



Abel Ecology

Flora and fauna assessment report

for

**Honeycomb Drive, Eastern Creek
Lots 2 and 3, DP 1145808**

**Proposed Energy from Waste Facility,
Eastern Creek (SSD 6236).**

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Prepared for: The Next Generation NSW Pty Ltd (TNG NSW)

Prepared by: Abel Ecology



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List of Abbreviations

CPW	Cumberland Plain Woodland
d.b.h.	Diameter at breast height (~1.4 metres)
EEC	Endangered Ecological Community
EPZ	Environmental Protection Zone
ESD	Ecologically Sustainable Development
LEP	Local Environmental Plan
LGA	Local Government Area
NP	National Park
NR	Nature Reserve
PDA	Principal Development Area

Note regarding maps in this report

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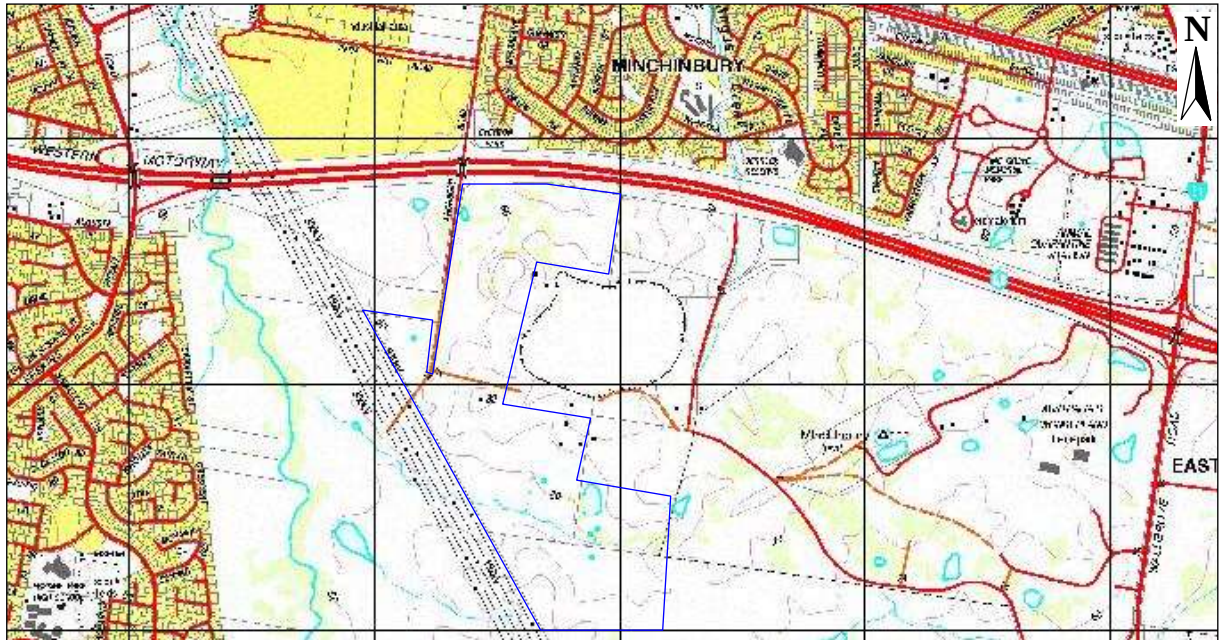


Figure 1. Locality map for Honeycomb Drive, Eastern Creek Lots 2 and 3, DP 1145808.

 Approx Site Locality

Scale: grid spacing = 1 km

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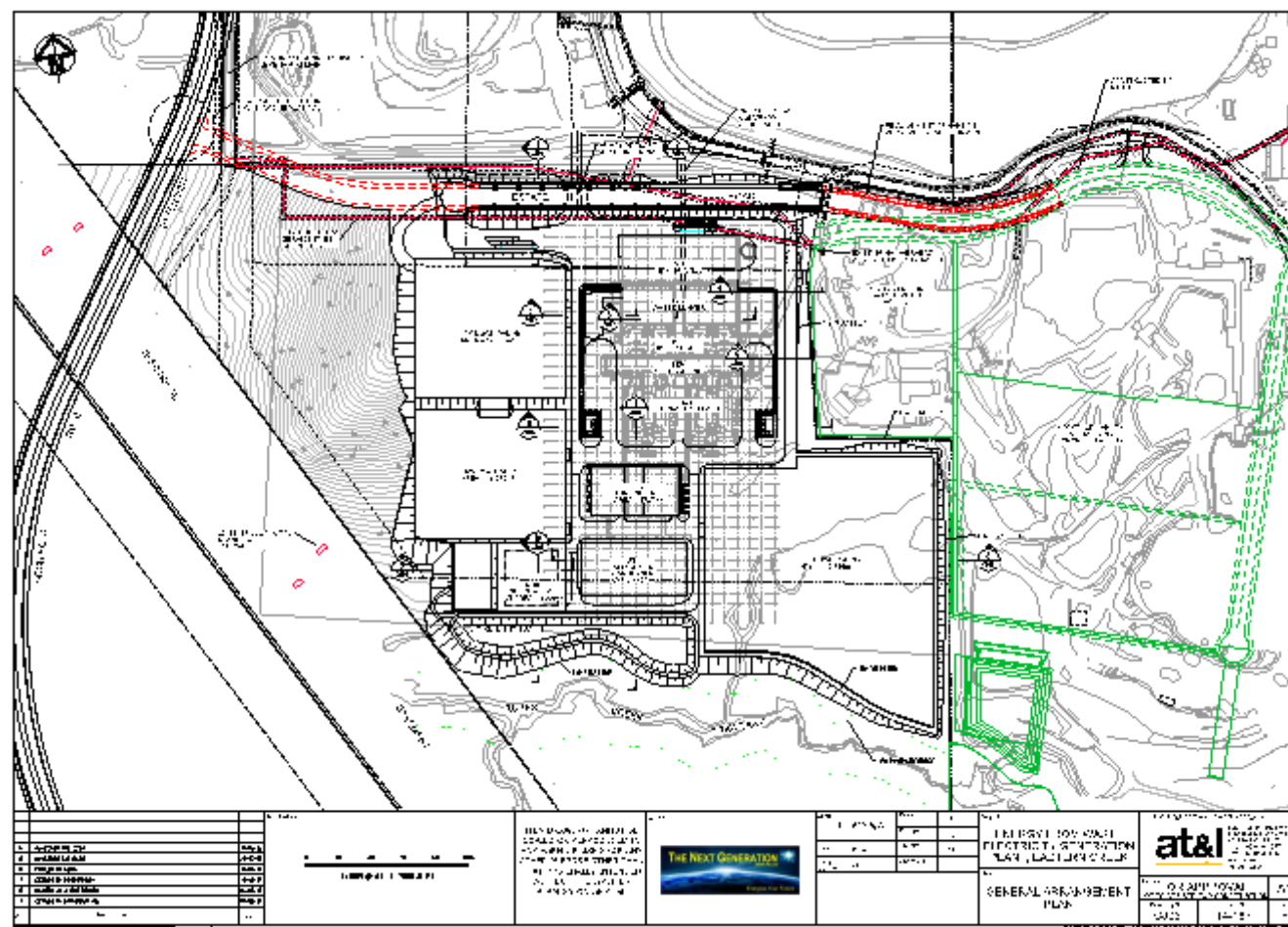


Figure 2. Proposal Diagram.



Figure 3. Soil map for site and surrounding area.

 Approx Site locality

Scale: grid square = 1 km

KEY

RESIDUAL

bt (Blacktown) - Gently undulating rises on Wianamatta Group shales.

FLUVIAL

sc (South Creek) - Floodplains, valley flats and drainage depressions of the channels on the Cumberland Plain.

DISTURBED

xx Cleared

Source: Soil Conservation Service of NSW Soil landscape series sheet 9030, Penrith, 1989.



Figure 4. Air photo of the site and local area.



Approx Site locality

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Figure 5. Vegetation map for the site and surrounding area.



Approx Site locality

Scale: grid square = 1 km

Key

	Modified or disturbed
	Cumberland Shale Plains Woodland
	Cumberland Shale Hills Woodland
	Cumberland River Flat Forest

Source Map: M.G. Tozer *et. al* (2010) Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands, Penrith vegetation map.

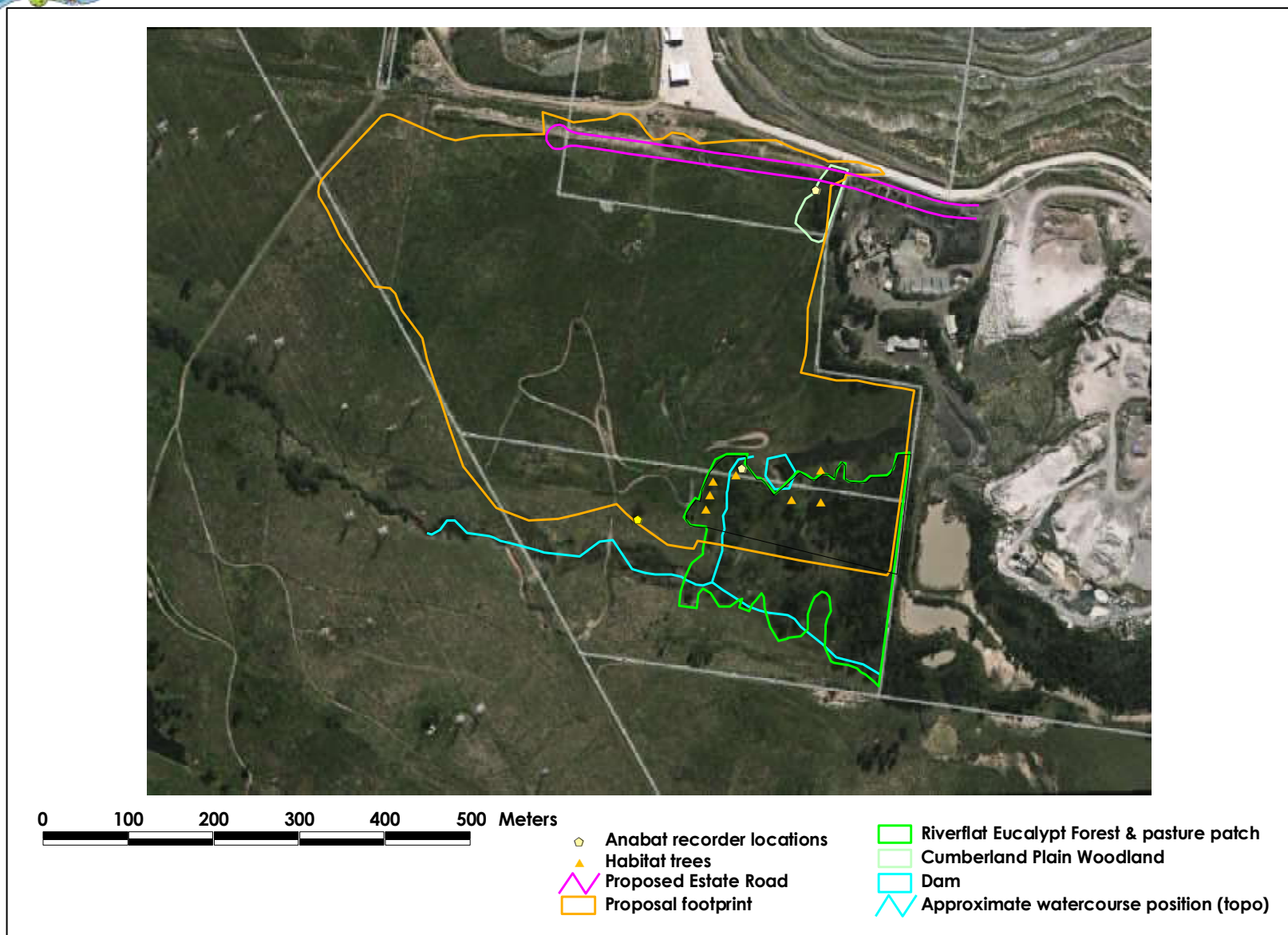


Figure 6. Survey area vegetation, habitat and fauna survey methodology map.

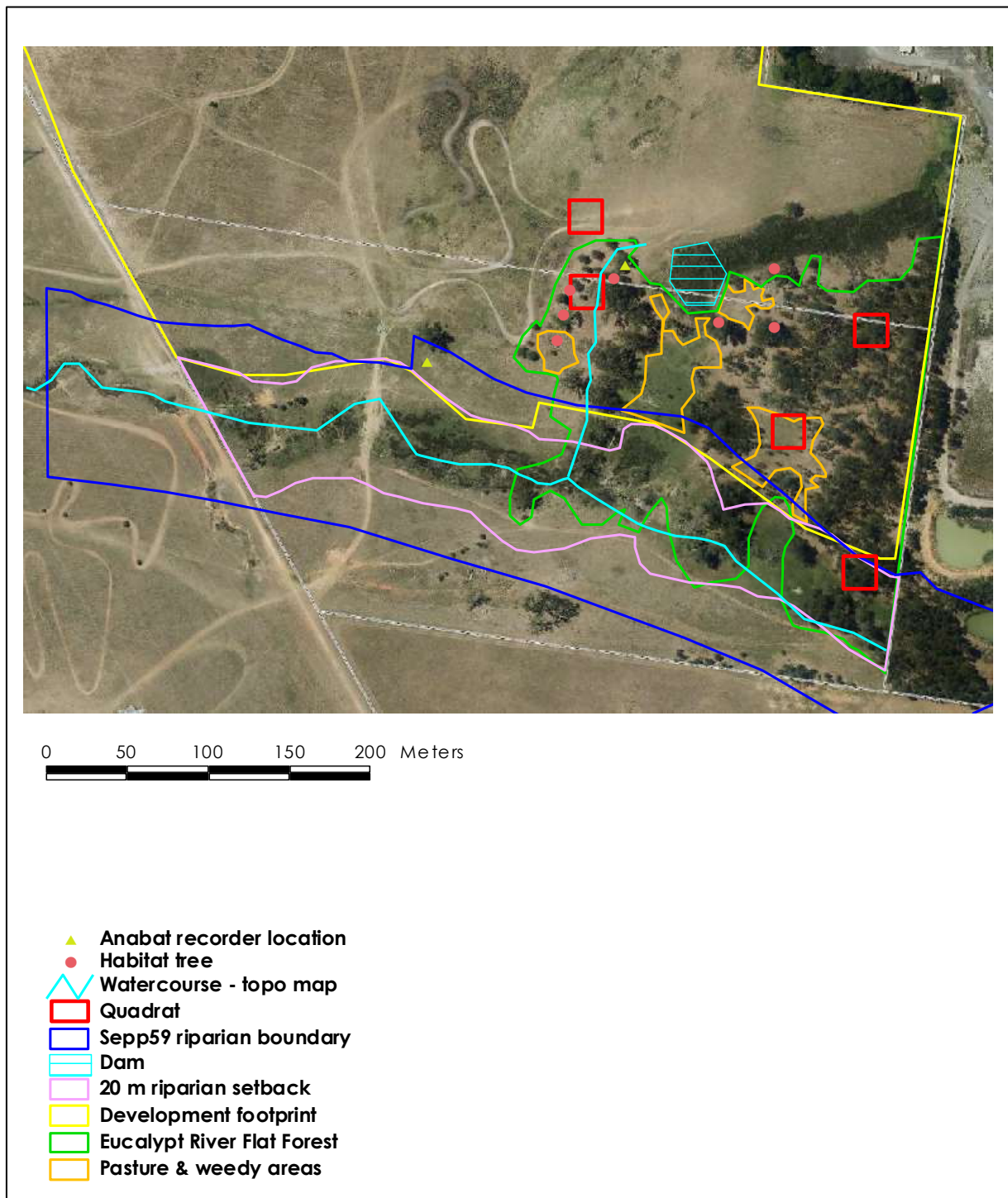


Figure 7. Close up of vegetation adjacent to Ropes Creek Tributary and adjoining areas.

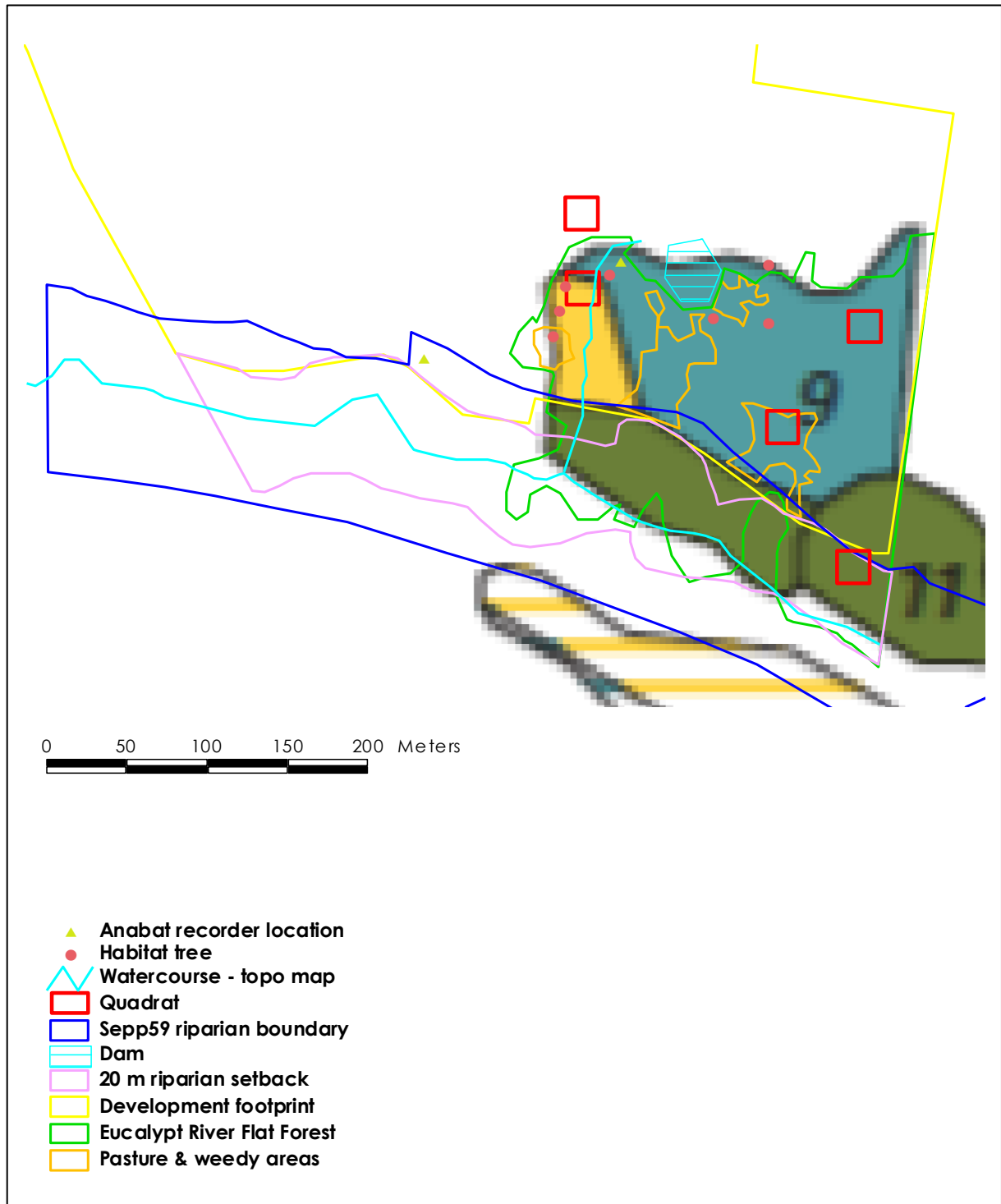
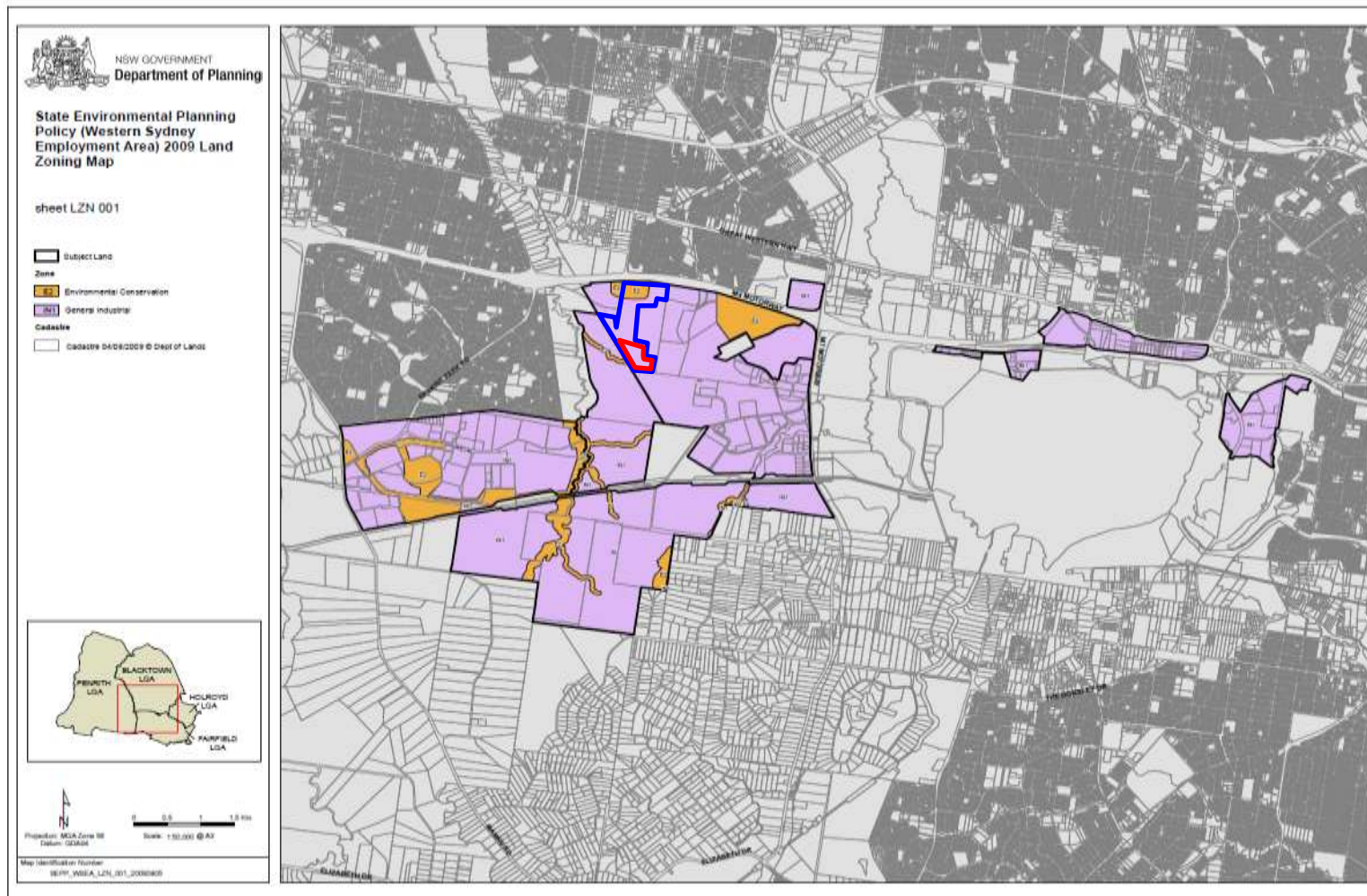


Figure 8. This figure displays the same features from Figure 7 overlaying the OEHL 2002 Native Vegetation of the Cumberland Plain vegetation map.



- Approximate site location
- Approximate survey location

Figure 9. Land zoning Map 2009.

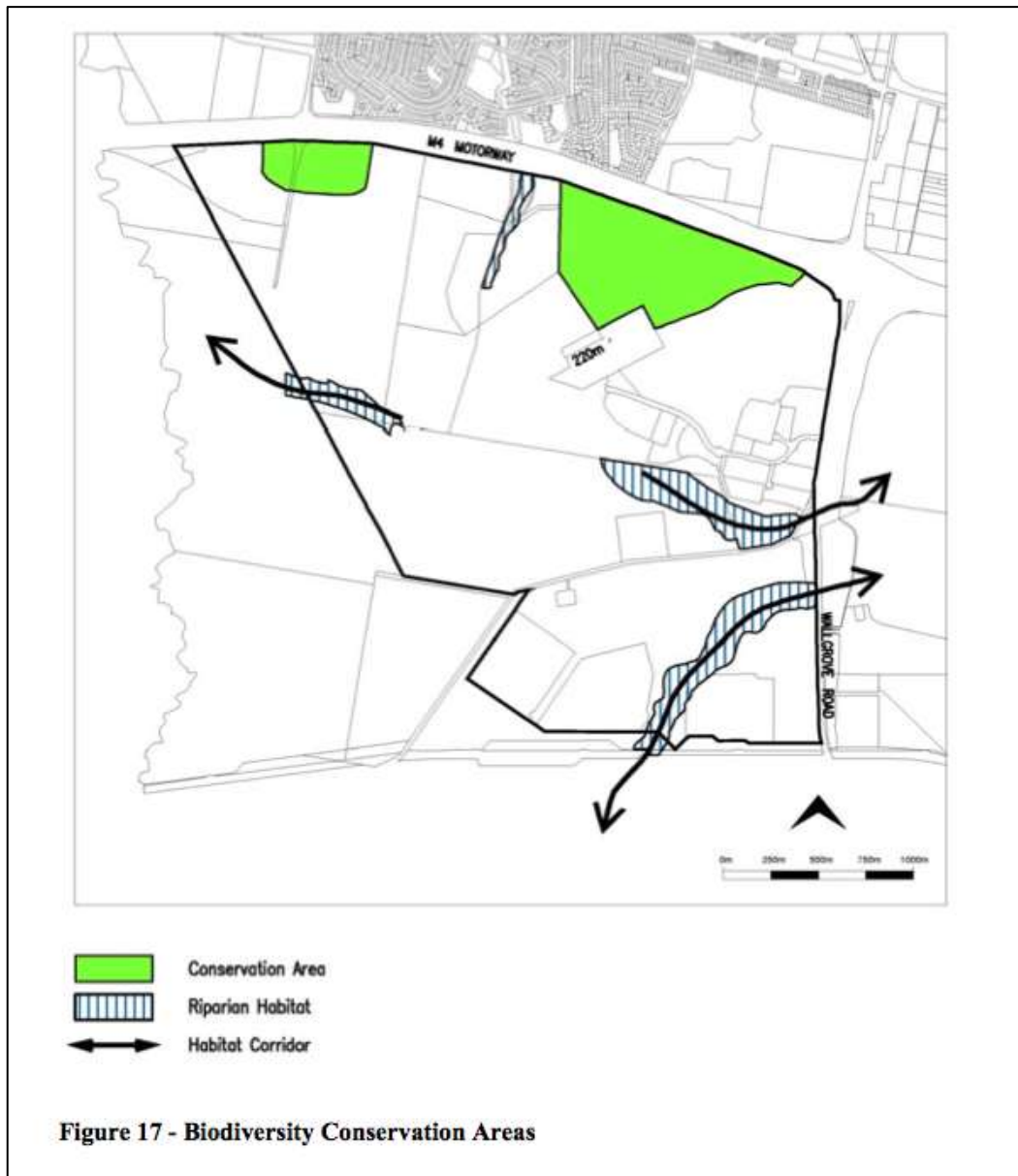


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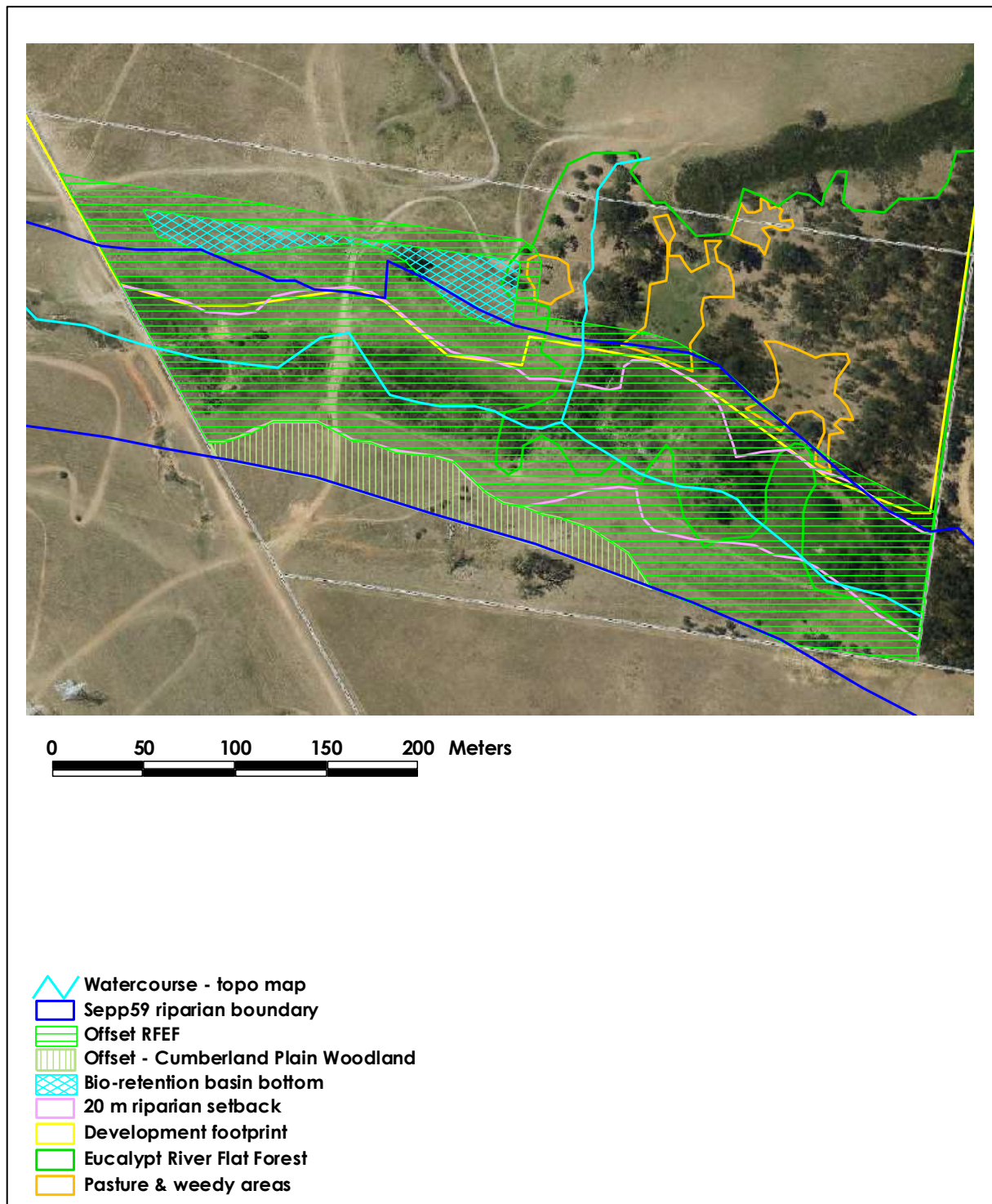


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Figure 18. This photo illustrates the location of quadrat 6. The vegetation in this area is similar to the location of quadrat 2 as both areas are dominated by Swamp She-oak *Casuarina glauca*.



Executive Summary

The proposal is to construct an Energy from Waste (EFW) Electricity Generation Plant.

A flora and fauna survey was carried out within the proposal footprint and adjoining areas to assess the likely impacts of the proposal on species present on the site, and whether there is likely to be any significant effect on any endangered ecological community, endangered population, threatened species or their habitats, as per the listings in the Threatened Species Conservation Act 1995 (TSC Act 1995) (state legislation), the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act 1999) (Commonwealth legislation) and other applicable local or regional policies.

The survey area has had a long history of disturbance and is currently primarily used for grazing cattle. The proposal footprint is approximately 24.4 hectares in size. Approximately 22.5 ha of this area is grazing pasture which will be removed. Other areas of indigenous vegetation proposed for removal are: approximately 2700 m² of the critically endangered ecological community Cumberland Plain Woodland, approximately 2.89 ha hectares of River-flat Eucalypt Forest, and approximately 970 m² of Cumbungi within a farm dam. The proposal will also require the removal of eight potential habitat trees. The survey contains suitable habitat for a range of common indigenous species, feral species and some threatened indigenous species.

Table 1. Endangered ecological communities and threatened fauna species recorded within the survey area.

Species/ Communities	C'wealth listing EPBC Act '99	State listing TSC Act '95	Result
Yellow-bellied Sheath-tail-bat <i>Saccolaimus flaviventris</i>		Schedule 2, Vulnerable	No significant effect
Eastern Freetail-bat <i>Mormopterus norfolkensis</i>		Schedule 2, Vulnerable	No significant effect
Cumberland Plain Woodland	Crit End	Crit End	No significant effect
River-flat Eucalypt Forest		End.	No significant effect



Both of the threatened ecological communities were present as degraded remnants in Class 2/3 condition, with an understorey dominated by weeds.

The provisions of the EPBC Act 1999 apply to this proposal. The outcome is not significant, however, and does not require referral to the Commonwealth.

There is not likely to be a significant effect on the Yellow-bellied Sheath-tail-bat, Eastern Freetail-bat, Cumberland Plain Woodland or River-flat Eucalypt Forest.

Recommendations for this proposal include:

a. Fencing and signs

- i. A fence consisting of at least star pickets and a single strand of wire must be installed adjacent to the southern boundary of the development footprint. Signs must be placed at 100 m intervals along the fence stating "No entry protected vegetation" or similar. The fence and the signs must be installed prior to the commencement of any on-ground works. The fence and signs will reduce the likelihood of any accidental entry by earthmoving machinery or machinery involved in vegetation clearing entering the vegetation to be retained along the Ropes Creek tributary. The fence and signs must remain in place until the completion of all building works on any part of the development footprint.

b. Vegetation Clearing

- i. No vegetation clearing work is to commence on site until supervised by the project ecologist.
- ii. A pre-clearance fauna survey must be conducted prior to the removal of vegetation on the site. Fauna will be moved to the area of retained and regenerated or revegetated River Flat Eucalypt Forest and Cumberland Plain Woodland south along the Rope's Creek Tributary.

c. Removal of habitat trees

The proposed removal of hollow-bearing trees must take place prior to the commencement of any earthworks. At least 100m of logs including the hollows must be relocated to the area of Cumberland Plain



Woodland adjacent to the M4. The logs can be cut into manageable pieces. This will provide additional habitat for ground dwelling fauna.

For each of the hollow-bearing trees removed two nesting or roosting boxes must be installed within the Ropes Creek Tributary. Thus twenty (20) fauna roosting boxes or nesting boxes must be installed in retained trees within the Ropes Creek Tributary, this includes an additional 20% as discussed in this report. The next/roosting boxes must be installed at least two weeks prior to the vegetation clearing works. Each box must be inspected annually to ensure that it is still functioning adequately, and if required it must be replaced. Any nesting or roosting boxes that are damaged or have fallen out of the tree must be replaced or re-installed as required.

d. Removal of dam

The existing dam will be filled and the earth reshaped to provide a building platform. Prior to filling of the dam, the dam must be drained and any native fauna are to be moved to wet areas within the retained Ropes Creek Tributary. This activity must be supervised by an experienced and qualified ecologist.

e. Offsets for removal of indigenous vegetation

Approximately 0.54 ha of Cumberland Plain Woodland will be regenerated through weed control and replanting in the south-western portion of the SEPP59 riparian corridor.

Approximately 4.98 ha of River-Flat Eucalypt Forest will be regenerated through weed control and planting along the SEPP59 riparian corridor on the Ropes Creek Tributary. Part of the planting of River Flat Eucalypt Forest will also occur on the batters of the building platform and the batters around the bio-retention basin.

Details of the regeneration and weed control works can be specified in a Vegetation Management Plan for the Ropes Creek Tributary as required.



f. Stormwater management

Stormwater quality discharged from the site must meet or exceed the requirements of SEPP59. A gross pollutant trap can be included in the stormwater management system as required.

Outlet structures must be designed and installed so that they are consistent with the requirements of the NSW Office of Water.

g. Landscaping

- i. **Landscape Plantings.** Appropriate indigenous species must be included in any landscape plantings. These have been derived from the indigenous vegetation community Cumberland Plain Woodland. Appropriate species include

Trees – Eucalyptus tereticornis, Eucalyptus crebra, Eucalyptus longifolia, Eucalyptus eugenioides, Corymbia maculata, Eucalyptus sideroxylon.

Shrubs – Acacia decurrens, Acacia parramattensis, Indigophora australis, Melaleuca decora.

Groundcovers – Themeda australis/triandra, Microlaena stipoides, Dichondra repens, Imperata cylindrica, Dianella longifolia.

Note: the above list is for plantings within the development footprint. It is not a list of species for use for regeneration or replanting within the SEPP59 area.

The landscape plan is to list all proposed plant species and describe the estimated height of each species.

- ii. **Planting near and around basins.** These species have been derived from Riverflat Eucalypt Forest:

Trees – Angophora floribunda, Eucalyptus amplifolia, Casuarina glauca.

Shrubs – Acacia decurrens, Acacia floribunda, Acacia parramattensis, Melaleuca linearifolia, Melaleuca styphelioides, Melaleuca erubescens



Groundcovers – *Dianella longifolia*, *Lomandra longifolia*, *Commelina cyanea*, *Dichondra repens*, *Pratia purpurascens*, *Oplismenus aemulus*, *Goodenia ovata*, *Scaevola albida*.

Groundcover on edge of basin – *Juncus usitatus*, *Carex appressa*, *Paspalum distichum*.

- iii. Planting of indigenous vegetation around the two water storage dams along the southern boundary of the development footprint will provide habitat for indigenous flora and fauna.
- h. Provision of fauna nesting or roosting boxes
 - i. Prior to the removal of the eight habitat trees, Prior to the removal of the eight habitat trees, for each of the hollow-bearing trees removed two nesting or roosting boxes must be installed within the Ropes Creek Tributary. The total number of fauna boxes recommended to be installed is twenty, an additional 20% has been included.
 - i. Habitat boxes are to be installed by a qualified and experienced ecologist to ensure correct placement and suitable sizes are installed relevant to the species within the region.
 - ii. Some boxes must be suitable for microbats, while others must be suitable for birds or arboreal mammals.
- i. Soil management
 - i. Erosion and sediment control structures are to be installed prior to any earthworks commencing. Erosion and sediment fences must be installed down-slope of the development footprint.
 - ii. Erosion and sediment control fencing or a similar structure must be erected along all downslope edges of the proposal footprint, particularly along the entire length of the southern and western boundaries of the proposal footprint.
 - iii. Erosion and sediment control structures are to be inspected and maintained if required after each rainfall event.



j. Soil and potential weed management

If after earthworks large areas of soil are left exposed, it is recommended that a cover grass such as a cereal wheat *Triticum aestivum*, Triticale x *Triticosecale* or another suitable annual species is sown, if sowing is undertaken in the cooler months or billion-dollar grass *Echinochloa frumentacea* if the sowing is undertaken in summer. Note: these grasses are not known to naturalise and thus will not create an ongoing weed problem. Sowing with annual grasses will both reduce the open areas of soil available to weeds and assist in stopping erosion.

k. Stormwater management

- i. Any stormwater generated within the development footprint must pass through a gross pollutant trap prior to the entry into the proposed water storage dams along the southern boundary of the development footprint.

Special considerations

- a) Site vegetation conditions detailed in this report are subject to change over time due to various factors, e.g. germination from seed bank, bushfire, etc. It is recommended that this report be submitted within 6 months, after which further fieldwork may be required.
- b) With regard to any clearing of native vegetation on the property, it is the responsibility of the landowner to check whether all required permissions from local and statutory authorities are in place. This may include Parts 3A, 4 and 5 of the EP&A Act; s.91 and s.95 licences or joint management agreements under the TSC Act; licence or conservation agreement under the NP&W Act; and approved Property Vegetation Plan under the Native Vegetation Act.



1. Introduction

A fauna and flora survey of the proposed development footprint and adjoining areas at Honeycomb Drive, Eastern Creek (parts of Lots 2 and 3 DP 1145808) ('the survey area' –Figure 6) was undertaken on 23-24 April and 6 May 2014.

The main aim of this survey was to determine whether the present proposal is likely to cause a significant effect on any endangered ecological community, endangered population, threatened species or their habitats. This assessment is based on the seven factors listed in Section 5A of the Environmental Planning and Assessment Act 1979, no. 203, (as amended), which are specifically addressed in Sections 9.4.1, 10.2 and Appendix 1 of this report.

This assessment addresses both 'endangered' and 'vulnerable', as required by the Threatened Species Conservation Act, 1995 (TSC Act 1995). Throughout this report 'threatened' refers to those species and communities listed as 'endangered' or 'vulnerable' in Schedules 1 & 2 of the TSC Act 1995. 'Protected fauna' refers to any native bird, mammal (except the dingo), reptile or amphibian in NSW.

Other planning instruments considered include the State Environmental Planning Policy (Western Sydney Employment Area) 2009 and SEPP59.

1.1 Review of the proposal

This Flora and Fauna Report has been amended to address the comments in the letters from Susan Harrison (Senior Team Leader, Planning, Greater Sydney Regional Operations - NSW Office of Environment and Heritage) (Reference: SSD 6236 / DOC14/247891); Glennys James (Director City Strategy and Development - Blacktown City Council (File no: MC-13-2284) and an Adequacy Assessment undertaken by ARUP on behalf of the NSW Department of Planning and Environment. These comments from the various government authorities have been addressed primarily in Section 8, however new information is also provided in many other locations within the report.



2. Description of the proposal and the site

2.1 The proposal

The proposal is to clear all vegetation within the site for industrial development, leaving grasslands to the west and south and riparian forest to the south east (Figure 4).

The proposed development involves the construction of an Energy from Waste (EFW) Electricity Generation Plant for The Next Generation NSW Pty Ltd (TNG) in Eastern Creek, approximately 36km west of the Sydney CBD.

The development involves the construction and operation of an Electricity Generation Plant, which will allow for unsalvageable and uneconomic residue waste from the Genesis Xero Material Processing Centre (MPC) and Waste Transfer Station (WTS) to be used for generation of electrical power. The EFW Plant is proposed to be located on Lots 2 and 3, DP 1145808.

This development site is part of a proposal to construct and operate NSW's largest Energy from Waste Plant using as fuel, residual waste which would otherwise be land filled, to allow for a "green" electricity generation facility. The plant, powered by burning non-recyclable combustible waste material, will have a capacity for up to 1.35 million tonnes of waste material per annum, as follows:

- 850,000 tonnes per annum from waste already being received at the neighbouring Genesis Xero Waste Facility; and
- Up to 500,000 tonnes per annum from external (new) sources.

The proposed EFW Facility will employment of a total of up to 55 staff upon operation, working over 3 shifts (i.e. not on site at any one time).

The project is identified as State Significant Development (SSD) under Schedule 1 of the State Environmental Planning Policy (State and Regional Development) 2011 being:



Cl. 20 Electricity generating works and heat or co-generation:

Development for the purpose of electricity generating works or heat or their co-generation (using any energy source, including gas, coal, biofuel, distillate, waste, hydro, wave, solar or wind power) that:

- (a) has a capital investment value of more than \$30 million, or*
- (b) has a capital investment value of more than \$10 million and is located in an environmentally sensitive area of State significance*

The proposal has a capital investment value of greater than \$30 million and therefore is classified as a State Significant Development.

The site which is accessed off Honeycomb Drive at Eastern Creek is surrounded by land owned by the Corporate Group Alexandria Landfill Pty Ltd, ThaQuarry Pty Ltd, Australand, Hanson, Jacfin, the Department of Planning and Infrastructure and Sargents. The site and surrounding land is identified as part of the 'State Environmental Planning Policy (Western Sydney Employment Area) 2009 (WSEA SEPP)' to be redeveloped for higher end industrial and employment uses over the next decade. The site has a total area of approximately 56 Ha including the Riparian Corridor, with a specific development area circa 9 Ha.

The proposed works will, in addition to the Energy from Waste Electricity Generation Facility, include the adoption of a plan of subdivision and the following ancillary works:

- Earthworks associated with the balance of the site;
- Internal roadways;
- Provision of a direct underpass connection (Precast Arch and Conveyor Culvert) between TNG Facility and the Genesis Xero Waste Facility;
- Staff amenities and ablutions;
- Staff carparking facilities;
- Water detention and treatment basins;
- Services (Sewerage, Water Supply, Communications, Power Supply).



Further to the above physical works associated with the proposed Energy from Waste Facility, this application seeks approval for the subdivision Lot 1, 2 and 3 in DP 1145805 in order to create a separate lot of 10,000 m² for the Transgrid Switching or Substation and additional lots to allow for future development of land not associated with the Energy from Waste Facility and the Genesis Xero Material Processing Plant.

2.2 Definitions

Survey Area – The survey area is defined as the footprint of the proposed development and closely adjoining areas. It consists of parts of Lots 2 and 3 DP 1145808.

Site – The site is defined as Lots 2 and 3 DP1145808. It is located on Honeycomb Road, Eastern Creek, within the Blacktown LGA

Study Area – This area is the wider area and includes both the site and adjoining areas. It extends beyond Ropes Creek to the west, beyond the M4 to the north, beyond Wallgrove Road to the east and more than a kilometre to the south.

2.3 Survey area description

For the purposes of this report, the survey area is displayed in Figure 6. It is approximately 27 hectares in size and includes the development proposal footprint and the adjoining areas to the south including the Ropes Creek tributary. The elevation varies from approximately 50 to 80 metres above sea level.

All of the survey area is zoned IN1 General Industrial on the State Environmental Planning Policy (Western Sydney Employment Area) 2009 Land Zoning Map. No part of the survey area or the proposal footprint is zoned E2 Environmental Conservation on the State Environmental Planning Policy (Western Sydney Employment Area) 2009 Land Zoning Map (see Figure 9).

The survey area generally slopes to the south. There is a dam within the development footprint and the upper parts of a mostly dry, presumably



historic drainage line flowing south from the dam. This is indicatively displayed as blue line in an approximate north-south position in Figure 6. It merges with a westerly flowing tributary that eventually flows into Ropes Creek.

Presently overflow appears to exit the eastern side of the dam, primarily as overland flow, it subsequently merges with the southerly flowing drainage line.

The adjacent properties are commercial and industrial properties as well as areas of land used for grazing.

The vegetation is described in detail in Section 5.2 below and fauna habitat is detailed in Section 4 below.

2.4 History of the site

The site is comprised of two lots (Lots 2 and 3 DP 1145808) and is located adjacent to Honeycomb Road, at Eastern Creek in the Blacktown LGA. The site is primarily used for grazing. An area of Cumberland Plain Woodland approximately 9 ha in size is present in the north-western corner. It is fenced and not used for grazing cattle.

2.5 Soils

Original soils are of the Blacktown type in the Residual Group. They are shallow to moderately deep hardsetting mottled texture contrast soils, red and brown podzolic soils on crests grading to yellow podzolic soils on lower slopes and in drainage lines. (Hazelton *et al.*, 1989). (See Figure 3) There is an area that has been disturbed by human activity.



3. Methodology

3.1 Literature review

Literature reviewed in order to assess possible issues relating to this site include:
Air photo

EcoLogical Australia (June 2013) Exhibition Draft – Broader Western Sydney Employment Area – Biodiversity and Riparian Assessment. Prepared for NSW Department of Planning and Infrastructure.

Keystone Ecological (May 2007) Guiding Ecological Principles and Constraints Lot 2 DP 262213, Lot 1 DP 400697, Lot 10 DP 241859, Lot W DP 419612, Archbold Road, Eastern Creek Blacktown LGA; For: Light Horse Business Centre (Ref: BC 05-062/1)

Keystone Ecological (March 2007) Flora and Fauna Impact Assessment Lot 2 DP 262213, Lot 1 DP 400697, Lot 10 DP 241859, Lot W DP 419612, Archbold Road, Eastern Creek Blacktown LGA; For: Light Horse Business Centre (Ref: BC 05-062/2)

Proposal diagram (AT&L).

Vegetation map (Tozer)

Schedules to the TSC Act 1995

Schedules to the EPBC Act 1999

SEPP 44 Koala Habitat Protection

OEH Atlas of NSW Wildlife

3.2 Field work

Over the three days of fieldwork a total of 19.2 hours were spent undertaking survey work on the site and surrounding habitat areas.



Table 2. Survey dates and weather conditions

Date	Times	Weather (°C)	Task	Hours (hrs x no. people)
23Apr14	9:50am-9:15pm	Cloudy/sunny (23.5)	Site visit, vegetation survey, incidental fauna survey, Owl call playback, Anabat® recording.	(9.58 hr x 1) = 9.58 hr
24Apr14	8:55am-9:45am	Sunny	Cumberland plain land snail survey	(0.83 hr x 1) = 0.83 hr
5May14	3.35pm - 8:00pm	Sunny to cold (25.3-6.0)	Frog survey, macroinvertebrate/tadpole survey, Anabat® recordings, vegetation survey	(4.41 hr x 2) = 8.82 hr
9Feb15	7:45am – 17:10pm	Cloudy (24.0-26.0)	Vegetation survey, incidental fauna survey	(9.42 hr x 2) = 18.84 hr
12Feb15	8:15am – 10:05pm	(19.0-28.0)	Vegetation survey, incidental fauna survey	(1.83 hr x 1) = 1.83 hr
			Total	39.9 hours

Survey effort was concentrated within the survey area, although adjacent surrounding vegetation was noted (Figure 6).

3.3 Flora survey method

A flora survey was conducted. Random meanders were undertaken through the survey area to compile vegetation descriptions and vascular flora species lists for the site. Targeted surveys were made for threatened species (See Appendix 8) *Acacia pubescens*, *Dillwynia tenuifolia*, *Grevillea juniperina* subsp. *juniperina*, *Isotoma (Hypsela) sessiliflora*, *Marsdenia viridiflora* subsp. *viridiflora*, *Pilularia novae-hollandiae* and *Pimelea spicata*. on the basis of local species records and suitable habitat within the survey area.

Quadrat analysis

Twenty metres by twenty metres (20 x 20 m) quadrat surveys were undertaken to assist in the determination of the plant communities present. All vascular flora present within the 20 m x 20 m quadrat was identified apart from very occasional young seedlings. Occasionally, young seedlings with limited features are present and cannot be easily identified to species. However, these unidentified species usually only represent less than 1% of all plant species recorded in series of quadrats, and significantly less than 1% of the biomass. The cover and abundance (CA) of each species was also recorded for each quadrat and sometimes comments about the species were written.



Flora species are listed firstly in order of cover and abundance, that is those species with the greater scores of cover and abundance were listed before those species with lesser scores. Flora species were then listed in alphabetical order.

The results of the quadrat data were compared to Appendix 3 of Tozer *et al.* (2010). The most likely vegetation communities present were compared to the quadrat data in each quadrat. The details of the analyses are tabulated in Appendix 4. Note Tozer *et al.* (2010) uses a different name for each vegetation communities (ecological community) to that described in the NSW Threatened Species Conservation Act (TSC) or the Commonwealth Environment Protection & Biodiversity Conservation Act (EPBC), however, Tozer *et al.* (2010) nominates the relationship of their vegetation community name with listed ecological communities under the TSC Act and the EPBC Act. These related listed ecological communities are detailed below in Section 3.4 and in Section 5.

Often in degraded vegetation communities the number of indigenous species required for a statistical test is inadequate; however, the information provided in Tozer *et al.* (2010) can still provide some guidance on the identity of the indigenous vegetation.

3.4 Vegetation Community Names

Classification and naming of vegetation communities (vegetation types) has progressed from very basic classification that are readily understandable such as rainforest or desert vegetation through to more recent analysis using statistics and much finer classifications. Early studies on the classification of vegetation within the Sydney Basin include the work and report of Pidgeon (1941).

Recently the naming of vegetation types has proceeded through a number of changes. This report relies on various studies and documentation detailed in Table 3 below.



Table 3 Vegetation types and their relationships

Vegetation Community name mostly used in this report	Cumberland Shale Plains Woodland	Cumberland Shale Hills Woodland	Floodplain Swamp Forest	Cumberland River Flat Forest
Tozer <i>et al.</i> 2010 name	Cumberland Shale Plains Woodland	Cumberland Shale Hills Woodland	Floodplain Swamp Forest	Cumberland River Flat Forest
OEH 2002 name	Cumberland Plain Woodland – Shale Plains Woodland	Cumberland Plain Woodland – Shale Hills Woodland	Riparian Woodland (included within Alluvial Woodland on mapping).	Sydney Coastal River-flat Forest – Alluvial Woodland
Name in the Final Determination (NSW TSC Act)	Cumberland Plain Woodland	Cumberland Plain Woodland	Swamp Oak Forest on Coastal Floodplains EEC (TSC Act) River Flat Eucalypt Forest on Coastal Floodplains EEC (TSC Act)	River Flat Eucalypt Forest on Coastal Floodplains EEC
Name in the Final Determination (Commonwealth EPBC Act)	Cumberland Plain Woodlands	Cumberland Plain Woodlands	Not applicable	Not applicable

NB: The vegetation type names within each column refer to similar and sometimes identical vegetation types. As each publication or document may define the vegetation type slightly differently sometime the names within each column may not refer to identical vegetation types.



Class System for vegetation quality

Vegetation communities may be classified according to the grading system developed by Perkins for Cumberland Plain Woodland, and outlined by Berzins (1999). The Class system may also be used as the basis for classification of other vegetation communities and is used in this report in the description of the on-site vegetation.

Three main classes of vegetation quality are recognised, together with cleared and previously cleared areas constituting a fourth class. There is variation within each class, and in addition the class boundaries are somewhat fluid where one grades into the other.

CLASS 1 - areas consist of remnant or regenerating areas with a range of indigenous species and are representative of the description for the specific vegetation unit involved. Natural soils still dominate, and weed invasion is relatively minimal.

CLASS 2 - remnants and regenerating areas with a range of native canopy species, but with reduced native understorey and groundcover layers by comparison to Class 1.

CLASS 2 REGENERATING - similar to Class 2, but in the primary stages of regeneration after disturbance. Native understorey and groundcovers may be present, but assessment over time is needed to determine the abundance or otherwise of these species.

CLASS 3 - areas with a range of canopy species but native understorey and groundcover is generally absent. Weeds may be present, sometimes as dense cover. Natural soils are either absent or have been intensively and/or repeatedly disturbed. This Class does not meet the condition in the Final Determination that an area is likely to achieve a near-natural structure or a seral stage towards that structure under natural processes.

Note: (for Cumberland Plain Woodland)

For Class 2 and Class 2 Regenerating CPW the understorey is generally grassy to herbaceous with patches of shrubs, or if disturbed, contains components of



indigenous native species sufficient to re-establish the characteristic native understorey.

For Class Three CPW, it does not meet the condition in the Final Determination that an area is likely to achieve a near natural structure or a seral stage towards that structure under natural processes.

The Cumberland Plain Woodland includes regrowth, which is likely to achieve a near natural structure, or is a seral stage towards that structure.

3.5 Fauna survey method

The methods of survey undertaken to detect the various faunal groups or their habitat are outlined below. Locations for specific survey methodologies are shown in Figure 6.

Surveys for mammals, reptiles and frogs are generally run concurrently. Targeted searches were made for both the habitat and/or evidence of the following threatened species listed below; on the basis of known local species records and habitat availability (Appendix 7).

Invertebrates: Cumberland Plain Land Snail *Meridolum corneovirens*,

Amphibians: Green and Golden Bell Frog *Litoria aurea*.

Birds: Powerful Owl *Ninox strenua*, Barking Owl *Ninox connivens*, Masked Owl *Tyto novaehollandiae*, Little Eagle *Hieraaetus morphnoides*, Square-tailed Kite *Lophoictinia isura*, Little Lorikeet *Glossopsitta pusilla*, Painted Snipe *Rostratula benghalensis*, Freckled Duck *Stictonetta naevosa*

Mammals (bats): Grey-headed Flying-fox *Pteropus poliocephalus*, Eastern False Pipistrelle *Falsistrellus tasmaniensis*, Large-eared Pied Bat *Chalinolobus dwyeri*, Eastern Freetail-bat *Mormopterus norfolkensis*, Eastern Bentwing-bat *Miniopterus schreibersii oceanensis*, Greater Broad-nosed Bat *Scoteanax rueppellii*, Yellow-bellied Sheath-tail-bat *Saccolaimus flaviventris*, Little Bentwing-bat *Miniopterus australis* and Southern Myotis *Myotis macropus*.



Dates and weather of all fieldwork were recorded and are tabulated in Section 3.2 above.

3.5.1 Aquatic survey

Survey for aquatic biota including macroinvertebrates, fish, and tadpoles was conducted with a small dip net in both the onsite dam and the immediate pools percolating from this dam. Within the dam a range of representative habitats were sampled including benthic areas, open water, and around emergent and fringing terrestrial vegetation.

3.5.2 Call playback

Call playback was undertaken for the following species:

Powerful Owl *Ninox strenua*

Masked Owl *Tyto novaehollandiae*

Barking Owl *Ninox connivens*

3.5.3 Diurnal fauna searches

Searching, opportunistic observations and call recording provides an indication of types of species using a site. These methods are used to identify and record live animals, or record indirect evidence of animal presence on the site. On occasions, specific surveys may be conducted for a targeted group or species, such as searching the margins of a dam for frogs. Generally though, birds, reptiles, frogs and mammals, or evidence of them, may all be present in the same habitat at the time of survey, therefore searching for these faunal groups is generally run concurrently. This involved:

- a) Searching shelter sites, basking sites, opportunistic observation, and assessment of shelter site diversity suitability for reptiles.
- b) Searching shelter sites, calling sites, egg deposition sites, spotlighting and triangulation on calling males for frogs.
- c) Opportunistic observations and identification of calls of species, and search for indirect evidence such as nests, feathers, scratchings and feeding signs for birds.



- d) Searching for indirect evidence, such as diggings, droppings, runways and burrows, and opportunistic observations for mammals.

While rigorous surveys are likely to find more species, high species richness for birds can be recorded in a relatively short amount of time. Bird surveys are used as a simple indicator of other parameters, such as biodiversity and the functioning of the ecosystem.

3.5.4 Nocturnal fauna searches

Spotlighting was undertaken by 1 or 2 people for a total of approximately 7 hours on the 23 April 2014 and 5 May 2014. Each person used a 12-volt, 50-watt spotlight and 10 x 50 binoculars within the survey area.

Nocturnal searches may encompass all the surveying methods used during the day, but generally consist of either locating a live animal or recording its call. Nocturnal species, such as arboreal mammals, large forest owls, flying-foxes and calling male frogs, are specifically targeted. Survey methods for microbats are outlined below in 3.5.6.

3.5.5 Stag watching

A stag watch of hollow habitat trees was conducted for fauna. This consisted of quiet watching of a hollow tree for 30 minutes before dusk and 1 hour after dusk to see what fauna emerged.

3.5.6 Microbat ultrasonic call recording

The method for identifying free-flying bats by their species-specific echolocation calls is one that has become standard in the last decade (Richards 2001). Insectivorous bats were surveyed on this site by Anabat recordings directly to cf storage zcain, for four hours from dusk (Duffy *et al.* 2000). Any other bat survey methodology, such as tape recorded calls, and brief survey time, is certain to miss bat species scheduled by the TSC Act 1995. Scheduled species are recorded on average within 1.5 hours (94 ± 64 minutes) of recording but up to four hours is required to record all threatened species present (Richards 2001). Of the eight threatened species in the Sydney



Bioregion, Yellow-bellied Sheath-tail-bat *Saccolaimus flaviventris* has the largest home range and takes up to four hours to reliably appear at any point in its range. For a small site, any bats that appear in the first half hour are likely to be roosting nearby, with probability of recording 57% in the first half hour and 68% in the first whole hour (Richards 2001). Storage to zcain provides high quality call recordings with very little noise, enabling high reliability in call identification, as opposed to storage to magnetic tape. Flying-foxes and insectivorous bats were sought by nocturnal spotlight transects and searching for roost sites, and Anabat recordings were analysed by Becky Southwell. Opportunistic observations during fieldwork were noted.

Table 4. Anabat recording dates and weather conditions

Date	Times	Weather
23Apr14	6:30 pm to 8:45 pm	Warm to mild
5May14	5:30 pm to 7:45 pm	Mild to cool

3.6 Species likely to occur

Species to be listed as 'likely to occur' or 'expected' (see Appendix 6), are common species generally found in the region, which are likely to occur on site if suitable habitat is present.

Native flora may include species local to the area (occurring in local remnants). Structure and species composition will depend upon locally occurring communities.

Expected species are common and, by definition, are not threatened species.

3.7 Limitations of the survey

This survey was conducted in the autumn season. This was not suitable for summer migrants or species of winter-flowering orchids that lose their aerial stems after fruiting.



The weather conditions were cool-warm (23.5°C, no wind/rain) on the day of the first site visit. This was suitable for herpetofauna, represented by the observation of a blue-tongued lizard. On the day of the second site visit, daytime conditions were similar in temperature (23.5°C) with cold conditions at night (6°C). However, amphibians were still active with several frog species heard and observed at night.

Species that may use the site were not detected during the survey for the following reasons:

- a) The species was present during the survey but was not detected due to dormancy, inactivity or cryptic habits.
- b) The species use the site at other times of the year, but was not present during the survey due to being nomadic or migratory.

4. Survey Results: Habitat

4.1 Site habitat descriptions

The survey area habitat is described below. The distribution of vegetation/habitat types within the survey area and surrounding areas is shown in Figure 6.

4.1.1 Forest and woodland

This habitat type was present in two areas. One patch of trees is present in the north-east corner of the survey area. There is also a larger patch of trees mixed with open areas of pasture adjacent to the Ropes Creek tributary. The dominant species were *Eucalyptus* and *Casuarina*. This habitat type is further divided into two vegetation communities described in Section 5.2.

4.1.2 Open paddocks

The majority of the survey area was historically cleared for grazing. There are a few scattered exotic trees in this area. However the majority (90-99%) of the area consists of open grassland presently used for cattle grazing.



4.1.3 Farm dam, watercourse and drainage line

In the southern extent of the site a small dam (970m²) exists with scattered, shallow pools occurring below the dam. The dam is fed by a drainage line that flows from the northeast. This drainage line is dominated by exotic Spike Rush *Juncus acutus*, whereas the dam is dominated by Cumbungi *Typha orientalis*. The scattered pools below the dam lack emergent vegetation except for the deeper pools (> 0.5m) where Cumbungi *Typha orientalis* occurs in low density.

Also in the southern extent of the site, outside of the development footprint, there is a watercourse named Ropes Creek tributary on Figure 2. Ropes Creek tributary flows west from the site and enters Ropes Creek some 1.25km downstream. Along the Ropes Creek tributary there is a high density of Spike Rush *Juncus acutus* and to a lesser extent Cumbungi *Typha orientalis*. There are also scattered indigenous trees along the Ropes Creek tributary.

Specific habitat features, rather than types, are listed below in Section 4.2.

4.1.4 Soil salinity near Ropes Creek Tributary

The dominance of Swamp She-oak *Casuarina glauca* and other plant species that are tolerant of saline conditions, for example, *Atriplex prostrata*, *Atriplex semibaccata*, *Cynodon dactylon* and *Juncus acutus* in the forested area adjacent to Ropes Creek Tributary suggests that soil salinity is higher than other areas on the Cumberland Plain where Forest Red Gum *Eucalyptus tereticornis* and Grey Box *Eucalyptus moluccana* are dominant.

It is also of note that the area where vegetation tolerant of raised salinity levels appears is primarily east of the dam. On the western side of the dam downslope to the Ropes Creek Tributary the dominant canopy species are *Eucalyptus*.

The reason for the raised salinity levels is unclear. The report from Ian Grey Groundwater Consulting Pty Ltd (June 2014) suggests that:



"Salinity of the shallow groundwater is low on the higher ground and mid-slopes, with groundwater becoming saline closer to the creek. This suggests that discharge of saline groundwater from deeper fractured rock aquifer(s) hosted by the Bringelly Shale is occurring in these areas in addition to shallow groundwater discharge, as the increase is too great to be explained by evaporative concentration alone."

Another alternative explanation is that the raised salinity levels have arisen due to the higher saline levels present in water draining from the site to the east. These higher salinity levels were presumably present historically and may not be presently current. If the salinity was present historically it is reasonable to expect a greater number of positive indicator species for Floodplain Swamp Forest, whereas within the area dominated by Swamp She-oak positive indicator species for this community were generally low.

The main importance of the source of the salinity relates to the identity of the vegetation community along the Rope's Creek Tributary. This will be discussed further below in Section 5.2.3.

4.2 Specific habitat features

Important habitat features that have significance for fauna occupation of the site are discussed below. These include both site disturbance and natural features.

Eight potential habitat trees were observed within the survey area. There is generally a lack of fallen logs and dead wood/coarse woody debris. Fallen logs and coarse woody debris is generally confined to the forest and woodland areas.

Shelter/nesting/roosting sites and diversity	Scattered Logs, occasional rock, canopy vegetation and long grass, tree hollows. The emergent vegetation present on the dam provides suitable habitat for frog species. The water bodies, emergent vegetation and aquatic detritus also provides habitat for macroinvertebrates and tadpoles identified during the second field visit.
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Food resources	Eucalyptus and Casuarina. Fallen and rotting material, fungus, Swamp (insects), grass, vertebrate prey. Aquatic detritus (e.g. leaves, fallen logs) acts as a food source for macroinvertebrates present in the dam.
Vegetation layers and density of cover	Small patches of tree leaf litter. 90-99% grass and herb layer, canopy layer approximately 10% and the shrub layer is less than 5%.
Clearing	Large areas of grazing paddocks, some dirt roads
Fire damage and regrowth status	No evidence of recent fire.
Vehicle traffic and road mortality	Within the survey area traffic is uncommon, however, vehicle traffic is common in the adjoining waste facility and the M4 along the northern boundary of the site is often very busy.

4.3 Off-site habitat

Off-site habitat consists of other industrial areas, grazing land, other farm dams, drainage lines, a riparian corridor along Ropes Creek to the west and scattered patches of forest or trees within the grazing landscape. The M4 adjoins the site but is only likely to contain habitat for common species not sensitive to traffic.

5. Survey Results: Flora

5.1 Species and communities of conservation concern

The survey area contains a patch approximately 2700 m² in size of the Critically Endangered Ecological Community Cumberland Plain Woodland comprising of trees, most commonly Grey Box *Eucalyptus moluccana* and Forest Red Gum *Eucalyptus tereticornis*; as well as scattered indigenous groundcovers. This ecological community is listed under both the NSW government TSC Act & the Commonwealth government EPBC Act.

The southern portion of the survey area contains the Endangered Ecological Community River-flat Eucalypt Forest. This endangered ecological community is listed under the NSW government TSC Act.



No threatened flora species were recorded within the survey area.

5.2 Vegetation description

5.2.1 Grazing paddocks

This area contains a mixture of exotic and indigenous herbaceous species but it was dominated by exotic species. Exotic species observed include: *Briza subaristata*, Summer Grass *Digitaria sanguinalis*, Cats Ear *Hypochaeris radicata*, *Paspalum dilatatum*, Kikuyu *Pennisetum clandestinum*, *Phalaris Phalaris* sp. and Slender Pigeon Grass *Setaria parviflora*. Indigenous species recorded include: Red-leg Grass *Bothriochloa macra*, Windmill Grass *Chloris ventricosa*, Weeping Rice Grass *Microlaena stipoides* and Kangaroo Grass *Themeda australis*. There were a few scattered trees and shrubs within this area including exotic species Pear *Pyrus communis* and African Olive *Olea europaea* subsp. *africana*. Quadrat 5 is a quantitative plat sample of the vegetation within the area of pasture. Details of quadrat 5 are found in Section 5.3.

5.2.2 Cumberland Plain Woodland

A patch of degraded and regrowth Cumberland Plain Woodland approximately 2700 m² in size is present in the north-east corner of the proposal footprint. This consists of Forest Red Gum *Eucalyptus tereticornis* and Grey Box *Eucalyptus moluccana*. The trees all appear to be regrowth with no trees likely to be older than about 50 years. One habitat tree containing a single hollow was observed within this patch. Indigenous shrubs are generally absent. The groundcover layer is degraded with more than 50% of the groundcover layer comprised of exotic species. This vegetation community is in Class 2/3 condition.

Quadrat 1 is a quantitative plat sample of the vegetation within the area of Cumberland Plain Woodland. Details of quadrat 1 are found in Section 5.3.



5.2.3 River-flat Eucalypt Forest

A degraded patch of River-flat Eucalypt forest is present along and adjacent to the Ropes Creek tributary that is present south of the development footprint. The common canopy species are Red Forest Gum *Eucalyptus tereticornis*, Grey Box *Eucalyptus moluccana* and Swamp Oak *Casuarina glauca*. Indigenous shrubs are generally absent but the patches of the noxious weed African Boxthorn *Lycium ferocissimum* are present in this area. Indigenous groundcovers are also uncommon with weed invasion significant.

The form of River-flat Eucalypt Forest is unusual in part of the mapped area as Swamp Oak *Casuarina glauca* dominates large areas and is the most dominant canopy species. This is atypical. If this type of vegetation was present at a lower elevation it would possibly be considered a different vegetation community. Additionally, many of the Swamp Oak trees are relatively young, approximately 30 to 60 years old. This species may be able to out compete Eucalypts on these potentially modified soils. This is consistent with the high degree of disturbance in the locality. Quadrats 2 and 6 describe the areas of Eucalypt River Flat Forest that are dominated by Swamp She-oak *Casuarina glauca* (See Section 5.3 for further details).

A possible explanation of the abundance of *Casuarina glauca* along the watercourse is the increase in salinity and possibly flooding. The three indigenous canopy species found in the locality are Grey Box *Eucalyptus moluccana*, Red Forest Gum *Eucalyptus tereticornis* and Swamp She-Oak *Casuarina glauca*. Grey Box *Eucalyptus moluccana* prefers areas where the water table is permanently low so it is unlikely to grow near the watercourse. In contrast both Swamp She-oak *Casuarina glauca* and Red Forest Gum *Eucalyptus tereticornis* are both known to grow in wetter areas and have some tolerance to salinity (Benson & McDougall 1995; 1998). However, Swamp She-oak appears to have more tolerance to salinity (Van der Moezel & al 1989, Marcar 1993) and perhaps more tolerant to waterlogging. Cabbage Gum *Eucalyptus amplifolia* typically replaces Red Forest Gum *Eucalyptus tereticornis* in Western Sydney, however, it appears absent on this site.



There are also two other variants within the River Flat Eucalypt Forest (Cumberland River-Flat Forest) along the Ropes Creek Tributary. One area to the west of the dam is dominated by Eucalypts. Quadrat 4 provides a description of this area is provided. See Section 5.3 for further details.

The second variant is the open areas with few or any canopy dominants. Quadrat 3 (Section 5.3) is a sample of the vegetation within one of these areas.

This vegetation community is in Class 2/3 condition.

Seven potential habitat trees were recorded within this vegetation community within the development footprint. Five of the trees appear to contain obvious hollows. Another two trees contained hollows or openings but it is unclear whether they were suitable as roosting or nesting places for wildlife.

5.2.4 Dam and watercourses

A constructed farm dam is present near the southern boundary of the development footprint. It is dominated by Cumbungi *Typha orientalis*.

Downslope of the dam there is a dry watercourse, this is included within the mapped area of Cumberland River Flat Forest (River Flat Eucalypt Forest). It historically acted as a regular channel for water but appears to now only transport water during wet times when the dam overflows. The vegetation along the dry watercourse is generally similar to other areas except Grey Box *Eucalyptus moluccana* and Red Forest Gum *Eucalyptus tereticornis* are more common. There were also a few herbaceous species that are more common in damp areas such as *Alternanthera denticulata* and *Persicaria decipiens*.

There is also a tributary of Ropes Creek south of the development footprint that flows to the west. The vegetation along the watercourse is mixed with Cumbungi *Typha orientalis* and the exotic species Spike Rush *Juncus acutus* present to the west. Spike Rush *Juncus acutus* dominates portions of the watercourse. There are a small number of indigenous trees species also present. These can be seen in the aerial photo but are not mapped. There is



no proposal to remove these scattered trees. The eastern side of the Ropes Creek Tributary is dominated by Swamp She-oak and a sample of this area is described under the heading Quadrat 6.

The vegetation along the watercourse and closely adjoining areas is generally in Class 2/3 condition.

Appendix 3 shows the list of flora found on the site.

5.3 Analysis of quadrat data

Data from each quadrat was compared to Tozer *et al* (2010). The relationship between the vegetation communities described by Tozer *et al* (2010) and ecological communities listed in either NSW or Commonwealth legislation is described below in Table 5.

Table 5 Relationship between the vegetation types described by Tozer *et al.* (2010) and related communities listed under NSW or Commonwealth legislation

Tozer <i>et al</i> 2010 Map unit name (vegetation community)	Related TEC (ecological community) listed under the NSW TSC Act or the Commonwealth EPBC Act
Cumberland Shale Plains Woodland	Cumberland Plain Woodland EEC (TSC Act) Cumberland Plain Woodlands EEC (EPBC Act)
Cumberland Shale Hills Woodland	Cumberland Plain Woodland EEC (TSC Act) Cumberland Plain Woodlands EEC (EPBC Act)
Floodplain Swamp Forest	Swamp Oak Forest on Coastal Floodplains EEC (TSC Act) River Flat Eucalypt Forest on Coastal Floodplains EEC (TSC Act)
Cumberland River Flat Forest	River Flat Eucalypt Forest on Coastal Floodplains EEC (TSC Act)

A quantitative assessment of the vegetation using 20 x 20 m quadrats was undertaken to provide information on the species composition of various



locations within the remnant vegetation and adjoining weedy areas. The quadrats were used to assist in the identification of vegetation communities.

As described in the methodology section (Section 3.3) the statistical analysis of quadrat data in weed invaded vegetation can potentially generated erroneous results, as the number of indigenous species present is typically less than the required number. However, statistical/numerical analysis can still provide some useful information.

A summary of the results from each quadrat is provided below. Data from each quadrat sheet is found in Appendix 4.

It is important to note that within quadrats 2, 3 and 6 the most common canopy species was Swamp She-oak *Casuarina glauca*. This species is typically found on slightly saline soils. This report has assumed that the source of salinity is artificial and as such the original vegetation type along the Rope's Creek Tributary was originally dominated by *Eucalyptus* spp. However, the report by Ian Grey (Ian Grey Groundwater Consulting Pty Ltd – February 2015) indicates that the source of the salinity may be natural and caused by a deep fracture. If the raised salinity is completely or largely a natural phenomenon then it is much more likely that the vegetation along the Rope's Creek tributary was always dominated by Swamp She-oak *Casuarina glauca*.

Quadrat 1 was located in the patch of *Eucalyptus* on the slope of a rise near the north-eastern corner of the proposal footprint. The OEH 2002 mapping (Native vegetation of the Cumberland Plain) does not display any indigenous vegetation at this location. The number of indigenous species recorded within the quadrat does not meet the minimum criteria using Tozer *et al.* (2010) for both the number of indigenous species recorded within a quadrat and the number of positive indicator species. It is difficult to confidently state which indigenous community this patch of native vegetation represents. It is considered in this report to be Cumberland Shale Hills Woodland as the number of positive (+ve) indicator species (13) is closer to the number required (20), whereas for Cumberland Shale Plains there were 17 +ve indicator species, however at least 26 are required.



Quadrat 2 was located within the patch of vegetation dominated by Swamp She-oak and downslope from the drainage line dominated by the exotic spike rush *Juncus acutus*. The OEH 2002 mapping displays Shale Hills Woodland at this location. Similar to the other quadrat analyses undertaken, it does not meet the minimum requirement for a statistical analysis for two vegetation communities, namely Cumberland Shale Plains Woodland and Cumberland River Flat Forest. However, it does meet the both minimum requirement and the number of positive (+ve) diagnostic species for a test to determine if it meets the Tozer *et al.* 2010 criteria as Floodplain Swamp Forest. While the vegetation in this quadrat does appear to be consistent with the vegetation community Floodplain Swamp Forest, it is considered that the original vegetation type was Cumberland River Flat Forest and Swamp She-oak *Casuarina glauca* and other species tolerant of slightly saline areas have increased in abundance due to the artificially raised salinity levels.

Quadrat 3 was located within the vegetation mapped as Shale Hills Woodland in the 2002 OEH mapping. Quadrat 3 is also a sample of an area within the larger area described in this report as Cumberland River Flat Forest that is described as dominated by pasture and weeds, indicated by yellow polygons in Figures 7 and Figure 8

This quadrat was dominated by groundcover grasses including native species such as *Microlaena stipoides* and *Bothriochloa macra* as well as the cosmopolitan species *Cynodon dactylon*, the lack of canopy species is indicated by the low cover and abundance scores for *Casuarina glauca*, as a few tall saplings were present within the quadrat. Both the total number of indigenous species and positive indicator species present within the quadrat was inadequate to enable a statistical test to be undertaken to determine the likely vegetation community. However, the likely vegetation communities appear to be either Floodplain Swamp Forest or Cumberland Shale Plains Woodland. Cumberland River-Flat Forest would generally be considered to more likely be the present than Cumberland Shale Plains Woodland at this location due to its proximity to the watercourse. However, the number of indigenous species within this quadrat is low ($N = 9$) and the apparent similarities to Cumberland Plain Woodland most likely represent the significant degradation of the remnant vegetation. It is considered that the original vegetation type was Cumberland River Flat Forest and Swamp She-oak



Casuarina glauca and other species tolerant of slightly saline areas have increased in abundance due to the artificially raised salinity levels.

Quadrat 4 was located west of the dam in the area mapped as Shale Plains Woodland by OEH (2002). This area was obviously visually different to the other areas to the east as a canopy of *Eucalyptus* spp dominates it rather than Swamp She-oak *Casuarina glauca*. Similar to all other quadrats the number of indigenous species was lower than generally expected for an undisturbed vegetation community. While not statistically robust, this quadrat appears closest to either Floodplain Swamp Forest or Cumberland River Flat Forest based on the difference between the number of positive indicator species observed and that required. However the canopy dominance of the *Eucalyptus* species suggests Cumberland River Flat Forest.

Quadrat 5 was located within the area of pasture but near to the bushland. This area was dominated by pasture grasses and weeds. The indigenous and cosmopolitan Common Couch *Cynodon dactylon* was the most common species within the quadrat followed by other pasture grasses or weeds including *Digitaria sanguinalis*, *Paspalum dilatatum*, *Senecio pterophorus*, *Bidens pilosa* as well as many other exotic species. Apart from the cosmopolitan species Common Couch *Cynodon dactylon*, other indigenous species within this quadrat all had the lowest Cover-Abundance scores. The vegetation within this quadrat was typical of that expected for a pasture used for grazing within Western Sydney.

Quadrat 6 was located in near the Rope's Creek Tributary within the area mapped by OEH (2002) as Sydney Coastal River-flat Forest – Alluvial Woodland. Swamp-she Oak *Casuarina glauca* was the dominant canopy species within this quadrat. The canopy species within this quadrat also included Red Forest Gum *Eucalyptus tereticornis*, although Red Forest Gum was generally absent in the other areas where Swamp She-oak was dominant. Additionally the Forest Red Gum present within the quadrat appeared to have less leaves than a typical specimen, perhaps due to leaf drop after excess salts had accumulated in the leaves. It is considered that the original vegetation type was Cumberland River Flat Forest and Swamp She-oak *Casuarina glauca* and other species tolerant of slightly saline areas have increased in abundance due to the artificially raised salinity levels.



5.4 Conclusion regarding the identity of the vegetation on site based upon quadrat data

A highly confident determination of the vegetation types present within and adjacent to the proposal area is not possible due to the degraded nature of the vegetation. It is considered the most likely vegetation most likely represents Cumberland Shale Hills Woodland near quadrat 1 while the vegetation dominated by either *Eucalyptus* spp. or *Casuarina glauca* along and adjacent to the Rope's Creek Tributary is Cumberland River Flat Forest in varying condition. However, the presence of either or both Cumberland Shale Plains Woodland and Floodplain Swamp Forest cannot be completely excluded.

5.5 Disturbance and weeds

Noxious weeds on the site include:

Crofton Weed	<i>Ageratina adenophora</i>	Class 4
Pampus Grass	<i>Cortaderia selloana</i>	Class 4
Large-leaf Privet	<i>Ligustrum lucidum</i>	Class 4
African Boxthorn	<i>Lycium ferocissimum</i>	Class 4
Blackberry	<i>Rubus anglocandicans</i>	Class 4

These species are present in varying number sometimes occurring as isolated plants but also occurring as patches.

The environmental weed Spike Rush *Juncus acutus* was common along drainage lines and the watercourse to the south.

Weed Control Classes

- Class 1** - State Prohibited Weeds. "The plant must be eradicated from the land and the land must be kept free of the plant."
- Class 2** - Regionally Prohibited Weeds. "The plant must be eradicated from the land and the land must be kept free of the plant."
- Class 3** - Regionally Controlled Weeds. "The plant must be fully and continuously suppressed and destroyed."



- Class 4** - Locally Controlled Weeds. *"The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority."*
- Class 5** - Restricted Plants. *"The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with."*

Control objectives

The control objectives for each class is as follows:

- Class 1** is to prevent the introduction and establishment of those plants in NSW.
- Class 2** is to prevent the introduction and establishment of those plants in parts of NSW.
- Class 3** is to reduce the area and the impact of those plants in parts of NSW.
- Class 4** is to minimise the negative impact of those plants on the economy, community or environment of NSW.
- Class 5** is to prevent the introduction of those plants into NSW, the spread of those plants within NSW or from NSW to another jurisdiction.

Class 5 weeds are predominately weeds listed under the old Seeds Act, which has been repealed. There is no obligation to control Class 5 weeds. However Class 5 weeds are notifiable weeds. This means that the plant, or any animal or thing, which has the weed on it or in it, cannot be sold, purchased or offered for sale in NSW. It cannot be removed from any land to another place and it cannot be scattered on land or water.



6. Survey results: Fauna

6.1 Species of conservation concern

Two threatened insectivorous bat species, namely the Yellow-bellied Sheath-tail-bat *Saccolaimus flaviventris* and Eastern Freetail-bat *Mormopterus norfolkensis* were recorded on the site through the use of the Anabat recorder.

6.2 Fauna results

A total of 47 species were detected, including mammals, birds, frogs, fish, macroinvertebrates and reptiles. Species listed as 'likely to occur' in the area are presented in Appendix 6. Note that the majority of the 'Expected Species' would not occur on the site due to the lack of habitat, but do occur in the area. All the species listed as 'likely to occur' are common throughout the locality and the region. It is unlikely that protected species will be affected at a local, regional or state-wide scale by the proposal.

The habitats for threatened species that occur in the area are tabulated in Appendix 7.

Table 6. List of fauna detected within or near the survey area

Common Name	Scientific Name	Conservation Status	Recorded AE
Birds			
White-faced Heron	<i>Egretta novaehollandiae</i>		O
Cattle Egret	<i>Ardea ibis</i>		O
Masked Lapwing	<i>Vanellus miles</i>		W
Brown Goshawk	<i>Accipiter fasciatus</i>		O*
Crested Pigeon	<i>Ocyphaps lophotes</i>		O
Galah	<i>Eolophus roseicapilla</i>		O
Sulphur-crested Cockatoo	<i>Cacatua galerita</i>		O
Rainbow Lorikeet	<i>Trichoglossus haematodus</i>		O
Crimson Rosella	<i>Platycercus elegans</i>		O
Eastern Rosella	<i>Platycercus eximius</i>		O
Red-rumped Parrot	<i>Psephotus haematodotus</i>		O
Superb Fairy-wren	<i>Malurus cyaneus</i>		O
Spotted Pardalote	<i>Pardalotus punctatus</i>		W
Noisy Miner	<i>Manorina melanocephala</i>		W, O
Magpie-lark	<i>Grallina cyanoleuca</i>		O
Willie Wagtail	<i>Rhipidura leucophrys</i>		O
Grey Butcherbird	<i>Cracticus torquatus</i>		W



Common Name	Scientific Name	Conservation Status	Recorded AE
Australian Magpie	<i>Cracticus tibicen</i>		W, O
Pied Currawong	<i>Strepera graculina</i>		W
Australian Raven	<i>Corvus coronoides</i>		O
Red-browed Finch	<i>Neochmia temporalis</i>		O
Welcome Swallow	<i>Hirundo neoxena</i>		O
Common Starling*	<i>Sturnus vulgaris</i>		O
Common Myna*	<i>Sturnus tristis</i>		O
Golden-headed Cisticola	<i>Cisticola exilis</i>		W, O

Mammals			
White-striped Mastiff-bat	<i>Tadarida australis</i>		A – C
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>	Sch. 2, Vul.	A – C
Gould's Wattled Bat	<i>Chalinolobus gouldii</i>		A – C
Chocolate Wattled Bat	<i>Chalinolobus morio</i>		A – C
Eastern Freetail-bat	<i>Mormopterus norfolkensis</i>	Sch. 2, Vul.	A – C
Eastern Grey Kangaroo	<i>Macropus giganteus</i>		S, O
Fox*	<i>Vulpes vulpes</i>		S, O
Black Rat*	<i>Rattus rattus</i>		O
Rabbit*	<i>Oryctolagus cuniculus</i>		O
Cow	<i>Bovus taurus</i>		S, O

Reptiles			
Eastern Blue-tongued Skink	<i>Tiliqua scincoides</i>		O

Fish			
Longfinned Eel	<i>Anguilla reinhardtii</i>		O

Macroinvertebrates			
Freshwater snail	<i>Hygrophila (order)</i>		O
Mayfly	<i>Ephemeroptera (order)</i>		O
Caddisfly	<i>Trichoptera (order)</i>		O
True bug	<i>Hemiptera (order)</i>		
Freshwater beetle	<i>Coleoptera (order)</i>		O

Frogs			
Eastern Dwarf Tree Frog	<i>Litoria fallax</i>		W
Verreaux's Tree Frog	<i>Litoria verreauxii</i>		W, O
Common Eastern Froglet	<i>Crinia signifera</i>		W
Brown-striped Frog	<i>Limnodynastes peronii</i>		W
Spotted Grass Frog	<i>Limnodynastes tasmaniensis</i>		W, O



Key

*	=	Introduced fauna
A – C	=	Anabat – Confident
O	=	Observed
S	=	Scats
W	=	Calls

6.3 Fauna Summary

The number of species from each faunal group, listed as 'likely to occur' can be seen in Appendix 6.

Mammals

Mammal species detected on the site totalled 10. No species observed or recorded was considered highly unusual.

Reptiles

Reptile species detected on the site totalled 1. The only reptile detected during the survey was an Eastern Blue Tongue Lizard *Tiliqua scincoides*. This was not observed within or near the proposed development area. It was observed in the patch of Cumberland Plain Woodland near the M4. The observation of this species while not within the survey area has been included in this report as it provides evidence that the weather was suitable for surveying reptiles.

Frogs

Frog species detected on the site totalled 5. All species observed or heard are common or have been previously recorded in the western suburbs of Sydney.

Birds

Bird species detected on the site totalled 25. All species observed or recorded are common or reasonably common within western Sydney. Species not recorded during the survey but likely to occur on the site include Sulphur Crested Cockatoo and Little Corella.



Fish

Only one fish species was detected on the site. This was a single longfinned eel that was observed at dusk in the shallows of the dam. Plague minnow was not detected at any of the water bodies on the site despite apparently suitable conditions.

Macroinvertebrates

Macroinvertebrates belonging to five separate orders were captured in the field and identified thereafter. The most common of these was members of the order Hemiptera, which were commonly found swimming in open water. Freshwater snails of the order Hygrophila were infrequently encountered during sampling. Freshwater shrimp species were not present in any of the water bodies that occur on the site.

Despite a targeted survey for Cumberland Plain Land Snail undertaken in suitable habitat in the southern part of the survey area, no evidence of this species was observed. A previous survey on the site undertaken by Keystone Ecological (March 2007) did not find this species within or adjacent to this development proposal. However, it was recorded by Keystone Ecological in the large area of Cumberland Plain Woodland adjacent to the M4.

6.4 Microbats

Three common bat species and two threatened bat species were detected. Where calls were easily identifiable to species, they were classed as Confident. Where the calls were most likely to represent a particular species, they were classed as Probable. Where calls were likely to belong to a species but the quality or length of the call precluded a confident identification, they were classed as Possible. Where the calls could have belonged to two or more species, they were classified into a species group. Any calls of very poor quality, which could not be reliably placed into any species or species group category, were classified as Unknown. The vast majority of calls were of very good quality and the poor ones most likely represented bats flying just within the bat detector's outer detection limits.



Foraging Habitat

This survey area provides potentially suitable foraging habitat for six of the eight possible threatened species. *Myotis macropus* (syn. *Myotis adversus*) has no suitable foraging habitat in the form of open water bodies. While a dam is present in the survey area it is covered in Cumbungi *Typha orientalis*. *Kerivoula papuensis* is only likely to forage in areas within a few kilometres of rainforest or rainforest gullies.

Roosting Habitat

The survey area has tree hollows that provide suitable roosting habitat for *Falsistrellus tasmaniensis*, *Mormopterus norfolkensis*, *Scoteanax rueppellii*, *Myotis macropus*, *Miniopterus australis* and *Saccolaimus flaviventris*. The survey area does not have any caves, culverts, bridges, buildings and other suitable (often human-made) structures that provide potentially suitable roosting habitat for *Chalinolobus dwyeri*, *Miniopterus schreibersii oceanensis*, *Myotis macropus*. *Kerivoula papuensis* normally roosts in hanging bird nests or trees in rainforest gullies so is very unlikely to roost in the surveyed site.

6.5 Feral fauna

Expected feral fauna such as the Common Myna, Starling, Fox, Rabbit and Black Rat were all observed within the survey area.

Despite the absence of the exotic Plague Minnow at the site, there is a high likelihood of this species occurrence in Ropes Creek, located approximately 1 km west from the site.

7. Discussion of results

The survey area has had a high disturbance regime, indicated by the extensive areas of pasture and presence of weed species including noxious weeds. This is not unexpected as the site has been used for grazing for many years. While there are patches of remnant indigenous vegetation, these patches also display signs of disturbance as ground cover weeds are



abundant within the patches. Feral indicator species, Red Fox, indicates that native terrestrial fauna abundance is likely to be low. Ecological services for the site e.g. bioturbators, pollinators, seed dispersers may be present but do not appear to be functioning normally. There is generally a lack of recruitment of the indigenous Eucalypts within the survey areas. This may be caused by rabbits or perhaps cattle grazing on saplings.

The site provides some habitat primarily in the form of the two areas of indigenous vegetation (Cumberland Plain Woodland and River-flat Eucalypt Forest) and the seven habitat trees present in the River-flat Eucalypt Forest and single habitat tree in the Cumberland Plain Woodland.

Weeds were present in significant numbers within the survey area and it is likely that they will remain in high numbers.

The singular longfinned eel observed in the dam is likely to have migrated there from a nearby habitat. The occurrence of this species is expected as it is commonly found in farm dams. The absence of Plague Minnow is unexpected as the dam within the survey area offers apparently suitable conditions and their prevalence in farm dams in surrounding regions. However, this dam may be ephemeral in nature, hence, establishing long-term presence in this dam may be problematic for this species.

The occurrence of certain macroinvertebrates on the site highlight that the dam is utilised by fly species (e.g. mayfly and caddisfly) to complete the larvae stage of their life cycle before terrestrial emergence. Fully aquatic members of the orders Hemiptera and Coleoptera are also present, with the former being the most frequently encountered order of macroinvertebrates on the site. The identified macroinvertebrates are consistent with those that occur in disturbed farm dams. In addition, these macroinvertebrates may act as a potential food source for eels and frogs that are present on the site

7.1 Discussion of Couch Grass on the site

Couch grass *Cynodon dactylon* is a common grass on the site both in areas with indigenous canopy species such as *Eucalyptus* sp. or *Casuarina glauca* and also in some areas completely dominated by pasture. Couch Grass also



has a cosmopolitan (almost world-wide) distribution. The dominance of couch on the site is most likely to represent favourable practices aimed at retaining this species and other pasture species as well as the probable oversowing of additional seed of Couch grass to enhance its cover, as it is a useful pasture species. It is a widely cultivated pasture grass and is considered a weed in some situations (Wheeler *et al.* 2002), it is also known to be mildly tolerant of salinity (Marcum & Murdoch 1994) and waterlogging (Tan *et al.* 2010). Thus its high scores of cover and abundance on the site represent practices aimed at providing grazing pastures rather than remnant vegetation.

There has over a long period been varying opinions on whether Common Couch *Cynodon dactylon* should be considered an indigenous Australian species or whether it is an introduction (Langdon 1954). Recent work undertaken by Jewell *et al.* (2012) on a range of genotypes suggests that *Cynodon dactylon* has only been present for hundreds of years in Australia rather than being an ancient introduction. While there remains the possibility that some Common Couch *Cynodon dactylon* genotypes are indigenous Australian species, it is likely that the overwhelming majority of Common Couch *Cynodon dactylon* recorded in Australia is of non-Australian origin.

8. Additional information to address the comments from various government authorities

Three documents were received which contained comments relevant to the Flora and Fauna Assessment undertaken by Abel Ecology for the proposal. The documents were:

1. Letter from OEH: Letter from Susan Harrison (Senior Team Leader, Planning – Greater Sydney – Regional Operations). NSW Office of Environment and Heritage to David Mooney (A/Team Leader – Industry, Key Sites & Social Projects) NSW Department of Planning and Environment (Reference: SSD 6236/DOC 14/247891).
2. Letter from Blacktown Council: Letter from Glennys James (Director City Strategy and Development) Blacktown City Council. (File no: MC-13-



2284) to The Secretary (Attention: David Mooney – Department of Planning and Environment, GPO Box 39, Sydney NSW 2001). This letter also contained an attachment from an Independent Consultant (Jacobs) who reviewed the proposal on behalf of council. Jacobs provided a table of issues. The relevant portions of the Jacobs table are produced below.

3. ARUP Adequacy Assessment. An assessment of the proposal was also undertaken by ARUP Pty Limited on behalf of the NSW Department of Planning and Environment. A table containing their comments was provided to TNG Energy From Waste Electricity Generational Facility. The relevant portions of the ARUP Pty Limited table are produced below.

A heading is provided below for each document and the text from the documents is reproduced. A response is then provided.

8.1 Letter from OEH

1. Biodiversity

The Director General Requirements (DGRs) state that the proposal must 'describe how the principles of "avoid, mitigate, offset" have been used to minimise the impacts of the proposal on biodiversity'. However, there is no discussion in the Ecology Assessment or in the EIS of the alternatives that have been considered to avoid biodiversity impacts, and there is no proposal to offset impacts. As such, OEH does not consider that the proposal meets the requirements of the DGRs. Impacts on biodiversity should be appropriately offset. OEH considers the measures in section 8.5 ('Offsets') of the assessment to be mitigation measures, not offsets.

Response: Some areas of remnant indigenous vegetation have been retained and thus clearing has been avoided. Approximately 1.29 ha of River-flat Eucalypt Forest will be retained south of the proposal footprint.

However an area of approximately 0.27 ha of Cumberland Plain Woodland and 2.89 ha of River Flat Eucalypt Forest will be cleared for the proposal. Clearing on these areas has not been avoided, but will be offset.



Mitigation of some impacts will be achieved by the following actions:

1. Potential erosion will be mitigated through the use of sediment fencing adjacent to the downslope edge of the development footprint.
2. Stormwater quality discharged from the site will meet or exceed the requirements of SEPP59 and thus this will mitigate against potential impact of poor water quality. It is recommended that the bio-retention basin be planted with local indigenous wetland species to create wetland habitat.
3. A pre-clearance survey will be undertaken and any vertebrate fauna and Cumberland Plain Land Snails captured will be moved to the retained area of River Flat Eucalypt Forest to the south of the development footprint.

Offsetting will be achieved within the SEPP59 area along the Ropes Creek Tributary and also on the batters surrounding the Bio-retention basin and the batters to the south of the development footprint. Figure 11 displays the offset areas. Approximately 0.54 ha of Cumberland Plain Woodland will be regenerated or replanted for the 0.27 ha that will be removed and approximately 4.98 ha of River Flat Eucalypt Forest will be regenerated or replanted for the 2.89 ha that will be removed. The River Flat Eucalypt Forest will be regenerated and replanted within the SEPP59 Ropes Creek Tributary riparian corridor.

The location of offsets is displayed in Figure 11.

The loss of hollow-bearing trees will also be offset through the installation of fauna roosting/nesting boxes within the retained River Flat Eucalypt Forest along the Ropes Creek Tributary. For each of the hollow-bearing trees removed two nesting or roosting boxes must be installed within the Ropes Creek Tributary. The total number of fauna boxes recommended to be installed is twenty, an additional 20% has been included.

Section 5.2.3 of the Ecology Assessment states that there is approximately two hectares of River-flat Eucalypt Forest (RFEF) on site, whereas elsewhere in the document (eg the Executive Summary) it states that extent of the community is 1.5 ha.



Response: Figures 6, 7 and 8 displays the area of River-flat Eucalypt Forest (RFEF) (Cumberland River Flat Forest) within and immediately adjacent to the proposal area. The total size of the green polygon (Figure 6) is approximately 4.18 ha. The total area of RFEF proposed for removal is approximately 2.89 ha, that is the portion of the orange polygon overlapping the green polygon (See Fig 6). The 2.89 ha of RFEF proposed to be removed is comprised of areas where the canopy layer is typical of a forest and this amounts to approximately 2.43 ha, the remaining amount of weedy areas dominated by pasture grasses and weeds within the RFEF totals approximately 0.46 ha. The areas dominated by pasture and weeds, located within the RFEF is indicated in Fig 7 and 8 by the yellow polygons. The proposal will retain approximately 1.29 ha of RFEF along the Rope's Creek Tributary south of the proposal footprint.

This report has been amended to state consistently that:

"Approximately 2.89 ha of River-flat Eucalypt Forest will be removed for the proposal, comprised of approximately 2.43 ha of forest and approximately 0.46 ha where the flora species are dominated by pasture species and weeds. The proposal will retain approximately 1.29 ha of River-flat Eucalypt Forest."

The 'Native Vegetation of the Cumberland Plain, Western Sydney' (OEH 2002) mapping identified a patch of remnant vegetation in the south-east of the site of approximately 3 ha in size. This patch was mapped mostly as Cumberland Plain Woodland (CPW), with some RFEF. However, the Ecology Assessment has mapped this as being all RFEF and states it is approximately 1.5 or 2 ha in size. The assessment also states that there are a number of patches of RFEF spread over an area of four hectares, and that the areas in between are 'pasture and weeds'. It would be useful if the assessment included plot data or other quantifiable data to demonstrate the level of weed infestation, to justify that the patches mapped as pasture and exotic vegetation are not degraded remnant vegetation. Since only one combined flora species list is provided, it is difficult to confirm the classification of the vegetation communities and pasture areas.



Response: This report has been amended to state consistently that “Approximately 2.89 ha of River-flat Eucalypt Forest will be removed for the proposal, comprised of approximately 2.43 ha of forest and approximately 0.46 ha where the flora species are dominated by pasture species and weeds. The proposal will retain approximately 1.29 ha of River-flat Eucalypt Forest.”

Two quadrats, namely quadrat 3 and quadrat 5 provide plot data from areas that are dominated by pasture and weeds. An additional four quadrats provide plot data for the vegetation within other areas where the quadrats are dominated by canopy species. The detail of all quadrats is provided in Appendix 4 and the location of the quadrats is displayed in Figure 6, Figure 7, Figure 8. Tozer *et al.* (2010) has been used to assist in determining the classification of the vegetation communities and pasture areas, details this analysis are also provided in Appendix 4.

The vegetation within the yellow polygons (Figure 7 and Figure 8) is described as pasture and exotic weeds, however, it may meet the definition of degraded remnant vegetation as scattered regenerating canopy species are present, often only as regenerating saplings, typically Swamp She-oak *Casuarina glauca*. These areas of vegetation within the yellow polygons have been included within the area of River-flat Eucalypt Forest in this report.

There is a record in the Atlas of NSW Wildlife of a Cumberland Land Snail adjacent to the site. According to the Ecology Assessment, less than one hour in autumn was spent undertaking searches for this species. OEH considers this is unlikely to be an adequate level of survey effort for this species, given the size of the remnant on site. Further targeted surveys are likely to be required pre-clearing.

Response: The suitable habitat for this species was low in this area. Figure 14, Figure 15, Figure 16 and Figure 18 display the lack of bark and coarse woody debris on the ground. Thus only a short period of survey for the snail was considered necessary. However, Further surveying and suitable movement to the Ropes Creek Tributary can be undertaken during the pre-clearance survey or also earlier as required by the consent authority.



Additionally Abel Ecology considered that in the area where Swamp She-oak *Casuarina glauca* dominated it was unlikely that the Cumberland Land Snail would be present as it was not their suitable habitat. The following enquiry was emailed to Dr Stephanie Clark to investigate. Dr Clark studied the Cumberland Land Snail for her PhD and she has also published studies on this species in peer-reviewed journals.

Abel Ecology: *"Hello Stephanie, Please tell me if you think CPW snails inhabit semi-saline areas dominated by Swamp She-oak Casuarina glauca?"*

Dr Stephanie Clark: *"If the area has saline influence then I would assume that species such as Meridolum would not be present. If there is CPW extending to the edge of the saline zone then it might be possible to find snails but once in the Casuarina proper I would not expect it as the leaf litter layer is different etc."*

The mitigation measures listed in section 10 include the recommendation that if any fauna are located prior to clearing, that they are translocated to the Conservation Area of Cumberland Plain Woodland adjacent to the M4. If such a proposal was to be undertaken, a Translocation Plan in accordance with the "Policy for the Translocation of Threatened Fauna in NSW" (OEH 2001) will need to be prepared.

Response: The proposal has been modified to include the retention of indigenous vegetation along the Ropes Creek Tributary, that is the area adjacent to the proposal area rather than the Conservation Area adjacent to the M4. If any fauna are located in a pre-clearing survey they will be relocated to the existing remnant vegetation along the Ropes Creek Tributary. It is assumed that most, possibly all fauna that may be found will most likely be common rather than threatened species. The only threatened fauna likely to be resident in the area are Cumberland Plain Land Snails or perhaps threatened microbats may be roosting temporarily in one of the hollows. Other threatened fauna may use this area but are likely to be



transient and thus are unlikely to be encountered during the pre-clearance survey.

The mitigation measures also include the recommendation to install nest boxes in the Conservation Area. However, there is no description of the Conservation Area provided in the Ecology Assessment, or how the installation of nest boxes may impact on resident fauna. Also, no information is provided on the maintenance of these nest boxes, so it is unclear whether their installation is likely to offset fauna impacts in the long term.

Response: The proposal has been modified so that the recommended location for the installation of nest/roosting boxes will be within the retained remnant vegetation along the Rope's Creek Tributary. It is recommended in this report that the nest/roosting boxes are installed at least two weeks prior to the vegetation clearing works. This will assist in resident fauna becoming familiar with the new nesting and roosting boxes. A description of the remnant vegetation along Rope's Creek Tributary is provided in Section 5.2.3 and part of Section 5.2.4.

While the Conservation Area is not being proposed as area to place the nest or roosting boxes a description of the area is still provided in Appendix 5. Installation of nesting/roosting boxes will have a positive benefit on resident fauna. Currently on the site there is a lack of hollow-bearing trees, this is true both within the remnant vegetation along the Rope's Creek Tributary and within the remnant vegetation in the Conservation Area. There is also a lack of suitable habitat in the form of hollows or hollow substitutes (nesting and roosting boxes) in the wider locality.

Maintenance of the nest boxes can be undertaken annually. A recommendation of this report is that an annual inspection of nest and roosting boxes be undertaken, if any nest or roosting boxes are damaged or have fallen out of a tree then they will be replaced. An additional 20% of nest and roosting boxes will be installed above that required. Thus the installation and maintenance of the nest and roosting boxes will assist in offsetting fauna impacts in the long term.



The Ecology Assessment states that the proposal does not require a species impact statement (SIS), however an SIS is never required for State Significant Developments.

Response: The report has been amended to state that Species Impact Statements are never required for State Significant Developments.

2. Aboriginal Cultural Heritage

Only one of the five paragraphs within the letter from OEH discussing Aboriginal Cultural Heritage is relevant to the Ecological Assessment. This paragraph is produced below:

The ACHAR further states that some of the sites in the northern part of the site will be protected in a conservation offset area, but no further details have been provided about this, particularly the purpose of the conservation offset area (is it for cultural or environmental reasons) and about the mechanisms for protecting the conservation offset area in perpetuity.

Response: A description of the existing SEPP59 area is described in Section 5.2.3 and part of Section 5.2.4. This report recommends that this area be used as a biodiversity offset (conservation). However, this area may also be used to accommodate items of Aboriginal Cultural Heritage. See the Cultural Heritage report for further details.

8.2 Letter from Blacktown Council

Only relevant extracts or comments to ecological assessment from the letter from Blacktown Council and the review by Jacobs will be provided below.

8.2.1 Comments from Blacktown Council

The landscaping plans are considered to lack vital detail regarding the height of proposed species. The landscaping plan is required to be amended to clearly show all proposed plant species and the height of the species.



Response: This report contains recommended species for use in landscaping. It is recommended that the landscape plan lists and describes the estimated height of each species.

The proponent shall clearly demonstrate on the site plans that no works are proposed within 40m of the creek.

Response: Works are proposed within 40 m of the Rope's Creek Tributary. The southern boundary of the development footprint will be approximately 20 m north of the Rope's Creek Tributary. The document "*Guidelines for riparian corridors on waterfront land*" provides information applicable to this proposal. It is available from <http://www.water.nsw.gov.au/Water-licensing/Approvals/Controlled-activities/Controlled-activities>. However, note on this website it is called "Riparian Corridor" rather than the full name.

Part of a 1st order mapped watercourse will be removed for the proposal. Gina Potter of the NSW Office of Water has been contacted to confirm that this is acceptable to the NSW Office of Water.

A Vegetation Management Plan for the Ropes Creek Tributary can be prepared as required.

All works near the creek shall be stabilised and details of measures to be applied to ensure the on-going stabilisation and maintenance of this area shall be submitted from review.

Response: An Erosion and Sediment Control Plan has been prepared by AT&L. This plan will assist in the stabilisation of the soil near the creek (Rope's Creek Tributary) during the proposed building and construction works. It is recommended that outlet structures must be designed and installed so they are consistent with the following publications of the NSW Office of Water requirements.

Ongoing maintenance of the erosion and sediment control structures has been specified on the plans. A recommendation of this report is that the



following words (or similar) be included as text on all Erosion and Sediment Control plans related to the proposal.

“Erosion and sediment control structures are to be inspected and maintained if required after each rainfall event.”

A Vegetation Management Plan for the Ropes Creek Tributary will be prepared when requested by the NSW Department of Planning and Environment.

8.2.2 Comments from Jacobs – Independent Consultant

Commonwealth – Only listed threatened species and ecological communities were identified as a potential trigger for MNES [Matters of National Environmental Significance] under the EPBC Act. Appendix G indicates that impacts are not likely to be significant. It is noted that whilst the Proponent may be able to make a determination about whether impacts are likely to be significant, only the Commonwealth can ultimately decide whether or not an action is a controlled action.

Response: The Commonwealth provides has published two documents that are relevant to the proposal and whether a referral to the Australian Government Department of the Environment on whether assessment and approval is required under the EPBC Act. The two documents are:

1. Matters of National Environmental Significance – Significant impact guidelines 1.1 *Environment Protection and Biodiversity Conservation Act 1999*. Commonwealth of Australia 2013. (Available from: http://www.environment.gov.au/system/files/resources/42f84df4-720b-4dcf-b262-48679a3aba58/files/nes-guidelines_1.pdf)
2. Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest – A guide to identifying and protecting the nationally threatened ecological community – *Environment Protection and Biodiversity Conservation Act 1999* Policy Statement 3.31. Commonwealth of Australia 2010. (Available from: <http://www.environment.gov.au/system/files/resources/3c01d3d1->



c135-4d91-a605-f5730975d78c/files/cumberland-plain-shale-woodlands.pdf)

On page 1 of the document *Matter of National Environmental Significance – Significant impact guidelines* it states:

These guidelines outline a 'self-assessment' process, including detailed criteria, to assist persons in deciding whether or not referral may be required.

On page 11 of the document *Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest – A guide to identifying and protecting the nationally threatened ecological community* the following flow chart is provided (see below on the following page).

The only vegetation present within the proposal footprint that is classified as Cumberland Plain Woodland is the patch of vegetation in the north-eastern corner. The questions in the flow chart are answered as follows:

1. *Are native tree species present with a minimum projected foliage cover of 10%?*

Answer: Yes

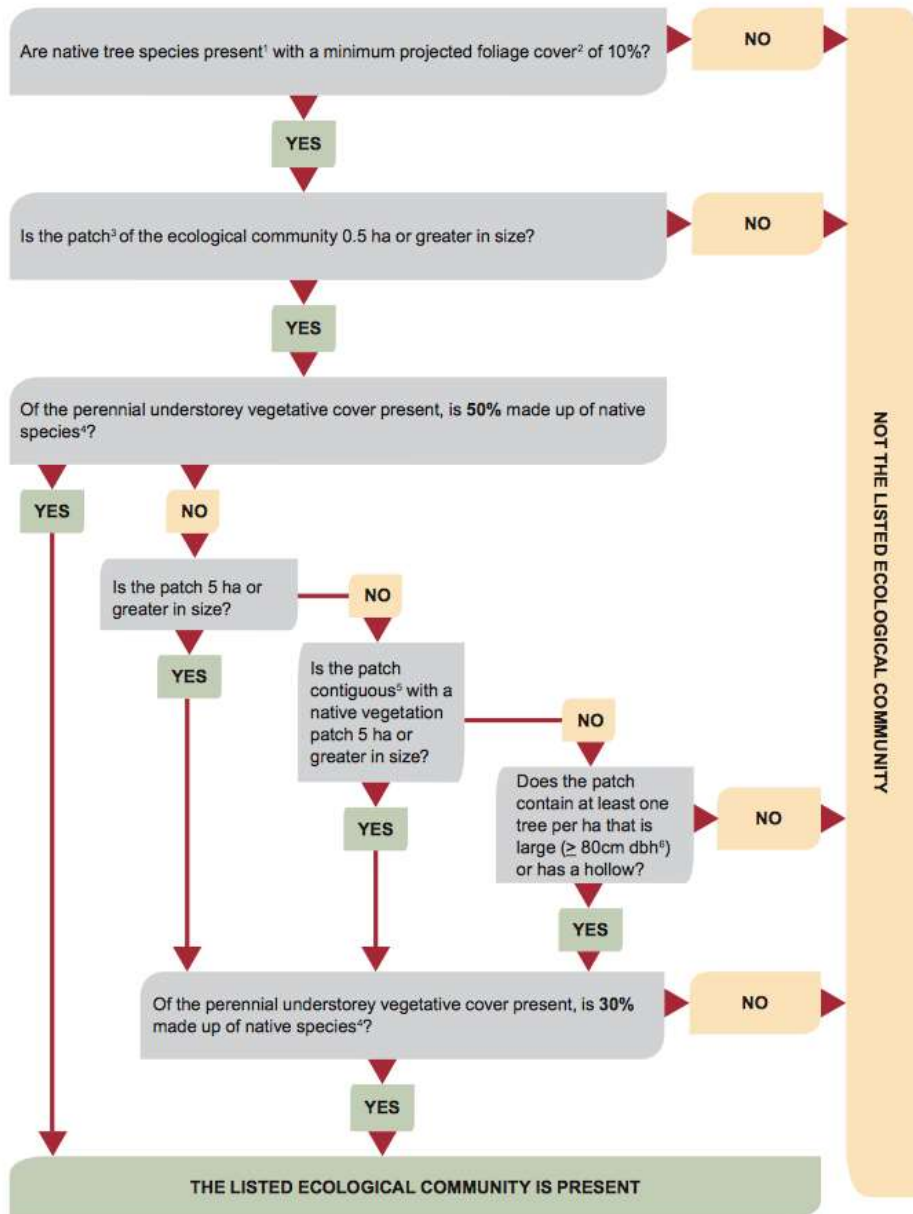
2. *Is the patch of the ecological community 0.5 ha or greater in size?*

Answer: Yes (If the patch is considered to be continuous with the site to the east (Lot 5 DP1145808). The adjoining site was not surveyed, however, parts of the adjoining site could be viewed from the survey area. The site to the east has been extensively modified as steep batters have been constructed at some time in the past. Figure 12 and Figure 13 displays the sloped batters and the vegetation on the batters.

If the patch is consider to be only the patch within the site, its size is approximately 0.27 ha. Thus if the patch is considered to only be within the site the answer to this question is no and the conclusion is "Not the listed community"



Flowchart of key diagnostic features and condition thresholds to identify the Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community





3. Of the perennial understorey vegetative cover present, is 50% made up of native species (and additional questions listed in the flowchart).

Answer: To move through the flow chart to get to question 3, the patch must be larger than 0.5 ha in size. The patch can only be considered to be larger if the patch is considered to include the areas of vegetation on the batter on the adjoining lot (Lot 5 DP114580) and other areas on the adjoining site. The vegetation within the 0.27 ha does not meet the criteria of having a perennial understorey cover present greater than 50%, nor does it contain a hollow in a tree that is larger (or equal to) 80 cm dbh. A hollow bearing tree was recorded in the 0.27 ha patch but it was less than 80 cm dbh. The listed community can only be considered to exist if there was greater than 30% native species (on average) over the area of the patch both on the site and the adjoining site. While the vegetation within the 0.27 ha patch meets the 30% criteria, the vegetation on the adjoining site, including the batters, and roads or tracks does not appear to meet this criteria. Thus again the conclusion is "Not the listed Ecological Community"

Zone E2 is not a prescribed zone and hence cannot rely on the ISEPP [State Environmental Planning Policy (Infrastructure)] rather it would be subject to the specific provisions of SEPP (WSEA) [State Environmental Planning Policy (Western Sydney Employment Area)]. Under SEPP (WSEA) the development would be prohibited in this zone. Notwithstanding, the development would not have any physical impact on this zone. Furthermore section 89E (3) of the EP&A Act provides that for SSD [State Significant Development]. "Development consent may be granted despite the development being partly prohibited by an environmental planning instrument".

The EIS indicates an intention that the E2 zoned land be subdivided for future employment land (ie: Lot 10 approx. 10.6 ha). This would not be consistent with the provisions of SEPP (WSEA).

Response: The proposal includes the subdivision of the site and part of the site contains the E2 zone. Remnant vegetation will be retained within Lot 10. The



E2 zone was presumably originally mapped coarsely as illustrated below by the following aerial photographs. The first coloured aerial photo below displays the E2 zone boundary in white as well as the proposed boundaries for Lot 10. The second aerial photo from 1986 shows that a road located in the south-east corner had been constructed well before the designation of the E2 zone. The road area is likely to be highly disturbed and presumably has been graded, possibly excavated, filled and compacted. The proposal does not include the subdivision of the higher quality Cumberland Plain Woodland.

Therefore the proposed subdivision is consistent with the E2 zone objective:

To protect, manage and restore areas of high ecological, scientific, cultural or aesthetic values. Lot 10 creates an individual lot containing high ecological value bushland which can be managed as appropriate. Any E2 zone that is present in the other lots, namely Lots 5, 6 and 10 can be assessed at a future date when a development application for these lots is lodged.



Figure 19. Recent aerial photo with the proposed cadastral boundaries and E2 zone displayed.

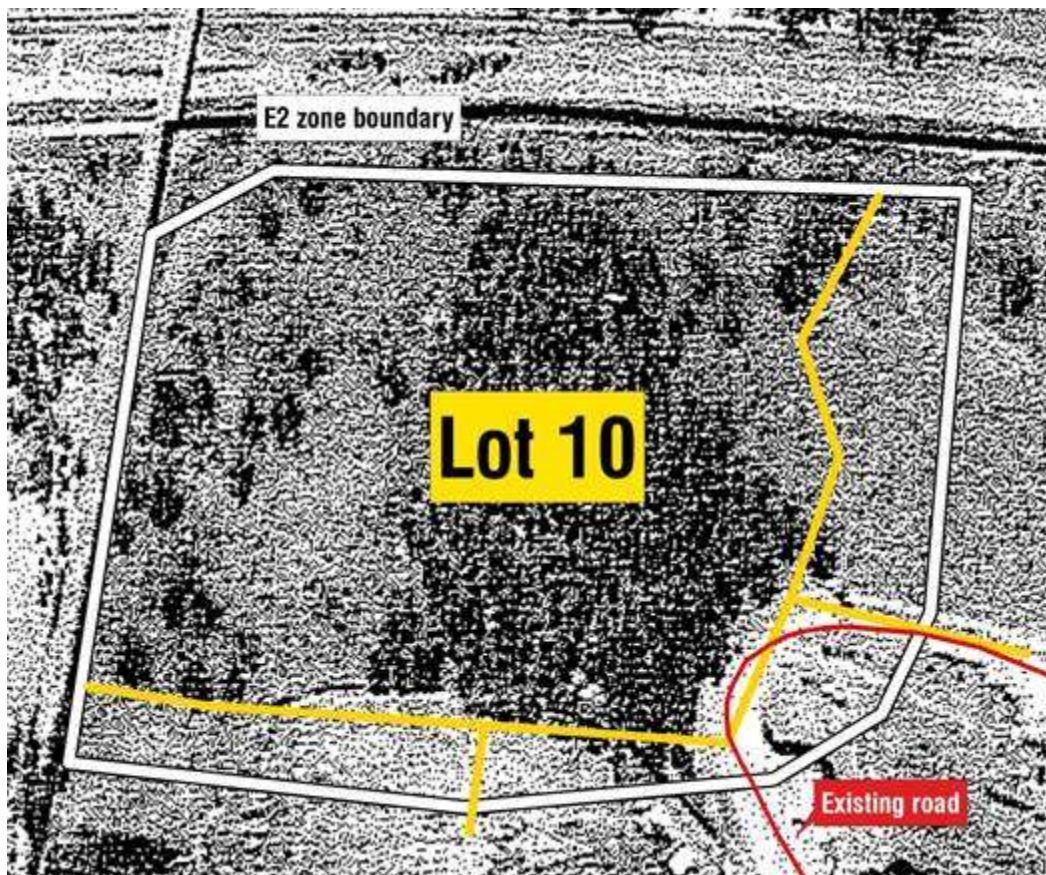


Figure 20. Aerial photo from 1986 with the proposed cadastral boundaries and E2 zone displayed. Note the existing road is present within the E2 zone.

As indicated above sub-division of the E2 zone land as future employment land would not be consistent with the Structure Plan which assigns this land for environmental protection.

Response: As discussed above the higher quality bushland will be retained within Lot 10. No subdivision of the higher quality bushland within the E2 zone is proposed. It appears that the E2 zone was only originally coarsely mapped as it clearly includes exiting infrastructure such as the road, that have little if any direct relevance to bushland conservation or presumably other values of the E2 zone.

Results of previous contamination investigations undertaken by ADI P/L (1995) indicated contamination of soils and sediments in the eastern



area of the site and within direct drainage pathways due to the adjacent asphalt manufacturing plant.

Recent Phase 1 and 2 contamination investigations (ADE Consulting P/L 2014) conclude that no contamination of the site from potential contaminating practices undertaken on and off site have occurred and that concentrations of potential contaminants with soil, sediment and surface water samples were below the applied criteria.

ADE Consulting conclude that the site is deemed suitable for the commercial/industrial land use and the proposed development.

The sampling densities imposed for the Phase 2 sampling and analytical event are not considered to be in accordance with the NSW EPA Sampling Design Guidelines (1995). Vegetation appears to have prohibited access and for inspection and assessment at many areas on site. The relatively shallow depth of assessment (0.5 meters Below ground surface) does not allow for an opinion on the potential depth of contamination. Ecological investigation levels have not been applied to soil samples for all of the soils assessed.

Based on the relatively low sampling density compared to the size of the site, and the limits for access across many areas of the site, there remains the potential for unexpected occurrences of contamination to be encountered during the construction phase.

Response: This response from Jacobs is only indirectly relevant to ecology. It has been included as it described a potential source of salinity discussed in Section 4.1.4 of this report.

Brookfield Multiplex state that they operate under ISO14001 accredited environmental management system (EMS), including regular inspections, audits and reporting requirements. Under the application, a Construction Environmental Management Plan (CEMP) has been submitted. The CEMP nominates environmental management strategies to form the key controls under the CEMP., including:

- Risk registers to identify aspects and impacts and risk workshops;
- Environmental management plans and environmental work method statements;
- Environmental site inspections.



Key erosion and sediment controls are to be contained in the Erosion and Sediment Control Plan (CEMP Appendix C). No details regarding any specific erosion or sediment controls are contained in Appendix 6. Detailed erosion and sediment control plans and systems are required.

Specific development area is approximately 20 hectares. Earthworks associated with general site construction activities, including:

Bulk earthworks and piling;

Internal roadways, underpass connection between TNG Facility and Waste Facility;

- Staff amenities;*
- Staff car parking*
- Water detention and treatment basins,*
- Sewerage, water supply, communication and power supply services.*

Dewatering from groundwater wells is proposed to lower water levels to facilitate construction activities. Direct discharge to stormwater and the Ropes Creek Tributary is proposed. There is insufficient detail contained in the EIS to support direct discharge to Ropes Creek Tributary. There is insufficient detail contained in the EIS to support dewatering activities to facilitate excavations below the water table. Detailed investigations to support dewatering and the disposal of pumped/collected water is required

Response: Much of the above relates to other documentation. This report will responds to two details required above.

1. Erosion and Sediment Control - The following recommendations is included in this report. All sediment and control plans that display downslope edges of the development footprint must conform to the following requirements.

- i. Erosion and sediment control structures are to be installed prior to any earthworks commencing.
- ii. Erosion and sediment control fencing or a similar structure must be erected along all downslope edges of the proposal footprint,



particularly along the entire length of the southern and western boundaries of the proposal footprint.

- iii. Erosion and sediment control structures are to be inspected and maintained if required after each rainfall event.

2. Groundwater. Abel Ecology has been advised by AT&L that no groundwater is anticipated to be encountered, thus no groundwater will be pumped out. AT&L base this on the following information: The PSM geotechnical report states that no groundwater was encountered in any boreholes or test pits apart from BH23 which is located around 300 m away from the proposed waste bunkers. Furthermore in BH23 the groundwater was due to a perched water table, rather than being from a general elevation of the water table.

AT&L also received advice from PSM (Agustria Salim) that groundwater surrounding the proposed waste bunkers should not present any problems for construction or hydrostatic pressures until the quarry is filled and this is not anticipated to occur for many years. An allowance has been made on the current documentation for future proofing the waste bunkers from hydrostatic pressure by specifying several 150 mm diameter agricultural poly pipe lines surrounding the waste bunkers and an empty man hole for future installation of a pump if needed. However, this is only a pre-emptive installation for a requirement that may arise in many years time.

Thus no dewatering is anticipated for the current project.

CEMP Water Quality Management Sub-plan includes objectives, targets and KPI's associated with surface and groundwater quality. Assessment of potential surface and groundwater impacts is contained within Proposed Energy from Waste Facility, Eastern Creek (SSD6236) Soil and Water, IGGC P/L June 2014. Key features associated with stormwater management include:

- *Majority of site surfaces will be impervious, with open gutters pits and underground pipes to an on-site detention basin located in south west corner of development area;*



- *EfW, lay-down areas substation and roadways linked by piped stormwater drainage systems to the bio-retention basin.*

Tipping hall design floors are higher than roadway levels and containment systems are proposed to deliver all drainage to an internal drainage containment system. Volumes of leachate and/or contaminated process water generated as part of the EfW process are stated to be small and be collected and evaporated via the thermal treatment process. Effective separation of stormwater drainage from potentially contaminated areas is required to ensure the stormwater drainage system is protective

Proposed re-use of stormwater run-off on site is expected to require 100% of available collected water.

Discharge of excessively high peak flows leading to increased erosion and flood risk has been identified in the EIS. Inadequate treatment or characterisation of discharged stormwater or groundwater could impact on the receiving aquatic environment.

Risks to groundwater quality are considered low, based on the proposed impermeable surfaces over the majority of the site and the proposed surface water collection and containment systems.

Further investigation of salinity conditions should be undertaken to identify high risk salinity areas close to drainage lines and monitoring programs designed to establish baseline and operational water quality values.

Response: The following information is based on the details in the report by AT&L (Report no 14-187-5001-03 Rev 03 February 2015) and discussions with Russell Hogan (AT&L).

The proposal has been modified so that surface stormwater will be directed to the bio-retention basins. Roof stormwater will be collected for reuse. Any overflow of the roof water re-use system during high rainfall periods will be directed to the bio-retention basin.



Ash and other by-products generated by the EFW process will be retained within the building and disposed of in an appropriate manner. Any water used within the buildings will be directed to an internal drainage system that is completely separate to the stormwater system that is directed to the Bio-retention basin and Rope's Creek.

Discharged stormwater will be managed so that it meets or exceeds the SEPP59 WSUD requirements. This will mitigate against any potential impacts on the receiving aquatic environment. No extraction and discharge of groundwater will occur during the construction phase. It is anticipated that no groundwater will be extracted for many years from within the EFW facility until after leachate pumping from the Genesis Facility landfill ceases (Ian Grey Groundwater Consulting Report Rev D February 2015).

The report by Ian Grey Groundwater Consulting (Rev D February 2015) also further describes salinity. This report states:

"The proposed development involves construction of large areas of hard surfaces, and provision of a formal stormwater drainage system for the site. Vegetation removal will be limited to pasture and minor scrub. This will result in a reduction in rainfall recharge and therefore some reduction in both shallow groundwater levels and incidence of surface waterlogging."

Thus salinity along the Rope's Creek Tributary may actually decrease over the long term by implementation of the proposal.

Potential for the EFT process to result in contamination of stormwater drainage system if effective separation of stormwater drainage from potentially contaminated areas is not undertaken. These areas include:

- *Tipping hall;*
- *Flue gas treatment and energy recovery system;*
- *Residue handling and treatment area*



- Areas/systems used for handling, treatment and disposal of contaminated process water, including any leachate generated in the tipping hall.

Laydown area pads no 1 through 5 are all up-gradient from Ropes Creek Tributary. The bio-retention basin is directly adjacent to and up-gradient to the Ropes creek Tributary. These areas pose a significant risk to water quality and the local catchment, if not managed appropriately.

Measures to prevent contamination of stormwater include:

- EfW process to be undertaken within roofed buildings, limiting the potential for leaching of contaminants from incoming waste to process residue;
- Design floors, internal drainage systems, grated drains, wash-down areas. Tipping hall design floor and related infrastructure is designed to be contained within a closed system to allow collection and reuse of stormwater.

Proposed development includes excavations of up to 15 meters below ground surface. CEMP Water Quality Management Sub-plan includes incomplete information regarding the proposed abstraction of groundwater for construction purposes.

Water demand for the EfW plant is understood to be provided by collection and storage of rainwater runoff from roof areas, re-use of stormwater from bio-retention basins and top-up from Sydney Water mains.

Previous land usage has altered the flow regime and water quality of the riparian corridor and Ropes Creek Tributary. Further information is required regarding surface water quality and groundwater quality. Additional baseline monitoring should be undertaken to allow appropriate pre-development and operational monitoring requirements.

Response: The following information is based on the details in the report by AT&L (Report no 14-187-5001-03 Rev 03 February 2015) and discussions with



Russell Hogan (AT&L) as well as the report by Ian Grey Groundwater Consulting (Rev D Feb 2015).

1. Contamination of stormwater – Stormwater that may be contaminated generated from within the EFW building/s will be contained within a separate closed system. This water is not discharged to the bio-retention basins or into the Rope's Creek Tributary.

Groundwater extraction – No extraction of groundwater during the building process is anticipated. It is anticipated that no groundwater will be extracted for many years from within the EFW facility until after leachate pumping from the Genesis Facility landfill ceases (Ian Grey Groundwater Consulting Report Rev D Feb 2015).

The proposal has been modified so that water entering the bio-retention basins will not be reused. Water entering the bio-retention basin will be managed so that it meets or exceeds the requirements of SEPP59 WSUD and will then be discharged to the Rope's Creek Tributary.

8.3 ARUP Adequacy Assessment

Potential impacts to surface and groundwater are assessed in Appendix P and described briefly in Section 15.4. Although significant impacts are not identified, the ecological implications of potential changes to groundwater should be considered, particularly in relation to the Threatened Ecological Community on site and the riparian corridor. Appendix P indicates that further investigations into groundwater contamination is occurring, although significant problems are not anticipated. If available, this work should be included in the EIS for completeness. Reference is made to a Stormwater Management Plan that has been prepared by AT&L in 2014. This Plan should be appended to the EIS (not available in the copy provided for review - this may be a reference to the Civil Infrastructure Report in Appendix E, but it is not clear). Section 22.0 references a flood report, however it does not appear too appended; this should be included if available. The design measures to control surface water runoff and potential contamination



are well described. Further Information on management controls and monitoring should be provided.

Response: The following information within this Response is based on the details in the report by AT&L (Report no 14-187-5001-03 Rev 03 February 2015) and discussions with Russell Hogan (AT&L). No groundwater is proposed or anticipated to be extracted during the construction phase of the proposal. In the distant future, perhaps twenty to forty years time or longer the extraction of groundwater may be required. Some infrastructure has been included in the present proposal to future proof this possibility. Groundwater extraction even at this later date is considered to be minor.

Thus no impact to the threatened ecological community along the Rope's Creek Tributary is anticipated.

Stormwater generated from hard ground surfaces on the site will flow to the bio-retention basins and then will flow to the Rope's Creek Tributary to assist in providing water for the riparian vegetation. Stormwater water will be treated so it matches or exceeds the requirements of SEPP 59. Stormwater treatment is designed to meet the following Water Sensitive Urban Design (WSUD) target reductions:

- 85% Total Suspended Solids (TSS)
- 65% Total Phosphorus (TP)
- 45% Total Nitrogen (TN)
- 90% Total Hydrocarbons
- 90% Gross Pollutants (GP)

Ash and other by-products generated during operation of the EFW plant will be retained within the building and disposed of via a separate process. The stormwater is a completely separate system and ash generated by the EFW process will not be directed to the bio-retention basin and similarly will not flow into the Rope's Creek Tributary.

Appendix P provides an overview of historical soil contamination investigations undertaken in relation to minor levels of contamination associated with the nearby Asphalt Plant. These investigations should be



attached if available. Further assessment is recommended in Appendix P; the main body of the EIS should describe the extent of this further work and provide a description of treatment measures proposed during construction.

Response: This report will only address salinity as a potential soil contamination issue. All other soil contamination issues are not addressed in this report.

It is assumed that some of the raised salinity levels adjacent to the south-east corner of the Rope's Creek Tributary may have arisen from the contamination generated by the nearby asphalt plant. However Ian Grey Groundwater Consulting has also described an alternate possibility. Further details are found in Section 4.1.4 of this report.

An assessment of the direct impacts of the project on threatened species, populations and communities and their habitat has been made. There has been no assessment of any indirect impacts however, including noise, water quality, changes to hydrology, introduction of weeds or light impacts. In particular, further assessment of indirect impacts on the ecology of the flora and fauna of the Roper Creek tributary corridor and the 9ha of the critically endangered Cumberland Plain Woodland within the study area is warranted. Should indirect impacts be identified, the project may require referral under the Environmental Protection and Biodiversity Conservation Act 1999. It is acknowledged that the 0.2ha patch of Cumberland Plain Woodland to be removed does not meet Conservation Advice published by the Commonwealth Government, however there is no discussion on whether any offsets are still warranted at a state level. Despite this patch not meeting the significance criteria, further discussion on protection and ongoing management of this area in accordance with the conservation advice should be provided. Further information on the long-term monitoring and management of revegetated areas and fauna protection measures e.g. bat boxes, would be beneficial.

Response: This comment includes the following issues that are discussed in numerical order below:



Indirect impacts on the 9 ha of Cumberland Plain Woodland

The most obvious indirect impacts on the 9 ha of critically endangered Cumberland Plain Woodland are the existing impacts primarily from the M4, this includes existing traffic noise, both day and night, light impacts from vehicle headlights and taillights at night. No impacts are anticipated that on hydrology or water quality from the proposal which are likely to impact on the 9 ha of Cumberland Plain Woodland. The proposal will remove a large area of pasture that also contains weeds and this will be replaced over time with buildings and other areas of hard surfacing. This will significantly reduce the number of weeds in the locality. If a VMP is prepared then, if required, weed management of the area within the development footprint can occur prior to occupation.

Indirect impacts on the Rope's Creek Tributary

The Rope's Creek Tributary also currently experiences noise and disturbance in the form of noise and other impacts from adjoining areas as well as the cattle that regularly graze within this area. However, the noise and light impacts are likely to increase after the commencement of the proposal. The proposal may impact on the Rope's creek Tributary during two different phases. Phase one is the construction phase and phase two is the operational phase. Phase one will include civil works to create reasonably level building pads as well as the construction of buildings.

Increases in light and noise will increase during both phases. Most, possibly all of the more mobile fauna, known in the area such as Kangaroos, both megabats and microbats and birds using the habitat within the Ropes Creek Tributary will forage over a wider area including areas next to the M4. Thus these species will all have experienced higher levels of noise and light, and are unlikely to be impacted by changes in noise and light.

If after earthworks large areas of soil are left exposed a recommendation of this report is to sow a cover grass such as a cereal wheat *Triticum aestivum*, Triticale x *Triticosecale* or another suitable annual species, if sowing is undertaken in the cooler months or billion-dollar grass *Echinochloa*



frumentacea if the sowing is undertaken in summer. Note: these grasses are not known to naturalise and thus will not create an ongoing weed problem. Sowing with annual grasses will both reduce the open areas of soil available to weeds and assist in stopping erosion.

Changes to hydrology and water may occur from the proposal, however, the proposal has been designed to minimise these impacts through the following. Stormwater will be collected and flow into the bio-retention basin. Water discharging from the bio-retention basin will flow from two exits one near the eastern end of the bio-retention basin and one near the western end. These two discharge points will deliver water to approximately half the length of the Ropes Creek Tributary. The eastern section of the Ropes Creek Tributary will still receive water flowing from the adjoining site to the east. Stormwater flowing to the Rope Creek Tributary will meet or exceed the requirements of SEPP59 WSUD.

No impacts to the 9 ha of Cumberland Plain Woodland adjacent to the M4 are anticipated. Thus it is not necessary to refer the proposal to the Commonwealth for assessment under the EPBC Act.

Offsets for the removal of the 0.2 ha are included within the recommendations of this report. Offsets for the both the Cumberland Plain Woodland (Cumberland Shale Hills Woodland) and the River Flat Eucalypt Forest (Cumberland River Flat Forest) are recommended as part of regeneration and revegetation of the SEPP59 riparian corridor and the southern batters of the proposal area and batters of the bio-retention basin.

Monitoring and management of the revegetated areas can be included in a VMP if one is required. Monitoring and management of fauna nest and roosting boxes (eg: bat boxes) can be undertaken annual through an inspection of each of the fauna nest or roosting boxes and replacement of any box if required.



9. Impact on flora and fauna

9.1 Long-term prospects with no development or maintenance

Grazing is likely to continue on the site. Exotic pasture species and weed species are likely to remain high. Recruitment (germination and establishment) of indigenous *Eucalypt* species is below that expected for an intact community. Areas of indigenous vegetation within the survey area are likely to persist in a similar form for many decades, perhaps with increasing numbers of weeds in the groundcover layer. It is difficult to determine the long-term (100s of years) prospects for the areas of indigenous vegetation.

Feral fauna is likely to remain common on the site.

9.2 Proposal and impact

9.2.1 Short-term impact

All vegetation, including pasture, approximately 0.27 ha of Cumberland Plain Woodland and approximately 2.89 ha Eucalypt River-flat forest, the eight habitat trees and the farm dam, which are within the proposal footprint will be cleared.

The proposal will retain approximately 1.29 ha.

Removal of weeds including noxious and environmental weeds within the proposal footprint will be of benefit to the surrounding locality.

A recommendation of this report is the replanting/regeneration of approximately 4.98 ha of River Flat Eucalypt Forest, 0.54 ha of Cumberland Plain Woodland and planting of 0.32 ha of indigenous wetland species within the bottom of the bio-retention basin. An additional recommendation of this report is the installation of 20 fauna boxes within the retained trees in the 1.29 ha of River Flat Eucalypt Forest.



9.2.2 Long-term impact

Long-term impacts will be similar to short-term impacts. However, appropriate landscaping plantings, the installation of bat roosting boxes and the offset planting of indigenous vegetation including areas of both Cumberland Plain Woodland and River Flat Eucalypt Forest around the bio-retention basin, along the southern boundary of the development footprint and other parts of the SEPP59 area will provide habitat for indigenous flora and fauna.

Emissions from the EFW plant are unlikely to significantly affect indigenous flora and fauna as they will be required to meet standards suitable for humans.

9.2.3 Stormwater

Stormwater falling within the development footprint will be directed to the bio-retention basin proposed for construction along part of the southern boundary of the development footprint.

It is recommended that all stormwater generated within the development footprint be diverted and filtered by a gross pollutant trap prior to entry into the proposed bio-retention basin if required by SEPP59.

9.3 Principles of avoid, mitigate, offset

Measures to avoid impacts

Some areas of remnant indigenous vegetation have been retained and thus clearing has been avoided. Approximately 1.29 ha of River-flat Eucalypt Forest will be retained south of the proposal footprint.

However an area of approximately 0.27 ha of Cumberland Plain Woodland and 2.89 ha of River Flat Eucalypt Forest will be cleared for the proposal. Clearing on these areas has not been avoided, but will be offset.

Lot 10 adjacent to the M4 will contain the Cumberland Plain Woodland within the E2 zone.



Measures to mitigate against impacts

Mitigation of some impacts will be achieved by the following actions:

1. Potential erosion will be mitigated through the use of sediment fencing adjacent to the downslope edge of the development footprint.
2. Stormwater quality discharged from the site will meet or exceed the requirements of SEPP59 and thus this will mitigate against potential impact of poor water quality. It is recommended that the bio-retention basin be planted with local indigenous wetland species to create wetland habitat.
3. A pre-clearance survey will be undertaken and any vertebrate fauna and Cumberland Plain Land Snails captured will be moved to the retained area of River Flat Eucalypt Forest to the south of the development footprint.
4. Use of locally indigenous flora in landscape planting is a recommendation of this report.
5. Weeds will be removed within the development proposal footprint. This will mitigate against further weed spread.

Offset measures

Offsetting will be achieved within the SEPP59 area along the Ropes Creek Tributary and also on the batters surrounding the Bio-retention basin and the batters to the south of the development footprint. Figure 11 displays the offset areas. Approximately 0.54 ha of Cumberland Plain Woodland will be regenerated or replanted for the 0.27 ha that will be removed and approximately 4.98 ha of River Flat Eucalypt Forest will be regenerated or replanted for the 2.89 ha that will be removed. The River Flat Eucalypt Forest will be regenerated and replanted within the SEPP59 Ropes Creek Tributary riparian corridor.

The location of offsets is displayed in Figure 11.

The loss of hollow-bearing trees will also be offset through the installation of fauna roosting/nesting boxes within the retained River Flat Eucalypt Forest along the Ropes Creek Tributary. For each of the hollow-bearing trees



removed two nesting or roosting boxes must be installed within the Ropes Creek Tributary. The total number of fauna boxes recommended to be installed is twenty, an additional 20% has been included.

9.4 Impact on floral and faunal species, populations and communities

9.4.1 Seven-part test summary

Habitat requirements for locally occurring threatened faunal species, and the presence or absence of such habitat on the site, is tabulated in Appendix 7. Threatened plant species, listed in the TSC and EPBC Acts are shown in Appendix 8.

Under Section 5A of the EP&A Act several factors (listed in Appendix 1) need to be considered in deciding whether there is likely to be a Significant effect on threatened species, populations or ecological communities, or their habitats.

Species Impact Statements are never required for State Significant Development.

While the overall proposal incorporates mitigating considerations and offsets, these are not taken into account in determining the outcome of the seven-part tests.



Table 7. Summary of the seven-part tests shown in full in Appendix 1

Species/Communities	Recorded in survey area	C'wealth listing EPBC Act '99	State listing TSC Act '95	Result
Insectivorous bats Eastern False Pipistrelle <i>Falsistrellus tasmaniensis</i> Large-eared Pied Bat <i>Chalinolobus dwyeri</i> Eastern Freetail-bat <i>Mormopterus norfolkensis</i> Eastern Bentwing-bat <i>Miniopterus schreibersii oceanensis</i> Greater Broad-nosed Bat <i>Scoteanax rueppellii</i> Yellow-bellied Sheath-tail-bat <i>Saccolaimus flaviventris</i> Little Bentwing-bat <i>Miniopterus australis</i> Southern Myotis <i>Myotis macropus</i>	Yes	- Vulnerable - - -	Sch. 2, Vul. Sch. 2, Vul. Sch. 2, Vul. Sch. 2, Vul. Sch. 2, Vul. Sch. 2, Vul. Sch. 2, Vul. Sch. 2, Vul.	No significant effect
Threatened Owls Powerful Owl <i>Ninox strenua</i> Barking Owl <i>Ninox connivens</i> Masked Owl <i>Tyto novaehollandiae</i>	No	- - -	Sch 2, Vul. Sch 2, Vul. Sch 2, Vul.	No significant effect
Threatened Raptors Little Eagle <i>Hieraaetus morphnoides</i> Square-tailed Kite <i>Lophoictinia isura</i>	No	- -	Sch 2, Vul. Sch 2, Vul.	No significant effect
Little Lorikeet <i>Glossopsitta pusilla</i>	No		Sch 2, Vul.	No significant effect
Grey-headed Flying-fox <i>Pteropus poliocephalus</i>	No	Vulnerable	Sch 2, Vul.	No significant effect
Green and Golden Bell Frog <i>Litoria aurea</i>	No	Vulnerable	Sch. 1, End	No significant effect
Threatened water birds Painted Snipe <i>Rostratula benghalensis</i> Freckled Duck <i>Stictonetta naevosa</i>	No		Sch 2, Vul Sch 2, Vul	No significant effect
Cumberland Plain Land Snail <i>Meridolum corneovirens</i>	No		Sch. 1, End	No significant effect
River-flat Eucalypt Forest	Yes		Endangered	No significant effect
Cumberland Plain Woodland	Yes	Critically Endangered	Crit End	No significant effect
Threatened Plants <i>Acacia pubescens</i> , <i>Dillwynia tenuifolia</i> , <i>Grevillea juniperina</i> subsp. <i>juniperina</i> , <i>Isotoma (Hypsela) sessiliflora</i> , <i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> , <i>Pilularia novae-hollandiae</i> and <i>Pimelea spicata</i> .	No	Vulnerable Endangered	Sch 2, Vul Sch 2, Vul Sch 2, Vul Sch. 1, End Sch. 1, End Sch. 1, End Sch. 1, End	No significant effect



10. Planning Instruments

10.1 Environment Protection and Biodiversity Conservation Act 1999

Cumberland Plain Woodland is protected under Commonwealth legislation by the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act 1999) and is listed as Critically Endangered. The provisions of the EPBC Act apply to this proposal. The outcome is not significant, however, and does not require referral to the Commonwealth.

10.1.1 Criteria Critically Endangered and Endangered Ecological Communities

An action has, will have, or is likely to have a significant impact on a critically endangered or endangered ecological community if it does, will, or is likely to:

- a. lead to a long-term adverse effect on an ecological community, or
- b. reduce the extent of a community, or
- c. fragment an occurrence of the community, or
- d. adversely affect habitat critical to the survival of an ecological community, or
- e. modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for the community's survival, or
- f. result in invasive species that are harmful to the critically endangered or endangered community becoming established in an occurrence of the community*, or
- g. interfere with the recovery of an ecological community.

(*Introducing an invasive species into the occurrence may result in that species becoming established. An invasive species may harm a critically endangered or endangered ecological community by direct competition, modification of habitat, or predation.)

The proposal is to clear approximately 2,700 m² of the Critically Endangered Cumberland Plain Woodland. This will result in a net loss for this ecological community on the site. However, a 2,700 m² patch is not considered part of



the Listed Ecological Community by the Commonwealth Government. See Section 8.2.2 for further details.

However, there is approximately 9 ha of Cumberland Plain Woodland within the site which is not proposed for removal, that is located adjacent to the M4. No impact to the large patch of 9 hectares of Cumberland Plain Woodland is anticipated by the present proposal.

10.2 EP & A Act section 79C

What effect would development have on the maintenance of biodiversity and:

- 1. Protection and management of critical habitats; threatened species, populations, ecological communities or their habitats; and other protected species - see any recovery plans or threat abatement plans under Threatened Species Conservation Act?**

The proposal will remove approximately 2700 m² of Cumberland Plain Woodland and approximately 2.89 hectares of River-flat Eucalypt Forest, eight potential habitat trees, a farm dam and approximately 22.5 ha of grazing land will be removed for the proposal.

- 2. adjacent wilderness areas and national parks - see any conservation agreements and plans of management under the National Parks and Wildlife Act?**

There are no adjacent wilderness areas or national parks.

- 3. Wildlife corridors and remnant vegetation?**

The closest significant wildlife corridors are the riparian vegetation to the west along Ropes Creek and a portion of the Western Sydney Parklands near Wallgrove Road. The wildlife corridor values of the closest area of the Western Sydney Parklands, adjacent to Wallgrove Road, are presently unlikely to be high, as this portion of Western Sydney Parklands is presently degraded.

Regeneration and replanting of the Ropes Creek Tributary with local indigenous species will assist in the provision of a wildlife corridor. However, it



is unlikely to provide a fully vegetated corridor to the west as it is interrupted by the existing power easement.

4. The relationship of vegetation to soil erosion/stability and water cycle?

Existing vegetation is likely to significantly assist in the mitigation of soil erosion within the survey area. The existing vegetation is also likely to slow the flow of water to the south and west and assist with infiltration of this water into the soil. A soil erosion management plan is a recommendation of this report. This will assist in mitigating the likelihood of erosion during on-site works. It is assumed that after completion of the building works the majority of the stormwater will be directed to the bio-retention basin along part of the southern boundary of the development footprint.

5. Weeds, feral animal activity, vermin and disease?

Weeds are likely to be significantly reduced within the development footprint. The proposal is unlikely to significantly increase vermin or disease within the site.

If after earthworks large areas of soil are left exposed a recommendation of this report is to sow a cover grass such as a cereal wheat *Triticum aestivum*, Triticale x *Triticosecale* or another suitable annual species, if sowing is undertaken in the cooler months or billion-dollar grass *Echinochloa frumentacea* if the sowing is undertaken in summer. Note: these grasses are not known to naturalise and thus will not create an ongoing weed problem. Sowing with annual grasses will both reduce the open areas of soil available to weeds and assist in stopping erosion.

6. Disturbance to native fauna and habitats?

The proposal will disturb native fauna as existing habitat will be removed. Highly mobile fauna will easily disperse to other areas of suitable habitat, such as the retained 9 hectares of Cumberland Plain Woodland. Nearly all habitat for indigenous flora and fauna beneath the proposal footprint will be removed. Some indigenous species such as microbats and birds will still probably forage within the development footprint.



7. The amount and location of vegetation disturbance and clearance?

Approximately 24.4 ha of vegetation will be removed, including a large area of grazing pasture noxious and environmental weeds, exotic species as well as indigenous vegetation. Areas of indigenous vegetation proposed for removal include approximately 2700 m² of Cumberland Plain Woodland, approximately 2.89 hectares of River-flat Eucalypt Forest, approximately 970 m² of indigenous vegetation within the dam as well as indigenous herbaceous species within the pasture.

8. New vegetation - species selection, placement and purpose?

A recommendation of this Flora and Fauna Report is the inclusion of appropriate indigenous landscaping plantings within the development and the offset planting of indigenous vegetation around the bio-retention basin proposed along the southern boundary, also on the proposed batters and as well as both regeneration and replanting within the SEPP59 riparian corridor.

11. Recommendations

I. Fencing and signs

- iii. A fence consisting of at least star pickets and a single strand of wire must be installed adjacent to the southern boundary of the development footprint. Signs must be placed at 100 m intervals along the fence stating "No entry protected vegetation" or similar. The fence and the signs must be installed prior to the commencement of any on-ground works. The fence and signs will reduce the likelihood of any accidental entry by earthmoving machinery or machinery involved in vegetation clearing entering the vegetation to be retained along the Ropes Creek tributary. The fence and signs must remain in place until the completion of all building works on any part of the development footprint.



2. Vegetation Clearing

- iv. No vegetation clearing work is to commence on site until supervised by the project ecologist.
- v. A pre-clearance fauna survey must be conducted prior to the removal of vegetation on the site. Fauna will be moved to the area of retained and regenerated or revegetated River Flat Eucalypt Forest and Cumberland Plain Woodland south along the Rope's Creek Tributary.

3. Removal of habitat trees

The proposed removal of hollow-bearing trees must take place prior to the commencement of any earthworks. At least 100m of logs including the hollows must be relocated to the area of Cumberland Plain Woodland adjacent to the M4. The logs can be cut into manageable pieces. This will provide additional habitat for ground dwelling fauna.

For each of the hollow-bearing trees removed two nesting or roosting boxes must be installed within the Ropes Creek Tributary. Thus twenty (20) fauna roosting boxes or nesting boxes must be installed in retained trees within the Ropes Creek Tributary, this includes an additional 20% as discussed in this report. The next/roosting boxes must be installed at least two weeks prior to the vegetation clearing works. Each box must be inspected annually to ensure that it is still functioning adequately, and if required it must be replaced. Any nesting or roosting boxes that are damaged or have fallen out of the tree must be replaced or re-installed as required.

4. Removal of dam

The existing dam will be filled and the earth reshaped to provide a building platform. Prior to filling of the dam, the dam must be drained and any native fauna are to be moved to wet areas within the retained Ropes Creek Tributary. This activity must be supervised by an experienced and qualified ecologist.



5. Offsets for removal of indigenous vegetation

Approximately 0.54 ha of Cumberland Plain Woodland will be regenerated through weed control and replanting in the south-western portion of the SEPP59 riparian corridor.

Approximately 4.98 ha of River-Flat Eucalypt Forest will be regenerated through weed control and planting along the SEPP59 riparian corridor on the Ropes Creek Tributary. Part of the planting of River Flat Eucalypt Forest will also occur on the batters of the building platform and the batters around the bio-retention basin.

Details of the regeneration and weed control works can be specified in a Vegetation Management Plan for the Ropes Creek Tributary as required.

6. Stormwater management

Stormwater quality discharged from the site must meet or exceed the requirements of SEPP59. A gross pollutant trap can be included in the stormwater management system as required.

Outlet structures must be designed and installed so that they are consistent with the requirements of the NSW Office of Water.

7. Landscaping

- i. **Landscape Plantings.** Appropriate indigenous species must be included in any landscape plantings. These have been derived from the indigenous vegetation community Cumberland Plain Woodland. Appropriate species include

Trees – Eucalyptus tereticornis, Eucalyptus crebra, Eucalyptus longifolia, Eucalyptus eugenioides, Corymbia maculata, Eucalyptus sideroxylon.

Shrubs – Acacia decurrens, Acacia parramattensis, Indigophora australis, Melaleuca decora.



Groundcovers – *Themeda australis/triandra*, *Microlaena stipoides*, *Dichondra repens*, *Imperata cylindrica*, *Dianella longifolia*.

Note: the above list is for plantings within the development footprint. It is not a list of species for use for regeneration or replanting within the SEPP59 area.

The landscape plan is to list all proposed plant species and describe the estimated height of each species.

- ii. **Planting near and around basins.** These species have been derived from Riverflat Eucalypt Forest:

Trees – *Angophora floribunda*, *Eucalyptus amplifolia*, *Casuarina glauca*.

Shrubs – *Acacia decurrens*, *Acacia floribunda*, *Acacia parramattensis*, *Melaleuca linearifolia*, *Melaleuca styphelioides*, *Melaleuca erubescens*

Groundcovers – *Dianella longifolia*, *Lomandra longifolia*, *Commelina cyanea*, *Dichondra repens*, *Pratia purpurascens*, *Oplismenus aemulus*, *Goodenia ovata*, *Scaevola albida*.

Groundcover on edge of basin – *Juncus usitatus*, *Carex appressa*, *Paspalum distichum*.

- iii. Planting of indigenous vegetation around the two water storage dams along the southern boundary of the development footprint will provide habitat for indigenous flora and fauna.

8. Provision of fauna nesting or roosting boxes

- ii. Prior to the removal of the eight habitat trees, for each of the hollow-bearing trees removed two nesting or roosting boxes must be installed within the Ropes Creek Tributary. The total number of fauna boxes recommended to be installed is twenty, an additional 20% has been included.
- iii. Habitat boxes are to be installed by a qualified and experienced ecologist to ensure correct placement and suitable sizes are installed relevant to the species within the region.



- iv. Some boxes must be suitable for microbats, while others must be suitable for birds or arboreal mammals.

9. Soil management

- i. Erosion and sediment control structures are to be installed prior to any earthworks commencing. Erosion and sediment fences must be installed down-slope of the development footprint.
- ii. Erosion and sediment control fencing or a similar structure must be erected along all downslope edges of the proposal footprint, particularly along the entire length of the southern and western boundaries of the proposal footprint.
- iii. Erosion and sediment control structures are to be inspected and maintained if required after each rainfall event.

10. Soil and potential weed management

If after earthworks large areas of soil are left exposed, it is recommended that a cover grass such as a cereal wheat *Triticum aestivum*, Triticale x *Triticosecale* or another suitable annual species is sown, if sowing is undertaken in the cooler months or billion-dollar grass *Echinochloa frumentacea* if the sowing is undertaken in summer. Note: these grasses are not known to naturalise and thus will not create an ongoing weed problem. Sowing with annual grasses will both reduce the open areas of soil available to weeds and assist in stopping erosion.

11. Stormwater management

- i. Any stormwater generated within the development footprint must pass through a gross pollutant trap prior to the entry into the proposed water storage dams along the southern boundary of the development footprint.



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Appendix 1. Seven-part tests

While the overall proposal incorporates mitigating considerations and offsets, these are not taken into account in determining the outcome of the seven-part tests.

The Assessment of Significance (NSW Department of Environment and Climate Change, August 2007) states that “*Proposed measures that mitigate, improve or compensate for the action, development or activity should not be considered in determining the degree of the effect on threatened species, populations or ecological communities, unless the measure has been used successfully for that species in a similar situation.*”

Insectivorous bats

Eastern False Pipistrelle *Falsistrellus tasmaniensis*

Large-eared Pied Bat *Chalinolobus dwyeri*

Eastern Freetail-bat *Mormopterus norfolkensis*

Eastern Bentwing-bat *Miniopterus schreibersii oceanensis*

Greater Broad-nosed Bat *Scoteanax rueppellii*

Yellow-bellied Sheath-tail-bat *Saccolaimus flaviventris*

Little Bentwing-bat *Miniopterus australis*

Southern Myotis *Myotis macropus*

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

Eastern False Pipistrelle prefers moist habitats, with trees taller than 20 m. It generally roosts in Eucalypt hollows but has also been known to occupy space under loose bark and buildings. It forages for beetles, moths and other flying insects.

Large-eared Pied Bat is most likely to forage for small flying insects below the forest canopy. Its daytime roosts include caves, mine tunnels and the abandoned, bottle-shaped mud nests of Fairy Martins. It is found in a variety



of dry habitats, including the dry sclerophyll forests and woodlands to the east and west of the Great Dividing Range.

Eastern Freetail Bat roosts in tree hollows and forages above the canopy and in uncluttered habitats. It feeds on a variety of flying insects, such as moths, ants, cockroaches and grasshoppers, foraging mainly in forests on richer soils.

Eastern Bentwing-bat roosts in caves, old mines, stormwater channels and comparable structures including buildings. It forages in well-timbered valleys above the canopy.

Greater Broad-nosed Bat catches large beetles and other slow-flying insects. It inhabits a variety of habitats including woodlands through to rainforest, though not at altitudes above 500 m. The more open vegetation is preferred by this species due to its style of flight, but in denser habitats it overcomes difficulties by using natural and man-made openings in the forest.

Yellow-bellied Sheathtail-bat feeds in and above the canopy but comes lower to the ground in open country or mallee. It roosts in tree hollows or the abandoned nests of Sugar Gliders.

Little Bentwing-bat forages for small insects beneath the canopy of densely vegetated habitats of moist eucalypt forest, rainforest or dense coastal Banksia scrub. Daytime roosts include caves, tunnels and sometimes tree hollows.

Southern Myotis generally roosts in groups of 10-15 in caves, mine shafts, under bridges, stormwater channels, buildings and hollow bearing trees, which are found close to water. They forage over pools, dams and streams catching fish with their feet across the water surface.

The proposed activity requires the clearing of approximately 24.4 ha of vegetation, including the removal of hollow-bearing trees and a dam within the proposed development footprint. Approximately 95% of the proposal area consists of areas of grazing pasture.



Additionally, these species are known to forage in a modified environment, thus the clearing of approximately 24.4 ha of disturbed native vegetation is unlikely to have an adverse effect, particularly with the green corridor of Ropes Creek in a nearby locality. Subsequently, the life cycle of these species is such that a viable population will not be placed at the risk of extinction.

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

Not applicable. This test is for a group of threatened species.

c. In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

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

Not applicable. This test is for a group of threatened species.

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

Not applicable. This test is for a group of threatened species.

d. In relation to the habitat of a threatened species, population or ecological community:

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

Approximately 24.4 ha of potential foraging habitat will be cleared or modified. Also seven potential habitat trees that may provide roosting habitat will be removed for the proposal. Most bats known to occur in the area that are likely to use the proposal footprint will continue to forage on areas of pasture nearby. These species are also known to forage around



houses and in gardens, so are likely to still forage around buildings after the completion of the various developments within the proposal footprint.

None of the habitat proposed for removal is suitable for foraging by the Large-footed Myotis. This species requires areas of open water without vegetation. This habitat type is not present within the proposal footprint.

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

No. This group of species is highly mobile. The clearing or modification of 24.4 ha is unlikely to isolate or fragment habitat for these species.

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

Low. Clearing or modification of 24.4 ha of foraging habitat, as well as the removal of eight potential roosting trees is unlikely to have any significant effect on these species at local or regional scales.

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

No. Critical habitat has not been declared for these species.

f. whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

No. A National recovery plan exists for Large-eared Pied Bat, but none exist for the remaining species. However, a number of priority actions have been identified for each of these species, as indicated in brackets after each name: Eastern False Pipistrelle (16), Large-eared Pied Bat (17), Eastern Freetail-bat (18), Eastern Bentwing-bat (25), Greater Broad-nosed Bat (18), Yellow-bellied Sheath-tail-bat (21), Little Bentwing-bat (25), and Southern Myotis (15).



The clearing of native vegetation is not consistent with the intent of any priority actions or objectives of recovery plans. Similarly the removal of potential roosting trees for those species that require them is not consistent with the overall aims of any existent recovery plans or priority actions.

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

Yes. Although building construction is not listed as a key threatening process, the proposed development will require the “Clearing of native vegetation” and the “Removal of hollow-bearing trees” which are key threatening processes relevant to these species. Key threatening processes are listed under the TSC Act, 1995 and the Commonwealth’s EPBC Act, 1999.

Conclusion

The proposed activity is unlikely to have a significant effect on Eastern False Pipistrelle, Large-eared Pied Bat, Eastern Freetail-bat, Eastern Bentwing-bat, Greater Broad-nosed Bat, Yellow-bellied Sheath-tail-bat, Little Bentwing-bat or Southern Myotis.



Large Forest Owls

Powerful Owl *Ninox strenua*

Barking Owl *Ninox connivens*

Masked Owl *Tyto novaehollandiae*

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

No. The proposal is unlikely to have an adverse effect on Large Forest owls due to the high mobility of these species and limited quantity of suitable foraging habitat on site. It is unlikely that a viable local population of any of these species will be placed at risk of extinction by the proposal.

No owls were observed using the hollow-bearing trees during the site survey. Similarly no owls were recorded during the survey.

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

Not applicable. This test is for a group of threatened species.

- c. In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed;**

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

Not applicable. This test is for a group of threatened species.



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

Not applicable. This test is for a group of threatened species.

d. In relation to the habitat of a threatened species, population or ecological community:

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

Approximately 24.4 ha of potential foraging habitat will be cleared, however the majority of the 24.4 ha is marginal foraging habitat at best. The proposal area is dominated by pasture grasses with only a small area of fragmented bushland present in the north eastern corner of and south-eastern corner of survey area.

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

No. These species are highly mobile and the size of the impact area is small when compared with their foraging ranges.

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

Low to Negligible. The site is heavily disturbed with cleared areas predominant. While these species may forage on site, the habitat potential is not high, and there is abundant natural habitat available off site in the nearby Ropes Creek green corridor.

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

No. Critical habitat has not been declared for these species.



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

No. A recovery plan exists for Large Forest Owls, which includes Powerful Owl and Masked Owl while a draft Recovery Plan exists for Barking Owl. The proposal is unlikely to modify potential breeding habitat for Powerful Owl, Masked Owl or Barking Owl, as the hollow present in the habitat trees were generally smaller than that or at a lower height than that used by these owls.. However, neither the clearing of native vegetation nor the removal of marginal breeding habitat in the form of hollows is generally not consistent with the objectives of these recovery plans.

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

Yes. Although building construction is not listed as a key threatening process, the proposed development will require the "Clearing of native vegetation" and the "Removal of hollow-bearing trees" which are key threatening processes relevant to these species.. Key threatening processes are listed under the TSC Act, 1995 and the Commonwealth's EPBC Act, 1999.

Conclusion

The proposed activity is unlikely to have a significant effect on Powerful Owl, Barking Owl or Masked Owl.



Threatened Raptors

Little Eagle *Hieraaetus morphnoides*

Square-tailed Kite *Lophoictinia isura*

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

No. These species are highly mobile and have very large home ranges. The preferred habitat of riparian forest and open woodland/ agricultural land is available elsewhere within the district. Therefore it is highly unlikely to have an adverse effect such that a local population of any of these species will be placed at risk of extinction.

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

Not applicable. This test is for a group of threatened species.

- c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed;**

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

Not applicable. This test is for a group of threatened species.

- (ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction**

Not applicable. This test is for a group of threatened species.



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

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

Approximately 24.4 hectares of foraging habitat will be removed or altered for the proposal.

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

No. These species are highly mobile, the proposal is unlikely to cause significant fragmentation or isolation of habitat. Similar habitat is available elsewhere in the study area.

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

Low. Similar habitat is available elsewhere in the study area. it is highly unlikely long-term survival of locally occurring populations will be adversely affected by the proposed works.

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

No. Critical habitat has not been declared for these species.

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

No. There are no recovery plans available for these species, however three priority actions have been identified for Square-tailed Kite. The threats common to these species include the disturbance of foraging habitat, nesting sites and the clearing of habitat. The clearing of native vegetation is not consistent with the intent of any priority actions or objectives of recovery plans. While the proposed works will clear or modify 24.4 ha of foraging habitat, the effect is not considered significant.



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

Yes. Although building construction is not listed as a key threatening process, the proposed development will require the "Clearing of native vegetation" which is a key threatening processes relevant to these species. Key threatening processes are listed under the TSC Act, 1995 and the Commonwealth's EPBC Act 1999.

Conclusion

The proposed activity is unlikely to have a significant effect on Little Eagle or Square-tailed Kite.

Cumberland Plain Land Snail *Meridolum corneovirens*

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

No. This species was not recorded within the survey area, however, this species has been recorded previously elsewhere on the site. The survey area is degraded because of clearing of habitat, as well weed invasion. Vegetation to be removed for the proposal is potentially suitable habitat for the snail; however, no snails were recorded during targeted searches in the survey area. Moreover, bark and coarse woody debris is scarce in most of the River Flat Eucalypt Forest. The works are highly unlikely to significantly affect the life cycle of the species or place any viable local population at risk of extinction.

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

Not applicable. This test is for a group of threatened species.



c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed;

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

Not applicable. This test is for a group of threatened species.

- (ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction**

Not applicable. This test is for a group of threatened species.

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

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

The suitable habitat for this species occurs within the River-flat Eucalypt Forest. Approximately 2.89 hectares of Eucalypt River-flat Forest will be removed for the proposal. However, not all of the River-flat Eucalypt forest is suitable habitat. No snails were recorded during targeted searches in the survey area. Therefore, proposed works are unlikely to impart any significant effect on this species.

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

No. Approximately 2.89 ha potentially containing some areas of suitable habitat within the River-flat Eucalypt Forest will be removed for the proposal. The remaining 1.29 ha of the River-flat Eucalypt Forest will not be more fragmented or isolated than the present situation, although less potential habitat will be available.



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

Low. The vegetation to be removed for this proposal is unlikely to have an effect on the long-term survival of the species.

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

No. Critical habitat has not been declared for this species.

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

No threat abatement plan or recovery plan exists for this species. However the proposal is unlikely to be consistent with the priority actions as potential habitat will be removed.

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

Yes. Although building construction is not listed as a key threatening process, the proposed development will require the "Clearing of native vegetation", "Removal of Dead Wood and Dead Trees" and "Bushrock removal" which are key threatening processes relevant to this species, the amount of potentially suitable habitat to be removed would be small and is unlikely to significantly impact this species. Key threatening processes are listed under the TSC Act, 1995 and the Commonwealth's EPBC Act, 1999.

Conclusion

The proposed activity is unlikely to have a significant effect on Cumberland Plain Land Snail.



Grey-headed Flying-fox *Pteropus poliocephalus*

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

No. The proposed works will require removal of few trees including Eucalypts, which are foraging habitat for this species. No roosting camps were observed within the survey area. The removal of the Eucalypt trees for the proposal, is unlikely to have a significant effect on this species as similar habitat is widespread in the region and these species are highly mobile.

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

Not applicable. This test is for a group of threatened species.

- c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed;**

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

Not applicable. This test is for a group of threatened species.

- (ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction**

Not applicable. This test is for a group of threatened species.



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

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

The proposed works will remove 2700 m² of Cumberland Woodland and 2.89 hectare of River Flat Eucalypt Forest which both contain suitable foraging tree species. However, parts of the River Flat Eucalypt Forest are dominated by Swamp She-oak *Casuarina glauca*. This tree does not produce nectar during flowering and thus does not provide suitable foraging habitat for the Grey-headed Flying-fox.

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

No. Grey-headed Flying-fox is a highly mobile species with home ranges in excess of 50 km. The proposed works require the removal patches of foraging habitat, which is not likely to fragment or isolate habitat for this species.

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

Low. As this species is highly mobile the removal of habitat is unlikely to adversely affect the ongoing survival of this species. Any individuals that forage on the site will have the same opportunities to forage in nearby habitats.

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

No. Critical habitat has not been declared for this species.



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

Yes. There is a draft national recovery plan (2009) for Grey-headed Flying-fox. Removal of habitat and disturbance of camps are threats for this species. No Grey-headed roosting sites (camps) were observed within the study area. The removal of foraging habitat is not consistent with the overall aims of the recovery plan.

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

Yes. Although building construction is not listed as a key threatening process, the proposed development will require the "Clearing of native vegetation" which is a key threatening process relevant to this species. Key threatening processes are listed under the TSC Act, 1995 and the Commonwealth's EPBC Act, 1999.

Conclusion

The proposed activity is unlikely to have a significant effect on Grey-headed flying-fox.

Green and Golden Bell Frog *Litoria aurea*

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

No. The proposal will not have a significant impact on Green and Golden Bell Frogs. Despite there being suitable habitat on-site for this species, none were observed or heard during the survey. In addition, a past surveys at this site by AMBS and Keystone Ecological (the results of both surveys were detailed in the Keystone Ecological report (2007) recorded no Green and Golden Bell Frogs. Therefore, proposed works including vegetation clearing and dam filling are unlikely to have an adverse effect such that a local viable population will be placed at risk of extinction.



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

Not applicable. This test is for a group of threatened species.

- c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed;**

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

Not applicable. This test is for a group of threatened species.

- (ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction**

Not applicable. This test is for a group of threatened species.

- d) In relation to the habitat of a threatened species, population or ecological community:**

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

The dam is approximately 970 m² in size and this is the approximate area of suitable habitat for this species that will be removed for the proposal.

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

No significant increase in fragmentation or isolation of habitat for this species is likely to result from the proposal. Farm dams are generally already separated in the environment. Similar habitat appears to be present elsewhere in the study area.



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

Low-negligible. While suitable habitat will be removed for the proposal, no individuals were recorded during this survey or earlier surveys.

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

No. Critical habitat has not been declared for this species.

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

Yes. A draft recovery plan exists for the Green and Golden Bell Frog. The removal of potential habitat is unlikely to ever be consistent with the overall aims of any recovery plan.

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

Yes. Although building construction is not listed as a key threatening process, the proposed development will require the "Clearing of native vegetation" which is a key threatening process relevant to this species. Key threatening processes are listed under the TSC Act, 1995 and the Commonwealth's EPBC Act, 1999.

Conclusion

The proposed activity is unlikely to have a significant effect on the Green and Golden Bell Frog.



Little Lorikeet *Glossopsitta pusilla*

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

No. This species is highly mobile and generally prefers larger areas of contiguous habitat. The habitat present within the survey area is in two different somewhat isolated patches. The area of suitable habitat for this species within the survey area is the Cumberland Plain Woodland (possible nesting habitat and foraging habitat) and the River-flat Eucalypt Forest (foraging habitat and potential nesting habitat). If the habitat is used within the survey area is it highly likely that it is only occasionally used. It is unlikely that a viable local population of the Little Lorikeet would be placed at risk of extinction from proposed works.

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

Not applicable. This test is for a threatened species.

- c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed;**

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

Not applicable. This test is for a threatened species.

- (ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction**

Not applicable. This test is for a threatened species.



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

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

The proposed works will remove 2700 m² of Cumberland Woodland and 2.89 hectare of River-flat Eucalypt Forest which both contain suitable foraging tree species. The proposal will also remove eight habitat trees, some of which may contain suitable nesting hollows.

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

No. This species is highly mobile, the proposal is unlikely to cause significant fragmentation or isolation of habitat for this species.

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

Negligible-low. The vegetation to be removed for this proposal is unlikely to have an effect on the long-term survival of the species.

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

No. Critical habitat has not been declared for this species.

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

No. A recovery plan exists for Little Lorikeet. Clearing of native vegetation and the removal of hollow-bearing trees is generally not consistent with the intent of any priority actions (6) or objectives of the recovery plan.



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

Yes. Although building construction is not listed as a key threatening process, the proposed development will require the "Clearing of native vegetation" and the "Removal of hollow-bearing trees" which are key threatening processes relevant to this species. Key threatening processes are listed under the TSC Act, 1995 and the Commonwealth's EPBC Act, 1999.

Conclusion

The proposed activity is unlikely to have a significant effect on the Little Lorikeet.

Water Birds

Painted Snipe *Rostratula benghalensis*

Freckled Duck *Stictonetta naevosa*

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

No. The clearing of the dam, which is approximately 970 m² in size, is unlikely to have an adverse effect on the lifecycle or population of these species. These species are highly mobile and there is quality habitat available off site, which suggests any individuals that may use the site would also forage off site. It is unlikely that a viable local population would be placed at risk of extinction from proposed works.

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

Not applicable. This test is for a group of threatened species.



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

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

Not applicable. This test is for a group of threatened species.

- (ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction**

Not applicable. This test is for a group of threatened species.

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

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

Approximately 970 m² of potential foraging habitat will be removed.

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

No. These species are highly mobile, the proposal is unlikely to cause significant fragmentation or isolation of habitat for these species.

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

Negligible. The vegetation to be removed for this proposal is unlikely to have an effect on the long-term survival of these species.



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

No. Critical habitat has not been declared for these species.

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

No. A recovery plan exists for Freckled Duck and Painted Snipe. The clearing of native vegetation is not consistent with the objectives of any priority actions (5 for each species) or objectives of the recovery plan.

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

Yes. Although building construction is not listed as a key threatening process, the proposed development will require the "Clearing of native vegetation" which is a key threatening process relevant to these species. Key threatening processes are listed under the TSC Act, 1995 and the Commonwealth's EPBC Act, 1999.

Conclusion

The proposed activity is unlikely to have a significant effect on these species.



River-flat Eucalypt Forest

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

Not applicable. This test is for an endangered ecological community.

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

Not applicable. This test is for an endangered ecological community.

- c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed;**

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

No. While the proposal will reduce the extent of the ecological community, this community extends both over the subject land as well as the adjacent land to the east and south. It is approximately 4.18 hectares in size on the site and appears to also be present on the adjoining site to the east.

The local occurrence of this community is not likely to be placed at a significantly greater risk of extinction than already present. The proposal will reduce the extent of the patch of Eucalypt River-flat forest as approximately 2.89 ha of the patch lies within the development footprint. However, this is unlikely to place the ecological community at an increased risk of extinction because the remaining area will have similar viability to the existing area. The existing ecological community is degraded and recruitment (germination and establishment) of new indigenous canopy Eucalyptus is low, perhaps as a result of the cattle grazing the young Eucalyptus saplings. Recruitment of the *Casuarina glauca* is generally good, this may be occurring through suckering



from the root systems of existing trees rather than germination and establishment from seed.

Indigenous shrubs are uncommon to rare and the proposal is unlikely to significantly modify the frequency of germination and recruitment for shrubs within this ecological community.

The groundcover layer is degraded and dominated in some areas by exotic weeds, such as Spike Rush *Juncus acutus*. Groundcover weeds probably represent the greatest threat for the indigenous groundcover layer.

(ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

No. An approximately similar composition of plant species will remain in the 1.29 hectares of Eucalypt River-flat forest that is not proposed for removal.

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

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

The development footprint overlaps an area of approximately 2.89 hectares, comprised of single trees and patches of trees of the endangered ecological community Eucalypt River-flat forest. All of this 2.89 hectare will be removed.

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

No. Approximately 1.29 hectares of Eucalypt River-flat forest will remain south of the development footprint. The existing area of approximately 4.18 hectares on the site is already isolated. Isolation or fragmentation is unlikely to increase with the proposed action.



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

Low.

The quality of this patch of endangered ecological community is low. It is highly disturbed suffering both from weed invasion and possibly from altered soil conditions. Larger patches of ecological communities are nearly always on average more viable than smaller patches. However, the other significant impacts on this community such as weed invasion and possibly altered soil conditions are also highly likely to be having an effect on the long-term survival of this patch of Eucalypt River-flat Forest.

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

No. Critical habitat has not been declared for this endangered ecological community.

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

No.

The removal of an area of the endangered ecological community Eucalypt River-flat Forest, even a degraded area is unlikely to be consistent with the overall aims of any recovery plan.

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

Yes. The proposed development will require the "Clearing of native vegetation" and the "Removal of hollow-bearing trees" which are key threatening processes relevant to this ecological community. Key threatening processes are listed under the TSC Act, 1995 and the Commonwealth's EPBC Act, 1999.



Conclusion

The proposed activity is unlikely to have a significant effect on the endangered ecological community Eucalypt River-flat Forest.

Cumberland Plain Woodland

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

No. Within the survey area there is approximately 2700 m² of degraded Cumberland Plain Woodland present in the north-east corner of the development footprint. This will be removed for the proposal. Approximately 9 hectares of better quality Cumberland Plain Woodland is present on the site adjacent to the M4. There is no proposal to remove the area of Cumberland Plain Woodland adjacent to the M4.

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

Not applicable. This test is for an endangered ecological community.

- c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed;**
- (i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**

The patch of approximately 2700 m² beneath the footprint will be removed. The 9 hectares within the site adjacent to the M4 will remain. It is highly unlikely that the viability of the 9 hectares will be significantly adversely affected.



(ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

No. This ecological community is present in at least two patches on the site. One is the 2700 m that will be removed for the proposal, and the second much larger patch of 9 ha adjacent to the M4 that will not be impacted by the proposal. The loss of the 2700 m² patch is highly unlikely to adversely modify the composition of the 9 ha of Cumberland Plain Woodland adjacent to the M4. The 9 ha is highly unlikely to receive significant amounts of pollen or seed from the 2700 m² patch, and thus does not rely on the smaller patch for its viability.

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

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

Approximately 2700 m² of habitat of Cumberland Plain Woodland will be removed for the proposal. This is approximately 2% of the local occurrence within the site. The aerial photo and the report indicate other areas off-site.

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

Yes. The adjoining site to the east was not surveyed. It is assumed that site may potentially contain Cumberland Plain Woodland, however it may only consist of indigenous trees such as Red Forest Gum *Eucalyptus tereticornis* on fill. Thus, the proposal will increase isolation for the trees remaining off-site to the east. However, some connectivity for the fragment to east will remain because some of the canopy species that occur in Cumberland Plain Woodland also occur within the River-flat Forest. Also a large area of Cumberland Plain Woodland (adjacent to the M4) and various patches within the grazing land to the south will still provide exchange of genetic material through pollen and possible seed for some floral species.



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

Low.

The most important areas of Cumberland Plain Woodland in the locality are the 9 ha adjacent to the M4 on the site and another larger patch approximately 1 km to the north-east also adjacent to the M4. It is unlikely that this patch of 2700 m² provide significant support to either of these patches.

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

No. Critical habitat has not been declared for this endangered ecological community.

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

No.

The removal of an area of Cumberland Plain Woodland, even a degraded area is unlikely to be consistent with the overall aims of the recovery plan.

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

Yes. The proposed development will require the "Clearing of native vegetation" which is a key threatening process relevant to this ecological community. Key threatening processes are listed under the TSC Act, 1995 and the Commonwealth's EPBC Act, 1999.

Conclusion

The proposed activity is unlikely to have a significant effect on Cumberland Plain Woodland.



Threatened plants

Acacia pubescens, *Dillwynia tenuifolia*, *Grevillea juniperina* subsp. *juniperina*, *Isotoma (Hypsela) sessiliflora*, *Marsdenia viridiflora* subsp. *viridiflora*, *Pilularia novae-hollandiae* and *Pimelea spicata*.

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

No. None of these species were observed within the survey area.

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

Not applicable. This test is for a group of threatened species.

- c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed;**

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

Not applicable. This test is for a group of threatened species.

- (ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction**

Not applicable. This test is for a group of threatened species.



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

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

The footprint of the proposal is approximately 24.4 hectares, however the majority of this area is highly disturbed and unlikely to be suitable habitat for any of these threatened plant species. The majority of this area consists of pasture with exotic species and native herbaceous species. The site appears to have a long history of grazing and consequently disturbance is high. *Isotoma (Hypsela) sessiliflora* and *Pilularia novae-hollandiae* are only found in wet areas. The area of habitat to be removed or modified that is suitable for these two species is considerably less, approximately 500 m².

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

No.

This area is on the edge of an existing larger area of development extending from the site east to Wallgrove Road. Similar habitat occurs to the south, west and north-east. No fragmentation or isolation will occur for these areas.

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

Negligible.

None of these species have been recorded within the survey area. Moreover, the site has a long history of disturbance and it is unlikely that any of these species will be naturally introduced to the survey area.

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

No. Critical habitat has not been declared for these species.



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

No. Removal of potential habitat, even degraded potential habitat is never likely to be consistent with any recovery or threat abatement plan.

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

Yes. Although building construction is not listed as a key threatening process, the proposed development will require the "Clearing of native vegetation", (albeit mostly highly degraded within the survey area), which is a key threatening process relevant to these species. Key threatening processes are listed under the TSC Act, 1995 and the Commonwealth's EPBC Act, 1999.

Conclusion

The proposed activity is unlikely to have a significant effect on threatened plant species.



Appendix 2. Final Determinations

The Scientific Committee, established by the Threatened Species Conservation Act 1995, has made a Final Determination to list the following processes, which are applicable to the proposal, as key threatening processes on Schedule 3 of the Act:

- a) Clearing of Native Vegetation
- b) Removal of Dead Wood and Dead Trees
- c) Loss of Hollow-bearing Trees
- d) Bushrock Removal
- e) Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands

A full profile of all listed key threatening processes can be seen at the NSW NPWS website:

http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/home_threats.aspx



Appendix 3. Flora species list

The grid reference for this locality is 298 542 East, 6 257 786 North (GDA 1994)

Flora List

23 April 2014, 9 Feb 15, 12 Feb 15

MAGNOLIOPSIDA

DICOTYLEDONS

- * *Ageratina adenophora*
- * *Anagallis arvensis*
- * *Araujia sericifera*
- * *Aster subulatus*
- * *Atriplex prostrata*
- * *Atriplex prostrate*
- * *Bidens pilosa*
- * *Bidens subalternans*
- * *Carthamus lantanus*
- * *Chenopodium album*
- * *Cirsium vulgare*
- * *Conyza bonariensis*
- * *Cyclospermum leptophyllum*
- * *Datura ferox*
- * *(Diospyros virginiana?)*
- * *Euphorbia peplus*
- * *Gamochaeta americana*
- * *Gomphocarpus fruticosus*
- * *Hydrocotyle bonariensis*
- * *Hypochaeris radicata*
- * *Lepidium africanum*
- * *Letonodon taraxacoides*
- * *Ligustrum lucidum* N
- * *Lotus corniculatus*.
- * *Lycium ferocissimum*
- * *Malva parviflora*
- * *Modiola carolinana*
- * *Olea europaea subsp cuspidata*
- * *Pavonia hastata*
- * *Phyllanthus tennellus*
- * *Phytolacca octandra*
- * *Plantago lanceolata*
- * *Polygonium aviculare*
- * *Pyrus communis*
- * *Rosa rubiginosa*.
- * *Rubus anglocandicans* N
- * *Rumex crispus*
- * *Senecio madagascariensis*
- * *Senecio pterophorus*
- * *Sida rhombifolia*
- * *Solanum linnaeanum*
- * *Solanum nigrum*
- * *Solanum pseudocapsicum*
- * *Solanum sisymbirifolium*
- * *Taraxacum officinale*
- * *Trifolium repens*
- * *Verbena bonariensis*
- * *Veronica persica*
- * *Xanthium occidentale*



Acaena novae-zelandiae
Alternanthera denticulata
Angophora floribunda
Atriplex semibaccata
Brunoniella australis
Bursaria spinosa
Casuarina glauca
Centella asiatica
Dichondra repens
Einadia nutans
Einadia trigonos
Eucalyptus moluccana

Eucalyptus tereticornis
Galium gaudichaudii
Geranium homeanum
Glycine clandestina
Glycine tabacina
Hypericum gramineum
Mentha satureioides
Oxalis exilis
Persicaria decipiens
Rumex brownii
Wahlenbergia gracilis

MONOCOTYLEDONS

* *Asparagus asparagoides*
 * *Axonopus ficifolius*
 * *Briza subaristata*
 * *Bromus catharticus*
 * *Chloris gayana*
 * *Cortaderia selloana* N
 * *Cyperus eragrostis*
 * *Cyperus sesquiflorus*
 * *Digitaria sanguinalis*

* *Eragrostis curvula*
 * *Juncus acutus*
 * *Lolium perenne*
 * *Paspalum dilatatum*
 * *Paspalum notatum*
 * *Pennisetum clandestinum*
 * *Pennisetum villosum*
 * *Phalaris aquatica*
 * *Setaria parviflora*

Bothriochloa macra
Carex inversa
Chloris truncata
Chloris ventricosa
Commelina cyanea
Cynodon dactylon
Cyperus gracilis
Echionopogon obovatus
Eragrostis leptostachya
Eriochloa pseudoacrotricha
Fimbristylis dichotoma
Hypoxis pratensis var. *pratensis*

Juncus usitatus
Microlaena stipoides
Paspalum distichum
Rytidosperma fulvum
Sporobolus elongatus
Themeda triandra
Typha orientalis

*** = Exotic species (weeds).**

= Non-local native species – a weed in Sydney and the Blue Mountains.

N = Noxious weed



Appendix 4. Quadrat Data

Survey Details

Quadrat No:1

Name of surveyor	Dr Daniel McDonald Jesse Tree	Contact number	(02) 4751 9487
Number of surveyors	2	Date of survey	9 February 2015
Total effort expressed in person hours	3	Quadrat size	20 x 20 m
Location Details Location description	Located in the north-eastern corner of the proposal survey area within a patch of Eucalyptus spp. _____		
Map number	_____	Map name	_____
NE corner of quadrat (AMG)	_____	AMG Zone	_____
Easting (6 digits):	_____	Start time (24hr)	_____
Northing (7 digits):	_____	End time (24 hr)	_____
Weather Details			
Wind direction and speed	Calm Strong	Light	Mod
Rain	None Rain	Light drizzle	Heavy drizzle
		Heavy	Fresh
		Cloud cover	Temp. (°C)
		 /8	
Veg description			
Community	_____		
Dominant/common species	_____		
Adjoining vegetation	_____		
Hollow-bearing trees	_____		
Leaf litter	_____		
Debris	_____		
Logs	_____		
Stags	_____		
Drainage	_____		
Slope/aspect	_____		
Rock outcrop	_____		
Fire			
Date: 0-5, 5-10, >10 years	_____		
Scorch height, dead trees, ...	_____		
Other features			
(Fence, pegs, posts, rubbish, ruins, etc.)	_____		



Species name	CA	Comments	Cumberland Shale Plains Woodland +ve diagnostic species	Cumberland Shale Hills Woodland +ve diagnostic species
<i>Eucalyptus tereticornis</i>	6		Y	Y
<i>Eucalyptus moluccana</i>	5		Y	Y
<i>Dichondra repens</i>	4		Y	Y
<i>Microlaena stipoides</i>	4		Y	Y
<i>Bothriochloa macra</i>	2		Y	Y
<i>Brunonelia australis</i>	2		Y	Y
<i>Commelina cyanea</i>	2		Y	Y
<i>Cynodon dactylon</i>	2		N	N
<i>Cyperus gracilis</i>	2		Y	Y
<i>Einaridia trigonos</i>	2		Y	Y
<i>Geranium hominarum</i>	2		Y	Y
<i>Glycine tabacina</i>	2		Y	Y
<i>Mentha satureioides</i>	2		N	N
<i>Oxalis exilis</i>	2		Y	N
<i>Carex inversa</i>	1		Y	Y
<i>Eragrostis leptostachya</i>	1		Y	Y
<i>Hypoxis pratensis</i> var. <i>pratensis</i>	1		Y	N
<i>Juncus usitatus</i>	1		Y	N
<i>Rumex brownii</i>	1		N	Y
<i>Themeda triandra</i>	1		Y	Y
N = 20			+ve = 17	+ve = 13
Requirement for statistical test Tozer <i>et al.</i> , 2010			N ≥ 31 +ve ≥ 26	N ≥ 31 +ve ≥ 20
Difference between required +ves and observed +ves			9	7
* <i>Senecio pterophorus</i>	4			
* <i>Bidens pilosa</i>	3			
* <i>Paspalum dilatatum</i>	3			
* <i>Phalaris aquatica</i>	3			
* <i>Setaria parviflora</i>	3			
* <i>Bidens subalternans</i>	2			
* <i>Cirsium vulgare</i>	2			
* <i>Euphorbia peplis</i>	2			



Species name	CA	Comments	Cumberland Shale Plains Woodland +ve diagnostic species	Cumberland Shale Hills Woodland +ve diagnostic species
* <i>Ligustrum lucidum</i>	2			
* <i>Lolium perenne</i>	2			
* <i>Lycium ferrocissimum</i>	2			
* <i>Pennisetum clandestinum</i>	2			
* <i>Phytolacca octandra</i>	2			
* <i>Sida rhombifolia</i>	2			
* <i>Araujia sericifera</i>	1			
* <i>Gomphocarpus fruticosus</i>	1			
* <i>Bromus catharticus</i>	1			
* <i>Cyperus eragrotis</i>	1			
* <i>Hypochaeris radicata</i>	1			
* <i>Olea europaea</i> subsp <i>cuspidata</i>	1			
* <i>Phyllanthus tenellus</i>	1			
* <i>Plantago lanceolata</i>	1			
* <i>Solanum pseudocapsicum</i>	1			
* <i>Solanum sisymbirifolium</i>	1			
* <i>Taraxacum officinale</i>	1			
* <i>Trifolium repens</i>	1			
* <i>Verbena bonariensis</i>	1			

Modified Braun-Blanquet scale

All angiosperm species rooted within the boundary of the quadrat are assigned a cover/abundance estimate using a modified Braun-Blanquet scale (Westhoff and van der Maarel 1978) as follows:

- 1) one/a few individuals and < 5% cover;
- 2) uncommon and < 5% cover;
- 3) common and < 5% cover;
- 4) very abundant and < 5% cover or 5-20% cover;
- 5) 20-50% cover;
- 6) 50-75% cover; and
- 7) 75-100% cover.



Survey Details

Quadrat No: 2

Name of surveyor	Dr Daniel McDonald Jesse Tree	Contact number	(02) 4751 9487
Number of surveyors	2	Date of survey	9 February 2015
Total effort expressed in person hours	3	Quadrat size	20 m x 20 m
Location Details			
Location description			
Map number		Map name	
NE corner of quadrat (AMG)		AMG Zone	
Easting (6 digits):		Start time (24hr)	
Northing (7 digits):		End time (24 hr)	
Weather Details			
Wind direction and speed	Calm	Light	Mod
Rain	None	Light drizzle	Heavy drizzle
	Rain		Heavy
			Temp. (°C)
			Cloud cover
			 /8
Veg description			
Community			
Dominant/common species			
Adjoining vegetation			
Hollow-bearing trees			
Leaf litter			
Debris			
Logs			
Stags			
Drainage			
Slope/aspect			
Rock outcrop			
Fire			
Date: 0-5, 5-10, >10 years			
Scorch height, dead trees,			
...			
Other features			
(Fence, pegs, posts, rubbish, ruins, etc.)			



Species name	CA	Comments	Cumberland Shale Plains Woodland +ve diagnostic species	Floodplain Swamp Forest +ve diagnostic species	Cumberland River Flat Forest +ve diagnostic species
Casuarina glauca	7		N	Y	Y
Commelina cyanea	4		Y	Y	Y
Microlaena stipoides	4		Y	C	Y
Eriochloa pseudoacrotricha	3		Y	N	N
Oplismenus aemulus	2		Y	N	Y
Oxalis exilis	2		Y	N	N
Alternanthera denticulata	1		N	Y	Y
Cynodon dactylon	1		Y	Y	Y
Cyperus gracilis	1		Y	N	Y
Einardia trigonos	1		Y	N	Y
Fimbristylis dichotoma	1		Y	N	N
Paspalum distichum	1		N	N	N
N = 12			+ve = 9	+ve = 4	+ve = 9
Requirement for statistical test Tozer <i>et al.</i> 2010			N ≥ 31 +ve ≥ 26	N ≥ 12 +ve ≥ 3	N ≥ 26 +ve ≥ 16
Difference between required +ves and observed +ves			17	-1	7
* Bidens pilosa	4				
* Juncus acutus	4				
* Lycium ferocissimum	3				
* Bidens subalternans	2				
* Cirsium vulgare	2				
* Paspalum dilatatum	2				
* Setaria parviflora	2				
* Asparagus asparagoides	1				
* Conyza bonariensis	1				
* Cyperus eragrostis	1				
* Lepidium africanum	1				
* Senecio madagascariensis	1				
* Senecio pterophorus	1				
* Sida rhombifolium	1				
* Solanum nigrum	1				
* Solanum pseudocapsicum	1				
* Solanum <u>sisymbriifolium</u>	1				
* Verbena bonariensis	1				



Survey Details

Quadrat No:3

Name of surveyor	Dr Daniel McDonald Jesse Tree		Contact number	(02) 4751 9487			
Number of surveyors	2		Date of survey	9 February 2015			
Total effort expressed in person hours	3		Quadrat size	20 x 20 m			
Location Details							
Location description							
Map number			Map name				
NE corner of quadrat (AMG)			AMG Zone				
Easting (6 digits):			Start time (24hr)				
Northing (7 digits):			End time (24 hr)				
Weather Details							
Wind direction and speed	Calm	Light	Mod	Fresh	Strong	Temp. (°C)	
Rain	None	Light drizzle	Heavy drizzle	Heavy		Cloud cover	 /8
Veg description							
Community							
Dominant/common species							
Adjoining vegetation							
Hollow-bearing trees							
Leaf litter							
Debris							
Logs							
Stags							
Drainage							
Slope/aspect							
Rock outcrop							
Fire							
Date: 0-5, 5-10, >10 years							
Scorch height, dead trees, ...							
Other features							
(Fence, pegs, posts, rubbish, ruins, etc.)							



Species name	CA	Comments	Cumberland Shale Plains Woodland +ve diagnostic species	Floodplain Swamp Forest +ve diagnostic species	Cumberland River Flat Forest +ve diagnostic species
<i>Cynodon dactylon</i>	6		Y	Y	Y
<i>Microlaena stipoides</i>	4		Y	C	Y
<i>Bothriochloa macra</i>	2		Y	N	N
<i>Casuarina glauca</i>	2		N	Y	Y
<i>Oxalis exilis</i>	2		Y	N	N
<i>Carex inversa</i>	1		Y	N	N
<i>Fimbristylis dichotoma</i>	1		Y	N	N
<i>Glycine clandestina</i>	1		Y	N	N
<i>Hypoxis pratensis</i> var. <i>pratensis</i>	1		Y	N	N
N = 9			+ve = 8	+ve = 2	+ve = 3
Requirement for statistical test Tozer <i>et al.</i> 2010			N ≥ 31 +ve ≥ 26	N ≥ 12 +ve ≥ 3	N ≥ 26 +ve ≥ 16
Difference between required +ves and observed +ves			18	1	13
* <i>Paspalum dilatatum</i>	6	Improved pasture species			
* <i>Axonopus fissifolius</i>	5	Can invade improved pasture after declining fertility			
* <i>Bidens pilosa</i>	2				
* <i>Hypochaeris radicata</i>	2				
* <i>Paspalum notatum</i>	2	Sometime used for improved pasture			
* <i>Setaria parviflora</i>	2				
* <i>Sida rhombifolia</i>	2				
* <i>Aster subulatus</i>	1				
* <i>Briza subaristida</i>	1				
* <i>Cirsium vulgare</i>	1				
* <i>Conyza bonariensis</i>	1				
* <i>Cyclosporum leptophyllum</i>	1				
* <i>Cyperus eragrostis</i>	1				
* <i>Cyperus sesquiflorus</i>	1				
* <i>Gamochaeta americana</i>	1				
* <i>Plantago lanceolata</i>	1				
* <i>Senecio madagascariensis</i>	1				
* <i>Senecio pterophorus</i>	1				
* <i>Taraxicum officinale</i>	1				



Survey Details

Quadrat No:4

Name of surveyor	Dr Daniel McDonald Jesse Tree	Contact number	(02) 4751 9487
Number of surveyors	2	Date of survey	9 February 2015
Total effort expressed in person hours	3	Quadrat size	20 x 20 m
Location Details			
Location description			
Map number		Map name	
NE corner of quadrat (AMG)		AMG Zone	
Easting (6 digits):		Start time (24hr)	
Northing (7 digits):		End time (24 hr)	
Weather Details			
Wind direction and speed	Calm	Light	Mod
	Fresh	Strong	Temp. (°C)
Rain	None	Light drizzle	Heavy drizzle
	Heavy Rain	Cloud cover	 /8
Veg description			
Community			
Dominant/common species			
Adjoining vegetation			
Hollow-bearing trees			
Leaf litter			
Debris			
Logs			
Stags			
Drainage			
Slope/aspect			
Rock outcrop			
Fire			
Date: 0-5, 5-10, >10 years			
Scorch height, dead trees, ...			
Other features			
(Fence, pegs, posts, rubbish, ruins, etc.)			



Species name	CA	Comments	Cumberland Shale Plains +ve diagnostic species	Cumberland Shale Hills +ve diagnostic species	Floodplain Swamp Forest +ve diagnostic species	Cumberland River Flat Forest +ve diagnostic species
<i>Cynodon dactylon</i>	6		Y	N	Y	Y
<i>Eucalyptus moluccana</i>	5		Y	Y	N	N
<i>Eucalyptus tereticornis</i>	5		Y	Y	N	Y
<i>Microlaena stipoides</i>	5		Y	Y	C	Y
<i>Brunoniella australis</i>	3		Y	Y	N	Y
<i>Commelina cyanea</i>	3		Y	Y	Y	Y
<i>Cyperus gracilis</i>	3		Y	Y	N	Y
<i>Einardia trigonos</i>	3		Y	Y	N	Y
<i>Dichondra repens</i>	2		Y	Y	N	Y
<i>Glycine tabacina</i>	2		Y	Y	N	Y
<i>Oxalis exilis</i>	2		Y	N	N	N
<i>Bothriochloa macra</i>	1		Y	Y	N	N
<i>Chloris truncata</i>	1		Y	Y	N	N
<i>Einardia nutans</i>	1		Y	Y	N	N
<i>Eriochloa pseudoacrotricha</i>	1		Y	N	N	N
N = 15			+ve = 15	+ve = 12	+ve = 2	+ve = 9
Requirement for statistical test Tozer <i>et al.</i> 2010			N ≥ 31 +ve ≥ 26	N ≥ 31 +ve ≥ 20	N ≥ 12 +ve ≥ 3	N ≥ 26 +ve ≥ 16
Difference between required +ves and observed +ves			11	8	1	7
* <i>Bidens pilosa</i>	4					
* <i>Bidens subalternans</i>	3					
* <i>Lycium ferocissium</i>	2					
* <i>Setaria parviflora</i>	2					
* <i>Sida rhombifolia</i>	2					
* <i>Cirsium vulgare</i>	1					
* <i>Digitaria sanguinalis</i>	1					
* <i>Lepidium africanum</i>	1					
* <i>Malva parviflora</i>	1					
* <i>Modiola carolinana</i>	1					
* <i>Plantago lanceolata</i>	1					
* <i>Senecio madagascariensis</i>	1					
* <i>Senecio pterophorus</i>	1					
* <i>Solanum sisimbryofolium</i>	1					
* <i>Sonchus olearacea</i>	1					
* <i>Taraxacum officinale</i>	1					



Survey Details

Quadrat No: 5

Name of surveyor	Dr Daniel McDonald Jesse Tree		Contact number	(02) 4751 9487		
Number of surveyors	2		Date of survey	9 February 2015		
Total effort expressed in person hours	3		Quadrat size	20 x 20 m		
Location Details						
Location description						
Map number			Map name			
NE corner of quadrat (AMG)			AMG Zone			
Easting (6 digits):			Start time (24hr)			
Northing (7 digits):			End time (24 hr)			
Weather Details						
Wind direction and speed	Calm	Light	Mod	Fresh	Strong	Temp. (°C)
Rain	None	Light drizzle	Heavy drizzle	Heavy		Cloud cover
	Rain					 /8
Veg description						
Community						
Dominant/common species						
Adjoining vegetation						
Hollow-bearing trees						
Leaf litter						
Debris						
Logs						
Stags						
Drainage						
Slope/aspect						
Rock outcrop						
Fire						
Date: 0-5, 5-10, >10 years						
Scorch height, dead trees, ...						
Other features						
(Fence, pegs, posts, rubbish, ruins, etc.)						



Species name	CA	Comments	Cumberland Shale Plains Woodland +ve diagnostic species	Cumberland Shale Hills Woodland +ve diagnostic species	Cumberland River Flat Forest+ve diagnostic species
Cyndon dactylon	6		Y	N	Y
Carex inversa	1		Y	N	N
Commelina cyanea	1		Y	Y	Y
Eriochloa pseudoacrotricha	1		Y	N	N
Juncus usitatus	1		Y	N	Y
Oxalis exilis	1		Y	N	N
Sporobolus elongata	1		Y	Y	N
N = 7			+ve = 7	+ve = 2	+ve = 3
Requirement for statistical test Tozer <i>et al.</i> 2010			N ≥ 31 +ve ≥ 26	N ≥ 31 +ve ≥ 20	N ≥ 26 +ve ≥ 16
* Digitaria sanguinalis	5				
* Paspalum dilatatum	5				
* Senecio pterophorus	4				
* Bidens pilosa	3				
* Bidens subalternans	3				
* Verbena officinalis	3				
* Cyperus eragrostis	2				
* Eragrostis curvula	2				
* Phalaris aquatica	2				
* Polygonum aviculare	2				
* Sida rhombifolia	2				
* Bromus catharticus	1				
* Cirsium vulgare	1				
* Conzys bonariensis	1				
* Datura ferox	1				
* Leontodon taraxacoides	1				
* Lepidium africanum	1				
* Modiola carolinana	1				
* Phytolacca octandra	1				
* Plantago lanceolata	1				
* Senecio madagascariensis	1				
* Setaria parviflora	1				
* Taraxacum officinale	1				
* Trifolium repens	1				



Survey Details

Quadrat No: 6

Name of surveyor	<u>Dr Daniel McDonald</u>	Contact number	<u>(02) 4751 9487</u>
Number of surveyors	<u>1</u>	Date of survey	<u>12 February 2015</u>
Total effort expressed in person hours	<u>1.75</u>	Quadrat size	<u>20 x 20 m</u>
Location Details			
Location description			
Map number		Map name	
NE corner of quadrat (AMG)		AMG Zone	
Easting (6 digits):		Start time (24hr)	
Northing (7 digits):		End time (24 hr)	
Weather Details			
Wind direction and speed	<u>Calm</u>	<u>Light</u>	<u>Mod</u>
Rain	<u>None</u>	<u>Light drizzle</u>	<u>Heavy drizzle</u>
	<u>Rain</u>		<u>Heavy</u>
			<u>Temp. (°C)</u>
			<u>Cloud cover</u>
			<u>..... /8</u>
Veg description			
Community			
Dominant/common species			
Adjoining vegetation			
Hollow-bearing trees			
Leaf litter			
Debris			
Logs			
Stags			
Drainage			
Slope/aspect			
Rock outcrop			
Fire			
Date: 0-5, 5-10, >10 years			
Scorch height, dead trees, ...			
Other features			
(Fence, pegs, posts, rubbish, ruins, etc.)			



Species name	CA	Comments	Cumberland Shale Plains +ve diagnostic species	Floodplain Swamp +ve diagnostic species	Cumberland River Flat Forest +ve diagnostic species
<i>Casuarina glauca</i>	7		N	Y	Y
<i>Eucalyptus tereticornis</i>	4	Some dieback, plants also appear stressed and have less leaves than typical	Y	N	Y
<i>Cynodon dactylon</i>	3		Y	Y	Y
<i>Atriplex semibaccata</i>	2		N	N	N
<i>Brunoniella australis</i>	2		Y	N	Y
<i>Commelina cyanea</i>	2		Y	Y	Y
<i>Cyperus gracilis</i>	2		Y	N	Y
<i>Dichondra repens</i>	2		Y	N	Y
<i>Echinopogon obovatus</i>	2		Y	N	Y
<i>Einaridia trigonos</i>	2		Y	N	Y
<i>Alternanthera denticulata</i>	1		N	Y	Y
<i>Centella asiatica</i>	1		Y	Y	Y
<i>Chloris truncata</i>	1		Y	N	N
<i>Glycine clandestina</i>	1		Y	N	Y
<i>Einaridia nutans</i>	1		Y	N	N
<i>Eragrostis leptostachya</i>	1		Y	N	Y
<i>Eriochloa pseudoacrotricha</i>	1		Y	N	N
<i>Fimbristylis dichotoma</i>	1		Y	N	Y
<i>Microlaena stipoides</i>	1		Y	C	Y
<i>Oxalis exilis</i>	1		Y	N	N
<i>Portulaca oleracea</i>	1		N	N	N
<i>Rumex brownii</i>	1		N	Y	N
N = 22			+ve = 15	+ve = 2	+ve = 9
Requirement for statistical test Tozer et al. 2010			N ≥ 31 +ve ≥ 26	N ≥ 12 +ve ≥ 3	N ≥ 26 +ve ≥ 16
Difference between required +ves and observed +ves			11	1	7
* <i>Lycium ferrocissimum</i>	4				
* <i>Aster subulatus</i>	3				



Species name	CA	Comments	Cumberland Shale Plains +ve diagnostic species	Floodplain Swamp +ve diagnostic species	Cumberland River Flat Forest +ve diagnostic species
* <i>Atriplex prostrata</i>	3				
* <i>Paspalum dilatatum</i>	3				
* <i>Setaria parviflora</i>	3				
* <i>Bidens pilosa</i>	2				
* <i>Sida rhombifolia</i>	2				
* <i>Verbena officinalis</i>	2				
* <i>Asparagus asparagoides</i>	1				
* <i>Axonopus fissifolius</i>	1				
* <i>Bidens subalternans</i>	1				
* <i>Bromus catharticus</i>	1				
* <i>Chenopodium album</i>	1				
* <i>Cirsium vulgare</i>	1				
* <i>Conyza</i> sp	1	Seedling/young plant			
* <i>Cyperus eragrostis</i>	1				
* <i>Leontodon taraxacoides</i>	1				
* <i>Lepidium africanum</i>	1				
* <i>Lotus corniculatus</i>	1				
* <i>Phytolacca octandra</i>	1				
* <i>Plantago lanceolata</i>	1				
* <i>Senecio madagascariensis</i>	1				
* <i>Senecio pterophorus</i>	1				
* <i>Solanum nigrum</i>	1				
* <i>Solanum pseudocapsicum</i>	1				
* <i>Solanum sysimbriifolium</i>	1				
* <i>Sonchus oleracea</i>	1				



Appendix 5. Brief description of the E2 zone

The letter from Susan Harrison – Senior Team Leader, Planning – Greater Sydney – Regional Operations (dated 4 November 2014) (Your reference SSD 6236 – Our reference DOC14/247891) includes the following paragraph:

“The mitigation measures also include the recommendation to install nest boxes in the Conservation Area. However, there is no description of the Conservation Area provided in the Ecology Assessment, or how the installation of nest boxes may impact on resident fauna. Also, no information is provided on the maintenance of these nest boxes, so it is unclear whether their installation is likely to offset fauna impacts in the long term.”

A response has been provided to all issues in the paragraph above in Section 8.1 apart from a description of the Conservation Area. While the current proposal does not include any mitigation measures located in the Conservation Area a description of the Conservation Area is still provided below.

The E2 zone has been assessed as having high ecological importance due to its size, connectivity with other remnants, structural diversity and the potential or realised habitat for threatened species (EcoLogical 2013). However, it has been partially cleared and disturbed, as illustrated by the 1943 aerial photo (Figure 21). It has very few large mature trees with hollows, has many young trees, a patchy understorey, and patches of weeds and a canopy of very strongly dominated by Grey Box *Eucalyptus moluccana*. Many of the Grey Box *Eucalyptus moluccana* show signs of stress in the form of epicormic growth. It is possibly more common adjacent to the M4.

While several threatened plant species were expected to occur in this area, only potential habitat has been recorded in this area. The closest record of a threatened species known to the author is two small groups of *Grevillea juniperina* located off-site on the western batter of Archbold Road within the road reserve.

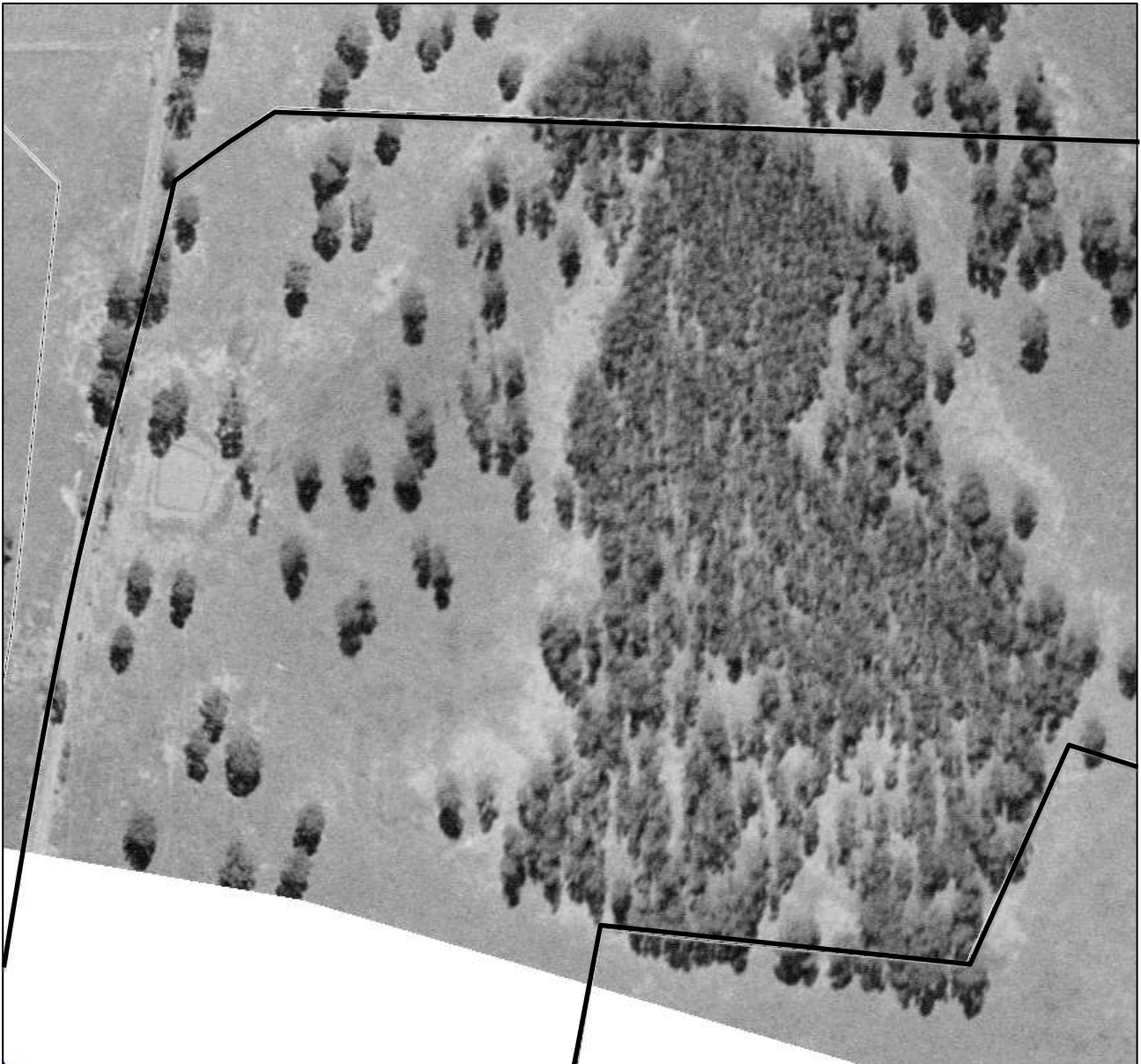


Figure 21. A photo from the SIX website of the E2 area from 1943. The lower right hand corner of this photo that is missing is also absent on the website. Note the dam on the western side and that most of the trees have also been cleared on the western side.



At the time of the site visit for this report, the vegetation in this area was observed to range from open grassy woodland to woodland with dense young tree regrowth. The shrub layer was very patchy, there were some reasonably dense areas and other areas where shrubs were almost absent. Weeds were scattered and widespread particularly herbaceous species. There is a patch of African Boxthorn (*Lycium ferocissimum*) in the south east corner of the E2 zone on the site. The dam in west of the area supported a range of native and exotic aquatic and wet area plants. Figure 22 to Figure 29 illustrate the characteristics of the E2 zone.



Figure 22. This illustrates an area that contains open patches of grassland and trees mostly less than around 50 years old.



Figure 23. This illustrates an area that contains open patches of grassland and trees mostly less than around 50 years old.



Figure 24. An open area containing a track.



Figure 25. One of the small number of large Grey Box *Eucalyptus moluccana* in the E2 zone.



Figure 26. An old track is present within the E2 zone.



Figure 27. Fringing vegetation dominated by *Bolboschoenus* sp. around the dam.



Figure 28. A termite mound. Also note the epicormic growth on some of the lower branches in the background.



Figure 29. Epicormic growth on the lower trunk of a Grey Box *Eucalyptus moluccana*.



Appendix 6. Expected fauna species in the Sydney Basin

Mammals

Common name	Scientific name
White-striped Freetail-bat	<i>Tadarida australis</i>
Gould's Wattled Bat	<i>Chalinolobus gouldii</i>
Chocolate Wattled Bat	<i>Chalinolobus morio</i>
Lesser Long-eared Bat	<i>Nyctophilus geoffroyi</i>
Gould's Long-eared Bat	<i>Nyctophilus gouldi</i>
Bush Rat	<i>Rattus fuscipes</i>
Swamp Rat	<i>Rattus lutreolus</i>
Long-nosed Bandicoot	<i>Perameles nasuta</i>
Brown Antechinus	<i>Antechinus stuartii</i>
Dusky Antechinus	<i>Antechinus swainsonii</i>
Yellow-footed Antechinus	<i>Antechinus flavipes</i>
Common Wombat	<i>Vombatus ursinus</i>
Common Ringtail Possum	<i>Pseudocheirus peregrinus</i>
Sugar Glider	<i>Petaurus breviceps</i>
Feathertail Glider	<i>Acrobates pygmaeus</i>
Eastern Grey Kangaroo	<i>Macropus giganteus</i>
Large Forest Bat	<i>Vespadelus darlingtoni</i>
Little Forest Bat	<i>Vespadelus vulturnus</i>
Common Wallaroo	<i>Macropus robustus</i>
Red-necked Wallaby	<i>Macropus rufogriseus</i>
Swamp Wallaby	<i>Wallabia bicolor</i>
Common Brushtail Possum	<i>Trichosurus vulpecula</i>
Greater Glider	<i>Petauroides volans</i>
Short-beaked Echidna	<i>Tachyglossus aculeatus</i>
Fox	<i>Vulpes vulpes</i>
Black Rat	<i>Rattus rattus</i>
Rabbit	<i>Oryctolagus cuniculus</i>

Frogs

Common Name	Scientific Name
Green Tree Frog	<i>Litoria caerulea</i>
Blue Mountains Tree Frog	<i>Litoria citropa</i>
Bleating Tree Frog	<i>Litoria dentata</i>
Eastern Dwarf Tree Frog	<i>Litoria fallax</i>
Jervis Bay Tree Frog	<i>Litoria jervisiensis</i>
Broad-palmed Frog	<i>Litoria latopalmata</i>
Peron's Tree Frog	<i>Litoria peronii</i>
Leaf-green Tree Frog	<i>Litoria phyllochroa</i>
Tyler's Tree Frog	<i>Litoria tyleri</i>
Verreaux's Frog	<i>Litoria verreauxii</i>
Common Eastern Froglet	<i>Crinia signifera</i>
Eastern Banjo Frog	<i>Limnodynastes dumerilii</i>
Ornate Burrowing Frog	<i>Limnodynastes ornatus</i>
Brown-striped Frog	<i>Limnodynastes peronii</i>
Spotted Grass Frog	<i>Limnodynastes tasmaniensis</i>
Haswell's Froglet	<i>Paracrinia haswelli</i>
Smooth Toadlet	<i>Uperoleia laevigata</i>
Tyler's Toadlet	<i>Uperoleia tyleri</i>



Reptiles

Common Name	Scientific Name
Diamond Python	<i>Morelia spilota spilota</i>
Common Death Adder	<i>Acanthophis antarcticus</i>
Yellow-faced Whip Snake	<i>Demansia psammophis</i>
Common Tree Snake	<i>Dendrelaphis punctulatus</i>
Golden-crowned Snake	<i>Cacophis squamulosus</i>
Eastern Small-eyed Snake	<i>Cryptophis nigrescens</i>
Red-naped Snake	<i>Furina diadema</i>
Black-bellied Swamp Snake	<i>Hemiaspis signata</i>
Tiger Snake	<i>Notechis scutatus</i>
Red-bellied Black Snake	<i>Pseudechis porphyriacus</i>
Eastern Brown Snake	<i>Pseudonaja textilis</i>
Dwyer's Snake	<i>Parasuta dwyeri</i>
Bandy Bandy	<i>Vermicella annulata</i>
Blackish Blind Snake	<i>Ramphotyphlops nigrescens</i>
Wood Gecko	<i>Diplodactylus vittatus</i>
Lesueur's Velvet Gecko	<i>Oedura lesueurii</i>
Broad-tailed Gecko	<i>Phyllurus platurus</i>
Thick-tailed Gecko	<i>Underwoodisaurus milii</i>
Burton's Snake-lizard	<i>Lialis burtonis</i>
Common Scaly-foot	<i>Pygopus lepidopodus</i>
Jacky Lizard	<i>Amphibolurus muricatus</i>
Bearded Dragon	<i>Pogona barbata</i>
Punctate Worm-skink	<i>Anomalopus swansoni</i>
Eastern Blue-tongue	<i>Tiliqua scincoides</i>
Southern Rainbow-skink	<i>Carlia tetradactyla</i>
Cream-striped Shinning-skink	<i>Cryptoblepharus virgatus</i>
Robust Ctenotus	<i>Ctenotus robustus</i>
Copper-tailed Skink	<i>Ctenotus taeniolatus</i>
Mainland She-oak Skink	<i>Cyclodomorphus michaeli</i>
Pink-tongued Skink	<i>Cyclodomorphus gerrardii</i>
Cunningham's Skink	<i>Egernia cunninghami</i>
Black Rock Skink	<i>Egernia saxatilis</i>
White's Skink	<i>Liopholis whitii</i>
Eastern Water-skink	<i>Eulamprus quoyii</i>
Barred-sided Skink	<i>Eulamprus tenuis</i>
Dark-flecked Garden Sunskink	<i>Lampropholis delicata</i>
Pale-flecked Garden Sunskink	<i>Lampropholis guichenoti</i>
Weasel Skink	<i>Saproscincus mustelinus</i>
Red-throated Skink	<i>Acritoscincus platynota</i>
Three-toed Skink	<i>Saiphos equalis</i>
Lace Monitor	<i>Varanus varius</i>
Eastern Snake-necked Turtle	<i>Chelodina longicollis</i>



Birds

Common Name	Scientific Name
Brown Quail	<i>Coturnix ypsilophora</i>
Black Swan	<i>Cygnus atratus</i>
Australian Wood Duck	<i>Chenonetta jubata</i>
Mallard	<i>Anas platyrhynchos</i>
Pacific Black Duck	<i>Anas superciliosa</i>
Grey Teal	<i>Anas gracilis</i>
Chestnut Teal	<i>Anas castanea</i>
Australasian Grebe	<i>Tachybaptus novaehollandiae</i>
Great Crested Grebe	<i>Podiceps cristatus</i>
Hoary-headed Grebe	<i>Poliiocephalus poliocephalus</i>
Little Pied Cormorant	<i>Microcarbo melanoleucos</i>
Little Black Cormorant	<i>Phalacrocorax sulcirostris</i>
Great Cormorant	<i>Phalacrocorax carbo</i>
Australian Pelican	<i>Pelecanus conspicillatus</i>
White-faced Heron	<i>Egretta novaehollandiae</i>
Little Egret	<i>Egretta garzetta</i>
White-necked Heron	<i>Ardea pacifica</i>
Great Egret	<i>Ardea alba</i>
Cattle Egret	<i>Ardea ibis</i>
Intermediate Egret	<i>Ardea intermedia</i>
Australian White Ibis	<i>Threskiornis molucca</i>
Straw-necked Ibis	<i>Threskiornis spinicollis</i>
Royal Spoonbill	<i>Platalea regia</i>
Black-shouldered Kite	<i>Elanus axillaris</i>
Whistling Kite	<i>Haliastur sphenurus</i>
Wedge-tailed Eagle	<i>Aquila audax</i>
White-bellied Sea-eagle	<i>Haliaeetus leucogaster</i>
Swamp Harrier	<i>Circus approximans</i>
Brown Goshawk	<i>Accipiter fasciatus</i>
Collared Sparrowhawk	<i>Accipiter cirrocephalus</i>
Brown Falcon	<i>Falco berigora</i>
Australian Hobby	<i>Falco longipennis</i>
Nankeen Kestrel	<i>Falco cenchroides</i>
Buff-banded Rail	<i>Gallirallus philippensis</i>
Purple Swamphen	<i>Porphyrio porphyrio</i>
Dusky Moorhen	<i>Gallinula tenebrosa</i>
Eurasian Coot	<i>Fulica atra</i>
Latham's Snipe	<i>Gallinago hardwickii</i>
Black-winged Stilt	<i>Himantopus himantopus</i>
Black-fronted Dotterel	<i>Eseyornis melanops</i>
Masked Lapwing	<i>Vanellus miles</i>
Silver Gull	<i>Chroicocephalus novaehollandiae</i>
Rock Dove	<i>Columba livia</i>
White-headed Pigeon	<i>Columba leucomela</i>
Spotted Turtle-dove	<i>Streptopelia chinensis</i>
Brown Cuckoo-dove	<i>Macropygia amboinensis</i>
Emerald Dove	<i>Chalcophaps indica</i>
Common Bronzewing	<i>Phaps chalcoptera</i>
Crested Pigeon	<i>Ocyphaps lophotes</i>
Bar-shouldered Dove	<i>Geopelia humeralis</i>
Wonga Pigeon	<i>Leucosarcia picata</i>
Topknot Pigeon	<i>Lopholaimus antarcticus</i>
Yellow-tailed Black-cockatoo	<i>Calyptorhynchus funereus</i>
Galah	<i>Eolophus roseicapilla</i>



Common Name	Scientific Name
Little Corella	<i>Cacatua sanguinea</i>
Sulphur-crested Cockatoo	<i>Cacatua galerita</i>
Rainbow Lorikeet	<i>Trichoglossus haematodus</i>
Scaly-breasted Lorikeet	<i>Trichoglossus chlorolepidotus</i>
Australian King-parrot	<i>Alisterus scapularis</i>
Crimson Rosella	<i>Platycercus elegans</i>
Eastern Rosella	<i>Platycercus eximius</i>
Fan-tailed Cuckoo	<i>Cacomantis flabelliformis</i>
Horsfield's Bronze-cuckoo	<i>Chalcites basalis</i>
Channel-billed Cuckoo	<i>Scythrops novaehollandiae</i>
Asian Koel	<i>Eudynamys scolopaceus</i>
Southern Boobook	<i>Ninox novaeseelandiae</i>
Barn Owl	<i>Tyto alba</i>
Tawny Frogmouth	<i>Podargus strigoides</i>
White-throated Nightjar	<i>Eurostopodus mystacalis</i>
Australian Owlet-nightjar	<i>Aegotheles cristatus</i>
White-throated Needletail	<i>Hirundapus caudacutus</i>
Laughing Kookaburra	<i>Dacelo novaeguineae</i>
Sacred Kingfisher	<i>Todiramphus sanctus</i>
Rainbow Bee-eater	<i>Merops ornatus</i>
Dollarbird	<i>Eurystomus orientalis</i>
Superb Lyrebird	<i>Menura novaehollandiae</i>
Satin Bowerbird	<i>Ptilonorhynchus violaceus</i>
Superb Fairy-wren	<i>Malurus cyaneus</i>
Variegated Fairy-wren	<i>Malurus lamberti</i>
Spotted Pardalote	<i>Pardalotus punctatus</i>
White-browed Scrubwren	<i>Sericornis frontalis</i>
Large-billed Scrubwren	<i>Sericornis magnirostra</i>
Brown Gerygone	<i>Gerygone mouki</i>
White-throated Gerygone	<i>Gerygone albogularis</i>
White-throated Treecreeper	<i>Cormobates leucophaea</i>
Brown Thornbill	<i>Acanthiza pusilla</i>
Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>
Yellow Thornbill	<i>Acanthiza nana</i>
Striated Thornbill	<i>Acanthiza lineata</i>
Red Wattlebird	<i>Anthochaera carunculata</i>
Little Wattlebird	<i>Anthochaera chrysoptera</i>
Noisy Friarbird	<i>Philemon corniculatus</i>
Bell Miner	<i>Manorina melanophrys</i>
Noisy Miner	<i>Manorina melanocephala</i>
Lewin's Honeyeater	<i>Meliphaga lewinii</i>
Yellow-faced Honeyeater	<i>Lichenostomus chrysops</i>
White-plumed Honeyeater	<i>Lichenostomus penicillatus</i>
Brown-headed Honeyeater	<i>Melithreptus brevirostris</i>
White-naped Honeyeater	<i>Melithreptus lunatus</i>
New Holland Honeyeater	<i>Phylidonyris novaehollandiae</i>
Eastern Spinebill	<i>Acanthorhynchus tenuirostris</i>
Scarlet Honeyeater	<i>Myzomela sanguinolenta</i>
Jacky Winter	<i>Microeca fascinans</i>
Rose Robin	<i>Petroica rosea</i>
Eastern Yellow Robin	<i>Eopsaltria australis</i>
Eastern Whipbird	<i>Psophodes olivaceus</i>
Crested Shrike-tit	<i>Falcunculus frontatus</i>
Golden Whistler	<i>Pachycephala pectoralis</i>
Rufous Whistler	<i>Pachycephala rufiventris</i>
Grey Shrike-thrush	<i>Colluricincla harmonica</i>
Black-faced Monarch	<i>Monarcha melanopsis</i>



Common Name	Scientific Name
Leaden Flycatcher	<i>Myiagra rubecula</i>
Restless Flycatcher	<i>Myiagra inquieta</i>
Magpie-lark	<i>Grallina cyanoleuca</i>
Rufous Fantail	<i>Rhipidura rufifrons</i>
New Zealand Fantail	<i>Rhipidura fuliginosa</i>
Willie Wagtail	<i>Rhipidura leucophrys</i>
Spangled Drongo	<i>Dicrurus bracteatus</i>
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>
White-bellied Cuckoo-shrike	<i>Coracina papuensis</i>
Olive-backed Oriole	<i>Oriolus sagittatus</i>
Dusky Woodswallow	<i>Artamus cyanopterus</i>
Grey Butcherbird	<i>Cracticus torquatus</i>
Australian Magpie	<i>Cracticus tibicen</i>
Pied Currawong	<i>Strepera graculina</i>
Australian Raven	<i>Corvus coronoides</i>
White-winged Chough	<i>Corcorax melanorhamphos</i>
Apostlebird	<i>Struthidea cinerea</i>
Eurasian Skylark	<i>Alauda arvensis</i>
Australasian Pipit	<i>Anthus novaeseelandiae rogersi</i>
House Sparrow	<i>Passer domesticus</i>
Red-browed Finch	<i>Neochmia temporalis</i>
Double-barred Finch	<i>Taeniopygia bichenovii</i>
Mistletoebird	<i>Dicaeum hirundinaceum</i>
Welcome Swallow	<i>Hirundo neoxena</i>
Tree Martin	<i>Petrochelidon nigricans</i>
Fairy Martin	<i>Petrochelidon ariel</i>
Cicadabird	<i>Coracina tenuirostris</i>
Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>
Australian Reed-warbler	<i>Acrocephalus australis</i>
Little Grassbird	<i>Megalurus gramineus</i>
Golden-headed Cisticola	<i>Cisticola exilis</i>
Silvereye	<i>Zosterops lateralis</i>
Eurasian Blackbird	<i>Turdus merula</i>
Common Starling	<i>Sturnus vulgaris</i>
Common Myna	<i>Sturnus tristis</i>



Appendix 7. Habitat requirements for locally-occurring threatened fauna species

Invertebrates

Common Name Scientific Name Schedule Listing	Preferred Habitat	Comments
Cumberland Plain Land Snail <i>Meridolum corneovirens</i> TSC Act, Sch. 1, End. EPBC Act, Vul.	Found amongst logs and debris in Cumberland Plain and Castlereagh woodlands.	Suitable natural habitat occurs within the survey area.

Mammals

Common Name Scientific Name Schedule Listing	Preferred Habitat	Comments
Large-eared Pied Bat <i>Chalinolobus dwyeri</i> TSC Act, Sch. 2, Vul. EPBC Act, Vul.	Found in drier habitats including dry sclerophyll and woodlands. Roosts in caves and abandoned Fairy Martin nests. Does not roost in tree hollows.	Suitable natural habitat occurs within the survey area.
Eastern False Pipistrelle <i>Falsistrellus tasmaniensis</i> TSC Act, Sch. 2, Vul.	Little known of habitat. Has been found roosting in stem holes of living Eucalypts	Suitable natural habitat occurs within the survey area.
Eastern Freetail-bat <i>Mormopterus norfolkensis</i> TSC Act, Sch. 2, Vul.	Dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roosts mainly in tree hollows but will also roost under bark or in man-made structures.	Suitable natural habitat occurs within the survey area.
Eastern Bentwing-bat <i>Miniopterus schreibersii oceanensis</i> TSC Act, Sch. 2, Vul.	Well-timbered valleys. Roosts in caves and storm-water channels and similar structures. Does not roost in tree hollows.	Suitable natural habitat occurs within the survey area.
Little Bentwing-bat <i>Miniopterus australis</i> TSC Act, Sch. 2, Vul.	Well-timbered habitats incl. rainforest, Melaleuca swamps and dry sclerophyll forests. Roosts in caves and storm-water channels and similar structures. Does not roost in tree hollows.	Suitable natural habitat occurs within the survey area.
Southern Myotis <i>Myotis macropus</i> TSC Act, Sch. 2, Vul.	Requires open areas of water over which it hunts. Roosts in caves, under bridges and buildings and sometimes in dense foliage in rainforests. May roost in tree hollows.	No suitable natural habitat occurs within the survey area. The dam is covered with bulrush and spike rush.
Greater Broad-nosed Bat <i>Scoteanax rueppellii</i> TSC Act, Sch. 2, Vul. EPBC Act, Lower risk (near threatened)	Found in woodlands, moist and dry sclerophyll forests and rainforests. Prefers gullies. Roosts in tree hollows only.	Suitable natural habitat occurs within the survey area.
Yellow-bellied Sheath-tail-bat <i>Saccolaimus flaviventris</i> TSC Act, Sch. 2, Vul.	Found in a variety of Eucalypt habitats including tall forests and mallee. Roosts in tree hollows and occasionally abandoned Sugar Glider nests	Suitable natural habitat occurs within the survey area.
Grey-headed Flying-fox <i>Pteropus poliocephalus</i>	Found in rainforest, wet and dry sclerophyll forest and mangroves. Camps are usually	Suitable natural habitat occurs within the survey



Common Name Scientific Name Schedule Listing	Preferred Habitat	Comments
TSC Act, Sch. 2, Vul. EPBC Act, Vul.	in gullies, close to water and in vegetation with a dense canopy. Feeds on a wide variety of flowering and fruiting plants.	area. No roosting colonies were observed within the survey area.
Koala <i>Phascolarctos cinereus</i> TSC Act, Sch. 2, Vul.	Eucalypt forests rich in Swamp Mahogany (<i>E. robusta</i>), Forest Red Gum (<i>E. tereticornis</i>), and Grey Gum (<i>E. punctata</i>).	Poor connectivity.
Spotted-tailed Quoll <i>Dasyurus maculatus</i> TSC Act, Sch. 2, Vul. EPBC Act, End.	Occurs mostly in sclerophyll forest and woodlands as well as coastal heath lands and rainforests. Requires suitable den sites such as hollows or caves and large areas of intact vegetation.	Poor connectivity.
Eastern Pygmy-possum <i>Cercartetus nanus</i> TSC Act, Sch. 2, Vul.	Found in a variety of habitats from rainforests through sclerophyll forests to tree heath. Favours areas with abundant Banksias and Myrtaceous shrubs.	No suitable natural habitat occurs on the site.
Squirrel Glider <i>Petaurus norfolcensis</i> TSC Act, Sch. 2, Vul.	Inhabits dry sclerophyll forest and woodland. Requires abundant hollow-bearing trees and a mix of Eucalypts, acacias and Banksias. At least one floral species should flower heavily in the winter and one or more species of Eucalypts need to be smooth-barked.	No suitable natural habitat occurs on the site.

Frogs

Common Name Scientific name Schedule Listing	Preferred Habitat	Comments
Red-crowned Toadlet <i>Pseudophryne australis</i> TSC Act, Sch. 2, Vul.	Almost totally confined to the Hawkesbury sandstone formation. Found in damp situations but not usually associated with permanent water.	No suitable natural habitat occurs on the site.
Giant Burrowing Frog <i>Heleioporus australiacus</i> TSC Act, Sch. 2, Vul. EPBC Act, Vul.	Most common on Hawkesbury Sandstone. Males call from burrows which are situated in sandy banks close to water. They are usually associated with crayfish burrows.	No suitable natural habitat occurs on the site.
Green and Golden Bell Frog <i>Litoria aurea</i> TSC Act, Sch. 1, End. EPBC Act, Vul.	Permanent water sources with vegetated margins in dams, lagoons, streams, swamps or ornamental ponds.	Suitable natural habitat occurs within the survey area.

Reptiles

There is no suitable habitat on the site for any threatened reptiles occurring within the Sydney Basin.



Birds

Common Name Scientific Name Schedule Listing	Preferred Habitat	Comments
Bush Stone-curlew <i>Burhinus grallarius</i> TSC Act, Sch. 1 Endangered	. Found in lightly timbered open forest or woodlands. Preferred habitat is often associated with woodlands of casuarina, eucalyptus, acacia and epolycarpa.	Old record. No existing populations are known near the site.
Diamond Firetail <i>Stagonopleura guttata</i> TSC Act Sch. 2, Vul	Mostly inhabits grassy eucalypt woodlands, also occurring in open forest and riparian areas within these. Feeds exclusively on the ground, occurring in flocks between five to 40+ birds	Probable aviary escapee or old record. No existing populations are known near the site.
Flame Robin <i>Petroica phoenicea</i> TSC Act Sch. 2, Vul.	In NSW it breeds in upland moist eucalypt forests and woodlands, often on ridges and slopes, in areas of open understorey. It migrates in winter to more open lowland habitats such as grassland with scattered trees and open woodland on the inland slopes and plains	Suitable natural habitat occurs on the site but more likely a vagrant to the locality. Poor connectivity.
Freckled Duck <i>Stictonetta naevosa</i> TSC Act, Sch. 2, Vul.	Inhabits a variety of plankton-rich wetlands including vegetated swamps, large open lakes, farm dams and flood waters. Aggregate in the non-breeding season on large deep water lakes or dams (fresh or saline).	A small area of suitable natural habitat occurs within the survey area.
Gang-gang Cockatoo <i>Callocephalon fimbriatum</i> TSC Act, Sch. 2, Vul.	In summer, occupies tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, occurs at lower altitudes in drier, more open eucalypt forests and woodlands – also in urban areas including parks and gardens. Requires tree hollows for nesting	Poor connectivity.
Glossy Black-cockatoo <i>Calyptrorhynchus lathamii</i> TSC Act, Sch. 2, Vul.	Found in open forests with <i>Allocasuarina</i> species and hollows for nesting.	Poor connectivity and fragmentation of vegetation. This species requires extensive areas of intact forest in the adjoining areas.
Little Eagle <i>Hieraaetus morphnoides</i> TSC Act Sch. 2, Vul.	Occupies open Eucalypt forest, woodland or open woodland. She-oak or acacia woodlands and riparian woodlands are also used. Builds a stick nests in winter in tall living trees within remnant patches	Suitable natural habitat occurs on the site.
Painted Honeyeater <i>Grantiella picta</i> TSC Act, Sch. 2, Vul.	Found in Eucalypt forests and woodlands. Prefers areas with high densities of mistletoe.	Poor connectivity.
Black-chinned Honeyeater <i>Melithreptus gularis gularis</i> TSC Act, Sch. 2, Vul.	Prefers upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially <i>Eucalyptus sideroxylon</i> , <i>E. albens</i> , <i>E. microcarpa</i> , <i>E. melliodora</i> , <i>E. blakelyi</i> and <i>E. tereticornis</i> .	Poor connectivity.
Painted Snipe <i>Rostratula benghalensis australis</i> TSC Act, Sch. 2, Vul.	Inhabits shallow freshwater wetlands, particularly where there is a cover of vegetation. Tends to prefer areas that	A small area of suitable natural habitat occurs within the survey area.



Common Name Scientific Name Schedule Listing	Preferred Habitat	Comments
	have a mixture of grass tussocks (nest sites) and open mud areas (feeding sites).	
Regent Honeyeater <i>Xanthomyza discolor</i> TSC Act, Sch. 1, Endangered.	Occurs in temperate Eucalypt woodlands and open forests. Has a particular liking for Box and Ironbark Eucalypts as well as Swamp Mahogany and Spotted Gum.	No suitable natural habitat occurs on the site and poor connectivity.
Scarlet Robin <i>Petroica boodang</i> TSC Act Sch. 2, Vul.	Inhabits dry Eucalypt forests and woodlands, usually prefers grassy understorey with scattered shrubs. Occasionally occurs in mallee or wet forest communities	Poor connectivity.
Speckled Warbler <i>Pyrholaemus sagittatus</i> TSC Act Sch. 2, Vul.	Inhabits 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	Poor connectivity.
Spotted Harrier <i>Circus assimilis</i> TSC Act Sch. 2, Vul.	Occurs in grassy open woodland including acacia and mallee remnants, inland riparian woodland, grassland. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands.	Vagrant from inland.
Square-tailed Kite <i>Lophoictinia isura</i> TSC Act, Sch. 2, Vul.	Inhabits coastal forest and woodlands. Most commonly associated with ridge and gully forests dominated by Woollybutt, Spotted Gum or Peppermint Gum.	Suitable natural habitat occurs on the site.
Little Lorikeet <i>Glossopsitta pusilla</i> TSC Act, Sch. 2, Vul.	Forages primarily in the canopy of open Eucalypt forest and woodland, and also forages on Angophora, Melaleuca and other tree species. Favours riparian habitats.	Suitable natural habitat occurs on the site.
Swift Parrot <i>Lathamus discolor</i> TSC Act, Sch. 2, Vul. EPBC Act, End.	Occurs in a variety of Eucalypt forests. Migrates from Tasmania to the mainland during the winter/autumn months to feed mostly on winter flowering Eucalypts	No suitable natural habitat occurs on the site.
Turquoise Parrot <i>Neophema pulchella</i> TSC Act, Sch. 2, Vul.	Occurs in eucalyptus woodlands and open forests with a ground cover of grasses and low understorey of shrubs.	No suitable natural habitat occurs on the site and poor connectivity.
Varied Sittella <i>Daphoenositta chrysoptera</i> TSC Act Sch. 2, Vul.	Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland	Poor connectivity.
Hooded Robin <i>Melanodryas cucullata cucullata</i> TSC Act, Sch. 2, Vul.	Favours lightly wooded country, typically eucalypt woodland, acacia shrubland and mallee, often in or near clearings or open areas.	Poor connectivity. Vagrant in this locality.
Brown Treecreeper <i>Climacteris picumnus victoria</i> TSC Act, Sch. 2, Vul.	Prefers eucalypt woodlands and dry open forest of the inland slopes and plains. Favours woodlands dominated by stringybarks or other rough-barked eucalypts with a grassy or scattered shrub understorey. Fallen timber is an important	Poor connectivity. Vagrant in this locality.



Common Name Scientific Name Schedule Listing	Preferred Habitat	Comments
	habitat component for foraging.	
Powerful Owl <i>Ninox strenua</i> TSC Act, Sch. 2, Vul.	Pairs occupy permanent territories in mountain forests, gullies and forest margins, sparser hilly woodlands, coastal forests, woodlands and scrubs.	Suitable natural habitat occurs on the site.
Barking Owl <i>Ninox connivens</i> TSC Act, Sch. 2, Vul.	Found in open forests, woodlands, dense scrubs, river red gums and other large trees near watercourses.	Suitable natural habitat occurs on the site.
Sooty Owl <i>Tyto tenebricosa</i> TSC Act, Sch. 2, Vul.	Tall, wet forests in sheltered mountain gullies, usually with an east and Southeast aspect.	No suitable natural habitat occurs on the site.
Masked Owl <i>Tyto novaehollandiae</i> TSC Act, Sch. 2, Vul.	Forests, open woodlands and farms with large trees, e.g. river red gums adjacent to cleared country.	Suitable natural habitat occurs on the site.



Appendix 8. Habitat requirements for locally-occurring threatened plant species

Botanical name conservation status	Habitat description	Suitable habitat on site
<i>Acacia bynoeana</i> ROTAP, 3VC - TSC Act, Sch. 1, End. EPBC Act, Vul.	Grows mainly in heath and dry sclerophyll forest, in sandy soils.	No
<i>Acacia pubescens</i> ROTAP, 3VCa TSC Act, Sch. 2, Vul. EPBC Act, Vul.	Usually grows in dry sclerophyll forest and woodland in clay soils. Often in roadside and railside bushland remnants.	Yes
<i>Allocasuarina glareicola</i> ROTAP, 2E TSC Act, Sch. 1, End. EPBC Act, End.	Grows in open forest on lateritic soil; restricted to a few small populations in or near Castlereagh S.F., NE of Penrith.	No
<i>Callistemon linearifolius</i> ROTAP, 2RCi TSC Act, Sch. 2, Vul.	Grows in dry sclerophyll forest on the coast and adjacent ranges, chiefly from Georges R. to the Hawkesbury R.	No
<i>Cynanchum elegans</i> ROTAP, 3ECi TSC Act, Sch. 1, End. EPBC Act, End.	Rare, recorded from rainforest gullies scrub and scree slopes; from the Gloucester district to the Wollongong area and inland to Mt Dangar.	No
<i>Darwinia biflora</i> ROTAP, 2VCa TSC Act, Sch. 2, Vul. EPBC Act, Vul.	Grows in heath on sandstone or in the understorey of woodland on shale-capped ridges; Cheltenham to Hawkesbury R., rare.	No
<i>Dillwynia tenuifolia</i> ROTAP, 2RCa TSC Act, Sch. 2, Vul.	Grows in dry sclerophyll woodland on sandstone, shale or laterite; from Cumberland Plain, Blue Mtns to Howes Valley area.	Yes
<i>Diuris aequalis</i> ROTAP, 3VC - TSC Act, Sch. 2, Vul. EPBC Act, Vul.	Grows among grass in sclerophyll forest, mainly in the ranges and tablelands; chiefly from Braidwood to Kanangra and Liverpool.	No
<i>Epacris purpurascens</i> var. <i>purpurascens</i> TSC Act, Sch. 2, Vul.	Grows in sclerophyll forest, scrubs and swamps on sandstone from Gosford and Sydney districts.	No
<i>Eucalyptus</i> sp. 'Cattai' TSC Act, Sch. 1, End.	Grows as isolated trees or small groups of trees in scrub, heath and low woodland, in sandstone-derived soils.	No
<i>Grevillea juniperina</i> subsp. <i>juniperina</i> TSC Act, Sch. 2, Vul.	Grows in open dry sclerophyll (eucalypt-dominated) forest or woodland, at altitudes of less than about 50 m, in sandy to clay-loam soils and red pseudolateritic gravels.	Yes
<i>Grevillea parviflora</i> subsp. <i>parviflora</i> TSC Act, Sch. 2, Vul. EPBC Act, Vul.	Grows in heathy associations or shrubby woodland, in sandy or light clay soils usually over shale substrates.	No
<i>Hibbertia superans</i> TSC Act, Sch. 1, End.	Recorded on dry sclerophyll forest on sandstone ridges in the Sydney district.	No



Botanical name conservation status	Habitat description	Suitable habitat on site
<i>Isotoma sessiliflora</i> (was <i>Hypsela sessiliflora</i>) ROTAP, 2X TSC Act, Sch. 1, End.	Grows in damp places, on the Cumberland Plain, very rare.	Yes
<i>Leucopogon exolasius</i> ROTAP, 2VC - TSC Act, Sch. 2, Vul. EPBC Act, Vul.	Grows in woodland on sandstone, restricted to the Woronora and Grose Rivers and Stokes Creek, Royal N.P.	No
<i>Leucopogon fletcheri</i> subsp. <i>fletcheri</i> ROTAP, 2RC - TSC Act, Sch. 1, End.	Grows in woodland on lateritic soils; rare, in the Springwood area.	No
<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> TSC Act, Sch. 1, End. Pop.	Grows in woodland and scrub; north from the Razorback Ra. (Bankstn, Blacktn, Camden, Campbelltn, Fairfield, Holroyd, Liverpool & Penrith LGAs)	Yes
<i>Micromyrtus minutiflora</i> ROTAP, 2V TSC Act, Sch. 1, End. EPBC Act, Vul.	Grows in dry sclerophyll forest in western part of the Cumberland Plain; rare.	No
<i>Persoonia hirsuta/evoluta</i> ROTAP, 3KCi TSC Act, Sch. 1, End. EPBC Act, End.	Grows in woodland to dry sclerophyll forest on sandstone; both subspecies occurring as isolated individuals or very small populations.	No
<i>Persoonia nutans</i> ROTAP, 2ECi TSC Act, Sch. 1, End. EPBC Act, End.	Grows in woodland to dry sclerophyll forest on laterite and alluvial sand; confined to the Cumberland Plain.	No
<i>Pilularia novae-hollandiae</i> TSC Act, Sch. 1, End.	Widespread but not common in seasonally dry depressions and margins of marshes; may grow submerged.	Yes
<i>Pimelea curviflora</i> var. <i>curviflora</i> TSC Act, Sch. 2, Vul. EPBC Act, Vul.	Confined to coastal areas around Sydney on sandstone.	No
<i>Pimelea spicata</i> ROTAP, 3ECi TSC Act, Sch. 1, End. EPBC Act, End.	Grows on the coast from Lansdowne to Shellharbour and inland to Penrith; rare.	Yes
<i>Pterostylis nigrans</i> ROTAP, 3V TSC Act, Sch. 2, Vul.	Grows in coastal scrub and heath	No
<i>Pterostylis saxicola</i> ROTAP, (2E) TSC Act, Sch. 1, End. EPBC Act, End.	Grows in shallow soil over sandstone sheets, often near streams; rare, from Picnic Point to Picton area.	No
<i>Pultenaea parviflora</i> ROTAP, 2E TSC Act, Sch. 1, End. EPBC Act, Vul.	Grows in dry sclerophyll forest on Wianamatta Shale, laterite or alluvium, Cumberland Plain.	No
<i>Pultenaea pedunculata</i> TSC Act, Sch. 1, End.	Grows in dry sclerophyll forest and disturbed sites on a variety of soils on the South Coast and edge of the Southern Tableland, but with disjunct restricted populations on Wianamatta Shale on the Cumberland Plain in N.S.W.	No



Botanical name conservation status	Habitat description	Suitable habitat on site
<i>Syzygium paniculatum</i> TSC Act, Sch. 1, End. EPBC Act, Vul.	Rainforest and open forest near riparian zones.	No
<i>Tetratheca glandulosa</i> ROTAP, – 2VC – TSC Act, Sch. 2, Vul. EPBC Act, Vul.	Grows in sandy or rocky heath or scrub, from Mangrove Mtn to the Blue Mtns and Sydney.	No

Species of national/state significance with unsubstantiated records in western Sydney

Acacia mathewii (Cattai NP)
Atkinsonia ligustrina (Grose Vale)
Boronia serrulata (Baulkham Hills)
Deyeuxia appressa (Duck River, Auburn)
Haloragis exalata var. *exalata* (Maroota, Baulkham Hills)
Syzygium paniculatum (Cornelia, Baulkham Hills)

Key

TSC Act 1995:

Sch1 = Schedule 1: Endangered species
 Part 1: endangered species
 Part 2: endangered populations
 Part 3: endangered ecological communities
 Part 4: species presumed extinct
 Sch2 = Schedule 2: Vulnerable species

EPBC Act 1999:

CE = Critically Endangered
 E = Endangered
 V = Vulnerable
 EP = Endangered Population

W-Syd End = Western Sydney endemic species
 X – WSyd = Extinct in western Sydney

ROTAP Codes

1 Known by one collection only
 2 Geographic range in Australia < 100Km
 3 “ “ “ “ “ > 100Km
 E Endangered
 V Vulnerable
 R Rare
 X Extinct
 K Poorly known
 C Reserved
 a > or = 1000 plants reserved
 i < 1000 plants reserved
 † Total known population reserved
 - Reserved population size unknown
 + Overseas occurrence



Appendix 9. Company Profile

Abel Ecology has been in the flora and fauna consulting business since 1991, starting in the Sydney Region, and progressively more state wide in New South Wales since 1998, and now also in Victoria. During this time extensive expertise has been gained with regard to Master Planning, Environmental Impact assessments including flora and fauna, bushfire reports, Vegetation Management Plans, Management of threatened species, Review of Environmental Factors, Species Impact Statements and as Expert Witness in the Land and Environment Court. We have done consultancy work for industrial and commercial developments, golf courses, civil engineering projects, tourist developments as well as residential and rural projects. This process has also generated many connections with relevant government departments and city councils in NSW. Our team consists of four scientists and two administrative staff, plus casual assistants as required.

Licences

NPWS s132C Scientific licence number is SL100780 expires 30 April 2015

NPWS GIS data licence number is CON95034

DG NSW Dept of Primary Industries Animal Care and Ethics Committee Approval expires 8 December 2015

DG NSW Dept of Primary Industries Animal Research Authority expires 8 December 2014

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