

A vertical photograph of a grey squirrel climbing a tree trunk. The squirrel is positioned on the left side of the image, facing upwards with its mouth open. Its front paws are gripping the bark, and its hind legs are also visible. The tree bark is rough and textured. The background is a solid blue gradient.

Travers

bushfire & ecology

Biodiversity Development Assessment Report

Proposed Development
Chatswood Golf Club
128 Beaconsfield Road
Chatswood

APRIL 2020
(REF: 19WRL02BDAR)



Biodiversity Development Assessment Report

Proposed Development Chatswood Golf Club, 128 Beaconsfield Road, Chatswood

Report authors:	Michael Sheather-Reid B. Nat. Res. (Hons.) – Managing Director Accredited Assessor no. BAAS17085 George Plunkett B. Sc. (Hons.), PhD – Botanist – Accredited Assessor no. BAAS19010 Corey Mead B. App. Sc. – Senior Fauna Ecologist – Accredited Assessor no. BAAS19050 Nathan Stewart B. Env. Sc. Mgmt. – Fauna Ecologist
Fauna survey:	Nathan Stewart B. Env. Sc. Mgmt. – Fauna Ecologist
Plans prepared:	Sandy Cardow B. Sc. Angelene Wright B. Sc.
Approved by:	Michael Sheather-Reid (Accredited Assessor no. BAAS17085)
Date:	29/04/2020
File:	19WRL02BDAR

This document is copyright © Travers bushfire & ecology 2020

Disclaimer:

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

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

Executive Summary

Travers bushfire & ecology has been engaged to prepare a biodiversity development assessment for a proposed development at Chatswood Golf Club, 128 Beaconsfield Road, Chatswood. The eastern portions of Lot 1 DP1124646, Lot 22 DP626634, Lot 163 DP752067, and Lot 1 DP651667 incorporating the golf course area has been subject to detailed survey effort and will hereafter be referred to as the 'study area' (Figure 1.1).

The 'development footprint' will hereafter refer to the area of direct impacts by the proposal, including the building envelope, earthworks, roads, driveways, services and landscaping (see Figures 1.1 & 1.2).

Development proposal

The proposed redevelopment of Chatswood Gold Leisure Resort, located to the west of Beaconsfield Road, involves the:

- Redesign of the existing golf course and demolition of the existing three (3) storey brick clubhouse building and ancillary structures within the central western portion of the broader site.
- Construction of a new four (4) storey clubhouse inclusive of; function rooms, cinema, servery, bar, storage and loading, dining / bistro / bar and kitchen;
- Construction of two (2) Independent Living Unit building Blocks; South Building and North Building;
- Driveway extension off Beaconsfield Road including parking as well as associated landscaping.

Recorded biodiversity

Ecological survey and assessment has been undertaken in accordance with the *Biodiversity Assessment Methodology* (BAM) as well as relevant legislation including the *Environmental Planning and Assessment Act 1979* (EP&A Act), the *Biodiversity Conservation Act 2016* (BC Act), the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the *Fisheries Management Act 1994* (FM Act). Compliant survey and limitations for candidate species are explained in Sections 2.5, Section 4.3.2 (flora) and Section 4.4.4 (fauna).

In respect of matters required to be considered under the *EP&A Act* and relating to the species / provisions of the *BC Act*, one (1) threatened fauna species Grey-headed Flying-fox (*Pteropus poliocephalus*), two (2) threatened flora species, *Eucalyptus scoparia* and *Syzygium paniculatum* (both planted), and no threatened ecological communities (TECs) were recorded within the study area.

In respect of matters required to be considered under the *EPBC Act*, one (1) threatened fauna species Grey-headed Flying-fox (*Pteropus poliocephalus*), no protected migratory bird species, three (3) threatened flora species, *Macadamia integrifolia*, *Eucalyptus scoparia* and *Syzygium paniculatum* (all planted / naturalised) and no threatened ecological communities listed under this Act were recorded within the study area.

In respect of matters relative to the *FM Act*, no suitable habitat for threatened marine or aquatic species was observed within the subject site.

Impact assessment

The direct, indirect and cumulative ecological impacts of the proposal have been carefully considered in Section 5.2 of this report. Recommendations have been outlined within Section 5.4 to avoid/minimise/offset these impacts, to address threatening processes and to create a more positive ecological outcome for threatened biodiversity.

The development proposal will see the impact of 0.54ha of native vegetation, which includes impacts to three (3) different vegetation units including the following (PCT below refers to Plant Community Type):

- PCT1778 - Smooth-barked Apple - Coastal Banksia / Cheese tree open forest - moderate - 0.25 ha
- PCT1778 - Smooth-barked Apple - Coastal Banksia / Cheese tree open forest - poor - 0.057 ha
- Planted native vegetation equivalent to PCT 1778 - 0.233 ha

The assessment of serious and irreversible impacts are set out under Section 6.7.2 of the *BC Reg 2017* to guide the determining authority on this decision. These principles have been reviewed and it is considered that the proposal will not cause any serious and irreversible impacts on threatened biodiversity.

There will be no significant impact on matters listed under the *FM Act*.

The proposed subdivision development was not considered to have a significant impact on matters of national environmental significance. As such a referral to Department of Environment and Energy should not be required.

Biodiversity Offsets Scheme (BOS) – Threshold Assessment

The proposed development exceeds the nominated threshold trigger of the area clearing threshold as assessed in Section 4.1. Therefore biodiversity offsets are required under the Biodiversity Offsets Scheme (BOS). A biodiversity credit assessment is included as part of this BDAR.

BAM Calculator results

The BAM Calculator provides a means of objectively determining the loss of biodiversity as a result of a proposed development. The 'credits' generated (Table A & B) are the amount of credits required to be 'transferred' (purchased) to allow the proposed subdivision to proceed. The pricing of credits can vary greatly over time and it is advised that the proponent use the online Biodiversity Offset Payment Calculator tool to determine the current pricing of credits (<https://www.lmbc.nsw.gov.au/offsetpaycalc>).

Table A – Requirement for ecosystem credits

Zone	Veg. zone name	Veg. integrity loss	Area (ha)	Sensitivity to gain	Biodiversity risk weighting	Candidate SAI	Ecosystem credits
1	1778_moderate	30.7	0.3	High Sensitivity to Potential Gain	2.5	False	5
2	1778_poor	18.1	0.1	High Sensitivity to Potential Gain	2.5	False	1
3	1778_planted	30.9	0.2	High Sensitivity to Potential Gain	2.5	False	4
							Total: 10

Table B – Requirement for species credits

Veg. zone name	Veg. integrity loss	Area (ha)	Biodiversity risk weighting	Potential SAI	Species credits
Southern Myotis (Large-footed Myotis)					
1778_moderate	30.7	0.25	2	False	4
1778_planted	30.9	0.23	2	False	4
1778_poor	18.1	0.06	2	False	1
					Total: 9

List of abbreviations

APZ	asset protection zone
BAM	Biodiversity Assessment Method
BAR	Biodiversity Assessment Report
<i>BC Act</i>	<i>Biodiversity Conservation Act (2016)</i>
<i>BC Reg</i>	<i>Biodiversity Conservation Regulation (2017)</i>
BCAR	Biodiversity Certification Assessment Report
BDAR	Biodiversity Development Assessment Report
BOS	Biodiversity Offset Scheme
BOSET	Biodiversity Offset Scheme Entry Tool
BPA	bushfire protection assessment
BSSAR	Biodiversity Stewardship Site Assessment Report
CEEC	Critically endangered ecological community
<i>CM Act</i>	<i>Coastal Management Act 2016</i>
DCP	development control plan
DEC	NSW Department of Environment and Conservation (superseded by DECC from April 2007)
DECC	NSW Department of Environment and Climate Change (superseded by DECCW from October 2009)
DECCW	NSW Department of Environment, Climate Change and Water (superseded by OEH from April 2011)
DEWHA	Commonwealth Department of Environment, Water, Heritage & the Arts (superseded by SEWPAC)
DOEE	Commonwealth Department of Environment & Energy
DPIE	NSW Department of Planning, Industry and Environment
EEC	endangered ecological community
EPA	Environment Protection Authority
<i>EP&A Act</i>	<i>Environmental Planning and Assessment Act (1979)</i>
<i>EPBC Act</i>	<i>Environment Protection and Biodiversity Conservation Act (1999)</i>
<i>FM Act</i>	<i>Fisheries Management Act</i>
IBRA	Interim Biogeographic Regionalisation for Australia
LEP	local environmental plan
LGA	local government area
<i>LLS Act</i>	<i>Local Land Services Act (2013)</i>
NES	national environmental significance
<i>NPW Act</i>	<i>National Parks and Wildlife Act (1974)</i>
NRAR	Natural Resources Access Regulator (NSW)
NSW DPI	NSW Department of Industry and Investment
OEH	Office of Environment and Heritage (superseded by DPIE from August 2019)
PCT	plant community type
PFC	projected foliage cover
RFS	NSW Rural Fire Service
ROTAP	rare or threatened Australian plants
SAII	Serious And Irreversible Impacts
SEPP	State Environmental Planning Policy
SEWPAC	Commonwealth Dept. of Sustainability, Environment, Water, Population & Communities (superseded by DOEE)
SIS	species impact statement
SULE	safe useful life expectancy
TEC	threatened ecological community
TPZ	tree preservation zone
<i>TSC Act</i>	<i>Threatened Species Conservation Act (1995) – Superseded by the Biodiversity Conservation Act (2016)</i>
VMP	vegetation management plan

Table of Contents

SECTION 1.0 – INTRODUCTION.....	1
1.1 Purpose	2
1.1.1 Certification of BAM compliance.....	2
1.1.2 Terminology	2
1.2 Site description	3
1.2.1 Site overview	3
1.2.2 Landscape features	3
1.3 Proposed development	4
1.3.1 Identification of development site footprint	4
1.4 Statutory assessment requirements	5
1.4.1 Environmental Planning and Assessment Act 1979 (EP&A Act)	5
1.4.2 Biodiversity Conservation Act 2016 (BC Act)	5
1.4.3 Fisheries Management Act 1994 (FM Act)	5
1.4.4 Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).....	6
1.4.5 Coastal Management Act 2016 (CM Act)	6
1.4.6 Licences.....	7
SECTION 2.0 – SURVEY METHODOLOGY	13
2.1 Pre-survey information collation & resources	13
2.2 Flora survey methodology.....	15
2.3 Fauna survey methodology.....	16
2.4 Field survey effort	18
2.5 Survey limitations.....	20
2.6 Accuracy of identification	20
SECTION 3.0 – SURVEY RESULTS.....	23
3.1 Flora results	23
3.1.1 Native vegetation extent	23
3.1.2 Flora species	23
3.1.3 Plant community types (PCTs)	27
3.1.4 Vegetation descriptions of observed communities	29
3.1.5 Vegetation integrity assessment.....	34
3.2 Fauna results	37
3.3 Habitat results.....	38
3.3.1 Fauna habitat observations	38
3.3.2 Habitat tree data	39
SECTION 4.0 – BIODIVERSITY ASSESSMENT	40
4.1 BOS thresholds.....	40
4.1.1 Biodiversity Values Land	40
4.1.2 Area clearing threshold.....	40
4.1.3 Serious and Irreversible Impacts	41
4.2 Previous surveys reviewed	42
4.3 Flora	42
4.3.1 Local / Regional flora matters.....	43
4.3.2 State legislative flora matters.....	43
(a) Threatened flora species (NSW)	43
(b) Endangered flora populations (NSW)	43
(c) Threatened ecological communities (NSW)	43
(d) Ecosystem credit species.....	43
(e) Species credit species.....	43
(f) Local data	45

(g) Expert reports	45
(h) Endangered wetland communities	45
(i) Groundwater dependent ecosystems	46
4.3.3 Matters of national environmental significance - flora	47
(a) Threatened flora species (national)	47
(b) Threatened ecological communities (national)	48
4.4 Fauna	48
4.4.1 Key fauna habitat	48
4.4.2 State legislative fauna matters	49
(a) Threatened fauna species (NSW)	49
(b) Endangered fauna populations (NSW)	49
(c) Ecosystem credit species	49
(d) Species credit species	51
(e) Local data	53
(f) Expert reports	53
4.4.3 Matters of national environmental significance - fauna	53
(a) Threatened fauna species (National)	53
(b) Protected migratory species (National)	54
4.4 Vegetation connectivity and habitat corridors	54
SECTION 5.0 – CONCLUSION	58
5.1 Legislative compliance	58
5.2 Potential ecological impacts	58
5.2.1 BC Reg Prescribed impacts	58
5.2.2 Direct impacts	59
5.2.3 Indirect impacts	59
5.2.4 Cumulative impacts	59
5.3 Avoid and minimise impacts	60
5.4 Recommendations	60
5.5 Biodiversity credit requirements	61
5.5.1 Serious & Irreversible Impacts (SAILs)	61
5.5.2 Impacts requiring offset	61
5.5.3 Impacts not requiring offset	61
5.5.4 Areas not requiring assessment	62
SECTION 6.0 – BAM CREDIT RESULTS	63
6.1 Ecosystem credits and species credits	63
6.2 Ecosystem credit classes	64
6.3 Species credit classes	64
BIBLIOGRAPHY	65

Appendices

Appendix 1 – Threatened & protected migratory species habitat assessment
Appendix 2 – Plot datasheets
Appendix 3 – Matters of National Environmental Significance - Significant impact criteria
Appendix 4 – BAM-C outputs

Figures

Figure 1.1 – Development footprint (red)	1
Figure 1.2 – Proposed development layout	8
Figure 1.3 – Site map.....	9
Figure 1.4 – Location map.....	10
Figure 1.5 – Mitchell Landscapes.....	11
Figure 1.6 – Local geology	11
Figure 1.7 – Local soil landscapes	12
Figure 1.8 – Regional vegetation mapping (OEH 2016)	12
Figure 2.1 – Flora survey effort and results	21
Figure 2.2 – Fauna survey effort and results	22
Figure 4.1 – Biodiversity Land Map (purple) relative to the study area (yellow)	40
Figure 4.2 – Alluvial groundwater system discharging into a river.....	46
Figure 4.3 – Local connectivity.....	56
Figure 4.4 – Species credit species polygon.....	57

Tables

Table A – Requirement for ecosystem credits.....	iii
Table B – Requirement for species credits.....	iii
Table 1.1 – Site features.....	3
Table 1.2 – Landscape features	3
Table 2.1 – Fauna survey effort	18
Table 2.2 – Flora survey effort	19
Table 2.3 – Plot and transect survey effort – subject site	19
Table 3.1 – Flora observations within the study area.....	23
Table 3.2 – PCT shortlist and justification	28
Table 3.3 – PCTs.....	29
Table 3.4 – Current vegetation integrity score	34
Table 3.5 - Calculating future composition score	35
Table 3.6 - Calculating future structure score	35
Table 3.7 - Calculating future function score.....	36
Table 3.8 – Future vegetation integrity score	36
Table 3.9 – Fauna observations within the study area.....	37
Table 3.10 – Observed fauna habitat	38
Table 3.11 – Habitat tree data	39
Table 4.1 – BOSET report.....	41
Table 4.2 – Candidate SAIL species	41
Table 4.3 – Species credit species (flora)	44
Table 4.4 – Nationally listed threatened flora species with suitable habitat present.....	47
Table 4.5 – Ecosystem credit species (fauna)	49
Table 4.6 – Species credit species (fauna)	51
Table 4.7 – Nationally listed threatened fauna species with suitable habitat present.....	54
Table 6.1 – Requirement for ecosystem credits.....	63
Table 6.2 – Requirement for species credits.....	63
Table 6.3 – Ecosystem credit summary	64
Table 6.4 – Credit classes for PCT 877 and 1395 - Like for like options	64
Table 6.5 – Species credit summary	64
Table A1.1 – Nationally threatened flora habitat assessment.....	68
Table A1.2 – Nationally threatened fauna habitat assessment.....	76
Table A1.3 – Migratory fauna habitat assessment.....	82



Introduction

1

Travers bushfire & ecology has been engaged to prepare a biodiversity development assessment for a proposed development at Chatswood Golf Club, 128 Beaconsfield Road, Chatswood. The eastern portions of Lot 1 DP1124646, Lot 22 DP626634, Lot 163 DP752067, and Lot 1 DP651667 incorporating the golf course area has been subject to detailed survey effort and will hereafter be referred to as the 'study area' (Figure 1.1).

The 'development footprint' will hereafter refer to the area of direct impacts by the proposal (see Figures 1.1 & 1.2).



Figure 1.1 – Development footprint (red)

1.1 Purpose

The purpose of this Biodiversity Development Assessment Report (BDAR) are to:

- Carry out a botanical survey to describe the vegetation communities and their conditions
- Carry out a fauna habitat survey for the detection and assessment of fauna and their potential habitats
- Complete targeted surveys for threatened species, populations and ecological communities
- Prepare a biodiversity development assessment report in accordance with the requirements of the:
 - a) *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*,
 - b) *Biodiversity Conservation Act 2016 (BC Act)*,
 - c) *Biodiversity Conservation Regulation 2017 (BC Reg.)*,
 - d) *Fisheries Management Act 1994 (FM Act)*, and
- Prepare a Biodiversity Development Assessment Report (BDAR) in accordance with the Biodiversity Assessment Methodology (BAM)

1.1.1 Certification of BAM compliance

Section 6.15 of the *BC Act* regarding the currency of a BDAR requires:

- (1) *A biodiversity assessment report cannot be submitted in connection with a relevant application unless the accredited person certifies in the report that the report has been prepared on the basis of the requirements of (and information provided under) the biodiversity assessment method as at a specified date and that date is within 14 days of the date the report is so submitted.*
- (2) *A relevant application is an application for planning approval, for vegetation clearing approval, for biodiversity certification or in respect of a biodiversity stewardship agreement.*

George Plunkett (BAAS 19010), Corey Mead (BAAS 19050) and Michael Sheather-Reid (BAAS 17085) are accredited persons under the *BC Act*. We certify here that the report has been prepared on the basis of the requirements of (and information provided under) the BAM as at 29 April 2020, and that date is within 14 days of the date the report is so submitted. George Plunkett is the case owner in the BAM calculator.

Where survey has been undertaken that is not compliant with seasons, it is assumed present unless there is sufficient information to rule out the species. In the case of species credit species for this report report, Southern Myotis is assumed as being present.

There are no geological features or soil hazard features requiring assessment. Prescribed impacts are considered in section 5.2 of the report.

1.1.2 Terminology

Throughout this report the terms subject site and study area are used. It is important to have a thorough understanding of these terms as they apply to the assessment.

Development footprint means the area directly affected by the proposal.

Study area means the subject site and any additional areas which are likely to be affected by the proposal, either directly or indirectly. The study area should extend as far as is necessary to take all potential impacts into account.

Direct impacts are those that directly affect the habitat and individuals. They include, but are not limited to, death through predation, trampling, poisoning of the animal/plant itself and the removal of suitable habitat. When applying each factor, consideration must be given to all of the likely direct impacts of the proposed activity or development.

Indirect impacts occur when project-related activities affect species, populations or ecological communities in a manner other than direct loss. Indirect impacts can include loss of individuals through starvation, exposure, predation by domestic and/or feral animals, loss of breeding opportunities, loss of shade/shelter, deleterious hydrological changes, increased soil salinity, erosion, inhibition of nitrogen fixation, weed invasion, fertiliser drift, or increased human activity within or directly adjacent to sensitive habitat areas. As with direct impacts, consideration must be given, when applying each factor, to all of the likely indirect impacts of the proposed activity or development.

1.2 Site description

1.2.1 Site overview

Table 1.1 provides an overview the planning, cadastral and topographical details of the study area and an overview of the site and surrounds is shown on Figures 1.3 and 1.4 (site and location maps).

Table 1.1 – Site features

Location	128 Beaconsfield Road, Chatswood
Location description	The site is bound to the east by residential lots with dwellings. To all other aspects it is surrounded by golfing greens.
Area	Approximately 2.3 ha
Local government area	Willoughby
Zoning	RE2 - Private Recreation; E4 - Environmental Living
Grid reference MGA-56	330010E 6258340N
Elevation	Approximately 20–40 m AHD
Topography	Situated on a moderately steep north-west, west and south-westerly aspect. Topography has been modified to form at least two rock terraces each 4–8 m high.
Catchment and drainage	Drainage via overland flow into constructed ditches and piped infrastructure. Ultimate discharge is likely to be into Lane Cove River.
Existing land use	Golf Clubhouse, curtilage and car parking.

1.2.2 Landscape features

Table 1.2 examines the landscape features of the proposed development site in accordance with the BAM.

Table 1.2 – Landscape features

IBRA bioregions and subregions	Sydney Basin bioregion – Pittwater subregion (Figure 1.5 and 1.6)
NSW landscape region	Port Jackson Basin

and area (ha)	
Native vegetation extent in the buffer area (1500m)	362.26 ha - 43.52%
Evidence to support differences between mapped vegetation extent and aerial imagery	Mapped vegetation closely matches aerial imagery. Unmapped vegetation is exotic.
Rivers and streams classified according to stream order	The site map (Figure 1.3) shows the study area with first, second and third order streams.
Wetlands within, adjacent to and downstream of the site	There are no wetlands within the site
Connectivity features	There is some connectivity to the south-east and north-east. The location map (Figure 1.4) shows an overview of the extent of native vegetation in the locality.
Areas of geological significance and soil hazard features	Geology; Hawkesbury Sandstone. Soils; Glenorie landscape on the upper slopes; GyMEA landscape lower down.
Areas of outstanding biodiversity values	The site does not contain any areas of outstanding biodiversity values.
Patch size	~150 ha
Identification of method applied (i.e. linear or site-based)	Site based assessment

1.3 Proposed development

The proposed redevelopment of Chatswood Gold Leisure Resort, located to the west of Beaconsfield Road, involves the:

- Re-subdivision of 4 x golf course lots into 2 lots.
- Redesign of the existing golf course and demolition of the existing three (3) storey brick clubhouse building and ancillary structures within the central western portion of the broader site.
- Construction of a new four (4) storey clubhouse inclusive of; function rooms, cinema, servery, bar, storage and loading, dining / bistro / bar and kitchen.
- Construction of two (2) Independent Living Unit building Blocks; South Building and North Building.
- Driveway extension off Beaconsfield Road including parking as well as associated landscaping.

1.3.1 Identification of development site footprint

The development site footprint includes the entire area of the proposed redevelopment and associated works including buildings, earthworks, cut and fill, services, roads, paths and landscaping. The asset protection zone (APZ) as defined in the Bushfire Protection Assessment prepared by *Travers bushfire & ecology* (February 2020) is also considered as a direct impact on vegetation. In total the proposal will impact on 0.54 ha of native vegetation.

1.4 Statutory assessment requirements

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

Prior to any development taking place in New South Wales a formal assessment needs to be made of the proposed work to ensure it complies with relevant planning controls and, according to its nature and scale, confirm that it is environmentally and socially sustainable. State, regional and local planning legislation indicates the level of assessment required, and outlines who is responsible for assessing the development. The development assessment and consent system is outlined in Part 4 and the infrastructure and environmental impact assessment system is outlined in Part 5 of the *EP&A Act*.

1.4.2 Biodiversity Conservation Act 2016 (BC Act)

The *BC Act* repeals the *Threatened Species Conservation Act 1995*, the *Nature Conservation Trust Act 2001* and the animal and plant provisions of the *National Parks and Wildlife Act 1974*.

The *BC Act* and the *BC Reg.* establishes a regulatory framework for assessing and offsetting impacts on biodiversity values due to proposed developments and clearing. It establishes a framework to avoid, minimise and offset impacts on biodiversity from development through the Biodiversity Offsets Scheme. Where development consent is granted, the authority may impose as a condition of consent an obligation to retire a number and type of biodiversity credits determined under the new Biodiversity Assessment Method (BAM).

For local development, the BOS includes two (2) elements to the threshold test – an area trigger and a Sensitive Biodiversity Values Land Map trigger. If clearing exceeds either trigger, the Biodiversity Offset Scheme applies to the proposed clearing.

Development consent cannot be granted for non-State significant development under Part 4 of the *EP&A Act* if the consent authority is of the opinion it is likely to have serious and irreversible impacts (SAIL) on biodiversity values. The determination of SAIL is to be made in accordance with principles prescribed section 6.7 of the *BC Regulation 2017*. The principles have been designed to capture those impacts which are likely to contribute significantly to the risk of extinction of a threatened species or ecological community in New South Wales.

The threatened species test of significance is used to determine if a development or activity is likely to significantly affect threatened species or ecological communities, or their habitats. It is applied as part of the Biodiversity Offsets Scheme entry requirements and for Part 5 activities under the *EP&A Act*.

The test of significance is set out in s.7.3 of the *BC Act*. If the activity is likely to have a significant impact, or will be carried out in a declared area of outstanding biodiversity value, the proponent must either apply the Biodiversity Offsets Scheme or prepare a species impact statement (SIS).

The environmental impact of activities that will not have a significant impact on threatened species will continue to be assessed under s.111 of the *EP&A Act*.

1.4.3 Fisheries Management Act 1994 (FM Act)

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

threatened species, populations, ecological communities, or their habitats, an SIS is required to be prepared.

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

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

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

Actions are projects, developments, undertakings, activities, and series of activities or alteration of any of these. An action that needs Commonwealth approval is known as a controlled action. A controlled action needs approval where the Commonwealth decides the action would have a significant effect on an NES matter.

Where a proposed activity is located in an area identified to be of NES, or such that it is likely to significantly affect threatened species, ecological communities, migratory species or their habitats, then the matter needs to be referred to the Commonwealth Department of Environment and Energy (DOEE) for assessment. In the case where no listed federal species are located on site then no referral is required. The onus is on the proponent to make the application and not the Council to make any referral.

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

A significant impact is regarded as being:

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

Source: *EPBC Policy Statement*

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

1.4.5 Coastal Management Act 2016 (CM Act)

The *Coastal Management Act* (CM Act, 2016) establishes the framework and overarching objects for coastal management in New South Wales. The Act commenced on 29 June 2018 and replaces the previous *Coastal Protection Act* (1979).

The purpose of the *CM Act* is to manage the use and development of the coastal environment in an ecologically sustainable way, for the social, cultural and economic well-being of the people of New South Wales.

The *CM Act* also supports the aims of the *Marine Estate Management Act 2014*, as the coastal zone forms part of the marine estate.

The *CM Act* defines the coastal zone, comprising four (4) coastal management areas:

1. coastal wetlands and littoral rainforests area; areas which display the characteristics of coastal wetlands or littoral rainforests that were previously protected by SEPP 14 and SEPP 26
2. coastal vulnerability area; areas subject to coastal hazards such as coastal erosion and tidal inundation
3. coastal environment area; areas that are characterised by natural coastal features such as beaches, rock platforms, coastal lakes and lagoons and undeveloped headlands. Marine and estuarine waters are also included
4. coastal use area; land adjacent to coastal waters, estuaries and coastal lakes and lagoons.

The *CM Act* establishes management objectives specific to each of these management areas, reflecting their different values to coastal communities.

1.4.6 Licences

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

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



Figure 1.2 – Proposed development layout

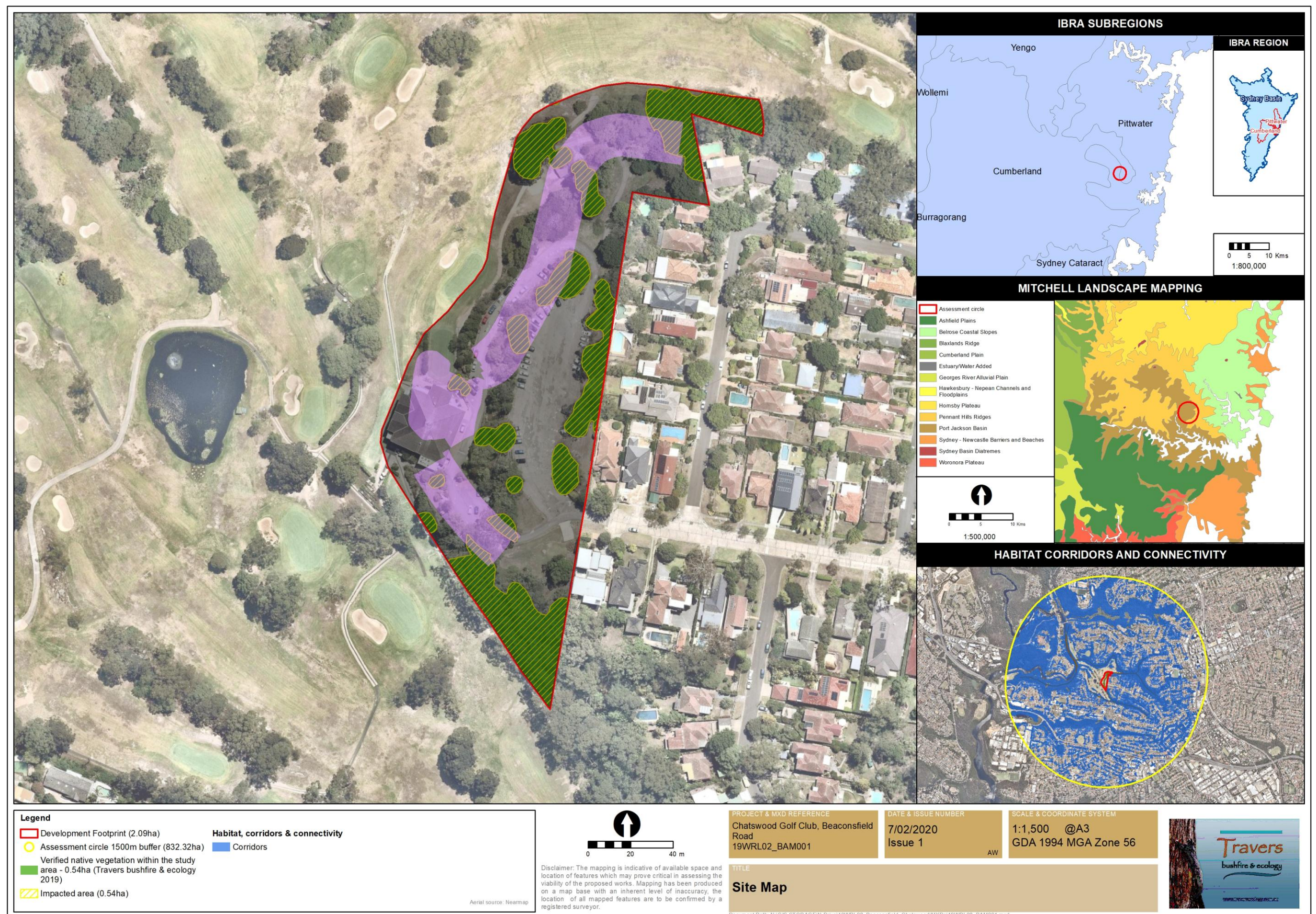


Figure 1.3 – Site map

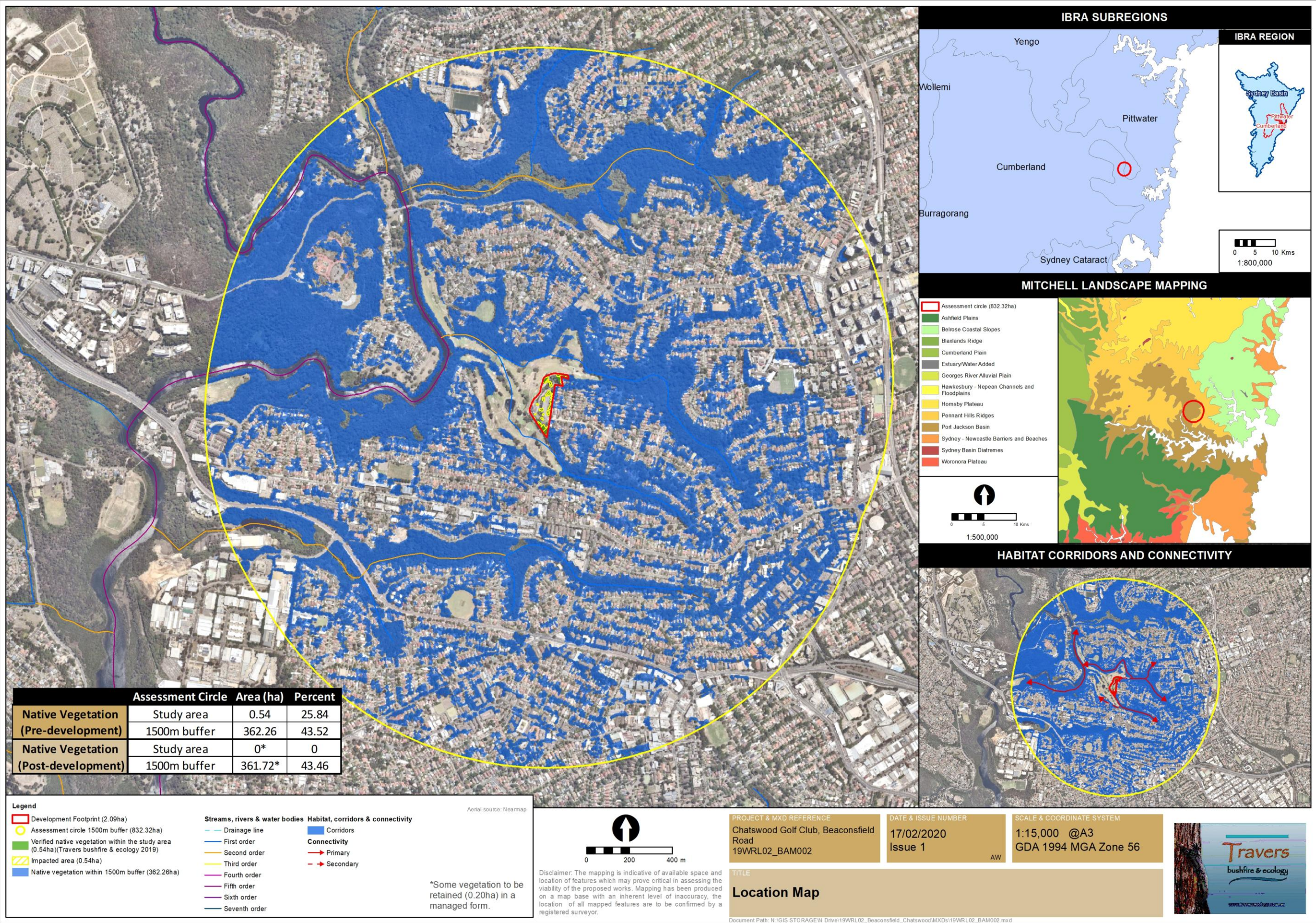


Figure 1.4 – Location map



Figure 1.5 – Mitchell Landscapes
 (Source: Google Earth Pro – Mitchell Landscape layer)



Figure 1.6 – Local geology
 (Source: Google Earth Pro – Geology 100K - Sydney)

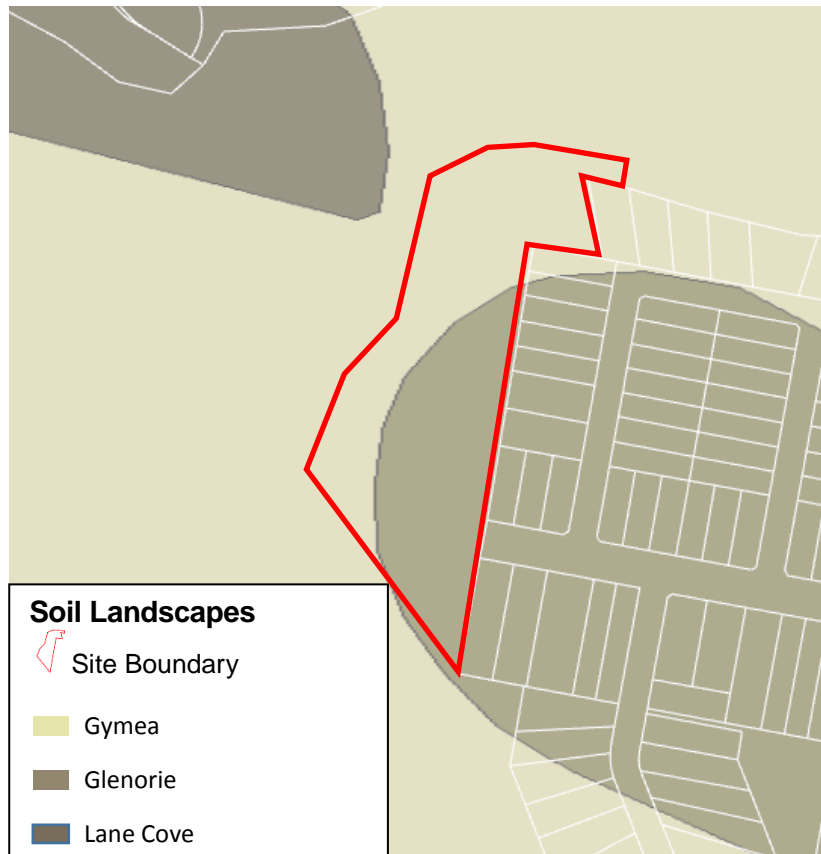


Figure 1.7 – Local soil landscapes
 (Source: eSPADE NSW Office of Environment and Heritage)

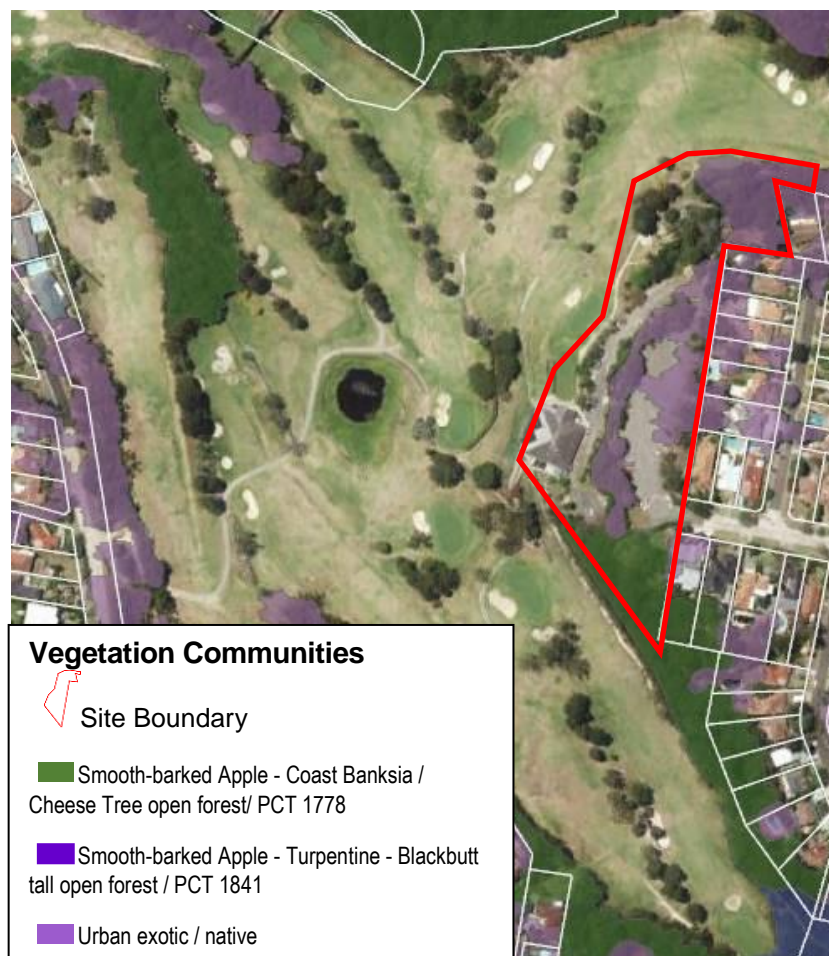


Figure 1.8 – Regional vegetation mapping (OEH 2016)



Survey Methodology

2

2.1 Pre-survey information collation & resources

A review of the relevant information pertinent to the subject site was undertaken.

Documents reviewed include:

- Site Compatibility Certificate Footprint Plan prepared by *Marchese partners*
- Report to the Sydney North Planning Panel prepared by *DPIE*
- Pre—DA Summary prepared by *Levy Planning*
- Flora and Fauna Study by *Travers bushfire & ecology* (July 2017)
- Comments by Willoughby Council – Planning & Infrastructure Department (18/8/17)

Standard technical resources utilised:

Legislation

- *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*
- *Biodiversity Conservation Act 2016 (BC Act)*
- *Biodiversity Conservation Regulation 2017 (BC Reg.)*
- *Fisheries Management Act 1994 (FM Act)*

Survey guidelines

- *Survey guidelines for Australia's threatened birds* (DEWHA 2010)
- *Survey guidelines for Australia's threatened fish* (DEWHA 2011)
- *Survey guidelines for Australia's threatened frogs* (DEWHA 2010)
- *Survey guidelines for Australia's threatened mammals* (DEWHA 2011)
- *Survey guidelines for Australia's threatened bats* (DEWHA. 2010)
- *Survey guidelines for Australia's threatened reptiles* (DEWHA 2011)
- *Matters of National Environmental Significance* (Commonwealth of Australia 2013)
- *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities 2004* (working draft), Department of Environment and Conservation (DEC)
- *Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna – Amphibians* (DECC – April 2009a)
- *Hygiene Protocol for the Control of Diseases in Frogs* (DECC 2008)
- *Region based guide to the echolocation calls of Microchiropteran bats* (DEC 2004)
- *Species credit threatened bats and their habitats* (DPIE 2018)
- *BAM* (2017)

Mapping resources

- Aerial photographs (Google Earth Pro / Spatial Information Exchange / NearMap)
- Topographical maps (scale 1:25,000)
- LiDAR data for contours (Land and Property Information, est. 2015 estimated)
- eSPADE – OEH tool for checking soil types

Threatened species records

- NSW Office of Environment and Heritage's BioNet - Atlas of NSW Wildlife, which holds data from a number of custodians (Data obtained Nov 2019 – Jan 2020)
- EPBC Protected Matters Search Tool - *DOEE* (Dec 2019)
- PlantNet NSW Flora online

Vegetation mapping/resources

- BioNet Vegetation Classification System
- The Native Vegetation of the Sydney Metropolitan Area. Version 3.0. (OEH 2016)
- NSW Guide to Surveying Threatened Plants (DPIE 2016)

Desktop assessment:

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

- **A literature review** – A review of readily available literature for the area was undertaken to obtain reference material and background information for this survey.
- **A data search** – A search of the *BioNet* (DPIE Nov 2019 - Dec 2020) was undertaken to identify records of threatened flora and fauna species located within a 10km radius of the site. Searches were also undertaken on the DOEE – ‘protected matters search tool’ website to generate a report that will help determine whether matters of national environmental significance or other matters protected by the *EPBC Act* are likely to occur in the area of interest. The search was broadened to a 10km radius like the Atlas search. These two searches combined, enabled the preparation of a list of threatened flora and fauna species that could potentially occur within the habitats found on the site (Tables A2.1, A2.2 and A2.3).

Vegetation mapping:

The Native Vegetation of the Sydney Metropolitan Area. Version 3.0. OEH (2016) identifies the following communities within the study area:

- PCT 1778 - Smooth-barked Apple - Coast Banksia / Cheese Tree open forest on sandstone slopes on the foreshores of the drowned river valleys of Sydney (equivalent to Coastal Sandstone Foreshores Forest)
- Urban Exotic/Native

A Flora and Fauna Study by *Travers bushfire & ecology* (July 2017) identified the following vegetation communities within the site:

- Urban Exotics and Natives
- Coastal Sandstone Foreshores Forest
- Managed Greens and Fairways

2.2 Flora survey methodology

2017

Initial botanical survey was undertaken on the 13th of March 2017 over a time frame of approximately 2.5 hrs. This included a random meander in accordance with *Cropper* (1993) to gain a full species list of the plants within the site and to determine vegetation communities within the study area.

A review of the NSW *Atlas of NSW Wildlife / BioNet* (OEH 2017) and the Commonwealth *Protected Matters Search Tool* (DOEE, 2017) were undertaken within 10 km of the subject site prior to the site visit to compile a combined list of threatened species that may have potential to occur within the locality.

The subject site was assessed for flora and fauna habitat attributes with regard to the potential for threatened species, populations or ecological communities to occur. Where a species had suitable habitat within the subject site then relevant targeted searches were undertaken as suited.

2019

Additional survey was undertaken on 28 November 2019, for compliance with survey requirements for the BAM. A review of the vegetation communities on site was undertaken in line with the current methodology. An updated BioNet search was undertaken prior to survey to account for any recent threatened species records or listings.

Targeted survey was undertaken for threatened flora within potential habitat.

Three (3) 20 x 50 m BAM plots were undertaken within the subject site. The following information was collected:

- Native overstorey, mid-storey and ground cover recorded for all observed species and an estimate of stems (20 m x 20 m plot).
- Stratum (and layer): stratum and layer in which each species occurs (20 m x 20 m plot).
- Growth form: growth form for each recorded species (20 m x 20 m plot).
- Species name: scientific name and common name (20 m x 20 m plot).
- Percent projected foliage cover of the understorey strata and exotic vegetation
- Number of trees with hollows visible from the ground (20 m x 50 m plot)
- The total length of fallen logs >10 cm in diameter (20 m x 50 m plot)
- The number of regenerating overstorey species (20 m x 50 m plot)
- Number of large trees (20 m x 50 m plot)
- Estimates of leaf litter cover, bare ground, cryptograms and rocks in 1x1m subplots at five (5) locations along the 50 m central transect

All plot sheets utilised for the BAM calculator are in Appendix 2.

2.3 Fauna survey methodology

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

A description of fauna survey techniques that have been tailored to the detailed study area are described below.

Diurnal birds

Three (3) diurnal bird census points were undertaken within the detailed study area. A minimum of 20 minutes of survey was undertaken at each census point in an area radiating out to between 20–30 m. Bird census points were selected to give an even spread and representation across the site and its communities (see Figure 2.1). Census points were also commenced in locations where bird activity was apparent, as often different small bird species are found foraging together. Opportunistic diurnal bird surveys were conducted throughout the study site whilst undertaking other diurnal surveys.

Given the previous recordings of Glossy Black-Cockatoo's (*Calyptorhynchus lathamii*) within the locality (Bionet 2019), opportunistic searches for signs of activity were carried out. Seeding *Allocasuarina* trees located within the detailed study area were searched for chewed cones to indicate foraging activity. GPS reference points were collected to indicate locations where seeding *Allocasuarina* were evident (refer to Figure 2.1).

Nocturnal birds

Spotlighting was undertaken on the evening of the 28 November 2019. Given the suitability of habitat present and observations, Powerful Owl (*Ninox strenua*) and Barking Owl (*Ninox connivens*) and Bush Stone-curlew (*Burhinus grallarius*) were targeted by call-playback techniques. Australian Bittern (*Botaurus poiciloptilus*) and Black Bittern (*Ixobrychus flavicollis*) were also target due to close proximity of habitat and records. Calls are played for five minute periods during nocturnal surveys. This is followed by quiet listening and spotlighting.

Detailed searches for suitable owl hollows was undertaken within the detailed study area. Opportunistic searches for Powerful Owl roosting activity was also undertaken where dense mid-story foliage was present in these areas.

Arboreal and terrestrial mammals

Arboreal and terrestrial mammals were surveyed by use of spotlighting and call-playback techniques. Yellow-bellied Glider (*Petaurus australis*) and Squirrel Glider (*Petaurus norfolcensis*) were targeted by call-playback techniques at this time. Calls are played for five minute periods during nocturnal surveys. This is followed by quiet listening and spotlighting.

Bats

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

Micro-chiropteran bats are surveyed by echolocation using ultrasonic recording detectors. These were used in fixed 'passive' monitoring positions and recorded overnight. Two (2) Ultrasonic Sound Recorders were deployed on site given an even spread across site whilst targeting key foraging areas such as open clearways through vegetation.

Amphibians

Due to the lack of suitable habitat for threatened frog species spotlighting and call identification were undertaken opportunistically on the evening of the 28 November 2019. Opportunistic habitat searches were undertaken during other diurnal surveys.

Reptiles

It is considered there is no suitable habitat for threatened reptiles. Opportunistic reptile surveys were undertaken during diurnal and nocturnal survey.

Habitat trees

Detailed habitat tree surveys were undertaken within subject site (development footprint) to effectively quantify the number of hollows that are to be impacted. This will allow for the relocation of any resident fauna present at the time of their removal.

Significant habitat trees

Significant habitat trees are defined typically as trees providing large hollows suitable for use by owls and cockatoos or containing a number of good quality or small hollows typically consisting of more than one medium (10–30 cm) sized hollow. A tree may also be considered significant where evidence of use by select fauna is found such as Yellow-bellied Glider sap feed tree, raptor nest, or owl roost.

Significant habitat trees were also surveyed within and around the detailed study area. Large hollows suitable for use by threatened owls and cockatoos were mostly targeted. Large raptor nests and Yellow-bellied Glider sap feed trees were also searched for at this time.

2.4 Field survey effort

Tables 2.1 and 2.2 below detail the flora and fauna survey effort undertaken for the subject site.

Table 2.1 – Fauna survey effort

Fauna group	Date	Weather conditions	Survey technique(s)	Time effort (24hr)
Diurnal birds	28/11/19	0/8 cloud, 32km NE, no rain, temp 23°C	Diurnal census x3	1hr 1530-1950
		0/8 cloud, 32km NE, no rain, temp 23°C	Diurnal opportunistic	4hrs 20mins 1530-1950
Nocturnal birds	28/11/19	0/8, 24km NE, no rain, full moon, temp 19-18 °C	Spotlighting	1hr 50mins 1950 - 2140
			Call playback (Section 2.5 species)	Commenced @ 0830
Arboreal mammals	28/11/19	0/8, 24km NE, no rain, full moon, temp 19-18 °C	Spotlighting	1hr 50mins 1950 - 2140
			Call playback (Section 2.5 species)	Commenced @ 2030
Terrestrial mammals	28/11/19	0/8, 24km NE, no rain, full moon, temp 19-18 °C	Spotlighting	1hr 50mins 1950 - 2140
Bats	28/11/19	0/8 cloud, 32km NE, no rain, temp 23°C	Rocky habitat roots searches opportunistic	4hrs 20mins 1530-1950
		0/8, 24km NE, no rain, full moon, temp 19-18 °C	Spotlighting	1hr 50mins 1950 - 2140
			Ultrasonic microbat recording (Passive monitoring) x2	Overnight from 1945
Reptiles	28/11/19	0/8 cloud, 32km NE, no rain, temp 23°C	Diurnal opportunistic / habitat searches	4hrs 20mins 1530-1950
		0/8, 24km NE, no rain, full moon, temp 19-18 °C	Spotlighting	1hr 50mins 1950 - 2140
Amphibians	28/11/19	0/8 cloud, 32km NE, no rain, temp 23°C	Diurnal opportunistic / habitat searches	4hrs 20mins 1530-1950
		0/8, 24km NE, no rain, full moon, temp 19-18 °C	Spotlighting / call identification (opportunistic)	1hr 50mins 1950 - 2140

Table 2.2 – Flora survey effort

Flora survey	Survey technique(s)	Dates
Vegetation communities	- Survey of the boundaries of all communities – field verification, plotting vegetation boundaries on aerial photographs	13 March 2017 28 Nov 2019
Targeted searches	- Targeted searches in known or potential habitats. - Opportunistic searches during all on-foot traverses across the site.	13 March 2017 28 Nov 2019
Stratified sampling	- Three (3) 20m x 20m / 50m x 20m floristic transect plots within native vegetation using BAM	28 Nov 2019

Table 2.3 – Plot and transect survey effort – subject site

Veg zone no.	PCT	Condition	Area (Ha)	Minimum plot transect sites required	Plot transect sites sampled
1	1778	Moderate	0.25	1	1
2	1778	Poor	0.057	1	1
3	1778	Planted	0.233	1	1

2.5 Survey limitations

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

Flora survey limitations

The species list does not include all household or exotic garden / landscaping species and those species which could not be identified at the time of the survey past genus level. Cryptic species not flowering at the time of the survey may not be observed during survey outside of peak flowering periods. Likewise cryptic orchid species are generally only recognisable when flowering.

It is not expected that there are any limitations to threatened flora species survey which could change the outcomes of significance assessment as survey has been undertaken at a time when most are readily flowering or can be observed.

Fauna survey limitations

Not all hollows potentially impacted have been stag-watched during survey. Given that no hollow-dependent threatened species (including microbats) recorded present during survey this is not regarded as essential. Pre-clearance survey should include inspections of hollows.

2.6 Accuracy of identification

Structural descriptions of the vegetation were made according to Specht *et al* (1995).



Figure 2.1 – Flora survey effort and results



Figure 2.2 – Fauna survey effort and results



Survey Results

3

3.1 Flora results

3.1.1 Native vegetation extent

The native vegetation extent within the development footprint has been ground-truthed and includes remnant, regrowth and planted native vegetation. The amount of native vegetation is 0.54 ha, all of which will be impacted by the proposal.

3.1.2 Flora species

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

Table 3.1 – Flora observations within the study area

Family	Scientific name	Common name
TREES		
Fabaceae	<i>Acacia decurrens</i>	Black Wattle
Fabaceae	<i>Acacia parramattensis</i>	Sydney Green Wattle
Aceraceae	<i>Acer negundo</i> *	Box Elder
Myrtaceae	<i>Acmena smithii</i>	Lillypilly
Casuarinaceae	<i>Allocasuarina littoralis</i>	Black She-oak
Myrtaceae	<i>Angophora bakeri</i>	Narrow-leaved Apple
Myrtaceae	<i>Angophora costata</i>	Smooth-barked Apple
Myrtaceae	<i>Angophora floribunda</i>	Rough-barked Apple
Araucariaceae	<i>Araucaria cunninghamii</i>	Hoop Pine
Arecaceae	<i>Archontophoenix cunninghamiana</i>	Bangalow Palm
Sterculiaceae	<i>Brachychiton acerifolius</i>	Illawarra Flame Tree
Cunoniaceae	<i>Callicoma serratifolia</i>	Black Wattle
Cupressaceae	<i>Callitris</i> sp.	Cypress
Lauraceae	<i>Cinnamomum camphora</i> *	Camphor Laurel
Myrtaceae	<i>Corymbia citriodora</i>	Lemon-scented Gum
Myrtaceae	<i>Corymbia ficifolia</i> *	Pink W.A. Gum
Myrtaceae	<i>Corymbia gummifera</i>	Red Bloodwood
Myrtaceae	<i>Corymbia maculata</i>	Spotted Gum
Eleocarpaceae	<i>Elaeocarpus reticulatus</i>	Blueberry Ash
Malaceae	<i>Eriobotrya japonica</i> *	Loquat
Fabaceae	<i>Erythrina crista-galli</i> *	Cockspur Coral Tree
Fabaceae	<i>Erythrina x sykesii</i> *	Coral tree
Myrtaceae	<i>Eucalyptus botryoides</i>	Bangalay / Southern Mahogany
Myrtaceae	<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark
Myrtaceae	<i>Eucalyptus microcarpa</i>	Western Grey Box
Myrtaceae	<i>Eucalyptus microcorys</i>	Tallowwood

Family	Scientific name	Common name
Myrtaceae	<i>Eucalyptus piperita</i>	Sydney Peppermint
Myrtaceae	<i>Eucalyptus racemosa</i>	Narrow-leaved Scribbly Gum
Myrtaceae	<i>Eucalyptus robusta</i>	Swamp Mahogany
Myrtaceae	<i>Eucalyptus saligna</i>	Sydney Blue Gum
Myrtaceae	<i>Eucalyptus scoparia</i>^{TS}	Wallangarra White Gum
Moraceae	<i>Ficus elastica</i> * (Cultivar)	Rubber Plant
Oleaceae	<i>Fraxinus</i> sp.*	
Phyllanthaceae	<i>Glochidion ferdinandi</i>	Cheese Tree
Proteaceae	<i>Grevillea robusta</i>	Silky Oak
Bignoniaceae	<i>Jacaranda mimosifolia</i> *	Jacaranda
Lythraceae	<i>Lagerstroemia indica</i> * (Cultivar)	Crepe Myrtle
Hamamelidaceae	<i>Liquidambar styraciflua</i> *	Sweetgum
Myrtaceae	<i>Lophostemon confertus</i>	Brush Box
Proteaceae	<i>Macadamia integrifolia</i>^{TS}	Macadamia
Malaceae	<i>Malus domestica</i> *	Apple
Anacardiaceae	<i>Mangifera indica</i> *	Mango
Myrtaceae	<i>Melaleuca decora</i>	-
Myrtaceae	<i>Melaleuca quinquenervia</i>	Broad-leaved Paperbark
Myrtaceae	<i>Melaleuca stypheloides</i>	Prickly-leaved Tea Tree
Meliaceae	<i>Melia azedarach</i>	White Cedar
Musaceae	<i>Musa acuminata</i> * (Cultivar)	Banana
Oleaceae	<i>Notelaea longifolia</i>	Mock Olive, Large Mock-olive
Oleaceae	<i>Olea europaea</i> subsp. <i>europaea</i> *	Common Olive Tree
Arecaceae	<i>Phoenix canariensis</i> *	Canary Island Date Palm
Pinaceae	<i>Pinus patula</i> *	Patula Pine
Pittosporaceae	<i>Pittosporum undulatum</i>	Sweet Pittosporum
Rosaceae	<i>Prunus persica</i> *	Peach Tree
Fabaceae/faboideae	<i>Robinia pseudoacacia</i> *	Black Locust
Araliaceae	<i>Schefflera actinophylla</i>	Umbrella Tree
Anacardiaceae	<i>Schinus mole</i> *	Pepper Tree
Proteaceae	<i>Stenocarpus sinuatus</i>	Queensland Firewheel Tree
Arecaceae	<i>Syagrus romanzoffiana</i> *	Cocos Palm
Myrtaceae	<i>Syncarpia glomulifera</i>	Turpentine
Myrtaceae	<i>Syzygium paniculatum</i>^{TS}	Magenta Lilly Pilly
SHRUBS		
Fabaceae	<i>Acacia floribunda</i>	White Sally
Fabaceae	<i>Acacia longifolia</i> var. <i>longifolia</i>	Sydney Golden Wattle
Fabaceae	<i>Acacia podalyriifolia</i>	Queensland Silver Wattle
Agavaceae	<i>Agave attenuata</i> *	Fox Tail Agave
Euphorbiaceae	<i>Breynia oblongifolia</i>	Coffee Bush
Myrtaceae	<i>Callistemon citrinus</i>	Crimson Bottlebrush
Myrtaceae	<i>Callistemon viminalis</i>	Weeping Bottlebrush
Theaceae	<i>Camellia japonica</i> *	Camellia
Theaceae	<i>Camellia sasanqua</i> *	Sasanqua Camellia
Cunoniaceae	<i>Ceratopetalum gummiferum</i>	NSW Christmas Bush
Solanaceae	<i>Cestrum parqui</i> *	Chilean Cestrum
Malaceae	<i>Cotoneaster pannosus</i> *	Cotoneaster (cultivar)
Sapindaceae	<i>Dodonaea triquetra</i>	Hop-bush

Family	Scientific name	Common name
Fabaceae	<i>Genista monspessulana</i> *	Montpellier Broom
Cupressaceae	<i>Juniperus</i> sp.*	Juniper
Verbenaceae	<i>Lantana camara</i> *	Lantana
Lamiaceae	<i>Lavandula</i> sp.*	Lavender
Myrtaceae	<i>Leptospermum polygalifolium</i>	Tantoon
Oleaceae	<i>Ligustrum lucidum</i> *	Large-leaved Privet
Oleaceae	<i>Ligustrum sinense</i> *	Small-leaved Privet
Proteaceae	<i>Lomatia silaifolia</i>	Crinkle Bush
Magnoliaceae	<i>Magnolia</i> sp.* (Cultivar)	Magnolia
Myrtaceae	<i>Melaleuca sieberi</i>	-
Rutaceae	<i>Murraya paniculata</i> *	Orange Jessamine
Apocynaceae	<i>Nerium oleander</i> *	Oleander Bush
Ochnaceae	<i>Ochna serrulata</i> *	Mickey Mouse Plant
Malaceae	<i>Photinia glabra</i> *	Japanese Photinia
Pittosporaceae	<i>Pittosporum revolutum</i>	Yellow Pittosporum
Apocynaceae	<i>Plumeria obtusa</i> * (Cultivar)	Frangipani
Araliaceae	<i>Polyscias sambucifolia</i>	Elderberry Panax
Fabaceae	<i>Pultenaea</i> sp.	
Ericaceae	<i>Rhododendron</i> sp. (cultivar)*	Azalea
Euphorbiaceae	<i>Ricinus communis</i> *	Castor Oil Plant
Caprifoliaceae	<i>Sambucus australasica</i>	Yellow Elderberry
Fabaceae	<i>Senna pendula</i> var. <i>glabrata</i> *	-
Bignoniaceae	<i>Tecoma capensis</i> *	Cape Honeysuckle
GROUNDCOVERS		
Polygonaceae	<i>Acetosa sagittata</i> *	Turkey Rhubarb
Alliaceae	<i>Agapanthus praecox</i> subsp. <i>orientalis</i> *	
Asteraceae	<i>Ageratina adenophora</i> *	Crofton Weed
Asteraceae	<i>Arctotheca calendula</i> *	Capeweed
Asparagaceae	<i>Asparagus aethiopicus</i> *	Asparagus Fern
Liliaceae	<i>Aspidistra elatior</i> *	Cast Iron Plant
Asteraceae	<i>Bidens pilosa</i> *	Cobbler's Pegs
Poaceae	<i>Briza maxima</i> *	Quaking Grass
Bromeliaceae	<i>Bromelia</i> sp.* (Cultivar)	Bromeliads
Poaceae	<i>Bromus cartharticus</i> *	Prairie Grass
Poaceae	<i>Bromus molliformis</i> *	Soft Brome
Crassulaceae	<i>Bryophyllum delagoense</i> *	Mother of Millions
Dicksoniaceae	<i>Calochlaena dubia</i>	Rainbow Fern
Convolvulaceae	<i>Calystegia silvatica</i> *	Bindweed
Cannaceae	<i>Canna indica</i> *	Arrowroot
Poaceae	<i>Cenchrus clandestinus</i> *	Kikuyu, Kikuyu Grass
Apiaceae	<i>Centella asiatica</i>	Swamp Pennywort
Asteraceae	<i>Cirsium vulgare</i> *	Spear Thistle
Commelinaceae	<i>Commelina cyanea</i>	Scurvy Weed, Native Wandering Jew
Asteraceae	<i>Conyza bonariensis</i> *	Flax-leaf Fleabane
Asteraceae	<i>Conyza sumatrensis</i> *	Tall Fleabane
Asteraceae	<i>Coreopsis lanceolata</i> *	Coreopsis
Crassulaceae	<i>Crassula ovata</i> *	Jade Plant
Poaceae	<i>Cynodon dactylon</i>	Common Couch

Family	Scientific name	Common name
Cyperaceae	<i>Cyperus gracilis</i>	Slender Flat Sedge
Apiaceae	<i>Daucus carota</i> *	Wild Carrot
Phormiaceae	<i>Dianella caerulea</i> var. <i>caerulea</i>	Flax Lily
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed
Iridaceae	<i>Dietes bicolor</i> *	Spanish Iris
Poaceae	<i>Digitaria ciliaris</i> *	Summer Grass
Blechnaceae	<i>Doodia aspera</i>	Prickly Rasp Fern
Doryanthaceae	<i>Doryanthes excelsa</i>	Gymea Lily
Poaceae	<i>Ehrharta erecta</i> *	Panic Veldtgrass
Poaceae	<i>Entolasia marginata</i>	Bordered Panic
Poaceae	<i>Entolasia stricta</i>	Wiry Panic
Poaceae	<i>Eragrostis brownii</i>	Brown's Lovegrass
Poaceae	<i>Eragrostis curvula</i> *	African Lovegrass
Asteraceae	<i>Erechtites valerianifolia</i> *	Brazilian Fireweed
Asteraceae	<i>Erigeron karvinskianus</i> *	Bony-tipped Fleabane
Iridaceae	<i>Freesia laxa</i> (Cultivar)*	Freesia
Asteraceae	<i>Gazania</i> sp.*	
Zingiberaceae	<i>Hedychium gardnerianum</i> *	Ginger Lily
Boraginaceae	<i>Heliotropium amplexicaule</i> *	Blue Heliotrope
Asteraceae	<i>Hypochaeris radicata</i> *	Flatweed
Asteraceae	<i>Hypochaeris</i> sp.*	A Catsear
Poaceae	<i>Imperata cylindrica</i>	Blady Grass
Cyperaceae	<i>Lepidosperma laterale</i>	Variable Sword-sedge
Lobeliaceae	<i>Lobelia purpurascens</i>	Whiteroot
Lomandraceae	<i>Lomandra longifolia</i>	Spiky-headed Mat-rush
Zamiaceae	<i>Macrozamia spiralis</i>	Cycad
Fabaceae	<i>Medicago polymorpha</i> *	Burr Medic
Poaceae	<i>Microlaena stipoides</i> var. <i>stipoides</i>	Weeping Rice Grass
Malvaceae	<i>Modiola caroliniana</i> *	Red-flowered Mallow
Davalliaceae	<i>Nephrolepis cordifolia</i>	Fish-bone Fern
Alliaceae	<i>Nothoscordum borbonicum</i> *	Onion Weed
Poaceae	<i>Oplismenus aemulus</i>	Basket Grass
Poaceae	<i>Oplismenus imbecillis</i>	-
Oxalidaceae	<i>Oxalis latifolia</i> *	Pink Fishtail
Poaceae	<i>Paspalum dilatatum</i> *	Paspalum
Poaceae	<i>Paspalum quadrifarium</i> *	Tussock Paspalum
Poaceae	<i>Paspalum urvillei</i> *	Vasey Grass
Araceae	<i>Philodendron bipinnatifidum</i> *	Philodendron
Plantaginaceae	<i>Plantago lanceolata</i> *	Ribwort
Rosaceae	<i>Potentilla indica</i> *	Indian Strawberry
Rubiaceae	<i>Richardia brasiliensis</i> *	White Eye
Rubiaceae	<i>Richardia humistrata</i> *	-
Poaceae	<i>Setaria</i> sp.*	
Malvaceae	<i>Sida rhombifolia</i> *	Paddy's Lucerne
Solanaceae	<i>Solanum chenopodioides</i> *	Whitetip Nightshade
Solanaceae	<i>Solanum nigrum</i> *	Black Nightshade, Black-berry Nightshade
Asteraceae	<i>Sonchus oleraceus</i> *	Common Sow-thistle
Poaceae	<i>Sporobolus elongatus</i>	Slender Rat's Tail Grass

Family	Scientific name	Common name
Poaceae	<i>Stenotaphrum secundatum</i> *	Buffalo Grass
Strelitziaceae	<i>Strelitzia juncea</i> * (Cultivar)	Bird of Paradise
Asteraceae	<i>Taraxacum officinale</i> *	Dandelion
Acanthaceae	<i>Thunbergia alata</i> *	Black-eyed Susan
Commelinaceae	<i>Tradescantia fluminensis</i> *	Wandering Jew
Fabaceae	<i>Trifolium glomeratum</i> *	Clustered Clover
Fabaceae	<i>Trifolium pratense</i> *	Red Clover
Fabaceae	<i>Trifolium repens</i> *	White Clover
Verbenaceae	<i>Verbena bonariensis</i> *	Purpletop
Verbenaceae	<i>Verbena rigida</i> var. <i>rigida</i> *	Veined Verbena
Apocynaceae	<i>Vinca minor</i> *	Blue Periwinkle
Iridaceae	<i>Watsonia bulbifera</i> *	Wild Watsonia
Xanthorrhoeaceae	<i>Xanthorrhoea media</i>	Forest Grass Tree
Apiaceae	<i>Xanthosia pilosa</i>	Woolly Xanthosia
VINES		
Basellaceae	<i>Anredera cordifolia</i> *	Madeira Vine
Pittosporaceae	<i>Billardiera scandens</i>	Hairy Appleberry
Lauraceae	<i>Cassytha glabella</i>	
Luzuriagaceae	<i>Eustrephus latifolius</i>	Wombat Berry
Fabaceae	<i>Glycine clandestina</i>	Twining Glycine
Araliaceae	<i>Hedera helix</i> *	English Ivy
Convolvulaceae	<i>Ipomoea indica</i> *	Morning Glory
Caprifoliaceae	<i>Lonicera japonica</i> *	Japanese Honeysuckle
Bignoniaceae	<i>Pandorea pandorana</i>	Wonga Vine
Menispermaceae	<i>Sarcopetalum harveyanum</i>	Pearl Vine
Smilacaceae	<i>Smilax glyciphylla</i>	Sarsaparilla
Fabaceae	<i>Vicia sativa</i> subsp. <i>sativa</i> *	Common Vetch
Fabaceae	<i>Wisteria sinensis</i> *	Chinese wisteria
Basellaceae	<i>Anredera cordifolia</i> *	Madeira Vine
EPIPHYTES		
Araceae	<i>Monstera deliciosa</i> *	Fruit Salad Plant
Polypodiaceae	<i>Platynerium superbum</i>	Staghorn
* denotes exotic species		
TS denotes threatened species		

3.1.3 Plant community types (PCTs)

Evidence used to identify a PCT

Evidence used to identify the PCTs within the site: the entire list of PCTs was exported from the online BioNet Vegetation Classification Tool. Dominant canopy species, mid-stratum species, ground cover species, and Interim Biogeographic Regionalisation for Australia (IBRA) region and sub-region (Pittwater) information were utilised to produce a short list of potential PCTs (Table 3.2). Final PCTs were then chosen based on species composition and presence, and similarity to descriptive attributes and distributional information provided in the BioNet Vegetation Classification Tool. Justification for inclusion or exclusion of each shortlisted PCT is provided in Table 3.2.

Table 3.3 provides a summary of the PCT occurring within the development site, including vegetation formation, percent cleared within and extent within the development site.

All plot sheets utilised for the BAM calculator are in Appendix 2.

Table 3.2 – PCT shortlist and justification

Zone	Shortlisted PCTs	PCT name	Match	Justification
1 & 2	1778	Smooth-barked Apple - Coast Banksia / Cheese Tree open forest on sandstone slopes on the foreshores of the drowned river valleys of Sydney	✓	Correct geology and soils (sandstone/sand). Correct landscape position - sheltered slopes. Presence of <i>Allocasuarina littoralis</i> and <i>Entolasia stricta</i> .
	1841	Smooth-barked Apple - Turpentine - Blackbutt tall open forest on enriched sandstone slopes and gullies of the Sydney region	x	Incorrect soil type (shale-enriched). Slightly fewer diagnostic species present.
3	1778	Smooth-barked Apple - Coast Banksia / Cheese Tree open forest on sandstone slopes on the foreshores of the drowned river valleys of Sydney	✓	Correct geology and soils (sandstone/sand). Correct landscape position - sheltered slopes.

Zones 1 & 2:

The identification of the most suitable PCT was based upon filtering for PCTs with *Angophora costata* and *Eucalyptus piperita* as upper stratum species, and *Pittosporum undulatum* and *Glochidion ferdinandi* as mid stratum species, within the Pittwater IBRA sub-region. This produced a shortlist of two PCTs: 1778 and 1841. Both of these PCTs are a potential match as several diagnostic species are present for each. PCT 1778 has slightly more diagnostic species such as *Allocasuarina littoralis* and *Entolasia stricta*, and is also the PCT mapped by the Native Vegetation of the Sydney Metropolitan Region (2016). The geology within the site, which is Hawkesbury Sandstone, and sandy soil is indicative of PCT 1778, whereas PCT 1841 occurs on shale-enriched soils. Although PCT 1778 is generally associated with coastal escarpments, it does occur up to 10 km inland. Based on this evidence, PCT 1778 is the most correct PCT for Zones 1 and 2.

Zone 3:

Zone 3 contains a mix of planted and re-established native species that would not naturally occur together or in that landscape position. It is therefore not possible to assign an accurate PCT based on species composition. Based on the determination of Zones 1 and 2, which contain remnant vegetation, it is likely that the original vegetation throughout most of the site was commensurate with PCT 1778. In this case, it is reasonable to assign Zone 3 to PCT 1778.

Table 3.3 – PCTs

PCT code	PCT name	Species relied upon	Vegetation formation	Vegetation class	% Cleared	Area within development site (ha)	TEC status
1778	Smooth-barked Apple - Coast Banksia / Cheese Tree open forest on sandstone slopes on the foreshores of the drowned river valleys of Sydney	<i>Angophora costata</i> , <i>Eucalyptus piperita</i> , <i>Glochidion ferdinandi</i> , <i>Pittosporum undulatum</i> , <i>Allocasuarina littoralis</i> , <i>Entolasia stricta</i>	Dry Sclerophyll Forests (Shrubby sub-formation);	Sydney Coastal Dry Sclerophyll Forests;	90	0.25 (moderate) 0.057 (poor) 0.233 (planted)	not a TEC

3.1.4 Vegetation descriptions of observed communities

The following vegetation communities were identified within the subject site through ground truthing:

- PCT 1778 – Smooth-barked Apple - Coast Banksia / Cheese Tree open forest on sandstone slopes on the foreshores of the drowned river valleys of Sydney (Zones 1 & 2)
- Planted native vegetation (Zone 3)
- Planted exotic vegetation

PCT 1778 – Smooth-barked Apple - Coast Banksia / Cheese Tree open forest on sandstone slopes on the foreshores of the drowned river valleys of Sydney (Zones 1 and 2)

This is the primary vegetation community on the site and occurs in the southern and north-eastern corners. This community is not commensurate with any threatened ecological community (TEC).

Most of this vegetation is of moderate quality (0.25 ha) but some areas in the north-eastern corner are in poor condition (0.057 ha), with sparse canopy and highly disturbed understorey.



Photo 1 – PCT 1778 – Smooth-barked Apple - Coast Banksia / Cheese Tree open forest (moderate) within plot 1.



Photo 2 – PCT 1778 – Smooth-barked Apple - Coast Banksia / Cheese Tree open forest (moderate) within the southern portion of the study area.

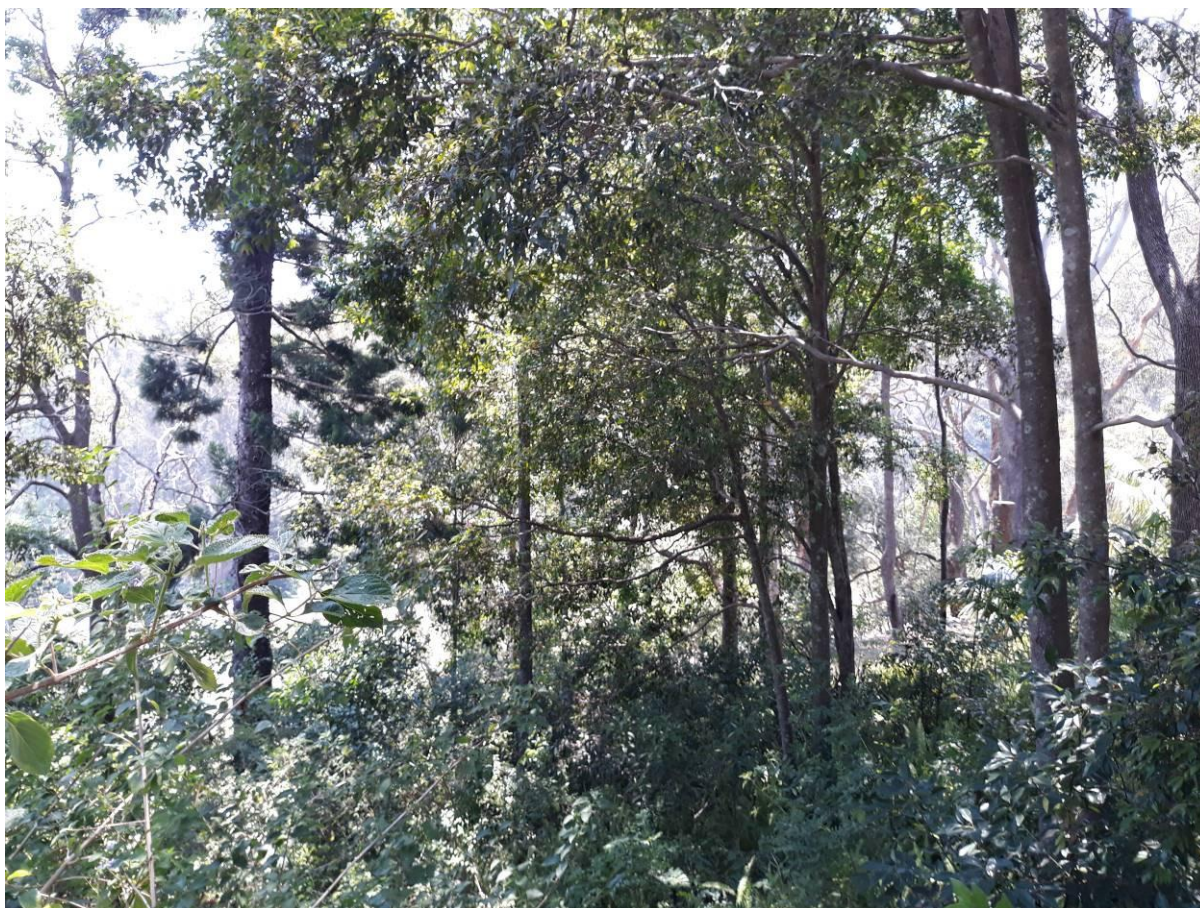


Photo 3 – PCT 1778 – Smooth-barked Apple - Coast Banksia / Cheese Tree open forest (poor) within the north-eastern portion of the study area

Canopy – 15 to 25 m high with 20–30% projected foliage cover (PFC). The dominant species is *Angophora costata*, with other species at lower abundance and including *Eucalyptus piperita*, *Corymbia maculata*, *Eucalyptus saligna* and *Angophora bakeri*. In parts of the poor condition vegetation the canopy is sparse or absent. Exotic *Cinnamomum camphora* is abundant, providing 15% PFC.

Mid - storey – *Allocasuarina littoralis*, *Pittosporum undulatum*, *Glochidion ferdinandi*, *Lomatia silaifolia*, *Pandorea pandorana*, *Smilax glycyphylla*, *Cassytha glabella* and *Elaeocarpus reticulatus*, providing a PFC of 15–30%. Exotic species such as *Lantana camara*, *Asparagus aethiopicus*, *Ligustrum lucidum*, *Senna pendula*, *Ochna serrulata* and *Olea europaea* are present and provide 40–50% PFC

Groundcovers – *Nephrolepis cordifolia*, *Dianella caerulea*, *Lomandra longifolia*, *Xanthorrhoea media*, *Calochlaena dubia*, *Xanthosia pilosa*, *Doodia aspera* and *Entolasia stricta* providing 5–20% PFC.

Planted native vegetation (Zone 3)

This vegetation occurs primarily close to the eastern boundary of the site, but also as scattered clumps of native species within the established landscaping. Common trees include *Eucalyptus* spp., *Melaleuca quinquenervia*, *Grevillea robusta*, *Acacia* spp., *Syncarpia glomulifera*, *Lophostemon confertus* and *Syzygium paniculatum*.

The mid storey and ground layer is dominated by exotic species, with a few native species present such as *Breynia oblongifolia*, *Leptospermum polygalifolium*, *Cynodon dactylon* and *Dichondra repens*.

Although planted, this vegetation must be assessed as native vegetation under the BAM. As explained in Section 3.1.3, not possible to assign an accurate PCT based on species composition. Here we have assigned this vegetation to PCT 1778 as the original vegetation would most likely have been attributable to this PCT. PCT 1778 is not commensurate with any TEC.



Photo 4 – Planted native vegetation within plot 2.

Planted exotic vegetation

The remainder of the vegetation within the site is comprised of planted exotic species. This vegetation is not shown in Figure 2.1 as it does not need assessment under the BAM.

Common trees include *Acer negundo*, *Eriobotrya japonica*, *Erythrina* species, *Fraxinus* sp., *Lagerstroemia indica*, *Liquidambar styraciflua*, *Phoenix canariensis*, *Pinus patula* and *Schinus* sp.

Mid-storey species include *Camellia* spp., *Cotoneaster pannosus*, *Ligustrum* spp., *Magnolia* spp., *Murraya paniculata*, *Nerium oleander*, *Ochna serrulata*, *Photinia glabra*, *Plumeria obtusa* and *Senna pendula*.

The ground layer was dominated by a large variety of exotic, cultivar or landscaping species such as *Asparagus aethiopicus*, *Agapanthus praecox*, *Bryophyllum delagoense*, *Crassula ovata*, *Ehrharta erecta*, *Modiola caroliniana* and *Paspalum* spp.



Photo 5 – Planted native and exotic vegetation in the centre of the site.



Photo 6 – Planted exotic species in the centre of the site.

3.1.5 Vegetation integrity assessment

A vegetation integrity assessment is an assessment on the site's condition. Vegetation patches are broken into zones of roughly equal quality and then surveyed by transect plots. The number of required transect plots is dependent upon the size of the zone.

Vegetation zone area (ha)	Minimum number of plots/transects
<2	1 plot/transect
>2–5	2 plots/transects
>5–20	3 plots /transects
>20–50	4 plots/transects
>50–100	5 plots/transects
>100–250	6 plots/transects
>250–1000	7 plots/transects; more plots may be needed if the condition of the vegetation is variable across the zone
>1000	8 plots/transects; more plots may be needed if the condition of the vegetation is variable across the zone

Once data from the transect plot has been collected, the composition of native plant species per growth form is assessed, along with numbers of stems, percentages of exotic or high threat exotic species present, number and sizes of native tree stems, litter cover, rock cover, cryptogram cover, hollows and fallen logs. Therefore the vegetation integrity assessment is a measure of composition, structure and function.

The breakdown of PCTs and zones, and the location of the plots in relation to the impacted areas are shown on Figure 2.1.

The vegetation integrity score is obtained using equations and weightings based upon a number of entities to calculate scores for composition, structure and function, for an overall current vegetation integrity score.

All Zones score relatively low for vegetation integrity. This is likely due to the poor composition and structure condition scores resulting from low species richness and cover. The vegetation integrity for PCT 1778 poor is below the threshold for assessment but as it is associated with threatened species habitat it must still be assessed. Table 3.4 shows the current vegetation integrity score.

Table 3.4 – Current vegetation integrity score

Vegetation zone name	Area (ha)	Composition condition score	Structure condition score	Function condition score	Current vegetation integrity score
1778 moderate	0.25	25.8	33.3	93.9	43.2
1778 poor	0.057	7	11.6	73.3	18.1
1778 planted	0.233	14.6	33.5	60.3	30.9

The future vegetation integrity score across the majority of the site is measured assuming there will be no vegetation retained within the development area, including building footprints and APZs. Given the above clarification, the future vegetation integrity score for these areas will be 0 as indicated in Table 3.5. There will only be a limited number of trees retained as per the Vegetation Management Plan, and it will be landscaped with non-endemic species. The value of the vegetation in the future is very limited within the poor and planted areas on site. These already have a very low vegetation integrity score and not worthy of splitting into management zones to reduce credit requirements.

The moderate quality vegetation not being built on will have a higher retention value of trees and some understorey, although the landscaping will likely replace a lot of the understorey vegetation. Where there is a building footprint, a 3 m buffer has been placed off the building wall to allow for cut/fill and full impacts. The retained vegetation has a reduced vegetation integrity score via the following mechanisms for APZ management.

Therefore, 1778 moderate has been split into Zone A - development 0.05 ha, and Zone B - APZ 0.20 ha. Zone A has a future integrity score of 0. Zone B has been modified in the following way, see Table 3.5, 3.6 and 3.7. The future composition score has been calculated based on the loss of one (1) species from each vegetation layer or group. The future structure score assumes a reduction in canopy and mid-storey species to 10% coverage in line with typical APZ management, nil loss of grass coverage, and a reduction of other ground layer coverage by half. The future function score has been calculated assuming no regeneration, the retention of one (1) large tree, a reduction of litter cover due to APZ management, retention of some coarse woody debris on ground for animals (although a large reduction), and management of high threat weeds.

Table 3.5 - Calculating future composition score

1778 moderate	Tree	Shrub	Grass and grass like	Forb	Fern	Other	Score
Current composition condition score	4	4	2	2	3	5	25.8
Future composition condition score	3	3	1	1	2	4	18.4

Values represent no. of species.

Table 3.6 - Calculating future structure score

1778 moderate	Tree	Shrub	Grass and grass like	Forb	Fern	Other	Score
Current structure condition score	26.1	20.5	2.1	0.2	5.7	3.4	33.3
Future structure condition score	10	10	2.1	0.1 (50%)	2.9 (50%)	1.7 (50%)	6.7

Values represent % native vegetation cover.

Table 3.7 - Calculating future function score

1778 moderate	Regeneration stems <5cm DBH	5-9	10-19	20-29	30-49	Number of large trees	Hollow bearing trees	Litter cover (%)	Coarse woody debris (m)	High threat weed coverage (%)	Score
Current function condition score	Present	✓	✓	✓	✓	2	2	88	40	57.2	93.9
Future function condition score	Absent	x	✓	✓	✓	1	n/a	20	10	5	30.5

Table 3.8 – Future vegetation integrity score

Vegetation zone name	Management zone	Area (ha)	Composition condition score	Structure condition score	Function condition score	Future vegetation integrity score
1778 moderate	A - Development	0.05	0	0	0	0
	B - APZ	0.20	18.4	6.7	30.5	15.6
1778 poor		0.057	0	0	0	0
1778 planted		0.233	0	0	0	0

3.2 Fauna results

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

Table 3.9 – Fauna observations within the study area

Common name	Scientific name	Method observed	
Birds		Nov 28	
Australian Brushturkey	<i>Alectura Lathamii</i>	O	
Australian Magpie	<i>Cracticus tibicen</i>	OW	
Australian Raven	<i>Corvus coronoides</i>	OW	
Australian Wood Duck	<i>Chenonetta jubata</i>	OW	
Galah	<i>Eolophus roseicapillus</i>	OW	
Laughing Kookaburra	<i>Dacelo novaeguineae</i>	OW	
Lewin’s Honeyeater	<i>Meliphaga lewinii</i>	W	
Long-billed Corella	<i>Cacatua tenuirostris</i>	OW	
Magpie-lark	<i>Grallina cyanoleuca</i>	OW	
Masked Lapwing	<i>Vanellus miles</i>	O	
Nankeen Night-Heron	<i>Nycticorax caledonicus</i>	OW	
Noisy Miner	<i>Manorina melanocephala</i>	OW	
Rainbow Lorikeet	<i>Trichoglossus haematodus</i>	OW	
Sulphur Crested Cockatoo	<i>Cacatua galerita</i>	OW	
Tawny Frogmouth	<i>Podargus strigoides</i>	O	
Welcome Swallow	<i>Hirundo neoxena</i>	OW	
Yellow-tailed Black-Cockatoo	<i>Calyptorhynchus funereus</i>	W	
Mammals			
Common Ringtail Possum	<i>Pseudocheirus peregrinus</i>	O	
Eastern Freetail-bat	<i>Mormopterus ridei</i>	U ^{PO}	
Gould’s Wattled Bat	<i>Chalinolobus gouldii</i>	U	
Grey-headed Flying-fox ^{TS}	<i>Pteropus poliocephalus</i>	OW	
White-striped Mastiff-bat	<i>Austronomus australis</i>	U	
Reptiles			
Delicate Skink	<i>Lampropholis delicata</i>	O	
Eastern Water Skink	<i>Eulamprus quoyii</i>	O	
Southern Leaf-tailed Gecko	<i>Phyllurus platurus</i>	O	
Elegant Snake-eyed Skink	<i>Cryptoblepharus pulcher</i>	O	
Amphibians			
Dwarf Tree Frog	<i>Litoria fallax</i>	W	
Peron’s Tree Frog	<i>Litoria peronii</i>	W	
Whistling Tree Frog	<i>Litoria verreauxii</i>	W	
<div>Note:<div><div>* indicates introduced species</div><div>^{TS} indicates threatened species</div><div>^{MS} indicates Migratory species</div></div><div>All species listed are identified to a high level of certainty unless otherwise noted as:</div><div><div>^{PR} indicates species identified to a ‘probable’ level of certainty – more likely than not</div><div>^{PO} indicates species identified to a ‘possible’ level of certainty – low-moderate level of confidence</div></div></div>			
E - Nest/roost	H - Hair/feathers/skin	P - Scat	W - Heard call
F - Tracks/scratchings	K - Dead	Q - Camera	X - In scat
FB - Burrow	O - Observed	T - Trapped/netted	Y - Bone/teeth/shell
G - Crushed cones	OW - Obs & heard call	U - Anabat/ultrasound	Z - In raptor/owl pellet

3.3 Habitat results

3.3.1 Fauna habitat observations

The fauna habitats present within the site are identified within the following table.

Table 3.10 – Observed fauna habitat

Topography										
Flat	✓	Gentle	✓	Moderate	✓	Steep	✓	Drop-offs	✓	
Vegetation structure										
Closed Forest		Open Forest	✓	Woodland	✓	Heath		Grassland		
Disturbance history										
Fire		Under-scrubbing	✓			Cut and fill works	✓			
Tree clearing	✓	Grazing								
Soil landscape										
DEPTH:		Deep	✓	Moderate	✓	Shallow		Skeletal		
TYPE:		Clay	✓	Loam	✓	Sand	✓	Organic	✓	
VALUE:		Surface foraging	✓	Sub-surface foraging	✓	Denning/burrowing	✓			
WATER RETENTION:		Well Drained	✓	Damp / Moist		Water logged		Swamp / Soak		
Rock habitat										
CAVES:		Large		Small	✓	Deep	✓	Shallow	✓	
CREVICES:		Large		Small	✓	Deep	✓	Shallow	✓	
ESCARPMENTS:		Winter / late sunny aspects				Shaded winter / late aspects				✓
OUTCROPS:		High Surface Area Hides		Med. Surface Area Hides			✓	Low Surface Area Hides		
SCATTERED / ISOLATED:		High Surface Area Hides		✓	Med. Surface Area Hides			Low Surface Area Hides		
Feed resources										
FLOWERING TREES:		Eucalypts	✓	Corymbias	✓	Melaleucas	✓			
		Banksias		Acacias	✓					
SEEDING TREES:		Allocasuarinas	✓	Conifers						
WINTER FLOWERING EUCALYPTS:		C. maculata	✓	E. crebra	✓	E. globoidea		E. sideroxylon		
		E. squamosa		E. grandis		E. multicaulis		E. scias		
		E. robusta		E. tereticornis	✓	E. agglomerata		E. siderophloia		
FLOWERING PERIODS:		Autumn	✓	Winter	✓	Spring	✓	Summer	✓	
OTHER:		Mistletoe		Figs / Fruit		Sap / Manna	✓	Termites	✓	
Foliage protection										
UPPER STRATA:		Dense	✓	Moderate	✓	Sparse				
MID STRATA:		Dense	✓	Moderate	✓	Sparse	✓			
PLANT / SHRUB LAYER:		Dense	✓	Moderate	✓	Sparse	✓			
GROUNDCOVERS:		Dense		Moderate	✓	Sparse	✓			
Hollows / logs										
TREE HOLLOW:		Large	✓	Medium	✓	Small	✓			
TREE HOLLOW TYPES		Spouts / branch	✓	Trunk	✓	Broken Trunk	✓	Basal Cavities	Stags	✓
GROUND HOLLOW:		Large		Medium		Small				
Vegetation debris										
FALLEN TREES:		Large		Medium		Small	✓			
FALLEN BRANCHES:		Large		Medium		Small	✓			
LITTER:		Deep	✓	Moderate	✓	Shallow	✓			
HUMUS:		Deep		Moderate	✓	Shallow	✓			
Drainage catchment										
WATER BODIES		Wetland(s)	Soak(s)	Dam(s)	✓	Drainage line(s)	✓	Creek(s)	River(s)	
RATE OF FLOW:		Still	✓	Slow		Rapid				

CONSISTENCY:	Permanent ✓	Perennial		Ephemeral
RUNOFF SOURCE:	Urban / Industrial ✓	Parkland ✓	Grazing	Natural
RIPARIAN HABITAT:	High quality	Moderate quality	Low quality ✓	Poor quality
Artificial habitat				
STRUCTURES:	Sheds ✓	Infrastructure ✓	Equipment ✓	
SUB-SURFACE	Pipe / culvert(s) ✓	Tunnel(s)	Shaft(s)	
FOREIGN MATERIALS:	Sheet ✓	Pile / refuse ✓		

3.3.2 Habitat tree data

Hollow-bearing trees and those considered to be significant habitat trees observed within the study area are tabled below. Significant habitat trees are defined as trees containing large hollows suitable for use by owls and/or containing a number of good quality hollows typically consisting of more than one medium (10-30cm) sized hollow. A tree may also be considered significant where evidence of use by select fauna is found. Significant habitat trees are indicated in bold.

Table 3.11 – Habitat tree data

Tree No	Scientific name	Common name	DBH (cm)	Height (m)	Spread (m)	Vigour (%)	Hollows & other habitat features recorded
HT1	<i>A. costata</i>	Smooth-barked Apple	29	14	9	75	1x 5cm branch spot 1x 10-15cm trunk hollow Scratches on trunk
HT2		Stag	17	18	3	0	1x 5cm branch spout
HT3	<i>A. costata</i>	Smooth-barked Apple	43	22	15	75	2x 10-15cm branch sprouts Scratches on trunk
HT4	<i>E. piperita</i>	Sydney Peppermint	34	17	9	65	1x 5-10cm trunk split 3m long
HT5		Stag	34	9	6	0	1x 5cm base hollow 2x 5-10cm ant nest hole 1x 10-15cm branch spout
HT6	<i>E. piperita</i>	Sydney Peppermint	47	19	14	65	1x 5cm trunk hollow 1x 5-10cm trunk split Wear on bark around hollow
HT7		Stag	18	8	1	0	1x 5-10cm branch spout 1x 5-10cm hollow split
HT8	<i>A. costata</i>	Smooth-barked Apple	65	22	18	55	1x 10-15cm branch split 1x 20-30cm trunk split 1x 20-30cm trunk hollow
HT9		Stag	67	20	4	0	1x 10-15cm branch spout 1x 30-40cm trunk hollow Sulphur-crested Cockatoo nest tree
HT10		Stag	41	8	3	0	1x 10-15cm trunk split 1x 15-20cm branch spout
HT11		Stag	37	18	3	0	1x 10-15cm trunk hollow
HT12	<i>E. piperita</i>	Sydney Peppermint	19,25,28	18	8	55	3x 5cm trunk hollows
HT13		Stag	15,17	10	4	0	2x 5cm trunk hollows 1x 5cm Ant nest hollow
HT14	<i>E. racemosa</i>	Narrow-leaved Scribbly Gum	0	0	0	0	1x 5-10cm branch spout Scratches on trunk
HT15	<i>A. costata</i>	Smooth-barked Apple	0	23	13	75	2x 5-10cm branch spouts 1x 5-10cm trunk split Scratches on trunk
HT16		Stag	65	9	1	0	2x 5cm trunk hollows 1x 5cm trunk split
HT17	<i>E. piperita</i>	Sydney Peppermint	78,74	22	18	0	2x 5-10cm trunk splits
HT18	<i>E. tereticornis</i>	Forest Red Gum	135	22	19	75	2x 15-20cm trunk split 1x 15-20cm branch spout
HT19	<i>E. racemosa</i>	Narrow-leaved Scribbly Gum	27,32	9	6	55	1x 20-30cm open trunk



Biodiversity Assessment

4

4.1 BOS thresholds

The BOS includes two (2) elements to the threshold test – an area trigger and a Biodiversity Values Land Map trigger. If clearing exceeds either trigger, the Biodiversity Offset Scheme applies to the proposed clearing.

4.1.1 Biodiversity Values Land

The study area is not located on lands mapped as Biodiversity Values Land (refer to Figure 4.1) – therefore an offset is not required as an outcome of this threshold test.

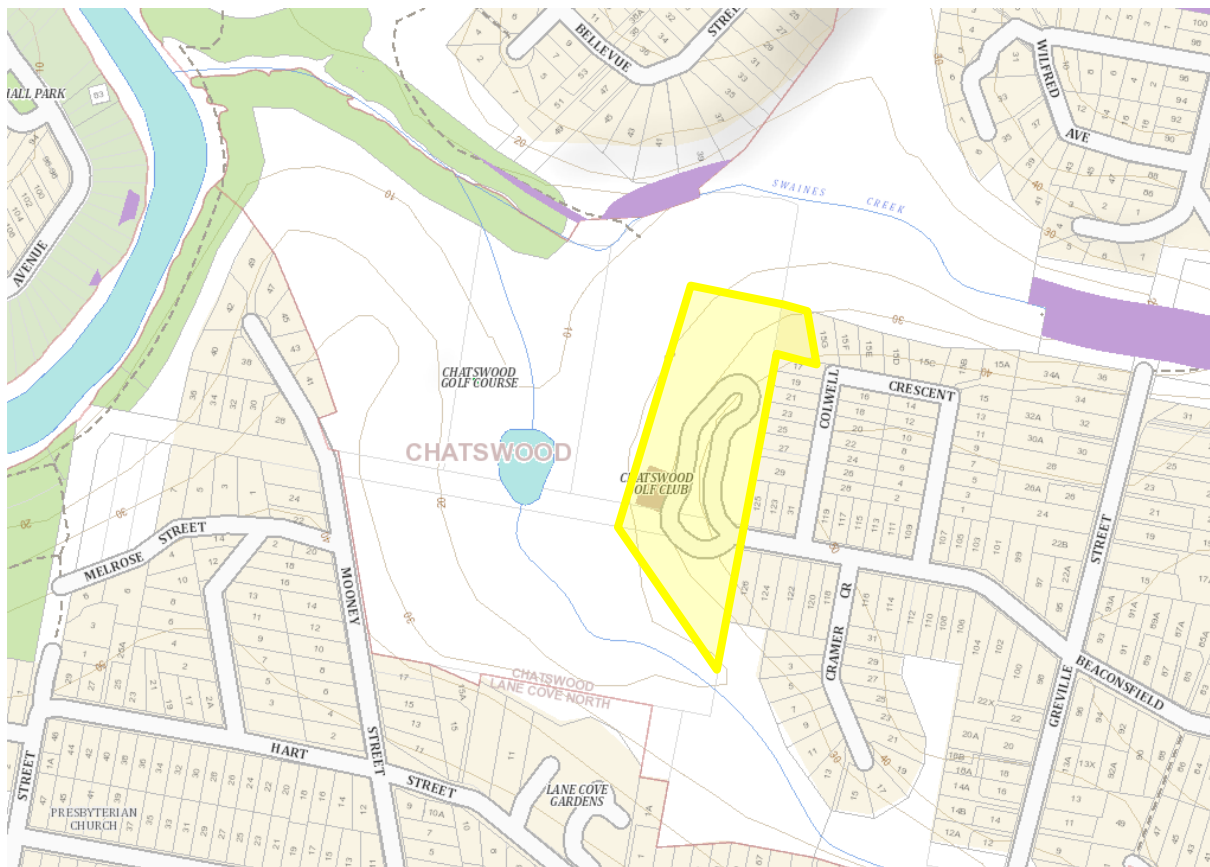


Figure 4.1 – Biodiversity Land Map (purple) relative to the study area (yellow)
(source: <https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BosetMap>)

4.1.2 Area clearing threshold

The area threshold varies depending on the minimum lot size (shown in the Lot Size Maps made under the relevant Local Environmental Plan (LEP)), or actual lot size (where there is no minimum lot size provided for the relevant land under the LEP).

The area threshold applies to all proposed native vegetation clearing associated with a development proposal – for example in the case of a subdivision; all future clearing across the lots subject to the subdivision, must be considered. Note that native vegetation includes planted species native to NSW. Thresholds outlined under the BOS are outlined in the table below.

The lots within the subject site do not have a specified minimum lot size under the Willoughby LEP and as such the actual lot size of the smallest lot (Lot 1 DP651667) is used by the Biodiversity Offset Scheme Entry Tool (BOSET). Table 5.1 identifies that the smallest lot is 0.69 ha in size, and the clearing area threshold for which the BOS applies is 0.25ha. Based on the preliminary concept plans (Figure 1.2), *TBE* concludes that the proposed development will remove greater than 0.25 ha of native vegetation therefore offsetting under BOS applies.

Table 4.1 – BOSET report

Date of Calculation	20/12/2019 10:12 AM	BDAR Required*
Total Digitised Area	1.77 ha	
Minimum Lot Size Method	Lot size	
Minimum Lot Size	0.69 ha	
Area Clearing Threshold	0.25 ha	
Area clearing trigger Area of native vegetation cleared	Unknown #	Unknown #
Biodiversity values map trigger Impact on biodiversity values map(not including values added within the last 90 days)?	no	no
Date of the 90 day Expiry	N/A	

The development proposal does exceed the nominated clearing thresholds therefore offsetting is required as an outcome of this test.

4.1.3 Serious and Irreversible Impacts

An impact is to be regarded as serious and irreversible if it is likely to contribute significantly to the risk of a threatened species or ecological community most at risk of extinction. Threatened species and communities that are potential for serious and irreversible impacts are outlined in Appendix 2 of *Guidance to assist a decision-maker to determine a serious and irreversible impact* (DPIE 2017). The principles for determining serious and irreversible impacts are set out under Section 6.7.2 of the *BC Reg*.

Candidate species recorded or with potential to occur within the study area include:

Table 4.2 – Candidate SAIL species

Species / EEC (Scientific name)	Species (Common name)	BC Act	Potential to occur
<i>Eucalyptus scoparia</i>	Wallangarra White Gum	E1	recorded on site
<i>Miniopterus schreibersii subsp. oceanensis</i>	Large Bent-wing Bat	E	✓
<i>Chalinolobus dwyeri</i>	Large-eared pied-bat	V	✓
<i>Miniopterus australis</i>	Little Bent-wing Bat	E	✓
<i>Lathamus discolor</i>	Swift parrot	E	low
<i>Anthochaera phrygia</i>	Regent honeyeater	E	unlikely

The additional impact assessment provisions for threatened species are outlined under Section 10.2.3 of the BAM (2017).

Eucalyptus scoparia was recorded within the study area only as planted specimens and thus not naturally occurring. These individuals are well outside the natural distribution for the species and are therefore not part of the naturally-occurring population. We do not consider that the removal of these individuals is of conservation significance and that an SAI assessment is not warranted.

The ecological data profiles of each of the remaining above listed candidate fauna species has been reviewed to determine any habitat constraints present for breeding and foraging. There is no presence of these constraints and therefore the proposal is not considered likely to cause serious and irreversible impacts.

4.2 Previous surveys reviewed

The following regional vegetation mapping and reports were examined to identify the potential vegetation communities and other threatened biodiversity with potential to occur for assessment.

The Native Vegetation of the Sydney Metropolitan Area. Version 3.0. OEH (2016).

This regional mapping by OEH identifies the following communities within the study area:

- PCT 1778 - Smooth-barked Apple - Coast Banksia / Cheese Tree open forest on sandstone slopes on the foreshores of the drowned river valleys of Sydney (equivalent to Coastal Sandstone Foreshores Forest)
- Urban Exotic/Native

Flora and Fauna Study - Chatswood Golf Course, Beaconsfield Road, Chatswood - Travers bushfire & ecology, July 2017

This report assessed the feasibility of a proposed seniors living development, a new golf clubhouse with ancillary facilities and a temporary clubhouse / green keepers shed. The following vegetation communities were identified within the site:

- Urban Exotics and Natives
- Coastal Sandstone Foreshores Forest
- Managed Greens and Fairways

This report did not find any threatened flora species nor were they considered likely to occur in a natural state, although it did note that planted *Syzygium paniculatum* or *Eucalyptus scoparia* may occur.

Fauna assessment was based on desktop analysis. Fauna survey was not undertaken but it was considered that the habitat attributes within the subject site do not provide any significant or unique habitat of breeding importance for any threatened fauna species.

4.3 Flora

No threatened flora species were observed.

All species are listed in Table 3.1.

4.3.1 Local / Regional flora matters

The Willoughby Development Control Plan and Local Environment Plan do not list any locally or regionally significant species.

4.3.2 State legislative flora matters

(a) Threatened flora species (NSW)

BC Act – Two (2) state listed threatened flora species, *Eucalyptus scoparia* and *Syzygium paniculatum*, were observed during survey undertaken.

Eucalyptus scoparia occurs in Queensland and reaches its southern limit in New South Wales, where it has only recently been discovered. In New South Wales, it is found on well drained granitic hilltops, slopes and outcrops, often as scattered trees in open forest and woodland. There are only three known natural locations within NSW, all near Tenterfield in the far northern New England Tableland Bioregion. The specimens observed within the study area are well outside this natural distribution and were planted on site, as many of this species were as feature or street trees. It is therefore considered that the likelihood of an impacted naturally occurring population of *Eucalyptus scoparia* is unlikely.

Syzygium paniculatum occurs in subtropical and littoral rainforest on sandy soil, from Forster to Jervis Bay. There is no naturally-occurring suitable habitat for this species within the study area. The specimens observed have been planted as part of landscaped garden beds. It is therefore considered that the likelihood of an impacted naturally occurring population of *Syzygium paniculatum* is unlikely.

(b) Endangered flora populations (NSW)

There are no endangered populations within the Willoughby LGA.

(c) Threatened ecological communities (NSW)

No TECs were observed within the study area.

(d) Ecosystem credit species

The BAM calculator did not predict any threatened flora species as ecosystem credit species.

(e) Species credit species

Based upon the BAM calculator and field surveys to date, the following predicted threatened species were considered as confirmed candidate species:

Table 4.3 – Species credit species (flora)

Scientific name	BC Act	Associated PCTs	Potential to occur (presence status)	Confirmed candidate species	Survey Adequacy			Presence		Presence
					Preferred Survey period (DPIE)	Actual Survey period	Survey Compliant (Yes/ No)	Assumed	Expert report	
<i>Allocasuarina portulensis</i>	E1	none	x	x				No		Absent (no potential to occur)
<i>Leptospermum deanei</i>	V	1778 (moderate)	✓	✓	Oct–Nov	March, Nov	Yes	No		Absent (based on survey)
<i>Melaleuca biconvexa</i>	V	none	x	x				No		Absent (no potential to occur)

Exclusions based on habitat features / survey

Habitat assessments for all species recorded within 10km of the study area are provided in detail and based on local records within Appendix 2. Some additional species for consideration have been generated by the BAM calculator and their potential to occur is considered here only. Species recorded present or considered with any potential to occur are then assessed for habitat presence. If these species have not been recorded some may be ruled out based on adequacy of survey (survey techniques and methodology have been described in section 3).

General exclusions from assessment have been based on a number of features. Although the BAM calculator may suggest particular species have potential habitat based upon the vegetation type, they may be excluded due to geographic distribution, last known local record being decades old, lack of suitable geological features, isolation of particular habitats or degradation of habitats. These factors were considered in detail to advise which candidate species could potentially be impacted.

Excluded species are mentioned below:

Allocasuarina portulensis

Originally known from Nielsen Park, in Woollahra LGA. Propagation and establishment of planted individuals has been undertaken at Nielsen Park and other locations in the local area, e.g. Gap Bluff, Hermit Point and Vacluse House. This species is not known to occur north of Sydney Harbour. The original habitat for this species is tall closed woodland. Vegetation within Zone 2 meets the description of closed woodland, but the understorey is so highly disturbed and dominated by exotics and “invasive” native species (e.g. *Nephrolepis cordifolia*) that there is no potential for *A. portulensis* to occur.

Melaleuca biconvexa

This species grows in forested wetlands that are periodically inundated, adjoining perennial streams. As there are no wetlands or periodically inundated areas within the subject site, there is no potential habitat for this species.

(f) Local data

Local data has not been used in this case.

(g) Expert reports

Expert reports have not been utilised for flora on this project.

(h) Endangered wetland communities

A number of wetland communities have been listed as TECs under the NSW *BC Act*. We note that ‘wetlands’ are included in the definition of ‘waterfront lands’ in accordance with the *Water Management Act 2000 (WM Act)* due to their inclusion in the definition of a ‘lake’ under the same Act. TECs that are considered to be an endangered protected wetland are as follows:-

- Artesian springs ecological community
- Castlereagh Swamp Woodland Community

- Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner bioregions
- Coastal Upland Swamp in the Sydney Basin bioregion
- Coolibah–Black Box woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain and Mulga Lands bioregions
- Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions
- Kurri sand swamp woodland in the Sydney Basin Bioregion
- Lagunaria swamp forest on Lord Howe Island
- Maroota Sands swamp forest
- Newnes Plateau Shrub Swamp in the Sydney Basin Bioregion
- Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions
- Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions
- The shorebird community occurring on the relict tidal delta sands at Taren Point
- Upland wetlands of the drainage divide of the New England Tableland Bioregion
- Wingecarribee Swamp

No endangered wetland communities were present within the subject site and therefore a referral to NRAR is not required.

(i) Groundwater dependent ecosystems

Groundwater dependent ecosystems (GDEs) are communities of plants, animals and other organisms whose extent and life processes are dependent on groundwater. Some examples of ecosystems which depend on groundwater are:

- wetlands;
- red gum forests, vegetation on coastal sand dunes and other terrestrial vegetation;
- ecosystems in streams fed by groundwater;
- limestone cave systems;
- springs; and
- hanging valleys and swamps.

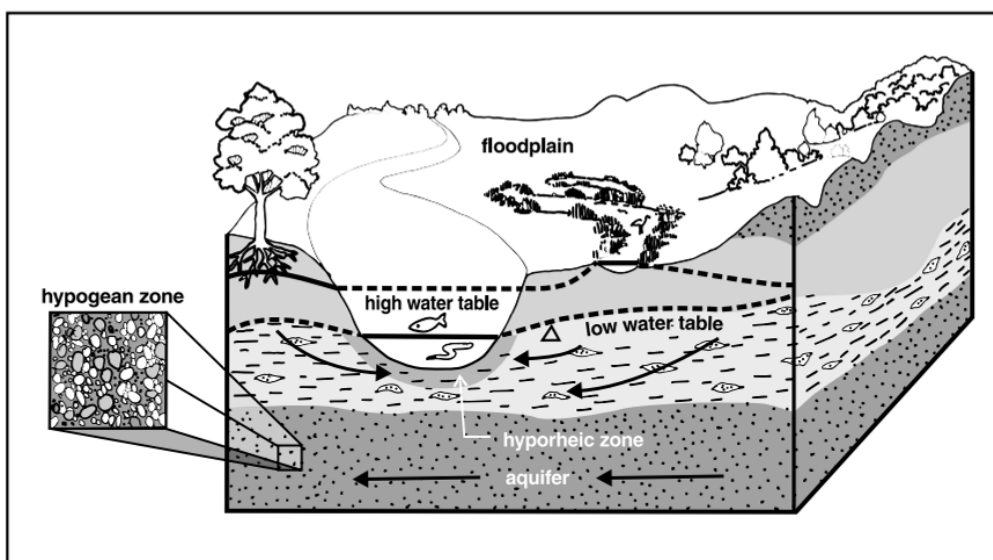


Figure 4.2 – Alluvial groundwater system discharging into a river

GDEs are therefore ecosystems which have their species composition and their natural ecological processes determined by groundwater (NSW State Groundwater Dependent Ecosystems Policy April 2002).

GDEs were not observed within the subject site and therefore the policy does not require any further consideration. A referral to NRAR is not required.

4.3.3 Matters of national environmental significance - flora

(a) Threatened flora species (national)

A review of the schedules of the *EPBC Act* indicated the potential for a list of threatened flora species to occur within a 10 km radius of the site. These species have been considered for habitat presence and potential to occur within Appendix 1.

Based on the habitat assessment within Appendix 1, it is considered that the subject site provides varying levels of potential habitat for the following nationally listed threatened flora species:

Table 4.4 – Nationally listed threatened flora species with suitable habitat present

Scientific name	EPBC Act	Potential to occur
<i>Macadamia integrifolia</i>	V	recorded (planted / naturalised)
<i>Eucalyptus scoparia</i>	V	recorded (planted)
<i>Syzygium paniculatum</i>	V	recorded (planted)
<i>Acacia bynoeana</i>	V	low
<i>Acacia terminalis</i> subsp. <i>terminalis</i>	E	low
<i>Darwinia biflora</i>	V	low
<i>Genoplesium baueri</i>	E	unlikely
<i>Hibbertia spanantha</i>	CE	unlikely

Three (3) nationally-listed threatened flora species *Macadamia integrifolia*, *Eucalyptus scoparia* and *Syzygium paniculatum* were observed within the study area.

Eucalyptus scoparia occurs in Queensland and reaches its southern limit in New South Wales, where it has only recently been discovered. In New South Wales, it is found on well drained granitic hilltops, slopes and outcrops, often as scattered trees in open forest and woodland. There are only three known natural locations within NSW, all near Tenterfield in the far northern New England Tableland Bioregion. The specimens observed within the study area are well outside this natural distribution and was planted on site, as many of this species were as feature or street trees. It is therefore considered that the likelihood of an impacted naturally occurring population of *Eucalyptus scoparia* is unlikely.

Macadamia integrifolia occurs naturally in rainforest in Queensland south to Currumbin Valley in the Gold Coast hinterland. It is not known to occur naturally in NSW, but is cultivated as a nut tree. The specimens observed within the study area are well outside the natural distribution for the species. One is likely to have been planted while the other established from seed dispersed from a planted tree. It is therefore considered that the likelihood of an impacted naturally occurring population of *Macadamia integrifolia* is unlikely.

Syzygium paniculatum occurs in subtropical and littoral rainforest on sandy soil, from Forster to Jervis Bay. There is no naturally-occurring suitable habitat for this species within the study area. The specimens observed have been planted as part of landscaped garden beds. It is therefore considered that the likelihood of an impacted naturally occurring population of *Syzygium paniculatum* is unlikely.

(b) Threatened ecological communities (national)

No TECs occur within the study area.

4.4 Fauna

All fauna species recorded during survey, key fauna habitat observations and habitat tree data are provided in Section 3.

4.4.1 Key fauna habitat

Most notable habitat features for threatened fauna species considered with most potential to occur (see Sections 4.4.4 & 4.4.5) include:

- Large hollows (30+cm), medium hollows (10-30cm) and small hollows (<10cm),
- Seeding *Allocasuarina* trees
- Rock on rock habitat
- Shallow and small caves along the rocky escarpment,
- Seasonal flowering opportunities for nectivorous species.
- Winter flowering trees

A complete assessment of the location of habitat trees and the size of hollows within and close to the development footprint was undertaken as part of surveys. Table 3.8 provides hollow-bearing tree data and Figure 2.1 shows locations of hollow-bearing trees including those deemed to be significant habitat trees.

One (1) large hollow within HT9 was recorded just outside of the development footprint to the south however this is a dead stag with an open broken trunk entry and not considered suitable for use by threatened owls. There is some potential suitability for use by Glossy Black-Cockatoo (which has been previously recorded across the golf course) however this tree is located at a sufficient distance from the proposed development (25 m from APZ edge and 70 m from building edge) such that survey during the winter breeding period is not considered necessary. If in the low potential that this tree is used in winter for nesting, the breeding pair would be well conditioned to nearby activity from the golf course.

One hollow-bearing tree (HT13) may be removed due to its close location to the proposed building footprint. Other habitat trees located in the APZ and potentially removed include HT17, HT12 and HT14-16). No hollow-dependent threatened fauna species were recorded during survey. There is still some potential for some threatened microbat to occur in the study area. Therefore we recommend that hollow-bearing trees are retained within the APZ where possible.

For hollows to be removed, a strict removal of hollows process is recommended in Section 5.4 to prevent impacts on hollow-dependent fauna. This includes the supervision of their removal to effectively recover fauna and the relocation of hollows (or replacement with nest boxes) within the conservation areas of the site.

4.4.2 State legislative fauna matters

(a) Threatened fauna species (NSW)

BC Act – One (1) state listed threatened fauna species Grey-headed Flying-fox (*Pteropus poliocephalus*), was recorded within the study area during survey.

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

(b) Endangered fauna populations (NSW)

There are no endangered fauna populations identified specifically to the Ryde LGA; however the site does fall within the Sydney Metropolitan Catchment Management Authority area. An endangered population of White-fronted Chat (*Epthianura albifrons*) is identified to this area which is made up of two known isolated sub-populations; one at Newington Nature Reserve on the Parramatta River and one at Towra Point Nature Reserve in Botany Bay.

The study area is located within the Ryde LGA which is located on the Parramatta River directly opposite Newington Nature Reserve. Despite this there is no suitable habitat for White-fronted Chat within the study area itself.

(c) Ecosystem credit species

Based upon the BAM calculator and field surveys to date, the following predicted threatened fauna species were considered as candidate species:

Table 4.5 – Ecosystem credit species (fauna)

Common name	BC Act	Potential to occur	Foraging habitat absent	Excluded (justified below)	Confirmed predicted species	Associated PCT
Grey-headed Flying-fox (foraging)	V	Yes (recorded)			✓	1778
Glossy Black-Cockatoo (foraging)	V	✓			✓	1778 (Mo & Po)
Little Lorikeet	V	✓			✓	1778
Varied Sittella	V	✓			✓	1778
Little Bent-wing Bat (foraging)	V	✓			✓	1778
Large Bent-wing Bat (foraging)	V	✓			✓	1778
Barking Owl (foraging)	V	✓			✓	1778
White-bellied Sea-Eagle (foraging)	V	✓	✓			
Powerful Owl (Foraging)	V	✓			✓	1778
Osprey (foraging)	V	✓	✓			
East-coast Freetail Bat	V	Low			✓	1778
Swift Parrot (foraging)	E1	Low			✓	1778 (PI)
Square-tailed Kite (foraging)	V	Low			✓	1778
Little Eagle (foraging)	V	Low			✓	1778
Dusky Woodswallow	V	Unlikely			✓	1778
Regent Honeyeater (foraging)	E4A	Unlikely			✓	1778 (PI)
Masked Owl (foraging)	V	No (not likely)		✓		
Spotted-tailed Quoll	V	No (not likely)		✓		
Koala (foraging)	V	No (not likely)		✓		
Rosenberg's Goanna	V	No		✓		

The species that have been excluded above are excluded based on the absence of any suitable habitat, available extent of remaining habitat, geographic distribution, last known local record being old, lack of suitable geological features, and isolation of particular habitats or degradation of habitats. For some species indicated this may also be backed up by an absence/lack of any recent records within 10 km.

(d) Species credit species

Based upon the BAM calculator and field surveys to date, the following predicted threatened fauna species were considered as confirmed candidate species:

Table 4.6 – Species credit species (fauna)

Common name	BC Act	Potential to occur (presence status) / Habitat	Breeding habitat absent	Survey adequacy			Presence of species		Confirmed candidate species	Associated PCTs
				referred Survey period (DPIE)	Actual survey period	Survey sufficient to rule out presence	Assumed	Expert report		
Grey-headed Flying-fox (breeding)	V	Yes (recorded)	✓							
Large Bent-wing Bat (breeding)	V	✓	✓							
Glossy Black-Cockatoo (breeding)	V	✓	✓							
Large-footed Myotis	V	✓	N/A	Oct-Mar	Nov	x	✓		✓	1778
Little Bent-wing Bat (breeding)	V	✓	✓							
Powerful Owl (breeding)	V	✓	✓							
White-bellied Sea Eagle (breeding)	V	✓	✓							
Barking Owl (breeding)	V	✓	✓							
Eastern Osprey (breeding)	V	✓	✓							
Little Eagle (breeding)	V	Low	✓							
Swift Parrot (breeding)	E1	Low	✓							
Square-tailed Kite (breeding)	V	Low	✓							
Regent Honeyeater (breeding)	E4A	Unlikely	✓							
Large-eared Pied Bat	V	No (not likely)								
Masked Owl (breeding)	V	No (not likely)								
Koala (breeding)	V	No (not likely)								
Long-nosed Bandicoot, North Head population	E2	No								
Red-crowned Toadlet	V	No								
Koala, Pittwater LGA population	E2	No								
Little penguin endangered population at Manly Point	E2	No								

Eastern Pygmy Possum	V	No								
Gang-gang Cockatoo population(Hornsby and Kuring-gail)	E2	No								
Giant Burrowing Frog	V	No								
Broad-headed Snake	E1	No								

Exclusions:

Large-eared Pied Bat

Habitat for this species is within 2 km of roosting rocky overhangs and caves. Such features do occur in the locality along the escarpments above the Lane Cove River however no previous *BioNet* records exist of Large-eared Pied Bat occurring within the main reaches of the Sydney Harbour or the Lane Cove River.

Masked Owl

Only 1 record of this species is known in the Lane Cove River. There are not enough large hollows to support roosting and foraging within a home range and there is also no potential for recolonization of the area based on the extensive surrounding urban landscape.

Koala

There is not enough expansive areas of suitable connective habitat containing feed trees to support a population within the locality and there are no records from *BioNet* of Koalas within the lower reaches of the Lane Cove River.

Long-nosed Bandicoot, Koala and Little Penguin populations

The study area is not located within the recognised area of these endangered populations.

Red-crowned Toadlet

There are no breeding opportunities within the development footprint or nearby including the combination of ephemeral drainages, appropriate water quality via seepages and opportunity to disperse to other adjacent breeding habitats.

Inclusions based on inadequacy of survey

Whilst survey and effort was undertaken within the appropriate season for Southern Myotis, this survey was during a prolonged dry period resulting in an absence of nearby open water foraging opportunity for this species. As hollows are present within the development area, their use has higher potential by Southern Myotis at times when open water exists nearby such as at the dam in the golf course and along the Swaines Creek to the nearby north.

(e) Local data

Local data has not been used in this case.

(f) Expert reports

Expert reports have not been utilised for fauna on this project.

4.4.3 Matters of national environmental significance - fauna

(a) Threatened fauna species (National)

EPBC Act – A review of the schedules of the *EPBC Act* identified a list of threatened fauna species or species habitat likely to occur within a 10 km radius of the subject site. These species have been listed in Appendix 1.

Based on the habitat assessment within Appendix 1, it is considered that the subject site provides varying levels of potential habitat for the following nationally listed threatened fauna species:

Table 4.7 – Nationally listed threatened fauna species with suitable habitat present

Common name	EPBC Act	Potential to occur
Grey-headed Flying-fox	V	Recorded
White-throated Needletail	V	✓
Large-eared Pied Bat	V	✓
Swift Parrot	E	Low
Regent Honeyeater	CE	Unlikely
Painted Honeyeater	V	Unlikely

One (1) nationally listed threatened fauna species, Grey-headed Flying-fox (*Pteropus poliocephalus*) was recorded as three individuals in flight over the study area during survey. The study area does not provide any suitable roosting and subsequent breeding habitat potential and foraging habitat to be removed is otherwise well represented in the locality.

The Significant Impact Criteria for a vulnerable species listed under the *EPBC Act* 1999 (Appendix 4) was reviewed to assess the impacts on this species as a result of the proposed development. It is concluded that there will not be any significant impact on this species, or other nationally listed threatened fauna species with potential to occur, as a result of the subdivision proposal.

(b) Protected migratory species (National)

The *EPBC Act Protected Matters Report* provides additionally listed terrestrial, wetland and marine migratory species of national significance likely to occur, or with habitat for these species likely to occur, within a 10 km radius of the subject site. The habitat potential of migratory species that have not been considered in the threatened species habitat assessment are considered in Appendix 1.

No nationally protected migratory bird species were recorded present during the survey. The impact assessment for nationally protected migratory species with potential to occur has concluded a not significant impact.

4.4 Vegetation connectivity and habitat corridors

The study area is situated on the eastern extent of Chatswood golf club bordering suburban estate which has been depicted in Figure 4.3. The open forest habitat provides a minor part of connectivity which encompasses the golf club.

The development site is centred on an already developed patch of land consisting of fragmented Smooth-barked Apple – Coastal Banksia/ Cheese tree open forest. This extends to the north and south with patchworks of planted native and non-native vegetation in between.

Connective vegetation extends east past the subject site where it disintegrates into suburbia. To the west, the bordering vegetation is fragmented and connects up to Lane Cove River extending north and south through the riparian vegetation.

The removal of this vegetation will result in the loss of a minor part of connectivity in the surrounding fringes of the golf course. This can be retained with the planting of trees on the outer edge of the proposed development.

These sentiments are also noted by Council in their comments on the proposal dated 18 August 2017:

Notwithstanding that the proposal for a Seniors Living development is mostly located on land already developed for a clubhouse and parking and does not have high biodiversity values, the golf course area as a whole is important in providing connections across the Council managed reserves in the Lane Cove River catchment. Ferndale Park, Coolaroo Reserve, OH Reid Reserve and Mowbray Park are all linked by the Chatswood golf course. This network of Open Space is precisely the objective of the 'Green Grid' concept as Council understands it, outlined by the Greater Sydney Commission, and is a crucial element for Sydney's long term liveability and sustainability.

The band of green space running through the site, which includes remnant native trees, non-native landscaping, tree planting and other green open space, is a significant element of the local green network. It represents the only un-interrupted vegetated corridor linking with the high canopy of Ferndale Park and Coolaroo Reserve which are in turn part of a larger network of continuously linked reserves that includes areas along the Lane Cove River and into Lane Cove National Park.

The construction of an interim Clubhouse off Mooney St in an area previously rejected by Council for residential development is likely to be controversial and despite being temporary will inevitably cause degradation. Even as a temporary structure it will impact the green corridor and could be perceived as encroachment by stealth. Any future DA should be conditioned to ensure full reinstatement of vegetation following demolition of the temporary structure.

Based on the connectivity assessment as well as these comments by council, it is recommended that landscaping on both sides of the proposal includes the planting of locally endemic and seasonally flowering trees in a north-south alignment to reinstate the existing connectivity values.

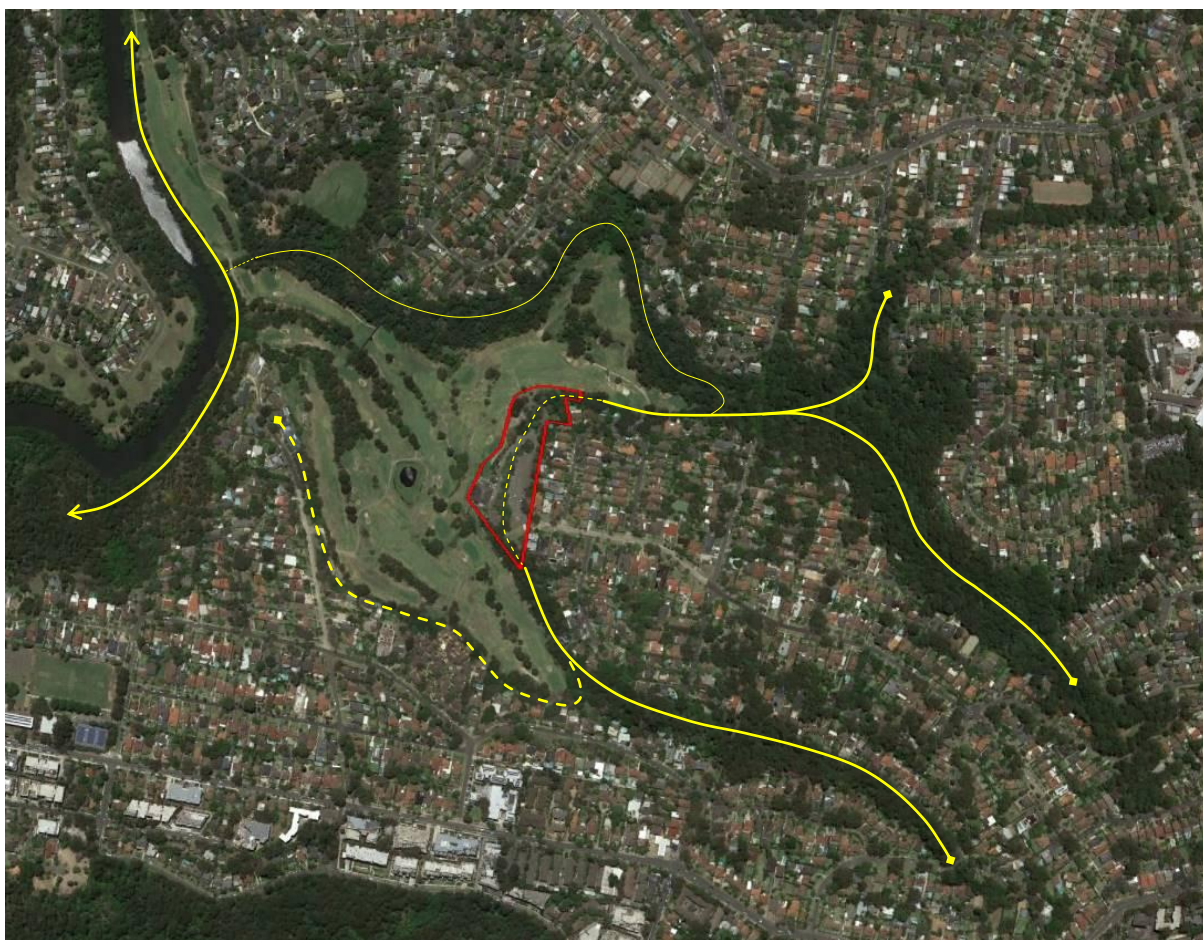


Figure 4.3 – Local connectivity



Figure 4.4 – Species credit species polygon



Conclusion

5

Travers bushfire & ecology has been engaged to prepare a biodiversity development assessment report (BDAR) for a proposed development at Chatswood Golf Club, 128 Beaconsfield Road, Chatswood.

Ecological survey and assessment has been undertaken in accordance with relevant legislation including the *Environmental Planning and Assessment Act 1979*, the *Biodiversity Conservation Act 2016*, the commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and the *Fisheries Management Act 1994*.

5.1 Legislative compliance

In respect of matters required to be considered under the *Environmental Planning and Assessment Act 1979* and relating to the species / provisions of the *Biodiversity Conservation Act 2016*, one (1) threatened fauna species Grey-headed Flying-fox (*Pteropus poliocephalus*), two (2) threatened flora species (planted) *Eucalyptus scoparia* and *Syzygium paniculatum*, and no TECs were recorded within the study area.

Offsetting under the Biodiversity Offsets Scheme (BOS) is required for the development associated with the proposed rezoning as the proposed clearing of vegetation is greater than the lot size threshold of 0.25 ha.

In respect of matters required to be considered under the *Environment Protection and Biodiversity Conservation Act 1999*, one (1) threatened fauna species Grey-headed Flying-fox (*Pteropus poliocephalus*), no protected migratory bird species, three (3) threatened flora species (planted / naturalised), *Eucalyptus scoparia*, *Macadamia integrifolia* and *Syzygium paniculatum*, and no TECs listed under this Act were recorded within the study area.

The proposed development is not considered to have a significant impact on matters of national environmental significance. As such a referral to Department of Environment and Energy should not be required.

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

5.2 Potential ecological impacts

The direct, indirect and cumulative ecological impacts have been considered in respect to recorded biodiversity, threatening processes and extent of impact as a result of the proposed works:-

5.2.1 BC Reg Prescribed impacts

The proposal has the potential to result in prescribed biodiversity impacts that are detailed in the *BC Regulation*. Potential prescribed impacts on biodiversity include:

Impacts of development on the habitat of threatened species or ecological communities associated with non-native vegetation,

Several threatened fauna species may potentially use non-native vegetation within the site for foraging. Grey-headed Flying-fox, Little Lorikeet and Swift Parrot may use flowering feed resources from *Corymbia citriodora* (lemon-scented Gum) and *Jacaranda mimosifolia* (Jacaranda), whilst Grey-headed Flying-fox may also fruiting *Eriobotrya japonica* (Loquat) and *Mangifera indica* (Mango). There are only a few plants of these species within the site and they are not likely to be important for the local and bioregional persistence of these threatened species.

5.2.2 Direct impacts

The other direct impacts of the proposal within the subject site are considered as:

- Removal / modification of 0.25 ha of PCT 1778 (moderate).
- Removal / modification of 0.057 ha of PCT 1778 (poor).
- Removal / modification of 0.233 ha of planted native vegetation.
- Subsequent removal of threatened fauna species foraging habitat including:
 - a) Seasonal flowering resources for Little Lorikeet and the recorded Grey-headed Flying-fox
 - b) Seeding *Allocasuarina* spp. for the recorded Glossy Black-Cockatoo
 - c) Air space and prey species habitat for Powerful Owl, and threatened microbats.
- Removal of hollows suitable for hollow-dependent threatened microbats.
- Removal of dead trees for perching use by raptors.

5.2.3 Indirect impacts

The potential indirect impacts of the proposal are considered as:

- The existing fragmented connectivity through the development footprint linking habitat to the north and south (refer to Figure 4.3) will become further fragmented.
- Reduced cross-site movements by small bird species such as passerines.
- Edge effects such as weed incursions caused from soil disturbance, repeated clearing and landscaping species becoming a nuisance in the adjacent remnant bushland.
- Increased spill-over from noise, activity, scent and lighting effects into the adjacent quality natural habitat areas.
- Increased soil nutrients from changes to runoff that may provide further opportunities for weed plumes.
- Concentrated stormwater runoff from solid surfaces and subsequent increased flows.

5.2.4 Cumulative impacts

The potential cumulative impacts (combined results of past, current and future activities) of the proposal are considered as:

- Increased risk of weed invasion and fungal mobilisation or infections
- Cumulative loss of PCT 1778 within the locality
- Cumulative loss of native vegetation within the locality
- Further fragmentation of the connective remnant

- Increased varied human presence and activity within the remaining natural habitat areas of the adjacent bushland remnant.
- Edge effects from inappropriate use of remaining native vegetation areas such as additional clearing, dumping of materials, dumping of faecal, food or general waste and building refuse.

5.3 Avoid and minimise impacts

The following actions and designing of works have been undertaken to either avoid or minimise impacts on biodiversity values:

- The development is located to utilise existing cleared areas, including existing buildings, driveways and parking lots, and areas of non-native vegetation. This reduces impacts on native vegetation within the golf course lands.
- Residual impacts are on relatively poor condition native vegetation with low vegetation integrity scores.
- The development avoids impacts on existing dams and riparian areas within the golf course lands which may be utilised by aquatic species, waterfowl and wading birds.
- In areas outside the construction and building footprints, but within the APZ, vegetation removal is to be limited to that required for APZ requirements.
- Integrated weed management and control of high threat exotics within retained vegetation will reduce impacts on biodiversity values.
- Adaptive management.

5.4 Recommendations

The following recommendations are made to avoid, minimise or ameliorate the above potential ecological impacts, address threatening processes and to guide a more positive ecological outcome for threatened species and their associated habitats.

- Landscaping within the property is to use locally occurring native species commensurate with PCT 1778.
- Revegetation of mid-storey species to APZ-compliance where possible.
- Priority areas for sediment and erosion control.
- Standard *Phytophthora cinnamomi* protocol applies to the cleaning of all plant, equipment, hand tools and work boots prior to delivery onsite to ensure that there is no loose soil or vegetation material caught under or on the equipment and within the tread of vehicle tyres. Any equipment onsite found to contain soil or vegetation material is to be cleaned in a quarantined work area or wash station and treated with anti-fungal herbicides.
- Based on the connectivity assessment as well as comments by council, it is recommended that landscaping on both sides of the proposal includes the planting of locally endemic and seasonally flowering trees in a north-south alignment to reinstate the existing connectivity values.

- Hollow-bearing trees located within the APZ should be retained where possible, based on their quality of health to persist safely in the landscape. Where the felling of hollow-bearing trees is required this is to be conducted under the supervision of a fauna ecologist to ensure appropriate animal welfare procedures are taken, particularly for threatened species. Hollows of high quality or with fauna recorded residing within should be dismantled for relocation and all hollows should be inspected for occupation, signs of previous activity and potential for reuse.
- Subsequent hollows of retention value are to be relocated to nearby conservation areas. If these are placed as on ground habitat and are not reattached to a new recipient tree then they are to be replaced with appropriately sized nest boxes affixed to a retained tree.

Constructed nest boxes should, as priority, target potential hollow-dependent threatened species. Boxes should be constructed all of weatherproof timber (marine ply), fasteners and external paint and appropriately affixed to a recipient tree under the guidance of a fauna ecologist.

If a threatened species is found to be occupying the hollow at the time of removal then this hollow section is to be reattached to a recipient tree within the nearby conservation areas as selected and directed by the fauna ecologist. The welfare and temporary holding of the residing animal(s) is at the discretion of the fauna ecologist.

The relocated hollow section and nest boxes should be well secured in the recipient tree in a manner that will not compromise the current or future health of that tree.

- The proposed APZ should retain trees where possible as a secondary priority to healthy hollow-bearing trees.

5.5 Biodiversity credit requirements

5.5.1 *Serious & Irreversible Impacts (SAILs)*

There are no potential SAIL entities within the development footprint.

5.5.2 *Impacts requiring offset*

The following impacts will require offsetting:

- Removal of 0.3ha* of PCT 1778 moderate
- Removal of 0.1ha* of PCT 1778 poor
- Removal of 0.2ha* of PCT 1778 planted
- Loss of habitat for threatened species, including species credits for Large-footed Myotis (Southern Myotis) (0.25 ha 1778 moderate, 0.06 ha 1778 poor, 0.23 ha 1778 planted).

*Note: the BAM calculator rounds impact requirements to the nearest 0.1 ha for ecosystem credits or 0.01 ha for species credits, hence the discrepancy with the values stated elsewhere in the BDAR.

5.5.3 *Impacts not requiring offset*

All areas of native vegetation impact will require offsetting and have been accounted for in the BAM calculator. The vegetation integrity for PCT 1778 poor is below the threshold for

assessment but as it is associated with threatened species habitat it must still be assessed under the BOS.

5.5.4 Areas not requiring assessment

Any native vegetation beyond the extent of the APZ has not been assessed in the calculator. Exotic vegetation also does not require assessment under the BAM.



BAM Credit Results

6

6.1 Ecosystem credits and species credits

Ecosystem credits and species credits that measure the impact of the development on biodiversity values have been calculated, assuming full removal of vegetation within the development footprint to the extent of the APZ with the exception of a portion of 1788 moderate that will retain some ecological value within the APZ. Future vegetation integrity score for each vegetation zone at the development site will therefore be 0 as shown in Section 3.1.5.

Habitat suitability for threatened species has been considered in Section 4. Some species are considered for species credits, particularly if potential breeding habitat is compromised or impacted.

Ecosystem credits for plant community types (PCTs), ecological communities and threatened species habitat is shown below in Table 6.1. Species credits for threatened species are shown in Table 6.2.

Table 6.1 – Requirement for ecosystem credits

Zone	Veg. zone name	Veg. integrity loss	Area (ha)	Sensitivity to gain	Biodiversity risk weighting	Candidate SAI	Ecosystem credits
1	1778_moderate	30.7	0.3	High Sensitivity to Potential Gain	2.5	False	5
2	1778_poor	18.1	0.1	High Sensitivity to Potential Gain	2.5	False	1
3	1778_planted	30.9	0.2	High Sensitivity to Potential Gain	2.5	False	4
							Total: 10

Table 6.2 – Requirement for species credits

Veg. zone name	Veg. integrity loss	Area (ha)	Biodiversity risk weighting	Potential SAI	Species credits
Southern Myotis (Large-footed Myotis)					
1778_moderate	30.7	0.25	2	False	4
1778_planted	30.9	0.23	2	False	4
1778_poor	18.1	0.06	2	False	1
					Total: 9

6.2 Ecosystem credit classes

Table 6.3 – Ecosystem credit summary

PCT	TEC	Area (ha)	Credits
1778-Smooth-barked Apple - Coast Banksia / Cheese Tree open forest on sandstone slopes on the foreshores of the drowned river valleys of Sydney	Not a TEC	0.5	10

Table 6.4 – Credit classes for PCT 877 and 1395 - Like for like options

PCT	Vegetation Class	Trading group	TEC	Containing hollow-bearing trees?	Credits
1778	Sydney Coastal Dry Sclerophyll Forests This includes PCTs: 1778	Sydney Coastal Dry Sclerophyll Forests - \geq 90% cleared group (including Tier 2 or higher).	no	Yes	Pittwater , Cumberland, Sydney Cataract, Wyong and Yengo <u>OR</u> any IBRA subregion that is within 100 km of the outer edge of the impacted site

6.3 Species credit classes

Table 6.5 – Species credit summary

Species	Area (ha)	Credits
Southern Myotis (Large-footed Myotis)	0.5	9
Total		9

All above-listed species need to be offset with the same species but anywhere in NSW.

The pricing of credits can vary greatly over time and it is advised that the proponent use the online Biodiversity Offset Payment Calculator tool to determine the current pricing of credits (<https://www.lmbc.nsw.gov.au/offsetpaycalc>).

Bibliography

- Auld, B. A. & Medd, R. W. (1996) *Weeds*. Inkata Press.
- Barker, J., Grigg, G. C. & Tyler, M. J. (1995) *A Field Guide to Australian Frogs*. Surrey Beatty & Sons.
- Briggs, J. D. & Leigh, J. H. (1995) *Rare or Threatened Australian Plants*. CSIRO.
- Churchill, S. (2008) *Australian Bats*, 2nd Ed., Jacana Books, Crows Nest, Sydney.
- Cogger, H. G. (1996) *Reptiles and Amphibians of Australia*. Reed Books, Australia.
- Cropper, S. (1993) *Management of endangered plants*. CSIRO Publications, Melbourne.
- DEC (2004) *Threatened Species Survey and Assessment: Guidelines for developments and activities (working draft)*, New South Wales Department of Environment and Conservation, Hurstville, NSW.
- DECC (2008) *Hygiene protocol for the control of disease in frogs*. Information Circular Number 6. DECC (NSW), Sydney South.
- DECCW & Water NSW (2010). *NSW Wetlands Policy* – NSW Department of Environment, Climate Change.
- DEWHA (2010) *Survey guidelines for Australia's threatened bats*. Department of Environment Water Heritage and Arts.
- DPIE (2019) *Atlas of NSW Wildlife* (BioNet).
- Ehmann, H. (1997) *Threatened Frogs of New South Wales*. FATS Group.
- EPBC (1999) Environmental Protection and Biodiversity Conservation Act 1999 - Interactive Map Database Search - <http://www.environment.gov.au/webgis-framework/apps/pmst/pmst-coordinate.jsf>
- Griffiths, K. (1997) *Frogs and Reptiles of the Sydney Region*. University NSW Press.
- Harden, G. (1993) *Flora of New South Wales*. University NSW Press.
- Hoser, R. (1989) *Australian Reptiles and Frogs*. Pierson & Co.
- Klaphake, V. (2010) *Eucalypts of the Sydney Region*. 2nd Ed. Van Klaphake, Byabarra.
- Lamp, C. & Collett, F. (1996) *A Field Guide to Weeds in Australia*. Inkata Press.
- Lunney, D., Urquart, C. A. & Reed, P. (1988) *Koala Summit*, NPWS.
- Marchant, S., & P. J. Higgins (Eds) (1990) *Handbook of Australian, New Zealand and Antarctic Birds*. Volumes 1-7 Oxford University Press, Melbourne.
- Morrison, R. G. B. (1981) *A Field Guide to the Tracks & Traces of Australian Animals*. Rigby.

- Murphy, C. L. & Tille, P. J. (1993) *Soil Landscapes of the Sydney 1:100,000 Sheet*. Department of Conservation & Land Management.
- OEH (2016) *NSW Guide to Surveying Threatened Plants*.
- OEH (2016) The Native Vegetation of the Sydney Metropolitan Area. Version 3.0. NSW Office of Environment and Heritage, Sydney.
- OEH (2018) 'Species credit' threatened bats and their habitats, NSW survey guide for the Biodiversity Assessment Method.
- Parnaby, H. (1992) *An interim guide to identification of insectivorous bats of south-eastern Australia*. The Australian Museum, Sydney, Technical Report, No. 8.
- Pennay, M., Law, B., Reinhold, L. (2004). Bat calls of New South Wales: Region based guide to the echolocation calls of Microchiropteran bats. NSW Department of Environment and Conservation, Hurstville.
- Phillott, A. D, Skerratt, L. F., McDonald, K. R., Speare, R., Hines, H. B., Meyer, E., Cashins, S. D., Mendez, D. & Berger, L. (2010) Minimising exposure of amphibians to pathogens during field studies. Inter-research. Diseases of Aquatic Organisms, *Contribution to DAO Special 4: 'Chytridiomycosis: an emerging disease'*
- Pizzey, G. & Knight, F. (1997) *A Field Guide to the Birds of Australia*. Angus & Robertson.
- Reader's Digest (1976) *Complete Book of Australian Birds*.
- Richardson, F. J., Richardson, R. G. & Shepherd, R. C. H (2011) *Weeds of the South-East: an Identification Guide for Australia*. Everbest Printing Co. Pty. Ltd. China.
- Robinson, L. (2003) *Field Guide to the Native Plants of Sydney. Revised 3rd Ed*. Kangaroo Press.
- Robinson, M. (1996) *A Field Guide to Frogs of Australia*. Reed.
- Schodde, R. and Tidemann, S. (Eds) (1986) *Readers Digest complete book of Australian Birds*. Second Edition. Reader's Digest Services Pty Ltd, Sydney.
- Simpson & Day (1996) *Field Guide to the Birds of Australia*. Viking.
- Specht, R. L., Specht, A., Whelan, M. B. & Hegarty, E. E. (1995) *Conservation Atlas of Plant Communities in Australia*. Southern Cross University Press, Lismore.
- Triggs, B. (1996) *Tracks, Scats & Other Traces: A Field Guide to Australian Mammals*. Oxford University Press, Melbourne.
- Trounson, Donald & Molly (1998) *Australian Birds Simply Classified*. Murray David Publishing Pty Ltd, NSW.
- Van Dyke, S. and Strahan, R. (Eds) (2008) *The Mammals of Australia* (3rd Edn). Reed New Holland. Sydney.

- Wheeler, D. J. B., Jacobs, S. W. L. & Norton, B. E. (1994) *Grasses of New South Wales*. University of New England.
- Wilson, K. W. and Knowles, D. G. (1988) *Australia's Reptiles - A Photographic Reference to the Terrestrial Reptiles of Australia*. Cornstalk Publishing.



Nationally Threatened & Migratory Species Habitat Assessment

A1

Table A1.1 provides an assessment of potential habitat within the study area for nationally listed threatened flora species recorded within 10km on the Atlas of NSW Wildlife (DPIE) or indicated to have potential habitat present within 10km on the *EPBC Act* Protected Matters Tool.

Table A1.1 – Nationally threatened flora habitat assessment

Scientific name <small>DATABASE SOURCE</small>	BC Act	EPBC Act	Growth form and habitat requirements <i>Distribution limit</i>	Recorded on site (✓)	If not recorded on site				Considered for referral assessment (✓)
					Suitable habitat present (✓)	Nearby and / or high number of record(s) (✓) <small>Notes 1,2 & 3</small>	Record(s) from recent years (✓) <small>Notes 1,2 & 3</small>	Potential to occur	
<i>Acacia bynoeana</i> <small>DPIE EPBC</small>	E1	V	Erect or spreading shrub to 0.3m high growing in heath and dry sclerophyll open forest on sandy soils. Often associated with disturbed areas such as roadsides. <i>Distribution limits</i> N-Newcastle S-Berrima.	x	low	4 km N	2008	unlikely	✓
<i>Acacia pubescens</i> <small>DPIE EPBC</small>	V	V	Spreading shrub 1-4m high open sclerophyll growing in open forest and woodlands on clay soils. <i>Distribution limits</i> N-Bilpin S-Georges River.	x	x	-	-	x	x

Scientific name DATABASE SOURCE	BC Act	EPBC Act	Growth form and habitat requirements Distribution limit	Recorded on site (✓)	If not recorded on site				Considered for referral assessment (✓)
					Suitable habitat present (✓)	Nearby and / or high number of record(s) (✓) Notes 1,2 & 3	Record(s) from recent years (✓) Notes 1,2 & 3	Potential to occur	
<i>Acacia terminalis</i> subsp. <i>terminalis</i> DPIE EPBC	E1	E	Erect shrub to 2m tall, flowers from March to July. Occurs in eucalypt woodland or forest, usually in sandy soil on creek banks, hillslopes or in shallow soil in rock crevices and sandstone platforms on cliffs. Typically restricted to Port Jackson and the eastern suburbs of Sydney.	x	low	1.5 km S	2016	low	✓
<i>Allocasuarina glareicola</i> EPBC	E1	E	Small shrub 1-2m high growing in open sclerophyll forest on lateritic soils derived from tertiary alluviums. Distribution limits Castlereagh NR region.	x	x	-	-	x	x
<i>Allocasuarina portuensis</i> DPIE	E1	E	A shrub of 3-5m tall, similar to other <i>Casuarinaceae</i> species. Grows in tall shrubland on sandstone headland at Nielsen Park, Vaucluse.	x	x	-	-	x	x
<i>Amperea xiphoclada</i> var. <i>pedicellata</i> DPIE EPBC	E4	Ext.	An erect shrub growing up to 60cm high, was previously widespread in heath, woodland and forest on low fertility and sandy soils and is now presumed extinct.	x	x	-	-	x	x
<i>Asterolasia elegans</i> EPBC	E1	E	Erect shrub 1-3m high growing in moist sclerophyll forests on Hawkesbury sandstone slopes hillsides. Distribution limits Maroota region.	x	low	x	x	x	x
<i>Caladenia tessellata</i> DPIE EPBC	E1	V	Terrestrial orchid. Clay-loam or sandy soils. LHCCREMS guidelines suggest the species grows in Map Unit 34 – Coastal Sand Wallum Woodland - Heath. Flowers in September – November. Distribution limits N-Swansea S-south of Eden.	x	x	-	-	x	x

Scientific name DATABASE SOURCE	BC Act	EPBC Act	Growth form and habitat requirements Distribution limit	Recorded on site (✓)	If not recorded on site				Considered for referral assessment (✓)
					Suitable habitat present (✓)	Nearby and / or high number of record(s) (✓) Notes 1,2 & 3	Record(s) from recent years (✓) Notes 1,2 & 3	Potential to occur	
<i>Cryptostylis hunteriana</i> DPIE EPBC	V	V	Saprophytic orchid. Grows in swamp heath on sandy soils. <i>Distribution limits N-Gibraltar Range S-south of Eden.</i>	x	x	-	-	x	x
<i>Cynanchum elegans</i> EPBC	E1	E	Climber or twiner to 1m. Grows in rainforest gullies, scrub & scree slopes. <i>Distribution limits N-Gloucester S-Wollongong.</i>	x	x	-	-	x	x
<i>Darwinia biflora</i> DPIE	V	V	Erect or spreading shrub to 0.8m high. Grows in heath or understorey of woodland on or near shale-capped ridges underlain by Hawkesbury sandstone. <i>Distribution limits N-Gosford S-Cheltenham.</i>	x	marginal	800 m N	2019	low	✓
<i>Deyeuxia appressa</i> DPIE EPBC	E1	E	Erect grass to 0.9m high. Grows on wet ground. <i>Distribution limits N-Hornsby S-Bankstown.</i>	x	x	-	-	x	x
<i>Dichanthium setosum</i> DPIE	V	V	An erect perennial grass to <1m high. Flowers in summer. Grows in woodland and is associated with heavy basaltic black soils and stony red-brown hard-setting loam with clay subsoil. <i>Known chiefly on the northern tablelands in the Saumarez area, west of Armidale, and 18-30 km east of Guyra. It is more rarely found on the north-western slopes, central western slopes and north-western plains of NSW</i>	x	x	-	-	x	x
<i>Eucalyptus camfieldii</i> DPIE EPBC	V	V	Stringybark to 10m high. Grows on coastal shrub heath and woodlands on sandy soils derived from alluviums and Hawkesbury sandstone. <i>Distribution limits N-Norah Head S-Royal NP.</i>	x	x	-	-	x	x

Scientific name DATABASE SOURCE	BC Act	EPBC Act	Growth form and habitat requirements Distribution limit	Recorded on site (✓)	If not recorded on site				Considered for referral assessment (✓)
					Suitable habitat present (✓)	Nearby and / or high number of record(s) (✓) Notes 1,2 & 3	Record(s) from recent years (✓) Notes 1,2 & 3	Potential to occur	
<i>Eucalyptus pulverulenta</i> DPIE	V	V	A small tree, typically mallee-like on shallow soils in open forest, typically dominated by Brittle Gum (<i>Eucalyptus mannifera</i>), Red Stringybark (<i>E. macrorhyncha</i>), Broad-leafed Peppermint (<i>E. dives</i>), Silvertop Ash (<i>E. sieberi</i>) and Apple Box (<i>E. bridgesiana</i>). There are two main areas or occurrence including Lithgow to Bathurst, and Bredbo to Bombala.	x	x	-	-	x	x
<i>Eucalyptus scoparia</i> DPIE	E1	V	Smooth-barked tree only known from vicinity of Bald Rock.	✓ (planted)	-	-	-	-	✓
<i>Genoplesium baueri</i> DPIE EPBC	E1	E	A terrestrial orchid that grows in sparse sclerophyll forest and moss gardens over sandstone. Flowers Feb–Mar. Distribution limits N – Hunter Valley S – Nowra.	x	marginal	2 km S	2017	unlikely	✓
<i>Genoplesium plumosum</i> DPIE	E4A	E	Terrestrial Orchid that grows on shallow soils exclusively in heathland, generally dominated by Violet Kunzea (<i>Kunzea parvifolia</i>), Common Fringe-myrtle (<i>Calytrix tetragona</i>) and parrot-peas (<i>Dillwynia</i> spp.). Flowers late Feb – Mar. Tallong area and Moreton NP.	x	x	-	-	x	x
<i>Grevillea caleyi</i> DPIE EPBC	E1	E	Shrub mostly 1-3m high. Grows in laterite. Distribution limits Terrey Hills-Belrose area.	x	x	-	-	x	x
<i>Haloragodendron lucasii</i> DPIE EPBC	E1	E	Straggling shrub to 1.5m high. Grows in open forest on sheltered slopes near creeks. Distribution limits Ku-ring-gai Plateau and Mt Wilson.	x	marginal	5 km N	2018	not likely	x

Scientific name DATABASE SOURCE	BC Act	EPBC Act	Growth form and habitat requirements Distribution limit	Recorded on site (✓)	If not recorded on site				Considered for referral assessment (✓)
					Suitable habitat present (✓)	Nearby and / or high number of record(s) (✓) Notes 1,2 & 3	Record(s) from recent years (✓) Notes 1,2 & 3	Potential to occur	
<i>Hibbertia spanantha</i> DPIE EPBC	E4A	CE	Grows in forest with canopy species including <i>E. pilularis</i> , <i>E. resinifera</i> , <i>C. gummifera</i> and <i>A. costata</i> . The understorey is open with species of Poaceae, Orchidaceae, Fabaceae and Liliaceae. Flowers Oct-Nov with odd flowers throughout the year. Substrate is identified as a light clay occurring on a shale sandstone soil transition.	x	marginal	2.5 km W	2018	unlikely	✓
<i>Lasiopetalum joyceae</i> DPIE	V	V	Erect shrub to 2m high. Grows in heath and open forest on Hawkesbury sandstone. <i>Distribution limits Hornsby Plateau.</i>	x	x	-	-	x	x
<i>Leptospermum deanei</i> DPIE EPBC	V	V	Shrub to 5m high. Grows on forested slopes. <i>Distribution limits near watershed of Lane Cove River.</i>	x	x	-	-	x	x
<i>Macadamia integrifolia</i> TBE	-	V	<i>The species was known to occur in north-east New South Wales and was collected from Camden Haven, and there are specimens also from Lismore.</i> This species grows in remnant rainforest, including complex mixed notophyll forest, and prefers partially open areas such as rainforest edges.	✓ (planted / naturalised)	-	-	-	-	x
<i>Melaleuca biconvexa</i> DPIE EPBC	V	V	Tall shrub. Grows in wetlands adjoining perennial streams and on the banks of those streams, generally within the geological series known as the Terrigal Formation. <i>Distribution limits N-Port Macquarie S-Jervis Bay.</i>	x	x	-	-	x	x
<i>Melaleuca deanei</i> DPIE EPBC	V	V	Shrub to 3m high. Grows in heath on sandstone. <i>Distribution limits N-Gosford S-Nowra.</i>	x	x	-	-	x	x

Scientific name DATABASE SOURCE	BC Act	EPBC Act	Growth form and habitat requirements Distribution limit	Recorded on site (✓)	If not recorded on site				Considered for referral assessment (✓)
					Suitable habitat present (✓)	Nearby and / or high number of record(s) (✓) <i>Notes 1,2 & 3</i>	Record(s) from recent years (✓) <i>Notes 1,2 & 3</i>	Potential to occur	
<i>Microtis angusii</i> DPIE	E1	E	Terrestrial orchid which is known from one population at Ingleside. Associated with the Duffy's Forest vegetation community. Flowers May-Oct.	x	x	-	-	x	x
<i>Persicaria elatior</i> EPBC	V	V	Herb to 90cm tall which grows in damp places especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance. <i>Varied distribution from SE NSW to QLD.</i>	x	x	-	-	x	x
<i>Persoonia hirsuta</i> DPIE EPBC	E1	E	Erect to decumbent shrub. Grows in dry sclerophyll forest and woodland on Hawkesbury sandstone with infrequent fire histories. <i>Distribution limits N-Glen Davis S-Hill Top.</i>	x	low	5 km S	2008	not likely	x
<i>Persoonia mollis</i> subsp. <i>maxima</i> EPBC	E1	E	Erect to prostrate shrub. Grows in moist to wet sclerophyll forests on Hawkesbury sandstone. <i>Distribution limits N-Cowan S-Hornsby.</i>	x	x	-	-	x	x
<i>Pimelea curviflora</i> var. <i>curviflora</i> DPIE EPBC	V	V	Woody herb or sub-shrub to 0.2-1.2m high. Grows on Hawkesbury Sandstone near shale outcrops. <i>Distribution Sydney.</i>	x	x	-	-	x	x
<i>Pimelea spicata</i> EPBC	E1	E	Decumbent or erect shrub to 0.5m high. Occurs principally in woodland on soils derived from Wianamatta Shales. <i>Distribution limits N-Lansdowne S-Shellharbour.</i>	x	x	-	-	x	x
<i>Prostanthera junonis</i> DPIE EPBC	E1	E	Small shrub. Grows in sclerophyll forest and heath in shallow soil on sandstone. <i>Distribution limits Somersby region.</i>	x	x	-	-	x	x

Scientific name <small>DATABASE SOURCE</small>	BC Act	EPBC Act	Growth form and habitat requirements Distribution limit	Recorded on site (✓)	If not recorded on site				Considered for referral assessment (✓)
					Suitable habitat present (✓)	Nearby and / or high number of record(s) (✓) <small>Notes 1,2 & 3</small>	Record(s) from recent years (✓) <small>Notes 1,2 & 3</small>	Potential to occur	
Prostanthera marifolia <small>DPIE EPBC</small>	E4A	CE	Erect shrub to 0.3m high. Woodland dominated by Eucalyptus sieberi and Corymbia gummifera. In deeply weathered clay soil with ironstone nodules. Has been recorded previously in the Sydney Harbour region.	x	x	-	-	x	x
Pterostylis saxicola <small>EPBC</small>	E1	E	Terrestrial orchid. Grows in shallow sandy soil above rock shelves, usually near Wianamatta / Hawkesbury transition. Distribution limits N-Hawkesbury River S-Campbelltown.	x	x	-	-	x	x
Sarcochilus hartmannii <small>DPIE</small>	V	V	An orchid which grows on volcanic rocks, often in shallow soil in sclerophyll forest or exposed sites usually at an elevation above 500m. Distribution – north from the Richmond River in the far north of NSW.	x	x	-	-	x	x
Syzygium paniculatum <small>DPIE EPBC</small>	V	V	Small tree. Subtropical and littoral rainforest on sandy soil. Distribution limits N-Forster S-Jervis Bay.	✓ (planted)	x	-	-	x	✓
Tetratheca juncea <small>DPIE</small>	V	V	Prostrate shrub to 1m high. Dry sclerophyll forest and heath. Distribution limits N-Bulahdelah S-Port Jackson.	x	low	x	1996	not likely	x
Thesium australe <small>EPBC</small>	V	V	Erect herb to 0.4m high. Root parasite. Themeda grassland or woodland often damp. Distribution limits N-Tweed Heads S-south of Eden.	x	x	-	-	x	x
DPIE	- Denotes species listed within 10km of the subject site on the Atlas of NSW Wildlife								
EPBC	- Denotes species listed within 10km of the subject site in the EPBC Act habitat search								
V	- Denotes vulnerable listed species under the relevant Act								

Scientific name <small>DATABASE SOURCE</small>	BC Act	EPBC Act	Growth form and habitat requirements <i>Distribution limit</i>	Recorded on site (✓)	If not recorded on site			Considered for referral assessment (✓)
					Suitable habitat present (✓)	Nearby and / or high number of record(s) (✓) <small>Notes 1,2 & 3</small>	Record(s) from recent years (✓) <small>Notes 1,2 & 3</small>	
E or E1	- Denotes endangered listed species under the relevant Act							
E4a or CE	- Denotes critically endangered listed species under the relevant Act							
NOTE:	1. This field is not considered if no suitable habitat is present within the subject site 2. 'records' refer to those provided by the <i>Atlas of NSW Wildlife</i> 3. 'nearby' or 'recent' records are species specific accounting for home range, dispersal ability and life cycle							

Table A1.2 provides an assessment of potential habitat within the study area for nationally listed threatened fauna species recorded within 10km on *BioNet* (DPIE) or indicated to have potential habitat present within 10km on the *EPBC Act* Protected Matters Tool.

Table A1.2 – Nationally threatened fauna habitat assessment

Common name <i>Scientific name</i> <small>Database source</small>	BC Act	EPBC Act	Preferred habitat <i>Distribution limit</i>	Recorded on site (✓)	If not recorded on site				Considered for referral assessment (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) <small>Notes 1,2 & 3</small>	Record(s) from recent years (✓) <small>Notes 1,2 & 3</small>	Potential to occur	
Giant Burrowing Frog <i>Heleioporus australiacus</i> DPIE EPBC	V	V	Inhabits open forests and riparian forests along non-perennial streams, digging burrows into sandy creek banks. <i>Distribution limit: N-Near Singleton S-South of Eden.</i>	x	x	-	-	x	x
Stuttering Frog <i>Mixophyes balbus</i> DPIE EPBC	E1	V	Terrestrial inhabitant of rainforest and wet sclerophyll forests. <i>Distribution limit: N-near Tenterfield S-South of Bombala.</i>	x	x	-	-	x	x
Green and Golden Bell Frog <i>Litoria aurea</i> DPIE EPBC	E1	V	Prefers the edges of permanent water, streams, swamps, creeks, lagoons, farm dams and ornamental ponds. Often found under debris. <i>Distribution limit: N-Byron Bay S-South of Eden.</i>	x	x	-	-	x	x
Littlejohn's Tree Frog <i>Litoria littlejohni</i> DPIE EPBC	V	V	Found in wet and dry sclerophyll forest associated with sandstone outcrops at altitudes 280-1,000m on eastern slopes of Great Dividing Range. Prefers flowing rocky streams. <i>Distribution limit: N-Hunter River S-Eden.</i>	x	x	-	-	x	x

Common name Scientific name <small>Database source</small>	BC Act	EPBC Act	Preferred habitat Distribution limit	Recorded on site (✓)	If not recorded on site				Considered for referral assessment (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) <small>Notes 1,2 & 3</small>	Record(s) from recent years (✓) <small>Notes 1,2 & 3</small>	Potential to occur	
Broad-headed Snake <i>Hoplocephalus bungaroides</i> <small>DPIE EPBC</small>	E1	V	Sandstone outcrops, exfoliated rock slabs and tree hollows in coastal and near coastal areas. <i>Distribution limit: N-Mudgee Park. S-Nowra.</i>	x	x	-	-	x	x
Australasian Bittern <i>Botaurus poiciloptilus</i> <small>EPBC</small>	E1	E	Found in or over water of shallow freshwater or brackish wetlands with tall reedbeds, sedges, rushes, cumbungi, lignum and also in ricefields, drains in tussocky paddocks, occasionally saltmarsh, brackish wetlands. <i>Distribution limit: N-North of Lismore. S- Eden.</i>	x	x	-	-	x	x
Red Goshawk <i>Erythrotriorchis radiatus</i> <small>DPIE EPBC</small>	E1	V	Inhabits tall open forests and woodlands. Breeds in tall trees adjacent to watercourses of wetlands. <i>Distribution limit: N-Border Ranges National Park. S-Foster.</i>	x	x	-	-	x	x
Australian Painted Snipe <i>Rostratula australis</i> <small>EPBC</small>	E1	E	Most numerous within the Murray-Darling basin and inland Australia within marshes and freshwater wetlands with swampy vegetation. <i>Distribution limit: N-Tweed Heads. S-South of Eden.</i>	x	x	-	-	x	x
Swift Parrot <i>Lathamus discolor</i> <small>DPIE EPBC</small>	E1	E	Inhabits eucalypt forests and woodlands with winter flowering eucalypts. <i>Distribution limit: N-Border Ranges National Park. S-South of Eden.</i>	x	Optimal	✓	✓	Low	✓

Common name Scientific name <small>Database source</small>	BC Act	EPBC Act	Preferred habitat Distribution limit	Recorded on site (✓)	If not recorded on site				Considered for referral assessment (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) <small>Notes 1,2 & 3</small>	Record(s) from recent years (✓) <small>Notes 1,2 & 3</small>	Potential to occur	
Superb Parrot <i>Polytelis swainsonii</i> <small>DPIE EPBC</small>	V	V	Inhabits open woodland and riverine forests of inland NSW. <i>Distribution limit: N-Near Walgett. S-South of Deniliquin.</i>	x	x	-	-	x	x
White-throated Needletail ^{MS} <i>Hirundapus caudacutus</i> <small>DPIE EPBC</small>	-	V	Airspace over forests, woodlands, farmlands, plains, lakes, coasts, towns; companies often forage along favoured hilltops and timbered ranges. Breeds Siberia, Himalayas, east to Japan. Summer migrant to eastern Australia. <i>Distribution limit: N-Tweed Heads. S-South of Eden.</i>	x	✓	✓	✓	✓	✓
Eastern Bristlebird <i>Dasyornis brachypterus</i> <small>DPIE EPBC</small>	E1	E	Coastal woodlands, dense scrubs and heathlands, especially where low heathland borders taller woodland or dense tall tea-tree. <i>Distribution limit: N-Tweed Heads. S-South of Eden.</i>	x	x	-	-	x	x
Regent Honeyeater <i>Xanthomyza Phrygia</i> <small>DPIE EPBC</small>	E4A	CE	Found in temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts. <i>Distribution limit: N-Urbanville. S-Eden.</i>	x	Marginal	x	✓	Unlikely	✓
Painted Honeyeater <i>Grantiella picta</i> <small>DPIE EPBC</small>	V	V	A nomadic bird occurring in low densities within open forest, woodland and scrubland feeding on mistletoe fruits. Inhabits primarily Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. <i>Distribution limit: N-Boggabilla. S-Albury with greatest occurrences on the inland slopes of the Great Dividing Range.</i>	x	Sub-optimal	x	x	Unlikely	✓

Common name <i>Scientific name</i> <small>Database source</small>	BC Act	EPBC Act	Preferred habitat <i>Distribution limit</i>	Recorded on site (✓)	If not recorded on site				Considered for referral assessment (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) <small>Notes 1,2 & 3</small>	Record(s) from recent years (✓) <small>Notes 1,2 & 3</small>	Potential to occur	
Spotted-tailed Quoll <i>Dasyurus maculatus</i> <small>DPIE EPBC</small>	V	E	Dry and moist open forests containing rock caves, hollow logs or trees. <i>Distribution limit: N-Mt Warning National Park. S-South of Eden.</i>	x	Marginal	x	x	Not likely	x
Southern Brown Bandicoot <i>Isoodon obesulus</i> <small>DPIE EPBC</small>	E1	E	Utilises a range of habitats containing thick ground cover - open forest, woodland, heath, cleared land, urbanised areas and regenerating bushland. <i>Distribution limit: N-Kempsey. S-South of Eden.</i>	x	Marginal	x	✓	Not likely	x
Koala <i>Phascolarctos cinereus</i> <small>DPIE EPBC</small>	V	V	Inhabits both wet and dry eucalypt forest on high nutrient soils containing preferred feed trees. <i>Distribution limit: N-Tweed Heads. S-South of Eden.</i>	x	x	-	-	x	x
Greater Glider <i>Petauroides volans</i> <small>EPBC</small>	-	V	Favours forests with a diversity of eucalypt species, due to seasonal variation in its preferred tree species. Population density is optimal at elevation levels at 845 m above sea level. Prefer overstorey basal areas in old-growth tree stands. Highest abundance typically in taller, montane, moist eucalypt forests, with relatively old trees and abundant hollows <i>Distribution limit: N-Border Ranges National Park. S- South of Eden.</i>	x	x	-	-	x	x

Common name <i>Scientific name</i> <small>Database source</small>	BC Act	EPBC Act	Preferred habitat <i>Distribution limit</i>	Recorded on site (✓)	If not recorded on site				Considered for referral assessment (✓)
					Suitable habitat present (✓)	Nearby and/or high number of record(s) (✓) <small>Notes 1,2 & 3</small>	Record(s) from recent years (✓) <small>Notes 1,2 & 3</small>	Potential to occur	
Brush-tailed Rock-wallaby <i>Petrogale penicillata</i> EPBC	E1	V	Found in rocky gorges with a vegetation of rainforest or open forests to isolated rocky outcrops in semi-arid woodland country. <i>Distribution limit: N-North of Tenterfield. S-Bombala.</i>	x	x	-	-	x	x
Grey-headed Flying-fox <i>Pteropus poliocephalus</i> DPIE EPBC	V	V	Found in a variety of habitats including rainforest, mangroves, paperbark swamp, wet and dry open forest and cultivated areas. Forms camps commonly found in gullies and in vegetation with a dense canopy. <i>Distribution limit: N-Tweed Heads. S-Eden.</i>	✓	-	-	-	-	✓
Large-eared Pied Bat <i>Chalinolobus dwyeri</i> DPIE EPBC	V	V	Warm-temperate to subtropical dry sclerophyll forest and woodland. Roosts in caves, tunnels and tree hollows in colonies of up to 30 animals. <i>Distribution limit: N-Border Ranges National Park. S-Wollongong.</i>	x	Sub-optimal	x	✓	✓	✓
New Holland Mouse <i>Pseudomys novaehollandiae</i> EPBC	-	V	Occurs in heathlands, woodlands, open forest and paperbark swamps and on sandy, loamy or rocky soils. Coastal populations have a marked preference for sandy substrates, a heathy understorey of leguminous shrubs less than 1m high and sparse ground litter. Recolonise of regenerating burnt areas. <i>Distribution limit: N-Border Ranges National Park. S-South of Eden.</i>	x	Marginal	x	✓	Not likely	x

Table A1.3 provides an assessment of potential habitat within the subject site for nationally *protected* migratory fauna species recorded within 10km on the *EPBC Act* Protected Matters Tool. Nationally *threatened* migratory species are considered in Table A1.2.

Table A1.3 – Migratory fauna habitat assessment

Common name Scientific name	Preferred habitat Migratory breeding	Suitable habitat present (✓)	Recorded on site (✓)	Comments
Oriental Cuckoo (<i>Cuculus optatus</i>)	Mainly inhabits forests, occurring in coniferous, deciduous and mixed forest. It feeds mainly on insects and their larvae, foraging for them in trees and bushes as well as on the ground.	✓	x	-
Fork-tailed Swift (<i>Apus pacificus</i>)	Aerial: over open country, from semi-arid deserts to coasts, islands; sometimes over forests, cities. Breeds Siberia, Himalayas, east to Japan and south east Asia. Summer migrant to east Australia. Mass movements associated with late summer low pressure systems into east Australia. Otherwise uncommon.	✓	x	-
Black-faced Monarch (<i>Monarcha melanopsis</i>)	Rainforests, eucalypt woodlands; coastal scrubs; damp gullies in rainforest, eucalypt forest; more open woodland when migrating. <i>Summer breeding migrant to coastal south east Australia, otherwise uncommon.</i>	✓	x	-
Spectacled Monarch (<i>Monarcha trivirgatus</i>)	Understorey of mountain / lowland rainforest, thickly wooded gullies, waterside vegetation, mostly well below canopy. <i>Summer breeding migrant to south-east Qld and north-east NSW down to Port Stephens from Sept / Oct to May. Uncommon in southern part of range.</i>	x	x	-
Satin Flycatcher (<i>Myiagra cyanoleuca</i>)	Heavily vegetated gullies in forests, taller woodlands, usually above shrub-layer; during migration, coastal forests, woodlands, mangroves, trees in open country, gardens. <i>Breeds mostly south-east Australia and Tasmania over warmer months, winters in north east Qld.</i>	✓	x	-
Rufous Fantail (<i>Rhipidura rufifrons</i>)	Undergrowth of rainforests / wetter eucalypt forests / gullies; monsoon forests, paperbarks, sub-inland and coastal scrubs; mangroves, watercourses; parks, gardens. On migration, farms, streets buildings. <i>Breeding migrant to south-east Australia over warmer months. Altitudinal migrant in north-east NSW in mountain forests during warmer months.</i>	✓	x	-
Yellow Wagtail (<i>Motacilla flava</i>)	The yellow wagtail typically forages in damp grassland and on relatively bare open ground at edges of rivers, lakes and wetlands, but also feeds in dry grassland and in fields of cereal crops.	✓	x	-

Common name Scientific name	Preferred habitat Migratory breeding	Suitable habitat present (✓)	Recorded on site (✓)	Comments
Painted Snipe (<i>Rostratula australis</i>)	Generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. They also use inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains. Typical sites include those with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire; often with scattered clumps of lignum or canegrass or sometimes tea-tree. The Australian Painted Snipe sometimes utilises areas that are lined with trees, or that have some scattered fallen or washed-up timber. Breeding habitat requirements may be quite specific: shallow wetlands with areas of bare wet mud and both upper and canopy cover nearby. Nest records are all, or nearly all, from or near small islands in freshwater wetlands, provided that these islands are a combination of very shallow water, exposed mud, dense low cover and sometimes some tall dense cover. Has also been recorded nesting in and near swamps, canegrass swamps, flooded areas including samphire, grazing land, among cumbungi, sedges, grasses, salt water couch (<i>Paspalum</i>), saltbush (<i>Halosarcia</i>) and grass, also in ground cover of water-buttons and grasses, at the base of tussocks and under low saltbush.	x	x	-
Swinhoe's Snipe (<i>Gallinago megala</i>)	During the non-breeding season Swinhoe's Snipe occurs at the edges of wetlands, eg. wet paddy fields, swamps and freshwater streams. Also known in grasslands, drier cultivated areas and market gardens. Habitat specific to Australia includes the dense clumps of grass and rushes around the edges of fresh and brackish wetlands. This includes swamps, billabongs, river pools, small streams and sewage ponds. Also found in drying claypans and inundated plains pitted with crab holes. <i>Breeds in central Siberia and Mongolia and moving south for the boreal winter.</i>	x	x	-
Pin-tailed Snipe (<i>Gallinago stenura</i>)	During non-breeding period the Pin-tailed Snipe occurs most often in or at the edges of shallow freshwater swamps, ponds and lakes with emergent, sparse to dense cover of grass/sedge or other vegetation. The species is also found in drier, more open wetlands such as claypans in more arid parts of species' range. It is also commonly seen at sewage ponds; not normally in saline or inter-tidal wetlands. <i>Breeds in Russia. Australian distribution is not well understood. There are confirmed records from NSW, with a single banded bird reported near West Wyalong.</i>	x	x	-
Latham's Snipe (<i>Gallinago hardwickii</i>)	Soft wet ground or shallow water with tussocks and other green or dead growth; wet parts of paddocks; seepage below dams; irrigated areas; scrub or open woodland from sea-level to alpine bogs over 2,000m; samphire on saltmarshes; mangrove fringes. <i>Breeds Japan. Regular summer migrant to Australia. Some overwinter.</i>	x	x	-

Common name <i>Scientific name</i>	Preferred habitat <i>Migratory breeding</i>	Suitable habitat present (✓)	Recorded on site (✓)	Comments
Black-tailed Godwit (<i>Limosa limosa</i>)	Primarily coastal habitat environment. The species is commonly found in sheltered bays, estuaries and lagoons with large intertidal mudflats or sandflats, or spits and banks of mud, sand or shell-grit; occasionally recorded on rocky coasts or coral islets. The use of habitat often depends on the stage of the tide. It is also found in shallow and sparsely vegetated, near-coastal, wetlands; such as saltmarsh, saltflats, river pools, swamps, lagoons and floodplains. There are a few inland records, around shallow, freshwater and saline lakes, swamps, dams and bore-overflows. They also use lagoons in sewage farms and saltworks	x	x	-



Plot Datasheets

A2

400 m ² plot: Sheet <u> </u> of <u> </u>		Survey Name	Plot Identifier	Recorders
Date	28/11/19	18/11/02 chets	(3)	GP

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	status	voucher
T	1	<i>Angophora costata</i>	N	20	12	
\	2	<i>Cinnamomum camphora</i>	HTE	15	20	
\	3	<i>Ligustrum lucidum</i>	HTE	25	50	
S	4	<i>Pittosporum undulatum</i>	N	20	10	
E	5	to <i>Dephdrogk arditia</i>	N	5	60	
\	6	<i>Apocynum androsaemum</i>	HTE	8	20	
\	7	<i>Gibba serotina</i>	HTE	2	6	
O	8	<i>Pandanus fruticosus</i>	N	0.1	3	
O	9	<i>Xanthorrhoea media</i>	N	2	3	
G	10	<i>Lomandra longifolia</i>	N	2	3	
O	11	<i>Cassytha glabrella</i>	N	0.1	3	
O	12	<i>Smilax glaucophylla</i>	N	1	6	
\	13	exotic ginger	E	2	6	
T	14	black wattle - <i>Callitriche serratifolia</i>	N	4	5	
\	15	<i>Lantana camara</i>	HTE	5	10	
F	16	<i>Dianella caerulea</i>	N	0.1	3	
S	17	alt based together = <i>Elaeagnus reticulatus</i>	N	0.4	3	✓
T	18	<i>Alnus fraxinifolia</i>	N	0.1	1	
T	19	<i>Eucalyptus piperita</i>	N	2	1	
S	20	<i>Lomandra silaefolia</i>	N	0.1	1	
O	21	<i>Billardiera scandens</i>	N	0.1	-	
S	22	<i>Ruttenaea</i>	N	0.1	1	✓
\	23	<i>Senna pendula</i>	HTE	2	10	
E	24	<i>Calochortus dubia</i>	N	0.5	3	
\	25	<i>Galium corn</i>	E	0.1	10	
F	26	<i>Xanthosia pilosa</i>	N	0.1	1	
E	27	<i>Drosera rotundifolia</i>	N	0.2	10	
\	28	<i>Olea europaea</i>	HTE	0.2	5	
G	29	<i>Grassia stricta</i>	N	0.1	3	
	30					
	31					
	32					
	33					
	34					
	35					
	36					
	37					
	38					
	39					
	40					

GF Code: see Growth Form definitions in Appendix 1 N: native, E: exotic, HTE: high threat exotic GF - circle code if 'top 3'.
 Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
 Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

400 m² plot: Sheet _ of _ Survey Name Plot Identifier Recorders
 Date 28/11/19 19WRL02 32 GP

GF Code	Top 3 native species in each growth form group: Full species name mandatory. All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund.	Strat. m	Push
T 1	<i>E. latipetala</i> <i>latipetala</i>	N	10	1		
T 2	<i>E. satyria</i>	N	5	2		
T 3	<i>Aeschynomene indica</i>	N	3	1		
\ 4	<i>Ligustrum lucidum</i>	HTE	3	5		
\ 5	<i>Turkey rhubarb</i>	E	8	50		
\ 6	<i>Eriobotrya indica</i>	HTE	2	20		
\ 7	<i>Cenchrus ciliaris</i>	HTE	10	200		
\ 8	<i>Asparagus setaceus</i>	HTE	4	10		
\ 9	<i>Bidens pilosa</i>	HTE	6.5	20		
\ 10	<i>Bromus carthartensis</i>	G	3	50		
F 11	<i>Richardsonia scabra</i>	N	0.1	20		
\ 12	<i>Witheringia indica</i>	E	3	10		
\ 13	<i>Mulberry of millions</i> - <i>Boraginaceae</i>	HTE?	3	60		
\ 14	<i>Plantago lanceolata</i>	E	0.2	10		
\ 15	<i>Conyza bonariensis</i>	E	0.1	3		
G 16	<i>Cynodon dactylon</i>	N	2	50		
\ 17	<i>Jap. morning glory</i> - <i>Convolvulaceae</i>	G	1	10		
\ 18	<i>Tradescantia virginiana</i>	HTE	3	100		
\ 19	<i>C. grandis</i> - <i>Cenchrus macranthus</i>	E	4	40		
\ 20	<i>Acer europaea</i>	HTE	0.5	1		
\ 21	<i>Sida rhombifolia</i>	E	1	20		
\ 22	<i>Old silver wattle</i>	E	2	1		
S 23	<i>Acacia long/ floribunda?</i>	N	3	1		
S 24	<i>Lepto. pty.</i>	N	1	1		
\ 25	<i>Broom?</i> - <i>Genista monspessulana</i>	HTE	4	5		
\ 26	<i>succulent</i> - <i>ph</i> - <i>Crotona ovata</i>	E	0.1	10		
S 27	<i>Begonia delavayana</i>	N	0.1	1		
\ 28	<i>Senna pendula</i>	HTE	0.1	3		
29						
30						
31						
32						
33						
34						
35						
36						
37						
38						
39						
40						

GF Code: see Growth Form definitions in Appendix 1 N: native, E: exotic, HTE: high threat exotic GF – circle code if 'top 3'.
 Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ..., 100% (foliage cover); Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m.
 Abundance: 1, 2, 3, ..., 10, 20, 30, ..., 100, 200, ..., 1000, ...

BAM Site – Field Survey Form Site Sheet no: 1 of 1

Date		Survey Name		Plot Identifier		Recorders	
28/12/19		19WRL02		32		GP	
Zone	Datum	IBRA region	Photo #		Zone ID		
Easting	Northing	Dimensions		Orientation of midline from the 0 m point		Magnetic °	
Vegetation Class						Confidence: H M L	
Plant Community Type						Confidence: H M L	
		EEC:					

Record easting and northing from the plot marker. If applicable, orient picket so that perforated rib points along direction of midline.
 Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m ² plot)	Sum values
Trees	3
Shrubs	3
Grasses etc.	1
Forbs	1
Ferns	0
Other	0
Count of Native Richness	
Sum of Cover of native vascular plants by growth form group	
Trees	18
Shrubs	6.1
Grasses etc.	2
Forbs	0.1
Ferns	0
Other	0
High Threat Weed cover	30.1

BAM Attribute (20 x 50 m plot)		# Tree Stems Count		Record number of living eucalypt* (Euc*) and living native non-eucalypt (Non Euc) stems separately
dbh	Euc*	Non Euc	Hollows†	
large trees for Euc* & Non Euc	80+ cm	Euc*	Non Euc	Hollows*
50 – 79 cm	11			nest box
30 – 49 cm	✓			
20 – 29 cm	✓			
10 – 19 cm	✓			
5 – 9 cm	✓			n/a
< 5 cm	✓			n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)		Tally space		total
				0

Counts must apply to each size class when the number of living tree stems within the size class is ≤ 10. Estimates can be used when the number of living tree stems within a class is > 10. Estimates should draw from the number series: 10, 20, 30..., 100, 200, 300

For a multi-stemmed tree, only the largest living stem is included in the count/estimate. For hollows count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	100/95/80/60/85	a b c d e	a b c d e	a b c d e
Average of the 5 subplots	84			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type	Landform Element	Landform Pattern	Microrelief
Lithology	Soil Surface Texture	Soil Colour	Soil Depth
Slope	Aspect	Site Drainage	Distance to nearest water and type

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (density, native stock)			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

400 m ² plot: Sheet _ of _		Survey Name	Plot Identifier	Recorders			
Date	21/01/2020	MWLO2 Enthusiast	G03	CAP			

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
T	1 Gloridion feedinganet	N	40	5		
S	2 Pittosporum undulatum	N	10	3		
T	3 Asplenium Laminophan	N	15	2		
\	4 Lignotum lucidum	HTE	2	5		
\	5 Lignotum sinense	HTE	10	3		
\	6 Cinnamomum camphora	HTE	10	10		
F	7 Commelina cyanea	N	2	10		
\	8 Lantana camara halicacabum	HTE	15	30		
\	9 vine Cordiospermum halicacabum	E	3	10		
\	10 Plectranthus verticillatus	E	3	10		✓
\	11 Arpacus aethiopicus	HTE	2	5		
\	12 Lonicera japonica	E	1	3		
\	13 Senecio pediculus	HTE	1	5		
\	14 Ochra serrulata	HTE	2	5		
\	15 ginger lily - Hedychium gardenium	E	0.5	3		
T	16 Eucalyptus laetripides x?	N	10	1		
\	17 Liquidambar styraciflua	E	4	1		
T	18 Eucalyptus racemosa	N	2	1		
\	19 Cornus masculata citriodora	E	5	2		
S	20 Dalmanea triquetra	N	0.1	2		
T	21 Anagallis ciliata	N	1	1		
\	22 smooth bark tree - Adiantum unedo	E	4	1		✓
\	23 Agapanthus	E	0.1	3		
\	24 Cathartix sinensis	E	2	3		
S	25 #Oncolanthus populneus	N	0.1	3		
O	26 Samolus palm: Hawea forsteriana	N	2	3		
\	27 Pinus sp. atrothi patula	HTE	10	1		
E	28 Nephrolepis cordifolia	N	60	1000		
	29					
	30					
	31					
	32					
	33					
	34					
	35					
	36					
	37					
	38					
	39					
	40					

GF Code: see Growth Form definitions in Appendix 1 N: native, E: exotic, HTE: high threat exotic GF = circle code if 'top 3'.
 Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ..., 100% (foliage cover); Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across. 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
 Abundance: 1, 2, 3, ..., 10, 20, 30, ..., 100, 200, ..., 1000, ...

BAM Site – Field Survey Form

Site Sheet no: 1 of 2

Date <u>22/10/20</u>		Survey Name <u>PRW02</u>	Zone ID	Recorders <u>GP</u>	
Zone	Datum	Plot ID <u>Q3</u>	Plot dimensions	Photo #	<input checked="" type="checkbox"/>
Easting	Northing	IBRA region	In m	Midline bearing from 0 m	Magnetic °
Vegetation Class					Confidence: H M L
Plant Community Type					EEC: tick Confidence: H M L

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m ² plot)	Sum values
Count of Native Richness	
Trees	5
Shrubs	3
Grasses etc.	0
Forbs	1
Ferns	1
Other	1
Sum of Cover of native vascular plants by growth form group	
Trees	68
Shrubs	10.2
Grasses etc.	0
Forbs	2
Ferns	60
Other	2
High Threat Weed cover	50

BAM Attribute (1000 m ² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm	1	
50 – 79 cm	1	
30 – 49 cm		
20 – 29 cm	✓	
10 – 19 cm	✓	
5 – 9 cm	✓	
< 5 cm		n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	10	Tally space

Counts apply when the number of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30, ..., 100, 200, 300, ...). For a multi-stemmed tree, only the largest living stem is included in the count/estimate. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	85 90 90 25 35	a b c d e	a b c d e	a b c d e
Average of the 5 subplots	65			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type	Landform Element	Landform Pattern	Microrelief
Lithology	Soil Surface Texture	Soil Colour	Soil Depth
Slope	Aspect	Site Drainage	Distance to nearest water and type

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)



National - Significant Impact Criteria

A3

Under the *EPBC Act* an action will require approval from the Australian Government Environment Minister if the action has, will have, or is likely to have, a significant impact on a matter of national environmental significance. The following significant impact criteria were sourced from the *EPBC Act* Policy Statement 1.1 (May 2006):

CRITICALLY ENDANGERED AND ENDANGERED SPECIES

Significant impact criteria

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

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

>> What is a population of a species?

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

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

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

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

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

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

VULNERABLE SPECIES

Significant impact criteria

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

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

>> What is an important population of a species?

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

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

CRITICALLY ENDANGERED AND ENDANGERED ECOLOGICAL COMMUNITIES

Significant impact criteria

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

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

MIGRATORY SPECIES

Significant impact criteria

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

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

>> What is important habitat for a migratory species?

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

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

>> What is an ecologically significant proportion?

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

>> What is the population of a migratory species?

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



BAM-C outputs

A4

Vegetation Zones Report
Predicted Species Report
Candidate Species Report
Credit Summary Report
Biodiversity Credit Report
Biodiversity Credit Report (Variation Options)

BAM Vegetation Zones Report

Proposal Details

Assessment Id	Assessment name	BAM data last updated *
00018977/BAAS19010/20/00018978		28/04/2020
Assessor Name	Report Created	BAM Data version *
	29/04/2020	25
Assessor Number	Assessment Type	BAM Case Status
	Part 4 Developments (General)	Finalised
* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.		Date Finalised
		29/04/2020
	Assessment Revision	
	1	

Vegetation Zones

#	Name	PCT	Condition	Area	Minimum number of plots	Management zones
1	1778_moderate	1778-Coastal sandstone foreshores forest	moderate	0.25	1	APZ (0.2 ha) Dev (0.05 ha)
2	1778_poor	1778-Coastal sandstone foreshores forest	poor	0.06	1	
3	1778_planted	1778-Coastal sandstone foreshores forest	planted	0.23	1	

BAM Predicted Species Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00018977/BAAS19010/20/00018978		28/04/2020
Assessor Name	Report Created	BAM Data version *
	29/04/2020	25
Assessor Number	Assessment Type	BAM Case Status
	Part 4 Developments (General)	Finalised
	Assessment Revision	Date Finalised
	1	29/04/2020

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Threatened species reliably predicted to utilise the site. No surveys are required for these species. Ecosystem credits apply to these species.

Common Name	Scientific Name	Vegetation Types(s)
Barking Owl	Ninox connivens	1778-Coastal sandstone foreshores forest
Broad-headed Snake	Hoplocephalus bungaroides	1778-Coastal sandstone foreshores forest
Dusky Woodswallow	Artamus cyanopterus cyanopterus	1778-Coastal sandstone foreshores forest
Eastern Coastal Free-tailed Bat	Micronomus norfolkensis	1778-Coastal sandstone foreshores forest
Glossy Black-Cockatoo	Calyptorhynchus lathami	1778-Coastal sandstone foreshores forest
Grey-headed Flying-fox	Pteropus poliocephalus	1778-Coastal sandstone foreshores forest
Large Bent-winged Bat	Miniopterus orianae oceanensis	1778-Coastal sandstone foreshores forest
Little Bent-winged Bat	Miniopterus australis	1778-Coastal sandstone foreshores forest
Little Eagle	Hieraaetus morphnoides	1778-Coastal sandstone foreshores forest
Little Lorikeet	Glossopsitta pusilla	1778-Coastal sandstone foreshores forest

BAM Predicted Species Report

Powerful Owl	Ninox strenua	1778-Coastal sandstone foreshores forest
Regent Honeyeater	Anthochaera phrygia	1778-Coastal sandstone foreshores forest
Square-tailed Kite	Lophoictinia isura	1778-Coastal sandstone foreshores forest
Swift Parrot	Lathamus discolor	1778-Coastal sandstone foreshores forest
Varied Sittella	Daphoenositta chrysopetra	1778-Coastal sandstone foreshores forest

Threatened species not within the area of these PCT's

Common Name	Scientific Name	Vegetation Types(s)
Eastern Osprey	Pandion cristatus	1778-Coastal sandstone foreshores forest
Koala	Phascolarctos cinereus	1778-Coastal sandstone foreshores forest
Masked Owl	Tyto novaehollandiae	1778-Coastal sandstone foreshores forest
Rosenberg's Goanna	Varanus rosenbergi	1778-Coastal sandstone foreshores forest
Spotted-tailed Quoll	Dasyurus maculatus	1778-Coastal sandstone foreshores forest
White-bellied Sea-Eagle	Haliaeetus leucogaster	1778-Coastal sandstone foreshores forest

BAM Candidate Species Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00018977/BAAS19010/20/00018978		28/04/2020
Assessor Name	Report Created	BAM Data version *
	29/04/2020	25
Assessor Number	Assessment Type	BAM Case Status
	Part 4 Developments (General)	Finalised
	Assessment Revision	Date Finalised
	1	29/04/2020

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

List of Species Requiring Survey

Name	Presence	Survey Months
<i>Leptospermum deanei</i> Leptospermum deanei	No (surveyed)	<div>Jan Feb Mar Apr May Jun</div> <div>Jul Aug Sep Oct Nov Dec</div>
<i>Myotis macropus</i> Southern Myotis	Yes (assumed present)	<div>Jan Feb Mar Apr May Jun</div> <div>Jul Aug Sep Oct Nov Dec</div>

List of Species Not On Site

Name
<i>Allocasuarina portuensis</i> Nielsen Park She-oak
<i>Calyptorhynchus lathami</i> Glossy Black-Cockatoo
<i>Cercartetus nanus</i> Eastern Pygmy-possum
<i>Chalinolobus dwyeri</i> Large-eared Pied Bat
<i>Lathamus discolor</i> Swift Parrot
<i>Lophoictinia isura</i> Square-tailed Kite
<i>Melaleuca biconvexa</i> Biconvex Paperbark

<i>Miniopterus australis</i> Little Bent-winged Bat
<i>Miniopterus orianae oceanensis</i> Large Bent-winged Bat
<i>Ninox connivens</i> Barking Owl
<i>Ninox strenua</i> Powerful Owl
<i>Pandion cristatus</i> Eastern Osprey
<i>Phascolarctos cinereus</i> Koala
<i>Pseudophryne australis</i> Red-crowned Toadlet
<i>Pteropus poliocephalus</i> Grey-headed Flying-fox
<i>Tyto novaehollandiae</i> Masked Owl
<i>Anthochaera phrygia</i> Regent Honeyeater
<i>Hieraaetus morphnoides</i> Little Eagle
<i>Phascolarctos cinereus - endangered population</i> Koala in the Pittwater Local Government Area
<i>Haliaeetus leucogaster</i> White-bellied Sea-Eagle
<i>Eudyptula minor - endangered population</i> Little Penguin in the Manly Point Area (being the area on and near the shoreline from Cannae Point generally northward to the point near the intersection of Stuart Street and Oyama Cove Avenue, and extending 100 metres offshore from that shoreline)
<i>Perameles nasuta - endangered population</i> Long-nosed Bandicoot, North Head
<i>Heleioporus australiacus</i> Giant Burrowing Frog
<i>Hoplocephalus bungaroides</i> Broad-headed Snake
<i>Callocephalon fimbriatum - endangered population</i> Gang-gang Cockatoo population in the Hornsby and Ku-ring-gai Local Government Areas

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00018977/BAAS19010/20/00018978		28/04/2020
Assessor Name	Report Created	BAM Data version *
	29/04/2020	25
Assessor Number	BAM Case Status	Date Finalised
	Finalised	29/04/2020
Assessment Revision	Assessment Type	
1	Part 4 Developments (General)	

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAIL	Ecosystem credits
Coastal sandstone foreshores forest								
1	1778_moderate	30.7	0.3	0.25	High Sensitivity to Potential Gain	2.50		5
2	1778_poor	18.1	0.1	0.25	High Sensitivity to Potential Gain	2.50		1

BAM Credit Summary Report

3	1778_planted	30.9	0.2	0.25	High Sensitivity to Potential Gain	2.50		4
							Subtotal	10
							Total	10

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Potential SALL	Species credits
Myotis macropus / Southern Myotis (Fauna)						
1778_moderate	30.7	0.25	0.25	2	False	4
1778_poor	18.1	0.06	0.25	2	False	1
1778_planted	30.9	0.23	0.25	2	False	4
					Subtotal	9



BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00018977/BAAS19010/20/00018978		28/04/2020
Assessor Name	Assessor Number	BAM Data version *
		25
Proponent Names	Report Created	BAM Case Status
Chatswood Golf Club Limited	29/04/2020	Finalised
Assessment Revision	Assessment Type	Date Finalised
1	Part 4 Developments (General)	29/04/2020

Potential Serious and Irreversible Impacts

Nil

Nil

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

BAM Biodiversity Credit Report (Like for like)

Predicted Threatened Species Not On Site

Name
Dasyurus maculatus / Spotted-tailed Quoll
Pandion cristatus / Eastern Osprey
Phascolarctos cinereus / Koala
Tyto novaehollandiae / Masked Owl
Varanus rosenbergi / Rosenberg's Goanna
Haliaeetus leucogaster / White-bellied Sea-Eagle

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	Number of credits to be retired
1778-Coastal sandstone foreshores forest	Not a TEC	0.5	10.00

1778-Coastal sandstone foreshores forest	Like-for-like credit retirement options			
	Class	Trading group	HBT	IBRA region
	Sydney Coastal Dry Sclerophyll Forests This includes PCT's: 1778	Sydney Coastal Dry Sclerophyll Forests >=90%	Yes	Pittwater, Cumberland, Sydney Cataract, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.



BAM Biodiversity Credit Report (Like for like)

1778-Coastal sandstone
foreshores forest

Species Credit Summary

Species	Area	Credits
Myotis macropus / Southern Myotis	0.5	9.00

Myotis macropus / Southern Myotis	1778_moderate	Like-for-like credit retirement options	
		Spp	IBRA region
		Myotis macropus /Southern Myotis	Any in NSW
	1778_planted	Like-for-like credit retirement options	
		Spp	IBRA region
		Myotis macropus /Southern Myotis	Any in NSW
	1778_poor	Like-for-like credit retirement options	
		Spp	IBRA region



BAM Biodiversity Credit Report (Like for like)

		Myotis macropus/Southern Myotis	Any in NSW



BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00018977/BAAS19010/20/00018978		28/04/2020
Assessor Name	Assessor Number	BAM Data version *
		25
Proponent Name(s)	Report Created	BAM Case Status
Chatswood Golf Club Limited	29/04/2020	Finalised
Assessment Revision	Assessment Type	Date Finalised
1	Part 4 Developments (General)	29/04/2020

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Nil

Nil

Additional Information for Approval

PCTs With Customized Benchmarks
No Changes

BAM Biodiversity Credit Report (Variations)

Predicted Threatened Species Not On Site

Name
Dasyurus maculatus / Spotted-tailed Quoll
Pandion cristatus / Eastern Osprey
Phascolarctos cinereus / Koala
Tyto novaehollandiae / Masked Owl
Varanus rosenbergi / Rosenberg's Goanna
Haliaeetus leucogaster / White-bellied Sea-Eagle

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	Number of credits to be retired
1778-Coastal sandstone foreshores forest	Not a TEC	0.5	10.00

1778-Coastal sandstone foreshores forest	Like-for-like credit retirement options			
	Class	Trading group	HBT	IBRA region
	Sydney Coastal Dry Sclerophyll Forests This includes PCT's: 1778	Sydney Coastal Dry Sclerophyll Forests >=90%	Yes	Pittwater, Cumberland, Sydney Cataract, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			

BAM Biodiversity Credit Report (Variations)

Formation	Trading group	HBT	IBRA region
Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 2 or higher	Yes (including artificial)	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Area	Credits
Myotis macropus / Southern Myotis	0.5	9.00

Myotis macropus/ Southern Myotis	1778_moderate	Like-for-like options		
		Spp		IBRA region
		Myotis macropus/Southern Myotis		Any in NSW
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

BAM Biodiversity Credit Report (Variations)

		Fauna	Vulnerable	Pittwater, Cumberland, Sydney Cataract, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1778_planted	Like-for-like options			
	Spp		IBRA region	
	Myotis macropus /Southern Myotis		Any in NSW	
	Variation options			
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below		IBRA region
	Fauna	Vulnerable	Pittwater, Cumberland, Sydney Cataract, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.	
1778_poor	Like-for-like options			
	Spp		IBRA region	
	Myotis macropus /Southern Myotis		Any in NSW	

BAM Biodiversity Credit Report (Variations)

		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pittwater, Cumberland, Sydney Cataract, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.