

bushfire & ecology

flora & fauna assessment

CSR Brick Plant Lot 1 DP 106143 327-335 Burley Road HORSLEY PARK

> February 2017 (REF: A16094F)



Flora & Fauna Assessment

CSR Brick Plant Lot 1 DP 106143 – 327-335 Burley Road, Horsley Park

Report Authors: Michael Sheather-Reid B. Nat. Res. (Hons.) - Senior Ecologist Lindsay Holmes B. Sc. - Botanist Robert Sansom B. Sc. (Hons.) - Botanist Corey Mead B. App. Sc. - Fauna Ecologist Plans prepared: Emma Buxton B. Sc. Kelly Tucker Dip. SIS. Checked by: Michael Sheather-Reid Date: 09/02/17 File: A16094EPBC

This document is copyright © Travers bushfire & ecology 2016

Disclaimer:

This report has been prepared to provide advice to the client on matters pertaining to the particular and specific development proposal as advised by the client and / or their authorised representatives. This report can be used by the client only for its intended purpose and for that purpose only. Should any other use of the advice be made by any person including the client then this firm advises that the advice should not be relied upon. The report and its attachments should be read as a whole and no individual part of the report or its attachments should be interpreted without reference to the entire report.

The mapping is indicative of available space and location of features which may prove critical in assessing the viability of the proposed works. Mapping has been produced on a map base with an inherent level of inaccuracy, the location of all mapped features are to be confirmed by a registered surveyor.

ABN 64 083 086 677 PO Box 7138 Kariong NSW 2250 38A The Avenue Mt Penang Parklands Central Coast Highway Kariong NSW 2250

t: 02 4340 5331 e: info@traversecology.com.au www.traversecology.com.au

Executive Summary

Travers bushfire & *ecology* has been engaged to undertake flora and fauna assessment within the CSR Horsley Park Brick Plant at Lot 1 DP 106143, 327-335 Burley Road, Horsley Park. This entire lot will hereafter be referred to as the 'study area'. This study area is subject to a staged 'proposed action' under the EPBC Act and therefore this definition will also refer to the entire lot.

The proposed action is to be undertaken under the State Environmental Planning Policy (Western Sydney Employment Area 2009). The proposal is for a 14 lot industrial subdivision in three stages to create 14 industrial usage lots and one lot for environmental conservation. Refer to Figure 1 for proposed subdivision layout and Section 1.3 for a full description of the proposal. The environmental conservation Lot 205 reserve is proposed to be biobanked and funded through this scheme.

The subdivision area subject to removal of existing habitat for industrial facilities inclusive of internal roads, APZ's and services will be referred to as the 'subject site'. There will be a small amount of habitat removal outside of Lot 1 as part of providing road access into the site and vegetation removal will be calculated for this as part of 'ancillary works'.

Ecological survey and assessment has been undertaken in accordance with relevant legislation including the *Environmental Planning and Assessment Act 1979*, the *Threatened Species Conservation Act 1995*, the commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and the *Fisheries Management Act 1994*.

Observations

Two (2) threatened ecological communities, Cumberland Plain Woodland (CPW – equivalent to *Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest under the EPBC Act*), and River Flat Eucalypt Forest (RFEF) were recorded within the study area.

CPW occurs throughout the eastern vegetated portion of the study area in medium to high condition with some small patches of low quality located within the central western portions of the site. The size of the eastern patch is approximately 11.09 ha and it is proposed to retain, protect and manage 10.14 ha of this vegetation. The proposal will remove the smaller low quality patches totalling 2.85 ha, which includes an ancillary patch of 0.04 ha located on Burley Road which will be removed due to road intersection upgrade works.

RFEF occurs as numerous small patches within the central-western portions of the site. These smaller fragmented remnants are low in native species diversity and are proposed to be removed.

Large dams providing notable habitat for fauna during 2013 surveys have since been infilled as part of standard mining operations. Large-footed Myotis has still been recorded foraging over remaining smaller dams within the study area in 2016.

The endangered Cumberland Plain Land Snail (*Meridolum corneovirens*) was recorded present throughout the eastern woodland portion of the study area. This includes along the western fringe of this vegetation which is part of the subject site area proposed for removal. Therefore there will be a requirement to relocate snails from this edge into the consolidated area before habitat removal. The exotic snails *Cornu aspersum* and *Bradybaena similaris* were also recorded at the outer fringes of this remnant and appear to be slowly encroaching on the internal habitat area. There were no recordings of *M. corneovirens* in remaining small isolated remnants within the study area.

Two hollow-dependent threatened microbat species including the Large-footed Myotis and Greater Broad-nosed Bat were recorded during surveys. Both species may also utilise structures for roosting and hence may utilise the existing site sheds and infrastructure.

A complete assessment of the location of habitat trees and the size of hollows within was undertaken as part of surveys. The hollows were found to be generally small and at very low density. This was the case even throughout the large eastern woodland remnant which is likely the result of previous selective logging or other previous clearance disturbance. There were no large hollows observed present within the study area and therefore no suitable nesting or hollow roosting habitat for owls or cockatoos is present.

Grey-headed Flying-foxes have been observed during nocturnal surveys however no roosting or subsequent breeding habitat for this species is present. Therefore site dependence for this species is for seasonal foraging as flowering resources permit.

Significance of Impact

In respect of matters required to be considered under the *Environmental Planning and* Assessment Act 1979 and relating to the species / provisions of the *Threatened Species Conservation Act 1995*, four (4) threatened fauna species including Grey-headed Flying-fox (*Pteropus poliocephalus*), Large-footed Myotis (*Myotis macropus*), Greater Broad-nosed Bat (*Scoteanax rueppellii*) and Cumberland Plain Land Snail (*Meridolum corneovirens*), no threatened flora species, and one (1) EEC, Cumberland Plain Woodland were recorded within the study area. The Greater Broad-nosed Bat was recorded only to a 'possible' level of certainty during both 2013 and 2016 surveys.

Environmental Planning and Assessment Act 1979

In accordance with Section 5A of the *Environmental Planning and Assessment Act 1979*, the 7 part test of significance concluded that the proposed subdivision development will not likely have a significant impact on any threatened species, populations or EECs. Therefore, a Species Impact Statement should not be required for the proposal.

Fisheries Management Act 1994

In respect of matters relative to the *Fisheries Management Act 1994*, no suitable habitat for threatened marine or aquatic species was observed within the study area and there are no matters requiring further consideration under this Act.

Environment Protection and Biodiversity Conservation Act 1999

In respect of matters required to be considered under the *Environment Protection and Biodiversity Conservation Act 1999*, one (1) threatened fauna species Grey-headed Flyingfox (*Pteropus poliocephalus*), two protected migratory bird species including Cattle Egret (*Ardea ibis*) and Latham's Snipe (*Gallinago hardwickii*), no threatened flora species, and one EEC, Cumberland Plain Shale Woodland and Shale-Gravel Transition Forest listed under this Act were recorded within the study area.

The proposed subdivision development was not considered to have a significant impact on matters of national environmental significance. Response from the DOEE (EPBC Ref: 2016/7744) dated 28th October 2016 indicated that Ms Kim Farrant, *Assistant Secretary, Assessments (NSW, ACT) and Fuel Branch* decided that the proposed action is a controlled action and that it will be assessed by preliminary documentation. Further information including survey and assessment was requested on EPBC listed matters only and this has been incorporated into this updated report.

A detailed assessment for CPW, Grey-headed Flying-fox, Koala and Swift Parrot has been undertaken as per the EPBC Act Policy Statement 1.1 *Significant Impact Criteria* for *Matters of National Environmental Significance*. The proposed subdivision development was not considered to have a significant impact on matters of national environmental significance.

Recommendations

It is recommended;

- 1. An 88B instrument that requires the Conservation Lot and surrounding 25 m APZ to be managed in accordance with the approved Vegetation Management Plan.
- 2. The conservation lot 205 will be protected in perpetuity through the same 88B instrument and maintained in perpetuity and if approved as a Biobank site.
- 3. All drainage within Lots 204, 203, 306 and 307 will be collected into the proposed stormwater system and will not be directed to the conservation lot. Drainage within the proposed asset protection zones will be via overland runoff across a grassed native pasture and will not result in any significant contaminants being delivered to the conservation lot. This is consistent with the sites current drainage pattern that does not direct any surface runoff into the CPW conservation lot except of the existing batters.
- 4. A 25m managed ecological zone in the form of a revegetated asset protection zone with a canopy cover of 30% and densely planted native groundlayers species will be provided and managed in perpetuity as per the approved vegetation management plan.
- 5. Street tree planting and landscaping within the industrial subdivision is to utilise native trees, shrubs and groundcovers endemic to Cumberland plain Woodland.
- 6. Any removal of hollows should be under the supervision of a fauna ecologist so that residing fauna may be effectively recovered. Hollows of high quality or with fauna recorded residing within should be sectionally dismantled and all hollows should be inspected for occupation, activity and potential for reuse. In the instance of recording the presence of threatened microbats during tree removal, maximum effort should ensure safe relocation of the roosting colony. Re-used hollows or those with likely occupation are to be relocated into the conservation area. All other hollows removed should be replaced with nest boxes. Every second box should be a design suitable for microbat species. Boxes should be constructed all of weatherproof timber (marine ply), fasteners and external paint.
- 7. In the event that microbats are found roosting within structures during the demolition process, work should cease immediately and a fauna ecologist contacted. The fauna ecologist is to recover the roosting colony by best practice measures to prevent or minimise impacts on this colony.

- If there is to be any replaced or newly constructed fencing within the subdivision is to be wildlife friendly. Fencing is not to include barbed wire strands except on the outer lot boundaries that contain grazing domestic cattle.
- Any windows within constructed buildings within the proposed subdivision are not to contain a reflective coating to cause a mirror effect that may increase the rate of bird strike, specifically for the endangered Swift Parrot.
- 10. Any Cumberland Plain Land Snail habitat restoration, relocation and habitat enhancement proposal should be accompanied with a pest species eradication process to ensure that *M. corneovirens* may establish itself within the retained CPW habitat with little competition. This will include a process of collecting and euthanizing as many exotic snails as possible. Simple perimeter barriers such as a permanent sediment filter fence surrounding the remnant or associated with the perimeter fencing will restrict re-colonisation of the CPW by exotic snails such as *Cornu aspersum* and *Bradybaena similaris*.
- 11. Sediment and erosion control measures are to be installed immediately prior to the commencement of demolition, construction and earthworks.
- 12. Inspection and removal of any aquatic fauna from the existing waterbodies.
- 13. Installation of protective fencing around drip zone of trees that interface with the development site to be retained. This is largely complete already.
- 14. Undertake weed control.
- 15. Enhance retained areas with mid-storey species of CPW origin where they are not present.
- 16. Provide a 20m bushland interface zone to effectively monitor and manage edge effects adjacent to proposed development.
- 17. Enhancement of Cumberland Plain Land Snail habitat.
- 18. Nest box installation in accordance with approved Vegetation management plan.

List of abbreviations

APZ	asset protection zone		
BPA	bushfire protection assessment		
CLUMP	conservation land use management plan		
DCP	Development Control Plan		
DEC	NSW Department of Environment and Conservation (superseded by DECC from 4/07)		
DECC	NSW Department of Environment and Climate Change (superseded by DECCW from 10/09)		
DECCW	NSW Department of Environment, Climate Change and Water (superseded by OEH from 4/11)		
DOEE	Commonwealth Department of Environment and Energy		
EEC	endangered ecological community		
EPA	Environmental Protection Agency		
EP&A Act	Environmental Planning and Assessment Act		
EPBC Act	Environment Protection and Biodiversity Conservation Act		
ESMP	ecological site management plan		
FF	flora and fauna assessment		
FM Act	Fisheries Management Act		
FMP	fuel management plan		
HTA	habitat tree assessment		
IPA	inner protection area		
LEP	Local Environment Plan		
LGA	local government area		
NES	national environmental significance		
NPWS	NSW National Parks and Wildlife Service		
NSW DPI	NSW Department of Industry and Investment		
OEH	Office of Environment and Heritage (Part of the NSW Department of Premier and Cabinet)		
OPA	outer protection area		
PBP	Planning for bushfire protection 2006		
POM	plan of management		
RF Act	Rural Fires Act		
RFS	NSW Rural Fire Service		
ROTAP	rare or threatened Australian plants		
SEPP 44	State Environmental Protection Policy No 44 – Koala Habitat Protection		
SEWPAC	Federal Department of Sustainability, Environment, Water, Population and Communities (now DOEE)		
SIS	species impact statement		
SULE	safe useful life expectancy		
TPO	tree preservation order		
TPZ	tree preservation zone		
TRRP	tree retention and removal plan		
TSC Act	Threatened Species Conservation Act		
VMP	vegetation management plan		

Table of Contents

Sectio	on 1.0 – Introduction	1
1.1	Aims Of The Assessment	1
1.2	Statutory Requirements	1
	1.2.1 Threatened Species Conservation Act 1995 (Tsc Act)	2
	1.2.2 Fisheries Management Act 1994 (Fm Act)	2
	1.2.3 Environment Protection And Biodiversity Conservation Act 1999 (Epbc	; Act)2
1.3 1 4	Proposed Works	3 5
Sectio	on 2.0 – Survey Methodology	7
2.1	Information Collation, Technical Resources, Desktop Assessments, Sp	ecialist
	Identification And Licences	7
2.2	Flora Survey Methodology	8
2.3	Fauna Survey Methodology	10
2.4	Field Survey Effort	11
2.5	Site Specific Survey Techniques	13
2.6	Survey Limitations	16
Sectio	on 3.0 – Survev Results	18
31	Flora Results	18
5.1	3.1.1 Flora Species	10
	3.1.2 Vegetation Communities	
3.2	Fauna Results	29
Sectio	on 4.0 – Ecological Assessment	34
4.1	Previous Surveys Reviewed	34
4.2	Flora	34
	4.2.1 State Legislative Flora Matters	
	4.2.2 Flora And Tsc Act (1995) Eec Assessment Conclusions	
4.0	4.2.3 Matters Of National Environmental Significance - Flora	
4.3	EPBC Protected Flora Matters	424
	4.3.1 Management Of The Dustrianu Interface And APZ / Buller	42 ЛЛ
	4.3.3 Managed Ecological Buffer (Inclusive Of Asset Protection Zones)	
	4.3.4 Vegetation Surrounding The Action Area	
	4.3.5 Proposed Offset Measures	
	4.3.6 Economic And Social Matters	
	4.3.7 EPBC Offsets Policy	
4.4	Fauna	52
	4.4.1 Fauna Habitat	
	4.4.2 Habitat Trees	
	4.4.3 LOCAI FAUNA MATTERS	
	4.4.4 State Legislative Faulta Matters	
	4 4 6 Fauna Assessment Conclusions	
4.5	Potential Ecological Impact	63
Sectio	on 5.0 – Conclusion	65
5.1	Observations	65
5.2	Legislative Compliance	
5.3	Recommendations And Mitigation Measures	

Bibliography	70	n
ыриодгариту	. / י	U

Figures

Figure 1 – Proposed subdivision development layout	6
Figure 2 – Flora and fauna survey effort	32
Figure 3 – Flora and fauna survey results	33
Figure 4 – Assessment of Cumberland Plain Shale Woodlands and Shale-Gravel T	ransition
Forest	41
Figure 5 – Closest Grey-headed Flying-fox camps	60
Figure 6 – Local records of Swift Parrot out to 10km radius	61

Tables

Table 1.1 – Site features	5
Table 2.1 – Fauna survey effort	11
Table 2.2 – Flora survey effort	13
Table 3.1 – Flora observations for the study area	18
Table 3.2 – Fauna observations for the study area	29
Table 4.1 – State listed threatened flora species with suitable habitat present	35
Table 4.2 – Nationally listed threatened flora species with suitable habitat present	39
Table 4.3 – Observed fauna habitat	52
Table 4.4 – Habitat tree data	54
Table 4.5 – State listed threatened fauna species with suitable habitat present	56
Table 4.6 – Nationally listed threatened fauna species with suitable habitat present	57
Table A2.1 – Threatened flora habitat assessment	85
Table A2.2 – Threatened fauna habitat assessment	90
Table A2.3 – Migratory fauna habitat assessment	102

Appendices

- Appendix 1 TBE fauna survey methodologies
- Appendix 2 Threatened & migratory species habitat assessment
- Appendix 3 TSC Act (1995) 7 part test of significance
- Appendix 4 National Significant Impact Criteria and assessments for Swift Parrot, Greyheaded Flying-fox and Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest



Introduction



Travers bushfire & *ecology* has been engaged to undertake flora and fauna assessment within the CSR Horsley Park Brick Plant at Lot 1 DP 106143, 327-335 Burley Road, Horsley Park. This entire lot will be referred to as the 'study area'. This study area is subject to a 'proposed action' under the EPBC Act and therefore this definition will also refer to the entire lot.

The subdivision area subject to removal of existing habitat for industrial facilities inclusive of internal roads, APZ's and services will be referred to as the 'subject site'. There will be a small amount of habitat removal outside of Lot 1 as part of providing road access into the site and vegetation removal will be calculated for this as part of 'ancillary works'.

1.1 Aims of the assessment

The aims of the flora and fauna assessment are to:

- Carry out a botanical survey to describe the vegetation communities and their conditions
- Carry out a fauna survey for the detection and assessment of fauna and their habitats
- Complete target surveys for threatened species, populations and ecological communities
- Undertake a threatened species habitat assessment
- Prepare a flora and fauna impact assessment in accordance with the requirements of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), the Threatened Species Conservation Act 1995 (TSC Act), the Fisheries Management Act 1994 (FM Act) and Threatened species assessment guidelines, the assessment of significance (DECC 2007)

1.2 Statutory requirements

The site is zoned IN1 General Industrial and E2 Environmental Conservation under the State Environmental Planning Policy (Western Sydney Employment Area) 2009. Since the site is zoned under the SEPP there is no applicable LEP or DCP. However, under the SEPP comment is required on matters (Schedule 4) that would substitute for a DCP.

However to assist with satisfying Schedule 4 of the SEPP the following matters are addressed within this report including the:

- Identification of any significant vegetation or habitat onsite that would require protection under the DCP such as threatened species and EECs; and
- Opportunities to offset the loss of high quality remnants of native vegetation.

Management plans that might be required as a consequence of this report's findings are addressed within the recommendations.

1.2.1 Threatened Species Conservation Act 1995 (TSC Act)

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

1.2.2 Fisheries Management Act 1994 (FM Act)

The *FM Act* provides a list of threatened aquatic species that require consideration when addressing the potential impacts of a proposed development. Where a proposed activity is located in an area identified as critical habitat, or such that it is likely to significantly affect threatened species, populations, ecological communities, or their habitats, an SIS is required to be prepared.

1.2.3 Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

The *EPBC Act* requires that Commonwealth approval be obtained for certain actions. It provides an assessment and approvals system for actions that have a significant impact on matters of *national environmental significance* (NES). These may include:

- World Heritage Properties and National Heritage Places
- Wetlands of International Importance protected by international treaty
- Nationally listed threatened species and ecological communities
- Nationally listed migratory species

Flora and Fauna Assessment, Burley Road, Horsley Park

Commonwealth marine environment

Actions are projects, developments, undertakings, activities, and series of activities or alteration of any of these. An action that needs Commonwealth approval is known as a controlled action. A controlled action needs approval where the Commonwealth decides the action would have a significant effect on an NES matter. Where a proposed activity is located in an area identified to be of NES, or such that it is likely to significantly affect threatened species, ecological communities, migratory species or their habitats, then the matter needs to be referred to the Department of Environment and Energy (DOEE) for assessment. In the case where no listed federal species are located on site then no referral is required. The onus is on the proponent to make the application and not the Council to make any referral.

A threshold criterion apply to specific NES matters which may determine whether a referral is or is not required, such as for the EPBC listed ecological communities Cumberland Plain Woodland and Shale-Gravel transition Forest. Consultation with SEWPAC may be required to determine whether a referral is or is not required. If there is any doubt as to the significance of impact or whether a referral is required, a referral is generally recommended to provide a definite decision under the EPBC Act 1999 thereby removing any further obligations in the case of 'not controlled' actions. A significant impact is regarded as being:

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

Source: EPBC Policy Statement

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

1.3 Proposed action

The proposal is for a 16 lot industrial subdivision in three stages to create 14 industrial usage lots and one lot for conservation. A residual lot within Stage 2 will remain undeveloped due to subsurface contamination. Refer to Figure 1 for proposed subdivision layout.

Stage 1 development of the proposed Lots 101 and 102 with industrial and remediation works (land reforming) will proceed immediately given the low impact on vegetation and setback from the conservation lot. This stage will also include ancillary works to construct a

wider section of Burley Road between Old Wallgrove Road and the north-eastern corner of proposed Lot 101.

This will include provision of associated roads and services within Stage 1. The road access extending from Burley Road to the western entrance of the proposed road loop between Lots 101 and 302 will be undertaken as part of the Stage 1 works. Vegetation removal of a small patch of CPW outside of the proposed action area along Burley Road will be calculated as part of ancillary works but will contribute to the total calculations for offsetting purposes.

Subdivision of Stages 2 and 3 only commences once conservation Lot 205 is established as a BioBanking site. Stage 2 includes Lots 201 - 205 (with Lot 205 being the proposed conservation lot). Stage 3 includes Lots 301 - 307.

Mine remediation works (including vegetation removal) will commence for Stages 2 and 3 immediately.

The boundary of the conservation area (Lot 205) will be fenced with restricted access as outlined within a Vegetation Management Plan. This area will be conserved, managed and funded for the protection of Cumberland Plain Woodland (CPW) and the habitats it contains in perpetuity under the NSW Biobanking Scheme. A Bushland Interface Zone 20 metres wide will be established within the boundary of Lot 205 as shown in the Vegetation Management Plan (VMP).

In addition, a dual purpose asset protection zone and ecological buffer (managed ecological zone) will be established adjacent (outside) the proposed Lot 205 Conservation Area. Managed ecological zone will be 25 metres wide and will be planted out with species commensurate with CPSW at densities that will allow it to perform as an Inner Protection Area (IPA).

The site contains a number of small dams that will all be dewatered and in-filled as part of the proposal. Two large dams that were present within the study area during 2013 surveys have since been removed as part of site mining operations.

Alternative development options

The CPW remnants proposed for removal through the subdivision development landscape are all small, degraded and isolated remnants. There is no logical alternative industrial subdivision layout within the site to involve the restoration of these remnants, particularly given that any revegetation and restoration within the site would be more beneficial by enhancing and increasing the large eastern patch. This patch provides higher recorded and potential threatened fauna species habitat, most notably the Cumberland Plain Land Snail which was recorded in this large area but not in any of the small degraded patches. The same can be said for threatened birds and bats that may make passage through the site.

1.4 Site description

Table 1.1 provides a summary of the planning, cadastral, topographical, and disturbance details of the study area.

Table 1.1 – Site features

Location	Lot 1 DP 106143, 327-335 Burley Road, Horsley Park
Local government area	Fairfield
Grid reference	298680E 6254400N
Elevation	70-90m AMSL approximately
Topography	Situated on slightly undulating landscape with constructed mounds and excavations outside of the woodland area to the west.
Geology and soils	Geology; Wianamatta Group – Shale, carbonaceous claystone, claystone, laminite, fine to medium-grained lithic sandstone, rare coal and tuff. Soils; Blacktown – gently undulating rises on Wianamatta Group shales.
Catchment and drainage Dams within the site drain north along an unnamed drainag Creek which flows into South Creek and eventually the Win of the Hawkesbury River.	
Vegetation	The native vegetation present in the eastern confines of the site is mature regrowth woodland. Trees are around 15-25m tall in most areas, with a dense shrub layer in some areas within. The vegetation outside of the eastern woodland remnant is highly modified throughout the study area due to previous clearing, brick works and continued grazing.
Existing land use	The woodland area outside of the brick pit areas is currently utilised for cattle grazing.
Clearing	Small areas and trails within the woodland area of the study area have been previously subject to small scale clearing and the remaining southern portions of the study area have been extensively cleared with removal of topsoil.



Figure 1 – Proposed subdivision development layout



Survey Methodology

2.1 Information collation, technical resources, desktop assessments, specialist identification and licences

A review of the relevant information pertinent to the study area was undertaken.

Standard Technical Resources utilised:

- Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities 2004 (working draft), Department of Environment and Conservation (DEC)
- Aerial photographs (Google Earth Pro / Spatial Information Exchange)
- Topographical maps (scale 1:25,000)
- Threatened Species Conservation Act 1995 (TSC Act)
- Fisheries Management Act 1994 (FM Act)
- Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)
- Rare or Threatened Australian Plants (ROTAP)
- NPWS (2002) Vegetation Mapping of the Cumberland Plain

Desktop Assessment:

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

- **A literature review** A review of readily available literature for the area was undertaken to obtain reference material and background information for this survey.
- A data search A search of the Atlas of NSW Wildlife (OEH 2016) was undertaken to identify records of threatened flora and fauna species located within a 10km radius of the site. Searches were also undertaken on the SEWPAC 'protected matters search tool' website to generate a report that will help determine whether matters of national environmental significance or other matters protected by the EPBC Act are likely to occur in the area of interest. The search was broadened to a 10km radius like the Atlas search. These two searches combined, enabled the preparation of a list of threatened flora and fauna species that could potentially occur within the habitats found on the site (Tables A2.1, A2.2 and A2.3).

Accuracy of identification:

Specimens of plants not readily discernible in the field were collected for identification. Structural descriptions of the vegetation were made according to Specht *et al* (1995).

Licences:

Individual staff members of *Travers bushfire* & ecology are licensed under Clause 20 of the *National Parks and Wildlife (Land Management) Regulation 1995* and Sections 120 & 131 of the *National Parks and Wildlife Act 1974* to conduct flora and fauna surveys within service and non service areas. NPWS Scientific Licence Numbers: SL100848.

Travers bushfire & ecology staff are licensed under an Animal Research Authority issued by the Department of Agriculture. This authority allows *Travers bushfire & ecology* staff to conduct various fauna surveys of native and introduced fauna for the purposes of environmental consulting throughout New South Wales.

2.2 Flora survey methodology

2.2.1 Previous Flora Surveys (2013)

Initial flora survey was undertaken on 14 August 2013. Survey was restricted to the remnant vegetation in the eastern portion of the study area. Nine (9) 20x20m floristic biometric style quadrats were assessed within the eastern woodland portion of the study area.

Biometric style quadrats are used to determine vegetation quality, particularly for endangered ecological community (EEC) assessment purposes.

The edges of this large remnant were defined and the EEC was broken down into a few vegetation types based upon dominant canopy species. A random meander was conducted during this period to create a broad species list of the area.

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

Consequently, target surveys were undertaken within this eastern portion of the study area for threatened species with potential habitat. One (1) specimen of *Pultenaea* was sent to the Royal Botanic Gardens for confirmation which was identified as a non-threatened species.

On the 27th of November 2013, one (1) full day of botanical survey was undertaken over the central and western portions of the site within the remnant fragmented patches.

The species list obtained from the random meander was appended and a further eleven (11) biometric style quadrats were undertaken within remnants large enough for those to be done.

Target survey for threatened flora species was conducted during the quadrat surveys and afterwards within areas not subjected to quadrat survey. A brief threatened flora survey was conducted over the south-eastern portion of the study area (previously surveyed in August 2013).

2.2.2 Flora Surveys 2016

Twenty eight (28) Biobanking transect plots were undertaken over five (5) dates in November 2016 (8th, 10th 15th, 16th, 17th and 23rd) in accordance with Bio-Banking Assessment Methodology (BBAM) 2014 methodology. Target threatened species searches were undertaken on these date also. Locations of these plots are shown in Figure 2.

The following information was collected at each of the fifteen (15) 20 x 20 m full floristic plots:

- Stratum (and layer): stratum and layer in which each species occurs
- Growth form: growth form for each recorded species
- Species name: scientific name and common name
- Percent projected foliage cover of the understorey strata and exotic vegetation

The following information was collected at each of the 20 x 50 m transect sites:

- Native overstorey cover recorded at 10 points along a 50 m transect
- Native midstorey cover recorded at 10 points along a 50 m transect
- Native ground cover recorded at 50 points along a 50 m transect for three life forms (shrubs, grasses and other)
- Number of trees with hollows visible from the ground within the 20 m x 50 m plot
- The total length of fallen logs >10 cm in diameter within the 20 m x 50 m plot
- The proportion of regenerating overstorey species within the vegetation zone

Stratification based on vegetation type and condition was taken into consideration when locating the plots and transects. Table 4.1 indicates that the minimum number of plot and transect sites required has been sampled for this assessment.

Flora and Fauna Assessment, Burley Road, Horsley Park

2.3 Fauna survey methodology

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

Current standard fauna survey techniques employed by *Travers bushfire & ecology* in line with relevant survey guidelines as well as current survey knowledge are provided in Appendix 1.

Fauna survey techniques that have been tailored to the site are provided in Section 2.5.

2.4 Field survey effort

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

Table 2.1 – Fauna survey effort

Fauna group	Date	Weather conditions	Survey technique(s)	Survey effort / time (24hr)
	14/8/13	0/8 cloud, mod W wind, no rain, temp 17-25°C	Opportunistic listening for calls	6hrs 25min 0920 - 1545
Diurnal birde	10/12/13	1/8 cloud, mod SE wind, no rain, temp 30-23°C	Diurnal opportunistic	5hrs 25min 1445- 2010
Diumai birus	16/11/16	1/8 cloud, mod SE wind, no rain, temp 23-18°C	Diurnal census/opportunistic	6hrs 50min 1300 - 1950
	10/12/13	0/8 cloud, no wind, light rain, ¼ moon, temp 22°C	Spotlighting Call playback (PO / MO / BO)	1hr 55min 2020 - 2215 Commenced @ 2120
Nocturnal	16/11/16	4/8 cloud, light E wind, no rain, temp 18°C	Spotlighting	2hrs 55min 1950 - 2245
bilds			Call playback (AB / BSC)	Commenced @ 2010
	10/12/13	0/8 cloud, no wind, light rain, ¼ moon, temp 22°C	Spotlighting Call playback (Section 2.5 species)	1hr 55min 2020 - 2215 Commenced @ 2130
Arboreal	16/11/16	4/8 cloud, light E wind, no rain, temp 18°C	Spotlighting	2hrs 55min 1950 - 2245
manniais			Call playback (Koala)	Commenced @ 2130
Torrostrial	10/12/13	0/8 cloud, no wind, light rain, ¼ moon, temp 22°C	Spotlighting	1hr 55min 2020 - 2215
mammals	16/11/16	4/8 cloud, light E wind, no rain, temp 18°C	Spotlighting	2hrs 55min 1950 - 2245
Bats	10/12/13	0/8 cloud, no wind, light rain, ¼ moon, temp 23°C	Spotlighting Anabat SD-2 (Passive monitoring) x2	2hrs 2000 - 2200 2 hrs 2010 - 2210
			Anabat 6 (Passive monitoring)	2 hrs 2010 - 2210
	17/2/14	3/8 cloud, no wind, no rain, temp 22°C	Habitat searches in structures	50min 1820 - 1910
	16/11/16	4/8 cloud, light E wind, no rain, temp 18°C	Spotlighting	2hrs 55min 1950 - 2245
			Ultrasonic recording x4	Overnight x4
Reptiles	14/8/13	0/8 cloud, mod W wind, no rain, temp 17-25°C	Habitat search, opportunistic	6hrs 25min 0920 - 1545

Fauna group	Date	Weather conditions		Survey technique(s)		Survey effort / time (24hr)
	10/12/13 1/8 cloud, mod SE wind, n		in, temp 30-23°C	Habitat search, oppo	rtunistic	5hrs 25min 1445- 2010
	16/11/16	1/8 cloud, mod SE wind, no rai	iin, temp 23-18⁰C	Habitat search, oppo	rtunistic	6hrs 50min 1300 - 1950
	10/12/13	1/8 cloud, mod SE wind, no rai	iin, temp 30-23°C	Habitat search, oppo	rtunistic	5hrs 25min 1445- 2010
Amphibians	10/12/13	0/8 cloud, no wind, light rain, ½	∕₄ moon, temp 22ºC	Spotlighting & call ide Call-playback (GGBF	entification	1hr 55min 2020 - 2215 Commenced @ 2020
	17/2/14	3/8 cloud, no wind, no rain, ten	mp 22⁰C	Habitat searches targ	geting GGBF	50min 1910 - 2000
		3/8 cloud, no wind, no rain, ten	mp 21-20°C, late 4/4 moon	GGBF target surveys	5	1hr 40min 2000 - 2140
	18/2/14	1/8 cloud, no wind, no rain, ten	mp 22°C, late 3/4 moon	GGBF target surveys	;	2hrs 15min 2000 - 2215
	16/11/16	4/8 cloud, light E wind, no rain, temp 18°C		Spotlighting & call identification		2hrs 55min 1950 - 2245
				Call-playback (GGBF	-)	Commenced @ 2100
	14/8/13	0/8 cloud, mod W wind, no rain, temp 17-25°C		Target searches in woodland area		6hrs 25min 0920 - 1545
Mollusos	10/12/13	1/8 cloud, mod SE wind, no rain, temp 30-23°C		Target searches in remaining small remnants		2 hrs 1445 - 1645
Monuses	16/11/16	1/8 cloud, mod SE wind, no rain, temp 23-18°C		Target searches in all CPW remnants		6hrs 50min 1300 - 1950
PO – Powerful Owl MO – Masked Owl		BO AB	BO – Barking Owl AB – Australian Bittern		BSC – Bush Stone-curlew GGBF – Green and Golden Bell Frog	

Table 2.2 – Flora survey effort

Flora survey	Survey technique(s)	Dates
Vegetation communities	Survey of the boundaries of all communities – field verification and aerial photographic interpretation Vegetation condition assessment – Biometric field method	14/8/13 (eastern portion) 27/11/13 (remainder of site) 8-23/11/16 (whole site)
Stratified sampling	Biometric quadrats in all existing bushland or remnant areas	14/8/13 (eastern portion) 27/11/13 (remainder of site) 8-23/11/16 (whole site)
Target searches	Target searches undertaken within preferred habitats for threatened flora	14/8/13 (eastern portion) 27/11/13 (remainder of site) 8-23/11/16 (whole site)

2.5 Site specific survey techniques

Diurnal birds

Five (5) diurnal bird census points were undertaken within the study area during December 2013 survey and a further four (4) were undertaken during November 2016 survey. A minimum of 20 minutes of survey was undertaken at each census point in an area radiating out to between 30-50m. Bird census points were selected to give an even spread and representation across the site and its vegetated communities (refer to Figure 2). Census points were also commenced in locations where bird activity was apparent, as often different small bird species are found foraging together. Opportunistic diurnal bird survey was conducted between census points and whilst undertaking other diurnal surveys.

Five (5) spotting scope outlook stations were undertaken to identify waterfowl and wading birds from different vantage points during December 2013 survey and another one (1) was undertaken during November 2016 survey. The spotting scope to x 47 magnification is placed on a tripod for stable long-distance views.

Nocturnal birds

Masked Owl (*Tyto novaehollandiae*), Powerful Owl (*Ninox strenua*) and Barking Owl (*Ninox connivens*), Black Bittern (*Ixobrychus flavicollis*), Australian Bittern (*Botaurus poiciloptilus*) and Bush Stone-curlew (*Burhinus grallarius*) were targeted by nocturnal call-playback techniques during 2013 survey. Given the absence of any likely important habitat for a number of these species only Australian Bittern and Bush Stone-curlew were targeted by call-playback during 2016 survey.

Arboreal mammals

The large remnant eastern patch of CPW within the study area is isolated from any adjacent contiguous habitat and is not considered of sufficient size to support core Koala habitat in its own right. There is also no suspected use of this remnant of transient animals or males in dispersal however a more detailed Koala survey was nonetheless undertaken as part of November 2016 surveys based on request by DOEE (EPBC Ref: 2016/7744).

Koala feed trees Forest Red (*Eucalyptus tereticornis*) were searched for characteristic Koala pock marks on the trunk. Larger trees were specifically targeted in a random meander. Any trees showing scratch marks were then searched for scats for analysis. Koala was also targeted at this time by spotlighting throughout the eastern CPW remnant and Koala call-playback at intervals along the eastern boundary (refer figure 2).

Two trees containing small to medium sized hollows were located within the northern portion of the large CPW remnant during November 2016 survey. These trees showed scratch marks indicating irregular use of these hollows by a small possum or glider. Stag-watching of these trees was undertaken on the 16th November 2016.

Microbats

Following the recording of threatened microbats that may utilise structures for roosting; an inspection of the facilities for roosting potential by microbats was undertaken on the 17th February 2014. The walls of all sheds providing shelter to the brickworks were found to not have any presence of a cavity that may be utilised for roosting. This was also the case for much of the roof area however some portions of ceiling provided insulation below the tin which may be accessed by a microbat colony. It was found to be impossible to safely examine all possibilities particularly given inability to access the ceiling in many locations.

Survey in November 2016 specifically targeted the water surface of the remaining dams on site during spotlighting to target the presence and activity of the Large-footed Myotis. This species was observed at this time and notably foraged away from the light when spotlighted. One individual then proceeded to fly up the edge of an adjacent large stockpile and appeared to disappear. An inspection of this area immediately followed in search of a potential roosting location in this area. No shelter cavities were located.

Amphibians

Green & Golden Bell Frog was targeted during initial December 2013 surveys and then following more suitable weather conditions in February 2014. GGBF was targeted by diurnal habitat searches, listening for calling males after dark and by call-playback techniques. Call-playback was again utilised during November 2016 survey.

Call-playback involved broadcasting recorded calls through a 15 watt Toa 'Faunatech' amplifier at stations adjacent to suitable habitat surrounding the north-western dams. At each station the call was played for a 5-minute period with 5-minute quiet listening for response. This was followed with quiet listening and spotlighting. Call-playback stations are shown on Figure 2.

Targeted GGBF survey in February 2014 also utilised a GGBF reference site at a known breeding location at North Avoca on the Central Coast following the site survey. Frogs were heard calling at North Avoca close to midnight on this occasion without emitting any call-playback methods.

Invertebrates

Target survey was undertaken for the CPLS (*Meridolum corneovirens*) as part of preliminary site surveys undertaken in August 2013. Of the threatened fauna species considered with potential to occur this endangered species was most critical to determine presence in the first instance given likely impacts. The potential of this species to occur was also based on the proximity to previous *Atlas of NSW Wildlife* records of the species and given the presence of its typical host vegetation community.

The total eastern Cumberland Plain Woodland remnant was searched during this initial August survey. Most appropriate areas of observed habitat were targeted. Dense areas of leaf litter with likely moisture retaining properties were scraped using a three pronged rake. Logs, stumps, artificial refuse and rocks were turned over.

The remaining larger woodland remnants within the study area were searched for snail presence during the December 2013 survey. These search areas are depicted on Figure 2.

The western fringes of the large eastern CPW remnant proposed for clearing as part of the proposal was again surveyed for presence of snails in November 2016. A search transect along this fringe using similar search techniques was undertaken (refer to Figure 2).

Habitat trees

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

A summary of hollow-bearing tree results is provided in Table 4.4.

A further two trees containing small to medium sized hollows were located within the northern portion of the large CPW remnant during November 2016 survey. These trees showed scratch marks indicating irregular use of these hollows by a possum or glider. These trees were not identified as part of the tree data as they are not within the subject site (proposed development landscape). Stag-watching of these trees was undertaken on the 16th November 2016 with no recorded activity.

2.6 Survey limitations

It is important to note that field survey data collected during the survey period is representative of species occurring within the study area for that occasion. Due to effects of fire, breeding cycles, migratory patterns, camouflage, weather conditions, time of day, visibility, predatory and / or feeding patterns, increased species frequency or richness may be observed within the study area outside the nominated survey period. Habitat assessments based on the identification of micro-habitat features for various species of interest, including regionally significant and threatened species, have been used to minimise the implications of this survey limitation.

Flora survey limitations

Whilst some flora species are difficult to identify unless flowering, the presence of some species on site may have been overlooked. Care has been taken to target any area where

native vegetation was present traversing in a linear fashion. The threatened species with potential habitat are not too cryptic. *Pimelea spicata* would be the most difficult to detect because of its size, however both survey dates are within the known flowering period for the species (May–January).

Fauna survey limitations

The large Cumberland Plain Woodland habitat in the eastern portions of the site is considered highly suitable for a number of threatened woodland birds known to utilise similar woodland habitats in Western Sydney. Hot dry and windy conditions during December 2013 survey likely reduced bird activity when bird census survey was undertaken, even in the late afternoon period when birds typically become more active. As such, some birds may have been more difficult to detect which is assumed given the notable lack of bird calls even late in the day through this woodland portion at this time. Given the proposed retention of this woodland area and brief successive visits, this survey deficiency would not require further survey during more ideal conditions.



Survey Results

3.1 Flora results

3.1.1 Flora species

The plants observed within the vegetation communities of the study area are listed in the Table 3.1 below.

Table 3.1 – Flora observations for the study area

Family	Scientific name	Common name
Trees		
Mimosoideae	Acacia baileyana	Cootamundra Wattle
Mimosaceae	Acacia decurrens	Black Wattle
Myrtaceae	Angophora floribunda	Rough-barked Apple
Myrtaceae	Corymbia citriodora	Lemon-scented Gum
Myrtaceae	Corymbia maculata	Spotted Gum
Myrtaceae	Eucalyptus crebra	Narrow-leaved Ironbark
Myrtaceae	Eucalyptus eugenioides	Thin-leaved Stringybark
Myrtaceae	Eucalyptus moluccana	Grey Box
Myrtaceae	Eucalyptus saligna X botryoides	Hybrid
Myrtaceae	Eucalyptus spp.	Planted Peppermint
Myrtaceae	Eucalyptus tereticornis	Forest Red Gum
Santalaceae	Exocarpos cupressiformis	Native Cherry
Moraceae	Ficus spp.	Fig
Myrtaceae	Melaleuca decora	-
Myrtaceae	Melaleuca stypheloides	Prickly-leaved Tea Tree
Amygdalaceae	Prunus spp.*	-
Myrtaceae	Syncarpia glomulifera	Turpentine
Shrubs		
Mimosaceae	Acacia falcata	Sickle Wattle
Mimosaceae	Acacia fimbriata	Fringed Wattle
Mimosaceae	Acacia implexa	Hickory
Mimosaceae	Acacia longifolia var. longifolia	Sydney Golden Wattle
Mimosaceae	Acacia saligna*	Orange Wattle
Mimosaceae	Acacia ulicifolia	Prickly Moses
Pittosporaceae	Bursaria spinosa var. spinosa	Native Blackthorn
Asteraceae	Cassinia aculeata	-
Solanaceae	Cestrum parqui*	Chilean Cestrum
Fabaceae	Daviesia ulicifolia	Gorse Bitter Pea

Family	Scientific name	Common name
Fabaceae	Dillwynia sieberi	Prickly Parrot-pea
Apocnynaceae	Gomphocarpus fruticosus*	Narrow Leaf Cotton Bush
Proteaceae	Hakea salicifolia	Willow Hakea
Fabaceae	Indigofera australis	Native Indigo
Verbenaceae	Lantana camara*	Lantana
Oleaceae	Ligustrum lucidum*	Large-leaved Privet
Oleaceae	Ligustrum sinense*	Small-leaved Privet
Solanaceae	Lycium ferocissimum*	African Boxthorn
Myrtaceae	Melaleuca armillaris subsp. armillaris	Bracelet Honey Myrtle
Berberidaceae	Nandina domestica*	Sacred Bamboo
Ochnaceae	Ochna serrulata*	Mickey Mouse Plant
Oleaceae	Olea europaea subsp. cuspidata*	African Olive
Asteraceae	Ozothamnus diosmifolius	Ball Everlasting
Fabaceae	Pultenaea microphylla	-
Euphorbiaceae	Ricinus communis*	Castor Oil Plant
Rosaceae	Rosa rubignosa*	Sweet Briar
Rosaceae	Rubus fruticosus sp. agg.*	Blackberry complex
Asteraceae	Senecio pterophorus*	African Daisy
Solanaceae	Solanum sisymbriifolium*	
Groundcovers		
Poaceae	Aira cupaniana*	Silvery Hairgrass
Myrsinaceae	Anagallis arvensis*	Scarlet Pimpernel
Poaceae	Aristida ramosa	Wire Grass
Poaceae	Aristida vagans	Three-awn Speargrass
Poaceae	Aristida warburgii	Wire Grass
Anthericaceae	Arthropodium milleflorum	Pale Vanilla Lily
Rubiaceae	Asperula conferta	Common Woodruff
Poaceae	Austrostipa pubescens	Tall Speargrass
Poaceae	Avena fatua*	Wild Oats
Poaceae	Axonopus fissifolius*	Narrow-leafed Carpet Grass
Asteraceae	Bidens pilosa*	Cobbler's Pegs
Brassicaceae	Brassica fruticulosa*	Twiggy Turnip
Brassicaceae	Brassica rapa*	Wild Turnip
Poaceae	Bromus cartharticus*	Prairie Grass
Acanthaceae	Brunoniella australis	Blue Trumpet
Acanthaceae	Brunoniella pumilio	Dwarf Blue Trumpet
Asphodeliaceae	Bulbine bulbosa	Native Leek
Anthericaceae	Caesia parviflora	Pale Grass Lily
Brassicaceae	Cardamine hirsuta*	Hairy Bittercress
Asteraceae	Carthamus lanatus*	Saffron Thistle
Gentianaceae	Centaurium erythraea*	Common Centaury
Apiaceae	Centella asiatica	Indian Pennywort
Sinopteridaceae	Cheilanthes sieberi	Rock Fern
Poaceae	Chloris gayana*	Rhodes Grass
Poaceae	Chloris truncata	Windmill Grass

Family	Scientific name	Common name
Poaceae	Chloris ventricosa	Tall Chloris
Asteraceae	Cirsium vulgare*	Spear Thistle
Asteraceae	Conyza sumatrensis*	Tall Fleabane
Brassicaceae	Coronpus didymus*	Lesser Swine-cress
Poaceae	Cortaderia selloana*	Pampas Grass
Crassulaceae	Crassula multicava*	-
Apiaceae	Cyclospermum leptophyllum*	Slender Celery
Poaceae	Cymbopogon refractus	Barbed-wire Grass
Poaceae	Cynodon dactylon*	Common Couch
Cyperaceae	Cyperus eragrostis*	Umbrella Sedge
Phormiaceae	Dianella longifolia	Blue Flax Lily
Poaceae	Dichelachne crinita	Long-hair Plume Grass
Poaceae	Dichelachne micrantha	Short-hair Plume Grass
Convolvulaceae	Dichondra repens	Kidney Weed
Poaceae	<i>Digitaria</i> spp.*	An exotic Finger Grass
Asteraceae	Dittrichia graveolens*	Stinkwort
Poaceae	Echinochloa crus-galli*	Barnyard Grass
Poaceae	Echinopogon caespitosus	Bushy Hedgehog-grass
Poaceae	Ehrharta erecta*	Panic Veldtgrass
Chenopodiaceae	Einadia hastata	Berry Saltbush
Chenopodiaceae	Einadia polygonoides	-
Poaceae	Entolasia marginata	Bordered Panic
Poaceae	Eragrostis brownii	Brown's Lovegrass
Poaceae	Eragrostis curvula*	African Lovegrass
Asteraceae	Erechtites valerianifolia*	Brazilian Fireweed
Euphorbiaceae	Euphorbia spp.*	Exotic weed
Apiaceae	Foeniculum vulgare*	Fennel
Asteraceae	Gamochaeta coarctata*	Cudweed
Geraniaceae	Geranium homeanum	Northern Cranesbill
Geraniaceae	Geranium solanderi	Cutleaf Cranesbill
Goodeniaceae	Goodenia hederacea	Ivy Goodenia
Clusiaceae	Hypericum gramineum	Small St Johns Wort
Clusiaceae	Hypericum perforatum*	St Johns Wort
Asteraceae	Hypochaeris radicata*	Flatweed
Juncaceae	Juncus acutus*	Sharp Rush
Juncaceae	Juncus continuus	-
Juncaceae	Juncus usitatus	Common Rush
Poaceae	Lachnagrostis filiformis	Blown Grass
Brassicaceae	Lepidium africanum	Common Peppercress
Poaceae	Lolium perrenne*	Perennial Ryegrass
Lomandraceae	Lomandra longifolia	Spiky-headed Mat-rush
Lomandraceae	Lomandra multiflora subsp. multiflora	Many-flowered Mat-rush
Fabaceae	Lotus suaveolans*	Hairy Bird's Foot Trefoil
Faboideae	Melilotus indicus*	Hexham Scent

Family	Scientific name	Common name
Poaceae	Microlaena stipoides var. stipoides	Weeping Grass
Malvaceae	Modiola caroliniana*	Red-flowered Mallow
Alliaceae	Nothoscordum borbonicum*	Onion Weed
Oxalidaceae	Oxalis perennans	-
Poaceae	Paspalum urvillei*	Vasey Grass
Poaceae	Panicum effusum	Hairy Panic
Poaceae	Paspalum dilatatum*	Paspalum
Malvaceae	Pavonia hastata*	-
Poaceae	Pennisetum clandestinum*	Kikuyu
Polygonaceae	Persicaria decipiens	Slender Knotweed
Plantaginaceae	Plantago gaudichaudii	Narrow Plantain
Plantaginaceae	Plantago lanceolata*	Ribwort
Lobeliaceae	Pratia purpurascens	Whiteroot
Acanthaceae	Pseuderanthemum variabile	Pastel Flower
Fabaceae	Pultenaea microphylla	Spreading Bush-pea
Iridaceae	Romulea rosea var. australis*	Onion Grass
Polygonaceae	Rumex crispus*	Curled Dock
Poaceae	Rytidosperma fulvum	Wallaby Grass
Poaceae	Rytidosperma tenuius	Wallaby Grass
Asteraceae	Senecio hispidulus	Hill Fireweed
Asteraceae	Senecio madagascariensis*	Fireweed
Poaceae	Setaria parviflora*	-
Malvaceae	Sida rhombifolia*	Paddy's Lucerne
Solanaceae	Solanum prinophyllum	Forest Nightshade
Solanaceae	Solanum pseudocapsicum*	-
Asteraceae	Sonchus oleraceus*	Common Sow-thistle
Poaceae	Sporobolus africanus*	Parramatta Grass
Poaceae	Sporobolus creber	Slender Rat's Tail Grass
Lamiaceae	Stachys arvensis*	Stagger Weed
Asteraceae	Taraxacum officinale*	Dandelion
Orchidaceae	Thelymitra spp.	A Sun Orchid
Poaceae	Themeda triandra	Kangaroo Grass
Commelinaceae	Tradescantis fluminensis*	Wandering Jew
Fabaceae	Trifolium repens*	White Clover
Anthericaceae	Tricoryne elatior	Yellow Rush Lily
Asteraceae	Vittadinia cuneata	A Fuzzweed
Campanulaceae	Wahlenbergia stricta subsp. stricta	Austral Bluebell
Verbenaceae	Verbena bonariensis*	Purpletop
Verbenaceae	Verbena litoralis*	-
Faboideae	Zornia dyctiocarpa var. dyctiocarpa	Zornia
Vines		
Basellaceae	Anredera cordifolia*	Madiera Vine
Apocnyaceae	Araujia sericifera*	Mothvine
Ranunculaceae	Clematis glycinoides var. glycinoides	Headache Vine
Fabaceae	Desmodium varians	-

Family	Scientific name	Common name	
Chenopodiaceae	Einadia nutans subsp. linifolia	Climbing Saltbush	
Fabaceae	Glycine clandestina	Twining Glycine	
Faboideae	Glycine microphylla	Small-leaf Glycine	
Fabaceae	Glycine tabacina	Variable Glycine	
Fabaceae	Hardenbergia violacea	False Sarsparilla	
Convolvulaceae	Ipomoea cairica*	Coastal Morning Glory	
Convolvulaceae	Ipomoea indica*	Blue Morning Glory	
Apocynaceae	Parsonsia straminea	Common Silkpod	
Fabaceae	Vicia sativa subsp. sativa*	Common Vetch	
Faboideae	Wisteria sinensis*	Chinese Wisteria	
Water plants			
Asteraceae	Epaltes australis	Spreading Nut-heads	
Juncaceae	Juncus cognatus*	-	
	Ludwigia peploides		
Onagraceae	subsp. montevidensis	Water Primrose	
Juncaginaceae	Triglochin microtuberosum	Water Ribbons	
Typhaceae	Typha orientalis	Broadleaf Cumbungi	
* denotes exotic species			

3.1.2 Vegetation communities

Essentially there are two (2) main vegetation communities on site:

- Cumberland Plain Woodland (Biometric Vegetation Type ID HN528 or Plant Community Type - PCT 849).
- River Flat Eucalypt Forest on Coastal Floodplains (RFEF) (Biometric Vegetation Type ID – HN526 or Plant Community Type - PCT 835).

There are other vegetation units present, but they do not correspond to any defined Plant Community Types (PCTs) as they are not natural. These include waterbodies (dams) with occasional fringing vegetation, as well as small fragments of planted vegetation including revegetation areas.

The development area contains 2.85 ha of Cumberland Plain Woodland and 0.70 ha of River-flat Eucalypt Forest on Coastal Floodplains. The residual lands (Lot 205) currently contain no River-flat Eucalypt Forest on Coastal Floodplains and 11.09 ha of Cumberland Plain Woodland. The development will require the removal of 2.85 ha of Cumberland Plain Woodland which includes 0.04 ha of ancillary Cumberland Plain Woodland that will be impacted for road intersection upgrade works.

Cumberland Plain Woodland

Cumberland Plain Woodland (CPW) within the study area is variable based upon the dominant canopy cover present. In some locations, *Eucalyptus tereticornis* (Forest Red Gum) with *Eucalyptus moluccana* (Grey Box) dominate, whilst parts of any patch may occasionally contain *Eucalyptus crebra* (Narrow-leaved Ironbark) or *Eucalyptus eugenioides* (Thin-leaved Stringybark).

One (1) large remnant occurs in the eastern portion of the study area which has been allocated its own additional lot (Lot 205) for future conservation of 10.14ha of CPW. This large remnant covering approximately 11.09 ha is variable with respect to dominant canopy species.

In the small isolated western remnants, the mid-storey was often absent or existed as scattered or clumped shrubs at an overall very low density. The ground layer was poor in respect to the weed coverage being generally a lot higher than the large eastern portion and the native species diversity being poor.

Condition assessment has been determined using the Biometric Field Assessment Method used for biobanking applications. Under that assessment, the over-storey does not fall into a class that would likely enable it to be classed as low condition.

Canopy trees are generally to a height of between 15-25m and a projected foliage cover of 20-35%, dependent upon the age of the trees and the level of previous impacts, particularly within the small remnants. Some of these trees were old remnant trees as indicated by their large diameter trunk and constituent hollows however, most of the large eastern woodland portion appears as mature regrowth given evidence of previous disturbances, including tree clearing and grazing (which continues to the present).

In the large eastern remnant, the shrub layer is largely dominated by *Bursaria spinosa* var. *spinosa, Acacia decurrens, Dillwynia sieberi, Daviesia ulicifolia, Acacia fimbriata* and *Exocarpos cupressiformis.* The shrub layer was 1-8m tall and accounted for between 30-65% coverage.

In the large eastern remnant, the ground layer was less than 1m tall and accounted for between 75-95% coverage. Dominant native species recorded included *Aristida vagans, Aristida ramosa Austrostipa pubescens, Microlaena stipoides, Themeda australis,*

Brunoniella pumilio, Chloris ventricosa, Dichondra repens, Cheilanthes sieberi, Eragrostis brownii, Glycine clandestina, Glycine tabacina, Hardenbergia violacea and Solanum prinophyllum.

<u>Classification</u>: The Cumberland Plain Woodland is commensurate with the Critically Endangered Ecological Community (CEEC) known as '*Cumberland Plain Woodland in the Sydney Basin Bioregion*' which is listed within the NSW *TSC Act* (1995). This vegetation community is also commensurate with '*Cumberland Plain Shale Woodlands and Shale*-*Gravel Transition Forest*' which is also listed as a CEEC within the Commonwealth *EPBC Act* (1999). It should be noted that not all remnants in the western portion of the study area may qualify to be classified as such under the EPBC Act, particularly where patch size is below 0.5 ha. A patch may be loosely described as fragments or contiguous vegetation within 100m of the next piece of vegetation.



Photo 1 – Good quality vegetation in the central part of the large eastern portion of Cumberland Plain Woodland


Photo 2 – Heavily impacted remnants approximately 100m from southern boundary – note groundlayer in foreground dominated by exotic species.



Photo 3 – Regrowth Cumberland Plain Woodland near the south-western boundary – Note groundlayer dominated by exotic species

River Flat Eucalypt Forest on Coastal Floodplains

River-flat Eucalypt Forest on Coastal Floodplains (RFEF) occurs in the north-western portion of the study area, associated with a previous drainage line which entered the site in that corner, as well as near the central western edge of the site.

The largest remnant has canopy that is dominated by *Melaleuca decora* 15-22m tall and with a projected foliage cover of 25-40%. The smaller remnants in the central west are dominated by *Angophora floribunda* with a minor clump of *Casuarina glauca*. The total area of this vegetation type amounts to 0.7 ha, with the majority attributed to one remnant.

The mid-storey is sparse to absent, consisting of *Bursaria spinosa* and a few juvenile *Eucalyptus tereticornis* to 2m tall and a projected foliage cover averaging no greater than 5%.

The ground layer is dominated by exotic species, but there are some moderate quality areas within the patches that contain native grass species, selected herbs and twiners. Common species may include *Microlaena stipoides, Echinopogon caespitosus, Austrostipa pubescens, Dichelachne crinita, Rytidosperma fulvum, Senecio hispidulus, Dichondra repens, Dianella longifolia, Einadia polygonoides, Brunoniella australis and Glycine clandestina.*

<u>Classification</u>: River-flat Eucalypt Forest on Coastal Floodplains is commensurate with the Endangered Ecological Community (EEC) by the same name as listed within the NSW *TSC Act* (1995).



Photo 4 – River-flat Eucalypt Forest vegetation near the central portion of the site, as viewed from approximately 50m east of the western boundary

Non Plant Community Type vegetation within the study area

Aquatic Vegetation

There were a number of water bodies on site, all of which were constructed as part of the previous clay quarry activities. The largest dams within the remediation area are currently in a dewatered and modified state due to bulk earth works.

Some aquatic vegetation may exist in remaining water bodies, but typically is dominated by *Typha orientalis* if present. There are some plantings of the non-endemic *Melaleuca armillaris* along the edges of 2 of the water bodies near the northern boundary.

Planted Vegetation

There are some other plantings across the study area, for example, a revegetation area comprising a remnant of approximately 0.1 ha which is half planted with *Eucalyptus crebra*, and half planted with *Melaleuca stypheloides*. There are also planted trees along the western study area boundary and central portion of the site, mostly *Corymbia citriodora*.

Exotic Groundlayer

Where highly modified vegetation exists it is usually in the form of grassland dominated by exotic grasses, herbs and forbs. Two quadrats were undertaken within this disturbed grassland to demonstrate the level of exotic species. These quadrats were representative of all exotic grasslands across the site. The percentage of exotic species within the exotic grasslands was in excess of 90%. Therefore, these areas do not correspond to 'Derived Grassland'.



Photo 5 – Former dams with fringing planted Melaleucas near the northern study area boundary (Dam has been dewatered and filled)



Photo 6 – Mostly planted Eucalypts on the central western boundary

3.2 Fauna results

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

Common name	Scientific name	Method C	bserved
Birds		Dec 2013	Nov 2016
Australasian Grebe	Tachybaptus novaehollandiae	0	
Australian Magpie	Gymnorhina tibicen	0	ΟW
Australian Pelican	Pelecanus conspicillatus		0
Australian Raven	Corvus coronoides	ΟW	ΟW
Australian White Ibis	Threskiornis molucca	ΟW	
Black-faced Cuckoo-shrike	Coracina novaehollandiae	ΟW	ΟW
Black-fronted Dotterel	Elseyornis melanops	ΟW	
Black-shouldered Kite	Elanus axillaris		0
Black Swan	Cygnus atratus		0
Cattle Egret	Ardea ibis	0	
Channel-billed Cuckoo	Scythrops novaehollandiae	W	
Chestnut Teal	Anas castanea	0	0
Clamorous Reed-Warbler	Acrocephalus stentoreus	С	
Common Blackbird	Turdus merula		W
Common Myna *	Acridotheres tristis	ΟW	ΟW
Common Starling *	Sturnus vulgaris	W	ΟW
Crested Pigeon	Ocyphaps lophotes		ΟW
Eastern Yellow Robin	Eopsaltria australis		W
Eurasian Coot	Fulica atra	ΟW	
Galah	Cacatua roseicapilla	W	
Golden-headed Cisticola	Cisticola exilis		W
Great Cormorant	Phalacrocorax carbo	0	
Great Egret	Ardea alba		0
Grey Butcherbird	Cracticus torquatus	ΟW	
Grey Fantail	Rhipidura fuliginosa		W
Hardhead	Aythya australis	0	
Latham's Snipe	Gallinago hardwickii	ΟW	
Laughing Kookaburra	Dacelo novaeguineae		W
Little Black Cormorant	Phalacrocorax sulcirostris		0
Little Pied Cormorant	Phalacrocorax melanoleucos		0
Magpie-lark	Grallina cyanoleuca	ΟW	ΟW
Masked Lapwing	Vanellus miles	W	
Nankeen Kestrel	Falco cenchroides	0	
Noisy Miner	Manorina melanocephala	ΟW	ΟW
Pacific Black Duck	Anas superciliosa	0	
Pallid Cuckoo	Cululus pallidus	0	
Pied Currawong	Strepera graculina		ΟW
Pink-eared Duck	Malacorhynchus membranaceus	0	
Purple Swamphen	Porphyrio porphyrio	ΟW	

Table 3.2 – Fauna observations for the study area

Common name	Scientific name	Method C	bserved
Rainbow Lorikeet	Trichoglossus haematodus	W	
Red-rumped Parrot	Psephotus haematonotus	ΟW	ΟW
Rock Dove *	Columba livia	W	0
Silvereye	Zosterops lateralis	ΟW	
Spotted Turtle-Dove *	Streptopelia chinensis	ΟW	ΟW
Spotted Pardalote	Pardalotus punctatus		W
Striated Pardalote	Pardalotus striatus		W
Superb Fairy-wren	Malurus cyaneus	ΟW	ΟW
Welcome Swallow	Hirundo neoxena	0	ΟW
White-browed Scrubwren	Sericornis frontalis		ΟW
White-faced Heron	Egretta novaehollandiae	0	0
White-plumed Honeyeater	Lichenostomus penicillatus		ΟW
White-winged Chough	Corcorax melanorhhamphos	0	
Willie Wagtail	Rhipidura leucophrys	ΟW	ΟW
Yellow-faced Honeyeater	Lichenostomus chrysops		ΟW
Yellow-rumped Thornbill	Acanthiza chrysorrhoa	ΟW	
Zebra Finch	Taeniopygia guttata	ΟW	
Mammals			
Brown Hare *	Lepus lepus	0	0
Cream-striped Shining Skink	Cryptoblepharus virgatus		0
Common Ringtail Possum	Pseudocheirus peregrinus		FPO
Delicate Skink	Lampropholis delicata		0
Domesticated Cattle *	Bos taurus	0	0
Eastern Freetail-bat	Mormopterus ridei	U	UPO
European Red Fox *	Vulpes vulpes	0	0
Feral Cat *	Felis cattus		0
Gould's Wattled Bat	Chalinolobus gouldii	U	U
Greater Broad-nosed Bat TS	Scoteanax rueppelli	UPO	UPO
Grey-headed Flying-fox TS	Pteropus poliocephalus		0
Large-footed Myotis ^{TS}	Myotis macropus	U	UO
Rabbit *	Oryctolagus cuniculus	0	0
Short-beaked Echidna	Tachyglossus aculeatus		F ^{PO}
Macropod	Macropus or Wallabia sp		Р
Reptiles			
Eastern Brown Snake	Pseudonaja textilis	Н	
Eastern Long-necked Turtle	Chelodina longicollis	0	0
Grass Skink	Lampropholis guichenoti	0	0
Amphibians			
Broad-palmed Frog	Litoria latopalmata	W	
Common Eastern Froglet	Crinia signifera	W	
Dusky Toadlet	Uperoleia fusca	W	W
Dwarf Tree Frog	Litoria fallax	W	W
Peron's Tree Frog	Litoria peronii	W	W
Spotted Marsh Frog	Limnodynastes tasmaniensis	W	

Common name	Scientific r	ame	Method C	ethod Observed			
Striped Marsh Frog	Limnodynastes	s peronii	W				
Mollusc							
Asian Tramp Snail *	Bradybaena si	milaris		0			
Cumberland Land Sna	il ^{TS} Meridolum cori	neovirens	0	0			
Common Garden Snai	I* Cornu aspersu	m	0	0			
A carnivorous snail *	Austrorhytida c	apillacea	0				
Note: * indicates introduced species ^{TS} indicates threatened species All species listed are identified to a high level of certainty unless otherwise noted as: ^{PR} indicates species identified to a 'probable' level of certainty – more likely than not ^{PO} indicates species identified to a 'possible' level of certainty – recorded to a moderate to high level of uncertainty usually applied to a threatened species of note.							
E - Nest/roost F - Tracks/scratchings FB - Burrow G - Crushed cones	H - Hair/feathers/skin K - Dead O - Observed OW - Obs & heard call	P - Scat Q - Camer T - Trapped/netted U - Anabat/ultrasou	ra X Y I Bone/te Z und pellet	- Heard call - In scat - eth/shell - In raptor/owl			



Legend



Figure 2 – Flora and fauna survey effort



Stage boundary Fauna Survey Resul

(Nov 2016)

Cumberland Plain Land Snail Survey Results Vegetation Communities (Nov 2016



Figure 3 – Flora and fauna survey results



Ecological Assessment



4.1 Previous surveys reviewed

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

Vegetation Mapping of the Cumberland Plain (NPWS 2002) identified vegetation within the study area as a combination of Shale Plains Woodland and Shale Hills Woodland, both constituents of Cumberland Plain Woodland (EEC vegetation).

4.2 Flora

No threatened flora species were observed. All flora species observed within the study area are listed in Table 3.1.

4.2.1 State legislative flora matters

(a) Threatened flora species (NSW)

TSC Act – A search of the *Atlas of NSW Wildlife* (OEH 2016) indicated a list of species that have been recorded within a 10 km radius of the study area. Those species are considered for suitable habitat and potential to occur in Table A2.1 (Appendix 2).

All flora species observed as part of the biometric quadrats undertaken are listed in Table 3.1. Targeted survey has been completed for threatened flora species within the study area. No threatened flora species have been identified as part of surveys undertaken. One (1) flora sample was collected with potential as *Pultenaea parviflora* and sent to the *Royal Botanic Gardens* for identification during the August 2013 survey. The specimen was confirmed as *Pultenaea microphylla*, a common species around the Cumberland Plain.

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

Scientific name	TSC Act	Potential to occur	Survey period
Acacia pubescens	V	\checkmark	any time of year
Dillwynia tenuifolia	V	\checkmark	spring
Grevillea juniperina subsp. juniperina	V	\checkmark	spring-early summer
Pimelea spicata	E1	\checkmark	summer
Pultenaea parviflora	E1	\checkmark	spring

Table 4.1 – State listed threatened flora species with suitable habitat present

Full habitat descriptions for these species are provided in Appendix 2. Detection times of year for survey are indicated in the table above. Species indicated for summer and / or spring are dependent on flowering periods for detection. No state listed threatened flora species were observed during survey(s) undertaken.

(b) Endangered flora populations (NSW)

This is the only known endangered flora population within Fairfield LGA.

• *Marsdenia viridiflora* subsp. *viridiflora* endangered population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith LGAs

It has a preference for:-

Dry sclerophyll forests (shrub/grass sub-formation) Cumberland Dry Sclerophyll Forests

- Broad-leaved Ironbark *Melaleuca decora* shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion
- Derived shrubland on Tertiary Gravels of the Cumberland Plain
- Narrow-leaved Ironbark Broad-leaved Ironbark-Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion

Dry sclerophyll forests (shrubby sub-formation) Sydney Sand Flats Dry Sclerophyll Forests

Coast Banksia scrub on sand in the Elderslie area, Sydney Basin Bioregion Grassy woodlands

Coastal Valley Grassy Woodlands

- Derived grasslands on shale hills of the Cumberland Plain (50-300m ASL)
- Derived grasslands on shale plains of the Cumberland Plain (<100m ASL)
- Grey Box Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion

 Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion

The vegetation present within the study area is most similar to those described under Coastal Valley Grassy Woodlands which is listed as a series of vegetation types that would support a population of the species, therefore potential habitat would be considered present however, the lack of records locally suggests that the potential for occurrence is low. During the survey(s) of the study area no specimens pertaining to the population have been observed.

(c) Endangered ecological communities (NSW)

Two (2) endangered or critically endangered ecological communities were determined to be present within the study area. These were:

Cumberland Plain Woodland

Cumberland Plain Woodland (CPW) is commensurate with the Critically Endangered Ecological Community (CEEC) known as '*Cumberland Plain Woodland in the Sydney Basin Bioregion*'

CPW occurs throughout the eastern vegetated portion of the study area in medium to high condition. This was despite the continued grazing by cattle in this area. The total area of CPW present within the study area is approximately 13.03 ha.

Cumberland Plain Woodland (CPW) within the study area is variable based upon the dominant canopy cover present. In some locations, Forest Red Gum with Grey Box dominate, whilst parts of any patch may occasionally contains *Eucalyptus crebra* or *Eucalyptus eugenioides*. The large eastern remnant (11.09 ha) meets the criteria for medium-high condition under a biometric assessment as the over storey is greater than 25% of the lower benchmark figure and the ground layer contains less than 50% exotic coverage.

The northern most spur of this larger remnant and some areas along the eastern side of it are impacted by previous clearing and subsequent regrowth which contains a very high proportion of exotic species. Therefore the proposed Lot205 Conservation Area will conserve the majority of the good condition vegetation.

The smaller fragmented remnants within the western portion of the site are depauperate of native species diversity and ecological complexity. They generally do not fit a low condition

rating only because they have an overstorey outside of the benchmarks for such classification. Notwithstanding that, they do not contain threatened flora species, and they were considered to be of poor habitat quality for threatened fauna utilisation.

The small fragments of CPW being removed in the western portion of the site and along the eastern portion of the largest remnant totals 2.85 ha, this includes 0.04 ha of CPW removal for ancillary works along Burley Road. Whilst each fragment has limited ecological functioning due to the previous removal of the ground and shrub layers, the conserved eastern portion would retain fully structured vegetation in-situ and will not be likely to lead to a local extinction of this EEC, and also 0.95 ha will be removed from the larger eastern patch.

This community has been assessed in the 7 part test of significance within Appendix 3.

River Flat Eucalypt Forest

River-flat Eucalypt Forest on Coastal Floodplains (RFEF) occurs in the north-western portion of the study area, associated with a previous drainage line which entered the site in that corner, as well as near the central western edge of the site.

The largest remnant has canopy that is dominated by *Melaleuca decora* 15-22m tall and with a projected foliage cover of 25-40%. The smaller remnants in the central west are dominated by *Angophora floribunda* with a minor clump of *Casuarina glauca*. The total area of this vegetation type amounts to 0.7 ha, with the majority attributed to one remnant patch.

The mid-storey is sparse to absent, consisting of *Bursaria spinosa* and a few juvenile *Eucalyptus tereticornis* to 2m tall and a projected foliage cover averaging no greater than 5%.

The ground layer is dominated by exotic species, but there are some moderate quality areas within the patches that contain native grass species, selected herbs and twiners. Common species may include *Microlaena stipoides, Echinopogon caespitosus, Austrostipa pubescens, Dichelachne crinita, Rytidosperma fulvum, Senecio hispidulus, Dichondra repens, Dianella longifolia, Einadia polygonoides, Brunoniella australis and Glycine clandestina.*

<u>Classification:</u> River-flat Eucalypt Forest on Coastal Floodplains is commensurate with the Endangered Ecological Community (EEC) by the same name as listed within the NSW *TSC*

Act (1995). This ecological Community is not listed as threatened within the Commonwealth EPBC Act (1999).

4.2.2 Flora TSC Act (1995) conclusions

In accordance with Section 5A of the *EPA Act 1979*, the 7 part test of significance (Appendix 3) concluded that the proposed development will not have a significant impact on any state listed threatened species, populations or EECs. This is provided that the large eastern portion be retained in-situ and provided as a conservation measure, as denoted (Lot 205) on the subdivision plans. Therefore, a Species Impact Statement should not be required for the proposed development in respect to state listed flora.

The study area was not found to contain any threatened flora species or populations that are listed within the schedules of the State *TSC Act* (1995)

4.2.3 Matters of national environmental significance - flora

(a) Threatened flora species (national)

A review of the schedules of the *EPBC Act* indicated the potential for a list of threatened flora species to occur within a 10km radius of the site. These species have been considered for the presence of suitable habitat and potential to occur within Appendix 2.1.

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

Table 4.2 – Nationally listed threatened flora species with suitable habitat present

Scientific name	EPBC Act	Potential to occur	Survey period
Acacia pubescens	V	\checkmark	any time of year
Dillwynia tenuifolia	V	\checkmark	spring
Pimelea spicata	E	\checkmark	summer
Pultenaea parviflora	V	\checkmark	spring

Note: Full habitat descriptions for these species are provided in Appendix 2. Detection times of year for survey are indicated in the table above. Species indicated for summer and / or spring are dependent on flowering periods for detection.

No nationally listed threatened flora species were observed within the study area.

(b) Endangered ecological communities (national)

Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest is the Commonwealth name given to the CEEC present within the study area.

It must be pointed out that the definition of this CEEC differs from that for Cumberland Plain Woodland under the TSC Act (1995), therefore there are differing sized areas attributed to each within this report. This is because patch 3 has been determined to fall short of the thresholds for CPSW (also see Figure 4).

					Retention	Retention
					/Loss of	/ Loss of
					CPW	CPSW
					for	for
					Patches	Patches
	Patch 1	Patch 2	Patch 3 +	Patch 4	1 to 4	1,2 & 4
Total Area (ha)	150	0.28	0.16	1.12	151.56	151.4
Area Removed (ha)	1.31	0.28	0.14	1.12	2.85	2.71
Area Retained (ha)	148.69	0	0	0	148.69	148.69
% Area removed	0.87%	100.00%	87.50%	100.00%	1.88%	1.79%
% Area Retained	99.13%	0.00%	0.00%	0.00%	98.11%	98.21%
+ Patch 3 is not classif	ied as CPSV	W&SGTF be	cause the pat	ch is less th	an 0.5ha in tot	tal area

and does not conform to EPBC thresholds

Despite the fact that the proposal will conserve a large portion of the best quality EEC present within the study area, the loss of 2.71 ha (which includes an ancillary remnant of 0.04 ha) of this vegetation community triggers a referral to the Department of Environment (DOE) given that there are patches within the proposed impact area that are over 0.5 ha.

The patches of *Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest* within the study area have been assessed in accordance with *Policy statement 3.31 Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest: A guide to identifying and protecting the nationally threatened ecological community* (DEWHA 2010) as shown in Figure 4. These patches are identified by dominant species, patch size, proximity to other patches, structure and quality.

An assessment of the impacts on *Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest* has been undertaken in accordance with the criteria for a critically endangered or endangered ecological community within Appendix 4.3.







Figure 4 – Assessment of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest

Flora and Fauna Assessment, Burley Road, Horsley Park

4.3 EPBC protected flora matters

The proposed action is to be undertaken under the State Environmental Planning Policy (Western Sydney Employment Area (2009). The proposal will impact on 2.71 ha (which includes an ancillary remnant of 0.04 ha) of Cumberland Plain Shale Woodlands and Shale – Gravel Transition Forest (CPSW&SGTF) which is listed as a Critically Endangered Ecological Community (CEEC) under the Commonwealth EPBC Act (1999). This includes the removal of numerous small patches of this CEEC in the central and south-western portions of the study area as well as a small ancillary patch of 0.04 ha along Burley Road between Old Wallgrove Road and the north-eastern corner of the proposed Lot 101.

The vegetation within the proposed Lot 205 totalling 10.14 ha is to be conserved containing the remaining Cumberland Plain Shale Woodlands and Shale – Gravel Transition Forest, protected, managed, improved and funded in perpetuity under the NSW Biobanking Scheme. A positive covenant over Lot 205 will ensure that all works required to conserve and maintain conservation area in perpetuity. An extract from Section 8 (d) Conservation Lot Report from the NSW Land and Environment Court, Case No 1634 of 2015 states that:

'The boundary of the environmental conservation area (proposed Lot 205) will be surveyed and fenced (minimum star picket and three strand wire) prior to any work commencing onsite to ensure the asset protection zone recommended in Section 5.2 and Figure 8 of the Statement of Environmental Effects does not encroach on the conversation (sic) area. The fence is to be signposted at regular intervals highlighting the protected vegetation area.'

This patch of CEEC vegetation within Lot 205 will be fenced for protection and managed in accordance with a Vegetation Management Plan (VMP).

4.3.1 Management of the Bushland Interface and APZ / Buffer

A 20 metre wide Bushland Interface Zone will be provided inside all boundaries of Lot 205 within the conservation zone to create a robust interface against future edge effects. Enrichment planting of shrub species only will be planted within this zone to create a dense shrub layer to minimise weeds. A minimum of seven (7) shrub species known to occur within Cumberland Plain Shale Woodland and Shale Gravel Transition Forest (CPSW&SGTF) will be used. Shrub planting densities are to establish one (1) shrub every 12m².

A dual purpose 25 metre wide managed Ecological zone (combined APZ and ecological buffer) will be established outside of the proposed Lot 205 Conservation Area. This area will

require vegetation removal immediately west of the proposed Conservation Area for installation of stormwater infrastructure and earthworks required for the creation of swales and batters for the industrial subdivision. This area has been disturbed by past clearing and is currently occupied by regrowth CPSW&SGTF or by exotic species. For Biobanking purposes, these areas have been given a Low condition (<5% canopy and >50% exotics in the ground layer). There are few eucalypts with mostly regrowth acacia species and a ground layer consisting of a very high percentage of exotic species.

The proposed managed ecological zone will be planted with species commensurate with CPSW&SGTF vegetation – but will be managed by planting of a dense layer of shubs to suppress weed growth. In addition regular targeted weed control works will be undertaken within this zone to prevent incursions of weeds into the Lot 205 Conservation Area.

Justification for the 25m wide APZ / Buffer is that the drainage from the proposed industrial subdivision does not pass through the reserve but is to be directed through a stormwater system that has a separate stormwater outlet into an existing watercourse. A 25m wide buffer is more than adequate to accommodate the indirect impacts expected along the interface. This is demonstrated by the edge effects that currently occur within the existing CPSW&SGTF reserve which do not exceed 20m (the maximum weed penetration observed was less than 12 metres). In addition, there is a full VMP which has been applied to the proposed Lot 205 Conservation Area which will be managed and funded in perpetuity under the NSW BioBanking Scheme or equivalent. In a management context the requirement for a 30 m wide buffer is not necessary and can be managed within the reserve itself. The VMP includes a 20m wide bushland interface zone inside the Conservation area boundary which has recommendations for revegetation and targeted weed control to specifically target any weed incursions.

With the establishment of the combined 25 metre wide APZ / Buffer area outside the Conservation Area boundary, and the implementation of the 20 metre wide Bushland Interface Zone within the Conservation Area boundary, it is considered that potential impacts from weed invasion can be successfully controlled.

Sedimentation will be controlled through the installation of stormwater infrastructure that will not discharge into Lot 205 as mentioned above. Dumping and feral animals will be controlled by fencing of the Conservation Area and restricted access as specified in the VMP. Fire will be controlled through standard fire prevention practices and infrastructure (hydrants) provided within the proposed industrial subdivision.

4.3.2 Future Use of the Conservation Area

The Conservation Area within proposed Lot 205 will be fenced with a minimum 5 strand plain wire fence with gates provided for access of emergency services, bushland regeneration contractors and maintenance crews. Access within the Conservation Area is considered inappropriate due to the sensitivity of the habitats and resident fauna such as Cumberland Plain Land Snails.

4.3.3 Provision of a Managed Ecological Buffer (inclusive of asset protection zones & ecological buffer)

A 25m managed ecological zone is proposed which has the function of an asset protection zone and an ecological buffer. This is achieved to ensure that all groundlayer species used in the APZ are native ground covers and a native canopy is planted to a maximum density of 1 tree every 300m² which equates to trees planted at 20m centres. Further management specifications are provided below.

Managed ecological zones are becoming increasingly used where joint functions are required of buffers which can be achieved by using only native plant species as part of the landscape.

Asset Protection Zones (APZs) for industrial developments are generally defined by the type of development, location and type of construction materials used. Nonetheless, where APZs are required within the study area they can be established as a dual purpose 25m wide APZ / buffer area located outside of the Lot 205 Conservation Area.

The APZ is to be replanted with ground layer species and occasional canopy species that are commensurate with CPW. The densities and placement of these plantings is to comply with the standards of an Inner Protection Area (IPA) as specified in *Planning for Bushfire Protection* (NSW RFS 2006).

Specifications for the management of an Inner Protection Area (IPA)

The following specifications are recommended (NSW RFS 2006) to manage fuel loads to the standard of an IPA and maintained so it does not exceed 4t/ha.

Trees are to be maintained to ensure;

• Canopy cover does not exceed 15%

- Trees (at maturity) do not touch or overhang the building
- Tree canopies (at maturity) should be well spread out and not form a continuous canopy
- There should be no unmanaged vegetation within 10m of windows, doorways, eaves and gutters
- Lower limbs should be removed up to a height of 2m above ground

Shrubs are to be maintained to ensure;

- Large discontinuities or gaps in vegetation
- Shrubs should not be located under trees
- Shrubs should be achieve a maxim coverage of 10%

Grass is to be maintained to ensure:

- A height of 10cm or less
- Leaves and debris is removed.

Revegetation within the IPA asset protection zone / buffer area

To achieve the above targets the following planting specifications are recommended

Trees are to be maintained to ensure;

- Canopy cover shall not exceed 15% plant trees to an average density of 1 tree every 300m² which equates to trees planted at 20m centres.
- Trees (at maturity) do not touch or overhang the building Avoid planting against the building, minimum separation of 10m is to be established between the trunk centre and the building edge.
- Tree canopies (at maturity) shall not form a continuous canopy path towards the buildings – this target is generally met by point 1, however future management of the trees may require selective pruning to minimise a continuous canopy. Clump planting of several species is permissible.
- There is be no un-managed vegetation within 10m of windows, doorways, eaves and gutters – maintain a 10 m managed area around the openings of the building and avoid planting or remove regrowth vegetation within 10m.
- Lower limbs will be removed if they are less than a height of 2m above ground selective pruning or 'undercutting' of lower limbs may be required.

Shrubs are to be maintained to ensure;

- Large discontinuities or gaps in vegetation are to be created recommend clump planting of shrubs which are to be separated from planted trees.
- Shrubs shall not be located under trees as above.
- Shrubs shall achieve a maximum coverage of 10% small clump planting of no greater than 5m² with maximum total cover of 10%.
- Shrubs should be no closer than 10 metres from an exposed window or door
 maintain a 10 m litter free managed area around the openings of the building and avoid planting or remove regrowth vegetation within 10m of the building openings.

Grass is to be maintained to ensure:

- A height of 10cm or less by regular slashing of the planted native grass layer.
- Leaves and debris is removed to be achieved by regular landscape maintenance.

4.3.4 Vegetation surrounding the Action Area

Vegetation in close proximity to the northern boundary has been determined by site visit to be Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest, as shown in Figures 3 and 4. This vegetation is shown as extending further to the north-east within the VisMap CumberlandPlain_LT10pc_E_2222. Available on the internet at: http://maps.six.nsw.gov.au/apps/channels_3.5/?config=vegetation

The remnant vegetation present along the northern boundary and along Burley Road extends further to the north and provides a somewhat tenuous link with the vegetated corridor associated with Reedy Creek which is a small tributary of Eastern Creek. There are no other vegetated linkages of any note that are located in proximity to the study area. There are some vegetated riparian areas associated with Eastern Creek approximately 3km to the east, and another approximately 1.5km to the west associated with Ropes Creek. These riparian vegetation areas are mapped as Map Unit 11 – Alluvial Woodland (Cumberland _V2_2008_VISmap_3785). Map Unit 11 – Alluvial Woodland does not form a component of the Commonwealth listed Cumberland Plain Shale Woodlands and Shale – Gravel Transition Forest CEEC.

The vegetation adjacent to the south-eastern corner of the study area was mapped as either Map Unit 10 – Shale Plains Woodland or Map Unit 9 – Shale Hills Woodland within Cumberland-V2_2008_VISmap_3785 and Cumberland Plain_GT10pc_E_2221. These areas are highly disturbed and provide poor connectivity to any proximal area of similar vegetation. The patches near the south-eastern corner is mapped as having a canopy with greater than 10% cover, while the shrub and ground layers were observed to be managed. It must be noted that one or more of the adjoining properties to the east of the Action Area are also in various stages of being developed.

Vegetation to the south of the study area is composed of new large lot residential developments and large areas of grassland. The grassland is currently used for pastoral purposes and has been used for this purpose for a long time period. The grassland is likely to contain a high percentage of exotic species, however detailed survey was not undertaken in this area for this project.

4.3.5 Proposed offset measures

The proposed removal of CPSW&SGTF within the subject site is to be offset by creating the Lot 205 Conservation Area which will protect, conserve and manage the CPSW&SGTF. This area is to be managed under a VMP which specifies the management strategies, works and funding required to conserve and improve the CPSW&SGTF in perpetuity.

The removal of 2.71 ha (including an ancillary remnant of 0.04 ha) of poor quality and fragmented CPSW&SGTF patches is expected to be wholly offset by the conservation and management of the Lot 205 Conservation Area totalling 10.14 ha of good quality CPSW&SGTF.

Few threatened flora and fauna species were observed or had potential habitat within the vegetation to be removed, while several threatened fauna species were observed within the proposed Conservation Area. The retention of the 10.14 ha area of vegetation will therefore retain the much larger and better quality patch, which also provides the vast majority of the known habitat for threatened fauna species and the CEEC.

The Conservation Area will initially be protected by the construction of a permanent fence with locked access gates around the entire perimeter of the Conservation Area. Signage notifying of the conservation area will be placed at regular intervals along the fence. This will be completed before any construction works commence. Thereafter, access into Lot 205 will be restricted to bushland regeneration contractors and the project ecologist for maintenance and monitoring works. This strategy will prevent unauthorised access and will prevent incursions by construction vehicles, equipment and materials.

Financial costs for the delivery of a restored conservation area is estimated at \$652,000 over 10 years as supplied in the Vegetation Management Plan (2016). The in perpetuity management cost based on the purchase of offset credits is estimated at \$1.8 million.

The biobanking assessment methodology has been applied to the proposed conservation lot to use a scientific approach to determining whether an improve or maintain outcome has been achieved. The proposed site is the Lot 205 Conservation area within the subject site. The outcomes of the biobanking offset assessment are provided in a separate Biobanking Assessment Report (*Travers bushfire & ecology* 2016).

A description of how the offset is considered to comply with the EPBC Act Environmental Offsets Policy (October 2012) is provided in Section 4.3.7.

4.3.6 Economic and Social Matters

The site is in a key location, adjacent to new and expanding industrial development, near the middle of the greater Sydney metropolitan area only a few kilometres from major transport hubs with good access to several freeways. The locality is a recognised employment zone with good access to transport networks and a readily accessible workforce. The proposed action recognises the high conservation value of the *Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest* and associated habitats.

The social and economic impacts of the development are a positive outcome for the local area with respect to providing additional lots to accommodate a range of industrial development. The development of the subject site will support the development of the Western Sydney Employment Area generating a positive economic impact for the employment area.

The proposed industrial subdivision is estimated to have \$385 million in direct economic benefits due to construction and employment within the site plus ancillary jobs and servicing of the facility in the long term. Approximately \$1.8 million is conservation outcomes for the site and locality is expected over the life of the project.

The proposed action achieves a balanced outcome that respects the employment opportunities and ecological attributes.

4.3.7 EPBC offsets policy

At the assessment stages of this project the Environment Protection and Biodiversity Conservation Act (1999) Environmental Offsets Policy (2012) states that the impacts of a proposed action must be fully understood. At the assessment stage the decision maker considers the following issues in detail. Please note that area measurements used in this section refer to the EEC which is EPBC listed and differs from the measurements used to described the EEC as per the TSC Act.

• What is the nature of the likely impacts on protected matters?

The protected matters are likely to be impacted by the action are the removal of numerous small patches of highly disturbed and fragmented Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest totalling 2.71 ha as shown in Figure 4. These patches are mostly canopy only that has had the native shrub layer removed, over a highly modified ground layer that is composed of less than 10% native species.

The removal of the 2.71 ha of highly disturbed patches is to be ameliorated by the retention, conservation and in perpetuity management of 10.14 ha of good quality Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest within the proposed Lot 205 Conservation Area. This area is to be managed under a Vegetation Management Plan which will enact restoration strategies to control weeds, allow natural regeneration, revegetation (planting) works, will consolidate the extent, quality and biodiversity of the vegetation and the Habitats for flora and fauna species within.

The viability of the small patches is considered to be low due to the high levels of previous disturbance. The patches are represented by canopy species only, there are numerous small patches with a high edge to area ratio. Consolidating them through remediation of the ground surfaces and revegetation (planting) works would be very costly, labour intensive and would not achieve a satisfactory result for more than 6 to 8 years.

The risks associated with this strategy are low. The small poor quality patches do not lend themselves to any retention strategy that is easily achieved, while the retention of the better quality larger patch within the proposed Lot 205 Conservation area is much more viable and meets the minimum biobank site size of 6 ha.

The impacts to the Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest will be a measurable positive one which will also be permanent.

• Can impacts on protected matters be avoided?

The proposal has avoided the fragmented patches on site and conserved Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest with Lot 205. Small and depauperate patches of the Critically Endangered Ecological Community (CEEC) are to be removed. As an amelioration strategy, the largest and good quality patch of this CEEC will be retained within the proposed Lot 205 Conservation Area. This patch is to be managed in perpetuity through a Vegetation Management Plan which will conserve, protect and enhance the CEEC vegetation within.

The proposed action would be unworkable if all patches of CEEC were to be retained. It is considered that the current proposal provides the best outcome, with a high probability of success and with minimal expense or works required.

Can impacts on protected matters be mitigated?

The proposal includes strategies to retain, conserve and manage the patch of better quality CEEC vegetation within the proposed Lot 205 Conservation area. This environmentally sensitive area is to be fenced off and managed under a Vegetation Management Plan (VMP) that runs for ten (10) years and then switches to a maintenance mode in perpetuity.

It is expected that erosion control works will be employed during and after the construction phase of the project in accordance with '*Managing Urban Stormwater: soils and Construction*' (Landcom 2004)

Access to the Conservation Area will be restricted and will not be open to the public. Therefore impacts such as rubbish, cars or garden waste dumping, formation of informal tracks, motocross or BMX bike riding, lighting of fires and soil disturbance will be prevented.

Are the residual impacts likely to be significant?

The impacts of the proposed action will be the removal of 2.71 ha of highly fragmented, disturbed and poor quality habitat within the small patches of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest.

These patches were assessed with regard to the habitat that they provide for threatened flora and fauna species. Despite detailed searches, no nationally or state listed threatened species were detected within these small disturbed patches.

No Commonwealth or State listed threatened flora species were observed within the entirety of the action area.

Four state listed threatened species (Grey-headed Flying-fox, Large-footed Myotis, Greater Broad-nosed Bat and the Cumberland Plain Land Snail) were observed within the proposed Lot 205 Conservation Area. No state listed threatened species were observed outside of the proposed Lot 205.

One Commonwealth listed fauna species (Grey-headed Flying-fox) was observed, also only within the proposed Lot 205 Conservation Area.

Therefore it is considered that the proposed action which removes the remaining fragments is not significant as it will only remove small areas of very low potential habitat for potential threatened species. Whereas the retention of the vegetation within the Lot 205 Conservation Area will protect, conserve and manage known habitat for at least four threatened fauna species known to utilise this area.

Are offsets a suitable approach?

It is considered that the removal of 2.71 ha of highly disturbed Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest that provides small areas of very poor potential habitat for threatened species is unlikely to result in any significant impacts to any threatened species, population or ecological community. Offsetting of important fragments is a reasonable for the residual impacts that cannot be avoided.

The conservation, protection, management and improvement of the 10.14 ha patch of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest within the proposed Lot 205 Conservation Area is considered to be a significant conservation outcome and a net gain or improvement outcome over current site management and in the long term as an industrial subdivision.

The use of Lot 205 as a biodiversity offset is a valid recognition of the avoidance that has been undertaken by the proponent. The resulting investment in restoration of the

conservation lot as a biodiversity offset will see an improvement in the quality of the remnant and its associated fauna habitat.

It is noted that offsets are not required where the impacts of a proposed action are not thought to be significant or could reasonably be avoided or mitigated in accordance with the EPBC Act Environmental Offsets Policy. It is considered that the proposed action will not result in a significant negative impact moreover it will result in a permanent measurable positive impact and should not require additional offsets.

4.4 Fauna

All fauna species recorded during survey(s) are listed in Table 3.2.

4.4.1 Fauna habitat

The fauna habitats present within the site are identified within Table 4.3.

			Topog	graphy					
Flat ✓	Gentle 🗸	Ń	loderate	\checkmark	Steep	\checkmark		Drop-offs	
		Veg	etatio	n structi	ure				
Closed Forest	Open Forest	W	/oodland	\checkmark	Heath			Grassland	\checkmark
		Dist	turban	ice histo	ory				
Fire		Under-scr	ubbing	\checkmark		Cut and	fill work	s √	
Tree clearing	\checkmark	Grazing		\checkmark					
		S	Soil Iar	ndscape					
DEPTH:	Deep	\checkmark	Modera	ate 🗸	Sha	llow		Skeletal	
TYPE:	Clay	\checkmark	Loam	\checkmark	San	d		Organic	
VALUE:	Surface fo	raging	\checkmark	Sub-surfac	e foraging	√	Denn	ing/burrowing	√
WATER RETENTION:	Well Drain	ied √	Damp /	/ Moist	Wat	er logged		Swamp / S	oak
			Rock	habitat	_			-	
CAVES:	Large		Small		Dee	эp		Shallow	
CREVICES:	Large		Small		Dee	ер		Shallow	
ESCARPMENTS:	Winter / la	te sunny as	oects		Sha	ded winter	/ late as	spects	
OUTCROPS:	High Surfa	ace Area Hid	les	Med. Surfa	ice Area I	lides	Low S	urface Area H	lides
SCATTERED / ISOLATED:	High Surfa	ace Area Hid	les	Med. Surfa	ice Area I	Hides	Low S	urface Area H	lides √
		F	eed re	sources	;				
	Eucalypts	\checkmark		Corymbias			Melale	eucas √	
FLOWERING TREES.	Banksias			Acacias	\checkmark				
SEEDING TREES:	Allocasua	rinas		Conifers					
	C. macula	ta	E. creb	ra √	E. g	loboidea		E. sideroxyl	on
FUCALYPTS	E. squamo	osa	E. gran	idis	E. m	nulticaulis		E. scias	
LOOMENT IO.	E. robusta		E. teret	ticornis 🗸	E. a	gglomerata	a	E. sideroph	loia
FLOWERING PERIODS	: Autumn		Winter	\checkmark	Spri	ng v	/	Summer	\checkmark
OTHER [.]	Mistletoe	\checkmark	Figs / F	Fruit	San	/ Manna		Termites	\checkmark

Table 4.3 – Observed fauna habitat

		Foliage	protection			
UPPER STRATA:	Dense		Moderate	\checkmark	Sparse	\checkmark
MID STRATA:	Dense		Moderate		Sparse	\checkmark
PLANT / SHRUB LAYER:	Dense √		Moderate	\checkmark	Sparse	\checkmark
GROUNDCOVERS:	Dense		Moderate	\checkmark	Sparse	\checkmark
		Hollo	ws / logs			
TREE HOLLOWS:	Large		Medium		Small	\checkmark
TEE HOLLOW TYPES	Spouts / branch 🗸	√ Trunk	Broken Trur	nk ✓ Basal (Cavities	✓ Stags ✓
GROUND HOLLOWS:	Large		Medium	\checkmark	Small	\checkmark
		Vegeta	tion debris			
FALLEN TREES:	Large ✓		Medium	\checkmark	Small	\checkmark
FALLEN BRANCHES:	Large ✓		Medium	\checkmark	Small	\checkmark
LITTER:	Deep 🗸		Moderate	\checkmark	Shallow	/ √
HUMUS:	Deep		Moderate	\checkmark	Shallow	/ √
		Drainage	e catchmen	t		
WATER BODIES	Wetland(s) ✓ S	Soak(s)	Dam(s) ✓ D	rainage line(s)	Creek	(s) River(s)
RATE OF FLOW:	Still ✓		Slow		Rapid	
CONSISTENCY:	Permanent	\checkmark	Perennial		Ephem	eral
RUNOFF SOURCE:	Urban / Industrial	Parkl	and	Grazing		Natural
RIPARIAN HABITAT:	High quality	Mode	rate quality	Low quality	\checkmark	Poor quality 🗸
		Artific	ial habitat			
STRUCTURES:	Sheds	\checkmark	Infrastructure	\checkmark	Equipm	ient 🗸
SUB-SURFACE	Pipe / culvert(s)		Tunnel(s)		Shaft(s)
FOREIGN MATERIALS:	Sheet √		Pile / refuse	\checkmark		

The large north-western dams present within the site during 2013 surveys were found to provide high quality habitat for water birds, waders and frog species including breeding/nesting habitat in surrounding vegetation. These two large dams were dewatered and infilled as part of regular mining operations. Any further habitat removal and dewatering of remaining smaller dams and surrounding vegetation should be undertaken with a fauna ecologist present to effectively recover turtles and other aquatic species.

The endangered CPLS (*Meridolum corneovirens*) was recorded present throughout the eastern woodland portion of the study area. There were no recordings of *M. corneovirens* in remaining small isolated remnants.

Other snail species were recorded during habitat searches. A single dead specimen of the carnivorous snail *Austrorhytida capillacea* was recorded in the middle of the woodland patch. Exotic snails *Cornu aspersum* and *Bradybaena similaris* were also recorded within the woodland areas. *C. aspersum* was recorded in large numbers with an obvious reduced presence in the southern portions. This species may therefore be associated with areas subject to edge effects which includes the narrower northern half of the woodland area and

around the outer fringes of the wider southern half. *B. similaris* was also recorded sporadically along the outer fringes of the woodland.

4.4.2 Habitat trees

A complete assessment of the location of habitat trees and the size of hollows within was undertaken as part of surveys. Table 4.4 below provides hollow-bearing tree data and other habitat features recorded. Figure 2 provides locations of habitat trees.

Tree No	Scientific Name	Common Name	DBH (cm)	Spread (m)	Height (m)	Vigour (%)	Hollows & Other Habitat Features Recorded
HT1*	Melaleuca decora	Paperbark	40	8	9	75	1x 10-15cm low trunk (good quality with nesting material, Common Myna?)
HT2	Eucalyptus tereticornis	Forest Red Gum	40/90	9	22	70	1x 0-5cm broken trunk
HT3		stag	45	9	19	0	2x 0-5cm branch
HT4	Eucalyptus tereticornis	Forest Red Gum	75	14	22	85	1x 5-10cm trunk (good quality with wear around entry)
HT5	Eucalyptus tereticornis	Forest Red Gum	60	13	21	80	1x 10-15cm trunk split
HT6*		stag	35	10	18	0	1x 0-5cm branch
HT7*		stag	55	12	19	0	1x 0-5cm branch (good quality)
HT8	Eucalyptus tereticornis	Forest Red Gum	75	14	23	80	1x 0- 5cm branch
HT9	Eucalyptus tereticornis	Forest Red Gum	40	12	24	80	White-faces Heron's nest

Table 4.4 – Habitat tree data

* Indicates to be removed for proposed action

A further two trees containing small to medium sized hollows were located within the northern portion of the large CPW remnant during November 2016 survey. These trees showed scratch marks indicating irregular use of these hollows by a possum or glider. These trees were not identified by gps or incorporated into the tree data as they are not within the subject site (proposed development landscape). Stag-watching of these trees was undertaken on the 16th November 2016 with no recorded activity.

The hollows present throughout the study area were found to be generally small and at very low density. This was the case even throughout the large eastern woodland remnant which is likely the result of previous selective logging or other previous clearance disturbance. There were no large hollows observed present within the study area and therefore no suitable nesting or hollow roosting habitat for owls is present.

Two hollow-dependent threatened fauna species including the Large-footed Myotis and Greater Broad-nosed Bat were recorded during survey. It is recommended that hollow - bearing trees identified within the subdivision landscape are retained where possible. Any removal of hollows should be under the supervision of a fauna ecologist so that residing fauna may be effectively recovered, particularly threatened species.

4.4.3 Local fauna matters

Fauna species recorded present during survey and listed as a regionally significant species within the *Native Fauna of Western Sydney - Urban Bushland Biodiversity Survey* (NPWS 1997) include the Latham's Snipe, White-winged Chough, Yellow-rumped Thornbill and Zebra Finch. A scat from a macropod was also observed within the eastern CPW remnant.

The White-winged Chough was recorded outside of the study area to the west but likely utilises the woodland habitat in the east proposed for retention.

The Latham's Snipe, Yellow-rumped Thornbill and Zebra Finch were all recorded within the Paperbark patch of CPW located to the east of the north-western dam area. The Latham's Snipe was foraging along the water's edge at this location. This area of woodland is proposed for removal as part of the proposal. The potential value of this Paperbark patch has been reduced since the removal of the adjacent large dam.

The Pink-eared Duck was recorded within the large dam during 2013 survey. This species is also a rarely encountered waterfowl within the western plains of the Sydney metropolitan area. Habitat for this species has since been removed.

4.4.4 State legislative fauna matters

(a) Threatened species (NSW)

TSC Act – A search of the *Atlas of NSW Wildlife* (OEH, 2016) provided a list of threatened fauna species previously recorded within a 10km radius of the study area. These species are listed in Table A2.2 (Appendix 2) and are considered for potential habitat within the study area.

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

Common name	TSC Act	Potential to occur
Grey-headed Flying-fox	V	recorded
Large-footed Myotis	V	recorded
Greater Broad-nosed Bat	V	recorded
Cumberland Plain Land Snail	Е	recorded
Little Eagle	V	\checkmark
Square-tailed Kite	V	\checkmark
Little Lorikeet	V	\checkmark
Swift Parrot	Е	\checkmark
Speckled Warbler	V	\checkmark
Varied Sittella	V	\checkmark
Dusky Woodswallow	V	\checkmark
Diamond Firetail	V	\checkmark
Yellow-bellied Sheathtail-bat	V	\checkmark
East-coast Freetail Bat	V	\checkmark
Eastern Falsistrelle	V	\checkmark
Little Bentwing-bat	V	\checkmark
Eastern Bentwing-bat	V	\checkmark
Green and Golden Bell Frog	E	low
Powerful Owl	V	low
Masked Owl	V	low
Black-chinned Honeyeater	V	low
Scarlet Robin	V	low
Regent Honeyeater	E4A	unlikely
Flame Robin	V	unlikely

Table 4.5 – State listed threatened fauna species with suitable habitat present

Full habitat descriptions for these species are provided in Appendix 2

Four (4) state listed threatened fauna species – Grey-headed Flying-fox (*Pteropus poliocephalus*), Large-footed Myotis (*Myotis macropus*), Greater Broad-nosed Bat (*Scoteanax rueppellii*) and Cumberland Plain Land Snail (*Meridolum corneovirens*) – were recorded within the study area during surveys. The Greater Broad-nosed Bat was recorded only to a 'possible' level of certainty. These species have been assessed in detail within Appendix 3.

No threatened woodland birds were recorded during surveys however the both survey days in 2013 were subject to strong winds which likely reduces birding behaviour and recording potential.

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

(b) Endangered populations (NSW)

There are no endangered fauna populations identified specifically to the Fairfield LGA; however, the site does fall within the Sydney Metropolitan Catchment Management Authority (CMA) area. An endangered population of White-fronted Chat (*Epthianura albifrons*) is identified to this area, however, this is made up of two (2) known isolated sub-populations; one at Newington Nature Reserve on the Parramatta River and one (1) at Towra Point Nature Reserve in Botany Bay. The study area provides limited suitable habitat however the White-fronted Chat was not recorded present during surveys.

(c) SEPP 44 Koala Habitat Protection

SEPP 44 Koala Habitat Protection applies to land within Local Government Areas (LGAs) listed under Schedule 1 of the Policy. In addition, Part 2 of the Policy outlines a three (3) step process to assess the likelihood of the land in question being potential or core koala habitat. Part 2 applies to land which has an area of greater than 1 hectare or has, together with any adjoining land in the same ownership, an area of more than 1 hectare.

The study area is not required to be considered under SEPP 44 as it falls within the Fairfield LGA, which is not listed on Schedule 1 of this Policy.

4.4.5 National environmental significance - fauna

(a) Threatened species (National)

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

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

Common name	EPBC Act	Potential to occur
Grey-headed Flying-fox	V	recorded
Swift Parrot	E	\checkmark
Green and Golden Bell Frog	V	low

Table 4.6 – Nationally listed threatened fauna species with suitable habitat present

Common name	EPBC Act	Potential to occur
Regent Honeyeater	E	unlikely

The Preliminary Documentation Requirements requested by DOEE in correspondence (EPBC Ref: 2016/7744) required a detailed assessment for Koala, Grey-headed Flying-fox and Swift Parrot.

The Significant Impact Criteria for species listed under the EPBC Act 1999 is provided in Appendix 4. A detailed assessment of impact has been undertaken in accordance with this criteria for the Swift Parrot (refer to Appendix 4.1) and Grey-headed Flying-fox (refer to Appendix 4.2). This assessment has concluded that the subdivision proposal and associated habitat removal will not have a significant impact on either of these two species.

<u>Koala</u>

No detailed assessment has been provided for Koala as the habitat assessment for this species in Table A2.2 (refer to Appendix 2) has concluded that there is no potential for the study area to support core Koala habitat based on local records, connectivity, extent of available habitat and as a result of targeted survey techniques. This table and its assessment conclusion has remained unchanged from 2013 reporting. The eastern bushland remnant has been comprehensively spotlighted during surveys in 2013 and 2016. Given the additional requests for assessment on this species the updated 2016 surveys also incorporated Koala call-playback during the peak activity period as well as scratch and scat searches.

No Koalas were recorded present and the study area is considered only likely to support temporary transient habitat most likely for young males in dispersal. Furthermore this is considered as unlikely potential for use given the degree of isolation, distance to known records and also that a high mesh fencing with barbed wire tops surrounds the study area.

Approximately 93% of the large consolidated patch of CPW containing Koala feed trees Forest Red Gum (*Eucalyptus tereticornis*) will be retained as part of the proposal such that this most suitable available habitat will remain generally constant in the long term.

The EPBC Act Referral Guidelines for the Vulnerable Koala were reviewed to the support the national assessment. It may be concluded that the impact area does not contain habitat critical to Koala survival based on a habitat assessment score of 2 or 3. The score is determined from:

- (a) no recorded occurrence, past or present
- (b) greater than 50% presence of a food tree
- (c) no connectivity
- (d) some degree of dog and vehicle threat is at least present, and
- (e) habitat is unlikely important to achieve the interim recovery objectives.

This is less than the 5 points threshold and therefore a referral is not recommended due to a low risk of resulting in significant impact, as guided by Figure 1 of the guidelines.

Grey-headed Flying-fox

The EPBC Act Administrative Guidelines on Significance – Supplemented for the Greyheaded Flying-fox makes no reference to survey requirements. This document further clearly indicates on page 8 that "This guideline is intended to provide guidance only in relation to management actions taken at or in camps and then further states that it does not apply to Actions in the vicinity of camps or actions that may impact on the foraging habitat. Proponents of actions of this kind should refer to the Significant Impact Guidelines 1.1". This was provided in the previous flora and fauna assessment report prepared by *Travers bushfire & ecology* (2013) and has been addressed in greater detail in Appendix 4.2 of the same report.

The DoEE correspondence (EPBC Ref: 2016/7744) also requests an analysis of the scale of impacts relative to the local and regional occurrences of the species with reference to the *EPBC Act Administrative Guidelines on Significance - Supplementary for the Grey-headed Flying-fox.* This booklet discusses control measures for orchardists to effectively balance this need with the protection and recovery of the species. This document does not relate to any survey requirements, assessment criteria or impact on native foraging habitat. Therefore this document is also irrelevant to this assessment.

As noted the DoEE correspondence (EPBC Ref: 2016/7744), three nationally significant Grey-headed Flying-fox camps are located approximately 6km north (Ropes Creek camp), 8km east (Wetherill Park camp) and 13km south-east (Cabramatta camp) from the study area. The locations of these closest camps are shown on Figure 4.

This figure also gives an indication of the local vegetation available for foraging, most nobly the large and connective remnants. The large consolidated path of CPW to be retained for

foraging within the study area can be seen on this figure and with comparison in size to other local remnants. Whilst no doubt this is a highly developed landscape with highly fragmented remnants, each of these may be as easily accessed by flying-foxes as single isolate urban trees.



Figure 5 – Closest Grey-headed Flying-fox camps

Swift Parrot

The Survey Guidelines for Australia's Threatened Birds requires that surveys for this species on the mainland should be conducted between March and July. No surveys within the site have been undertaken within this period. Therefore the survey assessment has been applied based on the presence and availability of habitat and assumption of the species presence.

As with the Grey-headed Flying-fox, the assessment conclusion of not significant for the Swift Parrot, as provided in Appendix 4.1 of the Flora and Fauna Assessment Report. The majority (10.14 ha) of the large 11.09 ha consolidated patch of CPW in the eastern portion of the study area will remain for winter foraging. Whilst this species is more likely to utilise this large eastern remnant patch, it too may also forage on the smaller isolated fragments of
varying quality proposed for removal in remaining parts of the study area. Despite their understorey and mid-storey quality, the canopy provides the winter foraging opportunity. Therefore the estimated total removal of habitat is 2.71 ha (including 0.04 ha due to ancillary intersection works on Burley Road). 10.14 ha of foraging habitat will be retained and restored (98% conservation).

This extent of retention, particularly given that a greater percentage of the large remnant will be retained, is not likely to result in a significant impact on the Swift Parrot. It is considered that this conclusion can be made in the absence of survey and with assumption of the species utilising the available habitat. Local records of Swift Parrot are provided in Figure 6.



Figure 6 – Local records of Swift Parrot out to 10km radius

Figure 5 shows the point location, the recorded year and the distance accuracy for each record. The nearest record is 5.9 km away to the south-east and the most recent within 10km is in 2007. A record from 2014 is also present approximately 13 km west. Many records are over the urban landscape where the species may be more likely recorded however the remnant CPW patches in the more rural locations are more likely to receive foraging visits. Therefore the study area has real potential for local winter foraging use.

As requested by EPBC Ref: 2016/7744, consideration of impacts such as strikes to buildings, fences and vehicles has been made. The proposal may increase potential for these processes but not of any notable degree or more than any other residential or industrial subdivision proposal. It is likely that the existing fencing surrounding the site will be retained however if there is potential for new fencing a recommendation will be made to ensure this is Swift Parrot friendly. A recommendation will also be made to ensure that any windows do not have a reflective coating to cause a mirror effect that may increase the likelihood of bird strikes. Vehicle strikes cannot be further avoided.

(b) Protected migratory species (National)

The EPBC Act Protected Matters Report provides additionally listed terrestrial, wetland and marine migratory species of national significance likely to occur, or with habitat for these species likely to occur, within a 10km radius of the study area. These migratory species are considered for habitat suitability in Table A2.3 (Appendix 2). Threatened migratory species are assessed for habitat suitability in Table A2.2 (Appendix 2).

Three (3) nationally protected migratory bird species Great Egret (*Ardea alba*), Cattle Egret (*Ardea ibis*) and Latham's Snipe (*Gallinago hardwickii*) were recorded present during the preliminary survey.

An individual Great Egret was observed foraging within the small reedy dam in the centre of the study area during November 2016 survey. The subject site does not provide any breeding habitat potential and foraging habitat is otherwise well represented in the locality. The removal of habitats is therefore not likely to significantly impact on this species.

Cattle Egret was recorded during both August and December 2013 surveys. August surveys recorded two individuals foraging with cattle to the north of the large woodland remnant within the study area. December survey did not recorded the species within the study area but recorded several individuals foraging with cattle in an adjacent paddock to the south in breeding plumage. The north-western dam areas previously provided suitable nesting habitat however no presence or nesting evidence by Cattle Egret was observed during previous 2013 survey prior to the infill of the large dams. The subject site now does not provide any breeding habitat potential and foraging habitat is otherwise well represented in the locality. The removal of habitats is therefore not likely to significantly impact on this species.

One and possibly two Latham's Snipes were recorded foraging around the perimeter of the north-western large dam area during the December 2013 survey. This was good quality foraging habitat for this species at this time however the large dams have since been removed. Foraging habitat is still present around the flat fringes to the remaining two smaller dams. Foraging habitat is well represented in the region and breeding habitat only exists in Japan. Therefore the removal of habitat will not significantly impact on this species.

4.4.6 Fauna assessment conclusions

In accordance with Section 5A of the *EPA Act 1979*, the 7 part test of significance (Appendix 3) concluded that the proposed development will not have a likely significant impact on any state listed threatened fauna species or threatened fauna populations. Therefore, a Species Impact Statement should not be required for the proposed development in respect to fauna.

The proposed development was not considered to have a significant impact on threatened or migratory fauna species listed as matters of national environmental significance under the *EPBC Act 1999.* As such a referral to *Department of Environment and Energy* should not be required in respect to fauna.

Mitigation measures have been outlined with the recommendations of this report in order to reduce or eliminate the identified impacts on threatened biodiversity.

4.5 Potential ecological impact

The conservation area has been designed in order to retain the majority of the high quality site vegetation and avoid impact on this consolidated patch of CPW. This is also the only area of recorded Cumberland Plain Land Snail habitat within the study area. This snail was recorded present in high numbers indicating quality habitat and thus impacts on this species have also been avoided.

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

- Potential loss of a small number of hollows suitable for hollow dependent threatened microbat species
- Removal of artificial structures which may be utilised by microbats for roosting
- Removal of quality areas of frog breeding habitat

- Removal of waterbird and wading bird foraging habitat
- Removal of small remnants suitable for foraging by woodland birds
- Clearing of small remnants of fragmented EEC vegetation, and
- Increased risk of weed invasion and fungal mobilisation or infections.



Conclusion

5

Travers bushfire & *ecology* has been engaged to undertake flora and fauna assessment within the CSR Horsley Park Brick Plant at Lot 1 DP 106143, Burley Road, Horsley Park. The proposal is for an industrial subdivision in three stages to create 14 lots and one lot for conservation. Refer to Figure 1 for proposed industrial subdivision layout. The proposed Lot 205 Conservation Area is proposed to be biobanked and funded through this scheme.

Ecological survey and assessment has been undertaken in accordance with relevant legislation including the *Environmental Planning and Assessment Act 1979*, the *Threatened Species Conservation Act 1995*, the commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and the *Fisheries Management Act 1994*.

5.1 Observations

Two (2) NSW TSC Act (1995) endangered ecological communities (EECs), Cumberland Plain Woodland (CPW), and River Flat Eucalypt Forest (RFEF) were recorded within the study area.

CPW occurs throughout the eastern vegetated portion of the study area in medium to high condition. This was despite the continued grazing by cattle in this area. The size of the eastern patch is approximately 11.09 ha and it is proposed to retain and protect 10.14 ha of this vegetation patch within the proposed Conservation Lot 205. The smaller fragmented remnants of CPW (2.85 ha which includes 0.04 ha of ancillary works) within the western and northern portions of the site are depauperate of native species diversity and ecological complexity and are proposed to be removed.

RFEF occurs as several small patches in the western portions of the study area. The largest patch is 0.58 ha in size, while the remaining four (4) small patches total 0.12 ha. All of the RFEF within the subject site is proposed for removal.

Initial surveys in 2013 identified the large north-western dams within the study area to provide high quality habitat for water birds, waders and frog species including breeding/nesting habitat in surrounding remnant vegetation. This includes habitat for the;

- Recorded threatened microbat species, in particular the Large-footed Myotis which is dependent on open water for foraging activity.
- Protected migratory Latham's Snipe
- Locally significant species Yellow-rumped Thornbill, Zebra Finch, Black-fronted Dotterel and Pink-eared Duck.

These large dams that previously provided habitat have since been infilled as part of remediation works. Large-footed Myotis has still been recorded foraging over smaller dams within the study area in 2016.

The endangered Cumberland Plain Land Snail (*Meridolum corneovirens*) was recorded present throughout the eastern woodland portion of the study area. This includes along the western fringe of this vegetation which is part of the subject site area proposed for removal. Therefore there will be a requirement to relocate snails from this edge into the consolidated area before habitat removal. The exotic *Cornu aspersum* and *Bradybaena similaris* were also recorded at the outer fringes of this remnant and appear to be slowly encroaching on the internal habitat area. There were no observations of *M. corneovirens* in remaining small isolated remnants within other parts of the study area.

Two hollow-dependent threatened microbat species including the Large-footed Myotis and Greater Broad-nosed Bat were recorded during surveys. Both species may also utilise structures for roosting and hence may utilise the existing site sheds and infrastructure.

A complete assessment of the location of habitat trees and the size of hollows within was undertaken as part of surveys. The hollows were found to be generally small and at very low density. This was the case even throughout the large eastern woodland remnant which is likely the result of previous selective logging or other previous clearance disturbance. There were no large hollows observed present within the study area and therefore no suitable nesting or hollow roosting habitat for owls or cockatoos is present.

Grey-headed Flying-foxes have been observed during nocturnal surveys however no roosting or subsequent breeding habitat for this species is present. Therefore site dependence for this species is for seasonal foraging as flowering resources permit.

5.2 Legislative Assessment Outcomes

In respect of matters required to be considered under the *Environmental Planning and Assessment Act 1979* and relating to the species / provisions of the *Threatened Species Conservation Act 1995*, four (4) threatened fauna species including Grey-headed Flying-fox (*Pteropus poliocephalus*), Large-footed Myotis (*Myotis macropus*), Greater Broad-nosed Bat (*Scoteanax rueppellii*) and Cumberland Plain Land Snail (*Meridolum corneovirens*), no threatened flora species, and one (1) EEC, Cumberland Plain Woodland were recorded within the study area. The Greater Broad-nosed Bat was recorded only to a 'possible' level of certainty during both 2013 and 2016 surveys.

Environmental Planning and Assessment Act 1979

In accordance with Section 5A of the *Environmental Planning and Assessment Act 1979*, the 7 part test of significance concluded that the proposed subdivision development will not likely have a significant impact on any threatened species, populations or EECs. Therefore, a Species Impact Statement should not be required for the proposal.

Fisheries Management Act 1994

In respect of matters relative to the *Fisheries Management Act 1994*, no suitable habitat for threatened marine or aquatic species was observed within the study area and there are no matters requiring further consideration under this Act.

Environment Protection and Biodiversity Conservation Act 1999

In respect of matters required to be considered under the *Environment Protection and Biodiversity Conservation Act 1999*, one (1) threatened fauna species Grey-headed Flyingfox (*Pteropus poliocephalus*), two protected migratory bird species including Cattle Egret (*Ardea ibis*) and Latham's Snipe (*Gallinago hardwickii*), no threatened flora species, and one EEC, Cumberland Plain Shale Woodland and Shale-Gravel Transition Forest (CPSW&SGTF) listed under this Act were recorded within the study area.

The proposed subdivision development was not considered to have a significant impact on matters of national environmental significance. Response from the DOEE (EPBC Ref: 2016/7744) dated 28th October 2016 indicated that Ms Kim Farrant, *Assistant Secretary, Assessments (NSW, ACT) and Fuel Branch* decided that the proposed action is a controlled action and that it will be assessed by preliminary documentation. Further information including survey and assessment was requested on EPBC listed matters only and this has been incorporated into this updated report.

A detailed assessment for CPSW&SGTF, Grey-headed Flying-fox, Koala and Swift Parrot has been undertaken as per the EPBC Act Policy Statement 1.1 *Significant Impact Criteria* for *Matters of National Environmental Significance*. The proposed subdivision development was not considered to have a significant impact on matters of national environmental significance.

5.3 Recommendations and mitigation measures

It is recommended;

- 1. An 88B instrument that requires the Conservation Lot and surrounding 25 m APZ to be managed in accordance with the approved Vegetation Management Plan.
- 2. The conservation lot 205 will be protected in perpetuity through the same 88B instrument and maintained in perpetuity and if approved as a Biobank site.
- 3. All drainage within Lots 204, 203, 306 and 307 will be collected into the proposed stormwater system and will not be directed to the conservation lot. Drainage within the proposed asset protection zones will be via overland runoff across a grassed native pasture and will not result in any significant contaminants being delivered to the conservation lot. This is consistent with the sites current drainage pattern that does not direct any surface runoff into the CPW conservation lot except of the existing batters.
- 4. A 25m managed ecological zone in the form of a revegetated asset protection zone with a canopy cover of 30% and densely planted native groundlayers species will be provided and managed in perpetuity as per the approved vegetation management plan.
- 5. Street tree planting and landscaping within the industrial subdivision is to utilise native trees, shrubs and groundcovers endemic to Cumberland plain Woodland.
- 6. Any removal of hollows should be under the supervision of a fauna ecologist so that residing fauna may be effectively recovered. Hollows of high quality or with fauna recorded residing within should be sectionally dismantled and all hollows should be inspected for occupation, activity and potential for reuse. In the instance of recording the presence of threatened microbats during tree removal, maximum effort should ensure safe relocation of the roosting colony. Re-used hollows or those with likely occupation are to be relocated into the conservation area. All other hollows removed should be replaced with nest boxes. Every second box should be a design suitable for microbat species. Boxes should be constructed all of weatherproof timber (marine ply), fasteners and external paint.

- 7. In the event that microbats are found roosting within structures during the demolition process, work should cease immediately and a fauna ecologist contacted. The fauna ecologist is to recover the roosting colony by best practice measures to prevent or minimise impacts on this colony.
- 8. If there is to be any replaced or newly constructed fencing within the subdivision is to be wildlife friendly. Fencing is not to include barbed wire strands except on the outer lot boundaries that contain grazing domestic cattle.
- Any windows within constructed buildings within the proposed subdivision are not to contain a reflective coating to cause a mirror effect that may increase the rate of bird strike, specifically for the endangered Swift Parrot.
- 10. Any Cumberland Plain Land Snail habitat restoration, relocation and habitat enhancement proposal should be accompanied with a pest species eradication process to ensure that *M. corneovirens* may establish itself within the retained CPW habitat with little competition. This will include a process of collecting and euthanizing as many exotic snails as possible. Simple perimeter barriers such as a permanent sediment filter fence surrounding the remnant or associated with the perimeter fencing will restrict re-colonisation of the CPW by exotic snails such as *Cornu aspersum* and *Bradybaena similaris*.
- 11. Sediment and erosion control measures are to be installed immediately prior to the commencement of demolition, construction and earthworks.
- 12. Inspection and removal of any aquatic fauna from the existing waterbodies.
- 13. Installation of protective fencing around drip zone of trees that interface with the development site to be retained. This is largely complete already.
- 14. Undertake weed control.
- 15. Enhance retained areas with mid-storey species of CPW origin where they are not present.
- 16. Provide a 20m bushland interface zone to effectively monitor and manage edge effects adjacent to proposed development.
- 17. Enhancement of Cumberland Plain Land Snail habitat.
- 18. Nest box installation in accordance with approved Vegetation management plan.

BIBLIOGRAPHY

Auld, B. A. & Medd, R. W. (1996) Weeds. Inkata Press.

- Bannerman, S. M. & Hazelton, P. A. (1990) Soil Landscapes of the Penrith 1:100 000 Sheet. Soil Conservation Service of NSW, Sydney.
- Barker, J., Grigg, G. C. & Tyler, M. J. (1995) A Field Guide to Australian Frogs. Surrey Beatty & Sons.
- Bishop, T. (1996) Field Guide to the Orchids of New South Wales and Victoria. UNSW Press.
- Briggs, J. D. & Leigh, J. H. (1995) Rare or Threatened Australian Plants. CSIRO.
- Brown, P. (1989) The Swift Parrot *Lathamus discolor*. a report on its ecology, distribution and status, including management considerations. Department of Lands, Parks and Wildlife, Hobart, Technical Report.

Churchill, S. (2008) Australian Bats, 2nd Ed., Jacana Books, Crows Nest, Sydney.

Cogger, H. G. (1996) Reptiles and Amphibians of Australia. Reed Books Australia.

- DEC (2004) Threatened Species Survey and Assessment: Guidelines for developments and activities (working draft), New South Wales Department of Environment and Conservation, Hurstville, NSW
- Department of Environment and Conservation NSW (2005) Draft Recovery Plan for the Green and Golden Bell Frog (*Litoria aurea*). DEC NSW, Hurstville, NSW.
- Department of the Environment, Water, Heritage and the Arts (2010) Policy statement 3.31 Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest: A guide to identifying and protecting the nationally threatened ecological community.

DECC (2008) Bio-banking Methodology.

Ehmann, H. (1997) Threatened Frogs of New South Wales. FATS Group.

- EPBC (1999) Environmental Protection and Biodiversity Conservation Act 1999 Interactive Map Database Search - <u>http://epbcweb.ea.gov.au/image/otherbatch.html</u>
- EPBC Listing Advice (2009) Advice to the Minister for the Environment, Heritage and the Arts from the Threatened Species Scientific Committee on an amendment to the List of Threatened Ecological Communities and the EPBC Act 1999 – Cumberland Plain Woodlands and Shale-Gravel Transition Forest.
- Griffiths, K. (1997) Frogs and Reptiles of the Sydney Region. University NSW Press.

Harden, G. (1993) Flora of New South Wales. University NSW Press.

Hoser, R. (1989) Australian Reptiles and Frogs. Pierson & Co.

Lamp, C. & Collett, F. (1996) A Field Guide to Weeds in Australia. Inkata Press.

- Lunney, D., Urquart, C.A. & Reed, P. (1988) Koala Summit, NPWS.
- Marchant, S., & P. J. Higgins (Eds) (1990) Handbook of Australian, New Zealand and Antarctic Birds. Volumes 1-7 Oxford University Press, Melbourne.

Morrison, R. G. B. (1981) A Field Guide to the Tracks & Traces of Australian Animals. Rigby.

- NSW National Parks and Wildlife Service (1997) Urban Bushland Biodiversity Survey NSW NPWS, Hurstville.
- NSW National Parks and Wildlife Service (2001) Grey-headed Flying-fox (*Pteropus poliocephalus*) Threatened Species Information;
- NSW National Parks and Wildlife Service (2002) Vegetation Mapping of the Cumberland Plain.
- NSW Rural Fire Service (2006) Planning for Bushfire Protection.
- OEH (2013) Atlas of NSW Wildlife for the relevant 1:100,000 scale map sheet.
- Parnaby, H. (1992) An interim guide to identification of insectivorous bats of south-eastern Australia. The Australian Museum, Sydney, Technical Report, No. 8.
- Parry-Jones, K.A. Augee, M.L. (1991) The diet of Flying-foxes in the Sydney and Gosford areas of NSW, based on sighting reports 1986-1990 in "Australian Zoologists." Vol.27(3&4) pgs 49-54. Lunney, D. (ed)
- Parry-Jones, K.A. Augee, M.L. (2001) Factors affecting the occupation of a colony site in Sydney, New South Wales by Grey-headed Flying-fox Pteropus poliocephalus. Australian Ecology (2001) 26, 47-55.
- Peacock, L. (2004) The Roost Preference of the Grey-headed Flying-fox in New South Wales, University of Sydney. Prepared for the Department of Environment and Conservation (NSW)
- Pizzey, G. & Knight, F. (1997) A Field Guide to the Birds of Australia. Angus & Robertson.
- Rainforest CRC (2006) Ecology and Management of Flying Fox Camps in an Urbanising Region.

Reader's Digest (1976) Complete Book of Australian Birds.

- Richardson, F. J., Richardson, R. G. & Shepherd, R. C. H (2007) Weeds of the South-East: an Identification Guide for Australia. Everbest Printing Co. Pty. Ltd. China.
- Robinson, L. (1994) Field Guide to the Native Plants of Sydney. Kangaroo Press.
- Robinson, M. (1996) A Field Guide to Frogs of Australia. Reed.
- Schodde, R. and Tidemann, S. (Eds) (1986) *Readers Digest complete book of Australian Birds*. Second Edition. Reader's Digest Services Pty Ltd, Sydney.

Simpson & Day (1996) Field Guide to the Birds of Australia. Viking.

- Snoyman, S. (2008) *Micro-climate Preferences of the Grey-headed Flying-fox, Pteropus Policephalus (Chiroptera: Pteropodidae), within the Sydney Region.* Macquarie University, Honours Thesis, Dept of Environmental Sciences.
- Strahan, R. (Ed)(1995) The Mammals of Australia The Australian Museum/Reed Books Sydney.
- Specht, R. L., Specht, A., Whelan, M. B. & Hegarty, E. E. (1995) *Conservation Atlas of Plant Communities in Australia.* Southern Cross University Press, Lismore.
- Tideman, C.R., Eby P., Parry-Jones K.A. and Nelson J.E. (2008) Grey-headed Flying-fox *Pteropus poliocephalus* Temminck, 1825. In *The Mammals of Australia*. Strahan, R. (ed). Reed Books, Chatswood;
- Triggs, B. (1996) *Tracks, Scats & Other Traces: A Field Guide to Australian Mammals.* Oxford University Press, Melbourne.
- Trounson, Donald & Molly (1998) *Australian Birds Simply Classified*. Murray David Publishing Pty Ltd, NSW.
- Van Dyke, S. and Strahan, R. (Eds) (2008) *The Mammals of Australia* (3rd Edn). Reed New Holland: Sydney.
- Wheeler, D. J. B., Jacobs, S. W. L. & Norton, B. E. (1994) *Grasses of New South Wales.* University of New England.
- Wilson, K. W. and Knowles, D. G. (1988) *Australia's Reptiles A Photographic Reference to the Terrestrial Reptiles of Australia*. Cornstalk Publishing.



Fauna Survey Methodologies



The fauna survey methods outlined within this Appendix are techniques employed by *Travers bushfire & ecology*, based on industry standards as well as additional methods found to be effective for select fauna groups. The fauna survey techniques deployed for each specific site are outlined within the survey effort table in the main body of this report. The techniques selected will depend upon the site characteristics and extent of available habitat as well as restrictions such as available survey time and weather conditions.

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

1 Standard survey techniques

1.1 Diurnal birds

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

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

Calls are identified in the field by the fauna surveyor. If an unknown call is heard it is crossmatched to comprehensive bird call reference libraries taken into the field. A call library of birds occupying the NSW coastal areas is also stored into a mobile phone for a quick reference. This phone is carried into the field at all times and may be used for call-playback methods and recording calls for later analysis. Diurnal bird census points may be undertaken at large sites where the total area may not be effectively covered during the survey period, or as a measure to ensure focused bird only survey.

1.2 Nocturnal birds

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

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

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

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

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

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

1.3 Arboreal mammals

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

Baiting and layout for Elliott trapping and hair tubing are typically incorporated into terrestrial trapping and hair tubing effort, unless where target survey is undertaken. Standard baiting and layout is therefore described in Section A1.3.2 below within terrestrial survey methods. Where gliders are targeted, the standard bait mix may be additionally laced with a nectarivor powder mix used for feeding captive birds. Where Brush-tailed Phascogales are targeted the standard bait mix may be additionally laced with an estatem Pygmy Possum is targeted, the bait mix will be more heavily laced with honey.

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

For all arboreal traps and hair tubes a mixture of honey and water is sprayed onto the trunk up to 8m above the trap and around the trap as a lure. Where Eastern Pygmy Possum is targeted, a high concentrate honey water mix is also sprayed from the base of trunk up and along connective branches.

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

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

1.3.1 Koala survey

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

SEPP 44 is applied to land within Local Government Areas (LGAs) listed under Schedule 1 of the Policy. Part 2 is applied to land which has an area of greater than 1ha or has, together with any adjoining land in the same ownership, an area of more than 1ha.

To determine Potential Koala Habitat (PKH) under the definitions of SEPP 44 an estimate of the percentage density of each tree species within vegetation communities is determined by averaging the percentage of stems counted. PKH is defined as land where at least 15% of the total number of trees in the upper or lower strata constitutes any of the tree species listed in Schedule 2 of the Policy.

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

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

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

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

1.4 Terrestrial mammals

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

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

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

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

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

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

1.5 Bats

Micro-chiropteran bats are surveyed by echolocation using Anabat detectors or trapped using harp (Constantine) traps, mist nets or trip lines. Microchiropteran bats are also surveyed by searches of subterranean habitats such as caves, tunnels or shafts where present, or by searching structures such as under bridges and abandoned buildings or wall / ceiling cavities, where entry is possible. Anabat Mk 2 and SD-1 detectors are used in fixed passive monitoring positions and / or during active nocturnal monitoring. Active monitoring is used in conjunction with spotlighting or during stag-watching for greater accuracy of recorded call identification.

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

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

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

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

1.6 Amphibians

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

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

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

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

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

1.7 Reptiles

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

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

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

1.8 Invertebrates

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

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

2 Habitat Trees

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

3 Survey Effort Table Descriptors:

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

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

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

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

Spotting-scope Outlook - A *Nikon* spotting scope with 16~47 zoom at x60 magnification on a mounted tripod is used for distant inspections of diurnal birds. This is undertaken at wetlands for viewing waterfowl and waders but also other difficult to access areas. It may also be used for inspecting activity at nests, hollows and combined with spotlight for a panoramic search in open areas.

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

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

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

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

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

Elliott trapping - Using *Elliott* type A (33x10x10cm) and Type B (45x15x15cm), B and / or Type C traps for trapping small sized mammals. Trapping nights' effort will be indicated in the survey effort table. Trapping layout, trap sizes, baiting and trapping period will be outlined within the site specific methodology section.

Medium Cage trapping - Using medium sized cage traps (17x17x45cm foldout cages with tread-plate mechanism or 22x25x58cm rigid cage with tread-plate mechanism) for trapping up to cat/bandicoot sized mammals. Trapping layout, target species, baiting and trapping period will be outlined within the site specific methodology section.

Large Cage trapping - Using large sized cage traps (25x25x50cm foldout cages with pull lever (meat) mechanism, 28x28x60cm foldout cages with tread-plate mechanism or 30x30x70cm rigid cage with tread-plate mechanism) for trapping up to quoll sized mammals. Trapping layout, target species, baiting and trapping period will be outlined within the site specific methodology section.

Hair tubing - Using small (40mm diameter x 120mm long) and/or large (90mm diameter x 200mm long) PVC pipe sections for collecting mammal hair samples. At one end of each tube is an enclosed chamber where the bait is placed and capped. Small drill holes in the inside face of the chamber allow the smell of the bait to permeate out through the tube without allowing access to the bait. At the other open entry end, double-sided tape is attached around the inner rim so hair samples of animals entering the tube are collected. Hair samples collected are sent to Barbara Triggs for identification. Trapping layout, tube sizes, baiting and trapping period will be outlined within the site specific methodology section.

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

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

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

Active Anabat monitoring - Is a method of active microbat recording during stag-watching or during complete nocturnal survey. Active monitoring involves an SD-1 recorder allied with a PDA for viewing call-sequences in real-time. When calls are heard the transducer microphone is actively directed towards the calling animal with the aid of a spotlight, so longer and clearer call sequences may be recorded. When calls of a potential threatened

species are observed on the PDA screen a view by spotlight of the bat size and wing morphology is attempted for greater identification accuracy.

Active vehicle Anabat monitoring - Is a method of active microbat recording deployed when large distances need to be covered in a nocturnal survey period. A Hi-mic extension cable allows the transducer microphone to be placed on a bracket on the roof of a travelling vehicle so calls may be viewed whilst driving. The vehicle travels at no more than 40km/h to prevent wind interference. When calls of a potential threatened species are observed on the dash mounted PDA screen active spotlighting is undertaken.

Harp trapping - Is used to capture microchiropteran bats. Harp traps have an aluminium frame with a two-bank 4.2m² area and calico capture bag set along the base area.

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

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

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

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

- Air temperature
- Cloud cover
- Rain (e.g. none, light drizzle, heavy drizzle, heavy rain)
- Recent rain events (where relevant)
- Wind Strength e.g. calm, light (leaves rustle), moderate (moves branches), strong (moves tree crowns)

- Wind direction
- Moon (where relevant) (e.g. none, 1/4 moon, 1/2 moon, 3/4 moon, full moon)

Threatened & Migratory Species Habitat Assessment

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

Table A2.1 – Threatened flora habitat assessment

A2

					IF I	TO BE			
Scientific name DATABASE SOURCE	TSC Act	EPBC Act	GROWTH FORM AND HABITAT REQUIREMENTS	RECORDED ON SITE (√)	Suitable habitat present (√)	Nearby and/or high number of record(s) (✓) Notes 1,2 & 3	Record(s) from recent years (*) Notes 1,2 & 3	Potential to occur	CONSIDERED IN ANY FUTURE 7 PART TEST OF SIGNIFICANCE (√)
Acacia bynoeana EPBC	E1	V	Erect or spreading shrub to 0.3m high growing in heath and dry sclerophyll Open Forest on sandy soils. Often associated with disturbed areas such as roadsides. Distribution limits N-Newcastle S-Berrima.	x	×	-	-	×	x
Acacia pubescens	V	V	Spreading shrub 1-4m high open sclerophyll growing in open forest and woodlands on clay soils. Distribution limits N-Bilpin S-Georges River.	×	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark

					IFN	NOT RECOR	DED ON-SI	TE	TO BE
Scientific name DATABASE SOURCE	TSC Act	EPBC Act	GROWTH FORM AND HABITAT REQUIREMENTS	RECORDED ON SITE (√)	Suitable habitat present (√)	Nearby and/or high number of record(s) (√) Notes 1,2 & 3	Record(s) from recent years (*) Notes 1,2 & 3	Potential to occur	CONSIDERED IN ANY FUTURE 7 PART TEST OF SIGNIFICANCE (*)
Allocasuarina glareicola ^{EPBC}	E1	E	Small shrub 1-2m high growing in open sclerophyll forest on lateritic soils derived from tertiary alluviums. Distribution limits Castlereagh NR region.	×	×	-	-	×	×
Callistemon linearifolius оен	V	-	Shrub to 4m high. Dry sclerophyll forest on coast and adjacent ranges. Distribution limits N-Nelson Bay S-Georges River.	×	×	-	-	×	×
Cynanchum elegans оен ервс	E1	E	Climber or twiner to 1m. Grows in rainforest gullies, scrub & scree slopes. Distribution limits N-Gloucester S- Wollongong.	×	x	-		×	×
<i>Dillwynia tenuifolia</i> оен	V	V	Erect shrub 0.6-1m high. Grows in Woodlands and Open Forest on sandstone shale or laterite. Distribution limits N-Howes Valley S-Cumberland Plain.	×	V	V	✓	✓	~
<i>Diuris aequalis</i> оен	E1	V	Terrestrial orchid which occurs in montane Eucalypt forest with grassy-heathy understorey. Very rare apart from Boyd Plateau. Distribution limits N-Blue Mountains S-Braidwood.	×	×	-	-	×	×
<i>Eucalyptus nicholii</i> оен	V	-	This species is widely planted as an urban street tree and in gardens but is quite rare in the wild. It is confined to the New England Tablelands of NSW, where it occurs from Nundle to north of Tenterfield, largely on private property.	×	x	-	-	×	×

					IF N	TO BE			
Scientific name DATABASE SOURCE	TSC Act	EPBC Act	GROWTH FORM AND HABITAT REQUIREMENTS	RECORDED ON SITE (√)	Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) Notes 1,2 & 3	Record(s) from recent years (\checkmark) Notes 1,2 & 3	Potential to occur	CONSIDERED IN ANY FUTURE 7 PART TEST OF SIGNIFICANCE (✓)
Eucalyptus scoparia оен	E1	V	Smooth-barked tree only known from vicinity of Bald Rock.	×	×	-	-	×	×
Genoplesium baueri ^{EPBC}	E1	E	A terrestrial orchid that grows in sparse sclerophyll forest and moss gardens over sandstone. Flowers Feb – Mar Distribution limits N – Hunter Valley S – Nowra	×	×	-	-	×	×
Grevillea juniperina subsp. juniperina ^{ОЕН}	V	-	Erect to spreading shrub 0.5-1.5m tall. Grows on laterite and Tertiary alluvium. Distribution limits St Marys-Londonderry- Prospect.	×	\checkmark	V	\checkmark	\checkmark	\checkmark
Grevillea parviflora subsp. parviflora оен ервс	V	V	Open to erect shrub to 1m. Grows in woodland on light clayey soils Distribution limits N-Cessnock S-Appin.	×	×	-	-	×	×
Haloragis exalata subsp. exalata ^{EPBC}	V	V	Shrub to 1.5m high. Grows in damp places near watercourses. Distribution limits N- Tweed Heads S-south of Eden.	×	×	-	-	×	×
Hypsela sessiliflora оен	E1	Extin ct	Prostrate herb, rooting at nodes, growing in damp places on the Cumberland Plain.	×	×	-	-	×	×
<i>Micromyrtus minutiflora</i> оен ервс	E1	V	Spreading shrub to 2m high. Grows in dry sclerophyll forest dominated by Scribbly gums and Ironbarks on Tertiary Alluviums. Distribution limits Western part of Cumberland Plain.	×	×	-	-	×	×

					IF NOT RECORDED ON-SITE				TO BE
Scientific name DATABASE SOURCE	TSC Act	EPBC Act	GROWTH FORM AND HABITAT REQUIREMENTS	RECORDED ON SITE (√)	Suitable habitat present (✓)	Nearby and/or high number of record(s) (√) Notes 1,2 & 3	Record(s) from recent years (*) Notes 1,2 & 3	Potential to occur	CONSIDERED IN ANY FUTURE 7 PART TEST OF SIGNIFICANCE (✓)
Persoonia nutans	E1	E	Erect to spreading shrub. Grows in dry sclerophyll forest and woodland on laterite and alluvial sands. Distribution limits Cumberland Plain.	×	×	-	-	×	×
Pilularia novae- hollandiae оен	E1	-	Widespread but not common in seasonally dry depressions and margins of marshes; may grow submerged.	×	×	-	-	×	×
Pimelea curviflora var. curviflora оен ервс	V	V	Woody herb or sub-shrub to 0.2-1.2m high. Grows on Hawkesbury sandstone near shale outcrops. Distribution Sydney.	×	×	-	-	×	×
<i>Рітеlea spicata</i> оен ервс	E1	E	Decumbent or erect shrub to 0.5m high. Occurs principally in woodland on soils derived from Wianamatta Shales. Distribution limits N-Lansdowne S- Shellharbour.	×	V	V	V	V	\checkmark
Pomaderris brunnea ^{EPBC}	V	V	Shrub to 3m high. Confined to Upper Nepean and Colo Rivers where it grows in open forest.	×	×	-	-	×	×
Pterostylis gibbosa EPBC	E1	E	Terrestrial orchid which occurs near Wollongong and in Hunter Valley in sclerophyll forest, sometimes with paperbarks.	×	×	-	-	×	×
Pterostylis saxicola OEH EPBC	E1	E	Terrestrial orchid. Grows in shallow sandy soil above rock shelves, usually near Wianamatta / Hawkesbury transition. Distribution limits N-Hawkesbury River S- Campbelltown.	×	×	-	-	×	×

						IF NOT RECORDED ON-SITE				
Scientific DATABASE SOL	name JRCE	TSC Act	EPBC Act	GROWTH FORM AND HABITAT REQUIREMENTS	RECORDED ON SITE (√)	Suitable habitat present (√)	Nearby and/or high number of record(s) (✓) Notes 1,2 & 3	Record(s) from recent years (*) Notes 1,2 & 3	Potential to occur	CONSIDERED IN ANY FUTURE 7 PART TEST OF SIGNIFICANCE (√)
Pultenaea parviflora оен ервс		E1	V	Erect shrub. Grows in dry sclerophyll forest at the intergrade between Tertiary Alluviums and Wianamatta Shales. Distribution limits Cumberland Plain.	×	\checkmark	×	\checkmark	\checkmark	\checkmark
Pultenaea pedunculata оен	а	E1	-	Prostrate shrub. Grows in dry sclerophyll forest and disturbed sites. Confined to Prestons and Villawood in NSW.	×	×	-	-	×	×
Streblus pendulinus ^{EPBC}		-	E	Tree or large shrub to 6m tall. Coastal species along watercourses in warmer rainforest area.	×	×	-	-	×	×
Thesium au EPBC	ustrale	V	V	Erect herb to 0.4m high. Root parasite. Themeda grassland or woodland often damp. Distribution limits N-Tweed Heads S-south of Eden.	×	×	-	-	x	×
OEH	- Den	otes spe	ecies liste	ed within 10km of the study area on the Atlas	of NSW Wildlife)				
EPBC	- Den	otes spe	ecies liste	ed within 10km of the study area in the EPBC	Act Protected	Matters To	ool.			
V	- Den	otes vul	nerable l	isted species under the relevant Act						
E or E1	E1 - Denotes endangered listed species under the relevant Act									
NOTE:	 This field is not considered if no suitable habitat is present within the study area TE: 2. 'records' refer to those provided by the <i>Atlas of NSW Wildlife</i> 3. 'nearby' or 'recent' records are species specific accounting for home range, dispersal ability and life cycle 									

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

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

					IFI				
COMMON NAME Scientific name DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT Distribution limit	RECORDED ON SITE (√)	Suitable habitat present (✓)	Nearby and/or high number of record(s) (*) Notes 1,2 & 3	Record(s) from recent years ()<br Notes 1,2 & 3	Potential to occur	CONSIDERE IN 7 PART TEST (✓)
Giant Burrowing Frog Heleioporus australiacus ^{EPBC}	V	V	Inhabits open forests and riparian forests along non-perennial streams, digging burrows into sandy creek banks. <i>Distribution Limit: N-Near Singleton S-</i> <i>South of Eden.</i>	×	×	-	-	×	x
Green and Golden Bell Frog <i>Litoria aurea</i> оен ервс	E	V	Prefers the edges of permanent water, streams, swamps, creeks, lagoons, farm dams and ornamental ponds. Often found under debris. <i>Distribution Limit: N-Byron Bay S-South of Eden.</i>	×	\checkmark	~	×	low	\checkmark
Southern Bell Frog Litoria raniformis EPBC	E	V	Prefers the edges of permanent water, streams, swamps, creeks, lagoons, farm dams and ornamental ponds. Often found under debris. <i>Distribution Limit: N-ACT Bay. S-Albury.</i>	×	\checkmark	×	×	x	x

Table A2.2 – Threatened fauna habitat assessment

					IF				
COMMON NAME Scientific name DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT Distribution limit	RECORDED ON SITE (√)	Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) Notes 1,2 & 3	Record(s) from recent years ()<br Notes 1,2 & 3	Potential to occur	CONSIDERED IN 7 PART TEST (√)
Broad-headed Snake Hoplocephalus bungaroides EPBC	E	V	Sandstone outcrops, exfoliated rock slabs and tree hollows in coastal and near coastal areas. <i>Distribution Limit: N-</i> <i>Mudgee Park. S-Nowra.</i>	×	x	-	-	×	x
Black-necked Stork Ephippiorhynchus asiaticus OEH	E	-	Occurs in tropical to warm temperate terrestrial wetlands, estuarine and littoral habitats such as mangroves, tidal mudflats, floodplains, open woodlands, irrigated lands, bore drains, sub-artesian pools, farm dams and sewerage ponds. <i>Distribution Limit: N-Tweed Heads. S-Nowra.</i>	×	V	×	×	unlikely	x
Australasian Bittern <i>Botaurus</i> <i>poiciloptilus</i> _{EPBC}	E	E	Found in or over water of shallow freshwater or brackish wetlands with tall reedbeds, sedges, rushes, cumbungi, lignum and also in ricefields, drains in tussocky paddocks, occasionally saltmarsh, brackish wetlands. <i>Distribution Limit: N-North of Lismore. S- Eden.</i>	×	V	×	x	x	x
Black Bittern Ixobrychus flavicollis оен	V		Found in shadowy, leafy waterside trees such as callistemons, casuarinas, paperbarks, eucalypts, mangroves and willows along tidal creeks, freshwater and brackish streams and ponds, sheltered mudflats and oyster slats. <i>Distribution</i> <i>Limit: N-Tweed Heads. S-South of Eden.</i>	×	x	-	-	×	x

					IFI				
COMMON NAME Scientific name DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT Distribution limit	RECORDED ON SITE (√)	Suitable habitat present (✓)	Nearby and/or high number of record(s) (*) Notes 1,2 & 3	Record(s) from recent years (*) Notes 1,2 & 3	Potential to occur	CONSIDERED IN 7 PART TEST (√)
Curlew Sandpiper Callidris ferruginea EPBC	E	CE	Mainly coastal, but many inland feeding along tidal mudflats, salt marsh, salt fields, fresh, brackish or saline wetlands and sewerage ponds. <i>Distribution Limit:</i> <i>N-Tweed Heads. S-South of Eden.</i>	×	×	-	-	×	×
Eastern Curlew <i>Numenius madagascariensis</i> ^{TBE}	-	CE	Primarily coastal especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass. Occasionally on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets. Often recorded among saltmarsh and on mudflats fringed by mangroves and also in coastal saltworks and sewage farms. <i>Distribution Limit: N-Tweed Heads. S-South of Eden.</i>	×	x	-	-	x	x
Little Eagle Hieraaetus morphnoides _{ОЕН}	V	-	Utilises plains, foothills, open forests, woodlands and scrublands; river red gums on watercourses and lakes. <i>Distribution Limit - N-Tweed Heads. S-South of Eden.</i>	x	\checkmark	V	~	~	\checkmark
Square-tailed Kite <i>Lophoictinia isura</i> оен	V	-	Utilises mostly coastal and sub-coastal open forest, woodland or lightly timbered habitats and inland habitats along watercourses and mallee that are rich in passerine birds. <i>Distribution Limit: N-Goondiwindi. S-South of Eden.</i>	×	V	~	✓	✓	\checkmark

					IFI				
COMMON NAME Scientific name DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT Distribution limit	RECORDED ON SITE (√)	Suitable habitat present (√)	Nearby and/or high number of record(s) (^) Notes 1,2 & 3	Record(s) from recent years (*) Notes 1,2 & 3	Potential to occur	CONSIDERED IN 7 PART TEST (√)
Black Falcon <i>Falco subniger</i> ^{ОЕН}	V	-	Inhabits plains, grasslands, foothills, timbered watercourses, wetland environs, crops; occasionally over towns and cities. <i>N-Tweed Heads. S-South of Eden</i>	×	×	-	-	×	×
Australian Painted Snipe Rostratula australis OEH EPBC	E	V	Most numerous within the Murray-Darling basin and inland Australia within marshes and freshwater wetlands with swampy vegetation. <i>Distribution Limit: N-Tweed Heads. S-South of Eden.</i>	×	\checkmark	×	×	×	×
Gang-gang Cockatoo <i>Callocephalon</i> <i>fimbriatum</i> оен	V	-	Prefers wetter forests and woodlands from sea level to > 2,000m on the Great Dividing Range, timbered foothills and valleys, timbered watercourses, coastal scrubs, farmlands and suburban gardens. <i>Distribution Limit: mid north</i> <i>coast of NSW to western Victoria.</i>	×	x	-	-	×	×
Glossy Black- Cockatoo <i>Calyptorhynchus</i> <i>lathami</i> _{ОЕН}	V	-	Open forests with <i>Allocasuarina</i> species and hollows for nesting. <i>Distribution Limit:</i> <i>N-Tweed Heads. S-South of Eden.</i>	×	×	-	-	×	×
Little Lorikeet Glossopsitta pusilla оен	V	-	Inhabits forests, woodlands; large trees in open country; timbered watercourses, shelterbeds, and street trees. <i>Distribution Limit: N-Tweed Heads. S-South of Eden.</i>	×	\checkmark	×	\checkmark	\checkmark	\checkmark

					IFI	ITE			
COMMON NAME Scientific name DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT Distribution limit	RECORDED ON SITE (√)	Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) Notes 1,2 & 3	Record(s) from recent years (<) Notes 1,2 & 3	Potential to occur	CONSIDERED IN 7 PART TEST (√)
Swift Parrot Lathamus discolour ОЕН ЕРВС	E	E	Inhabits eucalypt forests and woodlands with winter flowering eucalypts. Distribution Limit: N-Border Ranges National Park. S-South of Eden.	×	\checkmark	×	2007	✓	\checkmark
Barking Owl <i>Ninox connivens</i> оен	V	-	Inhabits principally woodlands but also open forests and partially cleared land and utilises hollows for nesting. <i>Distribution Limits: N-Border Ranges</i> <i>National Park. S-Eden.</i>	×	marginal	×	×	Not likely	×
Powerful Owl <i>Ninox strenua</i> оен	V	-	Forests containing mature trees for shelter or breeding and densely vegetated gullies for roosting. <i>Distribution Limits: N-Border Ranges National Park. S-Eden.</i>	×	Sub- optimal	×	\checkmark	low	\checkmark
Masked Owl <i>Tyto</i> novaehollandiae ^{ОЕН}	V	-	Open forest and woodlands with cleared areas for hunting and hollow trees or dense vegetation for roosting. <i>Distribution Limit: N-Border Ranges National Park. S-Eden.</i>	×	Sub- optimal	×	✓	low	\checkmark
Eastern Bristlebird Dasyornis brachypterus EPBC	E	E	Coastal woodlands, dense scrubs and heathlands, especially where low heathland borders taller woodland or dense tall tea-tree. <i>Distribution Limit: N-</i> <i>Tweed Heads. S-South of Eden.</i>	×	×	-	-	×	×

					IFI				
COMMON NAME Scientific name DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT Distribution limit	RECORDED ON SITE (√)	Suitable habitat present (√)	Nearby and/or high number of record(s) (^) Notes 1,2 & 3	Record(s) from recent years (1) Notes 1,2 & 3	Potential to occur	CONSIDERED IN 7 PART TEST (√)
Speckled Warbler Chthonicola sagittata оен	V	-	Found in temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts. <i>Distribution Limit: N- Urbanville. S-Eden.</i>	×	\checkmark	×	V	\checkmark	\checkmark
Black-chinned Honeyeater <i>Melithreptus</i> gularis gularis оен	V	-	Found in woodlands containing box- ironbark associations and River Red Gums, also drier coastal woodlands of the Cumberland Plain and Hunter Richmond and Clarence. <i>Distribution Limit: N-Cape</i> <i>York Pen. Qld. S-Victor H. Mt Lofty Ra &</i> <i>Flinders Ra. SA.</i>	×	V	×	2007	low	V
Painted Honeyeater <i>Grantiella picta</i> EPBC	V	V	A nomadic bird occurring in low densities within open forest, woodland and scrubland feeding on mistletoe fruits. Inhabits primarily Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. <i>Distribution Limit: N-Boggabilla.</i> <i>S-Albury with greatest occurrences on the</i> <i>inland slopes of the Great Dividing Range.</i>	×	V	×	×	Not likely	×
Regent Honeyeater Xanthomyza Phrygia оен ервс	E4A	E	Found in temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts. <i>Distribution Limit: N- Urbanville. S-Eden.</i>	×	✓	✓	×	unlikely	√

					IFI				
COMMON NAME Scientific name DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT Distribution limit	RECORDED ON SITE (√)	Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) Notes 1,2 & 3	Record(s) from recent years (*) Notes 1,2 & 3	Potential to occur	CONSIDERED IN 7 PART TEST (√)
Varied Sittella Daphoenositta chrysoptera OEH	V	-	Open eucalypt woodlands / forests (except heavier rainforests); mallee, inland acacia, coastal tea-tree scrubs; golf courses, shelterbelts, orchards, parks, scrubby gardens. <i>Distribution Limit: N-</i> <i>Border Ranges National Park. S-South of</i> <i>Eden.</i>	×	V	2km	V	V	V
Dusky Woodswallow Artamus cyanopterus cyanopterus OEH	V	-	Found in woodlands and dry open sclerophyll forests, usually dominated by eucalypts, including mallee associations. It has also been recorded in shrublands and heathlands and various modified habitats, including regenerating forests; very occasionally in moist forests or rainforests. Prefers habitat with an open understorey. Often observed in farmland tree patches or roadside remnants. <i>Widespread in eastern,</i> <i>southern and southwestern Australia.</i>	×	V	×	\checkmark	V	\checkmark
Scarlet Robin Petroica boodang оен	V	-	Found in foothill forests, woodlands, watercourses; in autumn-winter, more open habitats: river red gum woodlands, golf courses, parks, orchards, gardens. <i>Distribution Limit: N-Tweed Heads. S-South of Eden.</i>	×	V	x	V	low	\checkmark
					IFI				
--	------------	-------------	---	----------------------------	---------------------------------------	--	--	-----------------------	-------------------------------------
COMMON NAME Scientific name DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT Distribution limit	RECORDED ON SITE (√)	Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) Notes 1,2 & 3	Record(s) from recent years (^) Notes 1,2 & 3	Potential to occur	CONSIDERED IN 7 PART TEST (✓)
Flame Robin Petroica phoenicea _{ОЕН}	V	-	Summer: forests, woodlands, scrubs, from sea-level to <i>c</i> . 1800 m. Autumn-winter: open woodlands, plains, paddocks, golf courses, parks, orchards. <i>Distribution</i> <i>Limit: N northern NSW tablelands. S-</i> <i>South of Eden.</i>	×	\checkmark	×	x	unlikely	\checkmark
Diamond Firetail Stagonopleura guttata оен	V	-	Found in Eucalypt woodlands, forests and mallee where there is grassy understorey west of the Great Div. also drier coastal woodlands of the Cumberland Plain and Hunter Richmond and Clarence River Valleys. <i>Distribution Limit: N-</i> <i>Rockhampton Q. S-Eyre Pen Kangaroo</i> <i>Is. SA.</i>	×	V	×	~	V	~
Spotted-tailed Quoll Dasyurus maculatus OEH EPBC	V	E	Dry and moist open forests containing rock caves, hollow logs or trees. Distribution Limit: N-Mt Warning National Park. S-South of Eden.	×	×	-	-	×	×

					IF I				
COMMON NAME Scientific name DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT Distribution limit	RECORDED ON SITE (√)	Suitable habitat present (√)	Nearby and/or high number of record(s) (*) Notes 1,2 & 3	Record(s) from recent years (<) Notes 1,2 & 3	Potential to occur	CONSIDERED IN 7 PART TEST (√)
Greater Glider Petauroides volans EPBC	-	V	Favours forests with a diversity of eucalypt species, due to seasonal variation in its preferred tree species. Population density is optimal at elevation levels at 845 m above sea level. Prefer overstorey basal areas in old-growth tree stands. Highest abundance typically in taller, montane, moist eucalypt forests, with relatively old trees and abundant hollows <i>Distribution Limit: N-Border Ranges National Park. S- South of Eden.</i>	×	×	-	-	x	x
Koala <i>Phascolarctos</i> <i>cinereus</i> ОЕН ЕРВС	V	V	Inhabits both wet and dry eucalypt forest on high nutrient soils containing preferred feed trees. <i>Distribution Limit: N-Tweed</i> <i>Heads. S-South of Eden.</i>	×	\checkmark	×	×	Not likely	×
Grey-headed Flying-fox <i>Pteropus</i> <i>poliocephalus</i> OEH EPBC	V	V	Found in a variety of habitats including rainforest, mangroves, paperbark swamp, wet and dry open forest and cultivated areas. Forms camps commonly found in gullies and in vegetation with a dense canopy. <i>Distribution Limit: N-Tweed Heads. S-Eden.</i>	V	-	-	-	-	V
Yellow-bellied Sheathtail-bat Saccolaimus flaviventris OEH	V	-	Rainforests, sclerophyll forests and woodlands. <i>Distribution Limit: N-North of Walgett. S-Sydney.</i>	×	\checkmark	~	V	V	V

					IFI				
COMMON NAME Scientific name DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT Distribution limit	RECORDED ON SITE (√)	Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) Notes 1,2 & 3	Record(s) from recent years (*) Notes 1,2 & 3	Potential to occur	CONSIDERED IN 7 PART TEST (√)
East-coast Freetail Bat <i>Micronomus</i> <i>norfolkensis</i> _{OEH}	V	-	Inhabits open forests and woodlands foraging above the canopy and along the edge of forests. Roosts in tree hollows, under bark and buildings. <i>Distribution Limit: N-Woodenbong. S-Pambula.</i>	×	V	V	V	~	\checkmark
Large-eared Pied Bat <i>Chalinolobus</i> <i>dwyeri</i> EPBC	V	V	Warm-temperate to subtropical dry sclerophyll forest and woodland. Roosts in caves, tunnels and tree hollows in colonies of up to 30 animals. <i>Distribution Limit: N-Border Ranges National Park. S-Wollongong.</i>	×	x	-	-	×	×
Eastern Falsistrelle Falsistrellus tasmaniensis _{ОЕН}	V	-	Recorded roosting in caves, old buildings and tree hollows. <i>Distribution Limit: N-</i> <i>Border Ranges National Park. S-</i> <i>Pambula.</i>	×	V	√ possibly on-site	2001	~	\checkmark
Little Bentwing-bat Miniopterus australis ^{ОЕН}	V	-	Roosts in caves, old buildings and structures in the higher rainfall forests along the south coast of Australia. <i>Distribution Limit: N-Border Ranges</i> <i>National Park. S-Sydney.</i>	×	V	6km	~	✓	\checkmark
Eastern Bentwing- bat <i>Miniopterus</i> orianae oceansis оен	V	-	Prefers areas where there are caves, old mines, old buildings, stormwater drains and well-timbered areas. <i>Distribution Limit: N-Border Ranges National Park. S-South of Eden.</i>	×	√	~	V	✓	\checkmark

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

					IF						
COMMC Scientifi DATABASE	ON NA ic nan source	ME TS ne Ad	C t	EPBC Act	PREFERRED HABITAT Distribution limit	RECORDED ON SITE (√)	Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) Notes 1,2 & 3	Record(s) from recent years (<) Notes 1,2 & 3	Potential to occur	CONSIDERED IN 7 PART TEST (√)
Macquar Macquar australas EPBC	ie Per ria sica	ch \ (FM 199	Act 4)	Ε	Occurs in south east Australia at moderate to high altitudes in rivers and reservoirs. Historical records show the species was widespread and abundant in the upper reaches of the Lachlan, Murrumbidgee and Murray Rivers and their tributaries. Allen (1989) states that introduced populations are present in Nepean River and water supply dams in the Sydney area. Occurs in lakes and flowing streams, usually in deep holes.	×	x	-	-	×	×
Australia Prototroc maraena EPBC	n Grey ctes	yling Par Sec 19 Prote Fis (FM 195	2, on cted h Act 4)	V	Clear, moderate to fast flowing water in the upper reaches of rivers (sometimes to altitudes above 1,000m). Typically found in gravel bottom pools. Often forming aggregations below barriers to upstream movement (e.g. weirs, waterfalls).	×	x	-	-	×	×
OEH	-	Denotes s	ecies	s listed	within 10km of the study area on the Atlas of	NSW Wildlife					
EPBC	-	Denotes s	pecies	s listed	within 10km of the study area in the EPBC A	ct Protected Ma	atters Tool				
V	-	Denotes v	Inera	able liste	ed species under the relevant Act						
E	-	Denotes e	ndang	gered lis	sted species under the relevant Act						
NOTE:	 This field is not considered if no suitable habitat is present within the study area IOTE: 2. 'records' refer to those provided by the <i>Atlas of NSW Wildlife</i> 3. 'nearby' or 'recent' records are specific accounting for home range, dispersal ability and life cycle 										

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

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

COMMON NAME Scientific name	PREFERRED HABITAT Migratory breeding	Suitable habitat present (√)	Recorded on Site (✓)	COMMENTS
White-bellied Sea Eagle (Haliaeetus leucogaster)	Coasts, islands, estuaries, inlets, large rivers, inland lakes, reservoirs. Sedentary; dispersive.	marginal	×	-
White-throated Needletail (<i>Hirundapus caudacutus</i>)	Airspace over forests, woodlands, farmlands, plains, lakes, coasts, towns; companies forage often along favoured hilltops and timbered ranges. <i>Breeds Siberia, Himalayas, east to Japan. Summer migrant to eastern Australia.</i>	\checkmark	×	-
Rainbow Bee-eater (<i>Merops ornatus</i>)	Open woodlands with sandy, loamy soil; sandridges, sandspits, riverbanks, road cuttings, beaches, dunes, cliffs, mangroves, rainforest, woodlands, golf courses. <i>Breeding resident in northern Australia. Summer breeding migrant to south east and south west Australia.</i>	×	-	-
Black-faced Monarch (<i>Monarcha melanopsis</i>)	Rainforests, eucalypt woodlands; coastal scrubs; damp gullies in rainforest, eucalypt forest; more open woodland when migrating. <i>Summer breeding migrant to coastal south east Australia, otherwise uncommon.</i>	×	-	-
Satin Flycatcher (<i>Myiagra cyanoleuca</i>)	Heavily vegetated gullies in forests, taller woodlands, usually above shrub-layer; during migration, coastal forests, woodlands, mangroves, trees in open country, gardens. <i>Breeds mostly south</i> <i>east Australia and Tasmania over warmer months, winters in north</i> <i>east Qld.</i>	×	-	-
Rufous Fantail (<i>Rhipidura rufifrons</i>)	Undergrowth of rainforests / wetter eucalypt forests / gullies; monsoon forests, paperbarks, sub-inland and coastal scrubs; mangroves, watercourses; parks, gardens. On migration, farms, streets buildings. <i>Breeding migrant to south east Australia over</i> <i>warmer months. Altitudinal migrant in north east NSW in mountain</i> forests during warmer months.	\checkmark	×	-

Table A2.3 – Migratory fauna habitat assessment

COMMON NAME Scientific name	PREFERRED HABITAT Migratory breeding	Suitable habitat present (√)	Recorded on Site (√)	COMMENTS
Great Egret (<i>Ardea alba</i>)	Shallows of rivers, estuaries; tidal mudflats, freshwater wetlands; sewerage ponds, irrigation areas, larger dams, etc. <i>Dispersive; cosmopolitan.</i>	V	V	An individual Great Egret was observed foraging within the small reedy dam in the centre of the study area during November 2016 survey. The subject site does not provide any breeding habitat potential and foraging habitat is otherwise well represented in the locality. The removal of habitats is therefore not likely to significantly impact on this species.
Great Egret (<i>Ardea alb</i> a)	Shallows of rivers, estuaries; tidal mudflats, freshwater wetlands; sewerage ponds, irrigation areas, larger dams, etc. <i>Dispersive; cosmopolitan.</i>	\checkmark	×	-
Cattle Egret (<i>Ardea ibis</i>)	Stock paddocks, pastures, croplands, garbage tips, wetlands, tidal mudflats, drains. Breeds in summer in warmer parts of range including NSW.	V	V	Cattle Egret was recorded during both August and December 2013 surveys. August surveys recorded two individuals foraging with cattle to the north of the large woodland remnant within the study area. December survey did not recorded the species within the study area but recorded several individuals foraging with cattle in an adjacent paddock to the south in breeding plumage. The north-western dam areas provide suitable nesting habitat however no presence or nesting evidence by Cattle Egret was observed at this time. The removal of habitats is not likely to significantly impact on this species based on the extent of other suitable habitat in the locality.

COMMON NAME Scientific name	PREFERRED HABITAT Migratory breeding	Suitable habitat present (√)	Recorded on Site (√)	COMMENTS
Latham's Snipe (<i>Gallinago hardwickii</i>)	Soft wet ground or shallow water with tussocks and other green or dead growth; wet parts of paddocks; seepage below dams; irrigated areas; scrub or open woodland from sea-level to alpine bogs over 2,000m; samphire on saltmarshes; mangrove fringes. <i>Breeds</i> <i>Japan. Regular summer migrant to Australia. Some overwinter.</i>	V	V	One and possibly two Latham's Snipes were recorded foraging around the perimeter of the north- western dams during the December 2013 survey. This is good quality foraging habitat for this species however foraging habitat is well represented in the region and breeding habitat only exists in Japan. Therefore the removal of habitat will not significantly impact on this species.
Fork-tailed Swift (<i>Apus pacificus</i>)	Aerial: over open country, from semi-arid deserts to coasts, islands; sometimes over forests, cities. <i>Breeds Siberia, Himalayas, east to</i> <i>Japan south east Asia. Summer migrant to east Australia. Mass</i> <i>movements associated with late summer low pressure systems into</i> <i>east Australia. Otherwise uncommon.</i>	\checkmark	×	-



7 Part Test of Significance



Council is required to consider the impact upon threatened species, populations and / or EECs from any development or activity via the process of a 7 part test of significance. The significance of the assessment is then used to determine the need for a more detailed species impact statement (SIS).

The following 7 part test of significance relies on the ecological assessment provided in Sections 3 and 4 of this report and should be read as such. The 7 part test of significance is as follows.

Detailed flora and fauna investigations of the study area, together with habitat assessments, have resulted in the identification of potential habitat for a variety of threatened species.

Threatened flora

- Acacia pubescens
- Dillwynia tenuifolia
- Grevillea juniperina subsp.

juniperina

Endangered ecological communities

- Cumberland Plain Woodland (CPW)*
- River Flat Eucalypt Forest (RFEF)*

Threatened fauna

- Green and Golden Bell Frog
- Little Eagle
- Square-tailed Kite
- Little Lorikeet
- Swift Parrot
- Powerful Owl
- Masked Owl

- Pimelea spicata
- Pultenaea parviflora

- Scarlet Robin
- Flame Robin
- Diamond Firetail
- Grey-headed Flying-fox
- Yellow-bellied Sheathtail Bat
- East-coast Freetail Bat
- Eastern Falsistrelle

- Speckled Warbler
- Black-chinned Honeyeater
- Regent Honeyeater
- Varied Sittella
- Dusky Woodswallow

- Little Bentwing-bat
- Eastern Bentwing-bat
- Large-footed Myotis *
- Greater Broad-nosed Bat *
- Cumberland Plain Land Snail *

Swift Parrot

Endangered populations

 Marsdenia viridiflora subsp. viridiflora endangered population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith LGAs

An assessment of these species is as follows:

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

Species indicated with a "*" in the tables above were recorded within the study area during surveys. Despite the presence of potential habitat, the remaining listed species were not recorded during the flora and fauna surveys. It is considered that the proposal is unlikely to disrupt the life cycle for any of these listed species such that a viable local population would be placed at risk of extinction.

Summary of threatened species recorded

Cumberland Plain Land Snail (Meridolum corneovirens)

Meridolum corneovirens is wholly restricted to western Sydney and is primarily associated with the Cumberland Plain and Castlereagh Woodland vegetation types (Clark 2009). The species occasionally occurs along the edges of Coastal River Flat Forest, where it meets either of the above forest types. *M corneovirens* occurs generally in areas characterised by moist soils together with the growth of various species of lichen. This species is known to shelter under logs and other debris and in leaf litter, or around the base of trees where exfoliations occur. Where conditions permit, it will bury into loose soil especially under logs and around the bases of large trees (Clark 2009).

Spatial autocorrelation analysis indicates that *M. corneovirens* populations are highly structured at very short distances (2m) and that the radius of a genetic neighbourhood is approximately 350m (Clark & Richardson 2002).

M. corneovirens was recorded present throughout the eastern woodland portions of the study area where habitat is considered of high quality throughout. Searches within the other small remaining isolated fragments within the study area did not record presence of this species.

This species will make sporadic short movements away from shelter areas, particularly during moist conditions and otherwise will shelter under leaf litter and particularly logs. Logs are located both naturally and as artificially placed piles through the woodland remnant. Whilst this species will also shelter under artificial debris, such habitat was rarely encountered. This highlights the potential to enrich habitat areas where snails occur by the placement of large surface area logs. Such a proposal would no doubt be of value to enrich the areas proposed for retention.

One point of interest that became apparent during the field habitat assessment is that although *M. corneovirens* was recorded throughout the woodland area, the exotic garden snails *Cornu aspersum* appeared to occupy only the northern half of the woodland area and the far outer eastern fringes of the southern portion. The exotic Bradybaena similaris was also recorded in the outer disturbed fringes but to a lesser extent.

It is not clear if *M. corneovirens* is currently in competition with the exotic snail species present, but it does appear that living *M. corneovirens* numbers are less in the northern half and at outer fringes (refer to Figure 1) where exotic species are most prevalent. During 2013 target surveys only six (6) living snails were recorded present at individual isolated locations in the northern half in comparison with twenty one (21) living snails in the south. Up to seven (7) living snails were recorded at a single location in the south. Fifty eight (58) dead shells were encountered in the northern half and one hundred and twenty three (123) dead shell were found in the southern half with equivalent survey effort time attributed throughout. Many more living and dead snails are expected to occur, given the extent of habitat, and searches were concentrated in the best habitat locations.

The greater presence of exotic snails in the north may also be attributed to the adjacent nursery complex to the north east. Any habitat restoration, relocation and habitat enhancement proposal should be accompanied with a pest species eradication process to ensure that *M. corneovirens* may establish itself with little competition. This may simply be a process of collecting and terminating as many exotic snails as possible. Simple perimeter barriers such as a permanent sediment filter fence surrounding the remnant or associated with the perimeter fencing would also restrict re-colonisation of the CPW by *Helix* species.

Given that the large habitat area for Cumberland Plain Land Snail will be retained as part of the proposal and this area may support up to two genetic neighbourhoods, it is considered that the proposed subdivision will not significantly impact on this species.

Large-footed Myotis (Myotis macropus)

The Large-footed Myotis inhabits rainforests and open forests predominantly foraging along creeklines and over waterbodies where it takes insects and small fish from on and just below the water's surface (Richards 1995). The Large-footed Myotis roosts in tree hollows, caves, mines, under bridges, in tunnels and occasionally buildings (Richards 1995).

It is considered that the study area provides suitable foraging, roosting and breeding habitat for the Large-footed Myotis.

This species was recorded foraging over the large north-western dams during Anabat surveys in 2013. This species was also recorded at this time from a single flyby at the Anabat station located at the northern tip of the large eastern woodland remnant. This recording was just after dusk and was probably an individual en-route to foraging areas from a roost site.

The species was again recorded foraging over the remaining smaller dam by both observation and ultrasonic recording throughout the night in November 2016. At this time the species was again recorded from a single call along the western remnant edge but this may also be due to the presence of a small dam on the other side of the fence at this location.

The proposal will require removal of a small number of hollow-bearing trees as well as large existing infrastructure. Both of these may contain a roosting location (and potential breeding site). Roosting locations are difficult to locate without exhaustive and costly survey and therefore the assessment on microbats is often based on the amount of available remaining habitat in the locality. Based on local records and availability of habitat a significant impact on this species is not expected but cannot be truly determined without knowing locations and value of roosts if present on site. Therefore a not-significant impact on this species is

concluded provided that tree removal and building demolition provide best opportunities to recover any roosts present within.

The proposal will also require removal of open water foraging areas where this species was recorded. This is not considered to be significant given that amount of open water available foraging habitat remaining in the locality.

The following mitigation measures are outlined for hollow-dependent threatened microbats recorded or with potential to occur:

- The felling of hollow-bearing trees should be conducted under the supervision of a fauna ecologist to ensure appropriate animal welfare procedures are taken. Hollows of high quality or with fauna recorded residing within should be sectionally dismantled and all hollows should be inspected for occupation, activity and potential for reuse. In the instance of recording the presence of threatened microbats during tree removal, maximum effort should ensure safe relocation of the roosting colony.
- Re-used hollows or those with likely occupation are to be relocated to conservation areas within close proximity to the site. All other hollows removed should be replaced with nest boxes. Every second box should be a design suitable for microbat species. Boxes should be constructed all of weatherproof timber (marine ply), fasteners and external paint.
- The demolition process is often long and therefore in the event that microbats are found roosting within structures at any time through this process work should cease immediately and a fauna ecologist contacted. The fauna ecologist is to recover the roosting colony by best practice measures to prevent or minimise impacts on this colony.

Greater Broad-nosed Bat (Scoteanax rueppellii)

The Greater Broad-nosed Bat inhabits a wide variety of habitats from woodland through moist and dry eucalypt forest to rainforest. The open nature of eucalypt woodlands and forests suit its direct flight pattern, and the more cluttered environments of the wetter forests are overcome by utilising natural and human-made openings in the forest (Strahan, 1998). It is known to roost in tree hole/s and feed on small vertebrates / insects in the understorey vegetation. It is also known to forage in the interface of clearings and vegetation woodland (State Forests of NSW, 1995). Creeks and small rivers are favoured corridors where it hawks backwards and forwards for its prey. The species has been found in roof spaces of old buildings (Strahan, 1998).

It is considered that the study area provides suitable foraging, roosting and breeding habitat for the Greater Broad-nosed bat.

This species was recorded foraging over the large north-western dam from a single recorded pass during Anabat surveys in 2013. The species was again recorded with low confidence in 2016. As two other species are known within this calling frequency this species is only identified to a 'possible' level of certainty.

Like the Large-footed Myotis, the Greater Broad-nosed Bat occupies tree hollows and is also known to roost in structures, whilst the microhabitat requirements for these may well differ. Given this the assessment outcome for the Greater Broad-nosed Bat is the same as the Large-footed Myotis and a not significant impact may be concluded provided the recommended mitigation measures to appropriately recover any roosts present are addressed.

Grey-headed Flying-fox (Pteropus poliocephalus)

Grey-Headed Flying-foxes are canopy feeding frugivores and nectarivores, inhabiting a wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests and cultivated areas. This species roosts in camps, which may contain tens of thousands of individuals.

Camps are commonly formed in gullies, typically not far from water and usually in vegetation with a dense canopy (Tidemann 1998). Camps can be found in riparian rainforest patches, Melaleuca stands, mangroves, riparian woodland or modified vegetation in urban areas. Loyalty to a site is high and some camps in NSW have been used for over a century (NSW

NPWS 2001). Some camps are used at the same time every year by hundreds of thousands of flying-foxes while others are used sporadically by a few hundred individuals (Strahan 1995). Generally foraging is within 20km of camps but individuals are known to commute up to 50km to a productive food source.

It is considered that the study area provides suitable foraging habitat for the Grey-headed Flying-fox wherever large and mature native flowering trees occur.

Several Grey-headed Flying-fox were observed in flight over the study area after dusk flying in a NE to SE direction during survey on the 16th November 2016. No individuals were observed foraging within the study area at this time.

As outlined in this species national assessment within Appendix 4.2, 91.4% or 10.14 ha of the large 11.09 ha consolidated patch of CPW in the eastern portion of the study area will remain for seasonal foraging. This species may also forage on the smaller isolated fragments of varying quality proposed for removal in remaining parts of the study area. Despite their understorey and mid-storey quality, the canopy provides the foraging opportunity. Therefore the total calculations of potential CPW canopy foraging habitat removal including all available patches is 2.85 ha removed and 10.14 ha retained (78% retention in all throughout the subject site).

The three closest Grey-headed Flying-fox camps are located approximately 6km north (Ropes Creek camp), 8km east (Wetherill Park camp) and 13km south-east (Cabramatta camp) from the study area. The locations of these closest camps are shown on Figure 4.

This figure also gives an indication of the local vegetation available for foraging, most nobly the large and connective remnants. The large consolidated path of CPW to be retained for foraging within the study area can be seen on this figure and with comparison in size to other local remnants. Whilst no doubt this is a highly developed landscape with highly fragmented remnants, each of these may be as easily accessed by flying-foxes as single isolate urban trees.

Given that the study area does not provide any roosting or subsequent breeding habitat and given that foraging habitat will remain well represented within the study area it can be concluded that there will be no likely significant impact on this species as a result of the proposal.

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

Flora

One (1) endangered flora population has been identified to the Fairfield local government area (LGA). This is the *Marsdenia viridiflora* subsp. *viridiflora* endangered population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith LGAs. The vegetation present within the study area is most similar to those described under Coastal Valley Grassy Woodlands which is listed as a series of vegetation types that would support a population of the species, therefore potential habitat would be considered present however, the lack of local records suggests that the potential for occurrence is low. During the survey(s) of the study area no specimens pertaining to the population have been observed.

Endangered populations of Tadgell's Bluebell (*Wahlenbergia multicaulis*) and *P. prunifolia* (*Pomaderris prunifolia*) are known from neighbouring LGAs to the east but are not recorded in, or identified as threatened populations within the Fairfield local government area.

Fauna

There are no endangered fauna populations identified specifically to the Fairfield LGA; however, the site does fall within the Sydney Metropolitan Catchment Management Authority (CMA) area. An endangered population of White-fronted Chat (*Epthianura albifrons*) is identified to this area, however, this is made up of two (2) known isolated sub-populations; one at Newington Nature Reserve on the Parramatta River and one (1) at Towra Point Nature Reserve in Botany Bay. The study area provides suitable habitat however the White-fronted Chat was not recorded present during survey.

Therefore, it is considered that the action proposed is not likely to have an adverse effect on the life cycle of these species that constitute the endangered populations such that a viable local population of these species is likely to be placed at risk of extinction.

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

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

Two (2) threatened ecological communities were observed within the study area. These communities were:

• Cumberland Plain Woodland (CPW) listed as a Critically Endangered Ecological Community (CEEC).

• River Flat Eucalypt Forest (RFEF) listed as an Endangered Ecological Community (EEC).

The Cumberland Plain Woodland covers a total of 13.03 ha in area located along the eastern border of the study area along with small remnant woodland patches throughout the proposed subdivision landscape. 78% (10.14 ha) of the extent will be conserved in-situ within a proposed conservation lot (Lot 205). The edges within proposed development lots adjacent to the large remnant are proposed for clearing or modification to 25 metre wide dual purpose Buffers / bushfire Asset Protection Zones (APZs).

The highly fragmented vegetation in the central-western portions of the site are also Cumberland Plain Woodland. This is made up of numerous small remnants. Individually these have limited value within the ecological landscape and don't form part of any ecological corridor for fauna movement or threatened flora habitat.

Given the largest single patch of the highest quality remnant will be conserved within its own designated Lot 205, the proposal is unlikely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

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

Remnant CPW vegetation to be conserved will not be modified as part of the proposal. No APZ clearance will be permitted within this lot. In that regard, 10.14 ha of higher quality CPW will be retained in-situ and managed in perpetuity under a Vegetation Management Plan (VMP).

The removal of several small remnants of very poor condition RFEF totalling 0.7 ha within the western portions of the study area are required for the proposal. There are larger areas

of much better quality RFEF located within creeklines to the west and north of the study area. Therefore the proposal is unlikely to substantially and adversely modify the composition such that its local occurrence is likely to be placed at risk of extinction.

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

It is considered that the habitat attributes of the study area provide known or potential habitat for Cumberland Plain Woodland, River Flat Eucalypt Forest, *Acacia pubescens, Dillwynia tenuifolia, Grevillea juniperina* subsp. *juniperina, Pimelea spicata, Pultenaea parviflora,* Green and Golden Bell Frog, Little Eagle, Square-tailed Kite, Little Lorikeet, Swift Parrot, Powerful Owl, Masked Owl, Speckled Warbler, Black-chinned Honeyeater, Regent Honeyeater, Varied Sittella, Dusky Woodswallow, Scarlet Robin, Flame Robin, Diamond Firetail, Grey-headed Flying-fox, Yellow-bellied Sheathtail-bat, East-coast Freetail Bat, Eastern Falsistrelle, Little Bentwing-bat, Eastern Bentwing-bat, Large-footed Myotis, Greater Broad-nosed Bat and Cumberland Plain Land Snail.

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

The study area has an area of approximately 72.33 ha. The proposal is expected to remove or modify 3.59 ha of vegetation or habitat associated within the above species, and if the water bodies are removed, an estimated 7.59 ha of wetland habitat will be impacted which was considered to be of high quality on the fringes.

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

The study area is covered by a mixture of isolated and disturbed natural bushland and cleared areas and is not currently attached to or a part of any ecological corridors. The site is bound to the north, south and west by cleared landscapes and rural residential areas to the east and some of the south. The proposed development has been designed to be located predominantly within the existing cleared areas of the site and the larger and better quality vegetation patch in the south-eastern portion of the study area is to be conserved and managed within the proposed conservation Lot 205 to keep current areas of habitat for resident flora and fauna.

Therefore, it is considered that known habitat for a threatened species, population or ecological community within the local area and region is unlikely to become further fragmented or isolated as a result of the proposal.

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

The highest ecologically significant lands will be conserved within the proposed Conservation lot (Lot 205) near the south-eastern boundary. The remaining dams have a moderate to high significance and will be removed. All other fragments of remnant vegetation (to be removed) were considered to have low ecological significance.

The important habitat area for Cumberland Plain Land Snail will be retained as part of the proposal. Habitat proposed for removal may be important for threatened microbats recorded for roosting and breeding purposes. This is not expected based on survey to date and available habitat however mitigation measures have been recommended to attempt to recover any bat roosting colony present. The remaining dams provide habitat for the recorded threatened Large-footed Myotis and Greater Broad-nosed Bat.

The two large north-western dams have been recently infilled. These previously provided high quality habitat for non-threatened water birds, waders and frog species including breeding/nesting habitat in surrounding vegetation. This includes habitat for the protected migratory Latham's Snipe, locally significant species including Yellow-rumped Thornbill and Zebra Finch as well as non-common species including the Black-fronted Dotterel and Pinkeared Duck. These species were not recorded present during 2016 surveys following the removal of these large dams.

No threatened flora species have been recorded within the study area, but the importance of the vegetation is high given its critically endangered listing as a CEEC under state and commonwealth legislation, although the remnant is not part of a large extent of the EEC and thus is not part of a regional corridor or a priority conservation area. It is nonetheless a large patch with a high value and contains habitat for a large number of locally occurring flora and fauna species.

The proposal impacts on 2.85 ha of heavily fragmented small remnants within the study area. A further 10.14 ha will be conserved and managed in perpetuity under a VMP within the proposed Conservation Lot 205.

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

The site has not been identified as critical habitat within the provisions of the TSC Act. Therefore this matter does not require any further consideration at this time.

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

Draft state recovery plans have been prepared for the following threatened species with potential habitat within the study area:

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

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

- Acacia pubescens (NPWS 2003)
- Large Forest Owls ((Powerful Owl (*Ninox strenua*), Sooty Owl (*Tyto tenebricosa*) and Masked Owl (*Tyto novaehollandiae*)) (DEC 2006)
- Pimelea spicata (DEC 2004)

It is considered that the proposed development is generally consistent with the objectives or actions of the above-mentioned draft and approved recovery plans.

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

A key threatening process is defined in the *TSC Act* as a process that threatens, or could threaten, the survival or evolutionary development of species, populations or ecological communities.

The current list of key threatening processes under the *TSC Act*, and whether the proposed activity is recognised as a threatening process, is shown below.

Listed key threatening process (as described in the final determination of the Scientific Committee to list the threatening process)	Is the activity of of devel that is threaten	developr proposed o lopment o recognise ing proces	ment or of a class r activity ed as a s?
	Likely	Possible	Unlikely
Alteration of habitat following subsidence due to longwall mining			~
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands	1		
Anthropogenic Climate Change		\checkmark	
Bushrock removal		\checkmark	
Clearing of native vegetation	\checkmark		
Competition and habitat degradation by feral goats			\checkmark
Competition and grazing by the feral European Rabbit (<i>Oryctolagus cuniculus</i>)		\checkmark	
Competition from feral honeybees			\checkmark
Death or injury to marine species following capture in shark control programs on ocean beaches			~
Entanglement in, or ingestion of anthropogenic debris in marine and estuarine environments			√
Forest Eucalypt dieback associated with over-abundant psyllids and bell miners			\checkmark
High frequency fire resulting in the disruption of life-cycle processes in plants and animals and loss of vegetation structure and composition			~
Herbivory and environmental degradation caused by feral deer			\checkmark
Importation of red imported fire ants into NSW			\checkmark
Infection by <i>Psittacine circoviral</i> (beak and feather) disease affecting endangered psittacine species and populations			~
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis			1
Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae		√	
Infection of native plants by Phytophthora cinnamomi		\checkmark	
Introduction of the large earth bumblebee (Bombus terrestris)			\checkmark
Invasion and establishment of exotic vines and scramblers		\checkmark	
Invasion and establishment of Scotch Broom (<i>Cytisus scoparius</i>)			1
Invasion and establishment of the Cane Toad (Bufo marinus)			\checkmark
Invasion, establishment and spread of Lantana camara		\checkmark	

Listed key threatening process (as described in the final determination of the Scientific Committee to list the threatening process)	Is the activity of deve that is threaten	developr proposed o lopment o recognise ing proces	nent or of a class r activity ed as a s?
	Likely	Possible	Unlikely
Invasion of native plant communities by bitou bush & boneseed <i>Chrysanthemoides monilifera</i>			\checkmark
Invasion of native plant communities by exotic perennial grasses		√	
Invasion of native plant communities by African Olive (<i>Olea europaea</i> subsp. <i>cuspidata</i>)		1	
Invasion of the Yellow Crazy Ant (Anoplolepis gracilipes)			\checkmark
Loss of Hollow-bearing trees		\checkmark	
Loss and/or degradation of sites used for hill-topping by butterflies			\checkmark
Predation and hybridisation by feral dogs (<i>Canis lupus familiaris</i>)			\checkmark
Predation by the European Red Fox (Vulpes vulpes)		\checkmark	
Predation by the Feral Cat (Felis catus)			\checkmark
Predation by Plague Minnow or Mosquito Fish (Gambusia holbrooki)			\checkmark
Predation by the Ship Rat (<i>Rattus rattus</i>) on Lord Howe Island			\checkmark
Predation, habitat degradation, competition & disease transmission from Feral pigs (<i>Sus scofa</i>)			\checkmark
Removal of dead wood and dead trees	\checkmark		

Summary of "likely" or "possible" Key Threatening Processes

Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands

In accordance with the Water Management Act, consideration is to be given to the impact of the proposed action on local watercourses and native vegetation riparian buffers and stormwater measures will need to be implemented in accordance with a required Controlled Activity Approval issued by the NSW Office of Water.

The subject site has had previous cut and fill works for the constructed dams in the north west of the site. The current Mine Operations Plan (2016) seeks to infill these water-bodies as part of the mine remediation works, which may cause the downstream regimes to be affected. The proposal is also likely to modify and re-divert stormwater runoff from development areas (impermeable road and property surfaces) and concentrate this increased flow downstream.

Anthropogenic Climate Change

The proposal will require the removal of a small amount of vegetation which will result in a negative or positive contribution to climate change. Vegetation is considered to act as a sink for a range of greenhouse gases but in particular Carbon Dioxide. The maintenance of native vegetation cover is a key strategy to combat the contributing impacts of the proposed action on Climate Change. Whilst almost insignificant in size, the proposal is part of the cumulative effect and thus should be considered as contributing to this threatening process.

Bushrock removal

Very small natural surface bushrock occurs within the unaltered soil surface landscapes of the study area. The bush rocks present in these areas are generally individually located within the landscape and not in clumps or part of a rocky escarpment which represent higher quality habitat of this type. The bush rocks present within proposed development areas are not considered likely to support unique habitat or habitat of importance for threatened species.

Clearing of native vegetation

The proposal is of a class of development recognised as a threatening process. It is generally recommended that all sites should aim to achieve a maintain or improve outcome on the quality and quantity of native vegetation cover through protection and restoration measures.

Competition and grazing by the feral European rabbit

It is expected that the proposed development will increase or decrease the potential for rabbit invasion. Rabbit management and control such as through exclusion fencing, destruction of warrens and targeted "Pindone" baiting is recommended as a standard protocol within the Vegetation Management Plan.

Infection of native plants by Phytophthora cinnamomi

The proposal may temporarily increase the risk of fungal infection on site as it may be spread via vehicular movement and relocation of soil and vegetation. Consequently standard *Phytophthora cinnamomi* protocol applies to the cleaning of all plant, equipment, hand tools and work boots prior to delivery onsite to ensure that there is no loose soil or vegetation material caught under or on the equipment and within the tread of vehicle tyres. Any equipment found to contain soil or vegetation material is to be cleaned in a quarantined work area or wash station and treated with anti-fungal pesticides.

Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae

'Myrtle Rust' may be spread via machinery, animals and humans as well as by environmental factors such as wind. The presence of machinery and construction works is likely to slightly increase the potential for spread of this newly listed key threatening process. Similar protocols as to *Phytophthora cinnamomi* should be applied.

Invasion and establishment of exotic vines and scramblers / Invasion, establishment and spread of Lantana camara / Invasion of native plant communities by exotic perennial grasses / Invasion of native plant communities by African Olive

Disturbance often causes the spread of exotic species. The exotic vines and scramblers on site include Moth Vine, Morning Glory and Coastal Morning Glory. *Lantana camara* is present, and exotic perennial grasses such as Kikuyu and Narrow-leaved Carpet Grass are present as is African Olive. Without any intervention the spread of these species could be exacerbated. Therefore a weed control program is recommended to ensure there is adequate eradication, and control of invasive species that are listed as a key threatening process.

Loss of Hollow-bearing Trees

Hollow-bearing tree surveys identified a small number of hollow-bearing trees containing small (0-10cm) sized hollows within the subdivision development landscape. The proposal will therefore likely require the removal of hollow-bearing trees and as such would be a class of development recognised as a threatening process. Threatened species with suitable habitat within the site and dependant on hollows of this nature include Eastern Falsistrelle, East-coast Freetail Bat, Greater Broad-nosed Bat, Large-footed Myotis and Little Lorikeet. Two (2) of these species were recorded during surveys undertaken. The replacement of hollows with nest boxes is recommended to supplement the loss of natural hollows.

Predation by the European red fox

It is expected that the proposed development will provide an opportunity to manage the area with regard to European red fox invasion. European red fox management is encouraged for the retained vegetated areas of the study area.

Removal of dead wood and dead trees

The proposal will likely require the removal of deadwood and dead trees present within the subdivision landscape and as such is of a class of development recognised as a threatening process. Threatened fauna species with potential habitat within the study area and likely dependent on dead wood or dead trees include Speckled Warbler, Varied Sittella and Cumberland Plain Land Snail. These species have not been recorded to date within the habitat areas likely to be removed as part of the proposed subdivision. Given the low quality habitat present within the development areas, the removal of dead wood and dead trees is not considered likely to impact on threatened species or the biodiversity of the local area.



National - Significant Impact Criteria



Under the EPBC Act an action will require approval from the Australian Government Environment Minister if the action has, will have, or is likely to have, a significant impact on a matter of national environmental significance.

I refer you to the following pages addressing the significant impact criteria for :-

- Swift Parrot
- Koala
- Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest

The following significant impact criteria were sourced from the EPBC Act Policy Statement 1.1 (May 2006):

CRITICALLY ENDANGERED AND ENDANGERED SPECIES

Significant impact criteria

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

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

>> What is a population of a species?

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

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

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

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

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

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

VULNERABLE SPECIES

Significant impact criteria

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

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

>> What is an important population of a species?

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

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

CRITICALLY ENDANGERED AND ENDANGERED ECOLOGICAL COMMUNITIES

Significant impact criteria

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

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

MIGRATORY SPECIES

Significant impact criteria

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

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

>> What is important habitat for a migratory species?

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

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

>> What is an ecologically significant proportion?

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

>> What is the population of a migratory species?

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

A4.1 EPBC Significance Impact Assessment - Swift Parrot (Lathamus discolor)

Background

This species feeds mainly on nectar and lerp from eucalypt flowers, particularly Blue Gum (*Eucalyptus globulus*). On the mainland, the Swift Parrot congregates where winter flowering species occur such as Red Ironbark (*Eucalyptus sideroxylon*), White Box (*Eucalyptus albens*), Yellow Gum (*Eucalyptus leucoxylon*) and Swamp Gum (*Eucalyptus ovata*) (Brown, 1989). This species also occurs within Swamp Mahogany (*Eucalyptus robusta*) or Spotted Gum (*Corymbia maculata*) dominated communities along the coast. The Swift Parrot is a migratory species that breeds in Tasmania and its offshore islands in summer. In late March almost the entire population migrates to mainland Australia spreading from Victoria through to central and coastal NSW and south east Queensland (Schodde and Tidemann, 1986).

Recording

This species has not been recorded during surveys however surveys have not been undertaken during the optimal period. The Survey Guidelines for Australia's Threatened Birds requires that surveys for this species on the mainland should be conducted between March and July. Therefore the impact assessment has assumed the presence and availability of habitat and species presence.

Critically Endangered species assessment

Is there is a real chance or possibility that the proposal will:

• Lead to a long-term decrease in the size of a population;

No. The proposal will not affect the population size, nor will it affect the potential extent of use of the site by the population. This is given that 93% of the large 11.09 ha consolidated patch of CPW vegetation containing > 80% occurrence of winter flowering Forest Red Gum (*Eucalyptus tereticornis*) and Narrow-leaved Ironbark (*Eucalyptus crebra*) will be retained for foraging.

• Reduce the area of occupancy of the species;

No. The species will be able to continue to utilise the study area and local area.

• Fragment an existing population into two or more populations;

No. This is a highly mobile migratory species.

• Adversely affect habitat critical to the survival of a species;

No. The site provides winter flowering foraging habitat that is not critical habitat to the lifecycle of this species.

• Disrupt the breeding cycle of a population;

No. The site does not provide any breeding habitat for this species.

• Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;

No. 93% of the quality habitat areas of the site (11.09 ha consolidated patch of CPW vegetation) will be retained for foraging. All remaining smaller fragments will be removed however this will not further isolate the conserved patch nor will it likely result in the decline of presence of the species.

• Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;

No. The proposal will not likely result in the increased potential for invasive species to occur. No invasive species are considered likely to affect this species.

• Introduce disease that may cause the species to decline; or

No. The proposal will not likely introduce any relevant disease to this species. .

• Interfere with the recovery of the species.

No. The proposal will not likely interfere with the recovery objectives and actions for this species.

A4.2 EPBC Significance Impact Assessment - Grey-headed Flying-fox (*Pteropus poliocephalus*)

Background

Grey-Headed Flying-foxes are canopy feeding frugivores and nectarivores, inhabiting a wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests and cultivated areas. This species roosts in camps, which may contain tens of thousands of individuals.

Camps are commonly formed in gullies, typically not far from water and usually in vegetation with a dense canopy (Tidemann 1998). Camps can be found in riparian rainforest patches, Melaleuca stands, mangroves, riparian woodland or modified vegetation in urban areas. Loyalty to a site is high and some camps in NSW have been used for over a century (NSW NPWS 2001). Some camps are used at the same time every year by hundreds of thousands of flying-foxes while others are used sporadically by a few hundred individuals (Strahan 1995). Generally foraging is within 20km of camps but individuals are known to commute up to 50km to a productive food source.

Recording

Several Grey-headed Flying-fox were observed in flight over the study area after dusk flying in a NE to SE direction during survey on the 16th November 2016. No individuals were observed foraging within the study area at this time.

Vulnerable species assessment

Note: The following assessment has made consideration to the *Referral guideline for management actions in Grey-headed and Spectacled Flying-fox camps* as requested by DOEE in the Preliminary Documentation Requirements (EPBC Ref: 2016/7744).

Is there is a real chance or possibility that the proposal will:

• lead to a long-term decrease in the size of an important population of a species;

No. The proposal will not affect the population size, nor will it affect the potential extent of use of the site by the population. The National Recovery Plan for this species does not make

reference to any important populations and the other definitions of an 'important population' do not apply to the local recorded population.

• reduce the area of occupancy of an important population;

No. The species will be able to continue to utilise the study area and local area. The National Recovery Plan for this species does not make reference to any important populations and the other definitions of an 'important population' do not apply to the local recorded population.

• fragment an existing important population into two or more populations;

No. This is a highly mobile species and the proposal will not cause any fragmentation of any populations of this species. The National Recovery Plan for this species does not make reference to any important populations and the other definitions of an 'important population' do not apply to the local recorded population.

• adversely affect habitat critical to the survival of a species;

No. The site provides seasonal foraging habitat that is not critical or otherwise unique to the survival of this species.

• disrupt the breeding cycle of an important population;

No. The site does not provide any breeding habitat for this species. The National Recovery Plan for this species does not make reference to any important populations and the other definitions of an 'important population' do not apply to the local recorded population.

• modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;

No. 93% of the quality habitat areas of the site (11.09 ha consolidated patch of CPW vegetation) will be retained for foraging. All remaining smaller fragments will be removed however this will not further isolate the conserved patch nor will it likely result in the decline of presence of the species.

• result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;

No. The proposal will not likely result in the increased potential for invasive species to occur. No invasive species recorded present and likely to benefit from the proposal are considered likely to affect this species.

• introduce disease that may cause the species to decline; or

No. The proposal will not likely introduce any relevant disease to this species. .

• interfere substantially with the recovery of the species.

No. The proposal will not likely interfere with the recovery objectives and actions for this species.

A4.3 EPBC Significance Impact Assessment – *Cumberland Plain Shale Woodlands* and Shale-Gravel Transition Forest

Background

This ecological community is listed as a Critically Endangered Ecological Community (CEEC) within the Commonwealth *EPBC Act* (1999). Within the study area this CEEC is variable based upon the dominant canopy cover present. In some locations, *Eucalyptus tereticornis* (Forest Red Gum) with *Eucalyptus moluccana* (Grey Box) dominate, whilst parts of any patch may occasionally contain *Eucalyptus crebra* (Narrow-leaved Ironbark) or *Eucalyptus eugenioides* (Thin-leaved Stringybark).

One large area of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest occurs along the south-eastern boundary of the study area and occupies approximately 11.09 ha. While numerous small and highly disturbed remnants occur in the central western parts of the study area totalling approximately 2.75 ha. These small highly disturbed and depauperate patches are proposed for removal. While a total of 10.14 ha of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest within the Conservation Lot 205 is to be retained, managed and funded in perpetuity under the NSW Biobanking Scheme.

Critically Endangered Ecological Community assessment

Is there is a real chance or possibility that it will:

• Reduce the extent of an ecological community;

The proposal will reduce the extent of the Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest by 2.85 ha which includes 0.04 ha of ancillary works through the removal of numerous small and highly modified patches. This will be ameliorated by the conservation of 10.14 ha of this vegetation type within the conservation lot (Lot 205) located along the south-eastern boundary of the study area.

A 25m managed ecological zone (dual purpose ecological buffer and asset protection zone) will be established outside the western boundary of Lot 205 within the Vegetation Management Plan (VMP). This buffer will be planted out with flora species commensurate with Cumberland Plain Shale Woodlands and managed as an Inner Protection area (IPA) as specified by *Planning for Bushfire Protection* (NSW RFS 2006).

The conservation lot will be managed under a Vegetation Management Plan (VMP) for a minimum of ten (10) years and maintained in perpetuity. The aims of this VMP are to conserve, manage, improve and maintain this patch in the long term using strategies such as weed control, regeneration, restoration (planting) of species commensurate with this vegetation community and regular monitoring to provide proof of improvement and also a feedback loop to document and manage the works onsite to cope with situations such as new weed incursions, damage to fencing, pest species or other unforseen impacts.

Overall the proposed works are expected to achieve a maintain or improve outcome through the consolidation and improvement of the quality of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest within the conservation Lot 205.

• Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines;

The Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest within the study area is already highly fragmented. This is due to the presence of numerous small patches of highly disturbed and depauperate Cumberland Plain Shale Woodlands and

Shale-Gravel Transition Forest areas that are small in size, missing major structural shrub and groundcover layers and are also highly impacted by weed or exotic plant invasion.

The proposal is unlikely to further fragment this vegetation type within the locality because it is already highly fragmented and the proposed retention of the largest patch will retain a large patch of vegetation without having the high edge to area ratio that currently exists. The retention of the largest, structurally complete and diverse area of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest within the Lot 205 Conservation Area and its management through a VMP will consolidate this patch of vegetation and restore it within the local landscape as a large patch of valuable fully structured and diverse vegetation and the enhancement of the habitats it currently contains.

• Adversely affect habitat critical to the survival of an ecological community;

The small and fragmented patches currently within the study area are not critical to the survival of this Critically Endangered Ecological Community. The removal of these highly disturbed, structurally poor and species depauperate small patches are not critical to the survival of this ecological community within the locality or wider region.

In addition, the retention of the largest (10.14 ha) patch of this vegetation type and its enhancement through management via a VMP will consolidate, improve species diversity and improve the structure of this retained patch and will ameliorate any impacts from the removal of the smaller poor quality patches. It is therefore considered that the retention management and enhancement of this larger patch will ameliorate any adverse effects on the habitat necessary for the survival of this vegetation type.

• Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns;

The larger patch of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest located within the proposed Lot 205 Conservation Area is to be left in-situ. meaning that the abiotic factors within Lot 205 such as water, nutrients, soil, air, sunlight, geology, ground water, drainage patterns or other abiotic factors will remain the same. The proposed development will therefore not modify or destroy abiotic factors necessary for the survival of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest
• Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting;

The proposal will conserve 10.14 ha of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest within the Lot 205 Conservation Area. This area will be managed under a VMP specific to Lot 205 and will conserve and improve the species composition of this patch. The entire boundary of the Lot 205 Conservation Area will be fenced and access will be strictly managed. The decline or loss of functionally important species through regular burning or flora and fauna harvesting will therefore be unlikely to occur.

• Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:

assisting invasive species, that are harmful to the listed ecological community, to become established; or

The Lot 205 Conservation Area will be managed in accordance with a Vegetation Management Plan (VMP). This VMP includes strategies, methods and lists of currently present and potential noxious and ecological weed species to be targeted. Control of weed species will be undertaken over a 10 year time period using best practice strategies and methods. This VMP sets maximum weed levels over the course of primary, secondary and maintenance weed control works. Therefore the proposed action is unlikely to result in the reduction in quality or integrity of the ecological community due to weed invasion.

– causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community; or

The VMP will specify activities that are prohibited or strictly controlled within the Lot 205 Conservation Area. The use of chemical fertilisers will be prohibited while natural or locally sourced mulch can be used to enhance plantings within Lot 205.

Herbicides may be used as a last resort to control large or dense areas of weed invasion such as Lantana, African Olive or Mickey Mouse Plant. Nonetheless, the use of herbicides will be strictly controlled and applied as per the manufacturer's recommendations and state legislation. Herbicide use within the Conservation Area is very likely to be restricted to scrape and paint methodology in order to specifically target individual plants.

Other chemicals or pollutants are not to be dumped or used within the Conservation Area. To this end, the boundaries of the Lot 205 Conservation Area will be fenced to protect it from incursions by the public, or by vehicles or other impacts from adjacent industrial sites. Locked gates will be installed to provide access for bush regeneration crews who will undertake weed control and bushland restoration works, fencing contractors to maintain the fence, and ecologists for monitoring and certification as required.

Therefore, the works within the Conservation Area will enhance the growth of native species and will result in improvements to the extent, structure and diversity of the Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest community.

• Interfere with the recovery of an ecological community.

The establishment of the Conservation Area within Lot 205 will conserve in excess of 10 ha of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest. Restoration works will be in accordance with the *Cumberland Plain Recovery Plan* produced by the Department of Environment, Climate Change and Water (NSW) (2010). The works are also in accordance with the strategies and outcomes described in *Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest: A guide to identifying and protecting the nationally threatened ecological community, EPBC Act (1999) Policy Statement.* Therefore, the proposed Conservation area and its management is expected to result in a net gain of better coverage and structure with a corresponding increase in biodiversity.

The proposed action is therefore unlikely to result in interference with the recovery of this ecological community as it will actually result in a series of positive gains.