AIRDS BRADBURY RENEWAL PROJECT - STAGE 6 SUBDIVISION

Flora and Fauna Impact Assessment

For:

Urban Growth NSW

June 2017

Final Report

cumberland ecology

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Report No. 15074RP5

The preparation of this report has been in accordance with the brief provided by the Client and has relied upon the data and results collected at or under the times and conditions specified in the report. All findings, conclusions or recommendations contained within the report are based only on the aforementioned circumstances. The report has been prepared for use by the Client and no responsibility for its use by other parties is accepted by Cumberland Ecology.

Version	Date Issued	Amended by	Details
1	27/04/2017	GK / VO	Draft for issue.
2	27/06/2017	N/A	Final report issued.

Approved by: David Robertson

Position: Director

Signed: David Robertson

Date: *27 June, 2017*

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Glossary of Terms

DoEE	Commonwealth Department of the Environment and Energy
CEEC	Critically Endangered Ecological Community
CPW	Cumberland Plain Woodland
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
GIS	Geographic Information System
GPS	Global Positioning System
LGA	Local Government Area
Locality	The area within a 5 km radius of the centre of the subject site
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
Project	Airds Bradbury Urban Renewal Project, within the Project Boundary, as defined in Figure 1.1
SSTF	Shale Sandstone Transition Forest
Study area	Stages 3, 4, 5 and 6 as part of the Project
Subject site	Proposed development of Stage 6 of the Project
TSC Act	NSW *Threatened Species Conservation Act 1995*

Executive Summary

S1 Introduction

Cumberland Ecology Pty Ltd (Cumberland Ecology) has been commissioned by Urban Growth NSW, to conduct ecological assessments as part of the Airds Bradbury Renewal Project (the 'Project').

This ecological assessment has been prepared to support the development of Lot 11 in DP 1176190, Lots 1 and 2 in DP 1191996, Lots 381, 382 and 383 in DP 1056580, and Lots 37, 39 and 40 in DP 261258 for Stage 6 of the Project, hereafter referred to as the 'subject site'.

The purpose of this report is to describe the current biodiversity values of the subject site and to assess the potential impacts of the proposed redevelopment on flora and fauna, particularly threatened species, populations and communities that are listed under the New South Wales (NSW) *Threatened Species Conservation Act 1995* (TSC Act) known to occur within the locality of the subject site.

As the Project has previously been referred to the Department of Environment and Energy (DoEE) and has subsequently received Commonwealth approval, no further assessment of matters listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is required for Stage 6.

S2 Background

S2.1 Project Approvals

The Project involves the staged urban development of the Airds Bradbury Renewal Project area (i.e. the Project Boundary), which is located within the Campbelltown Local Government Area (LGA). The Project Concept Plan has received Part 3A approval under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) and Commonwealth approval under the EPBC Act.

A Biodiversity Offset Strategy was prepared by Travers bushfire and ecology to meet the Commonwealth and State offsetting requirements for impacts to Cumberland Plain Woodland (CPW) and Shale Sandstone Transition Forest (SSTF), both of which are listed as Critically Endangered Ecological Communities (CEECs) under the TSC Act and EPBC Act. The Biodiversity Offset Strategy includes on-site and off-site conservation areas and a maximum disturbance area for each community. Threatened and migratory species listed under the EPBC Act are covered by the Biodiversity Offset Strategy.

A Bushland Management Plan (BMP) was prepared by Travers bushfire and ecology for the Project Boundary in early 2015. The BMP is intended to provide for the protection and long-

term conservation management of remnant bushland within the Project Boundary. The BMP identifies six areas designated as Bushland Conservation Zones; these areas represent the on-site component of the Biodiversity Offset Strategy for the Project.

S2.2 The Study Area

Stages 1 and 2 civil works are now complete, with house construction in progress. Stages 3, 4, 5 and 6 (collectively referred to as the 'study area') are planned for future development. Additional Stages 7-9 are also forecast as part of the Project, but do not form part of the current assessment of the study area.

The study area is already extensively developed with residential dwellings, a shopping centre, BP petrol station and a number of open playing fields. However, it does include some areas of bushland previously identified as modified forms of CPW and SSTF. There are records of a small number of threatened fauna species from the study area, and there is also evidence in previous studies that Koala utilise the broader locality.

S2.3 The Subject Site

The subject site is approximately 7.59 hectares (ha) in size. The subject site is bounded by Briar Road to the north; Merino Crescent in the south; the Reiby Juvenile Justice Centre in the east; and the rear of the houses fronting Kullaroo Ave in the west. The area below the large Merino Crescent roundabout will be the site of some works to connect underground to overhead power and to reconnect some large water mains being redirected in the residential subdivision works. The subject site is currently zoned R2 - Low Density Residential, under *Campbelltown (Urban Area) Local Environment Plan 2002*.

S3 Methods

Database analysis was conducted to identify threatened species and communities with potential to occur in the study area. The Project Boundary has been the subject of numerous ecological assessments, including assessment for the preparation of the BMP. The existing data was reviewed and incorporated into the current assessment, where appropriate.

Vegetation/flora surveys, fauna habitat surveys and incidental fauna observations were undertaken within the study area by Cumberland Ecology on 2 November 2015. Additional survey was undertaken on 18 April 2017 for the Stage 6 area. Flora surveys involved recording the presence and abundance of flora species within 20 m x 20 m quadrats, recording the presence of species in random meanders and targeted threatened flora surveys. All vascular plants were recorded or collected and were identified to species level where possible. Fauna surveys included a habitat assessment and any incidental observations of birds and other vertebrates.

S4 Results

Vegetation within the subject site consists of a total of 0.40 ha of CPW in various condition classes, 0.08 ha of Aquatic vegetation and 0.29 ha of Urban Native and Exotic Cover, surrounded predominantly by exotic dominated grassland and residential land.

The CPW present on the subject site occurs as small patches in three forms: A single patch of moderate quality CPW with a native canopy and native dominated understorey, totalling 0.29 ha, which will be removed from the centre of the subject site, a patch of young regenerating CPW, totalling 0.07 ha which will be removed from the north, and scattered small patches of low condition CPW with a native canopy and absent or exotic dominated understorey present throughout the subject site. The low and moderate quality patch of CPW present on the subject site conform to the CEEC listing under the TSC Act but do not meet the minimum condition threshold for listing under the EPBC Act.

No threatened flora species have been recorded in the study area or on the subject site.

Two threatened microchiropteran bat (microbat) species have been recorded in the study area; Little Bentwing-bat (*Miniopterus australis*) and Eastern Bentwing-bat (*Miniopterus orianae oceanensis (*formerly *M. schreibersii oceanensis*). Potential foraging habitat is present for these species, on the subject site, in the form of sparse woodland, and open areas, although no roosting habitat is present, as both species roost in caves.

The Grey-headed Flying Fox (*Pteropus poliocephalus*) has been recorded in the study area, and has potential to forage on the subject site, although the sparse woodland habitat and planted trees and shrubs would provide very limited resources, as part of a large home range. No Flying-fox camps are known from the area.

The Cumberland Plain Land Snail (*Meridolum corneovirens*) has been recorded within the most intact patches of CPW in the study area. The sparse patches of CPW present on the subject site would provide sub-optimal habitat, while far better quality habitat exists in adjoining areas to the north and west, in the larger patches of CPW.

One record of the Koala (*Phascolarctos cinereus*) from 2001 exists in the Project Boundary, and a small number occur in the broader Airds area from between 1995 and 2006 and adjoining suburbs of St Helens Park and Holsworthy as recently as 2015, although these records are from established and connective biodiversity corridors in relation to the George River. However, the species has not been recorded on the subject site or in the study area during current or previous surveys for the Project. The study area is not considered to be Core Habitat, as defined under SEPP 44. Due to the lack of core habitat, connectivity to core habitat, and low number of records, it is expected that the subject site would represent only occasional transitional habitat for a small number of individuals.

Additionally, as identified by the desktop assessment and subsequent subject site inspections, a range of threatened fauna species are considered as having potential to occur within the subject site, including threatened birds, bats and arboreal mammals.

The known and potentially occurring fauna species are highly mobile and are expected to move between areas of remaining habitat within the immediate vicinity of the subject site, study area and wider locality.

S5 Impact Assessment

S5.1 Cumberland Plain Woodland CEEC under the TSC Act and EPBC Act

The proposed development will involve the removal of 0.40 ha of CPW consisting of several small patches of varied condition and quality. The largest patch is a total of 0.29 ha and is considered to be of a moderate quality due to the presence of a native canopy and native dominated understorey, however, the patch is small in size, and isolated from larger intact patches. The other patches of CPW present on the subject site are small in area, containing either mature native canopy trees or small tree layer of young regenerating native trees, but with an absent or exotic dominated understorey. The patches of CPW present on the subject site conform to the CEEC listing under the TSC Act but do not meet the minimum condition threshold for listing under the EPBC Act due to low condition understorey components and small patch sizes, and being fragmented from larger tracts of woodland. Therefore, the CPW removed on the subject site is not required to be offset as per the EPBC Act Approval.

In the context of impacts to the local occurrence of this community, the removal of CPW on the subject site represents the removal of 0.40 ha (or 4%) from the total area present in the study area, which includes a large patch to be retained to the north. This loss of vegetation will further fragment the proximate patches of CPW patches to a minor extent, although the local occurrence of this community is expected to remain viable. After consideration of the residual impacts of currently proposed and adjoining developments, a total of 5.05 ha of the proximate large CPW patch will be retained and will form part of a conservation area (BC2 – Riverside West). The conservation area will be managed to expand the area of this patch and improve the condition through active management.

This community is not considered to be significantly impacted by the proposed development in terms of the criteria under the EP&A Act.

S5.2 Threatened Flora and Fauna Species listed under the TSC Act

No threatened flora species were detected on the subject site or in the study area during the current or past surveys.

Some marginal foraging habitat for highly mobile threatened fauna species will be removed for the proposed development, however none of the known and potentially occurring threatened fauna species are likely to be dependent on habitat within the subject site for their survival. The species are highly mobile species that access resources from a wide area. Although known to be present in the study area, the Cumberland Plain Land Snail is not considered to be impacted by the proposed development on the subject site, due to a lack of substantial suitable habitat within the sparse patches of CPW. The Koala, which is known to occur in the Project Boundary and broader locality in very low density, will have a small area of potential habitat removed on the subject site, although the scattered feed trees would not represent core habitat.

Assessments of Significance have determined that the proposed development of Stage 6 is unlikely to have a significant impact on these threatened fauna species.

S6 Avoidance, Mitigation and Compensation Measures

S6.1 Avoidance Measures

Avoidance measures are difficult to achieve in an urban environment, and the subject site has already been heavily disturbed. Avoidance of impacts is not possible in the context of the proposed development, due to the extent of earthworks required to ensure optimum lot and road grades and stormwater drainage.

S6.2 Mitigation Measures

A number of mitigation measures are recommended for the proposed redevelopment project, in line with the development stages already under construction. The mitigation measures recommended to be implemented include:

- Erosion, sedimentation and pollution control;
- Pre-clearing and clearing surveys; and
- Weed control measures.

S6.3 Compensation/Offset Measures

Compensation measures have formed part of the overall Airds Bradbury Urban Renewal Project and include both onsite and offsite offset areas. A detailed BMP has been prepared for six Bushland Conservation Zones within the Project Boundary, including a large zone to the north of the subject site (referred to as BC2 - Riverside Drive West), and smaller patches to the east within the study area. Additional proposed offsite offset areas form part of the Project and include Gilead, which supports a large area of CPW.

The 0.40 ha of CPW present in the subject site conforms to the CEEC listing under the TSC Act but does not meet the minimum condition threshold for listing under the EPBC Act, and is not required to be offset as per the EPBC Act Approval (EPBC 2011/6169).

S7 Conclusion

Despite the impacts of previous disturbance and location within a fragmented landscape, the proposed development will require the modification and clearing of approximately 0.59 ha of native vegetation, and also large areas of exotic grassland with scattered urban native and exotic trees. The majority of the native vegetation present consists of patches of a low quality and regenerating form of CPW, which is listed as a critically endangered ecological community under the TSC Act but which does not meet the minimum condition class required for listing under the EPBC Act. The patches of native forest and woodland provide limited habitat for some threatened fauna species, primarily highly mobile bird and bat species.

No significant impact is predicted to occur to threatened species, populations or communities as a result of the proposed development. Therefore, the preparation of a Species Impact Statement (SIS) is not warranted for further assessment under the TSC Act. The Project was previously referred to DoEE and no further assessment under the EPBC Act is required.

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Chapter **1**

Introduction

1.1 Purpose

Cumberland Ecology Pty Ltd (Cumberland Ecology) has been commissioned by Urban Growth NSW, to conduct ecological assessments as part of the Airds Bradbury Renewal Project (the 'Project').

This ecological assessment has been prepared to support the redevelopment of Lot 11 in DP 1176190, Lots 1 and 2 in DP 1191996, Lots 381, 382 and 383 in DP 1056580, and Lots 37, 39 and 40 in DP 261258, for Stage 6 of the Project. The Stage 6 development area is hereafter referred to as the 'subject site' (**Figure 1.1**).

The purpose of this report is to describe the current biodiversity values of the subject site and to assess the potential impacts of the proposed redevelopment on flora and fauna, particularly threatened species, populations and communities that are listed under the New South Wales (NSW) *Threatened Species Conservation Act 1995* (TSC Act) known to occur within the locality of the subject site.

As the Project has previously been referred to the Department of Environment and Energy (DoEE) and has subsequently received Commonwealth approval, no further assessment of matters listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is required for Stage 6.

The specific objectives of this report are to:

- Describe the vegetation communities on the subject site;
- Describe fauna habitats and fauna usage of the subject site;
- Identify any threatened species, populations or ecological communities (as listed under the TSC Act) existing on the subject site;
- Assess the likelihood of occurrence of threatened species, populations or communities (as listed under the TSC Act) within the subject site;
- Assess the potential impact of the proposed development on threatened communities, flora and fauna, including the completion of Assessments of Significance under Section 5A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act); and

- Where relevant, recommend mitigation measures to reduce the impacts of the proposed development on biodiversity values.

1.2 Background

1.2.1 Project Location

The Project involves the staged urban development of the Airds Bradbury Renewal Project area (i.e. the Project Boundary), which is located within the Campbelltown Local Government Area (LGA). The Project is located within the Campbelltown Local Government Area (LGA), approximately 2.5 kilometres (km) south east of the Campbelltown CBD in the suburb of Airds and a small part of Bradbury (**Figure 1.1**). The Project Boundary is approximately 192 hectares (ha) bounded in the north by Georges River Road and by Georges River Parkway Reserve to the east. Merino Crescent/Akuna Avenue bounds the Project Boundary in the south and St Johns Road forms the western boundary.

The Project Boundary is already extensively developed with residential dwellings, a shopping centre, BP petrol station and a number of open playing fields. However, it does include some areas of modified bushland and these have been investigated previously as part of the work for the rezoning. Both Cumberland Plain Woodland (CPW) and Shale Sandstone Transition Forest (SSTF) occur in several areas on the Project Boundary. Both communities are listed as a Critically Endangered Ecological Community (CEEC) under both the *NSW Threatened Species Conservation Act 1995* (TSC Act) and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). There is also evidence that Koala (*Phascolarctos cinereus*) utilise the Project Boundary as part of a dispersal corridor between the Georges River and Kentlyn areas (Hayes Environmental, 2011).

1.2.2 Project Concept Approval

The Project Concept Plan has received Part 3A approval under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) and Commonwealth approval under the EPBC Act. In accordance with the conditions of approval under the EPBC Act (granted 1 July 2014), the proposed development must not clear more than 3.46 ha of CPW and 4.80 ha of SSTF within the Project Boundary.

A Biodiversity Offset Strategy was prepared by Travers bushfire and ecology (Travers Bushfire and Ecology, 2015)to meet the Commonwealth and State offsetting requirements for impacts to CPW and SSTF. Threatened and migratory species listed under the EPBC Act are also covered by the Biodiversity Offset Strategy.

The Biodiversity Offset Strategy includes on-site and off-site conservation areas that contain a collective total of 19.21 ha of CPW and 9.09 ha of SSTF, which will be protected and managed for the life of the impact and in perpetuity for conservation purposes.

A Bushland Management Plan (BMP) was prepared by Travers bushfire and ecology (Travers Bushfire and Ecology, 2015) for the Project Boundary in early 2015. The BMP is intended to provide for the protection and long-term conservation management of remnant bushland

within the Project Boundary. The BMP identifies six areas designated as Bushland Conservation Zones; these areas represent the on-site component of the Biodiversity Offset Strategy for the Project.

1.2.3 The Study Area

The Project includes nine stages of urban development. Stages 1 and 2 civil works are now complete, with house construction in progress. Stages 3, 4, 5 and 6 (collectively referred to as the 'study area', see **Figure 1.1**) are planned for future development. Additional Stages 7-9 are also forecast as part of the Project, but do not form part of the current assessment of the study area.

The study area is already extensively developed with residential dwellings, a shopping centre, BP petrol station and a number of open playing fields. However, it does include some areas of bushland previously identified as modified forms of CPW and SSTF. There are records of a small number of threatened fauna species from the study area, and there is also evidence in previous studies that Koala utilise the broader locality.

1.2.4 The Subject Site

The subject site is approximately 7.59 hectares (ha) in size. The subject site is bounded by Briar Road to the north; Merino Crescent in the south; the Reiby Juvenile Justice Centre in the east; and the rear of the houses fronting Kullaroo Ave in the west. Stage 6 also includes the area below the large Merino Crescent roundabout, which will be the site of some works to connect underground to overhead power and to reconnect some large water mains being redirected in the residential subdivision works. The subject site is currently zoned R2 - Low Density Residential under *Campbelltown (Urban Area) Local Environment Plan 2002* (**Figure 1.2**).

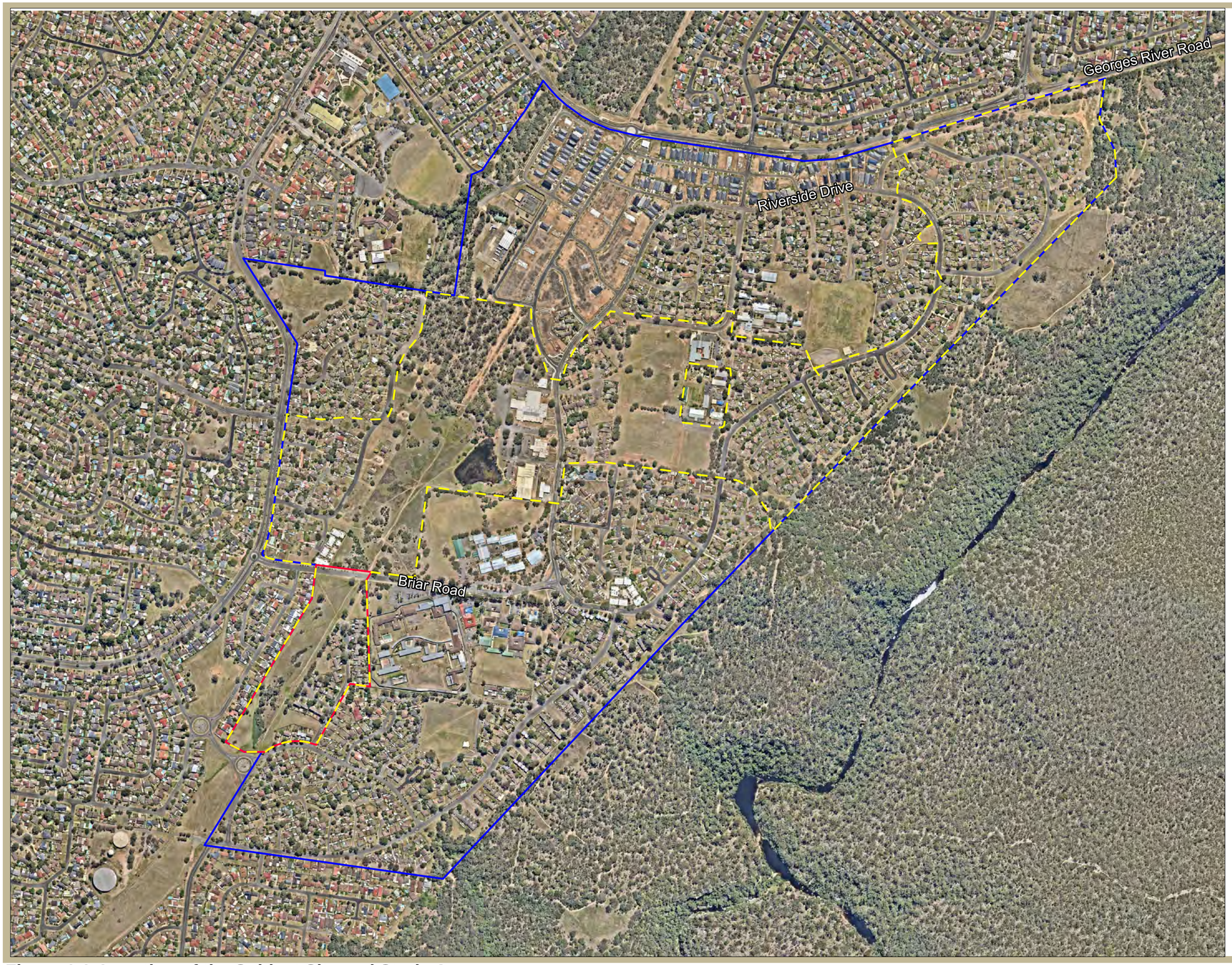
1.2.5 Description of the Proposed Development

This ecological assessment has been prepared to assess the impact of the Stage 6 development. Subsequent assessments will be prepared for the remaining portions of the Project Boundary.

The proposed redevelopment of the subject site (as part of Stage 6 works for the Project) will include the construction of the Stage 6 residential area comprising 144 residential lots. The stage 6 subdivision plan is shown on **Figure 1.3**). Stage 6 works will also include ancillary works; cut and fill works; battering; retaining walls; footpaths; and intersection crossings. The area below the large Merino Crescent roundabout will be the site of some works to connect underground to overhead power and to reconnect some large water mains being redirected in the residential subdivision works.

The works are further described in the Statement of Environmental Effects (SEE).

Coordinate System: MGA Zone 56 (GDA 94)



Legend

- Subject Site
- Study Area
- Project Boundary

Grid North

Image Source:
Nearmap (dated 13-02-2017)

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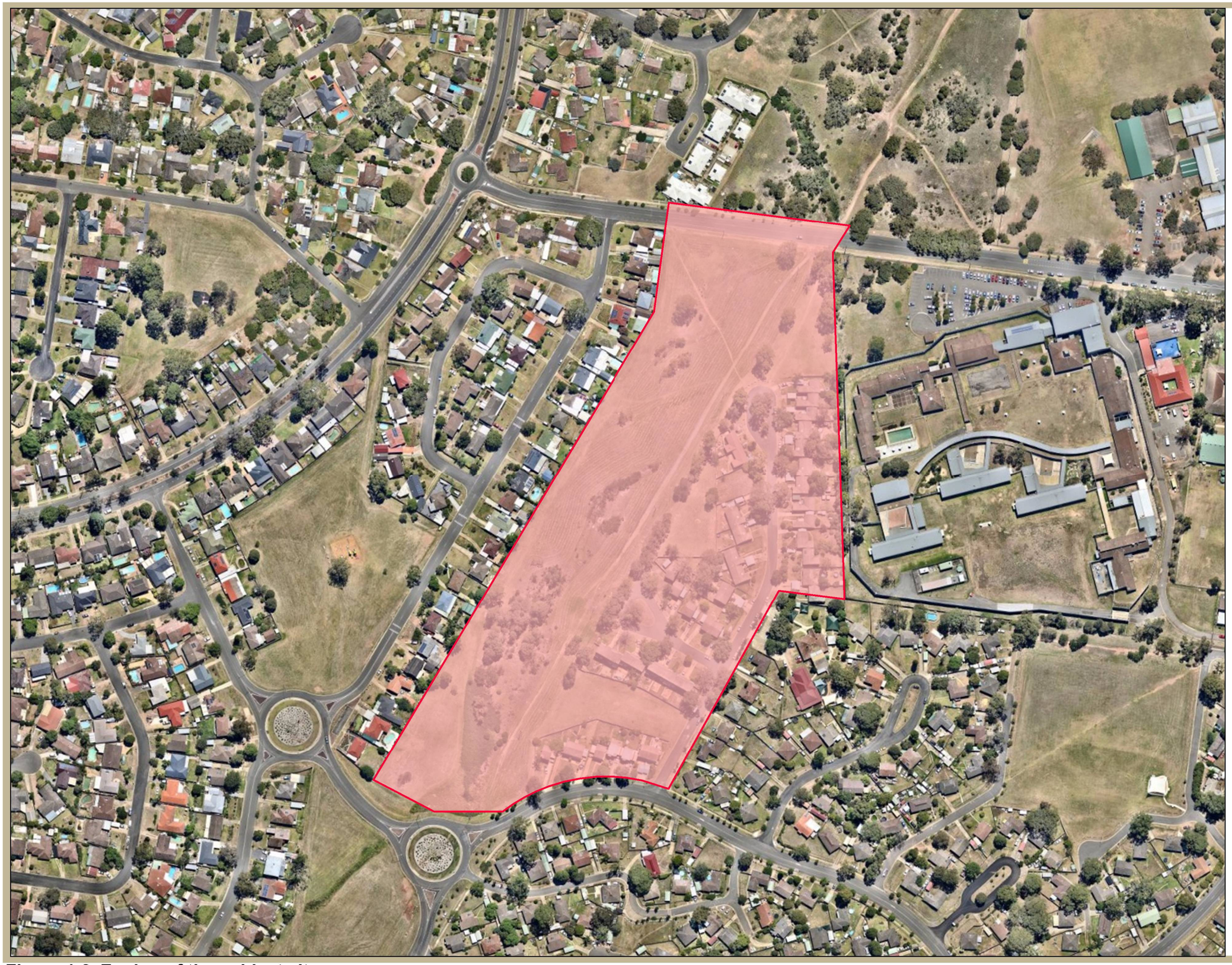
I:\...\15074\Figures\RP5\20170420\Figure 1.1. Location_Subject Site and Study Area

Figure 1.1. Location of the Subject Site and Study Area

100 0 100 200 300 400 m

Coordinate System: MGA Zone 56 (GDA 94)



Legend

Subject site

Zone

R2: Low Density Residential

Grid North

Image Source:
Nearmap (dated 13-02-2017)

Data Source:
Campbelltown Local Environmental Plan 2015

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I:\...\15074\Figures\RP5\20170420\Figure 1.2. Zoning_Subject Site

Figure 1.2. Zoning of the subject site

50 0 50 100 150 200 m

Lot Mix - Stage 6				
Lot Type	**Frontage**	**Depth**	**No. of Lots**	**%**
	10m	26m	8	5.5%
	10m	30m	47	33%
	12.5m	26m	5	3.5%
	12.5m	30m	39	27%
	15m	26m	1	1%
	15m	30m	16	11%
	Atypical		28	19%
		Total	**144**	

STAGE 6
144 LOTS

Briar Road

Kullaroo Avenue

Merino Crescent

URBIS
Tower 2, Level 23 Darling Park
201 Sussex Street, Sydney, NSW 2000
+61 2 8233 9900
www.urbis.com.au
Urbis Pty Ltd ABN 50 105 256 228

Stage 6 Subdivision Plan
Airds Bradbury Block Typology & Feasibility Study
Airds, NSW

This plan is conceptual and is for discussion purposes only. Subject to soil, thermal study, Council approval, engineering input, and survey. Cadastral boundaries, streets and dimensions are approximate only. Figured dimensions shall take preference to scaled dimensions. No responsibility will be taken for any financial dealings of this kind.

PROJECT No: NL1673
DRAWING No: SUB06-1
REV: D
DATE: 24.02.17

I:\...\15074\Figures\RP5\20170420\Figure 1.3. Stage 6 Subdivision

Figure 1.3. Stage 6 Subdivision

Image Source: Urbis. Stage 6 Subdivision Plan. Drawing No: SUB06-1 Rev D, 24-02-2017.

Chapter 2

Methods

2.1 Database Analysis

Database analysis was conducted for the locality using both the NSW Office of Environment and Heritage (OEH) Atlas of NSW Wildlife (OEH, 2017) and the Commonwealth Department of the Environment and Energy (DoEE) Protected Matters Search Tool (PMST) (DoEE, 2017). For the Atlas search, the locality is defined as the area within a 10 km by 10 km grid search of the subject site. For the PMST search, the locality is defined as the area within a 10 km radius of the subject site.

The Atlas of NSW Wildlife Database search was used to generate records of threatened flora and fauna species listed under the TSC Act within the locality of the study area. The Protected Matters Search Tool generated a list of Matters of National Environmental Significance listed under the EPBC Act potentially occurring within the locality of the study area. The lists generated from these databases were reviewed against available knowledge of the study area, in conjunction with the abundance, distribution and age of records, to ascertain the likelihood of occurrence of threatened species within the subject site.

Threatened flora species recorded in the locality are listed in **Table A.1** in **Appendix A**. Threatened fauna species recorded in the locality are listed in **Table B.1** in **Appendix B**.

2.2 Flora Survey

Flora surveys were conducted by Cumberland Ecology on the 2 November 2015, across the Stage 3-5 study area, to verify existing vegetation mapping as presented in the 2011 Hayes Environmental Assessment and other previous studies, with particular reference to threatened ecological communities (TECs). A supplementary survey of Stage 6 was conducted on 18 April 2017.

Flora surveys were undertaken by a botanist and ecologist over a 6 hour period in 2015 and 4 hour period in 2017. Surveys included vegetation mapping, quadrat sampling and targeted threatened flora searches.

2.2.1 Vegetation Mapping

Previous broad-scale mapping conducted by OEH (formerly the Department of Environment, Climate Change and Water) for the Cumberland Plain (DECCW, 2007) and previous surveys

(listed in **Table 2.1**) were utilised to determine potential vegetation communities likely to occur within the study area.

Cumberland Ecology conducted additional vegetation surveys to revise and update the vegetation mapping prepared by previous surveys. The vegetation within the study area was then ground-truthed to examine and verify the mapping of the condition and extent of the different vegetation communities. Where vegetation community boundaries were found to differ from the OEH mapping, records were made of proposed new boundaries using a hand-held Global Positioning System (GPS) and mark-up of aerial photographs.

2.2.2 Quadrat Sampling

Quadrat sampling was undertaken within the study area to obtain information on species composition and community structure. A total of four quadrats of 20 m x 20 m in area were sampled within the study area, two of which were within 20 m x 50 m BioBanking plots. The locations of flora quadrats were recorded using a hand-held GPS unit and are shown in **Figure 2.1**. The locations of the quadrats were selected so that sampling was conducted in areas most representative of the condition and composition of vegetation within the study area. The process of quadrat sampling included the following:

- Identifying and recording all vascular flora species present within the quadrat or directly adjacent to the quadrat;
- The stratum in which each species occurred;
- Assigning a cover-abundance value to each species recorded within the plot, using a modified Braun-Blanquet scoring system (Braun-Blanquet, 1927), to reflect their relative cover and abundance in the quadrat;
- Recording details about vegetation structure such as percentage foliage cover and height of each strata; and
- Taking photographs of the quadrat to provide a record of vegetation condition and appearance.

2.2.3 Random Meander Surveys

Random meander surveys were also undertaken within areas of the study area, as shown in **Figure 2.1**, to detect additional flora species not recorded during quadrat sampling. Transect surveys were also undertaken within each of the relevant Stages of the development in the study area and in surrounding remnant vegetation.

2.2.4 Targeted Threatened Flora Surveys

Targeted threatened flora searches were undertaken as part of the random meander surveys within suitable habitat of threatened flora species known from the locality. The locations of threatened flora specimens observed during surveys were recorded using a hand-held GPS.

2.3 Fauna Survey

Fauna surveys were undertaken within the study area by Cumberland Ecology on 2 November 2015 and 18 April 2017. Surveys included a fauna habitat assessment and incidental observations. The assessment included consideration of important indicators of habitat condition and complexity including the occurrence of microhabitats such as tree hollows, fallen logs, bush-rock and wetland areas such as dams, creeks and soaks. Structural features considered included the nature and extent of the understorey and ground stratum and extent of canopy. The survey also included an assessment of the presence of habitat features suitable for use by threatened fauna species known from the locality. Any incidental fauna species that were observed, heard calling, or otherwise detected on the basis of tracks or signs, were recorded and listed in the total species list for the study area.

2.4 Previous Surveys

Previous flora and fauna surveys have been conducted within the Project Boundary, including the study area, by Hayes Environmental in 2009, Anne Clements & Associates in 2003 and AMBS in 2001 & 2002 (Hayes Environmental, 2011). A summary of the survey effort within the study area is presented below in **Table 2.1**. The flora and fauna species inventory from previous surveys is presented in **Appendix C**.

Table 2.1 Previous flora and fauna surveys of the study area

Consultancy	Year of survey	Survey Area	Survey Methods
Hayes Environmental	2009	4 x Random Meander surveys in remnant and open space areas	Active diurnal searches for the Cumberland Plain Land Snail
			Diurnal Koala searches, including scats and scratches
			Bird Census for 30min at each location, over 2 days
			Amphibian searches by 2 persons over 2 evenings
			Call playback for *Litoria aurea* adjacent to pond
			Spotlighting/stag watching for 2.5 hours over 2 evenings
			Anabat detection recording for 3 hours
Anne Clements and Associates	2003	7 x Transects (3 contiguous 10x10m quadrats)	Flora surveys
		4 x Spot locations (10 m spot radius)	Flora surveys

Table 2.1 Previous flora and fauna surveys of the study area

Consultancy	Year of survey	Survey Area	Survey Methods
AMBS	2002	3 x Quadrats (20x20 m)	Targeted Koala surveys, including scats and scratches
AMBS	2001	3 x 'zig zag' Transects	Targeted search for Cumberland Plain Land Snail over 2 days.
		1 x Quadrat (20x20 m)	Targeted diurnal and nocturnal amphibian surveys, including aural detection around existing dams and creek lines and spotlighting.
			Diurnal and nocturnal searches for reptiles and birds.
			Targeted Koala surveys, including scats and scratches.
			Spotlighting arboreal mammals over 3 evenings.
			Anabat detection over 3 evenings.

2.5 Limitations

Vertebrate fauna and vascular flora of the locality are well known based upon a sizeable database of past records and various published reports. The surveys by Cumberland Ecology added to the existing database and helped to provide a clear indication of the likelihood that various species occur, or are likely to occur within the study area. The data obtained from database assessment and previous surveys of the study area furnished an appropriate level of information to support this assessment.

The weather conditions at the time of the flora surveys were generally favourable for plant growth and production of features required for identification of most species. Shrubs, grasses, herbs and creepers were readily identifiable in most instances. It is expected that not all flora species present would have been recorded during surveys. Despite this, it is considered that sufficient information has been collected to assess issues including conservation significance of the flora, condition and viability of bushland and likely impact on native vegetation.

Limited targeted fauna surveys were undertaken for this assessment, which relied on database analysis and fauna habitat assessment. In general, opportunistic observations of fauna provide a "snapshot" of some of the fauna present on a site that were active during time of the surveys. The data produced by the surveys is intended to be indicative of the types of species that could occur and not an absolute census of all vertebrate fauna species occurring within a site. Therefore not all fauna utilising the study area are likely to have been recorded during the surveys undertaken for this assessment.

Coordinate System: MGA Zone 56 (GDA 94)

Legend

- Subject site
- Flora Quadrat
- Random Meander Transect

Grid North

Image Source:
Nearmap (dated 13-02-2017)

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I:\...15074\Figures\RP5\20170420\Figure 2.1. Survey Locations

Figure 2.1. Survey Locations

25 0 25 50 75 100 m

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Chapter **3**

Results

3.1 Vegetation Communities of the Study Area

Previous vegetation mapping conducted by Hayes Environmental (2011) indicates that Cumberland Plain Woodlands (CPW) and Shale Sandstone Transition Forest (SSTF) are present within the study area. Both of these communities are listed as Critically Endangered Ecological Communities (CEECs) under the TSC Act and/or EPBC Act.

Surveys by Cumberland Ecology have refined the existing vegetation mapping of the study area and identified the following vegetation communities:

- Cumberland Plain Woodland – Native canopy with intact native understorey;
- Cumberland Plain Woodland – Native canopy with absent / exotic dominated understorey;
- Shale Sandstone Transition Forest – Native canopy with intact native understorey;
- Dam / Aquatic Vegetation; and
- Urban Native and Exotic Vegetation

Native vegetation communities present in the study area are shown in **Figure 3.1**, while all unmapped vegetation is considered to be urban native and exotic vegetation (which includes planted vegetation, scattered trees, and open areas of exotic grassland / lawn). **Table 3.1** shows the extent of the native vegetation communities within the subject site and study area. Descriptions of each of the vegetation communities are provided below.

Table 3.1 Vegetation Communities present in the subject site and study area

Vegetation Community	Study Area	Subject Site
	Area (ha)	
Cumberland Plain Woodland: native canopy within intact native dominated understorey	7.18	0.29
Cumberland Plain Woodland: native canopy with absent/ exotic dominated understorey	1.85	0.03

Table 3.1 Vegetation Communities present in the subject site and study area

Vegetation Community	Study Area	Subject Site
	Area (ha)	
Cumberland Plain Woodland: Young regeneration	0.07	0.07
Shale Sandstone Transition Forest: native canopy with intact native dominated understorey	2.35	0.00
Acacia regrowth with exotic understorey	0.09	0.09
Urban Native and Exotic	0.29	0.29
Dam/ Aquatic Vegetation	0.86	0.08
Total	**12.70**	**0.86**

3.1.1 Cumberland Plain Woodland

TSC Act Status: Critically Endangered Ecological Community (CEEC) – Cumberland Plain Woodlands in the Sydney Basin Bioregion (NSW Scientific Committee, 2009).

EPBC Act Status: Critically Endangered Ecological Community (CEEC) – Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (Threatened Species Scientific Committee, 2008).

Cumberland Plain Woodland occurs in three condition classes in the study area; native canopy with intact native dominated understorey, a lower condition variant with a native canopy and absent or exotic dominated understorey, and a young regenerating form. The three variants of CPW have been described further below:

i. Cumberland Plain Woodland – native canopy with intact native dominated understorey

The canopy of the intact variant of CPW was open and dominated by *Eucalyptus tereticornis* (Forest Red Gum), with *E. moluccana* (Grey Box) and *E. fibrosa* (Broad-leaved Stringybark) also present, with an average Projective Foliage Cover (PFC) of 20-30%. The Midstorey mid-storey was also dominated by sparse small trees of regenerating canopy eucalypts. A very sparse to moderate shrub layer was present in most patches, dominated by *Bursaria spinosa* (Blackthorn), *Acacia implexa* (Hickory Wattle), and *Daviesia ulicifolia* (Gorse Bitter Pea). The groundcover was dominated by native herbs and twiners typical of CPW; *Brunoniella australis* (Blue Trumpet), *Goodenia hederacea* (Forest Goodenia), *Dichondra repens* (Kidney Weed), *Opercularia diphylla* and *Glycine microphylla* (Small-leaved Glycine) and a few exotic herbs also dominant; *Sida rhombifolia* (Paddy's Lucerne) and *Richardia stellaris*. Native grasses were abundant and included: *Microlaena stipoides* (Weeping Meadow Grass), *Aristida vagans* (Three-awned Spear Grass) and *Themeda triandra* (Kangaroo Grass).

Exotic groundcover abundance within quadrats was estimated to be approximately 1-5%. Intact, moderate – good condition CPW with a shrub layer of *Bursaria spinosa* is shown in **Photograph 3.1**.

Photograph 3.1 Cumberland Plain Woodland – native canopy with intact native dominated understorey in the study area

ii. Cumberland Plain Woodland – native canopy with absent / exotic dominated understorey

The canopy of this low condition variant of CPW had an open canopy dominated by *Eucalyptus tereticornis* (Forest Red Gum), *E. moluccana* (Grey Box) and *E. fibrosa* (Broad-leaved Stringybark). A sub-canopy and shrub layer was generally absent, but where present, included exotic species; *Ligustrum lucidum* (Large-leaved Privet) and *Lycium ferocissimum* (African Boxthorn) and some planted non-indigenous Acacia species and uncommon regenerating canopy species. The understorey of this variant supports a far higher concentration of weeds than the native dominated sub-category, being dominated by few species of exotic grasses; mainly *Pennisetum clandestinum* (Kikuyu), *Cynodon dactylon* (Couch Grass), *Phalaris aquatica* (Phalaris), *Eragrostis curvula* (African Love Grass), and *Ehrharta erecta* (Panic Veldtgrass). Exotic herbs were also common and included; *Bidens pilosa* (Bidens), *Verbena bonariensis* (Purpletop), *Senecio madagascariensis* and *Hypochaeris radicata*. Native understorey species include those common in CPW and urban grassland; *Brunoniella australis, Einadia nutans* (Climbing Saltbush), *Microlaena stipoides* and *Dichondra repens*.

Exotic groundcover abundance within transects was estimated to be approximately 60-80%. The condition is classed as low, and due to the low percentage of cover of native understorey species, this example of CPW does not meet the condition class under the EPBC Act listing. Exotic dominated CPW is shown in **Photograph 3.2**.

Photograph 3.2 Cumberland Plain Woodland – native canopy and absent/exotic dominated understorey in the study area

iii. Regenerating Cumberland Plain Woodland

A small patch of regenerating CPW was recorded in the south of the study area. This patch included a small tree layer only, and was dominated by *E. tereticornis* and *Acacia parramattensis.* The groundcover was dominated by a mix of exotic grasses and herbs, as described by the low condition variant of CPW, in Section 3.1.1 ii above.

3.1.2 Shale Sandstone Transition Forest

TSC Act Status: Critically Endangered Ecological Community (CEEC) – Shale Sandstone Transition Forest in the Sydney Basin Bioregion (NSW Scientific Committee, 2014)

EPBC Act Status: Critically Endangered Ecological Community (CEEC) – Shale Sandstone Transition Forest of the Sydney Basin Bioregion (Threatened Species Scientific Committee, 2014)

Shale Sandstone Transition Forest occurs in the eastern extent of the study area and is not present in the subject site. Most examples of this community form part of a larger patch that

extends into Riverside Park on the eastern boundary of Airds, and the western bank of the Georges River, and is separated from the park vegetation by a narrow fire trail. This community can grade into CPW where their distribution overlaps, and soil composition changes from shale to increased proportions of sandstone.

In the study area, this community had a woodland structure, possibly cleared as part of fire management measures and other maintenance where it falls within road reserves. The north eastern extent was more intact, with a higher dominance of native understorey species, as shown in **Photograph 3.3**.

The native canopy was dominated by *Eucalyptus crebra* (Narrow-leaved Ironbark) and *E. punctata* (Grey Gum) and some *Angophora floribunda* (Rough-barked Apple) present. The sub-canopy included *Casuarina glauca* (Swamp Oak), *Eucalyptus fibrosa* (Broad-leaved Ironbark) and *Acacia decurrens* (Black Wattle). The shrub layer was sparse in parts and included native species; *Exocarpos cupressiformis* (Native Cherry), *Acacia parramattensis* (Parramatta Wattle), *Bursaria spinosa* and *Allocasuarina littoralis* (Black She-oak). Exotic shrubs included *Ligustrum lucidum* (Large-leaved Privet) and *Lantana camara* (Lantana). The groundcover was dominated by grasses, including natives *Microlaena stipoides* and *Dichelachne micrantha* (Short Plumegrass) and exotics; *Eragrostis curvula, Ehrharta erecta* and *Axonopus fissifolius* (Narrow-leaved Carpet Grass). Herbs were present, including native species; *Pomax umbellata, Veronica plebeia* (Trailing Speedwell), *Dichondra repens* and *Wahlenbergia gracilis* (Sprawling Bluebell), and exotic species; *Euphorbia peplus* (Petty Spurge), *Polycarpon tetraphyllum* (Four-leaved Allseed) and *Sida rhombifolia* (Paddy's Lucerne).

Shale Sandstone Transition Forest is shown in **Photographs 3.3**.

Photograph 3.3 Shale Sandstone Transition Forest with a native canopy and grassy understorey in the north eastern part of the study area

3.1.3 Dam/Aquatic Vegetation

TSC Act Status: Not listed

EPBC Act Status: Not listed

An existing dam occurs in the study area, to the east of the Stage 3 development area. The dam is not part of a natural watercourse or wetland, but contains some aquatic and fringing vegetation.

The fringing vegetation includes some scattered small non-indigenous trees that have been planted, including *Eucalyptus scoparia* (Wallangarra White Gum) and *Casuarina cunninghamiana* (River Oak), and exotic species *Salix babylonica* (Weeping Willow) and *Ligustrum sinense*. Aquatic species were dominated by exotic herbs and grasses, including *Myriophyllum sp., Alternanthera philoxeroides* (Alligator Weed), *Eragrostis curvula* and *Sisyrinchium* sp. Native reeds and rushes were present, including *Juncus usitatus, Juncus continuus, Eleocharis sphacelata* and *Lachnagrostis filiformis*.

The dam and aquatic vegetation is shown in **Photograph 3.4**.

Photograph 3.4 Dam/aquatic Vegetation in the study area

3.1.4 Urban Native/Exotic Vegetation

TSC Act Status: Not listed

EPBC Act Status: Not listed

The majority of the study area contains exotic grassland, with scattered trees, and planted urban / garden vegetation. Some of the trees present are local natives, although the majority are planted non-local native and exotic species. This vegetation type has not been accurately mapped, but includes all areas of vegetation outside of the native vegetation communities in **Figure 3.1**, which is interspersed with urban development and roads.

Species composition varies across the study area, although exotic grasslands, which have been maintained as managed lawns for an extended time period, was determined to consist of exotic species cover between 80-100%, as shown in **Photograph 3.5**. Planted urban vegetation also varied in composition, but included the existing playing fields with lawn and planted non-local native trees such as *Eucalyptus cinerea* (Argyle Apple) and *Eucalyptus scoparia* (Wallangarra White Gum), as shown in **Photograph 3.5**.

Photograph 3.5 Urban native and exotic vegetation with scattered native trees, located in the western part of the study area

Photograph 3.6 Urban native and exotic vegetation with planted non-indigenous native trees, located in the existing parklands in the study area

3.2 Vegetation Communities of the Subject Site

The vegetation of the subject site is consistent with that of the remaining parts of the study area, that include mature and regenerating forms of CPW and CPW with an absent or exotic dominated understorey. The species composition is consistent with patches in the study area, and although the condition varies from patch to patch, it is generally in a low-moderate condition due to the abundance of exotic species in the understorey, as shown in **Photograph 3.7**.

Photograph 3.7 CPW on the subject site

Adjoining the larger patch of CPW on the subject site, a stand of *Casuarina glauca* (Swamp Oak) occurs in association with a drainage depression. This patch is not part of the CPW community, and the canopy is exclusively dominated by *C. glauca*, with an exotic understorey. This community is considered part of the Urban Native and Exotic Cover, as this is not a naturally occurring watercourse or on the floodplain.

Acacia regrowth with an exotic dominated understorey is present in the centre of the subject site. This vegetation is dominated by the native species; *Acacia parramattensis* (Parramatta Wattle), which is a component of CPW, although the patch does not appear to be regenerating to CPW, due to the lack of regenerating canopy species or native understorey species, as shown in **Photograph 3.8**.

Photograph 3.8 Acacia regrowth with exotic dominated understorey on the subject site

A small ephemeral drainage line is also present in the south of the subject site, as shown in **Photograph 3.9**. The majority of the shallow drainage line contains exotic grasses and herbs, while the downslope portion appeared to retain a larger amount of water and contains some aquatic vegetation, including a patch of *Typha orientalis*, and also dense patches of the noxious species; *Rubus fruticosus aggregate* (Blackberry complex).

Photograph 3.9 Drainage depression in the south of the subject site

3.3 Flora Species

3.3.1 General Species

A total of 203 plant species were recorded during surveys of the study area. Species present within the study area consist of a mix of exotics (48%), planted natives (5%) and locally indigenous species (47%). The dominant plant families encountered within the subject site have consistently been represented by the Poaceae, Asteraceae, Myrtaceae, Fabaceae (Faboideae) and Solanaceae families. Quadrat and transect data collected by Cumberland Ecology and previous surveys for the subject site are provided in **Appendix C**.

3.3.2 Threatened Species

No threatened flora species have been recorded within the study area or the subject site. An analysis of the likelihood of occurrence on the subject site for each threatened flora species recorded within the locality is provided in **Appendix C**.

This assessment concluded that none of threatened flora species known from the locality are likely to occur within the subject site.

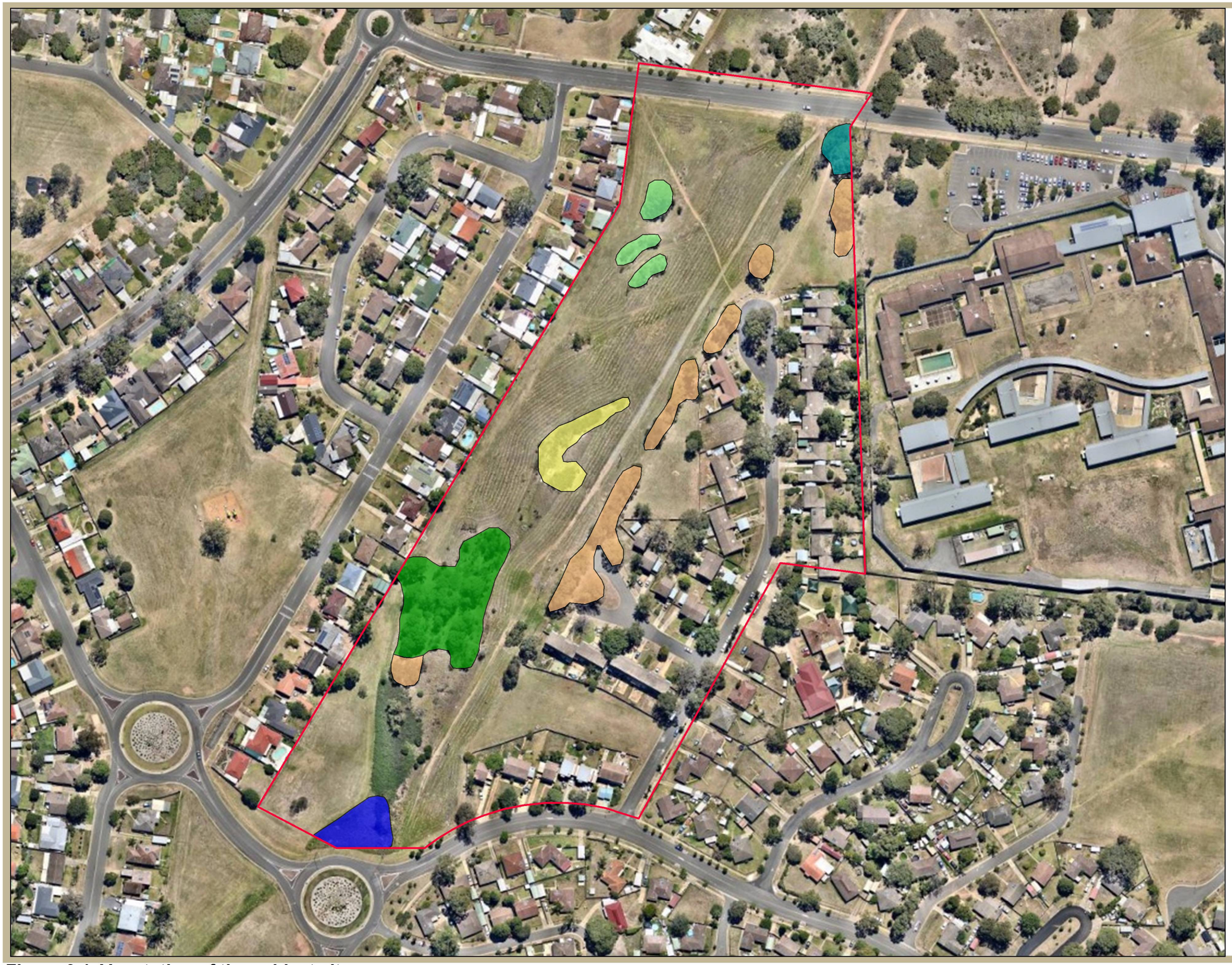
3.3.3 Noxious Weeds

A total of 97 exotic plant species were recorded in the study area, and 11 of these are listed as Declared Noxious Weeds under the NSW Noxious Weeds Act 1993 in the Campbelltown LGA. These species include; *Rubus fruticosus aggregate* (Blackberry complex) (which is abundant on the subject site), *Alternanthera philoxeroides* (Alligator Weed). *Lycium ferocissimum* (African Boxthorn), *Lantana camara* (Lantana), *Ligustrum sinense* (Small-leaved Privet), *Ligustrum lucidum* (Broad-leaved Privet), *Salix babylonica* (Weeping Willow), *Senecio madagascariensis* (Fireweed), *Ludwigia peruviana* (Peruvian Primrose), *Hypericum perforatum* (St Johns Wort) and *Nassella neesiana* (Chilean Needlegrass).

These species are all classified as Control Class 4 – locally controlled weeds, with the exception of *Alternanthera philoxeroides* and *Ludwigia peruviana* and which are classified as Control Class 3 - regionally controlled weed. Control Class 4 specifies that the growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed. Control Class 3 plants must be fully and continuously suppressed and destroyed.

Rubus fruticosus aggregate, Senecio madagascariensis, Lycium ferocissimum, Lantana camara, Salix fragilis, Nassella neesiana and *Alternanthera philoxeroides* are also listed as a Weed of National Significance (WoNS). These species have been identified by Australian governments based on their invasiveness, potential for spread, and environmental, social and economic impacts and are priorities for control.

Coordinate System: MGA Zone 56 (GDA 94)



Legend

- Subject site

Vegetation Community

- CPW (native canopy with intact native dominated understorey)
- CPW (native canopy with absent/exotic dominated understorey)
- Regenerating CPW
- Acacia regrowth with exotic understorey
- Urban Native and Exotic
- Dam/Aquatic Vegetation

Grid North

Image Source:
Nearmap (dated 13-02-2017)

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I:\...\15074\Figures\RP5\20170427\Figure 3.1. Vegetation_Subject Site

Figure 3.1. Vegetation of the subject site

25 0 25 50 75 100 m

3.4 Fauna

3.4.1 Fauna Habitat in the Study Area

The vegetation within the study area is a mixture of high quality and low condition habitat for fauna. The patches of intact CPW near the shopping centre are good condition habitat that contained hollows and fallen logs, which provide habitat for hollow-dependent fauna and microhabitats for reptiles. A number of large nests were also seen within this vegetation and hollows that were used as nests for Rainbow Lorikeets (*Trichoglossus haematodus)*. This vegetation is of high faunal value and would also provide suitable roosting habitat for microchiropteran (small insectivorous) bat species.

The low quality vegetation in areas adjacent to the open space and residential areas provides some potential, albeit sub-optimal habitat for fauna. Habitat is not of high faunal value as there is limited ground cover or structural complexity however they do provide connectivity between patches of vegetation. Mammals and birds may use this low condition vegetation as part of a larger foraging range.

The dam within the study area does provide habitat for waterfowl and eels, however the water quality is poor due to pollution and contains high numbers of plague minnow (mosquito fish). There is no defined riparian habitat, which limits the habitat value for fauna.

3.4.2 Fauna Habitat in the Subject Site

The subject site contains limited fauna habitat, consisting primarily of open grassland, although a small portion of the subject site includes a patch of relatively intact/structured woodland. The relatively intact patch of woodland in the centre of the subject site would provide moderate quality fauna habitat, due to the relatively small size, and includes foraging and roosting/nest resources available for a suite of species. No hollow-bearing trees were recorded on the subject site during the site inspection, although some are known from the study area. A number of the scattered large mature trees on the subject site were observed to contain decorticating bark, which provides potential roosting habitat for some microbat species, and shelter for reptiles.

3.4.3 General Species

A total of 23 vertebrate fauna species, primarily birds were recorded in the study area during recent and previous surveys. A comprehensive list of the total species records in previous surveys in the study area is provided in **Appendix D**. The disturbed nature of the study area is likely to have an impact on the types and abundance of fauna species occurring, and the fauna groups recorded represent primarily birds that are well adapted to urban environments. More intact woodland habitats occur in the adjoining bushland within the onsite offset area, and a greater diversity of fauna species is expected to occur.

3.4.4 Threatened Species

A number of threatened fauna species have been recorded from the locality and have the potential to occur within the study area. **Table B.1** in **Appendix B** analyses the likelihood of

occurrence within the study area for each threatened fauna species recorded or predicted to occur within the locality. A total of 23 threatened fauna species are considered as having potential to occur within the study area, including 1 amphibian, 11 birds, 10 mammals and 1 gastropod. Four of these species have previously been recorded in the study area or Project Boundary, including; Grey-headed Flying-fox (*Pteropus poliocephalus*), Eastern Bentwing-bat (*Miniopterus orianae oceanensis* (formerly *M. schreibersii oceanensis*)), Little Bentwing-bat (*Miniopterus australis*), Greater Broad-nosed Bat (*Scoteanax rueppellii*) and Cumberland Plain Land Snail (*Meridolum corneovirens*). The Koala (*Phascolarctos cinereus*) has also been recorded from outside of the study area, to the east, within the Georges River riparian area.

A discussion of the known and potentially occurring threatened fauna species is provided below.

i. Powerful Owl

The Powerful Owl (*Ninox strenua*) is listed as Vulnerable under the TSC Act. Potential foraging habitat for this species occurs within the study area, mainly within the intact forest and woodland vegetation, which includes some mature trees with large hollows, suitable for roosting and nesting. However, the subject site generally lacks large areas of intact woodland, and no hollows were recorded. The Powerful Owl is considered to have the potential to occur within the study area given the species is known to utilise fragmented habitat within urban areas, however the study area is considered to only provide marginal foraging habitat for this species.

ii. Raptors

The following raptor species have potential to occur in the study area, although none of these species have been recorded on site:

- Square-tailed Kite (*Lophoictinia isura*) – Vulnerable under the TSC Act; and
- Little Eagle (*Hieraaetus morphnoides*) – Vulnerable under the TSC Act.

Potential foraging and breeding habitat for these species occurs within the study area. These species could forage within the intact forest and woodland vegetation of the study area as part of their large home ranges which can be up to 100 km^2. Although these species could breed within the study area, no nests were observed during surveys.

iii. Woodland Birds

The following woodland bird species have potential to occur in the study area, although none of these species have been recorded on site:

- Gang-gang Cockatoo (^^*Callocephalon fimbriatum*) - Vulnerable under the TSC Act;
- Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*) – Vulnerable under the TSC Act;

- Regent Honeyeater (*Anthochaera phrygia*) – Critically Endangered under the TSC Act and EPBC Act;
- Black-chinned Honeyeater (eastern subspecies) (*Melithreptus gularis gularis*) – Vulnerable under the TSC Act;
- Varied Sittella (*Daphoenositta chrysoptera*) – Vulnerable under the TSC Act;
- Scarlet Robin (*Petroica boodang*) – Vulnerable under the TSC Act;
- Swift Parrot (*Lathamus discolor*) – Endangered under the TSC Act and EPBC Act;
- Little Lorikeet (*Glossopsitta pusilla*) - Vulnerable under the TSC Act

Potential foraging habitat for these species occurs within the study area, mainly within the intact forest and woodland vegetation, which includes some mature trees with large hollows, suitable for nesting by the Little Lorikeet. However, the subject site lacks hollows for this species. The woodland bird species are considered to have the potential to occur within the study area given the species are known to utilise fragmented habitat within urban areas for foraging as part of a broad home range, however the study area is considered to only provide marginal foraging habitat for this species.

iv. Grey-headed Flying-fox

The Grey-headed Flying-fox (*Pteropus poliocephalus*) is listed as Vulnerable under the TSC Act and EPBC Act.

Limited potential foraging habitat for this species occurs within the study area, where fruiting and flowering trees and shrubs occur, primarily within the intact eucalypt woodland and forest. Grey-headed Flying-foxes live in specific roost camps, the locations of which are well-known within the Sydney region. No camps were observed within the study area, and the closest recorded camp is at Campbelltown, approximately 4km from the subject site.

v. Hollow-roosting Microbats

The following hollow-dependant microbat species have potential to occur in the study area:

- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) - Vulnerable under the TSC Act;
- Eastern Freetail-bat (*Mormopterus norfolkensis*) - Vulnerable under the TSC Act;
- Greater Broad-nosed Bat (*Scoteanax rueppellii*) - Vulnerable under the TSC Act;
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) - Vulnerable under the TSC Act; and
- Southern Myotis (*Myotis macropus*) - Vulnerable under the TSC Act.

Potential foraging and roosting habitat for these species occurs within the study area, particularly in the more intact woodland and forest vegetation, although none have been confirmed to occur. Potential roosting habitat is provided in the form of sparse hollow-bearing trees within the study area. Hollow-trees are absent from the subject site, although some mature trees with decorticating bark may provide roosting habitat.

vi. Cave-roosting Microbats

Two microbat species have been recorded in the study area:

- Eastern Bentwing-bat (*Miniopterus orianae oceanensis* (formerly M. schreibersii oceanensis)) – Vulnerable under the TSC Act; and
- Little Bentwing-bat (*Miniopterus australis*) – Vulnerable under the TSC Act

These microbat species have the potential to forage in the study area, and on the subject site, although no roosting habitat, in the form of caves, are present. These species are known to forage throughout urban areas, as well as woodland and forest habitats, covering a large home range.

vii. Koala

One record of the Koala from 2001 exists in the Project Boundary, and a small number occur in the broader Airds area from between 1995 and 2006, and adjoining suburbs of St Helens Park and Holsworthy as recently as 2015, although these records are from established and connective biodiversity corridors in relation to the George River. However, the species has not been recorded on the subject site or in the study area during current or previous surveys for the Project (Hayes Environmental, 2011). The study area is considered to be Potential Koala Habitat, as defined under SEPP 44, based on the presence of a Schedule 2 listed Primary Food Tree; *Eucalyptus tereticornis*, which constitutes at least 15% of the total number of trees in the upper or lower strata of the tree component Core Habitat. However, the study area does not qualify as Core Koala Habitat, due to the absence of a known breeding population. Due to the lack of core habitat, or connectivity to core habitat and low number of records, it is expected that the subject site would represent only occasional transitional habitat for a small number of individuals.

viii. Cumberland Plain Land Snail

Potential habitat for the Cumberland Plain Land Snail include CPW that has litter and debris for shelter and foraging resources. The species is fairly immobile, and therefore fragmentation of patches can present a barrier for a breeding population of this species. All of the intact patches of CPW within the study area provides suitable habitat for the Cumberland Plain Land Snail, although the majority of the low condition patches and the regenerating CPW do not include adequate litter and debris to provide habitat for this species.

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Chapter 4

Impact Assessment

4.1 Impacts to Vegetation Communities and Habitat

4.1.1 Cumberland Plain Woodland CEEC under the TSC Act and EPBC Act

The proposed development will involve the removal of a total of 0.40 ha of CPW in various condition classes, 0.08 ha of Aquatic vegetation and 0.29 ha of Urban Native and Exotic Cover, surrounded by predominantly by exotic dominated grassland and residential land.

The CPW present on the subject site occurs as small patches in three forms; A single patch of moderate quality CPW with a native canopy and native dominated understorey, totalling 0.29 ha, which will be removed from the centre of the subject site, a patch of young regenerating CPW, totalling 0.07 ha which will be removed from the north, and scattered small patches of low condition CPW with a native canopy and absent or exotic dominated understorey present throughout the subject site. The low and moderate quality patches of CPW present on the subject site conform to the CEEC listing under the TSC Act but do not meet the minimum condition threshold for listing under the EPBC Act. Therefore, the CPW removed on the subject site is not required to be offset as per the EPBC Act Approval.

In the context of impacts to the local occurrence of this community, the removal of CPW on the subject site represents the removal of 0.40 ha (or 4%) from the total area present in the study area, which includes a large patch to be retained to the North West. This loss of vegetation will further fragment the proximate patches of CPW patches to a minor extent, although the local occurrence of this community is expected to remain viable. After consideration of the residual impacts of currently proposed and adjoining developments in the study area, a total of 5.05 ha of the proximate large CPW patch, adjoining the Kevin Wheatley Reserve, will be retained and will form part of a conservation area. The conservation area will be managed to expand the area of this patch and improve the condition through active management.

This community is not considered to be significantly impacted by the proposed development in terms of the criteria under the EP&A Act.

The remaining parts of the subject site consist of existing buildings and infrastructure and Urban Native and Exotic Vegetation, predominantly in the form of exotic grassland.

An assessment of significance of the impacts to CPW is provided in **Appendix E**. This assessments concluded that the proposed development is not likely to result in a significant

impact to this community. A suite of mitigation measures are proposed which are relevant to minimising impacts to the retained native vegetation (see **Chapter 5**).

4.1.2 Loss of Specific Habitat Features

In addition to the clearance of broad habitats within the subject site, a number of specific habitat features will be removed, including:

- Fallen logs;
- Hollow-bearing trees; and
- Nectar-producing trees.

4.1.3 Impact on Remaining Vegetation and Habitats

The proposed development has the potential to indirectly impact remaining vegetation and habitats. These impacts include:

- Increased habitat fragmentation - affects biodiversity by reducing the amount of available habitat for some species to occupy due to increased distances between habitat patches. Fragmentation is also increased through the development of new roads which act as barriers to movement of some species;
- Edge effects – affects biodiversity through microclimatic changes in light, temperature, humidity and wind, which can favour a suite of different species and therefore cause significant changes to the ecology of the patch (Lindenmayer and Fischer, 2006);
- Alteration to hydrological regimes – affects biodiversity through modification of hydrology necessary for vegetation and habitat survival, such as surface water drainage patterns and through the construction of hard surfaces;
- Increased sedimentation and erosion – affects biodiversity through the smothering of vegetation, increasing turbidity of waterways and transportation of weed matter and nutrients; and
- Weeds and feral animals – affects biodiversity through increased competition for resources.

However, these processes are already in operation in the study area, due to the existing urban land uses. The proposed development is therefore not considered likely to exacerbate these impacts greatly beyond current levels, as it will remain as an urban environment.

4.2 Impacts to Threatened Fauna Species

The proposed development has the potential to result in a number of direct and indirect impacts to threatened fauna species known or with potential to occur in the study area. In

addition to the direct removal and modification of vegetation within the subject site, potential indirect impacts to fauna species include:

- Habitat disturbance during the construction phase of the project (e.g. changes in noise);
- Runoff, erosion and sedimentation;
- Increased pollution;
- Hydrological changes resulting in altered fauna habitats; and
- Modification of microhabitat features resulting from long and short-term edge effects (e.g. changes in light filtration).

4.2.1 Threatened Species Listed under the TSC Act

A total of four threatened fauna species listed under the TSC Act have been recorded within the study area during previous surveys, and have potential to occur on the subject site, including; Grey-headed Flying-fox, Eastern Bentwing-bat, Little Bentwing-bat and Cumberland Plain Land Snail. A number of other threatened fauna species are known to occur in the locality and are considered to have the potential to occur within the subject site (see Section 3.3.3iii). This includes the Koala, which is known to occur in the Project Boundary and broader locality in very low density, will have a small area of potential habitat removed on the subject site, although the scattered feed trees would not represent core habitat.

Some marginal potential foraging and breeding habitat for threatened fauna species will be removed for the proposed development, however none of the known and potentially occurring threatened fauna species are likely to be dependent on habitat within the subject site for their survival. These are generally highly mobile species, including threatened bats and birds, that access resources from a wider area, in particular the higher value habitat is available in the locality of Georges River Reserve and retained native vegetation adjoining the subject site.

The proposed development will act to further fragment the remaining patches of habitat for these species to some extent. The construction of additional residential buildings may present a barrier or restriction to movement for some ground-dwelling and arboreal species, including the koala and Cumberland Plain Land Snail. However, the less mobile fauna species can move around residential buildings and through landscaped areas, and therefore the development is not considered a complete barrier to movement of the species. Furthermore, the subject site does not intersect a vegetated corridor, and the most intact habitat areas available in the study area are to the north and east of the proposed development, therefore the road will not fragment potential habitat to a large extent.

Assessments of significance for these species are provided in **Appendix E**. These assessments concluded the proposed development is not considered to significantly impact these species.

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Chapter 5

Avoidance, Mitigation and Offset Measures

5.1 Avoidance Measures

This flora and fauna impact assessment has assumed complete removal of all native vegetation in relation to the Stage 6 residential area, including mature trees present on the subject site. Generally, avoidance of impacts is not possible in the context of the proposed development, due to the extent of earthworks required for the final landform to be level in relation to the road networks and drainage requirements of the development.

5.2 Mitigation Measures

A number of mitigation measures are recommended for the proposed development during the pre-construction and construction phases. These measures should be implemented to minimise impacts to biodiversity impacts to adjoining habitats.

5.2.1 Erosion, Sedimentation and Pollution Control

Potential impacts to flora and fauna occurring in the construction phase that can be managed include: run-off, sedimentation, erosion and pollution. To reduce sedimentation on the construction site, erosion control measures should be implemented. This includes minimising the amount of exposed soils on the site at any given time. All soil stockpiles should be adequately covered when not in use to prevent erosion from heavy rainfall. Sediment fences should be established around the perimeter of the development area to prevent the impacts of sedimentation on the adjoining vegetation. During development, precautions should be taken to ensure that no pollution, such as petrochemical substances or water containing suspended solids, escapes the construction site. Pollution traps and efficient removal of pollution to an off-site location would help to minimise pollution impacts.

5.2.2 Pre-clearing and Clearing Surveys

Pre-clearing surveys are to be undertaken by a suitably qualified ecologist. Pre-clearing surveys will include:

- Demarcation of key habitat features as hollow-bearing trees, fallen logs, nests and bush rock; and
- Provision of a report following the completion of a pre-clearing survey, detailing the location and type of each habitat feature.

To minimise impacts to native fauna species, clearing should be undertaken in the following two-stage process under the supervision of a suitably qualified ecologist:

- The initial phase of clearing will involve clearing around identified habitat features and leaving the features overnight;
- The second stage will involve clearing of the habitat features left overnight followed by an inspection;

If possible, trees marked as containing hollows or nests will be shaken by machinery prior to clearing to encourage any animals remaining to leave the hollow/nest and move on. An ecologist should investigate all hollows and nests for the presence of fauna following felling of the tree.

An ecologist will be present while clearing habitat trees to rescue animals injured during the clearance operation. Provisions will be made to protect any native fauna during clearing activities by the following means:

- All persons working on the vegetation clearing will be briefed about the possible fauna present and should avoid injuring any present;
- Animals disturbed or dislodged during the clearance but not injured should be assisted to move to the adjacent bushland; and
- If animals are injured during the vegetation clearance, appropriate steps will be taken to humanely treat the animal (either taken to the nearest veterinary clinic for treatment, or if the animal is unlikely to survive, it will be humanely euthanased).

5.2.3 Weed Control Measures

Noxious weed species occurring within the subject site should be managed in order to prevent further spread. Prior to any vegetation clearance, noxious weeds in the canopy and shrub layers should be demarcated in order for these to be disposed of separately from native material. All groundcover should be disposed of as exotic as the majority is exotic grass with scattered noxious species including *Senecio madagascariensis, Lycium ferocissimum* and *Lantana camara* which are also Weeds of National Significance.

5.3 Compensation Measures

Compensation measures have formed part of the overall Airds Bradbury Urban Renewal Project, within the Project Boundary, and include both onsite and offsite compensation areas. A detailed BMP has been prepared for six Bushland Conservation Zones within the Project Boundary, including a large zone to the north of the subject site (referred to as BC2 - Riverside Drive West), and smaller patches to the east within the study area (Travers Bushfire and Ecology, 2015). Additional proposed offsite offset area form part of the Project, including Gilead CPW offset site, and St Helens Park SSTF offset site.

The revegetation and regeneration works proposed as part of the BMP will improve the overall condition of CPW (totalling 3.71 ha) within the Project Boundary. Replanting will also include feed tree and shrub species suitable as fauna foraging resources, including Koala feed tree species, which will increase the habitat value for threatened fauna in the locality.

The 0.40 ha of low and moderate condition CPW conforms to the CEEC listing under the TSC Act but does not meet the minimum condition threshold for listing under the EPBC Act, and is not required to be offset as per the EPBC Act Approval.

Chapter 6

Conclusion

Despite the impacts of previous disturbance and location within a fragmented landscape, the proposed development will require the modification and clearing of approximately 0.57 ha of native vegetation, and also large areas of exotic grassland with scattered urban native and exotic trees. The majority of the native vegetation present consists of patches of a low and moderate quality and regenerating form of CPW, totalling 0.40 ha, which is listed as a critically endangered ecological community under the TSC Act, but does not meet the minimum condition class required for listing under the EPBC Act.

The proposed works will not act to fragment the intact patches of CPW, and long-term viability of the local occurrence of this community is good due to the proposed active management proposed in the onsite conservation area to the north of the subject site. The large CPW patch to be conserved is of higher quality and is intact, compared to that of the subject site. For these reasons, a significant impact to CPW is not expected.

Some marginal potential foraging and breeding habitat for threatened fauna species will be removed for the proposed development, however none of the known and potentially occurring threatened fauna species are likely to be dependent on habitat within the subject site for their survival. These are generally highly mobile species, including threatened bats and birds, that access resources from a wider area, in particular the higher value habitat is available in the locality of Georges River Reserve and retained native vegetation adjoining the subject site.

No significant impact is predicted to occur to threatened species, populations or communities as a result of the proposed development. Therefore, the preparation of a Species Impact Statement (SIS) is not warranted. The Project has been referred to the Commonwealth DoEE, under the EPBC Act and no further assessment is required.

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Appendix A

Threatened Flora: Likelihood of Occurrence Assessment

Table A.1 Threatened flora species recorded in the locality (OEH, 2017) and an assessment of their likelihood of occurrence on the subject site

Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Likelihood of Occurrence
Ericaceae	*Leucopogon exolasius*	Woronora Beard-heath	V	V	Often found on rocky hillsides along creek banks in woodlands on sandstone and low nutrient soils. Associated with Sydney Peppermint (*Eucalyptus piperita*) and Silvertop Ash (*E. sieberi*). Distribution overlaps with Shale/Sandstone Transition Forest.	Unlikely. No suitable habitat on the subject site. May occur elsewhere in the study area, although it has not been recorded.
Fabaceae (Mimosoideae)	*Acacia pubescens*	Downy Wattle	V	V	Generally found in open woodland and forest on alluvium, shale and shale/sandstone. Soils are gravely, often ironstone. Associated with a variety of vegetation communities including Cooks River/Castlereagh Ironbark Forest, Shale/Gravel Transition Forest and Cumberland Plain Woodland.	Possible. Marginal habitat present in the woodland on the study area, however this species was not recorded during targeted surveys.
Myrtaceae	*Melaleuca deanei*	Deane's Paperbark	V	V	Predominately occurs in ridgetop woodland, with only 5% of sites in health on sandstone. The species is absent from unsuitable habitat on the Cumberland Plain in Western Sydney	Unlikely. No suitable habitat

Table A.1 Threatened flora species recorded in the locality (OEH, 2017) and an assessment of their likelihood of occurrence on the subject site

Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Likelihood of Occurrence
					and areas cleared for urban development.	
Orchidaceae	^*Pterostylis saxicola*	Sydney Plains Greenhood	E	E	Generally found in sclerophyll forest and woodland on shale/sandstone transition or shale soils. Found within depressions and crevices in sandstone rock shelves above cliff lines as scattered individuals or in small groups.	Unlikely. No suitable cliff habitat present
Proteaceae	*Grevillea parviflora subsp. parviflora*	Small-flower Grevillea	V	V	Found in a variety of habitats from heath to shrubby woodlands to open forest. Grows in sandy or light clay soils, generally over thin shales. Occurs at a variety of altitudes (30 - 300m ASL) and often is recorded in open, slightly disturbed sites.	Unlikely. No suitable habitat
Proteaceae	^^*Persoonia hirsuta*	Hairy Geebung	E	E	Typically found in open, dry sclerophyll forest, woodland and heath on sandstone. Generally found in sandy soils as isolated individuals or very, small populations.	Possible. Marginal habitat present in the woodland on the study area, however this species was not recorded during targeted surveys.

Table A.1 Threatened flora species recorded in the locality (OEH, 2017) and an assessment of their likelihood of occurrence on the subject site

Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Likelihood of Occurrence
Thymelaeaceae	*Pimelea spicata*	Spiked Rice-flower	E	E	Associated with Grey Box communities, particularly Cumberland Plain Woodland variants and Moist Shale Woodland, and in areas of ironbark, on well-structured clay soils.	Possible. Marginal habitat present in the woodland on the study area, however this species was not recorded during targeted surveys.

Key: TSC Act and EPBC Act Status - V = Vulnerable, E = Endangered, CE = Critically Endangered

Atlas records are from between 1990 -2017 (OEH, 2017)

Appendix B

Threatened Fauna: Likelihood of Occurrence Assessment

Table B.1 Threatened fauna species recorded in the locality (OEH, 2017) and an assessment of their likelihood of occurrence on the subject site

Class	Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Likelihood of Occurrence
Amphibia	Hylidae	*Litoria aurea*	Green and Golden Bell Frog	E	V	Inhabits a wide range of water bodies, particularly ephemeral ponds for breeding, with the exception of fast-flowing streams. Terrestrial habitat includes grassy low vegetation and diurnal shelter sites. In NSW, this species is commonly found in disturbed areas although vegetation diversity is positively associated with presence.	Possible. Some marginal habitat present in the drainage line present in the study area. However, this species has not been recorded, despite targeted surveys
Amphibia	Myobatrachidae	*Heleioporus australiacus*	Giant Burrowing Frog	V	V	Distribution is dependent on areas with native vegetation. Found in various vegetation communities including heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based. Associated with hanging swamps and perennial creeks in the northern portion of its range, and forest communities in the southern portion. Uses wet habitats for breeding.	Unlikely. No suitable habitat
Amphibia	Myobatrachidae	*Pseudophryne australis*	Red-crowned Toadlet	V		Occurs in open forests, mostly on Hawkesbury and Narrabeen Sandstones. Inhabits periodically wet drainage lines	Unlikely. No suitable habitat

Table B.1 Threatened fauna species recorded in the locality (OEH, 2017) and an assessment of their likelihood of occurrence on the subject site

Class	Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Likelihood of Occurrence
						below sandstone ridges that often have shale lenses or cappings. Shelters under rocks and amongst masses of dense vegetation or thick piles of leaf litter. Breeding congregations occur in dense vegetation and debris beside ephemeral creeks and gutters.	
Aves	Accipitridae	^^*Lophoictinia isura*	Square-tailed Kite	V		Commonly found around timbered watercourses in dry woodlands and open forests. Forages over large distances feeding on passerines. Often encountered in habitats with open acacia scrub, low open eucalypt woodland and grassy groundcover.	Possible. Some marginal habitat present in the open woodland present in the study area, as part of a large home range
Aves	Accipitridae	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	V	Ma , Mi	Found in coastal and terrestrial habitats along the coast of Australia. Known to occur near the sea or sea-shore around bays, lakes, billabongs, beaches etc. Recorded in terrestrial habitats including coastal dunes, grassland, heathland, woodland, forest and even urban areas.	Unlikely. No suitable habitat

Table B.1 Threatened fauna species recorded in the locality (OEH, 2017) and an assessment of their likelihood of occurrence on the subject site

Class	Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Likelihood of Occurrence
Aves	Accipitridae	*Hieraaetus morphnoides*	Little Eagle	V		Occurs in open eucalypt, Sheoak or Acacia forest, woodland and open woodlands. Also encountered in riparian woodlands. Requires tall living trees for nesting.	Possible. Some marginal habitat present in the open woodland present in the study area, as part of a large home range
Aves	Artamidae	*Artamus cyanopterus cyanopterus*	Dusky Woodswallow	V		In New South Wales the species is widespread from coast to inland, including the western slopes of the Great Dividing Range and farther west. The Dusky Woodswallow is found in woodlands and dry open sclerophyll forests, usually dominated by eucalypts, including mallee associations. The species primarily eats invertebrates, mainly insects, which are captured whilst hovering and sallying above the canopy or over water.	Unlikely. No suitable habitat
Aves	Cacatuidae	^^*Callocephalon fimbriatum*	Gang-gang Cockatoo	V		Occurs in tall mountain forests and woodlands in summer and drier more open eucalypt forests and woodlands in winter, and often found in urban areas. Require old growth attributes for nesting and roosting.	Possible. Suboptimal habitat present, mainly in the intact areas of woodland in the study area, which includes some hollow-bearing trees suitable for nesting.

Table B.1 Threatened fauna species recorded in the locality (OEH, 2017) and an assessment of their likelihood of occurrence on the subject site

Class	Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Likelihood of Occurrence
Aves	Cacatuidae	^*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V		Inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1000 m in which stands of she-oak species, particularly Allocasuarina littoralis, A. torulosa or A. verticillata occur. Feeds almost exclusively on the seeds of several species of she-oak (Casuarina and Allocasuarina species). Dependent on large hollow-bearing eucalypts for nest sites.	Unlikely. No suitable habitat
Aves	Climacteridae	*Climacteris picumnus victoriae*	Brown Treecreeper (eastern subspecies)	V		Typically found in dry open forest and eucalypt woodlands dominated by stringybarks and other rough-barked eucalypts, and an open grassy understorey. Requires fallen timber for foraging for insect and ants. Hollows are also essential for nesting.	Possible. Suboptimal foraging habitat present, mainly in the intact areas of woodland with fallen timber in the study area.
Aves	Meliphagidae	*Anthochaera phrygia*	Regent Honeyeater	CE	CE	Generally occurs in temperate woodlands and open forests particularly Box-Ironbark woodland and River Sheoak riparian forests but also known to occur in drier coastal woodlands.	Possible. Suboptimal foraging habitat present, mainly in the intact areas of woodland in the study area.

Table B.1 Threatened fauna species recorded in the locality (OEH, 2017) and an assessment of their likelihood of occurrence on the subject site

Class	Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Likelihood of Occurrence
Aves	Meliphagidae	*Melithreptus gularis*	Black-chinned Honeyeater (eastern subspecies)	V		Occurs in the upper levels of dry open forests and woodlands, dominated by box and ironbark eucalypts. Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks, river sheoaks and tea-trees.	Possible. Suboptimal foraging habitat present, mainly in the intact areas of woodland in the study area.
Aves	Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella	V		Eucalypt forest and woodlands, especially with rough barked species, smooth-barks with dead branches, mallee and acacia. Nests in living trees and feeds off insects in dead trees	Possible. Suboptimal foraging habitat present, mainly in the intact areas of woodland in the study area.
Aves	Petroicidae	*Petroica boodang*	Scarlet Robin	V		Occurs in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and regrowth vegetation. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps. Habitat usually contains abundant logs and fallen timber. Nests are often found in a dead branch in a live tree, or in a dead tree or shrub.	Possible. Suboptimal foraging habitat present, mainly in the intact areas of woodland with fallen timber in the study area.

Table B.1 Threatened fauna species recorded in the locality (OEH, 2017) and an assessment of their likelihood of occurrence on the subject site

Class	Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Likelihood of Occurrence
Aves	Psittacidae	^^*Lathamus discolor*	Swift Parrot	E	CE	Semi-nomadic species foraging in dry box-ironbark forest and woodlands, but also the coastal plains forest. Widespread along the south-eastern coast of Australia, however demonstrate high site fidelity.	Possible. Suboptimal foraging habitat present, mainly in the intact areas of woodland in the study area.
Aves	Psittacidae	*Glossopsitta pusilla*	Little Lorikeet	V		Forages primarily in the canopy of open eucalypt forest and woodland, yet also finds food in Angophoras, Melaleucas and other tree species. Riparian habitats are particularly used and also utilises isolated flowering trees in open country, e.g. paddocks, roadside remnants and urban trees. Roosts in treetops, often distant from feeding areas. Nests in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of smooth-barked Eucalypts.	Possible. Suboptimal habitat present, mainly in the intact areas of woodland in the study area, which includes some hollow-bearing trees suitable for nesting.
Aves	Strigidae	^^*Ninox strenua*	Powerful Owl	V		Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. Also occurs in fragmented habitats.	Possible. Suboptimal habitat present, mainly in the intact areas of woodland in the study area, which includes some hollow-bearing trees suitable for nesting.

Table B.1 Threatened fauna species recorded in the locality (OEH, 2017) and an assessment of their likelihood of occurrence on the subject site

Class	Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Likelihood of Occurrence
Gastropoda	Camaenidae	*Meridolum corneovirens*	Cumberland Plain Land Snail	E		Associated with Cumberland Plain Woodlands, a grassy open woodland, although it is also known to occur in Shale Gravel Transition Forests, Castlereagh Swamp Forests and River-flat Eucalypt forests. Often found under litter, bark and logs.	Known to occur in study area. Habitat occurs in all intact patches of CPW in the study area
Mammalia	Burramyidae	*Cercartetus nanus*	Eastern Pygmy-possum	V		Species is found in a broad range of habitats from rainforest to wet and dry sclerophyll forests through to woodland and heath. Woodland and heath habitats are preferred. The species feeds on pollen and nectar from banksias, eucalypts, and bottlebrushes, though will eat soft fruits when flowers are unavailable, and will also eat insects throughout the year. They shelter in tree hollows, rotten stumps, holes in the ground, abandoned birds' nests and Ringtail Possum dreys, and thickets of vegetation. Tree hollows are preferred for nesting but the species will also nest under tree bark and shredded bark in tree forks.	Unlikely. No suitable habitat

Table B.1 Threatened fauna species recorded in the locality (OEH, 2017) and an assessment of their likelihood of occurrence on the subject site

Class	Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Likelihood of Occurrence
Mammalia	Emballonuridae	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat	V		Roosts in tree hollows and buildings and forages over most habitats, with or without trees, in its very wide range.	Possible. Suboptimal foraging and denning habitat present in the in the study area.
Mammalia	Molossidae	*Mormopterus norfolkensis*	Eastern Freetail-bat	V		Occur in dry sclerophyll forest and woodland east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures.	Possible. Suboptimal foraging and denning habitat present in the more intact woodland in the study area.
Mammalia	Petauridae	*Petaurus norfolcensis*	Squirrel Glider	V		Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas.	Possible. Suboptimal foraging and denning habitat present in the more intact woodland in the study area.
Mammalia	Petauridae	*Petaurus australis*	Yellow-bellied Glider	V		Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Forest type preferences vary with latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south. Very mobile and occupy large home ranges between 20 to 85 ha to encompass	Unlikely. No suitable habitat

Table B.1 Threatened fauna species recorded in the locality (OEH, 2017) and an assessment of their likelihood of occurrence on the subject site

Class	Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Likelihood of Occurrence
						dispersed and seasonally variable food resources.	
Mammalia	Phascolarctidae	*Phascolarctos cinereus*	Koala	V	V	Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size.	Possible. A small number of records occur close to the study area, within the Georges River riparian area to the east. It is known that the locality supports a very low density of Koalas. Koala feed trees are very sparse in the study area, and it is unlikely that the area would represent more than a movement corridor for a small number of individuals.
Mammalia	Pteropodidae	*Pteropus poliocephalus*	Grey-headed Flying-fox	V	V	Roosts in large camps located close to a regular food source, often in gullies with a dense canopy near water. Habits include temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps.	Known to occur in study area. Foraging habitat present, but no roost camps present within the study area.
Mammalia	Vespertilionidae	*Chalinolobus dwyeri*	Large-eared Pied Bat	V	V	Found in well-timbered areas containing gullies. Roosts in caves, crevices in cliffs and old mine workings frequenting low to	Unlikely. No suitable forest types present in the study area and roosting habitat not available within

Table B.1 Threatened fauna species recorded in the locality (OEH, 2017) and an assessment of their likelihood of occurrence on the subject site

Class	Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Likelihood of Occurrence
						mid-elevation dry open forest and woodland close to these features.	or close to the study area
Mammalia	Vespertilionidae	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle	V		Prefers moist habitats, with trees taller than 20 m. Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings.	Possible. Some moist forest types occur in the study area, suitable for foraging and roosting
Mammalia	Vespertilionidae	*Miniopterus australis*	Little Bentwing-bat	V		Forages in moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. They roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings.	Known to occur in the Project Boundary. Suboptimal habitat occurs within the intact woodland in the study area. More suitable habitat occurs in the Georges River riparian area to the east of the study area.
Mammalia	Vespertilionidae	*Miniopterus schreibersii oceanensis*	Eastern Bentwing-bat	V		Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Hunt in forested areas, catching moths and other flying insects above the tree tops.	Known to occur in study area. Foraging habitat present, but a lack of roosting habitat in the study area.
Mammalia	Vespertilionidae	*Myotis macropus*	Southern Myotis	V		Forages over streams and pools to catch	Possible. Suitable foraging habitat in

Table B.1 Threatened fauna species recorded in the locality (OEH, 2017) and an assessment of their likelihood of occurrence on the subject site

Class	Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Likelihood of Occurrence
						insects and small fish. Roosts in small groups in caves, hollow-bearing trees, buildings close to water.	the dam and roosting habitat in hollow-bearing trees present in study area.
Mammalia	Vespertilionidae	*Scoteanax rueppellii*	Greater Broad-nosed Bat	V		More commonly found in tall wet forest but also occurs in dry eucalypt forest. Roosts in tree hollows and buildings. Forages along creek and river corridors.	Possible. This species has been recorded elsewhere in the Project Boundary, and suboptimal habitat is present in the study area. This species would be more likely to utilise the Georges River riparian corridor to the east for foraging.
Reptilia	Elapidae	*^Hoplocephalus bungaroides*	Broad-headed Snake	E	V	Inhabits rocky outcrops adjacent to sclerophyll forest and woodland. Often found in sandstone ridgetops under rocks and in crevices.	Unlikely. No suitable habitat

Key: TSC Act and EPBC Act Status - V = Vulnerable, E = Endangered, CE = Critically Endangered, C/J/K = Listed under international migratory agreements

Atlas records are from between 1990 -2017 (OEH, 2017)

Appendix C

Flora Species List

Table C.1 Flora species recorded on the subject site

Family		Scientific Name	Common Name	CPW	Exotic grassland	Acacia regeneration	Round-about to Sth	NE Random meander	Drainage line
Family	*	Scientific Name	Common Name						
Casuarinaceae		*Casuarina glauca*	Swamp Oak		X				
Myrtaceae		*Corymbia citriodora*	Lemon-scented Gum		X				
Myrtaceae		*Corymbia maculata*	Spotted Gum		X			X	
Myrtaceae		*Eucalyptus crebra*	Narrow-leaved Ironbark		X				
Myrtaceae		*Eucalyptus sideroxylon*	Mugga Ironbark		X				
Myrtaceae		*Eucalyptus tereticornis*	Forest Red Gum	X	X				
Casuarinaceae		*Casuarina glauca*	Swamp Oak	X					X
Myrtaceae		*Eucalyptus tereticornis*	Forest Red Gum	X					
Fabaceae (Mimosoideae)		*Acacia decurrens*	Black Wattle	X					
Fabaceae (Mimosoideae)		*Acacia implexa*	Hickory Wattle	X	X			X	
Fabaceae (Mimosoideae)		*Acacia parramattensis*	Parramatta Wattle			X			
Malvaceae		*Brachychiton populneus*	Kurrajong	X					
Meliaceae		*Melia azedarach*	White Cedar	X					
Myrtaceae		*Eucalyptus tereticornis*	Forest Red Gum	X					
Myrtaceae		*Melaleuca quinquenervia*	Broad-leaved Paperbark		X				
Oleaceae	*	*Ligustrum lucidum*	Large-leaved Privet	X		X			

Table C.1 Flora species recorded on the subject site

Family		Scientific Name	Common Name	CPW	Exotic grassland	Acacia regeneration	Round-about to Sth	NE Random meander	Drainage line
Pittosporaceae		*Bursaria spinosa*	Blackthorn	X					
Rosaceae	*	*Cotoneaster glaucophyllus*	Glaucous Cotoneaster	X					
Arecaceae	*	*Phoenix canariensis*	Canary Island Date Palm	X					
Alliaceae	*	*Nothoscordum borbonicum*	Onion Weed		X				
Apiaceae	*	*Cyclospermum leptophyllum*	Slender Celery				X		
Apiaceae	*	*Foeniculum vulgare*	Fennel				X		
Apocynaceae	*	*Gomphocarpus fruticosus*	Narrow-leaved Cotton Bush		X				
Araliaceae	*	*Hedera helix*	English Ivy				X		
Asteraceae	*	*Aster sp.*	-		X		X		
Asteraceae	*	*Bidens pilosa*	Cobblers Peg	X	X			X	
Asteraceae	*	*Cirsium vulgare*	Spear Thistle		X		X		
Asteraceae	*	*Conyza bonariensis*	Flaxleaf Fleabane		X	X	X	X	
Asteraceae	*	*Hypochaeris radicata*	Catsear		X	X	X	X	
Asteraceae	*	*Senecio madagascariensis*	Fireweed		X	X	X	X	
Asteraceae	*	*Soliva sessilis*	Bindyi					X	
Asteraceae	*	*Sonchus asper*	Prickly Sowthistle				X		
Brassicaceae	*	*Rapistrum rugosum*	Giant Mustard Weed					X	
Campanulaceae		*Wahlenbergia gracilis*	Sprawling Bluebell		X		X		
Caryophyllaceae	*	*Paronychia brasiliana*	Chilean Whitlow		X				

Table C.1 Flora species recorded on the subject site

Family		Scientific Name	Common Name	CPW	Exotic grassland	Acacia regeneration	Round-about to Sth	NE Random meander	Drainage line
Chenopodiaceae		*Einadia trigonos*	Fishweed		X				
Clusiaceae	*	*Hypericum perforatum*	St. John's Wort		X	X			
Convolvulaceae		*Dichondra repens*	Kidney Weed	X	X	X			
Euphorbiaceae	*	*Euphorbia peplus*	Petty Spurge				X		
Fabaceae (Faboideae)	*	*Trifolium dubium*	Yellow Suckling Clover		X				
Fabaceae (Faboideae)	*	*Trifolium repens*	White Clover		X		X		
Fabaceae (Mimosoideae)		*Acacia implexa*	Hickory Wattle						X
Malvaceae	*	*Modiola caroliniana*	Red-flowered Mallow		X				
Malvaceae	*	*Sida rhombifolia*	Paddy's Lucerne	X	X				
Myrtaceae		*Corymbia maculata*	Spotted Gum					X	
Oxalidaceae		*Oxalis perennans*	-		X		X	X	
Oxalidaceae		*Oxalis sp.*	-	X					
Plantaginaceae	*	*Plantago lanceolata*	Lamb's Tongues	X	X	X	X	X	
Plantaginaceae	*	*Veronica officinalis*	Heath Speedwell		X				
Polygalaceae		*Persicaria hydropiper*	Water Pepper						X
Polygalaceae	*	*Polygonum aviculare*	Wireweed				X		
Polygonaceae	*	*Rumex crispus*	Curled Dock			X			

Table C.1 Flora species recorded on the subject site

Family		Scientific Name	Common Name	CPW	Exotic grassland	Acacia regeneration	Round-about to Sth	NE Random meander	Drainage line
Rosaceae	*	*Rubus fruticosus aggregate*	Blackberry			X			X
Rubiaceae		*Asperula conferta*	Common Woodruff	X					
Solanaceae	*	*Solanum nigrum*	Black-berry Nightshade		X		X		
Verbenaceae		*Verbena africana*	-				X		
Verbenaceae	*	*Verbena bonariensis*	Purpletop			X		X	
Poaceae	*	*Andropogon virginicus*	Whisky Grass		X				
Poaceae	*	*Axonopus fissifolius (syn. A. affinis)*	Narrow-leafed Carpet Grass		X				
Poaceae		*Bothriochloa macra*	Red Grass		X			X	
Poaceae	*	*Bromus catharticus*	Prairie Grass		X				
Poaceae	*	*Cenchrus clandestinus*	Kikuyu Grass	X					
Poaceae		*Cymbopogon refractus*	Barbed Wire Grass		X				
Poaceae	*	*Cynodon dactylon*	Couch Grass		X	X			
Poaceae		*Dichelachne micrantha*	Short Plumegrass	X				X	
Poaceae		*Echinopogon caespitosus*	Bushy Hedgehog-grass	X					
Poaceae	*	*Ehrharta erecta*	Panic Veldtgrass	X	X				
Poaceae	*	*Eragrostis curvula*	African Love Grass	X	X				
Poaceae		*Eragrostis leptostachya*	Paddock Lovegrass		X				
Poaceae		*Microlaena stipoides*	Weeping Grass	X	X	X			
Poaceae	*	*Paspalum dilatatum*	Paspalum	X	X	X		X	

Table C.1 Flora species recorded on the subject site

Family		Scientific Name	Common Name	CPW	Exotic grassland	Acacia regeneration	Round-about to Sth	NE Random meander	Drainage line
Poaceae	*	*Pennisetum clandestinum*	Kikuyu Grass		X	X		X	
Poaceae		*Rytidosperma racemosum var. racemosum*	-	X					
Poaceae	*	*Setaria parviflora (syn. S. gracilis)*	Pigeon Grass		X	X		X	
Poaceae		*Sporobolus creber*	Western Rat-tail Grass		X				
Poaceae	*	*Eragrostis curvula*	African Lovegrass	X					
Anthericaceae		*Tricoryne elatior*	Yellow Autumn-lily		X				
Cyperaceae		*Carex inversa*	-		X				
Juncaceae		*Juncus usitatus*	-	X					
Typhaceae		*Typha orientalis*	Broadleaf Cumbungi						X
Apocynaceae	*	*Araujia sericifera (syn. A. hortorum)*	Moth Vine	X	X	X	X		
Asparagaceae	*	*Asparagus aethiopicus*	Ground Asparagus 'Fern'	X	X				
Asparagaceae	*	*Asparagus asparagoides*	Bridal Creeper	X					
Fabaceae		*Glycine clandestina*	-	X					
Fabaceae (Faboideae)		*Glycine microphylla*	Small-leaf Glycine		X			X	
Fabaceae (Faboideae)		*Glycine tabacina*	-	X	X				
Fabaceae (Faboideae)	*	*Vicia sativa*	-		x				

*Notes: * = exotic species, X = recorded in survey area*

Appendix D

Fauna Species List

Table D.1 Fauna species recorded during surveys on the study area by Cumberland Ecology (2015 and 2017)

Family		Scientific Name	Common Name
AVES			
Charadriidae		*Vanellus miles*	Masked Lapwing
Rallidae		*Porphyrio porphyrio*	Purple Swamphen
Corvidae		*Corvus coronoides*	Australian Raven
Cacatuidae		*Cacatua galerita*	Sulphur-crested Cockatoo
Psittacidae		*Platycercus eximius*	Eastern Rosella
Psittacidae		*Trichoglossus haematodus*	Rainbow Lorikeet
Meliphagidae		*Manorina melanocephala*	Noisy Miner
Sturnidae	*	*Acridotheres tristis*	Common Myna
Anatidae		*Chenonetta jubata*	Australian Wood Duck
Cacatuidae		*Cacatua tenuirostris*	Long-billed Corella
Cacatuidae		*Cacatua roseicapilla*	Galah
Halcyonidae		*Dacelo novaeguineae*	Laughing Kookaburra
Campephagidae		*Coracina novaehollandiae*	Black-faced Cuckoo-shrike
Cuculidae		*Scythrops novaehollandiae*	Channel-billed Cuckoo
Artamidae		*Cracticus torquatus*	Grey Butcherbird
Phalacrocoracidae		*Phalacrocorax sulcirostris*	Little Black Cormorant
Rallidae		*Fulica atra*	Eurasian Coot
Hirundinidae		*Hirundo neoxena*	Welcome Swallow
Rhipiduridae		*Rhipidura leucophrys*	Willie Wagtail
Monarchidae		*Grallina cyanoleuca*	Magpie-lark
Artamidae		*Gymnorhina tibicen*	Australian Magpie
Columbidae		*Ocyphaps lophotes*	Crested Pigeon
OTHER			
Anguillidae		*Anguilla reinhardtii*	Longfin Eel

Appendix E

Assessments of Significance

E.1 Threatened Ecological Communities

E.1.1 Cumberland Plain Woodland

Cumberland Plain Woodland (CPW) occurs in two forms; Shale Hills Woodland and Shale Plains Woodland. Shale Hills Woodland occurs in the south of the Cumberland Plain in more elevated areas. Shale Plains Woodland (SPW) is more widely distributed, occurring throughout the drier areas of the Cumberland Plain (NSW NPWS, 2001a). Dominant canopy species include Grey Box (*Eucalyptus moluccana*), Forest Red Gum (*E. tereticornis*), Narrow-leaved Ironbark (*E. crebra*), Spotted Gum (*Corymbia maculata*) and Thin-leaved Stringybark (*E. eugenioides*). The shrub layer is dominated by Blackthorn (*Bursaria spinosa*). Grasses dominate the ground layer (Benson and Howell, 1990).

The community is well adapted to fire and drought but is now under threat from disturbance triggering weed invasion, increased soil nutrients, rubbish dumping and altered fire regimes (NSW NPWS, 2001a).

In December 2009, the NSW Scientific Committee released a final determination for the listing of Cumberland Plain Woodland as a critically endangered ecological community. The definition of the community in this final determination includes areas of derived native grasslands, referring to areas where trees and shrubs have been cleared but a native understorey typical of Cumberland Plain Woodland still exists.

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

Not applicable.

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

Not applicable.

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

> *(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
>
> *(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction*

The CPW to be removed on the subject site occurs as small patches in three forms; A single patch of moderate quality CPW with a native canopy and native dominated understorey, and

totalling 0.29 ha, will be removed from the centre of the subject site, a patch of young regenerating CPW, totalling 0.07 ha will be removed from the north, and scattered small patches of low condition CPW with a native canopy and absent or exotic dominated understorey present throughout the subject site. In the context of impacts to the local occurrence of this community, the removal of CPW on the subject site is from sparse and degraded patches and will not impact on the larger intact patch to the north west, which totals more than 3 ha (post development on the Project Boundary). While increased fragmentation will occur throughout the landscape as a result of the proposed development, the works will not further fragment the larger intact patch of CPW, therefore the local occurrence of this community is expected to remain viable. The conservation area and high quality CPW patch will be expanded in area and the condition improved through active management.

There is a possibility that the composition of CPW may be modified in the adjoining areas of the study area, due to an increase in edge effects from the future infrastructure areas. However, such impacts are considered to be minimal, given the existing urban environment, and the suite of mitigation measures will be implemented to reduce impacts from the proposed development. Any edge-effects that may occur are expected to be localised, and would not be expected to adversely modify composition to place the local occurrence at risk of extinction.

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

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

It is assumed that all CPW within the subject site will be removed or substantially modified for the proposed development. The proposed development of the subject site will remove an area of approximately 0.40 ha of CPW. However, the most intact and large patch of CPW which occurs to the north west, will be retained in the Bushland Conservation Zones, and totals 3.6 ha.

The CPW of the study area occurs in isolated patches in the western extent of the site, which are already fragmented by existing development. Therefore the proposed development will not act to isolate any patches of woodland that occur outside of the development areas. The regenerating woodland on the subject site is sparse and is separated from the proximate patches. The proposed development will therefore marginally contribute to the increasing fragmentation of habitat within the study area.

The CPW to be removed or modified as a result of the proposed development is not likely to be of great importance to the long-term survival of the community within the locality. CPW of high conservation significance will be conserved within the Bushland Conservation Zones, and the offsite offset areas, that will be managed for conservation.

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

No critical habitat for this endangered ecological community has currently been identified by the Director-General of the OEH.

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

A Recovery Plan for the Cumberland Plain has been gazetted. The main actions proposed in the Recovery Plan include:

- Building the protected area network;
- Delivering best practice management;
- Promoting awareness, education and engagement; and
- Enhancing information, monitoring and enforcement.

The proposed development is consistent with these actions because the largest and best quality areas of CPW in the Project Boundary will be conserved, adding to the protected area network with opportunity to deliver best practice management. The sparse patches of CPW on the subject site are comparatively small and degraded compared to those represented in the conservation areas and will not greatly add to the viability of the community if retained, once the subject site is developed for urban purposes.

There are no threat abatement plans relevant to CPW.

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

The proposed development will result in the threatening process 'Clearing of native vegetation'. However, the vegetation to be cleared occurs as sparse and degraded patches, and is therefore already experiencing key threatening processes associated with edge-effects. The highest quality examples of the community will be conserved within the bushland conservation zones.

Other key threatening processes that may be increased as a result of the proposed development include:

- Competition and grazing by the Feral European Rabbit;
- Ecological consequence of high frequency fires; and

- Invasion of native plant communities by exotic perennial grasses.

The effects of rabbits are not likely to be greatly exacerbated by the proposed development, beyond current conditions.

The BMP has been designed to mitigate factors that could lead to high frequency fires. The plan of management for the bushland conservation zones will also ensure that this process is not exacerbated.

A Weed Management Plan will be implemented to reduce the impacts of exotic perennial grasses.

Conclusion

The development of the subject site will remove a relatively small area of habitat for this community, which occurs as sparse and degraded patches of woodland totalling 0.40 ha. However, the proposed development is not likely to have a significant impact on CPW such that the viable representatives in the bushland conservation zones would be placed at risk of extinction. No Species Impact Statement is required for the proposed clearing of this community.

E.2 Threatened Fauna Species

E.2.1 Cumberland Plain Land Snail

The Cumberland Plain Land Snail inhabits a very small area on the Cumberland Plain west of Sydney from Richmond and Windsor south to Picton and from Liverpool west to the Hawkesbury and Nepean Rivers at the base of the Blue Mountains. It primarily occurs in CPW, which is a grassy open woodland with occasional dense patches of shrubs. It lives under litter or bark, leaves and logs or shelters in loose soil around grass clumps (OEH 2013b). The Cumberland Plain Land Snail is listed as Vulnerable on Schedule 2 of the TSC Act (NSW Scientific Committee, 1997a).

a) In the case of a threatened species, whether the lifecycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

Little is known about the range of the Cumberland Plain Land Snail and the area required for a viable population, but it is thought that the remaining total population on the Cumberland Plain Land Snail consists of several disjunct populations (NSW Scientific Committee, 1997a). The study area is likely to support a sub-population of this species, confined mainly to the intact patches of CPW. The Cumberland Plain Land Snail is likely to be present within most or all of the larger patches of CPW in the study area.

The CPW present on the subject site is likely to provide suitable habitat, however, this habitat occurs as sparse and degraded patches, and hence it would be more greatly impacted by disturbance from edge-effects and trampling. The remaining portion of the patch constitutes the most intact and important habitat for this species, which will be retained in a

biodiversity conservation area and actively managed. Therefore, it is not likely that the proposed development would disrupt the life-cycle of this species.

Furthermore, because the CPW patches in the study area are isolated from other patches, it is questionable as to whether the sub-population would be viable in the long term as it may not survive stochastic events such as a long drought periods or disease.

b) In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised,

There are no populations of this species listed as endangered under the TSC Act.

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

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

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

Not applicable.

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

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

(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

(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.

A total of 0.29 ha of potential habitat (in the form of intact CPW) will be removed on the subject site. This represents a small area of the potential habitat for this species, while the large and intact proximate patch will be retained in the Bushland Conservation Area.

The potential habitat for this species occurs in patches fragmented from other occurrences in the study area. The proposed development will contribute to the existing fragmentation of the urban landscape to a minor extent, although the subject site is not part of a vegetated corridor.

The habitat to be removed, modified or isolated as a result of the proposed development may be important to the long-term survival of the species within the locality. However, areas

of known higher quality habitat occur within the bushland conservation zones in the study area, and conservation reserves in the locality.

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

No critical habitat for this species has currently been identified by the Director-General of the OEH.

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

A recovery plan has not been prepared for this species. No threat abatement plans are relevant to this species.

The Cumberland Plain Recovery Plan (DECCW 2011) focuses primarily on vegetation that constitutes habitat for this species.

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

Clearing of native vegetation resulting in the loss of habitat is a listed threatening process under the TSC Act. An area totalling 0.29 ha of potential habitat will be cleared for the proposed development. However, more intact patches, will be retained in bushland conservation zones in the study area, which will be managed to improve fauna habitat.

No other key threatening process that may be exacerbated by the proposed action will affect this species.

Conclusion

The proposed development is not likely to have a significant impact on the Cumberland Plain Land Snail. No species impact statement is required.

E.2.2 Woodland Birds

The following woodland bird species have potential to occur in the study area, although none of these species have been recorded on the subject site:

- Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*) – Vulnerable under the TSC Act;
- Regent Honeyeater (*Anthochaera phrygia*) – Critically Endangered under the TSC Act and EPBC Act;
- Black-chinned Honeyeater (eastern subspecies) (*Melithreptus gularis gularis*) – Vulnerable under the TSC Act;
- Varied Sittella (*Daphoenositta chrysoptera*) – Vulnerable under the TSC Act;

- Scarlet Robin (*Petroica boodang*) – Vulnerable under the TSC Act;
- Swift Parrot (*Lathamus discolor*) – Endangered under the TSC Act and EPBC Act; and
- Little Lorikeet (*Glossopsitta pusilla*) - Vulnerable under the TSC Act

The Brown Tree-creeper is known from inland plains and slopes of the Great Dividing Range and is less commonly found on coastal plains and ranges. The eastern subspecies lives in eastern NSW in eucalypt woodlands through central NSW and in coastal areas with drier open woodlands including the Cumberland Plain. It mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species (OEH, 2014b).

The Regent Honeyeater mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia but are also found in drier coastal woodlands and forests in some years. There are only three known key breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region. The Regent Honeyeater is a generalist forager, although it feeds mainly on the nectar from a relatively small number of eucalypts that produce high volumes of nectar, particularly in Box-Ironbark communities and riparian vegetation. (OEH, 2014e).

Black-chinned Honeyeater is recognised as two distinct subspecies in NSW, with the distribution of the eastern subspecies extending south from central Queensland, through NSW, Victoria into south eastern South Australia. In NSW it is widespread, with records from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina, although rarely recorded east of the Great Dividing Range. Foraging occurs mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts. Recent studies have found that the Black-chinned Honeyeater tends to occur in the largest woodland patches in the landscape as birds forage over large home ranges of at least 5 hectares (OEH, 2014a).

The Varied Sittella is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands. Its distribution in NSW is nearly continuous from the coast to the far west. The Varied Sittella's population size in NSW is uncertain but is believed to have undergone a moderate reduction over the past several decades (OEH 2012l).

The Scarlet Robin is found from south east Queensland to south east South Australia and also in Tasmania and south west Western Australia. In NSW, it occurs from the coast to the inland slopes. The species lives in dry eucalypt forests and woodlands with an open and grassy understorey with few scattered shrubs and abundant logs. This species lives in both mature and regrowth vegetation (OEH, 2013)

The Swift Parrot breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. This species commonly use lerp infested trees include *Eucalyptus microcarpa* (Inland Grey Box), *E. moluccana* (Grey Box) and *E. pilularis*

(Blackbutt) and they return to some foraging sites on a cyclic basis depending on food availability (OEH, 2014f).

The Little Lorikeet is found across the coastal and Great Divide regions of eastern Australia from Cape York to South Australia. Many individuals are nomadic, influenced by season and food availability however some individuals display residency. This species forages primarily on nectar and pollen in open Eucalypt forest and woodland, feeding also on Angophora, Melaleuca and other tree species. This species prefers riparian habitat, however is occasionally seen in open country and urban environments including paddocks, roadside remnants. Little Lorikeet roost in tree tops and typically selects small hollows high above the ground. Selected hollows are often repeatedly used for decades (OEH, 2014c).

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,*

Development of the subject will remove a relatively small area of potential habitat for these woodland bird species. However, this potential habitat is considered to be marginal, and part of a large foraging range for these species and therefore the proposed development is not likely to place a local population of the species at risk of extinction.

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

There are no populations of the species that are listed as endangered under the TSC Act.

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

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

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

Not applicable.

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

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

(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

(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.

Approximately 0.86 ha of marginal potential habitat will be removed on the subject site for the proposed works. However, larger and more intact patches will be retained in the study area, within the bushland conservation zones.

The potential habitat for the species in the study area occurs in sparse patches that are fragmented from larger occurrences in the Georges River Reserve to the east. The proposed development will not act to further fragment the remaining patches in the study area, as it is at the western extent of the development area, and is not part of a vegetated corridor.

The habitat to be removed, modified or isolated as a result of the proposed development is not likely to be important to the long-term survival of the species within the locality. Areas of higher quality habitat occur within the vegetation be conserved in the study area and will be managed for conservation.

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

No critical habitat for this species has currently been identified by the Director-General of the OEH.

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

The Red Fox threat abatement plan is relevant to these species, although the birds are not a priority species listed in the plan. The proposed development is consistent with the objectives of the plan.

No recovery plan has been prepared for the species.

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*

The proposed development will result in Clearing of native vegetation. However, the vegetation to be cleared consists of sparse and degraded areas of habitat for the species, and would not reach the minimum patch size required for occupation by these species. For this reason, the patch of native vegetation present would represent marginal, occasional foraging habitat, and would not be critical to the survival of a local population of the species. Larger areas of better quality habitat will be conserved within the bushland conservation zones and the east in the Georges River Reserve.

Other key threatening processes that may be increased as a result of the proposed development include:

- Predation by the European Red Fox; and
- Predation by the Feral Cat.

However, the abundance of feral and domestic animals is not likely to be greatly exacerbated by the proposed development, beyond current conditions.

Conclusion

The proposed development will not have significant impacts on the woodland bird species such that a local population would be placed at risk of extinction.

E.2.3 Powerful Owl

The Powerful Owl is distributed from Mackay to south western Victoria, mainly on the coastal side of the Great Dividing Range. This species occurs in many vegetation types from woodland and open sclerophyll to tall open wet forest and rainforest. It requires large tracts of native vegetation but can survive in fragmented landscapes. It roosts in dense vegetation and nests in large tree hollows. The Powerful Owl is listed as Vulnerable under the TSC Act (OEH, 2014d).

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*

The Powerful Owl has potential to use the subject site for foraging habitat as part of a much larger foraging range. They are highly mobile species that access resources from across a wide area and would not depend upon resources contained on the subject site for their survival. A number of scattered trees with large sized hollows, suitable for nesting by this species are present in the study area. The proposed works are not likely to place a viable local population of any of these species at risk of extinction due to the limited amount of foraging and breeding habitat present within the study area and subject site.

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

Not applicable.

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

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

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

Not applicable.

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

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

(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

(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.

Approximately 0.86 ha of marginal potential foraging habitat will be removed on the subject site for the proposed works. This represents a relatively small area of potential foraging habitat within the locality for this species. No hollow-bearing trees were recorded on the subject site, therefore no nesting habitat is present. Habitat is well represented in reserves in the locality, and in urban areas that support prey for this species, such as rats and possums. Native vegetation will be retained in areas adjoining the subject site, within the bushland conservation zones in the Project Boundary and the Georges River Reserve to the east. For these reasons, it is not considered the subject site would constitute important habitat for these species.

The potential habitat for the species in the study area occurs in sparse patches that are fragmented from larger occurrences in the Georges River Reserve to the east. The proposed development will however increase the effects of existing fragmentation. The proposed development will not act to further fragment the remaining patches, as it is at the south western extent of the development area, and is not part of a vegetated corridor.

The habitat to be removed, modified or isolated as a result of the proposed development is not likely to be important to the long-term survival of the species within the locality. Areas of higher quality habitat occur within the vegetation be conserved within the Project Boundary and managed for conservation.

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

No critical habitat for any of these species has currently been identified by the Director-General of the OEH.

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

A recovery plan has been prepared for large forest owls, including the Powerful Owl (DEC (NSW), 2006). The ultimate aim of the recovery plan is to ensure that the species it covers

persist in the wild in NSW in each region where they presently occur. The proposal is not considered to conflict with the objectives of the Recovery Plan.

The following main objectives are relevant to the proposed works:

- Objective 4: Ensure the impacts on large forest owls and their habitats are adequately assessed during planning and environmental assessment processes; and
- Objective 5: Minimise further loss and fragmentation of habitat by protection and more informed management of significant owl habitat (including protection of individual nest sites).

The proposed works do not involve the removal of significant owl habitat. The proposal is considered to be consistent with the objectives in that it will not decrease or fragment the extent of significant habitat for this species. The proposed works will not significantly increase the current level of isolation from nearby areas of forest or woodland on neighbouring properties.

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.

The following key threatening processes are relevant to the proposed works:

- Clearing of native vegetation;
- Removal of dead wood and dead trees;
- Invasion, establishment and spread of Lantana (*Lantana camara*);
- Invasion and establishment of exotic vines and scramblers; and
- Invasion of native plant communities by exotic perennial grasses.

The key threatening processes of 'clearing of native vegetation' and 'removal of dead wood and dead trees' potentially impact habitat for the owl species further than current conditions. However, the vegetation on the subject site is small in area, and would constitute a small portion of the total habitat within the home range of this species. Increases in weed invasion beyond current conditions, are likely to be localised and would not reduce the suitability of foraging habitat in the adjoining areas.

As potential habitat will remain in the vicinity of the subject site, these key threatening processes are not likely to significantly impact habitat for potentially occurring threatened species.

Conclusion

No significant impact is likely on this species discussed above and subsequently no Species Impact Statement is required.

E.2.4 Koala

The Koala (*Phascolarctos cinereus*) is listed as Vulnerable under the TSC Act and EPBC Act (NSW Scientific Committee, 2004). The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In NSW it mainly occurs on the central and north coast's with some populations in the west of the Great Dividing Range. It feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species, including *Eucalyptus tereticornis* (Forest Red Gum), as is present in the study area. Their home range size varies with quality of habitat, ranging from less than two hectares to several hundred hectares in size.

(a) *In the case of a threatened species, whether the lifecycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.*

The subject site consists of potential foraging habitat for the Koala due to the presence of scattered *Eucalyptus tereticornis* trees, which is a primary feed tree species in the CMA. There is a known population within the locality, centred on the Georges River vegetated corridor to the east, which is not well connected to the vegetation present on the subject site. This species has not been recorded on the subject site during surveys of the subject site or Project Boundary, although scattered database records occur from between 1995 and 2006. As there is no breeding population on the subject site or in the study area, it is considered unlikely that the proposed development would place a local population of the species at risk of extinction as it will result in the removal of a small area of low quality foraging habitat.

b) In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised,

There are no populations within the Campbelltown LGA of this species listed as endangered under the TSC Act.

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

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

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

Not applicable.

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

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

(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

(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.

A total of 0.40 ha of potential habitat for this species on the subject site will be removed or substantially modified as a result of the proposed development, however, patches of proximate habitat will be retained in the study area. The majority of the largest patch of CPW will be retained in the bushland conservation area to the north of the subject site.

The potential habitat for this species in the study area occurs in patches isolated from larger occurrences in proximate reserves to the east. The proposed development will act to further fragment the remaining patches to some extent, due to the increased housing density. However, the proposed Stage 6 residential area is not considered a complete barrier to movement of the species, and is not intersecting a vegetated corridor. Furthermore, the most intact habitat areas available in the study area are to the north and east of the proposed development, therefore the proposal will not fragment potential habitat to a large extent.

The habitat to be removed, modified or isolated as a result of the proposed development is not important to the long-term survival of this species within the locality, and would act as occasional foraging habitat for dispersing individuals rather than core habitat, due to the sparse vegetation present. Areas of high quality habitat occur within adjoining areas, particularly in association with the Georges River to the west. Additionally, bushland conservation zones in the study area will be conserved and managed for conservation to continue to provide foraging habitat for dispersing individuals.

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

No critical habitat for this species has currently been identified by the Director-General of the OEH.

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

A NSW recovery plan has been prepared for this species (DECC (NSW), 2008). The overall objective of this recovery plan is to reverse the decline of the koala in New South Wales, to ensure adequate protection, management and restoration of koala habitat, and to maintain healthy breeding populations of koalas throughout their current range.

The proposed development is not inconsistent with the objectives of the Recovery Plan, due to the conservation of the most intact habitat in the Study Area. The core area of habitat within the intact vegetation associated with the Georges River will not be impacted and connectivity between other proximate patches will remain.

No threat abatement plans are relevant to the species.

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.

Clearing of native vegetation is a listed key threatening process under the TSC Act. A relatively small area of native vegetation with mature trees occurs on the subject site, which provides potential foraging habitat, will be removed for the proposed development. However, this represents a small proportion of the total foraging area for this species, and proximate patches of habitat will remain in the bushland conservation zones in the Project Boundary, and within reserves in the locality. The extent of clearing proposed is therefore not considered to be a threat to the Koala.

No other key threatening process that may be exacerbated by the proposed action will affect this species.

Conclusion

The proposed development will not have a significant impact on the Koala. No species impact statement is required.

E.2.5 Microchiropteran Bats

The following Assessments of Significance demonstrates apply to the following species of microchiropteran bats known to occur in the locality:

- Eastern Bentwing-bat (*Miniopterus orianae oceanensis* (formerly *M. schreibersii oceanensis*);
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*);
- East-coast Freetail-bat (*Mormopterus norfolkensis*);
- Greater Broad-nosed Bat (*Scoteanax rueppellii*);
- Little Bentwing-bat (*Miniopterus australis*)
- Southern Myotis (*Myotis macropus*); and
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*).

The Eastern Bentwing Bat occurs along the east and north-west coasts of Australia. It roosts in caves, derelict mines, stormwater tunnels, buildings and other man-made structures. It forages above the canopy in forested areas. The Eastern Bentwing Bat forms maternity colonies in caves and populations usually centre on such caves (OEH 2012b). The Eastern Bentwing Bat is listed as Vulnerable on Schedule 2 of the TSC Act.

The Eastern False Pipistrelle is found on the south eastern coast and ranges of Australia from southern Queensland to Victoria and Tasmania (DEC (NSW), 2005d). It prefers moist

habitats and generally roosts in eucalypt hollows, but has been found under loose bark on trees or in buildings (OEH 2012c). The Eastern False Pipistrelle is listed as Vulnerable on Schedule 2 of the TSC Act (NSW Scientific Committee, 2004c).

The East-coast Freetail Bat occurs from southern Queensland to southern NSW, in dry sclerophyll forest and woodland. It roosts in tree hollows and sometimes under bark or in man-made structures (OEH 2012d). The East-coast Freetail Bat is listed as Vulnerable on Schedule 2 of the TSC Act (NSW Scientific Committee, 2004d).

The Greater Broad-nosed Bat occurs from the Atherton Tableland to north eastern Victoria in gullies and river systems that drain the Great Dividing Range. It roosts in tree hollows and sometimes in buildings. It occurs in woodland to moist and dry eucalypt forest and rainforest but is most common in tall wet forest (OEH 2012e). The Greater Broad-nosed Bat is listed as Vulnerable on Schedule 2 of the TSC Act.

The Little Bentwing-bat occurs along the east coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW. It is generally found in well-timbered areas of moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. It roosts in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings (OEH 2012h). The Little Bentwing-bat is listed as Vulnerable on Schedule 2 of the TSC Act.

The Southern Myotis occurs in coastal areas from north western Australia to south western Victoria (DEC (NSW), 2005i). It roosts close to water in caves, mine shafts, tree hollows, stormwater channels, buildings, under bridges and in dense foliage. It forages over streams and pools by raking its feet across the surface for insects and small fish (OEH 2012j) (DEC (NSW), 2005i). The Southern Myotis is listed as Vulnerable on Schedule 2 of the TSC Act.

The Yellow-bellied Sheathtail-bat is a wide-ranging species found across northern and eastern Australia. It roosts singly or in groups of up to six in tree hollows and buildings and are known to utilise mammal burrows in treeless areas. It forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory (OEH 2012m).

a) *In the case of a threatened species, whether the lifecycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.*

There is some limited potential roosting habitat for the hollow-dwelling species of these microchiropteran bats in the study area, provided by a sparse distribution of hollows (outside of the subject site), and mature trees with decorticating bark. There is no potential roosting habitat for cave-dwelling species. These species are likely to primarily utilise the study area as foraging habitat as part of a larger range. Potential habitat will be retained in the bushland conservation zones in the Project Boundary, and adjoining reserves where areas of more intact roosting and foraging habitat are located. It is therefore not likely that the proposal will affect the life cycle of these species such that a viable local population is placed at risk of extinction.

b) In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised,

There are no populations of these species listed as endangered under the TSC Act.

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

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

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

Not applicable.

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

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

(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

(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.

A total of 0.86 ha of potential habitat for these species on the subject site will be removed or substantially modified as a result of the proposed development, however, patches of proximate habitat will be retained in the study area.

The potential habitat for these species in the study area occurs in patches isolated from larger occurrences in proximate reserves to the east. The proposed development will not act to further fragment the remaining patches, as it is at the western extent of the development area, and is not part of a vegetated corridor.

The habitat to be removed as a result of the proposed development is not important to the long-term survival of these species within the locality. Areas of high quality habitat occur within adjoining areas, including bushland conservation zones in the Project Boundary, and will be conserved and managed for conservation.

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

No critical habitat for these species has currently been identified by the Director-General of the OEH.

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

No recovery plans have been prepared for these species. No threat abatement plans are relevant to these species.

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.

The following key threatening processes are relevant to the proposed works:

- Clearing of native vegetation; and
- Removal of dead wood and dead trees;

The key threatening processes of 'clearing of native vegetation' and 'removal of dead wood and dead trees' potentially impact habitat for the bat species further than current conditions. However, the vegetation on the subject site is small in area, and would constitute a small portion of the total habitat within the home range of these species. Increases in weed invasion beyond current conditions, are likely to be localised and would not reduce the suitability of foraging habitat in the adjoining areas.

As potential habitat will remain in the vicinity of the subject site, these key threatening processes are not likely to significantly impact habitat for potentially occurring threatened species.

Conclusion

The proposed development will not have a significant impact on threatened microchiropteran bats. No species impact statement is required.

E.2.6 Grey-headed Flying-fox

The Grey-headed Flying-fox is found along the east coast of Australia from Bundaberg to Melbourne. It occurs in subtropical and temperate rainforests, tall sclerophyll forest and woodlands, heaths, swamps, gardens and orchards. The species roosts in camps with high site fidelity. The Grey-headed Flying-fox is threatened by loss of foraging habitat, disturbance to camps, unregulated shooting and electrocution on power lines (OEH 2012f). It is listed as vulnerable under the TSC Act and the EPBC Act.

a) In the case of a threatened species, whether the lifecycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

The subject site consists only of potential foraging habitat for the Grey-headed Flying-fox as this species roosts in camps, the locations of which are well-known in the Sydney region. No

camps occur in the study area, and the closest know location is in Campbelltown, approximately 4 km to the west. The proposed development is unlikely to place a local population of the species at risk of extinction as it will result in the removal of a small area of low quality foraging habitat.

b) In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised,

There are no populations of this species listed as endangered under the TSC Act.

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

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

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

Not applicable.

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

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

(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

(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.

A total of 0.86 ha of potential habitat for this species on the subject site will be removed or substantially modified as a result of the proposed development, however, patches of proximate habitat will be retained in the study area.

The potential habitat for this species in the study area occurs in patches isolated from larger occurrences in proximate reserves to the east. The proposed development will not act to further fragment the remaining patches, as it is at the western extent of the development area, and is not part of a vegetated corridor.

The habitat to be removed, modified or isolated as a result of the proposed development is not important to the long-term survival of this species within the locality. Areas of high quality habitat occur within proximate areas, including bushland conservation zones in the study area, and will be conserved and managed for conservation.

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

No critical habitat for this species has currently been identified by the Director-General of the OEH.

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

A "Draft National Recovery Plan for the Grey-headed Flying-fox (*Pteropus poliocephalus)*" (2009) exists, the objectives of which are to encourage recovery by identifying actions to be undertaken to reverse decline and ensure long-term viability of the species. No threat abatement plans are relevant to the species.

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.

Clearing of native vegetation is a listed key threatening process under the TSC Act. A relatively small area of native vegetation with mature trees occurs on the subject site, which provides potential foraging habitat, will be removed for the proposed development. However, this represents a very small proportion of the total foraging area for this species, and proximate patches of habitat will remain in the bushland conservation zones in the Project Boundary, and within reserves in the locality. The extent of clearing proposed is therefore not considered to be a threat to the Grey-headed Flying-fox.

No other key threatening process that may be exacerbated by the proposed action will affect this species.

Conclusion

The proposed development will not have a significant impact on the Grey-headed Flying-fox. No species impact statement is required.