - Known occurrence of Cumberland Plain Land Snail
 - Known breeding habitat for wide ranging threatened species (e.g. bats and birds with large home ranges)
- Likely/Moderate
 - Likely occurrence of threatened flora or fauna
 - Likely occurrence of Cumberland Plain Land Snail
 - Likely breeding habitat for wide ranging threatened species (e.g. bats and birds with large home ranges)
- Nil/Low
 - Foraging habitat only, for wide ranging species (e.g. bats and birds with large home ranges)

Ecological Constraint

Information derived from the recovery potential, conservation significance and threatened species calculations are combined to determine ecological constraint. The tables on the following pages show the process for combining this information.

Recovery potential matrix

Source: Eco Logical Australia (2003).

Current condition and land use	Past land use and disturbance	Soil Condition	Vegetation	Recovery Potential	
Cleared (no woodland canopy). Includes <i>Bursaria</i> thickets in grassland	Recently cleared (<2 years)	Unmodified or largely natural. Uncultivated.	Native dominated	High	
			Exotic dominated	Moderate	
	Historically cleared (>2 years) and consistently managed as cleared.	Modified. Heavily cultivated and/or pasture improved. Imported material.	Unmodified or largely natural. Uncultivated.	Either	Low
				Native dominated	Moderate
			Modified. Heavily cultivated and/or pasture improved. Imported material.	Exotic dominated	Low
				Either	Very Low
Wooded/Native Canopy present or regenerating	No recent clearing of understorey	Unmodified or largely natural. Uncultivated.	Native understorey relatively intact or in advanced state of regeneration. Native dominated.	High	
			Native understorey significantly structurally modified, absent or largely absent. Includes areas dominated by African Olive.	Moderate	
			<i>Exotic dominated</i>	<i>Low</i>	
		<i>Moderately modified by long term grazing or mowing.</i>	<i>Native dominated</i>	<i>Low</i>	
		Modified. Heavily cultivated and/or pasture improved. Imported material.	Native understorey significantly structurally modified, absent or largely absent. Includes areas dominated by African Olive.	Very Low	
	Native understorey present. Heavily weed invaded.		Low		
	<i>Understorey patchily intact</i>	<i>Disturbed</i>	<i>Native dominated</i>	<i>Moderate</i>	
			<i>Exotic dominated</i>	<i>Low</i>	
	Recent clearing of understorey and or native understorey significantly structurally modified due to existing land use (eg. Mowing, grazing)	Unmodified or largely natural. Uncultivated.	Native dominated. If no vegetation present, assume native dominated.	High	
			Exotic dominated	Moderate	
		Modified. Heavily cultivated and/or pasture improved. Imported material.	Native dominated	Low	
			Exotic dominated	Very Low	

Conservation significance matrix

Source: NSW NPWS (2002)

Community type	Condition Code*	Patch Size	Connectivity	Code	Conservation Significance
Endangered Ecological Community (Critically endangered) ("CEEC")	ABC, TX or Txr	Any	Any	C3	Core
	Txu	Any	Any	URT	Urban remnant trees (critically endangered communities)
Endangered Ecological Community ("EEC")	ABC (with Understorey in good or moderate condition)	> 10 ha	Any	C1	Core
		< 10 ha	Adjacent to C1 or CEEC	C2	Core
			Adjacent to S1	S2	Support for core
			None	O	Other remnant vegetation
	TX or Txr, ABC (with poor Understorey condition)	Any	Adjacent to any Core	S1	Support for core
			None	O	Other remnant vegetation
	Txu	Any	Any	O	Other remnant vegetation

Decision matrix step 1:

This step combines the recovery potential and conservation significance maps (ELA 2003).

	Recovery Potential				
Conservation Significance		High	Moderate	Low	Very Low
	Core	High	High	High	High
	Support for core	High	Moderate	Moderate	Low
	Other	Moderate	Moderate	Low	Low

Decision matrix step 2:

This step combines results from the above table with the threatened species layer to determine overall ecological value (ELA 2003).

	Combined Recovery Potential and Conservation Significance (result of Table above)			
Threatened Species Assessment		High	Moderate	Low
	Known (High)	High	High	High
	Likely (Moderate)	High	Moderate	Moderate
	Nil (Low)	High	Moderate	Low

Aquatic Habitat Assessment

Study Area

Second Ponds Creek, the dominant watercourse within the study area, flows North through the precinct. Outside of the study area, Second Ponds Creek meets the Caddies Creek before flowing into the Cattai Creek shortly after Annangrove. Cattai Creek flows into the Hawkesbury River at Cattai.

The study area is part of the South Creek subcatchment within the Hawkesbury Nepean Catchment. This particular subcatchment "is perhaps the most degraded subcatchment in the Hawkesbury Nepean". The majority of the streams are "meandering vertical" river channel types streams, which are under great threat as they are confined largely to the Cumberland Plain in the Hawkesbury Nepean catchment.

Preliminary Assessment

A preliminary assessment of all types of water features within the study was carried out to assist with developing an appropriate methodology to highlight values and conditions of aquatic areas, defining 'Top of Bank' along watercourses and appraising the hydrological regime.

Threatened Species

Threatened species listed under the *Fisheries Management Act 1995* and the *Environmental Protection and Biodiversity Conservation Act 1999* were considered for their potential to occur within the study area by assessing habitat quality and availability as well as previous records. The following databases informed this process:

- NSW Fisheries Threatened Species Profiles
- NSW DECCW Wildlife Atlas database
- EPBC online Protected Matters Database Search
- NSW Government Bionet Database

Stream Categorisation

Watercourses within the study area were categorised using guidelines developed by the former NSW Department of Water and Energy (now part of DECCW) (NSW DWE 2008). DECCW representatives were primarily responsible for designating categories to the different watercourses throughout the study area.

Stream categorisation resulted in the delineation of Category One type watercourses (Core Riparian Zone) within the study area. The objectives for Core Riparian Zones under the guidelines include maintenance or development of fully structured native vegetation and the absence of infrastructure within the zone.

No other watercourses within the study area were assigned to a formal category and therefore future field investigations after the preliminary assessment were limited to the designated Category One watercourses.

Condition Assessment

A number of key indicators were used to assess condition along the watercourse. The chosen indicators recognise key components of watercourse health and function. The level of assessment conducted was chosen to assist with future management of watercourse and riparian environments within the study area by highlighting current values, threats and limits to potential improvements along the watercourse.

Stream health component	Indicator
Hydrology	Presence of artificial barriers.
	Comparison to natural hydrological regime.
Streamside Vegetation	Width, condition and connectivity of riparian vegetation.
	Recruitment of native canopy species.
Physical Form	Bank stability.
	Fish passage.
Water Quality and Aquatic Habitat	Observed turbidity and algal growth.
	Instream native woody debris and snags.
	Instream macrophytes - habitat and condition of any macrophyte assemblage as based on presence of native and exotic species, diversity, and basis for occurrence.
	Potential land management problems within adjacent riparian areas likely to be contributing to poor water quality.

Field surveys were conducted along the length of the watercourse wherever access was permitted. Differences in condition, as observed through the key indicators, were used to separate the watercourse into reaches.

A final overall condition class was assigned to each reach of the watercourse consistent with guidelines used by the NSW Department of Water and Land Conservation within the Hawkesbury Nepean Catchment (NSW DWLC 2000) as specified below:

Near Intact Condition – Streams in a natural or near natural condition. Indicative characteristics are; intact range of native vegetation, slow rate of geomorphic change and hydrologic conditions unaltered.

Good Condition – Streams with self adjusting river forms and processes and relatively intact vegetation associations. Streams with character and behaviour that befit their setting with high potential for ecological diversity. Dams reservoirs or weirs may alter hydrologic conditions.

Moderate Condition – Streams with localised degradation of character and behaviour, typically marked by modified patterns of geomorphic units. Vegetation associations and coverage are poor and hydrologic conditions have been altered.

Degraded Condition – These reaches generally have one or more of the following characteristics: abnormal or accelerated geomorphic instability (i.e. prone to planform change and/or bank or bed erosion), excessively high volumes of coarse bedload which blankets the bed reducing habitat diversity, low levels of bank vegetation, heavy weed infestation and artificially modified channel.

Appendix C: Flora & Fauna Lists

FLORA LIST

Scientific Name	Common Name
<i>Acacia decurrens</i>	Black Wattle
<i>Acacia falcata</i>	
<i>Acacia implexa</i>	Hickory Wattle
<i>Acacia mearnsii</i>	Black Wattle
<i>Alternanthera denticulata</i>	Lesser Joyweed
<i>Anagallis arvensis</i> *	Scarlet/Blue Pimpernel
<i>Angophora floribunda</i>	Rough-barked Apple
<i>Araujia sericifera</i> *	Moth Vine
<i>Aristida ramosa</i>	Purple Wiregrass
<i>Aristida vagans</i>	Threawn Speargrass
<i>Asparagus asparagoides</i> *	Bridal Creeper
<i>Asperula conferta</i>	Common Woodruff
<i>Austrodanthonia racemosa</i>	
<i>Austrodanthonia spp.</i>	
<i>Austrostipa ramosissima</i>	Stout Bamboo Grass
<i>Axonopus fissifolius</i> *	Narrow-leafed Carpet Grass
<i>Bidens pilosa</i> *	Cobbler's Pegs
<i>Bidens subalternans</i> *	Greater Beggar's Ticks
<i>Brachyscome angustifolia</i>	
<i>Brunoniella australis</i>	Blue Trumpet
<i>Bryophyllum delagoense</i> *	Mother of Millions
<i>Bulbine spp.</i>	
<i>Bursaria spinosa</i>	Native Blackthorn

Scientific Name	Common Name
<i>Carex breviculmis</i>	
<i>Carex spp.</i>	
<i>Casuarina glauca</i>	Swamp Oak
<i>Centella asiatica</i>	Indian Pennywort
<i>Centipeda spp.</i>	
<i>Cheilanthes sieberi subsp. sieberi</i>	
<i>Chenopodium pumilio</i>	Small Crumbweed
<i>Chloris gayana*</i>	Rhodes Grass
<i>Chloris truncata</i>	Windmill Grass
<i>Cirsium vulgare*</i>	Spear Thistle
<i>Commelina cyanea</i>	Native Wandering Jew
<i>Commelina spp.</i>	
<i>Convolvulus spp.</i>	
<i>Conyza bonariensis*</i>	Flaxleaf Fleabane
<i>Conyza spp.*</i>	
<i>Cotoneaster glaucophyllus*</i>	
<i>Cyclospermum leptophyllum*</i>	Slender Celery
<i>Cymbopogon refractus</i>	Barbed Wire Grass
<i>Cynodon dactylon</i>	Common Couch
<i>Cyperus eragrostis*</i>	Umbrella Sedge
<i>Cyperus gracilis</i>	Slender Flat-sedge
<i>Damasonium spp.</i>	
<i>Delairea odorata*</i>	Cape Ivy
<i>Desmodium brachypodum</i>	Large Tick-trefoil
<i>Desmodium rhytidophyllum</i>	
<i>Desmodium varians</i>	Slender Tick-trefoil
<i>Dianella caerulea</i>	Blue Flax-lily

Scientific Name	Common Name
<i>Dianella longifolia</i>	
<i>Dichelachne micrantha</i>	Shorthair Plumegrass
<i>Dichelachne spp.</i>	
<i>Dichondra repens</i>	Kidney Weed
<i>Dichondra spp.</i>	
<i>Digitaria parviflora</i>	Small-flowered Finger Grass
<i>Digitaria spp.</i>	
<i>Echinochloa spp.</i>	
<i>Echinopogon caespitosus</i>	Bushy Hedgehog-grass
<i>Echinopogon ovatus</i>	Forest Hedgehog Grass
<i>Echinopogon spp.</i>	
<i>Ehrharta erecta</i> *	Panic Veldtgrass
<i>Einadia hastata</i>	Berry Saltbush
<i>Einadia nutans</i>	Climbing Saltbush
<i>Einadia trigonos</i>	Fishweed
<i>Entolasia marginata</i>	Bordered Panic
<i>Entolasia spp.</i>	
<i>Entolasia stricta</i>	Wiry Panic
<i>Eragrostis curvula</i> *	African Lovegrass
<i>Eragrostis leptostachya</i>	Paddock Lovegrass
<i>Eragrostis spp.</i>	
<i>Eremophila debilis</i>	Amulla
<i>Eucalyptus amplifolia</i>	Cabbage Gum
<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark
<i>Eucalyptus eugenioides</i>	Thin-leaved Stringybark
<i>Eucalyptus fibrosa</i>	Red Ironbark
<i>Eucalyptus moluccana</i>	Grey Box

Scientific Name	Common Name
<i>Eucalyptus tereticornis</i>	Forest Red Gum
<i>Euchiton</i> spp.	
<i>Fimbristylis dichotoma</i>	Common Fringe-sedge
<i>Fimbristylis</i> spp.	
<i>Galium binifolium</i>	
<i>Geranium solanderi</i>	Native Geranium
<i>Geranium</i> spp.	
<i>Glycine clandestina</i>	
<i>Glycine</i> spp.	
<i>Glycine tabacina</i>	Glycine
<i>Gomphrena celosioides</i> *	Gomphrena Weed
<i>Goodenia</i> spp.	
<i>Grevillea robusta</i>	Silky Oak
<i>Hardenbergia violacea</i>	False Sarsaparilla
<i>Hippocratea barbata</i>	Knot Vine
<i>Hydrocotyle peduncularis</i>	
<i>Hypericum gramineum</i>	Small St John's Wort
<i>Hypochaeris radicata</i> *	Catsear
<i>Hypoxis hygrometrica</i>	Golden Weather-grass
<i>Jasminum</i> spp.	
<i>Juncus usitatus</i>	
<i>Lagenophora stipitata</i>	Common Lagenophora
<i>Lepidium</i> spp.	
<i>Leucopogon juniperinus</i>	Prickly Beard-heath
<i>Ligustrum lucidum</i> *	Large-leaved Privet
<i>Ligustrum sinense</i> *	Small-leaved Privet
<i>Lissanthe strigosa</i>	Peach Heath

Scientific Name	Common Name
<i>Lomandra filiformis</i>	Wattle Matt-rush
<i>Lomandra filiformis</i> subsp. <i>filiformis</i>	
<i>Lomandra longifolia</i>	Spiny-headed Mat-rush
<i>Lomandra multiflora</i> subsp. <i>multiflora</i>	Many-flowered Mat-rush
<i>Ludwigia peploides</i> subsp. <i>montevidensis</i>	Water Primrose
<i>Lycium ferocissimum</i> *	African Boxthorn
<i>Melaleuca linariifolia</i>	Flax-leaved Paperbark
<i>Mentha satureioides</i>	Native Pennyroyal U 8
<i>Microlaena stipoides</i>	
<i>Modiola caroliniana</i> *	Red-flowered Mallow
<i>Olea europaea</i> *	Common Olive
<i>Opercularia diphylla</i>	
<i>Oplismenus aemulus</i>	
<i>Oplismenus</i> spp.	
<i>Opuntia</i> spp.*	
<i>Oxalis perennans</i>	
<i>Oxalis</i> spp.	
<i>Ozothamnus diosmifolius</i>	White Dogwood
<i>Pandorea pandorana</i>	Wonga Wonga Vine
<i>Panicum</i> spp.	
<i>Parsonsia purpurascens</i>	Black Silkpod
<i>Paspalidium distans</i>	
<i>Paspalum dilatatum</i> *	Paspalum
<i>Paspalum</i> spp.	
<i>Pennisetum clandestinum</i> *	Kikuyu Grass
<i>Persicaria decipiens</i>	Slender Knotweed
<i>Phoenix canariensis</i> *	Canary Island Date Palm

Scientific Name	Common Name
<i>Phyllanthus spp.</i>	
<i>Phytolacca octandra*</i>	Inkweed
<i>Plantago gaudichaudii</i>	
<i>Plantago lanceolata*</i>	Lamb's Tongues
<i>Portulaca oleracea</i>	Pigweed
<i>Pratia purpurascens</i>	Whiteroot
<i>Pultenaea microphylla</i>	
<i>Ranunculus muricatus*</i>	Sharp Buttercup
<i>Ranunculus spp.</i>	
<i>Richardia humistrata*</i>	
<i>Rubus ulmifolius*</i>	Blackberry
<i>Rumex spp.</i>	
<i>Schoenus spp.</i>	
<i>Senecio madagascariensis*</i>	Fireweed
<i>Senecio spp.</i>	
<i>Setaria gracilis*</i>	Slender Pigeon Grass
<i>Setaria spp.</i>	
<i>Sida rhombifolia*</i>	Paddy's Lucerne
<i>Sigesbeckia orientalis subsp. orientalis</i>	Indian Weed
<i>Solanum linnaeanum*</i>	Apple of Sodom
<i>Solanum mauritianum*</i>	Wild Tobacco Bush
<i>Solanum nigrum*</i>	Black-berry Nightshade
<i>Solanum prinophyllum</i>	Forest Nightshade
<i>Solanum pseudocapsicum*</i>	Madeira Winter Cherry
<i>Solanum spp.</i>	
<i>Sonchus oleraceus*</i>	Common Sowthistle
<i>Sorghum halepense*</i>	Johnson Grass

Scientific Name	Common Name
<i>Sporobolus creber</i>	Slender Rat's Tail Grass
<i>Stackhousia viminea</i>	Slender Stackhousia
<i>Taraxacum officinale</i> *	Dandelion
<i>Themeda australis</i>	Kangaroo Grass
<i>Tradescantia albiflora</i> *	Wandering Jew
<i>Tricoryne elatior</i>	Yellow Autumn-lily
<i>Tricoryne spp.</i>	
<i>Trifolium repens</i> *	White Clover
<i>Typha orientalis</i>	Broad-leaved Cumbungi
<i>Verbena bonariensis</i> *	Purpletop
<i>Verbena officinalis</i> *	Common Verbena
<i>Vernonia cinerea</i>	
<i>Veronica plebeia</i>	Trailing Speedwell
<i>Viola hederacea</i>	Ivy-leaved Violet
<i>Wahlenbergia gracilis</i>	Sprawling Bluebell

* denotes exotic species

FAUNA LIST

	Scientific Name	Common Name
Amphibian	<i>Litoria fallax</i>	Eastern Dwarf Tree Frog
	<i>Crinia signifera</i>	Common Eastern Froglet
	<i>Litoria peronii</i>	Peron's Tree Frog
	<i>Limnodynastes peronii</i>	Brown-striped Frog
Aves	<i>Acridotheres tristis*</i>	Common Myna
	<i>Streptopelia chinensis*</i>	Spotted Turtle-Dove
	<i>Rhipidura leucophrys</i>	Willie Wagtail
	<i>Phalacrocorax varius</i>	Pied Cormorant
	<i>Manorina melanocephala</i>	Noisy Miner
	<i>Ocyphaps lophotes</i>	Crested Pigeon
	<i>Acanthiza pusilla</i>	Brown Thornbill
	<i>Acanthiza nana</i>	Yellow Thornbill
	<i>Acrocephalus australis</i>	Australian Reed-Warbler
	<i>Alcedo azurea</i>	Azure Kingfisher
	<i>Anas superciliosa</i>	Pacific Black Duck
	<i>Aquila audax</i>	Wedge-tailed Eagle
	<i>Cacatua galerita</i>	Sulphur-crested Cockatoo
	<i>Calyptorhynchus funereus</i>	Yellow-tailed Black-Cockatoo
	<i>Chenonetta jubata</i>	Australian Wood Duck
	<i>Corcorax melanorhamphos</i>	White-winged Chough
	<i>Corvus coronoides</i>	Australian Raven
	<i>Cracticus torquatus</i>	Grey Butcherbird
	<i>Dacelo novaeguineae</i>	Laughing Kookaburra
	<i>Eolophus roseicapillus</i>	Galah
<i>Eurystomus orientalis</i>	Dollarbird	
<i>Falco berigora</i>	Brown Falcon	

	Scientific Name	Common Name
	<i>Falco cenchroides</i>	Nankeen Kestrel
	<i>Gallinula tenebrosa</i>	Dusky Moorhen
	<i>Gerygone olivacea</i>	White-throated Gerygone
	<i>Glossopsitta concinna</i>	Musk Lorikeet
	<i>Grallina cyanoleuca</i>	Magpie-lark
	<i>Gymnorhina tibicen</i>	Australian Magpie
	<i>Hirundo neoxena</i>	Welcome Swallow
	<i>Malurus cyaneus</i>	Superb Fairy-wren
	<i>Platycercus adscitus eximius</i>	Eastern Rosella
	<i>Rhipidura albiscapa</i>	Grey Fantail
	<i>Strepera graculina</i>	Pied Currawong
	<i>Sturnus vulgaris</i> *	Common Starling
	<i>Trichoglossus haematodus</i>	Rainbow Lorikeet
	<i>Pachycephala rufiventris</i>	Rufous Whistler
	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike
	<i>Alisterus scapularis</i>	Australian King-Parrot
	<i>Trichoglossus chlorolepidotus</i>	Scaly-breasted Lorikeet
Mammalia	<i>Oryctolagus cuniculus</i> *	Rabbit
	<i>Trichosurus vulpecula</i>	Common Brushtail Possum
	<i>Rattus rattus</i> *	Black Rat
	<i>Pseudocheirus peregrinus</i>	Common Ringtail Possum
	<i>Petaurus breviceps</i>	Sugar Glider
	<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing Bat
	<i>Mormopterus norfolkensis</i>	Eastern Freetail Bat
	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail Bat
Reptilia	<i>Lampropholis delicata</i>	Dark-flecked Garden Sunskink
	<i>Tiliqua scincoides</i>	Eastern Blue-tongue

	Scientific Name	Common Name
	<i>Eulamprus quoyii</i>	Eastern Water-skink
	<i>Physignathus lesueurii</i>	Eastern Water Dragon
	<i>Pseudechis porphyriacus</i>	Red-bellied Black Snake
Gastropod	<i>Meridolum corneovirens</i>	Cumberland Plain Land Snail
	<i>Helix aspersa</i> *	Brown Garden Snail

* denotes exotic species

Appendix D: Likelihood of Occurrence Tables

<i>Scientific Name</i>	<i>Common Name</i>	<i>Habitat</i>	<i>TSC Status</i>	<i>EPBC Status</i>	<i>Likelihood of Occurrence</i>
Flora Species					
<i>Acacia bynoeana</i>	Bynoe's Wattle	Grows in sandy clay soils often containing ironstone gravels in open forest and shrubland, usually on ridgetops.	E1	V	Unlikely
<i>Acacia gordonii</i>		Sydney sandstone ridge top communities, often on rocky outcrops. Restricted to the north-west of Sydney, occurring in the lower Blue Mountains in the west, and in the South Maroota/Glenorie area in the east. Flowers August to September and produces fruit October to February. The fruit is a pod containing hard-coated seed .	V	E	Unlikely
<i>Acacia pubescens</i>	Downy Wattle	Scattered throughout the Cumberland plain where it grows on clay and clay-shale soils.	V	V	Unlikely
<i>Cryptostylis hunyeriana</i>	Leafless Tongue-orchid	It is known from a range of vegetation communities including swamp-heath and woodland. Flowers between November and February, although may not flower regularly.	V	V	Unlikely
<i>Darwinia biflora</i>		Occurs on the edges of weathered shale-capped ridges, where these intergrade with Hawkesbury Sandstone. The vegetation structure is usually woodland, open forest or scrub-heath.	V	V	Unlikely
<i>Dillwynia tenuifolia</i>		Castlereagh Ironbark Forest to Castlereagh Scribbly Gum Woodland.	V	V	Unlikely
<i>Epacris purpurascens</i> var <i>purpurascens</i>		Restricted to coastal zone around Sydney where it is uncommon. The species inhabits damp forest and grows on sands, shales or rocky sites.	V	-	Unlikely

Scientific Name	Common Name	Habitat	TSC Status	EPBC Status	Likelihood of Occurrence
<i>Eucalyptus nicholii</i>	Narrow-leaved Black Peppermint	Grows in dry grassy woodland, on shallow and infertile soils, mainly on granite.	V	V	Unlikely
<i>Eucalyptus sp. Cattai</i>		Occurs in scrub, heath and low woodland on sandy soils, sites being generally flat and on ridge tops. Occurs in the area between Colo Heights and Castle Hill, in North Western Sydney.	E1	-	Unlikely
<i>Grevillea juniperina</i> subsp. <i>juniperina</i>	Juniper-leaved Grevillea	Grows on reddish clay to sandy soils derived from Wianamatta Shale and Tertiary alluvium (often with shale influence), typically containing lateritic gravels.	V	-	Potential
<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	Small-flower Grevillea	Grows in sandy or light clay soils usually over thin shales. Occurs in a range of vegetation types from heath and shrubby woodland to open forest. Found over a range of altitudes from flat, low-lying areas to upper slopes and ridge crests often in open, slightly disturbed sites such as along tracks.	V	V	Unlikely
<i>Hibbertia superans</i>		Flowering time is July to December. The species occurs on sandstone ridgetops often near the shale/sandstone boundary. Occurs in both open woodland and heathland, and appears to prefer open disturbed areas, such as track sides.	E1	-	No
<i>Lasiopetalum joyceae</i>		Grows in heath on sandstone	V	V	Unlikely
<i>Leucopogon fletcheri</i> subsp. <i>fletcheri</i>		Occurs in dry eucalypt woodland or in shrubland on clayey lateritic soils, generally on flat to gently sloping terrain along ridges and spurs.	E1	-	Unlikely
<i>Melaleuca deanei</i>	Deane's Melaleuca	Found in heath on sandstone and also associated with woodland on broad ridge tops and slopes on sandy loam and lateritic soils.	V	V	Unlikely
<i>Micromyrtus minutiflora</i>		Grows in Castlereagh Scribbly Gum Woodland, Ironbark Forest, Shale/Gravel Transition Forest, open forest on tertiary alluvium and consolidated river	E1	V	Potential

Scientific Name	Common Name	Habitat	TSC Status	EPBC Status	Likelihood of Occurrence
		sediments.			
<i>Persoonia hirsuta</i>	Hairy Geebung	Is found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone.	E1	E	Potential
<i>Persoonia hirsuta</i> subsp. <i>hirsute/evoluta</i>		Sporadically distributed in the Putty, Glen Davis and Hill Top districts.	E1	-	No
<i>Persoonia nutans</i>		Is found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone.	E1	E	Unlikely
<i>Pilularia novae-hollandiae</i>	Austral Pillwort	Austral Pillwort grows in shallow swamps and waterways, often among grasses and sedges. It is most often recorded in drying mud as this is when it is most conspicuous.	E1	-	Unlikely
<i>Pimelea curviflora</i> var. <i>curviflora</i>		Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands.	V	V	Likely
<i>Pimelea spicata</i>		Occurs on undulating topography on substrates derived from Wianamatta Shale in areas of Cumberland Plain Woodland Vegetation Community.	E1	E	Potential
<i>Pultenaea parviflora</i>		May be locally abundant, particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays.	E1	V	Yes
Populations					
<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i>	Marsdenia viridiflora R. Br. subsp. viridiflora population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool	Grows in vine thickets and open shale woodland.	E2	-	No

<i>Scientific Name</i>	<i>Common Name</i>	<i>Habitat</i>	<i>TSC Status</i>	<i>EPBC Status</i>	<i>Likelihood of Occurrence</i>
	and Penrith local government areas				
<i>Dillwynia tenuifolia</i>	Dillwynia tenuifolia Sieber ex D.C. in the Baulkham Hills local government area	Occurs in vegetation similar to Cumberland Plain Woodland, on Wianamatta Shale soils.	E2	-	No
Ecological Communities					
Cumberland Plain Woodland		Woodland community occurring on shale derived soils throughout low rainfall areas of western Sydney.	E4	CE	Yes
Shale/Sandstone Transition Forest		Occurs at the edges of the Cumberland Plain, where clay soils from the shale rock intergrade with soils from sandstone, or where shale caps overlay sandstone (DECC 2009).	E4	E	No
Turpentine-Ironbark Forest in the Sydney Basin Bioregion		The Turpentine-Ironbark Forest typically occurs in moderately wet sites, with an annual rainfall of 800-1100 mm per year, and on clay soils derived from Wianamatta shale. Occurs mainly on the Cumberland Plain of the Sydney region, with patches extending onto the adjoining plateaux (DEWHA 2009).	E4	CE	No
River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions		Occurs exclusively along or close to minor watercourses draining soils derived from Wianamatta Shale. Common on soils of recent alluvial deposits and is found on the floodplains of the Hawkesbury-Nepean River.	E4	-	Yes

Scientific Name	Common Name	Habitat	TSC Status	EPBC Status	Likelihood of Occurrence
Fauna Species					
<i>Litoria aurea</i>	Green and Golden Bell Frog	Large permanent freshwater wetlands, with dense stands of reeds.	E1	V	Unlikely
<i>Heleioporus australiacus</i>	Giant Burrowing Frog	Found in heath, woodland and open forest with sandy soils and will travel several hundred metres to creeks to breed.	V	V	Unlikely
<i>Mixophyes iteratus</i>	Giant Barred Frog	Forage and live amongst deep, damp leaf litter in rainforests, moist eucalypt forest and nearby dry eucalypt forest, at elevations below 1000 m.	E1	E	Unlikely
<i>Litoria littlejohni</i>	Littlejohn's Tree Frog	Has a distribution that includes the plateaus and eastern slopes of the Great Dividing Range from Watagan State Forest (90 km north of Sydney) south to Buchan in Victoria. It occurs along permanent rocky streams with thick fringing vegetation associated with eucalypt woodlands and heaths among sandstone outcrops.	V	V	Unlikely
<i>Mixophyes balbus</i>	Stuttering Frog	A variety of forest habitats from rainforest through wet and moist sclerophyll forest to riparian habitat in dry sclerophyll forest that are generally characterised by deep leaf litter or thick cover from understorey vegetation. Breeding habitats are streams and occasionally springs.	E1	V	Unlikely
<i>Pseudophryne australis</i>	Red-crowned Toadlet	Found in steep escarpment areas and plateaus, as well as low undulating ranges with benched outcroppings on Triassic sandstones of the Sydney Basin. Within these geological formations, this species mainly occupies the upper parts of ridges, usually being restricted to within about 100 metres of the ridgetop. However they may also occur on plateaus or more level rock platforms along the ridgetop (DECC 2009).	V	-	Unlikely

Scientific Name	Common Name	Habitat	TSC Status	EPBC Status	Likelihood of Occurrence
<i>Pyrrholaemus sagittatus</i>	Speckled Warbler	Lives in a wide range of eucalypt dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy.	V	-	Potential
<i>Lophoictinia isura</i>	Square-tailed Kite	Diverse habitats from woodlands to timbered watercourses.	V	M	Potential
<i>Oxyura australis</i>	Blue-billed Duck	Well vegetated freshwater swamps, large dams, lakes. In winter more open waters.	V	M	Unlikely
<i>Botaurus poiciloptilus</i>	Australasian Bittern	Boggy marsh, wetland margins.	V	-	Unlikely
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	Occurs within a variety of forest and woodland types.	V	-	Unlikely
<i>Calyptorhynchus lathamii</i>	Glossy Black-Cockatoo	She-oaks in forests, woodlands, timbered watercourses.	V	-	Unlikely
<i>Climacteris picumnus</i>	Brown Treecreeper	Drier forests, woodlands, scrubs with fallen branches.	V	-	Unlikely
<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (eastern subspecies)	Drier eucalypt forests, woodlands, timber on water courses, often no understorey, scrubs. Favours ironbark woodlands on w. slopes.	V	-	Unlikely
<i>Xanthomyza phrygia</i>	Regent Honeyeater	Densely timbered woodlands and forests, particularly ironbark, yellow box, yellow gum.	E1	E, M	Potential
<i>Melanodryas cucullata</i>	Hooded Robin	Drier eucalypt forests, woodlands and scrubs with fallen logs and debris.	V	-	Potential
<i>Lathamus discolor</i>	Swift Parrot	Breeds in Tasmania, but winters on mainland in diverse timbered habitats, including forests, woodlands, plantations, banksias, street trees and gardens.	E1	E	Potential

Scientific Name	Common Name	Habitat	TSC Status	EPBC Status	Likelihood of Occurrence
<i>Neophema pulchella</i>	Turquoise Parrot	Open grassy woodland, with dead trees, near permanent water and forested hills.	V	-	Unlikely
<i>Rostratula benghalensis australis</i>	Australian Painted Snipe	Well-vegetated shallows and margins of wetlands, dams, sewerage ponds, wet pastures, marshy areas, open timber.	E1	V	Unlikely
<i>Tyto novaehollandiae</i>	Masked Owl	Associated with forest with sparse, open, understorey, typically dry sclerophyll forest and woodland and especially the ecotone between wet and dry forest, and non forest habitat. Known to utilise forest margins and isolated stands of trees within agricultural land and heavily disturbed forest where its prey of small and medium sized mammals can be readily obtained.	V	-	Unlikely
<i>Ninox strenua</i>	Powerful Owl	Pairs occupy large, probably permanent home ranges in forests to woodlands. Nest in large hollow.	V	-	Unlikely
<i>Meridolum comeovirens</i>	Cumberland Plain Land Snail	Primarily inhabits Cumberland Plain Woodland (an endangered ecological community). This community is a grassy, open woodland with occasional dense patches of shrubs.	E1	-	Potential
<i>Dasyurus maculatus maculatus</i> (SE mainland population)	Spotted-tailed Quoll	Occurs in wide variety of habitats in large remnants. Dens in tree hollows, hollow log or rock crevice.	V	E	Unlikely
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail-bat	In almost all habitats from wet and dry sclerophyll forests, open woodland, Acacia shrubland, mallee, grasslands and desert.	V	-	Known
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	Evidence suggests that the species depends on hollows and tree fissures for roosting sites.	V	-	Known
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	Roosts in large camps in Botanic Gardens.	V	V	Potential

Scientific Name	Common Name	Habitat	TSC Status	EPBC Status	Likelihood of Occurrence
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	Usually roosts in tree hollows in the higher rainfall forests within its range.	V	-	Potential
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	Forages above the canopy and eats mostly moths. Roosts in caves, old mines, road culverts.	V	-	Known
<i>Myotis adversus</i>	Large-footed Myotis	A range of habitats close to water from lakes, small creeks to large lakes and mangrove lined estuaries.	V	-	Potential
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	Uncommon but observed in wet and dry eucalypt forests.	V	V	Potential
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	Moist gullies in mature coastal forests or rainforests. Roosts in hollow tree trunks and branches.	V	-	Potential
<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	Rocky areas of sclerophyll forest of inland and subcoastal southeastern Australia.	E1	V	Unlikely
<i>Potorous tridactylus tridactylus</i>	Long-nosed Potoroo (SE mainland)	Known from coastal heathy woodland but also occurs in rainforest, wet sclerophyll and coastal wallum. Dense cover for shelter adjacent to open areas for foraging.	V	V	Unlikely
<i>Hoplocephalus bungaroides</i>	Broad-headed Snake	Occur under large exfoliating slabs of sandstone and rock crevices in areas of undisturbed bushland, usually on tops of cliffs.	E1	V	Unlikely
<i>Macquaria australasica</i>	Macquarie Perch	The natural geographical range of the Macquarie Perch is thought to have been confined to the Murray Darling R. system, north of the Great Divide, including Vic., NSW and the ACT (there are no confirmed records from Qld or SA). They also occur in some coastal rivers of NSW, including the Shoalhaven and Hawkesbury Rivers and also in some of Sydney's water supply dams.		E	Unlikely

Scientific Name	Common Name	Habitat	TSC Status	EPBC Status	Likelihood of Occurrence
<i>Prototroctes maraena</i>	Australian Grayling	On mainland Australia, this species has been recorded from rivers flowing E and S of the main dividing ranges, It is absent from the inland Murray-Darling system. It occurs widely in Tas. and is known from the northern, eastern and southern coastal river drainages with occasional reports from the W coast.		V	Unlikely
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	Established pairs usually maintain a territory in coastal areas or flooded inland swamps, lagoons and floodplains. Also often occur far inland along major rivers.	-	M	Unlikely
<i>Hirundapus caudacutus</i>	White-throated Needletail	Occupy high open spaces of sky above a variety of habitats including oceans. Often fly ahead of unsettled weather preceding thunderstorms.		M	Unlikely
<i>Merops ornatus</i>	Rainbow Bee-eater	Occurs in open country in a variety of habitat including open woodland, open forest, semi-arid scrub, grasslands, clearings in more wooded areas and farmland. Nests within tunnels dug into loamy soil in clearings, paddocks or road cuttings.		M	Unlikely
<i>Monarcha melanopsis</i>	Black-faced Monarch	Occurs in a range of habitats including rainforests, mangroves, forests and woodlands. A summer migrant to the south.		M	Unlikely
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	Favours dense wet sclerophyll forest during the breeding season and mangrove, coastal heath, woodland and forests outside of the breeding season. A summer breeding migrant to south eastern Australia.		M	Unlikely
<i>Rhipidura rufifrons</i>	Rufous Fantail	A summer breeding migrant in the south east of Australia. Occurs in rainforest as well as dense wet eucalypt forest, paperbark forests, mangrove swamps and riverside vegetation. Occupies open		M	Unlikely

Scientific Name	Common Name	Habitat	TSC Status	EPBC Status	Likelihood of Occurrence
		country during summer migration.			
<i>Ardea alba</i>	Great Egret	A common and widespread species that utilises any suitable permanent or temporary habitat. Inhabits wetlands and flooded pastures, dams, estuarine mudflats, mangroves and reefs.		M	Likely
<i>Ardea ibis</i>	Cattle Egret	Forages in moist pasture with tall grass as well as shallow open wetlands and margins. Also utilises mudflats.		M	Likely
<i>Gallinago hardwickii</i>	Latham's Snipe	Occupies low vegetation around wetlands in shallows, sedges, reeds, heaths salt marsh and irrigated crops.		M	Potential
<i>Rostratula benghalensis s. lat.</i>	Painted Snipe	Well-vegetated shallows and margins of wetlands, dams, sewerage ponds, wet pastures, marshy areas, open timber.		M	Potential
<i>Apus pacificus</i>	Fork-tailed Swift	Utilises low to very high airspace over varied habitat from rainforest to semi-desert. Foragers ahead of summer storms.		M	Potential



HEAD OFFICE

Suite 4, Level 1
2-4 Merton Street
Sutherland NSW 2232
T 02 8536 8600
F 02 9542 5622

SYDNEY

Suite 604, Level 6
267 Castlereagh Street
Sydney NSW 2000
T 02 9993 0566
F 02 9993 0573

ST GEORGES BASIN

8/128 Island Point Road
St Georges Basin NSW 2540
T 02 4443 5555
F 02 4443 6655

CANBERRA

Level 2
11 London Circuit
Canberra ACT 2601
T 02 6103 0145
F 02 6103 0148

HUNTER

Suite 17, Level 4
19 Bolton Street
Newcastle NSW 2300
T 02 4910 0125
F 02 4910 0126

NAROOMA

5/20 Canty Street
Narooma NSW 2546
T 02 4476 1151
F 02 4476 1161

COFFS HARBOUR

35 Orlando Street
Coffs Harbour Jetty NSW 2450
T 02 6651 5484
F 02 6651 6890

ARMIDALE

92 Taylor Street
Armidale NSW 2350
T 02 8081 2681
F 02 6772 1279

BRISBANE

93 Boundary St
West End QLD 4101
T 1300 646 131

WESTERN AUSTRALIA

108 Stirling Street
Perth WA 6000
T 08 9227 1070
F 08 9227 1078

WOLLONGONG

Level 2
25 Atchison Street
Wollongong NSW 2500
T 02 8536 8615
F 02 4254 6699