53B Warriewood Road, Warriewood – Flora and Fauna Assessment

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Template 2.8.1

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Abbreviations

Abbreviation	Description
BC Act	*Biodiversity Conservation Act 2016*
BAM	Biodiversity Assessment Methodology
BDAR	Biodiversity Development Assessment Report
BOS	Biodiversity Offset Scheme
CAA	Controlled Activity Approval
DA	Development Application
DotEE	Department of the Environment and Energy
ELA	Eco Logical Australia Pty Ltd
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
FFA	Flora and Fauna Assessment
HBT	Hollow bearing tree
LEP	Local Environmental Plan
LGA	Local Government Area
MNES	Matters of National Environmental Significance
NRAR	National Resources Access Regulator
OEH	Office of Environment and Heritage
Outer VRZ	Outer Vegetated Riparian Zone
PCT	Plant Community Type
RC	Riparian Corridor
SAII	Serious and Irreversible Impacts
SEPP	State Environmental Planning Policy
SMCMA	Sydney Metropolitan Catchment Management Authority
TEC	Threatened ecological community

Executive Summary

Eco Logical Australia Pty Ltd (ELA) was commissioned by ZYGT Pty Ltd to prepare a Flora and Fauna Assessment (FFA) report for the proposed new development at 53B Warriewood Road, Warriewood (i.e. the study area). ZYGT Pty Ltd propose to submit a Development Application (DA) to Northern Beaches Council under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

Eco Logical Australia Pty Ltd was engaged by Merrin Developments to prepare a flora and fauna assessment to support a development application to Northern Beaches Council. Potential impacts were assessed through application of the NSW *Biodiversity Conservation Act 2016* Test of Significance (5-part test) and application of the Commonwealth Significant Impact Criteria. This report identifies mitigation measures to minimise impacts to the environment.

The proposed works will consist of subdividing the land at 53B Warriewood Road into 16 residential lots and a reserve lot. An additional area to the rear will not be developed. This area will form part of the riparian corridor along Narrabeen Creek. This corridor is mapped on the Pittwater Local Environment Plan 2014 Terrestrial Biodiversity map.

This FFA documents the ecological values within the study area and considers the impacts from the proposed development in relation to current environmental planning legislation.

A field survey identified the presence of one native vegetation community. The community has been mapped as Coastal Flats Swamp Mahogany Forest. This community corresponds to the Threatened Ecological Community (TEC) Swamp Sclerophyll Forest on Coastal Floodplains of the Sydney Basin Bioregion. Swamp Sclerophyll Forest is listed as an endangered ecological community under the NSW *Biodiversity Conservation Act 2016*. The community present on 53B Warriewood Road persists primarily as canopy species. The remainder of the vegetation present was urban natives / exotics. This urban vegetation does not correspond to any TECs.

The proposal will remove 0.027 ha of this TEC. Indirect impacts include the potential for changes in hydrology and water quality, and increased potential for weed invasion. Measures and recommendations have been made to mitigate these potential impacts.

A test of significance was conducted for the Swamp Sclerophyll Forest EEC. This assessment concluded that there is unlikely to be a significant impact to the EEC as a result of the subdivision.

No threatened species were observed in the study area. Potential habitat was found in the study area for the following threatened species:

- *Calyptorhynchus lathami* (Glossy Black Cockatoo) – Vulnerable (TSC Act)
- *Miniopterus australis* (Little Bentwing Bat) – Vulnerable (TSC Act)
- *Miniopterus schreibersii oceanensis* (Eastern Bentwing Bat) – Vulnerable (TSC Act)
- *Myotis macropus* (Southern Myotis) – Vulnerable (TSC Act)
- *Pteropus poliocephalus* (Grey-headed Flying Fox) – Vulnerable (TSC and EPBC Acts).

Tests of significance and the Significant Impact Criteria concluded that the proposed subdivision is unlikely to result in significant impacts to these species, nor require the preparation of a BDAR or referral to the Commonwealth.

Approximately 0.12 ha of remnant and planted native/exotic vegetation will be removed by the proposed development. A further 0.2 ha of exotic grassland will be removed. The amount of native vegetation clearing does not exceed the native vegetation clearing threshold (0.25 ha) under the Biodiversity Offsets Scheme (BOS) for the minimum lot size for the current zoning. Additionally, the proposed subdivision is not located on land identified in the Biodiversity Values map.

Therefore, the BOS will not be triggered by the proposed development and a Biodiversity Development Assessment Report (BDAR) will not be required.

1. Introduction

1.1 Purpose of the report

Eco logical Australia Pty Ltd (ELA) was engaged by ZYGT Pty Ltd to prepare a Flora and Fauna Assessment (FFA) for 53B Warriewood Road, Warriewood to form part of a Development Application for proposed subdivision of the property. ZYGT Pty Ltd propose to submit a Development Application (DA) to Northern Beaches Council under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The lot number and street address are as follows:

- Lot 3DP1115877 – 53B Warriewood Road (referred to as the 'study area' in this report).

1.2 Study area

The survey area is the whole of the lot subject to the subdivision at 53B Warriewood Road (Lot 3 DP1115877), Warriewood (Figure 1), in the Northern Beaches Council local government area (LGA), approximately 27 km north of the Sydney CBD. The site is a rectangular-shaped block, with the eastern end containing residential buildings, a swimming pool and large storage sheds and the rear of the block comprised of mown grass with a few large *Eucalyptus robusta* (Swamp Mahogany) near the south western corner of the property. On the south eastern side of the site, a new residential development is in the process of being completed.

The study area is zoned R3 Medium Density Residential and is part of the Warriewood Valley Urban Release Area. The study area is within an urban development setting. Large residential blocks sit alongside this site, with Narrabeen Creek forming the rear boundary. Warriewood Wetlands are approximately 350 m to the south. The Narrabeen Creek corridor and some lands either side of this corridor are marked as 'biodiversity' on the terrestrial biodiversity map in the Pittwater Local Environmental Plan 2014 (Pittwater LEP). The northern boundary is the property at 53A Warriewood Road and the south western boundary is Narrabeen Creek which is dominated by exotic species, namely *Ludwigia peruviana* (Peruvian Primrose).

The geology of the study area is Quaternary sediments. These sediments are silty to peaty quartz sand and are part of the Warriewood soil landscape (Chapman and Murphy, 1989). The soils are loose, speckled, dark grey loamy sand with possible grading into the black sticky peats where the site is low lying. These soils support generally a tall open eucalypt forest to swampy sclerophyll forest.

Generally, within the landscape most of the previously-rural residential properties along Narrabeen Creek on Warriewood Road and Macpherson Street have been subdivided and developed into medium density housing areas. The vegetated riparian corridor links the area to the Warriewood Wetlands to the south of the site.

1.3 Scope of works

The DA will involve the subdivision of the property into 16 individual lots and one reserve lot.

The following key terms and definitions are used in this FFA:

- Proposed works –as specified in **Section 1.3**
- Subject site - the area directly affected by the proposal as per the definitions in the Threatened Species Assessment Guidelines (DECC 2007).
- Study area – this includes the subject site and any additional areas which are likely to be affected by the proposal (directly or indirectly) (as per DECC 2007 definitions). This includes the entire Lot 3 DP1115877- 53B Warriewood Road area (Figure 1).

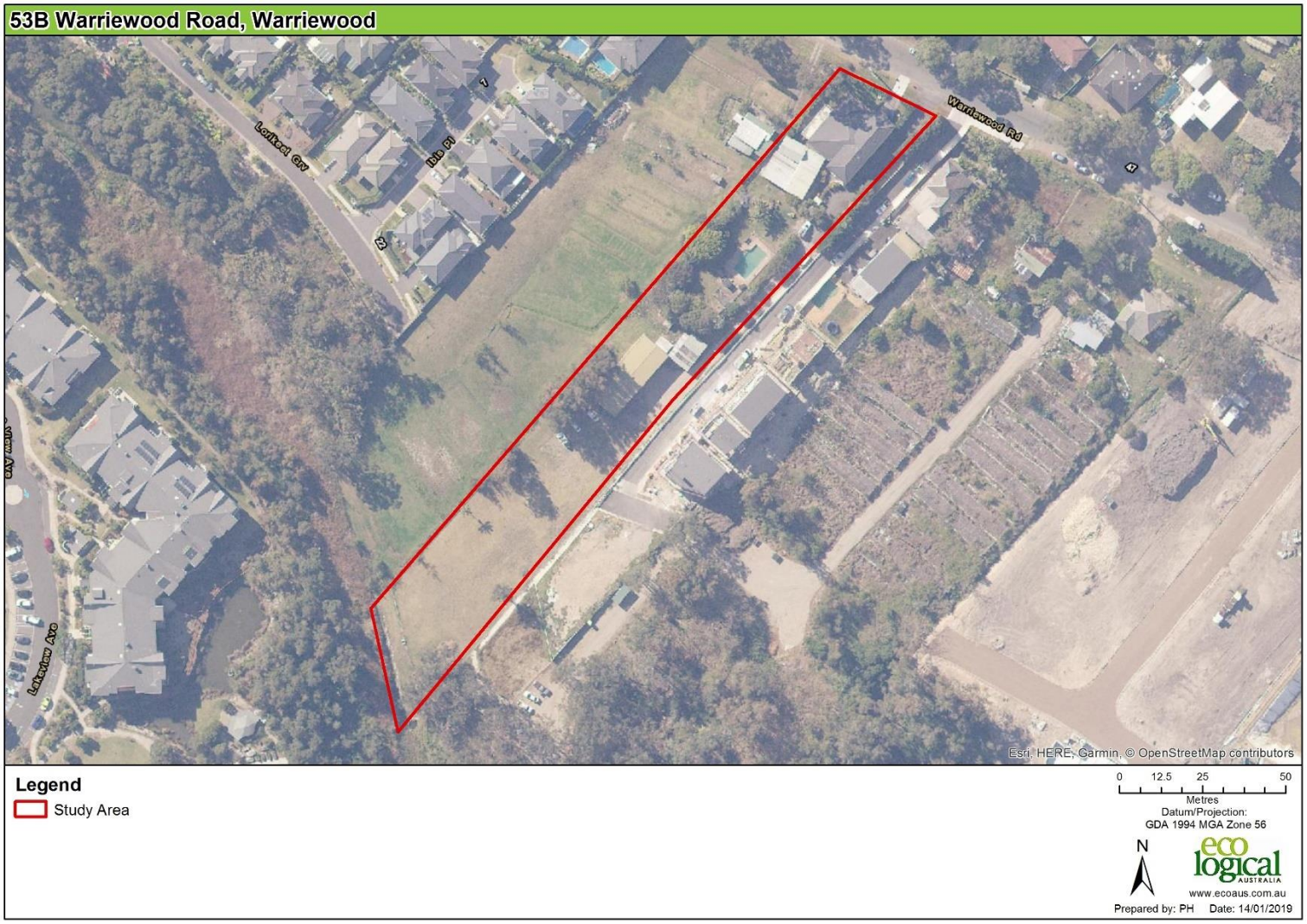

Figure 1: Study area

2. Legislative context

Table 1: Legislative context

Name	Relevance to the project	Report Section
Commonwealth		
EnvironmentProtection and Biodiversity Conservation Act 1999 **(EPBC Act)**	Matters of National Environmental Significance (MNES) have not been identified on or near the development site. This report assesses impacts to MNES and concludes that the development is not likely to have a significant impact on MNES.	5.5.4 and Appendix D
State		
Environmental Planning and Assessment Act 1979 **(EP&A Act).**	The proposed development requires development consent under Part 4 of the EP&A Act.	Section 5 Appendix C
Biodiversity Conservation Act 2016 **(BC Act)**	The BC Act outlines the assessment requirements to determine whether proposed development (Part 4 of the EP&A Act) or activity (Part 5 of the EP&A Act) is likely to significantly affect threatened species or ecological communities, or their habitats under section 7.3, and whether the Biodiversity Offsets Scheme (BOS) will be triggered. Works that exceed the BOS thresholds as set out in Part 7 of the Act and Part 7 of the *Biodiversity Conservation Regulation 2017* (BC Regulation), are required to undertake the ecological assessment in accordance with the Biodiversity Assessment Method (BAM), including the preparation of a Biodiversity Development Assessment Report (BDAR). Tests of significance for impacts to threatened species and threatened ecological communities in accordance with s7.3 of the Act have been undertaken for the proposed works. It was determined that a significant impact on threatened species is not likely. The proposed development does not exceed the BAM threshold, is not mapped on the Biodiversity Values Map (see below), and is unlikely to result in a significant impact to threatened species. Therefore the BOS is not triggered and a Biodiversity Development Assessment Report is not required.	Section 5.5 Appendix C
Biodiversity Conservation Regulation 2017 **(BC Regulation)**	The Biodiversity Values Map (BV Map) identifies land with high biodiversity value, as defined by the BC Regulation. The study area does not contain land identified on the BV Map (accessed 8 November 2018).	Section 5.5.2
Biosecurity Act 2016	Under the *Biosecurity Act 2015*, Priority weeds have been identified for local government areas and assigned strategies to contain, remove or manage. Occupiers of land (this includes owners of land) have responsibility for taking appropriate action for priority weeds on the land they occupy. The site contains weeds listed under the *Biosecurity Act 2015*.	Section 4.1.2
Fisheries Management Act 1994 **(FM Act)**	The FM Act is the principal piece of legislation protecting aquatic habitat in NSW. The Act aims to conserve fish stocks, key fish habitat, aquatic vegetation, and threatened species, populations and communities. Threatened aquatic species, populations and communities are listed under Schedules 4, 4A and 5 of the FM Act, while key threatening processes are listed under Schedule 6. Narrabeen Creek is not defined as Key Fish Habitat. The proposed development would not involve works within the waterway, obstruction of fish passage or involve dredging and/or reclamation of the creek bank, therefore there is no requirement for a Permit under Part 7 of the FM Act to be obtained as part of these works.	Sections 4.2.7 and Appendix B

Name	Relevance to the project	Report Section
Water Management Act 2000 **(WM Act)**	The proposed development is located within waterfront land (defined as being located within 40 m of the top of bank of a creek, river or estuary) and therefore will require a Controlled Activity Approval (CAA) under s91 of the WM Act from the Natural Resources Access Regulator (NRAR). As a 2nd order stream, a 20 m riparian corridor would be required to be maintained as part of the proposed works.	Sections 4.2.7
Planning Instruments		
State Environmental Planning Policy **(SEPP) (Coastal Management) 2018**	The *State Environmental Planning Policy (Coastal Management) 2018* (Coastal Management SEPP) gives effect to the objectives of the *Coastal Management Act 2016* (CM Act) from a land use planning perspective, by defining the four coastal management areas listed in the CM Act and specifying the assessment criteria that are tailored for each coastal management area. Part 2 of the CM Act identifies objectives related to four coastal management areas of the 'coastal zone': • Coastal wetlands and littoral rainforests area; • Coastal vulnerability area; • Coastal environment area; and • Coastal use area. The proposed development is located on land mapped within the Proximity Area for Coastal Wetlands under the Coastal Management SEPP.	Section 4.1.6
SEPP 44 – Koala Habitat Protection	The proposed development is located within a local government area to which SEPP 44 applies. No core habit or potential koala habitat is present within the study area.	
Pittwater Local Environment Plan 2014	The subject site is zoned 'R3 – Medium Density Residential' under the Pittwater LEP. The objectives of the zone are: • To provide for the housing needs of the community within a medium density residential environment. • To provide a variety of housing types within a medium density residential environment. • To enable other land uses that provide facilities or services to meet the day to day needs of residents. • To provide for a limited range of other land uses of a low intensity and scale, compatible with surrounding land uses. The site is also affected by Section 7.6 (Biodiversity) of Pittwater LEP 2014 which has mapped part of the site as having terrestrial biodiversity values. The section requires that certain ecological values be considered by Council when assessing a development application and that consent not be granted unless the development is consistent with the objectives of the clause. The site is also affected by Section 6.1 of Pittwater LEP 2014 which lists objectives for areas in or near riparian corridors. The objectives of this section are: • to permit development in the Warriewood Valley Release Area in accordance with the Warriewood Valley Strategic Review, • to ensure that development in that area does not adversely impact on waterways and creek line corridors, protects existing native riparian vegetation and rehabilitates the creek line corridors, • to facilitate the mitigation of odours from the Warriewood Sewage Treatment Plant on the users and occupiers of residential development in a buffer area.	Section 5.7

Name	Relevance to the project	Report Section
Pittwater 21 Development Control Plan	No controls apply to the subject site	

3. Methodology

3.1 Literature review and database search

A review of readily available databases pertaining to the ecology and environmental features of the entire extent of the study area and surrounding area and existing vegetation mapping was conducted to identify records of threatened species, populations and communities and their potential habitat.

Databases and vegetation mapping that were reviewed included:

- BioNet (Atlas of NSW Wildlife) database search (5 km) for threatened species, populations and ecological communities listed under the BC Act (OEH 2018) (Accessed January 2019).
- EPBC Act Protected Matters Search Tool (5 km) for threatened and migratory species, populations and ecological communities listed under the Commonwealth EPBC Act (Department of the Environment and Energy (DotEE) January 2019a).
- Fisheries NSW Spatial Portal
- Previous vegetation mapping
- Relevant and publicly available vegetation mapping
    - Sydney Metropolitan Catchment Management Authority (SMCMA 2009)
    - Office of Environment and Heritage (OEH) 2016 updated mapping
- Aerial photography (including historic 1943 aerial photography), topographic mapping and terrain data.
- Review of relevant planning instruments, documentation, and information relating to biodiversity values and threatened habitat
- Aerial photography (Bing Maps and Google Earth) of the study area and surrounds were also used to investigate the extent of vegetation cover and landscape features. In addition, relevant GIS datasets (soil, geology, drainage) were reviewed.

Species from both the BioNet Wildlife Atlas and DotEE online search were combined to produce a list of threatened species, populations and communities that may occur within the study area. The likelihood of occurrences for threatened species, populations and communities within the study area were then determined based on location of database records, the likely presence or absence of suitable habitat in the study area, and knowledge of the species' ecology. This information informed the subsequent field assessment and targeted survey.

After the field inspection had been completed the likelihood of occurrence of each species, population or communities was determined again. This was based on the increased knowledge about the extent and type of habitats and which species were present in the study area. The likelihood of occurrence of species, populations and communities following the field inspection is presented within the likelihood table in Appendix B.

3.2 Field inspection

3.2.1 Ecology survey

The site inspection was undertaken by senior ecologist Toni Frecker and aquatic ecologist Claire Wheeler on 10 January 2019 over three field hours to identify the biodiversity values of the study area, including validating the extent and condition of the native vegetation communities, identifying threatened flora

and fauna species and habitat for threatened fauna species within the study area. The field survey was also conducted to determine if a BDAR was required.

The field survey was undertaken in accordance with the BC Act and consisted of the following:

- Validation of the extent and quality of native vegetation to Plant Community Types (PCT), and mapping of threatened ecological communities listed under the NSW BC Act and/or the Commonwealth EPBC Act if present.
- Collection of vegetation integrity plot data, within each identified vegetation zone in accordance with the BC Act BAM Section 5.4.3.
- Identification of the presence of threatened species or populations' potential habitat within the study area.
- Identification of any other potential ecological constraints within the study area such as fauna habitat features (hollow-bearing trees (HBTs)).

Table 2: Weather conditions on day of field survey

Date	Min Temp (° C)	Max Temp (° C)	Max Wind (km/hr) and direction	Rainfall (mm)
10 January 2019	19.4	21.2	24 S	0

Data source: Bureau of Meteorology climate data for closest weather station, Terrey Hills Automatic Weather Station (066059).

3.3 Survey limitations

It should be noted that field inspections were conducted outside of the optimal survey period for some flora and fauna. Thus, it is possible that flora and fauna species that may occur in the study area were not recorded due to the life cycle and behaviour of species and seasonal considerations. Targeted surveys would need to be repeated over a number of seasons to more adequately capture the diversity of flora and fauna that could use the study area. Since this was not possible, habitat assessments were undertaken to predict the likely presence of species. In addition, considering the habitat available within the study area, the condition of the vegetation and the proposed impacts, the survey effort was deemed satisfactory for the purposes of this report.

A conservative approach was also taken in assuming the presence of species that could potentially occur in the site (that is, species were assessed to have the potential to be present even if the potential for this was low).

The level of survey effort was considered appropriate for the size of the site and the modified nature of the habitat present. The site survey revealed that the study area is currently used as residential properties with houses and several outbuildings, sheds, a pool, paths, fences and storage areas.

The study area has been subject to under-scrubbing and clearing of the canopy. There were large areas of managed vegetation and landscaped plants. The survey did not attempt to compile a complete list of species in the landscaped portions of the subject site. Regular mowing at the rear of the block has occurred. This made identification of the herbaceous and grassy plants difficult.

Presence of hollows was detected via visual survey. Only hollows that were visible from the ground were detected. There may be other hollows present that were not visible from the ground. The

positions of trees with hollows were marked using a handheld GPS. It should be noted that the accuracy of a hand help GPS can vary up to 20 m.

4. Results

4.1 Data audit and literature review

4.1.1 Vegetation communities

The literature review found the presence of three mapped vegetation communities on the site (OEH 2016) (Figure 2):

- Coastal Freshwater Swamp Forest
- Coastal Flats Swamp Mahogany Forest
- Weeds and exotics

The Coastal Flats Swamp Mahogany Forest aligns with the BC Act listed Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions.

The field survey confirmed the presence of this community.

4.1.2 Coastal Flats Swamp Mahogany Forest. (PCT 1795 – Swamp Mahogany / Cabbage Tree Palm – Cheese Tree – Swamp Oak tall open forest on poorly drained coastal alluvium in the Sydney Basin)

Coastal Flats Swamp Mahogany Forest is found in areas of impeded drainage near coastal swamps, lagoons and along low-lying drainage flats. This open forest is dominated by *Eucalyptus robusta (Swamp Mahogany)* with a smaller tree layer of *Casuarina glauca* (Swamp Oak) and *Melaleuca linariifolia* and *M. styphelioides* (paperbarks).

A distinct mesic element is present in the understorey with *Glochidion ferdinandi* (Cheese Tree) and *Livistona australis* (Cabbage Tree Palm) most prominent. Climbers such as *Stephania japonica* var. discolor (Snake Vine) and *Parsonsia straminea* (Common Silkpod) may be found winding around tree trunks and fallen branches. The ground cover is periodically wet with standing water rarely consistent throughout the year. While some sedges do occur amongst the ground cover it is the combination of ferns, grasses and herbs that are most abundant.

In the Sydney Metropolitan Catchment Management Authority area it is restricted to elevations between 1 and 6 m above sea level (SMCMA 2016). These forests appear to be more common on low lying alluvium rather than marine sediments (NPWS 2000; NPWS 2002; Bell 2009) although there is considerable gradation between the two. Largest areas of this forest within the SMCMA occur at the Warriewood Wetlands.

This vegetation community aligns with the TEC *Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions*, which is listed under the BC Act as endangered.

4.1.3 Weeds and exotics

The area mapped as weeds and exotics occurred in the southern portion of the study area and the areas around the dwellings and outbuildings. The latter were managed for either aesthetic or

production purposes (Figure 3). None of the vegetation around the dwellings could be considered to form part of a remnant native vegetation community.

Additionally, extensive areas of mown exotic grass are present within the southern portion of the study area.

There was a single large *Corymbia maculata* (Spotted Gum) overhanging the northern boundary of 53B Warriewood Road. However this tree is not within the study area and will not be directly impacted by the subdivision.

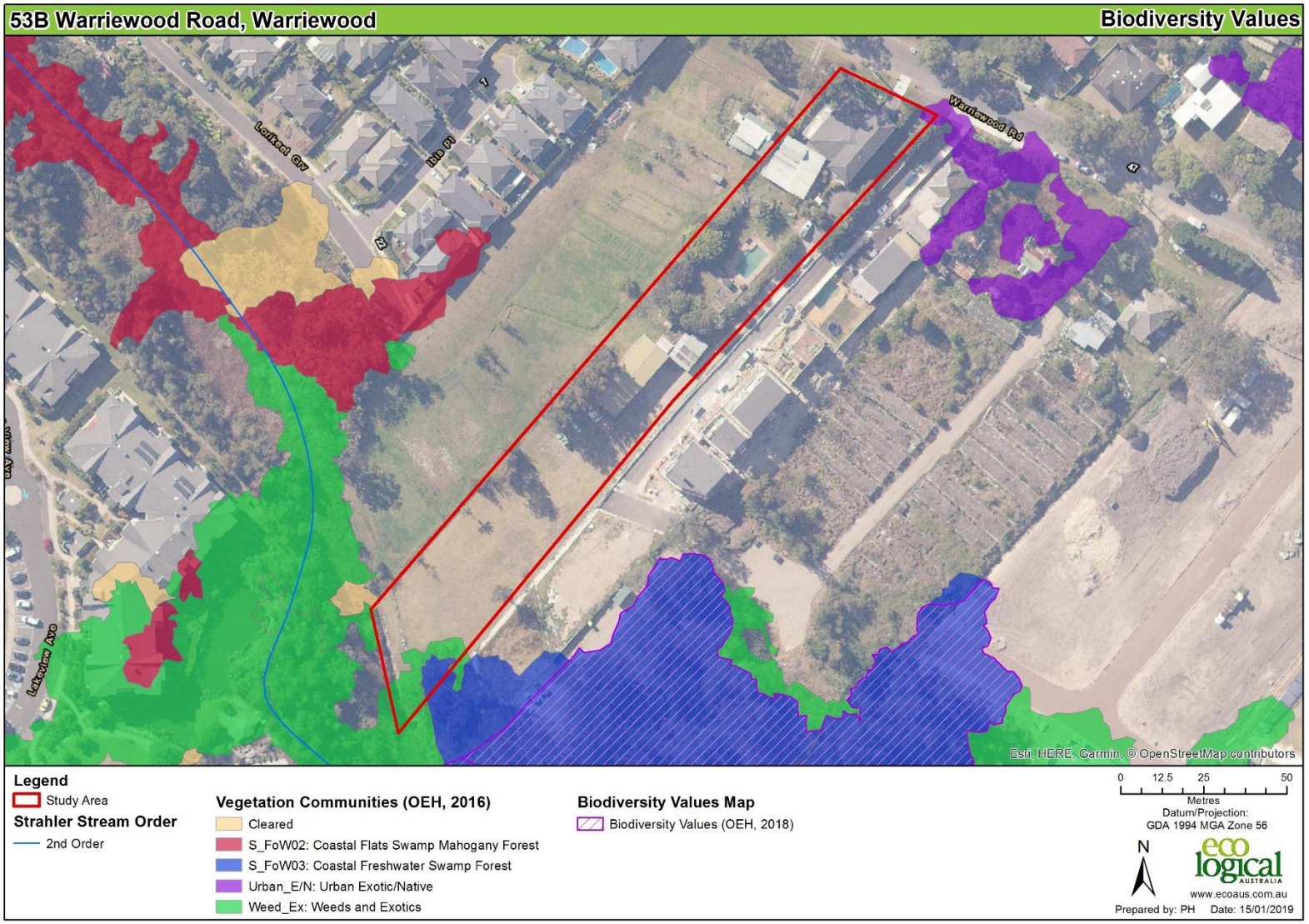

Figure 2: Previous vegetation mapping for the study area (OEH, 2016) and location of Biodiversity Values mapping

4.1.4 Threatened species

The search for threatened species using the Protected Matters Search Tool and Atlas of NSW Wildlife (within a 5 km buffer around the study area) and the review of literature resulted in a list of 25 threatened flora species. The combined data set searches revealed that there were 75 threatened fauna either recorded or with potential habitat within the locality. These included 3 fish, 5 frogs, 2 reptiles, 19 birds, 7 bats and 9 mammals (other than bats), 30 migratory marine and migratory wetland species Figure 3). A record of one endangered fauna population is also in the locality (see Appendix B).

It should be noted that the result of the Protected Matters Search Tool, which has been included in Appendix B, is only a list of species based on habitat modelling. Therefore, not all species listed in Appendix B are shown on the maps in this report. The Atlas of NSW Wildlife database records for the study area of threatened flora and fauna are shown in Figure 3.

There are nothreatened flora or fauna BioNet records located within the study area. The nearby riparian corridor and vegetation on surrounding properties may provide a connective corridor for dispersal of peri-urban fauna or highly mobile threatened fauna species; in particular, for threatened bird species including *Calyptorhynchus lathami* (Glossy Black Cockatoo) and foraging habitat for the *Pteropus poliocephalus* (Grey-headed Flying-fox), *Myotis macropus* (Southern Myotis), *Miniopterus schreibersii oceanensis* (Eastern Bentwing Bat) and *Miniopterus australis* (Little Bentwing Bat).

4.1.5 Soils, topography and hydrology

The site is located on the Warriewood soil landscape. It is characterised by Holocene silty to peaty quartz sand and medium to fine marine sand with podzols. Typically, land on this soil landscape has been extensively cleared. Remaining native tree species include *Melaleuca quinquenervia* (Broadleaved paperbark), *Banksia integrifolia* (Coastal banksia), *Casuarina glauca* (Swamp oak) and *Eucalyptus robusta* (Swamp Mahogany) (Chapman and Murphy 1989).

4.1.6 Biodiversity Values Land Map

ELA confirmed on 11 January 2019 during the desktop database search that the vegetation within the study area is not mapped as containing high biodiversity value on the Biodiversity Values Map, as defined in the BC Regulation. However, areas downstream of the site are mapped on the Biodiversity Values Map (Figure 2).

4.1.7 SEPP (Coastal Management) 2018

The site at 53B Warriewood Road is mapped within the Proximity Area for Coastal Wetlands under the SEPP (Coastal Management).

The SEPP (Coastal Management) outlines the following development controls for development within the Proximity Area for Coastal Wetlands:

11 (1) Development consent must not be granted to development on land identified as "proximity area for coastal wetlands" or "proximity area for littoral rainforest" on the Coastal Wetlands and Littoral Rainforests Area Map unless the consent authority is satisfied that the proposed development will not significantly impact on:

(a) the biophysical, hydrological or ecological integrity of the adjacent coastal wetland or littoral rainforest, or

(b) the quantity and quality of surface and ground water flows to and from the adjacent coastal wetland or littoral rainforest.

The proposed development does not involve the removal of any vegetation that is part of, or integral to, the coastal wetland. The vegetation on site is disconnected from the adjacent vegetation located on the property at 53C Warriewood Road, as the rear of the property is mainly mown grass. The rear of the property at 53B Warriewood Road would be revegetated and managed under a Vegetation Management Plan. This would allow for areas that are currently bare to be revegetated, and to establish a vegetated corridor along the riparian area and adjacent to the coastal wetland.

Figure 3: OEH records of Threatened flora and fauna species recorded within vicinity of study area

4.2 Field survey results

Two BAM plots were conducted within the study area. Due to the small patch size a modified version of the standard 20 m x 20 m plot was conducted, i.e. 10 m x 40 m vegetation. The BAM plot data is a requirement of the BC Act for BDARs. Plot data was collected during validation of the vegetation in case the development triggered the requirement for a BDAR rather than a FFA (See Section 5.5).

4.2.1 Vegetation communities

4.2.1.1 Study area vegetation

The field survey identified that the vegetation within the study area is highly disturbed with scattered mature native species as well as planted native species which have been incorporated into horticultural landscape gardens. There was a small amount of remnant vegetation present within the study area (Figure 4).

In the area surrounding the residential premises, there were a number of native planted species including *Melaleuca linariifolia* (Flax-leaved paperbark), *Syzygium paniculatum* (Magenta Lilly Pilly), as well as a number of horticultural species including *Clivia* sp. and *Photinia* sp. and exotic weed species including *Solanum nigrum* (Blackberry Nightshade) and *Asparagus aethiopicus* (Asparagus Fern).

The vegetation community, Coastal Flats Swamp Mahogany Forest, at 53B Warriewood Road was highly modified. It persists as canopy trees primarily. The trees were *Eucalyptus robusta* (Swamp Mahogany) and *Casuarina glauca* (Swamp Oak). The understorey at 53B Warriewood Road had been under-scrubbed. The groundcover was mostly mown lawn and grasses. The dominant species in the lawn was *Cenchrus clandestinus* (Kikuyu).

Along the northern boundary of the study area adjacent to 53A Warriewood Road were a number of *Casuarina glauca* (Swamp Oak) trees of differing sizes. Beneath these canopy trees were scattered native species including *Commelina cyanea* (Commelina), *Parsonsia straminea* (Common Silkpod), *Persicaria decipiens* (Slender Knotweed) and *Glochidion ferdinandi* (Cheese Tree) seedlings. A number of exotic species were also located within this area including *C. clandestinus, Sida rhombifolia* (Paddy's Lucerne), *Hydrocotyle bonariensis* (Pennywort), *Cestrum parqui* (Green Cestrum), *Plantago lanceolata* (Lamb's Tongues) and *Paspalum dilatatum* (Paspalum).

These Swamp Oak canopy species may be considered characteristic of the remnant vegetation communities.

Figure 4: ELA-validated vegetation communities

4.2.2 Flora species

A total of 33 flora species were identified within the study area (Appendix A). There were no threatened flora species recorded or likely to occur within the study area.

4.2.3 Priority weeds

Of the weeds identified during field surveys, two species is listed as a State priority weed and the remaining five weeds are listed as other weeds of regional concern. The weeds present, their priority listing under the Biosecurity Act 2017, their associated asset / value at risk and whether they are Weeds of National Significance (WoNS), are presented in Table 3.

The majority of the weed species identified during the field survey were located along the property boundaries or in the landscaped garden areas. Within the adjacent riparian corridor, the area was dominated by exotic species, particularly by *Ludwigia peruviana* (Peruvian Primrose).

Table 3: State level determined priority weeds and other weeds of concern present

Scientific name	Common name	WoNS	Priority weed obligations
State level priority weeds			
Asparagus aethiopicus	Ground Asparagus	Yes	Asset protection
Cestrum parqui	Green Cestrum	Yes	Asset protection
Regional Priority			
Agapanthus sp.	Agapanthus	No	Other regional weeds
Cenchrus clandestinus	Kikuyu	No	Other regional weeds
Ligustrum lucidum	Broad-leaved Privet	No	Other regional weeds
Senna pendula	Senna	No	Other regional weeds
Zantedeschia aethiopica	Arum Lily	No	Other regional weeds

Asset protection: These Weeds are widely distributed in some areas of the State. As Weeds of National Significance, their spread must be minimised to protect priority assets.

4.2.4 Fauna species and their habitat

There were no threatened flora or fauna species identified during the field survey. Additionally, the study area contains limited habitat features. However, one small hollow (<5cm) within a *Eucalyptus robusta* (Swamp Mahogany) was located near the south eastern boundary of the site. The tree is isolated from all other canopy species. A visual inspection from the ground could not determine if this hollow contained substantial depth suitable for microbat species or birds (Figure 5).

Nine fauna species were observed during the survey (see list in Appendix A). Several *Oryctolagus corniculatus* (European Rabbit) were observed in the study area and adjacent property. Scats and scratchings of these animals were also observed within the study area. A number of bird species were also observed during the field survey. The birds were ubiquitous urban tolerant species. These birds are typical of this type of peri-urban environment.

A list of habitat features recorded in the study area or within the adjacent riparian corridor is available below in Table 4.

Table 4: Habitat features recorded in the study area

Habitat feature	Associated species	Presence
Native vegetation	Birds, microchiropteran bats (microbats), megachiropteran bats (fruit bats), arboreal mammals, reptiles	Present. Some trees are present along boundary fence between 53A and 53B Warriewood Road, as well as mature *E. robusta* species at the rear of the study area.
Other vegetation	Small birds	The riparian area adjacent to the study area has a dense understorey of exotic species providing habitat for small birds.
Nectar producing species	Arboreal mammals/birds and fruit bats	Present in the study area as planted canopy and tall shrubs, and remnant mature trees
Hollow-bearing trees	Microbats, birds, mammals, amphibians, reptiles	Present. One small hollow <5 cm recorded
Coarse woody debris (fallen logs)	Terrestrial mammals, reptiles, invertebrates	Present. Two piles of logs were located in the mown grass area towards the rear of the property and at the base of the two larger *Eucalyptus robusta* near the boundary of the study area.
Water body	Amphibians, reptiles, microbats	Present at rear of study area Narrabeen Creek at the rear of the study area is densely covered in *Ludwigia peruviana* and no open areas of water were observed during the site survey.
Rocky outcrops	Microbats, reptiles	Absent

4.2.5 Threatened fauna species

No threatened fauna were observed during the field survey. After inspecting the study area, it was considered that five fauna species have the potential to use the site as foraging habitat. These were:

- *Calyptorhynchus lathami* (Glossy Black Cockatoo) – Vulnerable (BC Act)
- *Miniopterus australis* (Little Bentwing Bat) – Vulnerable (BC Act)
- *Miniopterus schreibersii oceanensis* (Eastern Bentwing Bat) – Vulnerable (BC Act)
- *Myotis macropus* (Southern Myotis) – Vulnerable (BC Act)
- *Pteropus poliocephalus* (Grey-headed Flying Fox) – Vulnerable (BCand EPBC Acts).

4.2.6 Fauna habitat

The vegetation in the study area has largely been modified. However, there were some *Eucalyptus robusta* trees that are likely to be suitable foraging habitat for Grey- headed Flying Fox. This species is known from camps at Warriewood and Balgowlah.

Casuarina glauca (Swamp Oak) was relatively common in the vegetated areas. This species may be used as a foraging species for Glossy Black Cockatoo. In the locality (e.g. along Narrabeen Creek and into the Warriewood Wetlands) *Allocasuarina* and *Casuarina* species were abundant (although not surveyed).

The one hollow bearing tree present in the study area may contain a small hollow suitable for roosting habitat for threatened microbat species.

The study area is unlikely to support many native terrestrial fauna. This is because of the highly modified understorey and the lack of other key habitat features. The survey area supports no:

- rock outcrops
- no terrestrial termite mounds
- no shrub thickets.

The study area is near to 49 Warriewood Road. This area contains more diverse and complex forest. This forest contains thickets of Melaleuca species, *Livistona australis* (Cabbage Tree Palm) and is likely to support a range of fauna.

The study area is bound by Narrabeen Creek, a 2nd order watercourse to the south-west. This creek forms a corridor and has been noted as important biodiversity under the Pittwater LEP and associated terrestrial biodiversity map (Figure 2). No aquatic assessment was conducted. The creek appears to have modified banks on one side (adjacent to the subject site), with rehabilitated bank vegetation on the far side. The rehabilitated vegetation appears to correspond with coastal Flats Swamp Mahogany Forest. Over time, this vegetation is likely to support a range of riparian and aquatic fauna.

4.2.7 Riparian corridor

Although the majority of proposed development is located outside of the riparian corridor (defined as 20 m from the top of the creek bank), it is still located on waterfront land and would require a CAA via an Integrated Development Application.

Figure 5: Potential hollow

5. Impact assessment

5.1 Summary of impacts

Both direct and indirect impacts during the construction and long-term impacts have been considered in the assessment below. The proposed residential development will result in the removal of remnant and planted native and exotic vegetation within the study area. The impacts of the proposal to selected threatened species and communities listed under the BC and EPBC Act have been assessed. Requirements under the BC Act for triggering the BOS and application of the BAM are also assessed to determine if the development application requires a BDAR or a FFA (see Section 5.5).

The following impacts may occur as a result of the proposed works and have been assessed in the following sections:

Direct impacts:

- Clearing of vegetation
- Loss/modification of threatened fauna habitat (including loss of an HBT)
- Fragmentation or isolation of habitats.

Indirect impacts

- Increased spread of weed infestations
- Shadowing of adjacent vegetation
- Soil erosion or compaction of soil from heavy machinery
- *Phytophthora cinnamomi* spread from machines/personnel
- Sediment mobilisation or change in water quality
- Run-off from hard surfaces into creekline and adjacent vegetation.

5.2 Direct impacts

5.2.1 Clearing of vegetation

The proposed works would result in the clearing of remnant and planted native and exotic vegetation. A total of 0.318 ha of vegetation including 0.2 ha of exotic grassland would be impacted within the study area.

Table 5: Assessment of vegetation impacted

Vegetation community	Direct Impact	Potential Indirect Impacts
PCT 1795 (CFSMF)	0.027 ha	0.02 ha
Weeds and exotics	0.091 ha	N/A
Exotic grassland	0.2 ha	N/A
TOTAL	0.318	0.02

A small area of remnant native vegetation (0.027 ha) will be directly impacted. Indirect impacts associated with shadowing and weeds are assessed below. Some vegetation to be removed has been

planted following the construction of the existing development. Landscaping works will be required within the study area as part of the DA and should include a mix of locally indigenous species representatives of PCT 1795 and horticultural varieties.

5.2.2 Loss / modification of threatened species habitat

The proposed works would result in the removal of one tree which may contain a small hollow suitable for roosting habitat for threatened microbat species. The on-ground visibility of the hollow was limited so it was difficult to determine if the hollow contained substantial depth required for microbats. However, a precautionary approach was taken in the field when identifying potential hollows.

There is potential that the removal of flowering canopy for threatened arboreal species such as the Grey-headed Flying-fox. Additionally, there is potential that the proposed works may result in a loss of foraging habitat for microbats. These species are likely to utilise the study area on occasion, with preference for the vegetative corridor located adjacent to the study area. Test of Significance under the BC Act and Significance Assessments under the EPBC Act have been prepared for these species and are found in Appendix C and Appendix D, respectively.

5.2.3 Modification of fragmentation of vegetation

The proposed works will result in a reduction in the canopy layer which may provide a stepping-stone habitat. However, only highly mobile threatened microbats, Grey Headed Flying Fox (GHFF) and bird species have been considered to utilise the vegetation within the study area.

Despite the removal of 0.318 ha of vegetation, connectivity within the landscape will be maintained via Narrabeen Creek riparian corridor and the required Vegetation Management Plan (VMP) area at the rear of the property.

5.3 Impacts to riparian corridor

There is potential that the works may result in indirect impacts to the native vegetation adjacent to the development footprint, located along the riparian corridor of Narrabeen Creek. Impacts to the riparian corridor may include:

- Increase in sediment flow into the bushland and creek
- Spread of weeds or soil/plant disease.

Mitigation measures have been provided in Section 6 to minimise direct and indirect impacts.

5.4 Other indirect impacts

Indirect impacts are those impacts that do not directly affect habitat and individuals but that have the potential to interfere through indirect action. Indirect impacts considered for this assessment are site impacts (noise, dust, vibrations and weed invasion) and downwind impacts (sedimentation, dust, accidental spills and leaks). These impacts result from the operation of heavy machinery to clear and construct the lots.

Without mitigation, sediment runoff could impact retained native vegetation and enter Narrabeen Creek. Potential impacts of sediment to areas of retained vegetation and the stormwater system should be managed via an appropriate sediment and erosion control plan. This will need to be implemented

during any construction or facilitation of the subdivision and following construction. Impacts to threatened species and native vegetation are unlikely to be significant.

Management of stormwater on the site will be a feature of the subdivision. It is understood that there will not be increased flows or a decrease in water quality impacting retained vegetation or Narrabeen Creek.

There may be indirect impacts to the retained remnant vegetation community as a result of the subdivision. The area subject to indirect impacts is small at 0.02 ha. The potential indirect impacts may include:

- increases in weed invasion into areas of retained native vegetation
- changes in hydrology as a result of embankments being constructed.

The areas of EEC vegetation should be subject to appropriate management to minimise these potential impacts.

As such, indirect impacts to threatened species and native vegetation are unlikely to be significant and will be managed.

5.5 Biodiversity Conservation Act 2016

In November 2016 the NSW parliament passed the BC Act. This new legislation replaced the *Threatened Species Conservation Act 1995* (TSC Act) and took effect 25 August 2017. Among other things, the BC Act introduces new requirements for biodiversity assessment and requires proponents to offset certain biodiversity impacts through the purchase and retirement of biodiversity credits. However, there are thresholds for triggering the Biodiversity Offsets Scheme (BOS) and BAM, and if triggered, a BDAR is required.

Triggers for the BOS and the BAM, include:

- Exceeding the clearance of native vegetation area threshold
- Clearing of land identified on the NSW Government Biodiversity Values Map.
- Tests of Significance for the threatened species for development that does not exceed the two thresholds listed above. If the Test of Significance determines a significant impact on threatened species, the BOS will be triggered, and a BDAR must be prepared.

5.5.1 Biodiversity Offset Scheme – area clearing threshold

The area clearing threshold is triggered when an area of native vegetation* to be cleared reaches the thresholds for the relevant lot size (Table 6).

A total area of 0.027 ha of remnant native vegetation across the study area will be removed. The total area of both remnant and planted native vegetation to be removed will be less than 0.118 ha. According to this, the BOS would not be triggered by the area clearing threshold for the minimum lot size (Table 6).

Table 6: Area clearing threshold

Minimum lot size associated with the property	Threshold for clearing native vegetation*, above which the BAM and BOS apply
Less than 1 ha	0.25 ha or more
1 ha to less than 40 ha	0.5 ha or more
40 ha to less than 1000 ha	1 ha or more
1000 ha or more	2 ha or more

* Note: native vegetation is defined in Section 1.6 if the BC Act (and has the same meaning as in Part 5A of the *Local Land Services Act 2013*), essentially encompasses any species native to NSW and does not necessarily conform to a Plant Community Type.

5.5.2 Offset Scheme Thresholds – Biodiversity Values Map

The Biodiversity Values Map (BV Map) identifies land considered to have high biodiversity value as defined by the *Biodiversity Conservation Regulation 2017*. The study area does not contain areas of high biodiversity value as mapped on the BV Map (Figure 2). There are no works proposed within the land mapped on the BV Map.

5.5.3 BC Act – Test of Significance

A Test of Significance (also known as a 5-part test) is required for Part 4 development that does not trigger the BOS by exceeding the area clearing thresholds and is not identified on the BV Map.

The 5-part test is used to determine if the development is likely to have a significant impact on any threatened species, population or ecological community. If a significant impact is indicated by the 5-part test, then the proposal would trigger the BOS and BDAR would be required.

Test of Significance (5-part tests) were undertaken for the following BC Act listed species (Appendix C):

- *Pteropus poliocephalus* (Grey-headed Flying-fox)
- *Calyptorhynchus lathami* (Glossy Black Cockatoo)
- *Myotis macropus* (Southern Myotis)
- *Miniopterus schreibersii oceanensis* (Eastern Bentwing Bat)
- *Miniopterus australis* (Little Bentwing Bat).

No threatened fauna species were recorded in the study area during the survey. Furthermore, suitable foraging habitat for threatened fauna species was limited within the study area due to the relatively small amount of native vegetation present. The removal of this habitat for the proposed development is considered negligible on a local scale and would not result in a long-term decline in the population of any fauna species. As such, a significant impact under Section 7.3 of the BC Act was considered unlikely for these threatened species.

5.5.4 Key threatening processes

The Key Threatening Processes (KTPs) listed under the BC Act and / or EPBC Act that are likely to be relevant to the proposed works include:

- Clearing of native vegetation (BC Act) / Land clearance (EPBC Act)
- Loss of hollow-bearing trees (BC Act)
- Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants (EPBC Act).

5.5.5 Serious and Irreversible Impacts

The BC Act requires a consent authority to reject a Part 4 (EP&A Act) development application that is likely to result in a serious and irreversible impact (SAII) on biodiversity values. Thresholds for triggering a SAII are yet to be published, therefore a SAII cannot be determined until the thresholds are released by the Office of Environment and Heritage (OEH). OEH has published the Guidance to Assist a Decision-Maker to Determine a Serious and Irreversible Impact (OEH, 2017) which contains a list of potential species (and their habitat) that meet the SAII principles and criteria. There are no SAII impacted by the proposed works.

5.6 EPBC Act – Assessment of Significance

The EPBC Act establishes a process for assessing the environmental impact of activities and developments where 'Matters of National Environmental Significance' may be affected. Under the Act any action which "has, will have, or is likely to have a significant impact on a Matter of National Environmental Significance" is defined as a "controlled action", and requires approval from the Commonwealth Department of the Environment and Energy (DotEE) which is responsible for administering the EPBC Act.

The following Assessment of Significance were undertaken for the EPBC Act listed species (Appendix D):

- *Pteropus poliocephalus* (Grey-headed Flying-fox).

Suitable foraging habitat for the Grey-headed Flying Fox was limited within the study area due to the relatively small amount of native vegetation present. The removal of this habitat for the proposed development is considered negligible on a local scale and would not result in a long-term decline in the population of any fauna species. As, such a significant impact was considered unlikely.

5.7 Pittwater Local Environmental Plan 2014 (Pittwater LEP)

Section 7.6 of the Pittwater LEP 2014 applies to land identified as 'Biodiversity' on the Biodiversity Map Sheet - BIO_012 (Appendix E). The south western end of the study area has been identified on this map. This flora and fauna assessment has been developed to address the criteria and a summary of the proposed activity relates to the criteria under this clause has been addressed below.

Section 3 Before determining a development application for development on land to which this clause applies, the consent authority must consider:

(a) whether the development is likely to have:

(i) any adverse impact on the condition, ecological value and significance of the fauna and flora on the land,

The native vegetation identified within the study area has been identified as remnant *Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions*, which is listed under the BC Act as endangered. Past clearing and current condition of the vegetation influence the ecological value of the areas indirectly impacted by the proposed subdivision. Tests of Significance and Significance Assessments on threatened species and have been undertaken and the potential impacts of the proposal are not likely to be significant.

(ii) any adverse impact on the importance of the vegetation on the land to the habitat and survival of native fauna,

One hollow bearing tree will be removed as part of the subdivision. During the field survey no threatened species were recorded however habitat for some threatened fauna species occurs within the study area. The proposed works will remove small amount (0.027 ha) of vegetation that represents potential foraging habitat for the Grey headed Flying Fox, Glossy Black Cockatoo, *Myotis macropus* (Southern Myotis), *Miniopterus schreibersii oceanensis* (Eastern Bentwing Bat) and *Miniopterus australis* (Little Bentwing Bat). The small amount of vegetation proposed to be removed is not likely to consist of important habitat for, or to be important to the long term survival of these threatened fauna species. The proposal is also unlikely to have a significant impact on these species.

(iii) any potential to fragment, disturb or diminish the biodiversity structure, function and composition of the land, and

The areas to be removed as a result of the subdivision are already structurally and compositionally altered. Some canopy trees will be removed (e.g. *Casuarina glauca*) however some trees will be retained. The function and composition of the study area in terms of biodiversity is not expected to be significantly fragmented, disturbed or diminished. A portion of fauna habitat will be retained which will continue to provide similar biodiversity functions compared to what is currently present. These areas are within the riparian corridor along Narrabeen Creek.

(iv) any adverse impact on the habitat elements providing connectivity on the land, and

The area subject to the biodiversity classification runs along the rear of the study area and is part of the corridor along Narrabeen Creek. The subdivision will not result in reducing connectivity of the TEC and other habitat elements. The design seeks to retain as many canopy species as possible. As a result of this retention, the connectivity to other areas marked 'biodiversity' on Biodiversity Map Sheet BIO_012 will not be severed.

(b) any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development.

Building lots have been arranged to take advantage of already developed areas. The native vegetation in the survey will be managed for its biodiversity values. Furthermore, the subdivision will result in an improvement to the biodiversity values of the creek corridor and TEC by the application of a vegetation management plan and by rehabilitating areas adjacent to the riparian corridor.

Section 4 Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that:

a. the development is designed, sited and will be managed to avoid any significant adverse environmental impact, or
b. if that impact cannot be reasonably avoided by adopting feasible alternatives—the development is designed, sited and will be managed to minimise that impact, or
c. if that impact cannot be minimised—the development will be managed to mitigate that impact.

The subdivision design seeks to avoid areas of remnant native vegetation. Building sites have been arranged to take advantage of already developed and cleared areas. In addition, the development

would not result in a significant impact to any species, populations or communities listed under the BC Act or MNES that would require a referral to the Commonwealth.

6. Recommendations

The following measures are recommended to lessen the impacts of the proposed development on surrounding bushland values, including habitat for threatened species and ecological processes. The ameliorative measures have been designed in consideration of relevant legislation and guidelines.

Species / sensitive area	Potential impact	Appropriate mitigation measure
Native vegetation	Compaction of soil Accidental damage/clearing	Pre-construction: • Install temporary barrier fencing to prevent entry into adjacent vegetation and appropriate 'no-go zone' signage. • Installation of tree protection measures around trees to be retained in the study area. Structures should be adequate to prevent machinery from entering within the drip zone. During construction: • Maintain temporary fencing to prevent access into the native vegetation Post construction: • Stabilise all disturbed areas, implement vegetation protection measures as required • Revegetation of native vegetation consistent with the relevant vegetation communities.
Water quality	Increase in sediment flow into waterways Modification of hydrological flow rate Reduction in water quality	During-construction: • No stockpiling of rubbish or storage of chemicals to occur near native vegetation or waterways. • The use of fuel, chemicals, herbicides should be limited near waterways and other sensitive areas
Sediments and erosion control	Increase in sediment flow into water control Runoff should be directed away from bushland or threatened flora/fauna species habitat	Pre-construction: • A Sediment and Erosion Control Plan is required prior to any on-ground work. • Soil and erosion control measures such as sediment fencing must be installed prior to on-ground works. These are to be inspected regularly (weekly), with more frequent inspections during rain periods to ensure structures are in proper working order. Post-construction: • Bare areas should be mulched, using on-site native vegetation if removed, following clearance works to prevent erosion or soil damage. Alternatively, erosion prone areas, when not in use, may be covered with

Species / sensitive area	Potential impact	Appropriate mitigation measure
		biodegradable weed matting or similar product.
Threatened species and habitat	Loss or modification of foraging habitat	Post construction • Revegetation works would be required within the VMP area Works should be done in liaison with Council's Biodiversity Officer. Revegetation works must use appropriate species of Coastal Flats Swamp Mahogany Forest (PCT 1795)
Spread of weeds and disease	Introduction or spread of weeds or disease into bushland or threatened species habitat	Pre-construction: • All equipment must be thoroughly cleaned of soil and weed propagules prior to entry into the study area • Priority weeds listing in **Section 4.2.3** should be removed using best management practices (including appropriate controls to prevent impacts to threatened species) prior to removal of native vegetation. Weed propagules are to be removed off site During construction • The use of chemicals should be limited due to the indirect impacts to threatened fauna and native vegetation Post construction: • All weed propagules are to be bagged and removed offsite, preferably the same day and disposed of at designated green waste facility. • Implementation of a Weed Management Plan and revegetation works may be required following the completion of works for the adjacent riparian corridor along Narrabeen Creek.
Adjacent riparian corridor	Overshadowing of vegetation resulting in changes in species composition increase spread of weeds	Post Construction • Implementation of a Vegetation Management Plan and revegetation works may be required for the adjacent riparian corridor along Narrabeen Creek following the completion of works • Landscaping within the study area should include a 50:50 mix of local indigenous plant species and exotics. • Revegetation works adjacent to Narrabeen Creek must only use provenance species which represents Coastal Flats Swamp Mahogany Forest (PCT 1795)

Species / sensitive area	Potential impact	Appropriate mitigation measure
		• Revegetation works should incorporate shade tolerant plants into the revegetation works adjacent to the riparian corridor.
Threatened fauna species	Removal of Hollow-bearing tree (HBT) which may provide important nesting habitat for threatened fauna species (microbats)	<u>Pre-Construction</u> • If works requires the removal of any hollow-bearing trees a wildlife handler must first inspect the hollow and be present during removal. • A qualified arborist must be used to trim any branches in sections under the instruction of the ecologist or wildlife handler <u>Post-Construction</u> • Reinstate the loss of hollows with the installation of appropriate microbat hanging nest boxes at a ratio of 1 nest box for every hollow removed. • Due to an absence of trees within the study area following the development, nest boxes may be installed in suitable trees along Narrabeen Creek with Council approval. Nest boxes should be installed by an arborist or qualified fauna ecologist.

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Appendix A Flora and fauna species list

Scientific Name	Common name	Native/Exotic
*Agapanthus spp.**	Agapanthus	E
Asparagus aethiopicus	Ground Asparagus	E
Brachychiton acerifolius	Illawarra Flame Tree	N
Callistemon viminalis	Weeping Bottlebrush	N
Casuarina glauca	Swamp Oak	N
*Cenchrus clandestinus**	Kikuyu Grass	E
*Centaurium erythraea**	Common Centaury	E
Cerastium sp.*	Chickweed	E
*Cestrum parqui**	Green Cestrum	E
*Cirsium vulgare**	Spear Thistle	E
Clivia sp.*	Clivia	E
Commelina cyanea	Commelina	N
*Conyza bonariensis**	Fleabane	E
*Cyperus eragrostis**	Umbrella sedge	E
*Cynodon dactylon**	Couch	E
*Ehrharta erecta**	Panic Veldt	E
Eucalyptus robusta	Swamp Mahogony	N
Glochidion ferdinandi	Cheese Tree	N
*Hydrocotyle bonariensis**	Largeleaf Pennywort	E
*Ligustrum lucidum**	Broad-leaved Privet	E
Melaleuca linariifolia	Flax-leafed Paperbark	N
*Modiola caroliniana**	Red-flowered Mallow	E
Parsonsia straminea	Common Silkpod	N
*Paspalum dilatatum**	Paspalum	E
Persicaria decipiens	Slender Knotweed	N
Photinia sp.	Photinia	E
*Plantago lanceolata**	Lamb's Tongue	E
*Rumex crispus**	Dock	E
*Senna pendula**	Senna	E
*Sida rhombifolia**	Paddy's Lucerne	E
*Solanum nigrum**	Blackberry Nightshade	E
Sonchus oleraceus	Common Sowthistle	E
Strelitzia nicolai	Bird of Paradise	E

Scientific Name	Common name	Native/Exotic
Syzygium paniculatum (horticultural variety)	Magenta Lilly Pilly	N
*Trachelospermum jasminoides**	Star Jasmine	E
Trifolium sp.*	Clover	E
Urtica incisa	Stinging Nettle	N
*Zantedeschia aethiopica**	Arum Lily	E

* Denotes exotic species

Scientific Name	Common Name	Observation
Acridotheres tristis	Common Myna*	Observed in study area
Columba livia	Rock Pigeon*	Observed in study area
Cracticus torquatus	Grey Butcherbird	Heard in adjacent bushland
Grallina cyanoleuca	Magpie Lark	Observed in study area
Malurus cyaneus	Superb Fairy Wren	Observed in riparian area
Neochmia temporalis	Red-browed Finch	Observed in riparian area
Oryctolagus cuniculus	European Wild Rabbit	Observed in study area and adjacent property
Rhipidura leucophrys	Willie Wagtail	Observed in study area
Scythrops novaehollandiae	Channel-billed cuckoo	Pair flew over study area

* Denotes exotic species

Appendix B : Likelihood of occurrence

The table below provides the collated results from the 5 km database searches (buffered around the study site) of the NSW Wildlife Atlas and the EPBC Protected Matters Search Tool. An assessment of likelihood of occurrence was made for threatened and migratory species identified from the database searches. Five terms for the likelihood of occurrence of species are used in this report. This assessment was based on database or other records, presence or absence of suitable habitat, features of the proposal site, results of the field survey and professional judgement. The terms for likelihood of occurrence are defined below:

- "yes" the species was or has been observed on the site
- "likely" a medium to high probability that a species uses the site
- "potential" suitable habitat for a species occurs on the site, but there is insufficient information to categorise the species as likely to occur, or unlikely to occur
- "unlikely" a very low to low probability that a species uses the site
- "no" habitat on site and in the vicinity is unsuitable for the species.

The likelihood of occurrence was only one factor among other factors, which was used to determine whether to apply the Assessment of Significance' (5-part test) and/or EPBC Significant Impact Criteria assessments to threatened species, populations, communities or migratory species.

Ecological Communities

Scientific name	Common name	TSC Act	EPBC Act	Habitat associations	Number of records	Likelihood
Endangered Ecological Communities						
-	Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E	E	This swamp community has an open to dense tree layer of eucalypts and paperbarks although some remnants now only have scattered trees as a result of partial clearing. The trees may exceed 25 m in height, but can be considerably shorter in regrowth stands or under conditions of lower site quality where the tree stratum is low and dense. The community also includes some areas of fernland and tall reedland or sedgeland, where trees are very sparse or absent. The most widespread and abundant dominant trees include *Eucalyptus robusta* (swamp mahogany), *Melaleuca quinquenervia* (paperbark). A layer of small trees may be present, including *Acacia irrorata* (green wattle), *Acmena smithii* (lilly pilly), *Elaeocarpus reticulatus* (blueberry ash), *Glochidion ferdinandi* (cheese tree), *Melaleuca linariifolia* and *M. styphelioides* (paperbarks). The groundcover is composed of abundant sedges, ferns, forbs, and grasses The community is associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. Its structure and composition are influenced by latitude soils, hydrology, nutrients and past disturbance. Some areas may have abundant exotic species present.		Known – community is present in the study area primarily with canopy only.
Flora						
Acacia terminalis subsp. *terminalis*	Sunshine Wattle	E	E	*Acacia terminalis* subsp. *terminalis* has a very limited distribution, mainly in near-coastal areas from the northern shores of Sydney Harbour south to Botany Bay, with most records from the Port	N/A	No – no suitable habitat

Scientific name	Common name	TSC Act	EPBC Act	Habitat associations	Number of records	Likelihood
				Jackson area and the eastern suburbs of Sydney. It occurs in coastal scrub and dry sclerophyll woodland on sandy soils (OEH 2014).		
Asterolasia elegans		E	E	*Asterolasia elegans* is restricted to a few localities on the NSW Central Coast north of Sydney, in the Baulkham Hills, Hawkesbury and Hornsby LGAs. It is found in sheltered forests on mid- to lower slopes and valleys, in or adjacent to gullies (OEH 2014).	N/A	No – no suitable habitat
Caladenia tessellata	Thick Lip Spider Orchid	E	V	*Caladenia tessellata* occurs in grassy sclerophyll woodland, often growing in well-structured clay loams or sandy soils south from Swansea, usually in sheltered moist places and in areas of increased sunlight (OEH 2014). It flowers from September to November (OEH 2014).	N/A	No – no suitable habitat
Chamaesyce psammogeton	Sand Spurge	E	-	Sand Spurge is found sparsely along the coast from south of Jervis Bay (at Currarong, Culburra and Seven Mile Beach National Park) to Queensland (and Lord Howe Island). Populations have been recorded in Wamberal Lagoon Nature Reserve, Myall Lakes National Park, Moonee Beach Nature Reserve and Bundjalung National Park. Grows on fore-dunes, pebbly strandlines and exposed headlands, often with Spinifex (Spinifex sericeus) and Prickly Couch (Zoysia macrantha) (OEH 2014).	5	No – no suitable habitat
Epacris purpurascens var. *purpurascens*		V	-	*Epacris purpurascens* var. *purpurascens* has been recorded between Gosford in the north to Avon Dam in the south, in a range of habitats, but most have a strong shale soil influence (OEH 2014).	1	No – no suitable habitat
Genoplesium bauera	Bauer's Midge Orchid	E	-	*Genoplesium baueri* grows in dry sclerophyll forest. The species has been recorded at locations now likely to be within the following conservation reserves: Berowra Valley Regional Park, Royal National Park and Lane Cove National Park. May occur in the Woronora, O'Hares, Metropolitan and Warragamba Catchments (OEH 2014).	4	No – no suitable habitat
Grammitis stenophylla	Narrow-leaf Finger Fern	E	-	In NSW, *Grammitis stenophylla* has been found on the south, central and north coasts, and as far west as Mount Kaputar National Park	1	No – no suitable habitat

Scientific name	Common name	TSC Act	EPBC Act	Habitat associations	Number of records	Likelihood
				near Narrabri, in moist places, usually near streams, on rocks or in trees, in rainforest and moist eucalypt forest (OEH 2014).		
Grevillea caleyi	Caley's Grevillea	E	E	The natural distribution of *Grevillea caleyi* is centred approximately on the northern Sydney suburb of Terrey Hills and also includes the areas of Duffys Forest, Belrose and Ingleside (OEH 2014). Occurs on the ridgetop between elevations of 170 to 240 m asl, in association with laterite soils and a vegetation community of open forest, generally dominated by *Eucalyptus sieberi* and *E. gummifera* (OEH 2014). Occasionally, *G. caleyi* occurs at the boundaries of the laterite soils in low open forests of *E. gummifera* and *E. haemastoma* (OEH 2014). A recent record from Middle Brother near Port Macquarie is thought to be a cultivated specimen and recent searches have failed to find any *G. caleyi* near this record (OEH 2014).	107	No – no suitable habitat
Haloragodendron lucasii		E	E	Known locations of this species are confined to a very narrow distribution on the north shore of Sydney. *Haloragodendron lucasii* is associated with low woodland on sheltered slopes near creeks on moist loamy sand on bench below small sandstone cliff lines, with continuous seepage (Benson and McDougall 1998).	N/A	No – no suitable habitat; understorey underscrubbed and concreted
Kunzea rupestris		V	V	*Kunzea rupestris* is endemic to the Hornsby Plateau, where it grows in heath on exposed sandstone rock platforms (NPWS 1997).	N/A	No – no suitable habitat
Melaleuca biconvexa	Biconvex Paperbark	V	V	*Melaleuca biconvexa* occurs in coastal districts and adjacent tablelands from Jervis Bay north to the Port Macquarie district. It grows in damp places often near streams (PlantNet 2011).	N/A	No – no suitable habitat
Melaleuca deanei	Deane's Paperbark	V	V	Found in heath on sandstone (OEH 2014), and also associated with woodland on broad ridge tops and slopes on sandy loam and lateritic soils (Benson and McDougall 1998).	N/A	No – no suitable habitat
Microtis angusii	Angus's Onion Orchid	E	E	Currently known from only one site at Ingleside, north of Sydney. A collection previously thought to be this species was made from Sunny Corner 100 km west of Sydney, but has since been confirmed as being genetically distinct and may possibly be a subspecies (OEH 2014).	1	No – no suitable habitat

Scientific name	Common name	TSC Act	EPBC Act	Habitat associations	Number of records	Likelihood
Pelargonium sp. *Striatellum*	Omeo's Stork's Bill	-	E	The species is known to occur in habitat usually located just above the high water level of irregularly inundated or ephemeral lakes. During dry periods, the species is known to colonise exposed lake beds. It is not known if the species' rhizomes and/or soil seedbank persist through prolonged inundation or drought (DoE 2014).	N/A	No – no suitable habitat
Persoonia hirsuta	Hairy Geebung	E	E	*Persoonia hirsuta* occurs from Singleton in the north, south to Bargo and the Blue Mountains to the west (OEH 2014). It grows in dry sclerophyll eucalypt woodland and forest on sandstone.	1	No – no suitable habitat
Persoonia laxa		Ext	Ext	*Persoonia laxa* was collected at Manly and Newport in NSW 1907 and 1908. It is now presumed to be extinct. *Persoonia laxa* presumably grew in heath or dry sclerophyll eucalypt woodland, or forest on sandstone, or in coastal sand (OEH 2014).	1	No – presumed extinct; lack of suitable habitat
Pimelea curviflora var. *curviflora*		V	V	*Pimelea curviflora var. curviflora* is confined to the coastal area of Sydney between northern Sydney in the south and Maroota in the north-west. It grows on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands (OEH 2014).	2	No – no suitable habitat
Prostanthera marifolia	Seaforth Mintbush	CE	CE	Occurs on deeply weathered clay-loam soils associated with ironstone and scattered shale lenses, a soil type which only occurs on ridge tops and has been extensively urbanised (OEH 2014).	N/A	No – no suitable habitat; and north of known range
Streblus pendulinus	Siah's backbone	-	E	On the Australian mainland, Siah's Backbone is found in warmer rainforests, chiefly along watercourses. The altitudinal range is from near sea level to 800 m above sea level. The species grows in well developed rainforest, gallery forest and drier, more seasonal rainforest (DoE 2014).	N/A	No – no suitable habitat; no rainforest on site
Syzygium paniculatum	Magenta Lilly Pilly	E	V	This species occupies a narrow coastal area between Bulahdelah and Conjola State Forests in NSW. On the Central Coast, it occurs on Quaternary gravels, sands, silts and clays, in riparian gallery rainforests and remnant littoral rainforest communities (Payne 1997). In the Ourimbah Creek valley, *S. paniculatum* occurs within	14	No – no suitable habitat; no rainforest on site

Scientific name	Common name	TSC Act	EPBC Act	Habitat associations	Number of records	Likelihood
				gallery rainforest with *Alphitonia excelsa*, *Acmena smithii*, *Cryptocarya glaucescens*, *Toona ciliata*, *Syzygium oleosum* with emergent *Eucalyptus saligna*. At Wyrrabalong NP, *S. paniculatum* occurs in littoral rainforest as a co-dominant with *Ficus fraseri*, *Syzygium oleosum*, *Acmena smithii*, *Cassine australe*, and *Endiandra sieberi*. Payne (1991) reports that the species appears absent from Terrigal formation shales, on which the gully rainforests occur. *S. paniculatum* is summer flowering (November-February), with the fruits maturing in May (OEH 2014).		
Tetratheca glandulosa		V	V	Associated with ridgetop woodland habits on yellow earths also in sandy or rocky heath and scrub (NPWS 1997). Often associated with sandstone / shale interface where soils have a stronger clay influence (NPWS 1997). Flowers July to November.	21	No – no suitable habitat
Fish						
Epinephelus daemelii	Black Cod	-	V	Black cod generally inhabit near-shore rocky and offshore coral reefs at depths down to 50 m, but are occasionally recorded from deeper waters. In coastal waters adult black cod are found in rock caves, rock gutters and on rock reefs (DoE 2014).	N/A	No –no suitable habitat
Macquarie australasica	Macquarie Perch	E (under FM Act)	E	Habitat for the Macquarie perch is bottom or mid-water in slow-flowing rivers with deep holes, typically in the upper reaches of forested catchments with intact riparian vegetation. Macquarie perch also do well in some upper catchment lakes. In some parts of its range, the species is reduced to taking refuge in small pools which persist in midland–upland areas through the drier summer periods.	N/A	No – although a creek is present, the water quality appeared poor
Prototroctes maraena	Australian Grayling	-	V	Historically, this species occurred in coastal streams from the Grose River southwards through NSW, VIC and TAS. On mainland Australia, this species has been recorded from rivers flowing east and south of the main dividing ranges. This species spends only part of its lifecycle in freshwater, mainly inhabiting clear, gravel-bottomed streams with alternating pools and riffles, and granite outcrops but has also been found in muddy-bottomed, heavily silted habitat. Grayling migrate	N/A	Unlikely – poor quality watercourse

Scientific name	Common name	TSC Act	EPBC Act	Habitat associations	Number of records	Likelihood
				between freshwater streams and the ocean and as such it is generally accepted to be a diadromous (migratory between fresh and salt waters) species.		
Frogs						
Heleioporus australiacus	Giant Burrowing Frog	V	V	Forages in woodlands, wet heath, dry and wet sclerophyll forest (Ehmann 1997). Associated with semi-permanent to ephemeral sand or rock based streams (Ehmann 1997), where the soil is soft and sandy so that burrows can be constructed (Environment Australia 2000).	16	No – no suitable habitat
Litoria aurea	Green and Golden Bell Frog	E	V	This species has been observed utilising a variety of natural and man-made waterbodies (Pyke & White 1996) such as coastal swamps, marshes, dune swales, lagoons, lakes, other estuary wetlands, riverine floodplain wetlands and billabongs, stormwater detention basins, farm dams, bunded areas, drains, ditches and any other structure capable of storing water (OEH 2014). Fast flowing streams are not utilised for breeding purposes by this species (Mahony 1999). Preferable habitat for this species includes attributes such as shallow, still or slow flowing, permanent and/or widely fluctuating water bodies that are unpolluted and without heavy shading (OEH 2014). Large permanent swamps and ponds exhibiting well-established fringing vegetation (especially bulrushes–Typha sp. and spikerushes–Eleocharis sp.) adjacent to open grassland areas for foraging are preferable (Ehmann 1997; Robinson 1993). Ponds that are typically inhabited tend to be free from predatory fish such as Mosquito Fish (*Gambusia holbrooki*) (OEH 2014).	N/A	Unlikely – not known from this area
Litoria littlejohni	Littlejohn's Tree Frog	V	V	Littlejohn's Tree Frog has a distribution that includes the plateaus and eastern slopes of the Great Dividing Range from Watagan State Forest (90 km north of Sydney) south to Buchan in Victoria (OEH 2014). It occurs along permanent rocky streams with thick fringing vegetation associated with eucalypt woodlands and heaths among sandstone outcrops. It appears to be restricted to sandstone woodland and	N/A	No – lack of suitable thick vegetation

Scientific name	Common name	TSC Act	EPBC Act	Habitat associations	Number of records	Likelihood
				heath communities at mid to high altitude (NSW Scientific Committee 2000). It forages both in the tree canopy and on the ground, and it has been observed sheltering under rocks on high exposed ridges during summer (NSW Scientific Committee 2000). It hunts either in shrubs or on the ground. Breeding is triggered by heavy rain and can occur from late winter to autumn, but is most likely to occur in spring when conditions are favourable. Males call from low vegetation close to slow flowing pools. Eggs and tadpoles are mostly found in slow flowing pools that receive extended exposure to sunlight, but will also use temporary isolated pools (OEH 2014).		
Mixophyes balbus	Stuttering Frog	E	V	A variety of forest habitats from rainforest through wet and moist sclerophyll forest to riparian habitat in dry sclerophyll forest (OEH 2014) that are generally characterised by deep leaf litter or thick cover from understorey vegetation (Ehmann 1997). Breeding habitats are streams and occasionally springs. Not known from streams disturbed by humans (Ehmann 1997) or still water environments (NSW Scientific Committee 2002).	N/A	No – lack of leaf litter at subject site
Reptiles						
Hoplocephalus bungaroides	Broad-headed Snake	E	V	Typical sites consist of exposed sandstone outcrops and benching where the vegetation is predominantly woodland, open woodland and/or heath on Triassic sandstone of the Sydney Basin (OEH 2012). They utilise rock crevices and exfoliating sheets of weathered sandstone during the cooler months and tree hollows during summer (Webb & Shine 1998)	N/A	No – no suitable habitat
Varanus rosenbergi	Rosenberg's Goanna	V	-	Associated with Sydney sandstone woodland and heath land. Rocks, hollow logs and burrows are utilised for shelter (Environment Australia 2000).	23	No – no suitable habitat
Diurnal birds						

Scientific name	Common name	TSC Act	EPBC Act	Habitat associations	Number of records	Likelihood
Anthochaera Phrygia (aka *Xanthomyza phrygia*)	Regent Honeyeater	E	E, M	Associated with temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts, and riparian forests of *Casuarina cunninghamiana* (River Oak) (Garnett 1993). Areas containing *Eucalyptus robusta* (Swamp Mahogany) in coastal areas have been observed to be utilised (NPWS 1997). The Regent Honeyeater primarily feeds on nectar from box and ironbark eucalypts and occasionally from banksias and mistletoes (NPWS 1995). As such it is reliant on locally abundant nectar sources with different flowering times to provide reliable supply of nectar (Environment Australia 2000).	5	Unlikely – may be occasional visitor to areas south of subject site
Botaurus poiciloptilus	Australasian Bittern	V	-	Terrestrial wetlands with tall dense vegetation, occasionally estuarine habitats (Marchant & Higgins 1993). Reedbeds, swamps, streams, estuaries (Simpson & Day 1999).	1	Unlikely – poor quality stream adjacent to subject site
Burhinus grallarius	Bush Stone-curlew	E	-	Associated with dry open woodland with grassy areas, dune scrubs, in savanna areas, the fringes of mangroves, golf courses and open forest / farmland (Pittwater Council 2000; Marchant & Higgins 1993). Forages in areas with fallen timber, leaf litter, little undergrowth and where the grass is short and patchy (Environment Australia 2000; Marchant & Higgins 1993). Is thought to require large tracts of habitat to support breeding, in which there is a preference for relatively undisturbed in lightly disturbed.	17	Unlikely – lack of suitable habitat
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	During summer in dense, tall, wet forests of mountains and gullies, alpine woodlands (Morcombe 2004). In winter they occur at lower altitudes in drier more open forests and woodlands, particularly box-ironbark assemblages (Shields & Chrome 1992). They sometimes inhabit woodland, farms and suburbs in autumn/winter (Simpson & Day 2004).	2	Unlikely – lack of good quality vegetation compared with areas in locality
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	Associated with a variety of forest types containing *Allocasuarina* species, usually reflecting the poor nutrient status of underlying soils (Environment Australia 2000; NPWS 1997; OEH 2014). Intact drier	30	Potential – may utilise the *Casuarina*

Scientific name	Common name	TSC Act	EPBC Act	Habitat associations	Number of records	Likelihood
				forest types with less rugged landscapes are preferred (OEH 2014). Nests in large trees with large hollows (Environment Australia 2000).		*glauca* on site for foraging. No suitable HBT
Dasyornis brachypterus	Eastern Bristlebird	E	E	Habitat is characterised by dense, low vegetation including heath and open woodland with a heathy understorey; in northern NSW occurs in open forest with tussocky grass understorey; all of these vegetation types are fire prone. Age of habitat since fires (fire-age) is of paramount importance to this species; Illawarra and southern populations reach maximum densities in habitat that has not been burnt for at least 15 years; however, in the northern NSW population a lack of fire in grassy forest may be detrimental as grassy tussock nesting habitat becomes unsuitable after long periods without fire; northern NSW birds are usually found in habitats burnt five to 10 years previously.	N/A	No – no suitable habitat
Glossopsitta pusilla	Little Lorikeet	V	-	In New South Wales Little Lorikeets are distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. Little Lorikeets mostly occur in dry, open eucalypt forests and woodlands. They have been recorded from both old-growth and logged forests in the eastern part of their range, and in remnant woodland patches and roadside vegetation on the western slopes. They feed primarily on nectar and pollen in the tree canopy, particularly on profusely-flowering eucalypts, but also on a variety of other species including Melaleucas and mistletoes. On the western slopes and tablelands *Eucalyptus albens* (White Box) and *E. melliodora* (Yellow Box) are particularly important food sources for pollen and nectar respectively.	4	No – lack of good quality forage species
Haematopus fuliginosus	Sooty Oystercatcher	V	-	A coastal species that inhabits rock coastlines, coral cays, reefs and occasionally sandy beaches and Marchant & Higgins 1993; Simpson & Day 1999).	1	No – no suitable habitat

Scientific name	Common name	TSC Act	EPBC Act	Habitat associations	Number of records	Likelihood
Hieraaetus morphnoides	Little Eagle	V	-	Utilises open eucalypt, sheoak and acacia forest, woodland or open woodland. Uses tall trees for nesting, with a large stick nest being built. Lays eggs in spring, and young fledge in early summer. Preys on birds, reptiles and mammals, and occasionally feeds on large insects or carrion.	2	Unlikely – no nests observed and limited canopy species
Ixobrychus flavicollis	Black Bittern	V	-	Occurs in both terrestrial and estuarine wetlands generally in areas of permanent water and dense vegetation (OEH 2014). In areas with permanent water it may occur in flooded grassland, forest, woodland, rainforest and mangroves (OEH 2014).	9	
Lathamus discolor	Swift Parrot	E	E	Breeds in Tasmania between September and January. Migrates to mainland in autumn, where it forages on profuse flowering Eucalypts (Hence, in this region, autumn and winter flowering eucalypts are important for this species. Favoured feed trees include winter flowering species such as *Eucalyptus robusta* (Swamp Mahogany), *Corymbia maculata* (Spotted Gum), *C. gummifera* (Red Bloodwood), *E. sideroxylon* (Mugga Ironbark), and *E. albens* (White Box) (OEH 2014).	5	Unlikely – although there are *Eucalyptus robusta* on the subject site.
Neophema pulchella	Turquoise Parrot	V	-	Steep rocky ridges and gullies, rolling hills, valleys and river flats and the plains of the Great Dividing Range compromise the topography inhabited by this species (Marchant & Higgins 1993). Spends much of the time on the ground foraging on seed and grasses (OEH 2014). It is associated with coastal scrubland, open forest and timbered grassland, especially low shrub ecotones between dry hardwood forests and grasslands with high proportion of native grasses and forbs (Environment Australia 2000).	1	No – lack of suitable forage species
Pandion cristatus	Eastern Osprey	V	-	Associated with waterbodies including coastal waters, inlets, lakes, estuaries, beaches, offshore islands and sometimes along inland rivers (Olsen 1995). Osprey may nest on the ground, on sea cliffs or in trees (Olsen 1995). Osprey generally prefer emergent trees, often dead or partly dead with a broken off crown (Olsen 1995).	10	Unlikely – no nests observed, unlikely to hunt in the subject site

Scientific name	Common name	TSC Act	EPBC Act	Habitat associations	Number of records	Likelihood
Rostratula australis	Australian Painted Snipe	E	V	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber (OEH 2014). Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds (ibid.). Breeding is often in response to local conditions; generally occurs from September to December (OEH 2014). Roosts during the day in dense vegetation (NSW Scientific Committee 2004). Forages nocturnally on mud-flats and in shallow water (OEH 2014). Feeds on worms, molluscs, insects and some plant-matter (ibid.).	N/A	Unlikely – lack of suitable habitat
Sterna albifrons	Little Tern	E	-	Almost exclusively coastal, preferring sheltered areas (OEH 2014), however may occur several kilometres inland in harbours, inlets and rivers (Smith 1990). Australian birds breed on sandy beaches and sand spits (Simpson & Day 1999).	N/A	No – lack of suitable habitat
Sternula nereis nereis	Australian Fairy Tern	-	V	Within Australia, the Fairy Tern occurs along the coasts of Victoria, Tasmania, South Australia and Western Australia; occurring as far north as the Dampier Archipelago near Karratha. The subspecies has been known from New South Wales (NSW) in the past, but it is unknown if it persists there (DoE 2014).	N/A	No – lack of suitable habitat
Nocturnal birds						
Ninox connivens	Barking Owl	V	-	Associated with a variety of habitats such as savanna woodland, open eucalypt forests, wetland and riverine forest. The habitat is typically dominated by Eucalypts (often Redgum species), however often dominated by Melaleuca species in the tropics (OEH 2014). It usually roosts in dense foliage in large trees such as *Allocasuarina cunninghamiana* (River She-oak), other Casuarina and Allocasuarina, eucalypts, Angophora, Acacia and rainforest species from streamside gallery forests. It usually nests near watercourses or wetlands. in large tree hollows with entrances averaging 2-29 m above ground, depending on the forest or woodland structure and the canopy height (Debus 1997).	16	Unlikely – no suitable nesting trees present

Scientific name	Common name	TSC Act	EPBC Act	Habitat associations	Number of records	Likelihood
Ninox strenua	Powerful Owl	V	-	Powerful Owls are associated with a wide range of wet and dry forest types with a high density of prey, such as arboreal mammals, large birds and flying foxes (Environment Australia 2000, Debus & Chafer 1994). Large trees with hollows at least 0.5m deep are required for shelter and breeding (Environment Australia 2000).	151	Unlikely – although there are many records, the site lacks the understorey or hollows of a sufficient density to support prey species
Mammals (excluding bats)						
Cercartetus nanus	Eastern Pygmy-possum	V	-	Found in wet and dry eucalypt forest, subalpine woodland, coastal banksia woodland and wet heath (Menkhorst & Knight 2004). Pygmy-Possums feed mostly on the pollen and nectar from banksias, eucalypts and understorey plants and will also eat insects, seeds and fruit (Turner & Ward 1995). The presence of Banksia sp. and Leptospermum sp. are an important habitat feature (OEH 2014). Small tree hollows are favoured as day nesting sites, but nests have also been found under bark, in old birds nests and in the branch forks of tea-trees (Turner & Ward 1995).	30	No – no suitable habitat
Dasyurus maculatus *Dasyurus maculatus maculatus*	Spotted-tailed Quoll Spotted-tailed Quoll (SE Mainland Population)	V -	- E	The Spotted-tailed Quoll inhabits a range of forest communities including wet and dry sclerophyll forests, coastal heathlands and rainforests (Mansergh 1984; OEH 2014j), more frequently recorded near the ecotones of closed and open forest. This species requires habitat features such as maternal den sites, an abundance of food (birds and small mammals) and large areas of relatively intact vegetation to forage in (OEH 2014). Maternal den sites are logs with cryptic entrances; rock outcrops; windrows; burrows (Environment Australia 2000).	7	No – no suitable habitat

Scientific name	Common name	TSC Act	EPBC Act	Habitat associations	Number of records	Likelihood
Isoodon obesulus	Southern Brown Bandicoot	E	E1	This species is associated with heath, coastal scrub, heathy forests (Menkhorst & Knight 2004), shrubland and woodland on well drained soils. This species is thought to display a preference for newly regenerating heathland and other areas prone to fire (Menkhorst & Seebeck 1990).	15	No – no suitable habitat
Petaurus norfolcensis	Squirrel Glider	V	-	The species is widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria. The squirrel glider inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas (OEH 2014).	1	No – no suitable habitat
Petaurus norfolcensis	Squirrel Glider on Barrenjoey Penninsula, north of Bushrangers Hill	E2	-	The endangered population is within the Pittwater Local Government Area on the Barrenjoey Peninsula, north of Bushrangers Hill (OEH 2014).	1	No – no suitable habitat
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	Rocky areas in a variety of habitats, typically north facing sites with numerous ledges, caves and crevices (Strahan 1998).	N/A	No – no suitable habitat
Phascolarctos cinereus	Koala	V	V	Associated with both wet and dry Eucalypt forest and woodland that contains a canopy cover of approximately 10 to 70% (Reed et al. 1990), with acceptable Eucalypt food trees. Some preferred Eucalyptus species are: *Eucalyptus tereticornis*, *E. punctata, E. cypellocarpa, E. viminalis*	65	No – no suitable habitat, lack of feed trees
Phascolarctos cinereus	Koala in the Pittwater Local Government Area	E2	-	The endangered population occurs within the Pittwater Local Government Area, with most recent records occurring on the Barrenjoey Peninsula (OEH 2014).	65	No – no suitable habitat, lack of feed trees
Potorous tridactylus *Potorous tridactylus tridactylus*	Long-nosed Potoroo Long-nosed Potoroo (SE Mainland Population)	V -	- V	Associated with dry coastal heath and dry and wet sclerophyll forests (Strahan 1998) with dense cover for shelter and adjacent more open areas for foraging (Menkhorst & Knight 2004).	N/A	No – no suitable habitat

Scientific name	Common name	TSC Act	EPBC Act	Habitat associations	Number of records	Likelihood
Pseudomys novaehollandiae	New Holland Mouse	-	V	A small burrowing native rodent with a fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Inhabits open heathlands, open woodlands with a heathland understorey and vegetated sand dunes. A social animal, living predominantly in burrows shared with other individuals. The home range of the New Holland Mouse ranges from 0.44 ha to 1.4 ha and the species peaks in abundance during early to mid stages of vegetation succession typically induced by fire (DoE 2014)	N/A	No – no suitable habitat
Mammals (bats)						
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	The Large-eared Pied Bat has been recorded in a variety of habitats, including dry sclerophyll forests, woodland, sub-alpine woodland, edges of rainforests and wet sclerophyll forests (Churchill 1998; OEH 2014). This species roosts in caves, rock overhangs and disused mine shafts and as such is usually associated with rock outcrops and cliff faces (Churchill 1998; OEH 2014).	N/A	No – no suitable habitat
Miniopterus australis	Little Bentwing-bat	V	-	Prefers well-timbered areas including rainforest, wet and dry sclerophyll forests, Melaleuca swamps and coastal forests (Churchill 1998). This species shelter in a range of structures including culverts, drains, mines and caves (Environment Australia 2000). Relatively large areas of dense vegetation of either wet sclerophyll forest, rainforest or dense coastal banksia scrub are usually found adjacent to caves in which this species is found (OEH 2014). Breeding occurs in caves, usually in association with *M. schreibersii* (Environment Australia 2000, OEH 2014).	11	Potential – may use trees and area to the south of subject site
Miniopterus schreibersii oceanensis	Eastern Bentwing- Bat	V	-	Associated with a range of habitats such as rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grassland (Churchill 1998). It forages above and below the tree canopy on small insects (AMBS 1995, Dwyer 1995). Will utilise caves, old mines, and stormwater channels, under bridges and occasionally buildings for shelter (Environment Australia 2000, Dwyer 1995).	32	Potential – may use trees and area to the south of study area

Scientific name	Common name	TSC Act	EPBC Act	Habitat associations	Number of records	Likelihood
Mormopterus norfolkensis	Eastern Freetail Bat	V	-	Most records of this species are from dry eucalypt forest and woodland east of the Great Dividing Range (Churchill 1998). Individuals have, however, been recorded flying low over a rocky river in rainforest and wet sclerophyll forest and foraging in clearings at forest edges (Environment Australia 2000; Allison & Hoye 1998). Primarily roosts in hollows or behind loose bark in mature eucalypts, but have been observed roosting in the roof of a hut (Environment Australia 2000; Allison & Hoye 1998).	1	Unlikely – lack of hollows
Myotis macropus	Southern Myotis	V	-	The Southern Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 km inland, except along major rivers. Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage (OEH 2014).	15	Potential – may use trees and area to the south of subject site
Pteropus poliocephalus	Grey-headed Flying-Fox	V	V	Inhabits a wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests and cultivated areas (Churchill 1998, Eby 1998). Camps are often located in gullies, typically close to water, in vegetation with a dense canopy (Churchill 1998).	36	Likely – may use site for foraging; camp at Warriewood and presence of *E. robusta*
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	Associated with moist gullies in mature coastal forest, or rainforest, east of the Great Dividing Range (Churchill, 1998), tending to be more frequently located in more productive forests (Hoye & Richards 1998). Within denser vegetation types use is made of natural and man made openings such as roads, creeks and small rivers, where it hawks backwards and forwards for prey (Hoye & Richards 1998).	3	Unlikely – lack of breeding structures and vegetation on the subject site not dense enough
Migratory marine species listed under EPBC Act						

Scientific name	Common name	TSC Act	EPBC Act	Habitat associations	Number of records	Likelihood
Apus pacificus	Fork-tailed Swift	-	M	Sometimes travels with Needletails. Varied habitat with a possible tendency to more arid areas but also over coasts and urban areas (Simpson & Day 1999).	N/A	Unlikely – too far east
Haliaeetus leucogaster	White-bellied Sea-Eagle	-	M	Forages over large open fresh or saline waterbodies, coastal seas and open terrestrial areas (Marchant & Higgins 1993, Simpson & Day 1999). Breeding habitat consists of tall trees, mangroves, cliffs, rocky outcrops, silts, caves and crevices and is located along the coast or major rivers. Breeding habitat is usually in or close to water, but may occur up to a kilometre away (Marchant & Higgins 1993).	N/A	Unlikely – no suitable breeding habitat and unlikely to be foraging in the creek
Hirundapus caudacutus	White-throated Needletail	-	M	Forages aerially over a variety of habitats usually over coastal and mountain areas, most likely with a preference for wooded areas (Marchant & Higgins 1993; Simpson & Day 1999). Has been observed roosting in dense foliage of canopy trees, and may seek refuge in tree hollows in inclement weather (Marchant & Higgins 1993).	N/A	No – no suitable habitat
Merops ornatus	Rainbow Bee-eater	-	M	Resident in coastal and subcoastal northern Australia; regular breeding migrant in southern Australia, arriving September to October, departing February to March, some occasionally present April to May. Occurs in open country, chiefly at suitable breeding places in areas of sandy or loamy soil: sand-ridges, riverbanks, road-cuttings, sand-pits, occasionally coastal cliffs (ibid). Nest is a chamber a the end of a burrow, up to 1.6 m long, tunnelled in flat or sloping ground, sandy back or cutting (*ibid*).	N/A	No – no suitable habitat
Monarcha melanopsis	Black-faced Monarch	-	M	Rainforest and eucalypt forests, feeding in tangled understorey (Blakers et al. 1984).	N/A	Unlikely – lack of suitable complex vegetation on the subject site
Monarcha trivirgatus	Spectacled Monarch	-	M	Wet forests, mangroves (Simpson and Day 1999).	N/A	No – no suitable habitat

Scientific name	Common name	TSC Act	EPBC Act	Habitat associations	Number of records	Likelihood
Myiagra cyanoleuca	Satin Flycatcher	-	M	Wetter, denser forest, often at high elevations (Simpson & Day 2004).	N/A	No – no suitable habitat
Rhipidura rufifrons	Rufous Fantail	-	M	The Rufous Fantail is a summer breeding migrant to southeastern Australia (Morcombe, 2004). The Rufous Fantail is found in rainforest, dense wet eucalypt and monsoon forests, paperbark and mangrove swamps and riverside vegetation (Morcombe, 2004). Open country may be used by the Rufous Fantail during migration (Morcombe, 2004).	N/A	No – no suitable habitat
Xanthomyza phrygia	Regent Honeyeater	E	E, M	SEE DIURNAL BIRDS ABOVE		As above
Migratory wetland species listed under EPBC Act						
Ardea alba	Great Egret	-	M	The Great Egret is common and widespread in Australia (McKilligan, 2005). It forages in a wide range of wet and dry habitats including permanent and ephemeral freshwaters, wet pasture and estuarine mangroves and mudflats (McKilligan, 2005).	N/A	No – no suitable habitat
Ardea ibis	Cattle Egret	-	M	Cattle Egrets forage on pasture, marsh, grassy road verges, rain puddles and croplands, but not usually in the open water of streams or lakes and they avoid marine environments (McKilligan, 2005). Some individuals stay close to the natal heronry from one nesting season to the next, but the majority leaves the district in autumn and return the next spring. Cattle Egrets are likely to spend the winter dispersed along the coastal plain and only a small number have been recovered west of the Great Dividing Range (McKilligan, 2005).	N/A	No – no suitable habitat
Gallinago hardwickii	Latham's Snipe	-	M	A variety of permanent and ephemeral wetlands, preferring open fresh water wetlands with nearby cover (Marchant and Higgins 1993). Occupies a variety of vegetation around wetlands (Marchant and Higgins 1993) including wetland grasses and open wooded swamps (Simpson and Day 1999). Latham's Snipe sometimes occur in habitats that have saline or brackish water, such as saltmarsh, mangrove creeks, around bays and beaches, and at tidal rivers (Frith et al. 1977; Naarding 1983; Patterson 1991). These habitats are most commonly	N/A	No – no suitable habitat

Scientific name	Common name	TSC Act	EPBC Act	Habitat associations	Number of records	Likelihood
				used when the birds are on migration (Frith et al. 1977). They are regularly recorded in or around modified or artificial habitats including pasture, ploughed paddocks, irrigation channels and drainage ditches, ricefields, orchards, saltworks, and sewage and dairy farms (Frith et al. 1977; Lane & Jessop 1985; Naarding 1982, 1983). They can also occur in various sites close to humans or human activity (e.g. near roads, railways, airfields, commercial or industrial complexes) (Frith et al. 1977; Naarding 1983).		
Rostratula australis (aka. *R. benghalensis*)	Painted Snipe (Australian subspecies)	E	V, M	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber (OEH 2014). Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds (ibid.). Breeding is often in response to local conditions; generally occurs from September to December (OEH 2014). Roosts during the day in dense vegetation (NSW Scientific Committee 2004). Forages nocturnally on mud-flats and in shallow water (OEH 2014). Feeds on worms, molluscs, insects and some plant-matter (ibid.).	N/A	No – no suitable habitat

E = Endangered species; E2 = Endangered population; CE = Critically Endangered; V = Vulnerable; M = Migratory

Appendix C : Test of Significance

The Test of Significance (5-part test) is applied to species, populations and ecological communities listed on Schedules 1 and 2 of the BC Act and Schedules 4, 4A and 5 of the Fisheries Management Act. The assessment sets out factors, which when considered, allow proponents to undertake a qualitative analysis of the likely impacts of an action and to determine whether further assessment is required via a Biodiversity Development Assessment Report, or a Species Impact Statement (SIS) for Reviews of Environmental Factors (REF's). All factors must be considered and an overall conclusion made based on all factors in combination.

The test is as follows:

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

b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

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

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

c) in relation to the habitat of a threatened species or ecological community:

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

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

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

d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).

e) whether the proposed development or activity constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Conclusion

Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions

This swamp community has an open to dense tree layer of eucalypts and paperbarks although some remnants now only have scattered trees as a result of partial clearing. The trees may exceed 25 m in height, but can be considerably shorter in regrowth stands or under conditions of lower site quality where the tree stratum is low and dense. The community also includes some areas of fernland and tall reedland or sedgeland, where trees are very sparse or absent.

The most widespread and abundant dominant trees include *Eucalyptus robusta* (swamp mahogany), *Melaleuca quinquenervia* (paperbark). Other trees may be scattered throughout at low abundance or may be locally common at few sites, including *Callistemon salignus* (sweet willow bottlebrush), *Casuarina glauca* (swamp oak) and *Eucalyptus resinifera* subsp. *hemilampra* (red mahogany), *Livistona australis* (cabbage palm) and *Lophostemon suaveolens* (swamp turpentine).

A layer of small trees may be present, including *Acacia irrorata* (green wattle), *Acmena smithii* (lilly pilly), *Elaeocarpus reticulatus* (blueberry ash), *Glochidion ferdinandi* (cheese tree), *Melaleuca linariifolia* and *M. styphelioides* (paperbarks). Shrubs include *Acacia longifolia, Dodonaea triquetra, Ficus coronata, Leptospermum polygalifolium* subsp. p*olygalifolium* and *Melaleuca* spp. Occasional vines include *Parsonsia straminea, Morinda jasminoides* and *Stephania japonica* var. *discolor*.

The groundcover is composed of abundant sedges, ferns, forbs, and grasses including *Gahnia clarkei, Pteridium esculentum, Hypolepis muelleri, Calochlaena dubia, Dianella caerulea, Viola hederacea, Lomandra longifolia, Entolasia marginata* and *Imperata cylindrica*.

This community is known from parts of the local government areas of Pittwater, Warringah and Manly, as well as others in the Bioregion.

Swamp Sclerophyll Forest (SSF) persists in the study area primarily as canopy. The canopy species, *Eucalyptus robusta*, is part of the riparian corridor. The community has been modified and the understorey components of the community are limited.

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

The SSF is not a threatened species

b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

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

The local occurrence of SSF includes the small patches on the site at 53B, and 53A, 53C and 49 Warriewood Road and adjoining properties. The vegetation continues along Narrabeen Creek corridor, crosses Macpherson St and would include the vegetation surrounding the Sydney Water Waste Water Treatment Plant to the south-east of the study area. In these areas the vegetation community transitions

in and out of Swamp Oak Floodplain Forest. There is also a small thin corridor of this vegetation type according to SMCMA (2012) mapping upstream along Narrabeen Creek.

A small area of SSF9 (0.027 ha, 270 sq metres) will be impacted by the subdivision.

The proposed subdivision will result in the reduction in extent of this community. However the reduction in extent is small and not likely to place the local occurrence at risk of extinction.

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

The proposed subdivision will result in impact to 0.027 ha to this community. The areas subject to impacts are already highly modified with limited understorey present. The potential impacts to the canopy will not place the local occurrence at risk of extinction.

c) in relation to the habitat of a threatened species or ecological community:

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

The proposed subdivision will result in the potential impact to 0.027 ha of this community.

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

The proposed subdivision will not result in fragmentation of this community. Connectivity with better quality patches of this community both down and upstream will be retained.

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

The quality of the EEC in the study area is poor. Poor quality SSF persists at 53B Warriewood Road. . Better quality patches are in the adjacent lots downstream of the subject site.

Some areas of poor quality SSF are to be retained in the study area. Better quality SSF will be retained in the local occurrence of this community.

The relative importance of the areas subject to impacts is less than the areas to be retained in the study area and local occurrence. The areas subject to indirect impacts are not considered important to the long-term survival of the community.

d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).

No declared area of outstanding biodiversity value will be impacted either directly or indirectly by the subdivision.

e) whether the proposed development or activity constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The proposed works constitutes one key threatening process of relevance to SSF namely Clearing of Native Vegetation, which would result in a small loss of remnant vegetation. Large areas of this community will be retained within the local occurrence. It is considered unlikely that the proposal would significantly exacerbate this key threatening process such that this community would be at risk of extinction.

Conclusion

On the basis of the above, it is unlikely that the proposal would result in a significant impact on Swamp Sclerophyll Forest. Consequently, a Biodiversity Development Assessment Report are not required for the proposal with respect to Swamp Sclerophyll Forest.

Calyptorhynchus lathami (Glossy Black-Cockatoo)

Calyptorhynchus lathami (Glossy Black-cockatoo) is listed as a vulnerable species under Schedule 2 of the BC Act. It inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1,000 m in which stands of she-oak species, particularly *Allocasuarina littoralis* (Black She-oak), *A. torulosa* (Forest She-oak) or *A. verticillata* (Drooping She-oak), occur. It feeds almost exclusively on the seeds of several species of *Casuarina* and *Allocasuarina* species (She-oak), shredding the cones with its bill. The species is dependent on large hollow-bearing eucalypts for nest sites. One or two eggs are laid between March and August.

The Glossy Black-cockatoo is threatened by a number of processes including habitat clearing and fragmentation, loss of mature hollow bearing trees, and inappropriate fire regimes which reduce its range and remove nesting and feeding resources.

This species was not recorded during the current surveys although it is known from within a 5 km radius of the study area. There is potential that vegetation in the study area is used occasionally for foraging. It is unlikely that individuals of this species are dependent upon the study area.

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

Factors likely to have an adverse effect on the life cycle of the Glossy Black-cockatoo would include a substantial loss and/or fragmentation of foraging habitat and loss of suitable nesting habitat.

The Glossy Black-cockatoo relies on the presence of suitable Casuarina and Allocasuarina trees for foraging and is dependent on large hollow bearing trees for breeding/nesting. No suitable breeding/nesting habitat was identified within the study area with no large hollow-bearing trees present. Under the proposal a small number (less than 15 and about 0.03 ha) of *Casuarina glauca* trees will be removed for the subdivision.

The proposed vegetation clearance is unlikely to have a significant impact on any viable local populations of this species as the study area is continuous with tracts of intact native vegetation which may provide suitable nesting and foraging habitat for the Glossy Black-cockatoo. As the proposed subdivision will not impact on potential nesting habitat (i.e. hollow-bearing trees) for this species and only include minor removal of a small amount of feed trees, it is unlikely that the proposal would have an adverse impact upon this the life cycle of any viable local population of this species.

g) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

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

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

Not applicable. The Glossy Black-cockatoo is not an endangered ecological community.

h) in relation to the habitat of a threatened species or ecological community:

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

The proposed works will include the removal of a small number of *Casuarina glauca* (a preferred foraging resource for the Glossy Black-cockatoo) and may also result in temporary disturbance to the species during vegetation clearance. These disturbances would include the actual clearing and construction noise. The proposed modification of potential habitat is considered minimal taking into account the highly mobile nature of this species and the large areas of habitat in the surrounding landscape and that high quality foraging habitat would be retained within the study area.

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

The proposed works are unlikely to result in the fragmentation or isolation of potential foraging habitat in the study area with adjoining areas. The study area is connected to intact native vegetation along Narrabeen Creek. The connectivity of the habitat for this highly mobile species with adjacent areas of bushland would be unaffected by the proposal

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

The majority of the vegetation within the study area is highly disturbed, however, it contains feed trees for this species, although no breeding habitat occur within the sites. Under the proposed works only a small number of feed trees (*Casuarina glauca*) will be removed and large amounts of potential habitat will remain outside of the study area that may also provide suitable nesting/breeding habitat for the Glossy Black-cockatoo.

i) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).

No declared area of outstanding biodiversity value will be impacted either directly or indirectly by the subdivision.

j) whether the proposed development or activity constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

One key threatening process listed under the BC Act is relevant to the current proposal and may pose a threat to the Glossy Black-cockatoo; clearing of native vegetation.

The proposal would not result in the loss of any hollow bearing trees but would result in the modification of native vegetation. The scale of this impact is not considered significant for this species as the vegetation to be modified by the proposal does not include quality foraging habitat or breeding habitat for this species.

Conclusion

The proposal is unlikely to impose a significant impact on the Glossy Black-cockatoo given that the proposed works:

- would modify small areas of potential foraging habitat within the study area, which are not considered to be high quality habitat for this species
- would not involve the removal of any hollow bearing trees with a breeding size hollow
- would not isolate an area of known habitat from currently interconnecting areas of potential habitat for this wide ranging species.

On the basis of the above considerations, it is not likely that the proposal will result in a significant impact on the survival of the Glossy Black-cockatoo.

Pteropus poliocephalus (Grey-headed Flying-fox)

Grey-headed Flying Fox (GHFF) is listed as a vulnerable species under the BC Act. The species is endemic to the east coast of Australia with a distribution from Bundaberg in the north to Melbourne in the south, from the western slopes of the Great Dividing Range to the coast (OEH, 2018).

Grey-headed Flying-fox is a highly mobile species whose migration patterns are determined by the availability of flowering food resources. The species is a canopy-feeding frugivore, blossom-eater and nectivore, and occurs in rainforest, woodlands, paperbark swamps and Banksia woodlands. This species feeds in particular on the nectar and pollen of native trees, especially *Eucalyptus* spp., *Melaleuca* spp. and *Banksias* spp., and fruits of rainforest trees and vines. During times when native food resources are limited, Grey-Headed Flying-foxes forage on fruit crops and cultivated gardens (OEH 2018).

Roosting camps are generally located next to rivers or creeks, and occur in a range of vegetation communities including rainforest, wet sclerophyll forest, *Melaleuca* woodland, *Casuarina* forest or mangroves (OEH, 2018). These sites have a dense canopy, providing them with the moist, humid microclimate they require. Campsites are critical for mating, birthing, rearing of young and as diurnal refuge from predators. Urban gardens, cultivated fruit crops and roadside verges may also provide temporary roosting habitat for this species

This species is threatened by a number of processes including loss of foraging habitat, disturbance of roosting sites, unregulated shooting, and electrocution on powerlines (OEH, 2018).

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

Factors likely to have an adverse effect on the life cycle of the Grey-headed Flying-fox would include a substantial loss and/or fragmentation of foraging habitat and loss of suitable roosting or breeding habitat. There are no known camps of this species in the subject site; however, the site has the potential to provide foraging habitat for this species. Impacts from the proposal on habitat for this species would include indirect impacts to foraging habitat in the study area.

There are many other nectar producing species in the locality. Large tracts of vegetation persist close to the study area and include the Warriewood Wetlands, Irrawong Reserve and along Narrabeen Creek.

It is unlikely that the potential indirect impacts to foraging habitat will have a significant impact on this a viable local population of this species such that it is likely to be placed at risk of extinction.

b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

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

Not applicable. These species are not an endangered population.

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

Not applicable. The GHFF is not a threatened ecological community.

c) in relation to the habitat of a threatened species or ecological community:

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

The proposal will potentially indirectly impact foraging habitat within the study area for the Grey-headed Flying-fox. The proposal would not result in the removal of any current camps and potential habitat for this highly mobile species is also present in other areas throughout the locality. The subdivision seeks to retain the potential foraging habitat. However the feed trees may be impacted by erosion, sedimentation and changes in hydrology. These impacts should be managed through the implementation of an erosion and sedimentation plan and through the management of water along the riparian corridor

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

No foraging habitat is to be isolated or fragmented as a result of the subdivision. The proposed subdivision avoids *Eucalyptus robusta* in the study area. No camps are to be affected by the subdivision.

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

The potential foraging habitat is to be retained but may be subject to indirect impacts. This does not pose a risk to the long term survival of the species given no known camp sites will be impacted and given the availability of large areas of potential foraging, movement and breeding habitat available in the locality.

d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).

No declared area of outstanding biodiversity value will be impacted either directly or indirectly by the subdivision.

e) whether the proposed development or activity constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The proposed works constitutes one key threatening processes of relevance to the GHFF, namely Clearing of Native Vegetation, which would result in a small loss of potential habitat. However, the scale of these impacts within the study area is not considered to be significant due to the small size of the habitat to be removed and the highly mobile nature of this species.

Conclusion

The proposed development is unlikely to impose a significant effect on Grey-headed Flying-fox given that the proposed works:

- would modify a very small of potential marginal foraging habitat within the site, which is not likely to impact on the life cycle of the species

- would not place a viable local population at risk of extinction
- would not isolate an area of known habitat from currently interconnecting areas of potential habitat for this species
- would not remove or disturb any campsites.

On the basis of the above considerations, it is unlikely that the proposed works would result in a significant impact on the survival of Grey-headed Flying-fox. Consequently, a Species Impact Statement and a Biodiversity Development Assessment Report are not required for the proposed development with respect to this species.

Microchiropteran Bats

Due to similar habitat requirements and associated impacts, a single 5-part test has been undertaken for the following microchiropteran bats:

- ***Miniopterus australis*** **(Little Bentwing Bat)**
- ***Miniopterus schreibersii oceanensis*** **(Eastern Bentwing Bat)**
- ***Myotis macropus*** **(Southern Myotis)**

The Little Benwting Bat is listed as a vulnerable species under the BC Act. The Little Bentwing-bat is found from the east coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW. They are found in moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats. They often share roosting sites with the Common Bentwing-bat and, in winter, the two species may form mixed clusters.

In NSW the largest maternity colony is in close association with a large maternity colony of Eastern Bentwing-bats and appears to depend on the large colony to provide the high temperatures needed to rear its young with only five nursery sites /maternity colonies are known in Australia.

The Little Bentwing-bat was not recorded during the field survey, however it is known from database records within a 5 km radius of the study area.

The Eastern Bentwing Bat is listed as a vulnerable species under the BC Act. This species occupies a range of forested environments (including wet and dry sclerophyll forests), along the coastal portion of eastern Australia, and through the Northern Territory and Kimberley area (subject to subdivision of this species).

This species has a fast, level flight exhibiting swift shallow dives. It forages from just above the tree canopy, to many times the canopy height in forested areas, and will utilise open areas where it is known to forage at lower levels. Moths appear to be the main dietary component. This highly mobile species is capable of large regional movements in relation to seasonal differences in reproductive behaviour and winter hibernation. Though individuals often use numerous roosts, it congregates in large numbers at a small number of nursery caves to breed and hibernate. Although roosting primarily occurs in caves, it has also been recorded in mines, culverts, stormwater channels, buildings, and occasionally tree-hollows. This species occupies a number of roosts within specific territorial ranges usually within 300 km of the maternity cave, and may travel large distances between roost sites.

The Eastern Bentwing-bat was not recorded during the field survey, however it is known from database records within a 5 km radius of the study area.

The Southern Myotis is listed as a vulnerable species listed under the BC Act. This species has a primarily coastal distribution, rarely found more than 100 km inland, although it does occur further inland along major rivers (Churchill 1998). This species inhabits most habitat types as long as they are near water,

where this species forages (Churchill 1998). The Southern Myotis forages along streams and pools, feeding on insects and small fish caught by raking their long feet across the water surface.

The Southern Myotis is a cave dweller but is also known to roost in tree hollows, under bridges, in clumps of vegetation, buildings, mine tunnels and stormwater drains (Churchill 1998). Southern Myotis has also been recorded roosting in disused *Hirundo ariel* (Fairy Martin) nests in culverts in QLD (Schulz 1998). Roosts are usually in groups of 10-15, in close proximity to water over which the bats forage. In northern NSW Large-footed Myotis can have two breeding events a season where young are born in October and mothers lactate through to January, at which point they may breed again.

This species is threatened by a number of processes including the loss or disturbance of roosting sites, clearing adjacent to foraging areas and reduction in stream water quality affecting food resources (OEH 2013).

The Southern Myotis was not recorded during the field survey, however it is known from 15 database records within a 5 km radius of the study area.

There is potential for these species to utilise the study area for foraging and potential roosting habitat is present in the form of hollow-bearing trees within the study area.

The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:

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

Factors likely to have an adverse effect on the viability of a local population include:

- loss or fragmentation of foraging habitat
- loss of roosting (hollows or under fibrous bark) or breeding habitat (HBTs)

The proposed works will result in the removal of 0.027 ha of remnant and 0.091 planted native / exotic vegetation which is considered potential foraging habitat for microbats. This is considered marginal considering the amount of vegetation retained along Narrabeen Creek and in the broader locality.

One HBT will be removed for the development. A visual inspection from the ground could not determine if the hollow had substantial depth suitable for microbats (Figure 5) as such a precautionary approach was taken to assume this hollow may provide roosting habitat for microbat species

Given the relatively large amount of intact vegetation adjacent to the study area and that limited roosting and no breeding habitat is available within the study area; the study area is unlikely to be important to any viable local populations of these species.

Considering these species are highly mobile, the small amount of foraging habitat proposed for removal and that no breeding habitat will be directly impacted, it is unlikely that the proposal would impact on these species such that it would place any local populations at risk of extinction.

b. in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

Not applicable. These species are not an endangered population

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

Not applicable

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

Not applicable. These species are not ecological communities.

c. in relation to the habitat of a threatened species or ecological community:

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

The proposal will include a small amount of vegetation clearance (0.012 ha) which represents potential foraging habitat for these species. However, there is extensive habitat available adjacent to the study area. Furthermore, the proposed works will not result in the disturbance to any known culverts or caves that represent potential breeding habitat for these species, and therefore, it is unlikely that the habitat proposed for removal would be considered to comprise of an important area of habitat for these highly mobile species within the locality.

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

The habitat removal is unlikely to fragment or isolate other areas of habitat. Habitat connection along the Narrabeen Creek corridor will remain. The proposed subdivision will not remove areas of habitat for these species.

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

Under the proposed works one potential HBT which may provide roosting habitat for microbat species will be required for removal. The presence of HBTs would usually be considered important habitat for microbats, however, this HBT is unlikely to be considered important habitat for the following reasons:

- the hollow may not contain substantial depth suitable for microbats roosting or breeding habitat.

Additionally, the proposed removal of 0.012 ha of vegetation that represents potential foraging habitat for these species is unlikely to affect breeding or feeding behaviour and as such does not pose a risk to the long term survival of the species. In addition, extensive habitat is located adjacent to the study area along Narrabeen Creek and further downstream at the Warriewood Wetlands, which contain potential foraging and breeding habitat

d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

No areas of outstanding biodiversity value have been listed within the study area. Areas of Biodiversity values have been identified in adjacent vegetation, however, the works will not directly impact this area.

e. whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process

Two key threatening processes are relevant to the current proposal and may pose a threat to these species: Clearing of native vegetation and loss of hollow-bearing trees.

Given these species are highly mobile, the small amount of native vegetation proposed for removal and the availability of foraging and roosting habitat throughout the study area, it is considered unlikely that the proposal would significantly exacerbate this key threatening process.

Conclusion

The proposal is unlikely to have a significant impact on these species given that:

- clearance area is very small
- no caves or stormwater culverts will be removed
- the proposal would not isolate habitat for these species
- a large amount of potential habitat for these species would remain within the site and is present throughout the locality.

On the basis of the above considerations, it is unlikely that the proposal would result in a significant impact on the survival of these species. Consequently, a Biodiversity Assessment Report is not required for the proposal with respect to the Little Bentwing-bat, Eastern Bentwing-bat and Southern Myotis.

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Appendix D : Significance Assessment EPBC

Pteropus poliocephalus (Grey-headed Flying-fox)

Pteropus poliocephalus (Grey-headed Flying-fox) is listed as vulnerable under the EPBC Act. Grey-headed Flying-foxes are found within 200 km of the eastern coast of Australia, from Bundaberg in Queensland to Melbourne in Victoria. They occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy (DECC 2005).

Individual camps may have tens of thousands of animals and are used for mating, birth and the rearing of young. Annual mating commences in January and a single young is born each October or November. Site fidelity to camps is high with some camps being used for over a century. They travel up to 50 km to forage (DECC 2005).

This species feeds on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines. They also forage in cultivated gardens and fruit crops and can inflict severe crop damage (DECC 2005).

The proposed subdivision would not disturb any known flying fox roosting camps. The nearest Grey-headed Flying-fox roost or "camp" is located to the east at Warriewood near Jacksons Road. There are several other camps located throughout the Sydney metropolitan area that are located further from the project. The closest largest camp is at Gordon, about 15 km south-west of the study area.

Foraging habitat would be lost through the clearing of potential marginal foraging habitat. Areas of potential foraging habitat to be cleared have been calculated based on the clearing of native vegetation within the construction footprint. While the species would also forage on cultivated gardens and fruit crops, this has not been included in the analysis. The proposed subdivision may result in indirect impacts to potential foraging habitat.

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

1. Lead to a long-term decrease in the size of an important population of the species

No. The study area does not support a breeding population (camp) of Grey-headed Flying-fox. There will be no loss of foraging habitat and the species forages widely on a variety of vegetation. Therefore, the study area is unlikely to support an important population of this species and no decline is expected to result in the size of any important population of the Grey-headed Flying-fox.

2. Reduce the area of occupancy of an important population

No. An important population of Grey-headed Flying-fox does not occur within the study area.

3. Fragment an existing important population into two or more populations

No. The species is highly mobile and an important population of Grey-headed Flying-fox does not occur within the study area.

4. Adversely affect habitat critical to the survival of a species

No breeding habitat (camps) would be impacted by the project. There may be indirect impacts to foraging habitat. The camp in closest proximity to the study area located to the south at Warriewood Wetlands, around 350 m away. This camp supports up to 1000 individuals and appears to be relatively stable.

Under the DECC (2009c) Draft National Recovery Plan, foraging habitat within a 50 kilometre radius of a roost site with greater than 30,000 individuals is foraging habitat critical to survival. A camp at Gordon (about 15 km south-west) can vary in the number of individuals present from zero to 80,000 (Ku-ring-gai Council 2013) and the data for this camp suggests that the camp will vary during the breeding season (summer) between 20,000 and 40,000. Therefore, there is foraging habitat present which meets the definition of habitat critical to the survival of the species.

The amount of loss of habitat is considered to be insignificant in terms of the regional context. Analysis of the Native Vegetation mapping GIS dataset for the Sydney Metropolitan Area (OEH 2013) in 2014 revealed that more than 77,000 ha of native vegetation were identified as occurring within 50 km of the Gordon camp site (ELA 2014). This dataset is limited in its extent to the Sydney Metropolitan Catchment Management Authority area, and thus includes approximately 50% of the native vegetation within 50km of the camp site. As a proportion of the mapped 77,000 ha, the impacts will act on 0.000017% of the available vegetation for the Gordon camp.

5. Disrupt the breeding cycle of an important population

No. No breeding habitat (camps) would be impacted by the project.

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

No. The species forages widely across the landscape on a variety of vegetation. The impacts to foraging habitat within the study area are unlikely to cause a decline for the Grey-headed flying Fox population.

7. Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

The project will not result in the establishment of an invasive species that is harmful to the GHFF. **8. Introduce disease that may cause the species to decline, or**

The project will not result in the introduction of disease that may cause GHFF populations to decline. **9. Interfere substantially with the recovery of the species.**

Considering the above factors, the project will not interfere substantially with the recovery of the species.

Is a significant impact on the species likely to result?

The proposed works are not likely to have a significant impact on the GHFF for the following reasons

- No breeding habitat will be impacted by the proposal
- GHFF forages widely and the impact area is small in comparison to the foraging habitat within 50 km of the nearest camp.

Appendix E Biodiversity Overlay (Pittwater LEP)


Pittwater Local Environmental Plan 2014
Biodiversity Map - Sheet BIO_012
Biodiversity
Biodiversity
Cadastre
Cadastre 7/7/2012
© Land & Property Information (LPI)
INGLESIDE
MONA VALE
WARRIEWOOD
N
W
E
S
metres
Scale: 1:10,000 @ A3
Projection: GDA 1994 MGA Zone 56
File Number: 6370_COM_BIO_012_010_20140217

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