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Flora and Fauna Assessment

Warriewood STP Buffer Area 3
Proposed Residential Development

Total Earth Care Pty Ltd
February 2010

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Date of Issue: March 1st 2010

Quality Control	© Total Earth Care Pty Ltd 2010		
Revision/Version No.	Final	Date of revision	19/02/2010
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Flora and Fauna Assessment

Warriewood STP Buffer Area 3 - Proposed Residential Development

1 INTRODUCTION

Meriton Apartments is proposing the development of 14-18 Boondah Rd, Warriewood Valley (subject site). Briefly, the proposed development includes the construction of 16 residential buildings, providing approximately 600 apartments. The development also includes internal roadways, landscaped areas, asset protection zones, core riparian and riparian buffer zones and the retention of significant native vegetation where possible. This project has been declared a Part 3A Major Project and the applicant will be submitting a Concept Application together with a detailed Stage 1 Project Application for 313 apartments to the Department of Planning. The Stage 2 Project Application will be submitted later in the year for the remaining 300 apartments. Total Earth Care has been engaged to address the Director General's Requirements for the application, with regard to Environmental Assessment Section12: Flora and Fauna and the requirements of DECCW.

Total Earth Care has been engaged previously by Meriton Apartments to conduct Flora and Fauna Survey and Assessments associated with Development Applications lodged with Pittwater Council in the past for the same site. In August 2003 Meriton Pty Ltd engaged Total Earth Care Pty Ltd (TEC) to carry out a flora and fauna survey and assessment on several land parcels at the corner of MacPherson St and Boondah Road, Warriewood Valley. Field survey for the assessment was carried out in August 2003 and the subsequent *Flora and Fauna Assessment Warriewood STP Buffer Sector 3, Proposed Residential Subdivision Master Plan* report was issued in January 2004 (TEC, 2004). This flora and fauna report assessed the potential impacts of the rezoning of the subject site in consideration of the flora and fauna recorded from the site during the field survey and potential habitat available for threatened biodiversity previously recorded from the locality.

An additional aspect of the 2004 report was survey and mapping in conjunction with Pittwater Council to better define the edge of the Warriewood Wetland at the southern boundary of the subject site. This agreed wetland edge defines the extent of the high conservation habitat mapped on-site by Pittwater Council. The wetland buffer widths, developed to reduce the potential impacts of a future development upon the wetland, as described in the 2004 report have been maintained through the various proposals for the site, and the current plans include the same setbacks and buffers as established at that time. These zones are further discussed in sections of this report below.

The 2004 report was updated in May 2006 to include additional targeted field survey and the amended report was submitted as part of a rezoning application to Pittwater Council for the site. Development Consent (NO615/04) was granted by Pittwater Council for the consolidation of several existing lots into one larger lot. The subject site is now referred to collectively as Lot 20 DP 1080979.

Meriton Apartments had previously investigated a proposal under the *State Environmental Planning Policy (SEPP) Housing for Seniors or People with a Disability*, for the construction of between 14 and 15 buildings on the site. TEC was approached in April 2008 by Flower and Samios Architects, acting as an agent for Meriton Apartments, to revise the flora and fauna assessment. The SEPP Seniors Living proposal however did not proceed.

1.1 Proposed Development Description

The current proposal comprises a multi-storey residential development as described above. The proposed building footprints can be seen in Map 1 (Appendix B). The current development plan includes the following key design measures (also shown in Map 3 Appendix B) related to the retention, protection, restoration and enhancement of environmental features.

- **Public Riparian Zone:** Creation of a 50 metre-wide Public Riparian Zone associated with Fern Creek along the western boundary. This buffer is consistent with the Pittwater Council P21 Development Control Plan Section C6.7.

- **Private Buffer Strip:** Creation of a 25 metre-wide Private Buffer Strip to directly adjoin the Public Riparian Zone to the east. This buffer strip is required under the P21 DCP Section C6.7.
- **Core Riparian Zone (CRZ):** retention of a 20 metre-wide vegetated buffer (referred to as the CRZ) along the southern boundary of the site (as requested by Pittwater Council in the pre Development Application meeting for the previous proposal held on the 17th March 2008);
- **10m Buffer Strip:** Retention of a 10 metre-wide buffer along the southern boundary of the site, to directly adjoin the CRZ to the north. This buffer is to protect the boundary of Warriewood Wetland and is required under the Pittwater 21 Development Control Plan (P21 DCP) Section B4.14. This buffer was negotiated between Council and the former DIPNR (now DECCW) in 2003 and is required to be maintained in the current proposal (as requested by Pittwater Council in the pre Development Application meeting for the previous proposal held on the 17th March 2008);
- **Asset Protection Zone (APZ):** Retention of a 25 metre-wide APZ along the southern boundary of the site which comprises the 10m Buffer Strip and an additional 15m Inner Protection Zone (IPZ). The IPZ will directly adjoin the 10m Buffer Strip to the north. This is a requirement of the Rural Fire Service (RFS) as the site has been identified as bushfire prone land.
- **Retention of an area of 'Swamp Oak Forest':** An area of 'Swamp Oak Forest', located in the south-eastern part of the site adjacent to Boondah Road will be retained where possible. This area will be subject to some clearing and development under the current proposal, however, the retained portion will be either contiguous or adjacent to the Wetland buffer strip and will form a partial vegetated link in the form of 'stepping stone' habitat to the same community located across Boondah Road within the Sydney Water site and within Warriewood Wetlands.

2 AIMS AND OBJECTIVES

The aims of the current report are to revise the previous flora and fauna assessment (TEC 2008), in accordance with the Director General's Requirements dated 23/12/09, and includes:

- Confirm the presence or likely occurrence of threatened species, populations and ecological communities (or their habitats), as listed under the Commonwealth *Environment Protection and Biodiversity Conservation (EPBC) Act* 1999 and *NSW Threatened Species Conservation (TSC) Act* 1995;
- Address the significance of potential impacts on flora and fauna, including threatened species, populations or endangered ecological communities or their habitats including Warriewood Wetlands;
- Make recommendations regarding the mitigation of any identified impacts on significant vegetation, associated plant communities, any significant fauna populations and their habitats; and;
- Demonstrate the implementation of measures to protect and rehabilitate the adjoining Fern Creek, the Warriewood Wetland area and riparian corridor.

3 METHODS

3.1 Desktop Research

Prior to field surveys, records of all threatened species, populations and endangered ecological communities previously recorded within 5 kilometres of the subject site (10km locality search) were obtained from the Department of Environment, Climate Change and Water (DECCW) Wildlife Atlas database, and the Federal Environment Department Protected Matters search tool. All previous reports and plans relating to the site were reviewed including the Flora and Fauna Assessment Reports (TEC 2004, 2006, and April 2008). Additionally, a review of all updated plans and reports

relating to the site, relevant legislation, recent vegetation mapping and other documentation were reviewed, including:

- *The Native Vegetation of the Sydney Metropolitan Catchment Management Authority Area* (Draft) (DECCW 2009a); and
- Broad-scale mapping of the Sydney 1:100,000 map sheet by Benson and Howell (1994).
- *Arboricultural Assessment/Vegetation Management Report* (TALC 2008);
- Landscape Master Plans (Landscape Direct 2009);
- *Guidelines for Controlled Activities: Riparian Corridors* (DWE 2008);
- *NSW State Rivers and Estuaries Policy (*NSW WRC 1993);
- *NSW Wetlands Management Policy (DL & WC 2000);* and
- *Groundwater Dependent Ecosystems.*

3.2 Previous Survey and Assessments

The current report does not include a flora and fauna survey. Previous survey effort conducted within the study area has been summarised in Table 1, and includes the use of nocturnal and diurnal survey methods.

Floristic surveys for the subject site have been conducted as per the general outline below;

- the identification of native and exotic plant species according to *Field Guide to the Native Plants of Sydney* (Robinson 2003) and the *Flora of NSW* (Harden 1992, 1993, 2000, 2002), with reference to recent taxonomic changes;
- the identification and mapping of plant communities (where present) according to the structural definitions of Specht & Specht (1999), and reference to previous broad-scale mapping of the Sydney 1:100,000 map sheet by Benson & Howell (1994) and the *Native Vegetation of the Sydney Metropolitan Catchment Management Authority Area* (Draft) (DECCW 2009a) vegetation mapping;
- targeted searches for plant species of conservation significance according to the "random meander" method (Cropper 1993).

The conservation significance of plant species and plant communities was determined according to:

- TSC Act for significance within NSW; and
- EPBC Act for significance within Australia.

Previous fauna survey included both nocturnal and diurnal survey techniques (Table 1). Nocturnal surveys involved call playback, spotlighting throughout the site and specifically targeting of potential habitat of threatened fauna previously recorded in the locality. An AnaBat Detector was placed in potential micro-bat flyways and left out for the duration of the survey. Targeted fauna species during nocturnal survey included (but were not limited to) Powerful Owl, Barking Owl, Masked Owl, Southern Brown Bandicoot, and Squirrel Glider.

The diurnal surveys involved observations of animal activity, habitat identification and searches for indirect evidence of fauna (such as scats, nests, burrows, hollows, tracks, scratches and diggings). Surveys for avifauna and amphibians involved visual detection and aural recognition of bird and frog calls.

The conservation significance of fauna species and populations was determined at a State level according to the TSC Act and at a national level according to the EPBC Act.

All flora and fauna species, as well as fauna habitat types and evidence of fauna activity, were recorded and an inventory of species was compiled (Appendix A).

Table 1 14-18 Boondah Rd, Warriewood Flora & Fauna Survey Effort

Survey Dates	Survey Effort	Survey Methods	Weather
21st August 2003	Diurnal Survey Throughout Subject Site	*Floristic survey* – 'random meander' & target search for threatened species *Avifauna* – visual and aural recognition *Reptiles/ Amphibians* – active search in habitats; logs, rocks, litter & base of trees *Amphibians* - frog aural detection *Diurnal mammals* – active search for; tree hollows, nests, scats, tracks and scratches *Habitat Assessment* – potential habitats for identified threatened species	Day Mild daily temperatures 18-20°C, light breeze and light cloud cover.
	Nocturnal Survey	*Arboreal Species* - spotlighting for 2hrs. Stag/hollow watch at dawn 0.5hr *Owl Species* – Playback calls for threatened Powerful & Barking Owls – 5 min repeats *Microchiroptera* - AnaBat Detector in southern boundary adjacent to water body left over night total of 13hrs. Harp trap in potential micro-bat flyway overnight and checked during the night and removed at dawn.	Night Cool to mild, Temperature 14 – 16°C
22nd August 2003	Diurnal Survey	*Avifauna* – visual and aural recognition	Morning Cool to mild Morning temperatures
3rd May 2006	Diurnal Survey	*Floristic survey* – 'random meander' & target search for threatened species *Avifauna* – visual and aural recognition *Amphibians* - frog aural detection *Diurnal mammals* – active search for tree hollows, nests, scats, burrows, diggings, tracks and scratches *Habitat Assessment* – potential habitats for identified threatened species	Day Mild, dry 20°C
	Nocturnal Survey	*Ground Species* – target spotlighting for Southern Brown Bandicoot but limited to. *Arboreal Species* - spotlighting for 2hrs. Stag/hollow watch at dawn 0.5hr. Target search for Squirrel Glider. *Owl Species* – Playback calls for threatened Powerful & Barking Owls – 5 min repeats *Microchiroptera* - AnaBat Detector in southern boundary adjacent to water body left over night total of 13hrs. Harp trap in potential micro-bat flyway overnight and checked during the night and removed at dawn.	Night Light breeze and low night light

Table 1 cont' 14-18 Boondah Rd, Warriewood Flora & Fauna Survey Effort

Survey Dates	Survey Effort	Survey Methods	Weather
4th May 2006	Diurnal Survey	*Avifauna* – visual and aural recognition	Morning Fine mild conditions, 17°C.
17th March 2008	Diurnal Survey	*Floristic survey* – 'random meander' & target search for threatened species *Avifauna* – visual and aural recognition *Reptiles/ Amphibians* – active search in habitats - logs, rocks, litter & base of trees *Amphibians* - frog aural detection *Diurnal mammals* – active search for tree hollows, nests, scats, tracks and scratches *Habitat Assessment* – potential habitats for identified threatened species	Day Mild temperature 25°C High night light
	Nocturnal Survey	*Ground Species* – target spotlighting for Southern Brown Bandicoot *Arboreal Species* - spotlighting for 2hrs. Stag/hollow watch at dawn 0.5hr. Target search for Squirrel Glider *Owl Species* – Playback calls for threatened Powerful & Barking Owls – 5 min repeats *Microchiroptera* - AnaBat Detector within possible Micro-bat flypath	Night Light breeze

3.3 Limitations

Previous field surveys at the subject site have been conducted over one day and evening during autumn 2008, one day and one evening in autumn 2006 and two days and one evening in winter 2003 (TEC 2008; TEC, 2006; and TEC, 2004). It was considered that additional survey was not required for the current report. However, the length of surveys and their timing mean that the full spectrum of flora and fauna species and ecological processes likely to occur on the site cannot be fully quantified or described in the reports. These limitations have been addressed by identifying potential habitats for such species and assessing the potential for these species to occur on the site based on previous records, the type and condition of habitats present, the land use of the site and its landscape context.

4 LANDSCAPE

4.1 Site Description

4.1.1 General

Warriewood STP Buffer Sector 3 is zoned 2 (f) Urban Purposes – Mixed Residential under the *Pittwater Local Environmental Plan 1997*. The site is located at the junction of Macpherson Street and Boondah Road, Warriewood, and is bounded by Boondah Road to the east, Warriewood Wetlands to the south, Warriewood Valley Sector 11 to the west and Macpherson Street to the north. The current land use is rural residential, with horse paddocks located at the rear of residential properties fronting

Macpherson Street, as well as disused agricultural land, plantation, and light industrial premises on Boondah Road.

Surrounding land uses include low density residential to the north and current construction of an aged care facility, medium density housing to the west (Sector 11), and conservation to the south (Warriewood Wetlands). Warriewood Sewage Treatment Plant and a Sydney Water Maintenance Depot lie to the east, opposite the site across Boondah Road.

4.1.2 Soils

The site lies within land mapped on the Sydney 1:100,000 soil landscape sheet as "disturbed terrain" (Chapman *et al*., 1989), which is described as "level to plain hummocky terrain, extensively disturbed by human activity" (Chapman & Murphy 1989). The original soils are likely to have been subject to complete burial or removal from previous agricultural and silvicultural land use. This description is consistent with the surface conditions observed during field surveys, which indicate that major levelling and filling has occurring over the majority of the site, with near complete removal of vegetation in some areas, and changes to surface and subsurface drainage, through the construction of irrigation channels and the surrounding road and drainage systems.

The surrounding land throughout the Warriewood Valley is mapped as the Warriewood Soil Landscape Group (Chapman *et al*., 1989) which occurs on "level to gently undulating swales, depressions and infilled lagoons on Quaternary sands". The Warriewood landscape group contains soils described as "deep, well sorted, sandy humus podzols and dark, mottled siliceous sands, overlying acid peats in depressions, and deep podzols and pale siliceous sands on sandy rises". Soils within the Warriewood landscape are highly permeable and subject to localised flooding, waterlogging, and high water tables. These soils are possibly still present at the surface on some parts of the site, and most likely occur at subsoil levels beneath fill and exotic vegetation.

4.1.3 Topography and Aspect

The site is located within the Warriewood Valley, and on the margins of the Fern Creek floodplain. The site is characterised by gently sloping topography, bordered by moderately inclined slopes to the north and the flat low-lying terrain of the Warriewood Wetlands to the south. The site has low relief, with a south-westerly aspect.

The water table is located close to the surface across most of the site and some areas, particularly in the south, are subject to waterlogging and periodic inundation. Surface runoff drains mainly into low-lying areas in the southern and western parts of the site, as well into artificial drainage channels constructed in various locations (apparently as irrigation channels for previous agricultural activities). The site drains into Fern Creek, which at this location, forms a direct link in the Warriewood Wetlands close to the southern boundary of the site.

4.1.4 Vegetation

The site contains a mixture of exotic pasture grasses and planted trees, horticultural garden plantings within existing residences and small areas of regrowth native vegetation.

Most of the original vegetation of the site has been removed, and those stands of native bushland still present appear to have regenerated following previous clearing events, based on the relatively young age of most of the trees. Localised infestations of common herbaceous and woody weeds are present in disturbed parts of the site. Overall, the natural resilience of most of the site would be very low, with the exception of sections of native vegetation along the Fern Creek boundary.

4.1.5 Habitat Corridors

Portions of the site are mapped as being part of a wildlife corridor as per the Pittwater Council mapping. The site is adjacent to Warriewood Wetlands which is mapped as a 'major habitat area',

and this classification crosses into the boundary of the site along the central southern boundary. This classification extends into the existing Poplar Forest community area and is not an accurate classification of the wetland area currently present. A Category 2 area has been mapped in the western corner of the subject site, along Fern Creek. Category 2 is defined as 'mostly cleared non-residential areas with good potential for improvement of habitat'. This classification is accurate and is reflected in the management proposed for this area under the current proposal. The remainder of the subject site is classified as 'developed area' in the habitat corridor mapping, which is correct given the disturbed nature of the site. The buffer areas described briefly in Section 1.1 provide for the protection of flora and fauna habitat and habitat corridor values, as required under the Pittwater 21 Development Control Plan (P21DCP) Section B4.4.

5 FLORA

5.1 Plant Species

Extensive flora survey has not been carried out as part of the current investigations at the subject site. The most recent surveys have focused on targeted survey for threatened species (as recorded from the DECC Wildlife Atlas), and confirmation of the previous detailed species inventory and plant community descriptions including structure and floristics that were recorded as part of the previous site assessment. A flora inventory for the site is provided in Appendix A.

A total of 87 plant species were recorded on the site during the flora field survey in March 2008, including 43 native species and 44 exotic species. Many species were horticultural introductions (i.e. planted) included exotic species, and eleven were noxious weeds (at the time of survey) as listed under the *NSW Noxious Weeds Act 1993* for the Pittwater LGA (Table 1). Recent changes to the *NSW Noxious Weeds Act 1993* particularly Weed Control Order No. 19 has resulted in amendment to weed control categories (to control classes), species listings and also strategies for noxious weed control throughout the state. Table 1 below lists the weeds recorded on site listed as noxious.

Table 2 Plant species recorded within the study site listed under the *NSW Noxious Weeds Act 1993* for the Pittwater LGA (Order No.21).

Control Class[1]	Scientific Name	Common Name
4	*Acetosa sagittata*	Turkey Rhubarb
4	*Asparagus aethiopicus*	Asparagus Fern
3	*Cestrum parqui*	Green Cestrum
3	*Cortaderia selloana*	Pampas Grass
4	*Ipomoea indica*	Morning Glory
5	*Lantana camara*	Lantana
4	*Ligustrum lucidum*	Large-leaf Privet
4	*Ligustrum sinense*	Small-Leaf Privet
3	*Ludwigia peruviana*	Ludwigia, Water Primrose
4	*Parietaria judaica*	Pellitory of the Wall
4	*Rubus fruticosus* sp. agg.	Blackberry

[1] Class 1 State Prohibited Weeds. The plant must be eradicated from the land and the land must be kept free of the plant.
Class 2 Regionally Prohibited Weeds. The plant must be eradicated from the land and the land must be kept free of the plant.
Class 3 Regionally Controlled Weeds. The plant must be fully and continuously suppressed and destroyed.
Class 4 Locally Controlled Weeds. The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority.
Class 5 Restricted Plants. The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with.

5.2 Vegetation Communities

Previous broad-scale mapping of the Sydney 1:100,000 map sheet (Benson & Howell, 1994) has identified the subject site as not supporting a native plant community, but with Coastal Swamp Forest Complex occurring nearby to the north and south. Mapping of the native vegetation of Pittwater has identified the subject site as supporting the 'Lowland' plant community Pittwater Council (2008).

The Native Vegetation of the Sydney Metropolitan Catchment Management Authority Area, a vegetation community mapping project conducted by Department of Environment, Climate Change & Water (DECCW 2009a) has been released since the previous site survey. This project has mapped a small portion of Bangalay Sand Forest and Sand Swamp Mahogany Forest occurring on the subject site, both of which are components of endangered ecological communities (EEC).

In the adjacent site the following EECs have been mapped in Warriewood Wetlands (DECCW 2009a) that are listed in Part 3 of Schedule 1 of the TSC Act;

- Bangalay Sand Forest of the Sydney Basin and South East Corner Bioregions;
- Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions;
- Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions; and
- Coastal Freshwater Reedland (DECCW, 2009a).

Warriewood Wetlands is a regionally significant vegetation community for local and international fauna species. The wetlands are considered the largest remaining sandplain wetlands in Northern Sydney, at 26 hectares, (Pittwater Council 2004) and are utilised by several threatened species. Migratory birds from China and Japan have been known to visit the wetlands, and are protected under the China-Australia Migratory Bird Agreement and Japan-Australia Migratory Bird Agreement.

Three plant communities were identified within the study site during the survey in March, consistent with the plant communities previously recorded from the site (TEC, 2004 and TEC, 2006), and they are as follows:

- Swamp Oak Forest / Swamp Sclerophyll Forest;
- Poplar Forest; and
- Cleared and Disturbed.

From the previous flora surveys the remnant areas of vegetation have been identified as an intergrade between the Swamp Oak Forest and Swamp Sclerophyll Forest EECs (TEC, 2004), and is collectively referred to as 'Swamp Oak Forest' for the purposes of this report.

The distribution of plant communities identified in the current survey within the study site is shown in Map 2 (Appendix B) and are described below. The 2009 DECCW mapping includes Bangalay Sand Forest and Freshwater Wetland vegetation communities within the study area, although neither is thought to occur within the subject site. A small area mapped as part of the Warriewood Wetland extends into the south-east boundary of the subject site, although the Freshwater Wetland vegetation is not mapped in this area.

Swamp Oak Forest

Swamp Oak Forest recorded from the surveys is located in the south east corner of the subject site. The canopy of this native plant community is dominated by Swamp Oak *Casuarina glauca*. The canopy is to a height of between 15 and 20 metres, with Foliage Projective Cover (FPC) of approximately 50-60%. Regrowth Swamp Oak dominates the mid canopy with the understorey to 3 metres dominated by woody weeds including Lantana, Senna *Senna pendula* var. *glabrata* and Small Leaved Privet *Ligustrum sinense,* with native species such as Bleeding Heart *Homalanthus populifolius* and Cheese Tree *Glochidion ferdinandi* var. *ferdinandi* occurring occasionally or uncommonly, FPC is 60%. The groundcover stratum is also dominated by exotic species throughout this community with Asparagus Fern *Asparagus aethiopicus* and Whisky Grass *Andropogon virginicus*

common. Native species present in the groundcover stratum include Native Reed *Phragmites australis* and False Bracken *Calochlaena dubia*.

There is a small stand of native vegetation at the eastern end of the Swamp Oak Forest, adjacent to Boondah Road, which has a floristic composition that reflects sandstone soil influence. This stand was noted in the previous surveys (TEC, 2004 and TEC, 2006) and is characterised by a canopy of Smooth-barked Apple *Angophora costata* and Bangalay *Eucalyptus botryoides*, from 12 to 15 metres. There is an understorey completely dominated by Lantana *Lantana camara*, which differs from the previous surveys where more native species were described dominating this area. The groundcover stratum is a mix of natives and exotic species such as Kikuyu Grass *Pennisetum clandestinum*, Blady Grass *Imperata cylindrical* and Spiny-headed Mat-rush *Lomandra longifolia*.

Resilience of the Swamp Oak Forest of the subject site varies from moderate to low. This community contains diagnostic species of a coastal floodplain endangered ecological community (EEC), Swamp Oak Floodplain Forest, which are listed under the TSC Act 1995. The vegetation at the eastern boundary of the subject site represents an intergrade between Swamp Oak Floodplain Forest and Swamp Sclerophyll Forest on Coastal Floodplains, both of which are listed as EEC's under the TSC Act.

Swamp Sclerophyll Forest

Provided the small extent of Swamp Sclerophyll Forest present and the difficulty distinguishing between the Swamp Sclerophyll Forest and Swamp Oak Forest this report will use the collective term 'Swamp Oak Forest' for consistency within the assessment. The two vegetation communities are endangered ecological communities and are represented by similar species.

The vegetation of the Swamp Sclerophyll Forest occurs on alluvial soil subject to waterlogging or periodic inundation. The forest canopy is generally open with a dominant layer of scrub consisting of ferns, reeds and sedges. Dominant species within the canopy layer *Eucalyptus botryoides* Bangalay and *Melaleuca quinquenervia* Paperbark. Groundcover is typically abundant with *Gahnia clarkei, Pteridium esculentum* Bracken and *Hypolepis Muelleri*.

Poplar Forest

Planted White Poplars *Populus alba* form a large stand in on the southern and south-western boundary and north-east portion of the subject site, Figure 1 of *Flora and Fauna Assessment Warriewood STP Buffer Sector 3, Proposed Residential Subdivision Master Plan* (TEC, 2004). Canopy heights in the two stands of Poplar Forest are approximately 20 metres and FPC is 10%. There is a very sparse understorey from 2 to 4 metres with FPC approximately 5%. Thickets of Lantana occur commonly in the understorey and other species include Senna *Senna pendula* var. *glabrata,* Blackberry *Rubus fruticosus complex* and Small Leaved Privet *Ligustrum sinense*. Native species in the understorey include Cheese Tree *Glochidion ferdinandi* var. *ferdinandi* and Cabbage Palm *Livistona australis* (uncommon). The groundcover stratum is to 1 metre and dominated by Kikuyu *Pennisetum clandestinum* and Whisky Grass *Andropogon virginicus.* Other exotic plant species include *Hydrocotyle bonariensis* and Montbretia *Crocosmia x crocosmiiflora*. The most commonly occurring native groundcover species was Bracken *Pteridium esculentum*.

Appendix 4 of the Pittwater 21 DCP states that there "is little historical or cultural value of introduced vegetation (in Warriewood Valley), with exception of two Poplar plantations between Garden Street and Boondah Road. The Valley was previously used for market gardening which involved clearing much of the existing native vegetation. The Poplar plantations provide a contrasting visual resource due to their height (20 metres) and contrasting rectilinear textural pattern (Pittwater Council, 2008)."

Resilience of the Poplar Forest of the subject site is generally low grading to moderate along the boundary with Swamp Oak Forest and other vegetation communities at the Warriewood Wetlands interface.

Cleared and Disturbed

This plant community corresponds to the Landscaped/Horticultural plant community described in the previous survey (TEC, 2004). The majority of the Cleared and Disturbed plant community comprises paddocks dominated by grazing pastures such as Kikuyu, Paspalum and Common Couch *Cynodon dactylon*. There are thickets of weeds such as Lantana and Privets *Ligustrum* spp and exotic and native species have been planted in landscaped areas and around dwellings of the subject site. Other shrubs and trees include Cocos Palm *Arecastrum romanzoffianum*, Irish Strawberry Tree *Arbutus unedo*, Crepe Myrtle *Lagerstroemia indica* and Crimson Bottlebrush *Callistemon citrinus*. Resilience of the Cleared and Disturbed plant community is very low.

Other vegetation communities are mapped within the locality, and descriptions of those are provided here for completeness.

Bangalay Sand Forest

According to the Sydney Metro CMA mapping (DECCW 2009b) Bangalay Sand Forest (BSF) vegetation community is located within the south-east boundary of the subject site. Recent site assessment confirmed the presence of *Eucalyptus botryoides* Bangalay and *Banksia integrifolia* subsp. *integrifolia* Coast Banksia as indicator species for this vegetation community.

Previous vegetation mapping of BSF community has not located BSF north of the Sydney region, including Pittwater LGA (Keith, 2004; NSW Scientific Committee, 2008). The Hydrogeological Report confirmed that the soils type was a composition of clay soils and bedrock of sandstone (Jeffery and Katauskas, 2010). Bangalay Sand Forest are known to occur closer to the coastal areas on deep sandy foredune and hind dunes area, often adjacent to the Swamp Sclerophyll Forest (DECC 2008). The current survey identified the BSF vegetation community previously mapped by the Sydney Metro CMA as an integrade of the Swamp Oak and Swamp Sclerophyll Forests. It is noted that a BSF stand is also mapped within the Warriewood Wetlands on the adjacent site.

Freshwater Wetlands

The Freshwater Wetlands on Coastal Floodplain are a significant endangered ecological community. Vegetation composition is typically sedges and reeds subject to periodically or semi-permanently inundated by freshwater. Some exposure to saline conditions is expected near the coast. The Freshwater Wetlands are typically situated on silt, mud or humic loams soils below an elevation of 20m within the Sydney Bioregions (NSW Scientific Community, 2008). The dense semi-aquatic vegetation acts as a natural buffer against erosion and surface water flow. Common species include; *Typha sp, Phragmites australis, Pseudoraphis spinescens* Spiny Mud Grass and *Carex appressa* Tall Sedge. The tree canopy is scare with some species from neighbouring communities co-existing such as Casuarina and Melaleuca species (DECCb 2008).

A small portion of the adjacent Warriewood wetland intersects the south-east boundary of the subject site. The vegetation is mapped by Sydney Metro CMA as Coastal Sand Swamp Mahogany Forest. The present survey has mapped this area collectively as ‘Swamp Oak Forest’. The Freshwater Wetlands community is mapped within the heart of the Warriewood Wetlands and does not occur within the subject site.

5.3 Threatened Plant Species

No threatened plant species listed under the TSC Act or EBPC Act were recorded on the subject site in the current or previous investigations.

A search of the DECCW Wildlife Atlas identified 11 threatened plant species occurring within 10 kilometres of the site (Table 2).

5.4 Endangered Ecological Communities

One threatened ecological community listed under the TSC Act were recorded on the subject site during the survey in March 2008. This community has been described and listed by the NSW Scientific Committee after the initial Flora and Fauna Report for this site was conducted in 2004.

The endangered ecological communities Swamp Sclerophyll Forest, Swamp Oak Floodplain Forest, and Freshwater Wetlands occur within the Warriewood Wetlands beyond the far southern corner of the site, at the rear of a property fronting Boondah Road, and elsewhere beyond the southern boundary of the site. The remnant native vegetation community on-site is believed to be an intergrade between the Swamp Oak Floodplain Forest and Swamp Sclerophyll Forest as listed under the TSC Act 1995. Several diagnostic species of both of these communities are present within the vegetation mapped as 'Swamp Oak Forest' (Figure 2). Species characteristic of Sand Bangalay Forest are also present although these are slightly less frequent and in addition soil types are less indicative of this community.

Table 2 Threatened flora species previously recorded within the locality (5km of the site) on the DECCW and EPBC databases.

Scientific Name	TSC Act Status[2]	EPBC Act Status[3]
Chamaesyce psammogeton	E1	
Epacris purpurascens var. purpurascens	V	
Eucalyptus camfieldii	V	V
Eucalyptus nicholii	V	V
Genoplesium baueri	V	
Grevillea caleyi	E1	E
Microtis angusii	E1	E
Persoonia hirsuta	E1	E
Pimelea curviflora var. *curviflora*	V	V
Syzygium paniculatum	V	V
Tetratheca glandulosa	V	V

6 FAUNA

6.1 Fauna Species

A total of 22 vertebrate fauna species were recorded during the field survey in March 2008, including 18 bird species and four mammals. A full list of species recorded during the current and previous surveys can be found in Appendix A.

[2] CE - critically endangered (Schedule 1A of the TSC Act); E1 – endangered (Schedule 1 of the TSC Act); V – vulnerable (Schedule 2 of the TSC Act).

[3] CE – critically endangered, E – endangered, V – vulnerable

The majority of species recorded on the site are generally typical of urban fringe or semi-rural areas within the Sydney Basin region and are widespread in distribution and common to abundant within their ranges.

One species listed as Vulnerable under the *Threatened Species Conservation Act* 1995 was observed during the survey in March 2008, Powerful Owl *Ninox strenua.*

6.2 Fauna Habitats

The main habitat types occurring within the study area are:

- Swamp Oak Forest / Swamp Sclerophyll Forest;
- Poplar Forest;
- Cleared and Disturbed; and
- Wetlands/Pond

'Swamp Oak Forest'

The canopy and understorey vegetation of the 'Swamp Oak Forest' provides shelter, nectar, blossom and seed for birds and arboreal mammals. The main habitats include well developed and intact native canopy, shrubs and woody weed thickets in the understorey and a well developed groundcover stratum in the predominately sandstone soil influenced section near Boondah Road. Very few hollows were observed in the canopy of the 'Swamp Oak Forest' suitable for roosting and nesting. Habitat features such as fallen branches, leaf litter, logs and rotting stumps are present and provide additional foraging and sheltering habitat for native ground dwelling mammals, invertebrates and reptiles. Lantana thickets smothered in exotic vine species along the margins of the 'Swamp Oak Forest' are likely to provide good nesting and sheltering habitat for arboreal mammals such as Common Brushtail Possums *Trichosurus vulpecular* and small birds such as Superb Fairy-wren *Malurus cyaneus* and Silver-eye *Zosterops lateralis*, as were recorded on site during the surveys.

As noted in previous assessment of this major habitat of the subject site, common native ground-dwelling mammals such as Long-nosed Bandicoot *Perameles nasuta* utilise this habitat. Other species may include Water Rat *Hydromys chrysogaster* and Brown Antechinus *Antechinus stuartii*. Canopy cover and connectivity to Warriewood Wetlands by vegetation and periodic inundation would also provide shelter, foraging opportunities and corridors for common reptile and amphibian species including Eastern Water Dragon *Physignathus lesueurii*, Diamond Python *Morelia spilota*, and the Striped Marsh Frog *Limnodynastes peronii*.

The threatened Powerful Owl *Ninox strenua* was observed roosting in this habitat (See Section 6.3 below).

Poplar Forest

Due to the spaced distribution and deciduous nature of the dominant tree species, canopy of the Poplar Forest provides limited and seasonal shelter, nectar, blossom and seed for birds and arboreal mammals. Hollows were observed in some larger trees and these would provide nesting and sheltering resources throughout the year. The sparse and patchy understorey has some habitat value and provides sheltering, nesting and foraging habitat for birds, arboreal mammals (eg. Common Brushtail Possum *Trichosurus vulpecular* and Willie Wagtail *Rhipidura leucophrys*).

A dense groundcover stratum in the southern stand of Poplar Forest provides good habitat for terrestrial native and exotic mammals such as Bush Rat *Rattus fuscipes* or Black Rat *Rattus rattus*. Connectivity through continuous groundcover into the semi aquatic and aquatic habitats of Warriewood Wetlands is likely to provide foraging and sheltering opportunities for reptiles and amphibians such as Eastern Water-skink *Eulamprus quoyii*, Red-bellied Black Snake *Pseudechis porphyriacus* and Eastern Dwarf Tree Frog *Litoria fallax*.

Cleared and Disturbed

The cleared and disturbed habitat is composed of pasture grasses with scattered trees, shrubs, occasional buildings, sheds, disused agricultural equipment and piles of building debris. It represents a highly modified landscape that lacks many of the natural habitat features and resources that are important in the maintenance of native fauna diversity and life cycles, including fully structured vegetation, a diverse shrub layer for food sources and protection, leaf litter and rocks and logs.

The cleared and disturbed habitat type favours ecological generalist species that are capable of utilising a wide range of habitats for foraging, as well as disturbance-tolerant species that are ubiquitous in modified urban and rural habitats throughout the region. An example of a generalist bird species that were recorded within this habitat are the Australian Magpie *Gynorhina tibicen* and the Spotted Turtle Dove *Streptopelia chinensis*. These species and common introduced and native mammal or reptile species such as Rabbit *Oryctolagus cuniculus*, Long-nosed Bandicoot and Bluetongue Lizard *Tiliqua scincoides* are likely to forage over the cleared parts of the site and throughout the locality in general.

Wetlands/Dams

The constructed pond and channel in the western portion of the subject site provides aquatic and semi-aquatic habitats that are likely to be used by water fowl and other birds, reptiles, amphibians and mammals for foraging, sheltering. Dusky Moorhen *Gallinula tenebrosa* and Australian Wood Duck *Chenonetta jubata*, were observed utilising adjacent ponds in Warriewood Wetlands and these and other native fauna such as Eastern Snake-necked Turtle *Chelodina longicollis*, Longfinned Eel *Anguilla reinhardtii*, Common Eastern Froglet *Crinia signifera* and Green-tree Snake *Dendrelaphis punctulatus* potentially may use this habitat type of the subject site.

6.3 Threatened Fauna Species

One threatened fauna species listed under the TSC Act was recorded on the subject site during the investigation in March 2008. A Powerful Owl *Ninox strenua*, listed as Vulnerable under this Act, was observed roosting in the eastern section of the 'Swamp Oak Forest', and appeared to be a large male (Map 4, Appendix B). In the current proposal, this area will be altered by the construction of an entrance way into the development and a local street which will require selective removal of vegetation that composes part of the fauna habitat on site.

The Powerful Owl is found in coastal areas and adjacent ranges of eastern Australia from South Australia to around Rockhampton in Queensland, generally within 200 kilometres from the coast. Within NSW, Powerful Owls are distributed throughout the length of the Great Dividing Range, which is their stronghold, and extend from the coast to the western slopes where they occur in much lower numbers. The Powerful Owl inhabits a wide range of vegetation types from wet Eucalypt forests with a Rainforest understorey to Dry Open Forests and Woodlands (DECC 2006). The species has been recorded utilising disturbed habitats such as exotic pine plantations and large trees in parks and gardens. The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes. The species breeds and hunts in open or closed sclerophyll forest or woodlands (DECC 2006).

The Powerful Owl is the largest predator of nocturnal forest-dwelling animals in Australian forests. Major prey species in NSW forests are the Greater Glider, Common Ringtail Possum, Sugar Glider, Grey-headed Flying Fox, and several species of diurnal birds, including the Pied Currawong, Magpie and Lorikeets. As most prey species require hollows and a shrub layer, these are important habitat components for the owl (DECC 2006).

It rests during the day amongst thick foliage, often grasping food-remains. The male of the species employs a slow, far-carrying 'whoo-hoo' call, more deliberate than the females call, which is higher pitched with the second note slightly higher than the first. Powerful Owls nest in a slight depression in the wood-mould on the base of a cavity in a large old tree, sometimes in excess of 25 metres above the ground. The breeding season of the Powerful Owl is highly synchronised, being strictly winter breeders. One or two young are produced, although some pairs do not breed in every year. Pairs appear to mate for life and occupy exclusive territories which range from 400-1450 hectares (DECC

2006). During the breeding season, the male Powerful Owl roosts in a "grove" of up to 20-30 trees, situated within 100-200 metres of the nest tree where the female shelters. As one individual was observed, it is highly likely that a family unit occurs in, or close to the locality.

A search of the DECC Wildlife Atlas identified 34 threatened fauna species, with potential relevance to the subject site, occurring within 10 kilometres of the site (Table 3). The list below excludes marine species.

The development proposal at 14-18 Boondah Rd, Warrriewood is connected to Fern Creek riparian corridor at the south eastern boundary of the site and adjacent to a significantly regional area at Warriewood Wetlands. Warriewood Wetlands is a natural detention basin for the surrounding creeks; it provides potential habitat for species such as the *Botaurus poiciloptilus* Australiasian Bittern.

6.4 Endangered Populations

No endangered fauna populations listed under the TSC Act were recorded on the subject site in the current investigation.

Table 3 Threatened fauna species previously recorded within the locality (10km search) on the DECCW and EPBC databases.

Scientific Name	Common Name	TSC Act Status[4]	EPBC Act Status[5]
Botaurus poiciloptilus	Australasian Bittern	V	
Ninox connivens	Barking Owl	V	
Ixobrychus flavicollis	Black Bittern	V	
Hoplocephalus bungaroides	Broad-headed Snake	E1	V
Burhinus grallarius	Bush Stone-curlew	E1	
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	
Mormopterus norfolkensis	Eastern Freetail-bat	V	
Cercartetus nanus	Eastern Pygmy-possum	V	
Puffinus carneipes	Flesh-footed Shearwater	V	
Callocephalon fimbriatum	Gang-gang Cockatoo	V	
Heleioporus australiacus	Giant Burrowing Frog	V	V
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	E
Scoteanax rueppellii	Greater Broad-nosed Bat	V	
Pteropus poliocephalus	Grey-headed Flying-fox	V	V
Phascolarctos cinereus	Koala population	E2	
Phascolarctos cinereus	Koala	V	
Myotis macropus	Large-footed Myotis	V	
Charadrius mongolus	Lesser Sand Plover	V	M
Miniopterus australis	Little Bentwing Bat	V	
Glossopsitta pusilla	Little Lorikeet	V	
Pandion haliaetus	Osprey	V	
Ninox strenua	Powerful Owl	V	
Pseudophryne australis	Red-crowned Toadlet	V	
Xanthomyza Phrygia	Regent Honeyeater	E1	E
Varanus rosenbergi	Rosenberg's Goanna	V	
Haematopus fuliginosus	Sooty Oystercatcher	V	
Isoodon obesulus obesulus	Southern Brown Bandicoot (eastern)	E1	E
Dasyurus maculatus	Spotted-tailed Quoll	V	E
Ptilinopus superbus	Superb Fruit-Dove	V	
Lathamus discolour	Swift Parrot	E1	E
Ptilinopus magnificus	Wompoo Fruit-Dove	V	

[4] CE critically endangered (Schedule 1A of the TSC Act); E1 & E2 – endangered (Schedule 1 of the TSC Act); V – vulnerable (Schedule 2 of the TSC Act).

[5] CE - critically endangered, E – endangered, V – vulnerable

7 HABITAT POTENTIAL FOR THREATENED SPECIES

7.1 Flora

Table 4 summarises the habitat potential of the subject site for the threatened flora species previously recorded as occurring within 10 km search on the DECCW Wildlife Atlas.

Table 4 Habitat potential for threatened flora species previously recorded within the locality (10km of the site) on the DECCW Wildlife Atlas

Scientific Name	Species Habitat Preference	Likelihood of Species to Occur on Subject Site
Chamaesyce psammogeton	Sand Spurge is a herb that forms mats to 1 m across and 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). Grows on fore-dunes and exposed headlands, often with Spinifex.	Low. Subject site habitat is not foredune or exposed headland.
Epacris purpurascens var. *purpurascens*	An erect shrub, 50 - 180 cm high with white or sometimes pinkish flowers. Recorded from Gosford in the north, to Narrabeen in the east and other districts. Found in a range of habitat types, most of which have a strong shale soil influence.	Nil to low. Subject site soil type not consistent with soil type of preferred habitat.
Eucalyptus camfieldii	Mostly a mallee to 4 m tall though can grow to a straggly tree to 9 m high. Bark is rough, fibrous and stringy, red or dark grey-brown and flowers creamy-white. Distribution restricted to a narrow band with the most northerly records in the Raymond Terrace Area south to Waterfall. Localised and scattered distribution includes sites at Norah Head (Tuggerah Lakes), Peats Ridge, Mt Colah, Elvina Bay Trail (West Head), Terrey Hills, Killara, North Head, Menai, Wattamolla and a few other sites in Royal National Park. Occurs in coastal areas in shallow sandy soils overlying Hawkesbury sandstone. Coastal heath mostly on exposed sandy ridges in small scattered stands near the boundary of tall coastal heaths and low open woodland of the slightly more fertile inland areas.	Nil to low. Subject site soil type not consistent with soil type of preferred habitat.
Eucalyptus nicholii	This species is widely planted as an urban street tree and in gardens but is quite rare in the wild. It is confined to the New England Tablelands of NSW, where it occurs from Nundle to north of Tenterfield, largely on private property. Grows in dry grassy woodland, on shallow and infertile soils, mainly on granite.	Low. The subject site is outside the known range of this species.
Genoplesium baueri	A terrestrial orchid with yellowish-green or reddish inflorescence 6-15 cm high, recorded from locations between Nowra and Pittwater and may occur as far north as Port Stephens. 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. Grows in sparse sclerophyll forest and moss gardens over sandstone.	Nil to low. Subject site soil type not consistent with soil type or vegetation type of preferred habitat.

Table 4 cont' Habitat potential for threatened flora species previously recorded within the locality (10km search) on the DECC Wildlife Atlas

Scientific Name	Species Habitat Preference	Likelihood of Species to Occur on Subject Site
Grevillea caleyi	A medium to tall shrub, with long spreading branches, growing to a height of up to 4 m. Restricted to an 8km square area around Terry Hills. All natural remnant sites occur within a habitat that is both characteristic and consistent between sites. All sites occur on the ridgetop between elevations of 170 to 240m asl, in association with laterite soils and a vegetation community of open forest, generally dominated by *Eucalyptus sieberi* and *Corymbia. Gummifera* and commonly found in the endangered Duffys Forest ecological community.	Nil to low. Subject site soil type not consistent with soil type or topography of preferred habitat.
Microtis angusii	A terrestrial "onion orchid" grows to 25 to 60 cm tall with green, linear cylindrical and tapering leaves. Currently only known from one site at Ingleside in the north of Sydney with habitat preference poorly defined due to the disturbed nature (modified soils and degree of weed infestation) of the only know site of occurrence.	Nil to low. Subject site soil type not consistent with soil type or vegetation type of the known location at Ingleside.
Persoonia hirsuta	The Hairy Geebung is best distinguished by its hairiness - long coarse hairs on flowers and branchlets and short stiff ones on the leaves. The Hairy Geebung has been recorded in the Sydney coastal area (subsp. hirsuta - Gosford to Berowra to Manly to Royal National Park), the Blue Mountains area (subsp. evoluta - Springwood, Lithgow, Putty) and the Southern Highlands (subsp. evoluta - Balmoral, Buxton, Yanderra and Hill Top areas). The Hairy Geebung is found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone. It is usually present as isolated individuals or very small populations. It is probably killed by fire (as other Persoonia species are) but will regenerate from seed.	Low - Medium. Subject site supports preferred soils for this species however most native vegetation has been highly modified and was not recorded on site.
Pimelea curviflora var. *curviflora*	A much-branched shrub 20 to 120cm high with hairy stems and flowers are red to yellow. Confined to the coastal area of Sydney between northern Sydney in the south and Maroota in the north-west. Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes in woodlands amongst dense grasses and sedges. It may not always be visible at a site as it appears to survive for some time without any foliage after fire or grazing.	Nil to low. Subject site soil type not consistent with soil type, vegetation type or topography of preferred habitat.
Syzygium paniculatum	The Magenta Lilly Pilly is a small to medium sized rainforest tree that grows to 8 m tall. The bark is flaky and the leaves are shiny, dark-green above and paler underneath. Plants produce white flower-clusters at the end of each branch fruits develop to a deep magenta and may be spherical or egg-shaped. The Magenta Lilly Pilly is found only in NSW, in a narrow, linear coastal strip from Bulahdelah south to Conjola State Forest. Occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. On the central coast Magenta Lilly Pilly occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities.	Low to medium. Subject site provides suitable soil and habitat nearby.

Table 4 cont' Habitat potential for threatened flora species previously recorded within the locality (10km of the site) on the DECC Wildlife Atlas

Scientific Name	Species Habitat Preference	Likelihood of Species to Occur on Subject Site
Tetratheca glandulosa	A small spreading shrub which grows 20 - 50cm in height. Stems often become entwined among other small shrubs, sedges and grasses. Flowers are pink with the flower stalk and sepals covered with dark-red gland-tipped hairs, which distinguishes T. glandulosa from other Tetratheca species. Restricted to the Baulkham Hills, Gosford, Hawkesbury, Hornsby, Ku-ring-gai, Pittwater, Ryde, Warringah and Wyong LGA's the eastern limit is at Ingleside and the western limit is at East Kurrajong. Occurs in shale-sandstone transition habitat where shale-cappings occur over sandstone, and the plant occupies ridgetops, upper-slopes and to a lesser extent mid-slope sandstone benches. Soils are generally shallow, consisting of a yellow, clayey/sandy loam. Stony lateritic fragments are also common in the soil profile on many of these ridgetops. Vegetation structure varies from heaths and scrub to woodlands/open woodlands, and open forest. Vegetation communities correspond broadly to Sydney Sandstone Ridgetop Woodland.	Nil to low. Subject site soil type not consistent with soil type or vegetation type of preferred habitat.

7.2 Fauna

Table 5 summarises the habitat potential of the subject site for the threatened fauna species previously recorded as occurring within 10 km search the DECCW Wildlife Atlas.

Table 5 Habitat potential for threatened fauna species previously recorded within the locality (10km of the site) on the DECCW Wildlife Atlas.

Scientific name	Species distribution and Habitat Preference	Likelihood of Species to Occur on Subject Site
Botaurus poiciloptilus	The Australasian Bittern occurs from southern Queensland through south-eastern Australia to Tasmania and is recorded in south western, Western Australia. In NSW the species has been observed along the east coast and in wetlands of the Murrumbidgee and Lachlan Rivers and the Murray Darling Basin. Generally sedentary, inhabiting terrestrial and estuarine wetlands with permanent water, preferring dense fringing emergent vegetation of sedges and reeds. Nests are created from trampled reeds and rushes over shallow water with a clutch consisting of 4 – 5 eggs. Feeds at dusk foraging over shallow water for frogs, fish, invertebrates and vegetation or fruit (NPWS 1999).	Medium. Suitable foraging and nesting habitat nearby in Warriewood Wetlands.

Table 5 cont' Habitat potential for threatened fauna species previously recorded within the locality (10km of the site) on the DECC Wildlife Atlas.

Scientific name	Species distribution and Habitat Preference	Likelihood of Species to Occur on Subject Site
Callocephalon fimbriatum	The Gang Gang Cockatoo is a relatively small, dark grey cockatoo. Feathers are distinctively squarish on the ends. Males have a bright red head and crest. Females have a grey head and crest and the females breast feathers are reddish – pink. The species is listed as Vulnerable in NSW and the population found in the Ku-ring-gai and Hornsby LGA's is listed as Endangered. This population is believed to be largely confined to an area bounded by Thornleigh and Wahroonga in the north, Epping and North Epping in the south, Beecroft and Cheltenham in the west and Turramurra/South Turramurra to the east. It is known to inhabit areas of Lane Cove National Park, Pennant Hills Park and other forested gullies in the area. It occurs within a variety of forest and woodland types and usually frequents forested areas with old growth attributes required for nesting and roosting purposes. Also utilises less heavily timbered woodlands and urban fringe areas to forage, but appears to favour well timbered country through which it habitually flies as it moves about. Individuals of this population are likely to move outside the 'defined' population boundary in the general area and should still be considered of this population.	Low. Minimal suitable foraging and nesting habitat on site or nearby in Warriewood Wetlands.
Calyptorhynchus lathami	The Glossy Black-cockatoo is a dusky brown to black cockatoo with a massive, bulbous bill and a broad, red band through the tail and are usually seen in pairs or small groups feeding in she-oaks. The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW. Inhabits open forest and woodlands of the coast and the Great Dividing Range. Feeds almost exclusively on the seeds of several species of she-oak particularly Black She-oak, Forest She-oak and Drooping She-oak. Is dependent on large hollow-bearing eucalypts for nest sites.	Medium. Suitable foraging habitat on site and nearby in Warriewood Wetlands. Minimal nesting habitat.
Cercartetus nanus	Adult Eastern Pygmy-possums have a head and body length of between 70 - 110 mm and are active climbers with prehensile tails. The Eastern Pygmy-possum is found in south-eastern Australia, from southern Queensland to eastern South Australia and in Tasmania. In NSW it extents from the coast inland as far as the Pillaga and to Wagga Wagga on the western slopes. Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred. Feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes and insects. Shelters in tree hollows, rotten stumps, holes in the ground, abandoned bird-nests, Ringtail Possum dreys or thickets of vegetation, (eg. grass-tree skirts) and are generally nocturnal.	Low. Minimal suitable foraging and nesting habitat on site or nearby in Warriewood Wetlands.

Table 5 cont' Habitat potential for threatened fauna species previously recorded within the locality (10km of the site) on the DECC Wildlife Atlas.

Scientific name	Species distribution and Habitat Preference	Likelihood of Species to Occur on Subject Site
Charadrius mongolus	The Lesser Sand Plover is a migratory species utilizing the eastern Australian coastline during the summer months. It stores fat supplies of 70% of its bodyweight to travel back to south east Asia for breeding in March-April. Foraging occurs along sheltered bays, mud and sand flats and estuaries. Roosting occurs within coral reefs, rock platforms and sandy shores. Diet consists of aquatic invertebrates.	Low. Minimal suitable foraging on subject site, minor areas nearby in sections of Warriewood Wetlands.
Dasyurus maculatus	The Spotted-tailed Quoll is about the size of a domestic cat with rust to dark-brown fur above, with irregular white spots on the back and tail, and a pale belly. The range has contracted and is now found on the east coast of NSW, Tasmania, eastern Victoria and north-eastern Queensland. Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Mostly nocturnal, it spends most of the time on the ground, but may also climb to raid possum and glider dens and prey on roosting birds. Prey includes gliders, possums, small wallabies, rats, birds, bandicoots, rabbits and insects and also eats carrion and takes domestic fowl. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites. Females occupy home ranges up to about 750 hectares and males up to 3500 hectares and usually traverse their ranges along densely vegetated creek lines.	Low. Minimal suitable foraging and potential den site habitat on subject site or nearby in Warriewood Wetlands.
Glossopsitta pusilla	The Little Lorikeet is the smallest of the Australian Lorikeets. The species is distributed from Cairns in QLD to Adelaide in SA. In New South Wales Little Lorikeets are occur in forests and woodlands from the coast to the western slopes of the Great Dividing Range, extending west to Albury, Parkes, Dubbo and Narrabri. The species predominately forages for nectar and pollen in the tree canopy as well as melaleucas and mistletoes.	Nil-low. Subject site does not support preferred foraging habitat.
Haematopus fuliginosus	The Sooty Oystercatcher is a large wader, reaching 50 cm in length with a bright orange-red bill, eye-ring and iris, and coral pink legs and feet and entirely black plumage. Sooty Oystercatchers are found around the entire Australian coast, including offshore islands, being most common in Bass Strait. Small numbers of the species are evenly distributed along the NSW coast. The availability of suitable nesting sites may limit populations. Favours rocky headlands, rocky shelves, exposed reefs with rock pools, beaches and muddy estuaries. Forages on exposed rock or coral at low tide for foods such as limpets and mussels. Breeds in spring and summer, almost exclusively on offshore islands, and occasionally on isolated promontories. The nest is a shallow scrape on the ground, or small mounds of pebbles, shells or seaweed when nesting among rocks.	Low. Nil to minimal suitable foraging and nesting habitat on site or nearby in Warriewood Wetlands.

Table 5 cont' Habitat potential for threatened fauna species previously recorded within the locality (10km of the site) on the DECC Wildlife Atlas.

Scientific name	Species distribution and Habitat Preference	Likelihood of Species to Occur on Subject Site
Heleioporus australiacus	The Giant Burrowing Frog is a large, slow-moving frog that grows to about 10 cm long. It occurs from the NSW Central Coast to eastern Victoria, but is most common on the Sydney sandstone geology from the coast to the Great Dividing Range. Found in heath, woodland and open forest with sandy soils the species generally lives in heath or forest and will travel several hundred metres to creeks to breed. Burrows into deep litter or loose soil, emerging to feed or breed after rain. Diet includes ground-dwelling invertebrates such as ants, beetles and spiders.	Low. Minimal suitable vegetation or soil type on site. However marginal habitat provided in Warriewood Wetlands, and species previously recorded nearby.
Hoplocephalus bungaroides	The Broad-headed Snake is generally black above with yellow spots forming narrow, irregular cross-bands and the average length is about 60 cm, with a maximum of around 150 cm. Largely confined to Triassic sandstones, including the Hawkesbury, Narellan and Shoalhaven formations, within the coast and ranges in an area within approximately 250 km of Sydney. A nocturnal species it shelters in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter and spring. Moves from the sandstone rocks to shelters in hollows in large trees within 200 m of escarpments in summer. Feeds mostly on geckos and small skinks and will also eat frogs and small mammals occasionally.	Nil to low. Minimal suitable foraging or sheltering habitat on site or in Warriewood Wetlands.
Isoodon obesulus obesulus	Southern Brown Bandicoots have a relatively short nose and ears, dark grey or yellowish brown fur on its upper body, tail and feet and a creamy white belly. The species has a patchy distribution. It is found in south-eastern NSW, east of the Great Dividing Range south from the Hawkesbury River, to coastal Victoria, south-eastern South Australia, south-west Western Australia and the northern tip of Queensland. Southern Brown Bandicoots are largely crepuscular and are generally only found in heath or open forest with a heathy understorey on sandy or friable soils. They feed on a variety of ground-dwelling invertebrates and the fruit-bodies of hypogenous (underground-fruiting) fungi. Their searches for food often create distinctive conical holes in the soil. Nesting during the day in a shallow depression in the ground covered by leaf litter, grass or other plant material. Nests may be located under Grass trees Xanthorrhoea sp. and other shrubs, or in rabbit burrows. The upper surface of the nest may be mixed with earth to waterproof the inside of the nest.	Low to medium. Subject site supports some potential foraging or nesting habitat on site and in Warriewood Wetlands.

Table 5 cont' Habitat potential for threatened fauna species previously recorded within the locality (10km of the site) on the DECC Wildlife Atlas.

Scientific name	Species distribution and Habitat Preference	Likelihood of Species to Occur on Subject Site
Ixobrychus flavicollis	The Black Bittern is a species of heron, dark grey to black in colour, with buff streaks on the throat and a characteristic yellow streak on the sides of the head and down the neck. The Black Bittern has a wide distribution, from southern NSW north to Cape York and along the north coast to the Kimberley region and in the south-west of Western Australia. In NSW, records of the species are scattered along the east coast, with individuals rarely being recorded south of Sydney or inland. Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves. Feeds on frogs, reptiles, fish and invertebrates, including snails, dragonflies, shrimps and crayfish, with most feeding done at dusk and at night. During the day, roosts in trees or on the ground amongst dense reeds. Nests, built in spring are located on a branch overhanging water and consist of a bed of sticks and reeds on a base of larger sticks.	Medium. Some suitable foraging and nesting within riparian zones on site and nearby in Warriewood Wetlands.
Lathamus discolor	Migrating from breeding grounds in Tasmania to the Australian mainland in winter Swift Parrot ranges from south-eastern South Australia across inland and coastal areas to southeast Queensland. The preferred habitat on mainland Australia is woodlands and riparian vegetation where there are winter flowering eucalypts such as the Swamp Mahogany, *Eucalyptus robusta* in coastal areas (NPWS 2002a). Breeding in Tasmania between September and February sometimes in small colonies the nest is an unlined tree hollow with three to five eggs laid. The species feeds mainly on nectar but also pollen and insects (NPWS 2003).	Medium. Suitable foraging habitat, including preferred tree species on site and nearby in Warriewood Wetlands.
Miniopterus schreibersii oceanensis	The Eastern Bent-wing Bat has chocolate to reddish-brown fur on its back and slightly lighter coloured fur on its belly. The species occur along the east and north-west coasts of Australia. Caves are the primary roosting habitat but also use man-made structures. Form discrete populations centered on a maternity cave that is used annually in spring and summer for the birth and rearing of young. Maternity caves have very specific temperature and humidity regimes and cold caves are used for hibernation in southern Australia. At other times of the year, populations disperse within about 300 km range of maternity caves. Forage in forested areas, catching moths and other flying insects above the tree tops.	Low to medium. Some potential foraging habitat on site and over Warriewood Wetlands. Low roosting and maternity cave habitat potential.
Mormopterus norfolkensis	The Eastern Freetail-bat has dark brown to reddish brown fur on the back and is slightly paler below and is found along the east coast from south Queensland to southern NSW. Occur in dry sclerophyll forest and woodland east of the Great Dividing Range and roost mainly in tree hollows but will also roost under bark or in man-made structures. Solitary and probably insectivorous.	Medium. Potential foraging and roosting habitat on site and in Warriewood Wetlands.

Table 5 cont' Habitat potential for threatened fauna species previously recorded within the locality (10km of the site) on the DECC Wildlife Atlas.

Scientific name	Species distribution and Habitat Preference	Likelihood of Species to Occur on Subject Site
Myotis macropus (formally *Myotis adversus*)	The Large-footed 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. Forage over streams and pools catching insects and small fish by raking their feet across the water surface. In NSW females have one young each year usually in November or December.	Low to medium. Potential foraging and roosting habitat on site and in Warriewood Wetlands.
Ninox connivens	The Barking Owl is a typical hawk-owl with no facial-disc and males may be up to 45 cm. The Barking Owl is found throughout Australia except for the central arid regions and Tasmania. It is quite common in parts of northern Australia, but is generally considered uncommon in southern Australia. It has declined across much of its distribution across NSW and now occurs only sparsely. It is most frequently recorded on the western slopes and plains. It is rarely recorded in the far west or in coastal and escarpment forests. Inhabits eucalypt woodland, open forest, swamp woodlands and timber along watercourses. Denser vegetation is used occasionally for roosting. Roost during the day they roost along creek lines, usually in tall understorey trees with dense foliage. Feeds on a variety of prey including insects, birds and mammals such as smaller gliders, possums, rodents and rabbits becoming important during breeding. Territories range from 30 to 200 hectares and birds are present all year. Nests are made in hollows of large, old eucalypts.	Medium. Potential foraging and roosting habitat on site and over Warriewood Wetlands. Some prey species recorded in survey.
Ninox strenua	The Powerful Owl is the largest owl in Australasia. It is a typical hawk-owl with no facial-disc. Adults reach 60 cm in length. The Powerful Owl is endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range from Mackay to south-western Victoria. In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands. Now uncommon throughout its range where it occurs at low densities. Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest and requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally in open habitats. It roosts by day in dense. Preys on medium-sized arboreal mammals particularly the Greater Glider, Common Ringtail Possum, Sugar Glider and flying foxes. Have high fidelity to a small number of hollow-bearing nest trees.	High. Species occupies a large home range, potential foraging and roosting habitat on site and over Warriewood Wetlands. Some prey species recorded in survey. Species located on-site roosting.

Table 5 cont' Habitat potential for threatened fauna species previously recorded within the locality (10km of the site) on the DECC Wildlife Atlas.

Scientific name	Species distribution and Habitat Preference	Likelihood of Species to Occur on Subject Site
Pandion haliaetus	The Osprey is a large, water-dependent bird of prey, distinctive in flight and when perched. Ospreys are found around the Australian coast line, except for Victoria and Tasmania. They are common around the northern coast, especially on rocky shorelines, islands and reefs. The species is uncommon to rare or absent from closely settled parts of south-eastern Australia. There are a handful of records from inland areas. Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water. Nests are made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea.	Low. Minimal suitable foraging or nesting habitat on site or in Warriewood Wetlands.
Phascolarctos cinereus	The Koala is an arboreal marsupial with fur ranging from grey to brown above, and is white below. The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In NSW it mainly occurs on the central and north coasts with some populations in the western region and in sparse and possibly disjunct populations along the south coast. Inhabit eucalypt woodlands and forests and feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Spend most of their time in trees, but will descend and traverse open ground to move between trees.	Nil to low. Although previously recorded nearby to the subject site the last sighting for the LGA was in 1997.
Pseudophryne australis	The Red-crowned Toadlet is an unmistakable small frog, usually measuring less than 30 mm long with distinctive reddish-orange patches, one between the eyes and one along the rump. The species has a restricted distribution and it is confined to the Sydney Basin, from Pokolbin in the north, the Nowra area to the south, and west to Mt Victoria in the Blue Mountains. Occurs in open forests, mostly on Hawkesbury and Narrabeen Sandstones inhabiting periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings. Shelters under rocks and amongst masses of dense vegetation or thick piles of leaf litter. Disperses outside the breeding period, when they are found under rocks and logs on sandstone ridges and forage amongst leaf-litter.	Low. Minimal suitable vegetation or other habitat on site or in Warriewood Wetlands.
Pteropus poliocephalus	The Grey-headed Flying-fox is the largest Australian bat. Grey-headed Flying-foxes are found within 200 km of the eastern coast of Australia, from Bundaberg in Queensland to Melbourne in Victoria. 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. Travel up to 50 km to forage and feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksias, and fruits of rainforest trees and vines.	Medium. Species occupies a large home range, potential foraging habitat on site and over Warriewood Wetlands.

Table 5 cont' Habitat potential for threatened fauna species previously recorded within the locality (10km of the site) on the DECC Wildlife Atlas.

Scientific name	Species distribution and Habitat Preference	Likelihood of Species to Occur on Subject Site
Ptilinopus magnificus	The Wompoo Fruit-dove is a large rainforest pigeon, up to 56 cm long, with a pale grey head shading into rich green back and wings. There is a broken yellow band across each wing. The breast and belly are plum-purple and the underparts are yellow. Occurs along the coast and coastal ranges from the Hunter River in NSW to Cape York Peninsula. It is rare south of Coffs Harbour. Three subspecies are recognised, with the most southerly in NSW and south-eastern Queensland. It used to occur in the Illawarra, though there are no recent records. Occurs in, or near rainforest, low elevation moist eucalypt forest and brush box forests. Feeds on a diverse range of tree and vine fruits and is locally nomadic - following ripening fruit. The nest is a typical pigeon nest - a flimsy platform of sticks on a thin branch or a palm frond, often over water, usually 3 - 10 m above the ground.	Low. Minimal suitable vegetation or other habitat on site or in Warriewood Wetlands.
Puffinus carneipes	Flesh-footed Shearwater are large blackish-brown shearwater with flesh-coloured feet. The large bill is straw coloured with a dark tip and the eyes are brown. Ranges throughout the Pacific and Indian Oceans. There are two main breeding areas in the world: one in the South West Pacific includes Lord Howe Island and New Zealand; the other along the coast of Western Australia. A marine species.	Nil to low. No suitable foraging or nesting habitat on site or in Warriewood Wetlands is absent.
Scoteanax rueppellii	The Greater Broad-nosed Bat is a large powerful micro bat. The Greater Broad-nosed Bat is found mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland. It extends to the coast over much of its range. In NSW it is widespread on the New England Tablelands. Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. The species usually roosts in tree hollows, but it has also been found in buildings. Open woodland habitat and dry open forest suits the direct flight of this species as it searches for beetles and other large, slow-flying insects; this species has been known to eat other bat species. Females congregate at maternity sites located in suitable trees.	Medium. Potential foraging habitat on site and over Warriewood Wetlands. Medium roosting habitat potential and low maternity camp habitat.

Table 5 cont' Habitat potential for threatened fauna species previously recorded within the locality (10km of the site) on the DECC Wildlife Atlas.

Scientific name	Species distribution and Habitat Preference	Likelihood of Species to Occur on Subject Site
Varanus rosenbergi	Rosenberg's Goanna reaches up to 1.5 metres in length. Rosenberg's Goanna occurs on the Sydney Sandstone in Wollemi National Park to the north-west of Sydney, in the Goulburn and ACT regions and near Cooma in the south and also occurs in South Australia and Western Australia. Found in heath, open forest and woodland. Associated with termites, the mounds of which this species nests in; termite mounds are a critical habitat component and individuals require large areas of habitat. Feeds on carrion, birds, eggs, reptiles and small mammals. Shelters in hollow logs, rock crevices and in burrows, which they may dig for themselves, or they may use other species' burrows, such as rabbit warrens. Lays up to 14 eggs in a termite mound; the hatchlings dig themselves out of the mounds.	Nil to low. Minimal suitable foraging, sheltering or nesting habitat on site or in Warriewood Wetlands
Xanthomyza phrygia	The Regent Honeyeater is a medium-sized, black and yellow honeyeater with a curved bill and mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. Birds are also found in drier coastal woodlands and forests in some years. Its range has contracted to between north-eastern Victoria and south-eastern Queensland and in NSW the distribution is very patchy and mainly confined to the two main breeding areas although in some years non-breeding flocks converge on flowering coastal woodlands and forests. The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak with large numbers of mature trees, high canopy cover and abundance of mistletoes. Non-breeding flocks are known to forage in flowering coastal Swamp Mahogany and Spotted Gum forests, particularly on the central coast. The species is a generalist forager and mainly feeds on the nectar from a wide range of eucalypts and mistletoes.	Low to medium. Potential foraging habitat and preferred feed trees on site and in Warriewood Wetlands.

8 LEGISLATION AND POLICY

8.1 *Environment Protection and Biodiversity Conservation Act* 1999

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) would only become relevant if it was considered that an impact on a 'matter of National Environmental Significance (NES)' were likely, thus providing a trigger for referral of the proposal to the Department of Environment and Heritage.

Matters of national environmental significance identified in the Act are:

- world heritage properties;
- national heritage places;
- Ramsar wetlands;

- nationally threatened species and communities;
- migratory species protected under international agreements;
- the Commonwealth marine environment; and
- nuclear actions.

The Commonwealth Government has published *Administrative Guidelines* (Environment Australia 2000) to assist in the determination of whether an action is likely to have a significant impact on a matter of NES.

No nationally threatened species, populations or ecological communities were observed in the study area. The matters of NES of potential relevance to the site include several "threatened species" and "migratory species" that have been recorded within 5 kilometres of the study area. These species include:

- Large-eared Pied Bat and Grey-headed Flying Fox (both listed as "vulnerable"); and
- Barking Owl, Swift Parrot, Black Bittern, Australasian Bittern, Little Lorikeet, Gang-gang Cockatoo, Glossy Black-Cockatoo, Little Bentwing-Bat, Eastern Bentwing-Bat, Southern Myotis, Spotted-tailed Quoll, Powerful Owl

Several significant migratory species are also identified within this area include;

- Lesser Sand Plover, White-bellied Sea Eagle, White-throated Needletail, Satin Flycatcher, Rufous Fantail and Regent Honeyeater. These species are nomadic to migratory and are rarely recorded in the Sydney metropolitan area. Whilst individuals of these species could occur on or over the site on occasion, they are not likely to nest on the site or permanently inhabit the site, owing to a lack of suitable nesting sites and their nomadic habit.

The consideration of the proposed activities on the threatened species identified within the 5km of the subject site is detailed within the fauna habitat table and the *Test of Significant* (Appendix C). A list of Key threatening processes relevant to the subject site is as follows;

- Land clearance;
- Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants;
- Predation by European red fox; and
- Predation by feral cats.

8.2 *Environmental Planning and Assessment Act* 1979 (EP&A Act) and *Threatened Species Conservation Act* 1995 (TSC Act)

Any proposal for the site should be assessed in accordance with the *Environmental Planning and Assessment Act 1979* and the *Environmental Planning and Assessment Regulation 2000*. The Act institutes a system for environmental planning and assessment, including approvals and environmental impact assessment. This project has been declared a major project, and will be assessed and approved under Part 3A provisions, rather than under Part 4 or Part 5 of the EPA Act. The Planning Minister is the consent authority. The site is located within the Pittwater local government area and the relevant local government control is the Pittwater Local Environmental Plan 1993, although as stated Council does not have a consent role. The need for further approvals related to the environmental planning instruments considered below is at the discretion of the Minister.

The *Threatened Species Conservation Act 1995* provides for the protection of all threatened plants and animals native to NSW and their habitats (including endangered populations and ecological communities, and their habitats). The TSC Act provides for the listing of species, populations and ecological communities considered to be threatened in NSW. Schedule 1 of the TSC Act contains listings of endangered species, populations and ecological communities, and Schedule 2 of the TSC Act contains listings of vulnerable species.

Section 5A (s.5A) of the *Environmental Planning & Assessment Act 1979* (the so called '7-part test') lists seven factors that "must be taken into account" by a determining authority in the administration of Sections 79C of the Act when considering a development. The aim of s.5A is to determine "whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats", as listed under Schedules 1 and 2 of the TSC Act, and hence whether a *Species Impact Statement* (SIS) is required for the action. As seven species and two EEC's listed under the TSC Act, the Swamp Oak Floodplain Forest / Swamp Sclerophyll Forest Intergrade, s.5A assessments have been completed for the current proposal and are attached in Appendix C. Four of the species were also listed as nationally threatened species under the *Environmental Protection and Biodiversity Conservation Act* and the Significant Impact Assessment was required. These are available within Appendix D.

A list of key threatening processes under the TSC Act relevant to the subject site;

- Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands
- Clearing of native vegetation
- Competition from feral honey bees (*Apis mellifera*)
- Invasion and establishment of exotic vines and scramblers
- Invasion and establishment and spread of *Lantana camara*
- Loss of hollow-bearing trees
- Predation by the European red fox (*Vulpes vulpes*) & feral cat (*Felis catus*)
- Competition and grazing by the feral European rabbit (*Oryctolagus cuniculus*)
- Removal of dead wood and dead trees

8.3 Water Management Act 2000

The former *River and Foreshore Improvements Act* 1948 has been repealed and replaced by the *Water Management Act* 2000 (The WMA) in NSW. The WMA aims to provide for sustainable and integrated management of water sources within NSW for the benefit of present and future generations.

To carry out works in, on or under waterfront land a 'controlled activity' approval is required from the NSW Dept of Water and Energy (formerly DIPNR) under Part 3 Section 91 of the WMA. The definition for a 'controlled activity' includes the "erection of a building or the carrying out of work" in, on or under waterfront land. However, no approval is required as the project is to be assessed under Part 3A of the EP&A Act. Guidelines for the riparian zone, developed in relation to this Act will be considered where relevant.

8.4 SEPP 19 – Bushland in Urban Areas

State Environmental Planning Policy No.19 - Bushland in Urban Areas (SEPP 19) aims to, amongst other things, "protect and preserve bushland" within the urban areas of Sydney (Department of Planning 1986). The policy applies where natural vegetation remains or vegetation representative of the structure and floristics of natural vegetation exists.

As the proposed development within the subject site adjoins bushland zoned or reserved for public open space purposes, the clearing of vegetation must consider the objectives of SEPP 19.

Any future proposed development should be designed to be sensitive to the urban bushland values of the subject site and adjoining land. This includes limiting the extent of clearing of vegetation, and considering the erosion of soils and the spread of weeds and exotic plants into surrounding areas.

8.5 SEPP 44 – Koala Habitat Protection

State Environmental Planning Policy No.44 - Koala Habitat Protection (SEPP 44) aims to protect the Koala and its habitat by incorporating prescriptions for consent authorities to consider during the assessment of development applications. SEPP 44 contains prescriptions for the consideration of "potential koala habitat" and "core koala habitat" for developments within Local Government Areas listed on Schedule 1 of the Policy. Pittwater LGA is listed on Schedule 1 as an area to which SEPP 44 applies.

"Potential koala habitat" is defined by SEPP 44 as "areas of native vegetation where the trees of types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component". One tree species listed under Schedule 2 of the Policy as Koala "feed tree species", Swamp Mahogany *Eucalyptus robusta*, was recorded on the subject site during previous field surveys. This species occurred occasionally on the site, and did not constitute a major component of the canopy within the Cleared and Disturbed plant community. As such, 15% or more of the total number of trees in the canopy stratum of the Cleared and Disturbed plant community or the subject site are "feed tree species" and hence the site does contain "potential koala habitat", as defined under SEPP 44.

In further consideration of the SEPP 44, "Core koala habitat" is defined as areas of land that contain "a resident population of koalas, evidenced by attributes such as breeding females and recent sightings of and historical records of a population". There is no evidence (such as sightings, calls, scats and fur) that the study area supports a resident population of the Koala and there is no evidence in general of koala activity. Hence, the site does not constitute "core koala habitat", within the meaning of SEPP 44.

On this basis, the provisions of Clause 9 of SEPP 44 do not apply to the proposed activity. A *Koala Plan of Management* is not required to be prepared as part of the proposal.

8.6 Pittwater LEP 1993

The Pittwater LEP aims to incorporate the relevant provisions of the Warringah LEP 1985 into an LEP for the area of Pittwater. It sets out development control within specified zones within the area. The subject site is zoned 2 (f) Urban Purposes – Mixed Residential under this LEP.

8.6.1 Pittwater 21 DCP

The Pittwater 21 Development Control Plan (P21 DCP) describes development controls for land within the Pittwater LGA. Part B4 describes various controls which apply to land which has been classified as Category 1, 2 or 3 and/or wildlife corridor. The land within the subject site is classified as containing a Flora and Fauna Enhancement Area (Category 2) and a Wildlife Corridor as part of the Warriewood Wetlands. As such, section B4.4 controls apply to this land. Controls include buffering wildlife corridors, retaining and enhancing habitat for threatened species, populations and communities, and ensuring that 60% of the open areas are to maintain native vegetation. Section B4.14 also applies to this land as the development is in the vicinity of wetlands. Controls include appropriate disposal of stormwater and wastewater, provision of an adequate buffer to wetlands, maintenance of wildlife corridors and ensuring that 80% of landscaping species are locally native.

Part C of the DCP describes controls for specific aspects of the land release areas in the Warriewood Valley. The land within the subject site contains a Core Riparian Zone and creekline buffer strip areas and as such sections *C6.7 Water Management and Creekline Corridors* and C6.13 *Landscaped Amenity Buffer Strips* controls apply to this land. These controls are further described below in Section 10.1.

9 IMPACT ASSESSMENT

9.1 General

The site may be described as a remnant rural/semi-rural landscape that has been subject to a history of anthropogenic disturbance and agricultural land use. The vegetation and habitats present have been substantially altered by human occupation and land use over a number of decades. As a consequence, the majority of the site contains very limited natural resources and supports a low diversity of native flora, fauna and their habitats.

The proposed residential development requires the clearance of vegetation predominately contained within Cleared and Disturbed areas and areas of Poplar Forest (Map 2, Appendix B) requiring the use of medium to heavy plant and equipment. These areas generally have a low to moderate habitat value as they provide limited shelter and foraging resources for native fauna that may occur within the study area. The soil profile in these areas is likely to have been greatly disturbed in the past.

The impact of urbanisation is well known, it the clearing of land has been attributed to causing fragmentation and isolation of many habitats. The clearing of native vegetation is listed as a key threatening process for the decline in many fauna and flora species. The affects of urbanisation and the impacts on the regionally significant Warriewood Wetlands in the adjacent site has been considered within the following assessment, and safeguards developed to reduce the potential impacts to flora and fauna of the locality, and the adjoining wetland habitat.

The proposed residential development requires the clearance of vegetation predominately contained within Cleared and Disturbed areas and areas of Poplar Forest. In addition, a small portion of 'Swamp Oak/Swamp Sclerophyll Forest', listed as an EEC under the TSC Act, in the south east of the site near Boondah Road is also to be modified for the construction of an entranceway, internal roadways, and some dwellings. Vegetation directly impacting the entranceway will be unavoidably cleared and a small grove of the 'SOF' will be retained to provide limited sheltering and foraging resources.

The vegetation forms a buffer between the Warriewood Wetlands connection and the residential dwellings. It also provides valuable substrata for the dispersal of fauna species between Boondah Road and the wetlands. As stated, the current designs have included protection of remnant trees and revegetation in this area will occur to reduce the potential fragmentation and isolation of Warriewood Wetlands with possible habitat in the adjacent sites. The significance of the selective removal of this relatively small area of vegetation is considered further in this report, and the presence of larger better quality examples of this community and its habitats nearby in the Warriewood wetlands is acknowledged. The development will include the creation and maintenance of creekline and wetland buffer zones and the predominant use of native plant species within landscape zones that will improve the fauna habitat values of the site over time.

Other potential direct and indirect impacts from the proposal include habitat fragmentation, weed infestation, alteration of ground water flows, overshadowing, creation of asset protection zones and edge effects. These issues are further discussed below, and impact mitigation measures have been proposed where there is a potential risk to the flora and fauna, and their habitats, occurring within the study area.

9.2 Flora

Whilst the proposed residential development of Lot 20 would involve the removal of areas of existing vegetation from the site, most of that proposed to be removed comprises exotic species which is of little or no conservation value. The vegetation to be removed comprises mainly paddocks of exotic grassland, stands of planted White Poplar and exotic horticultural plantings within existing gardens. The *Arboricultural Assessment/Vegetation Management Report* (TALC 2008) determined that the majority of the 749 trees located within the site to be affected (i.e. removed) occur within the Poplar Forest. The majority of trees proposed to be removed from the site comprise exotic species, including Populus *deltoids* Poplar*, Pinus radiata* Radiata Pine and *Erythrina x skyesii* Coral Tree.

No threatened flora species or populations listed under the TSC Act were recorded on the site during field investigations. Given the highly altered state of the site, no threatened plant species are likely to be adversely affected by the proposal. Native tree species located within the development footprint requiring removal include three *Angophora costata* Sydney Red Gum, one *Eucalyptus botryoides* Bangalay and five *Callistemon viminalis* Weeping Bottlebrush (TALC 2008).

Several *Casuarina glauca* Swamp Oaks have also been identified as requiring removal for the purpose of road construction and to allow for proposed flood storage requirement (TALC 2008). These trees predominately occur within the area mapped as a 'Swamp Oak Forest' intergrade by TEC (2008). The current proposal should aim to retain and rehabilitate as much of the remnant vegetation as possible in this area to form a vegetated link through the site between Warriewood Wetlands and Boondah Road and further into the Sydney Water Sewage Treatment Plant site. The current plans aim to retain a small grove of remnant native vegetation between the Warriewood Wetlands junction and the proposed entrance at Boondah Road. A Core Riparian Zone and surrounding buffer zones are required to safeguard Fern Creek and Warriewood Wetland water quality and filter sediments. The impact of the development on the 'Swamp Oak Forest' has been assessed (Appendix C) and it has been concluded that the removal of a small area of vegetation is unlikely to result in a significant effect on the 'Swamp Oak Forest' EEC.

In order to mitigate potential impacts on native trees to be retained, predominately *Casuarina glauca* Swamp Oak, the *Arboricultural Assessment/Vegetation Management Report* (TALC 2008) describes in detail the protections measures that should be implemented prior to and during construction works. Briefly, these measures include;

- establishment of Tree Protection Zone (TPZ) fencing encompassing several trees where possible;
- installation of siltation fencing to the extremities of TPZ fencing;
- boardwalk piers in or near a TPZ to be dug by hand or light machinery;
- any excavation for construction within a TPZ is to be monitored by the consulting Arborist; and
- no material storage or stockpiling within TPZs.

Provided these protection measures are implemented, potential adverse effects on trees to be retained as a result of development of the site are not expected to be significant.

The creation of a new 'edge effect' interface is likely following the clearing of the Poplar plantation for the construction of residential dwellings and internal road structures. Edge effects tend to occur within a transitional zone between two opposing habitats, and impacts may include increase in sun, rain and wind exposure on core vegetation. The edge effect will hopefully be reduced from that currently occurring on the site as the proposed riparian zones includes buffer areas designed to mitigate edge effects to the core riparian zones.

The proposed development includes the rehabilitation of remnant vegetation through regeneration, revegetation and weed control measures. The risk of weed infestation and impact of greater exposure to the elements are short-lived with the establishment of a healthier habitat, and construction activities will be excluded from the riparian zones to be created. The impact on Warriewood Wetlands is difficult to assess, however, given the 50m vegetated riparian buffer zone, it is unlikely that edge effects will significantly impact the wetland habitat, and if fact are expected to be reduced in relation to the existing situation. By creating and maintaining this zone the potential spread of weed is reduced and will assist in connectivity within and between the adjoining sites.

The proposed residential buildings have the potential to alter the vegetation retained within the riparian zones due to overshadowing. Overshadowing reduces the likelihood of plants establishing and the suppression of plant growth through the obstruction of the sunlight by buildings. This risk has been considered by review of the shadow diagrams, although these have only been prepared to date for the Stage 1 proposal. Stage 1 will not result in a significant impact to remnant native vegetation or the proposed riparian zones from overshadowing. For Stage 2, while the risk is higher during the morning daylight hours, the main areas at greater risk of overshadowing are not contained within the riparian buffer zones but within the Asset Protection Zone. The APZ is a combination of sparse vegetation, paths and road structures where overshadowing will have less impact, however following construction

the impacts of overshadowing upon the remnant native vegetation and riparian zones should be monitored and the revegetation strategy altered if required.

9.3 Fauna

The proposed development of the site will reduce the availability of those resources and habitats that are commonly associated with rural and semi-rural landscapes. This will have minor adverse effects on some of the locally occurring fauna that utilise the rural-urban land interface. The majority of these species are unlikely to be significantly affected by the proposal, as they are considered common within their range, widespread in distribution and tolerant of urban development and disturbance.

The proposed development requires the removal of the majority of the vegetation occurring across the subject site, mainly consisting of exotic trees, noxious and environmental weeds. The proposal also includes substantial landscapes areas that will support a variety of revegetating native tree and shrub species that will offer improved foraging, nesting, sheltering and roosting habitat for some fauna species in the future.

Forty trees were identified from the Poplar Forest and Cleared and Disturbed Areas as supporting potential fauna habitat features such as hollows, cavities and cracks (TALC 2008). The removal of Poplar trees from the central parts of the site may affect the life cycles of the arboreal fauna recorded in some of these trees, including the Common Ringtail Possum and Common Brushtail Possum and will reduce the availability of nesting sites for birds and arboreal species at this location. Provided that appropriate precautions are adopted prior to and during construction such as pre-clearing surveys, these adverse effects can be minimised. The installation of nest boxes for birds and arboreal mammals elsewhere within the site may offer alternative nesting and sheltering habitat to these species. These species and the majority of other fauna species identified from the subject site are considered common to abundant within urban areas in the locality and the habitats found on the site are not unique or restricted in the area. Consequently, potential adverse effects on these species as a result of development of the site are not expected to be significant, and these species should recolonise parts of the site once native vegetation has established within planted areas.

Due to the degraded nature of the community, the species recorded utilising it, the area of adjoining higher quality habitat in the Warriewood Wetlands, retention of remnant vegetation community in the riparian area, and the restoration measures proposed in this report for retained areas, a significant impact to threatened fauna species is not expected to result from the proposal. This has been based on the conclusions contained in the Assessments of Significance in Appendix C, namely that the current proposal is unlikely to result in a significant effect on threatened biodiversity recorded from the study area. Similarly, the current proposal is unlikely to result in a significant effect on the long term survival or habitats of any protected native flora and fauna occurring on the site, in the locality or the region. The current proposal is also unlikely to significantly add to the cumulative effects in the operation of any Key Threatening Process listed in Schedule 3 of the TSC Act.

The ‘SOF, vegetation retained off Boondah Road is at risk of degradation subsequent to the reduction in the size of the stand. Greater exposure to fragmentation, weed infestation and edge effect conditions is expected. The vegetation will be retained in order to maintain fauna movement between sites and as a precaution against fauna isolation. The corridor, while not considered to be critical to the survival of fauna species, has been highlighted for retention where possible, and supplementary planting of native species in this area will help to restore the quality of the corridor subsequent to the initial impacts of clearing.

The Guidelines for Asset Protection Zones by the NSW Rural Fire Service state that the canopy width between trees must amount to a distance of greater than 2m. The Guidelines also highlight the dangers of continuous vegetation and the elevated spread of bushfire. Under the NSW Rural Fire Service recommendations the Inner Protection Area (IPA) contains areas of semi-impermeable tracks and a reduction in fuel load and exotic weeds. The Asset Protection Zone (APZ) vegetation designs have included grasses and canopy trees in a 15% canopy for the IPA and a 30% cover canopy for the 10m Buffer Zone, which equates to the Outer Protection Area (OPA). Canopy vegetation assists in the dispersal and foraging of fauna arboreal species. The reduction on the canopy cover will slightly impact the fauna opportunities, however, optimal habitat within the riparian zone is still available.

Connectivity of vegetation is preserved through the protection of the riparian corridor adjacent to Fern Creek. Core and Vegetated Buffer Zones under the *Water Management Act 2000,* for proposed works within the riparian zone has increased the Pittwater Council previous recommendations. A 20m Core Riparian Zone and additional 10m Vegetated Buffer Zone at the western corner is essential for the protection against fragmentation of Fern Creek riparian corridor. Plans to rehabilitate the creek will assist in the connectivity of the vegetation with adjacent vegetation strata.

Impacts to the 'Swamp Oak Forest' adjacent to Boondah Road cannot be avoided due to the footprint of the current proposal. This will reduce the extent of habitat available for fauna species, and this is an area of the site where the Powerful Owl *Ninox strenua* species was located during the March 2008 survey. An additional grove of 'Swamp Oak Forest' will remain within this area to preserve the level of connectivity and establish a vegetated buffer zone against surface water runoff directly into Warriewood Wetlands. The proposal will include regeneration and revegetation of the endangered ecological community. The impact from the removal of vegetation has been assessed (Appendix C) via the 7-part test, which concluded that the current proposal is unlikely to result in a significant effect on threatened biodiversity recorded from the site. Habitat for this species is found within areas adjoining the site, and the restoration activities as part of the proposal will provide additional habitat for this species in the future, once the planting areas have established.

To off set the clearing of habitat within the Poplar plantation large canopy provenance species are incorporated in the landscape design. *Eucalyptus robusta* Swamp Mahogany and *Angophora costata* Sydney Red Gum are included along the Macpherson St interface. *E. robusta* is a significant feed tree for two endangered species the Swift Parrots and the Regent Honeyeater. The preparation of a Vegetation Management Plan is proposed, and this will detail the appropriate selection of plant species that will provide future habitat resources for fauna species, including threatened fauna species within the locality.

9.4 Wetland

The proposed development of the site may indirectly impact the adjacent Warriewood Wetland. The boundary of the wetland was assessed in detail during the 2004 assessment (TEC 2004) and it was concluded that the distance of the wetland boundary from the subject site varies from approximately 6.8 metres to 29.8 metres to the south and west of the site boundaries respectively. This wetland boundary line is included on the design plans for the proposal.

The establishment of the 20 metre-wide Core Riparian Zone, followed by the 10 metre-wide buffer zone, and additional 15 metres comprising an Asset Protection Zone (IPA), results in an effective wetland buffer width that varies from 57-80 metres. This is considered ample in order to effectively buffer direct impacts from the proposal. With the implementation of sufficient water and wastewater strategies and the installation of effective erosion and sediment controls during the construction phase, this buffer should also be ample in providing an effective buffer to indirect impacts as well.

Some migratory and regionally significant avian species are known to utilise the wetlands on periodic occasions. Consideration of construction activities and the potential impacts to arrival of significant birds to the wetlands needs to be considered as part of the Stage 2 works and the riparian zone restoration. Monitoring of the 'Swamp Oak Forest' for the presence of nesting by threatened birds during the breeding season is recommended, particularly the Black Bittern (December – March).

The Sediment and Erosion Plan explicitly outlines the appropriate measures taken during the proposed construction to reduce impact on water quality within Fern Creek and Warriewood Wetlands. Precautionary measures during the initial construction stage include the installation of the temporary rock check dams, sediment fences and the bio-retention basins. Sheet water runoff is diverted into sediment basins through sediment fences, while concentrated surface water runoff is reduced by the rock check dams. Surface water is filtered through a series of controls including the sediment and barrier fences prior to entering the wetlands.

As surface water runoff may potentially contain large quantities of sediment and chemicals, two bio-retention ponds and an overland flowpath has been included within the design of the site. An overland

flowpath at the western boundary of the site is designed to assist in reducing the flow of water and sediments. Water is then leeched out of the system through porous soils and vegetation.

Bio-retention ponds at the south of the site are located within the Asset Protection Zone more specifically within the Inner Protection Area. The basins act as a filtering system discharging cleaner water than the inflow, and provide potential habitat capacities. A combination of planted sedges, rushes and grasses and sand filtering will reduce the velocity of storm water runoff and remove large sediments.

The movement of ground water is from the north east across the site and drains towards Fern Creek and the wetlands at the south west boundary. The subject site has a downslope aspect of 1^0C and characteristics of a shallow groundwater table (Jeffery and Katauskas Pty Ltd 2009). The proposed construction for the underground car parks and building foundations involves cutting through the bedrock, therefore intercepting groundwater flows. The proposed design includes a groundwater collection and diversion system that will act to intercept flows on the high side of the development, diverting the groundwater through a series of subsoil drains under the construction, and then disperse it below ground towards the wetlands. The Hydrogeological Report confirms the drainage structures are capable of transporting intercepted groundwater around the development and discharging it back into the water table at a similar volume and depth as the existing situation. Obstruction of groundwater from the construction, according to the report should be negligible and the impact or changes to the hydrological regime into Warriewood Wetlands, and the associated vegetation communities not considered to be significant. Water quality and flow is expected to remain consistent with current flows. Regular monitoring will assist in the management of the ground water and wetlands.

Fern Creek and the Warriewood Wetland rehabilitation is a high priority restoration area. Activities include widening of the creek, installation of erosion control measures such as rock armouring, and revegetation of the corridor following weed control works. Short-term impacts of possible sedimentation into the riparian corridor and Warriewood Wetlands can be minimised through the installation of mitigation controls outlined within this report and the proposed stormwater management system designs.

10 ENVIRONMENTAL MANAGEMENT AND RECOMMENDATIONS

10.1 Buffer Zones and Landscaping

The Warriewood Valley Urban Release Area: Landscape Masterplan and Design Guidelines (Pittwater Council, 2007) has been created in order to assist in the planning and design of the streetscape, open space and creeklines through the development of the release areas within the Warriewood Valley. This Masterplan builds upon previous planning controls for the area including DCP No 9 and No 29, Pittwater 21 DCP, Section 94 Plan and the Roads Masterplan. The concept Masterplan includes Lot 20, Boondah Rd where landscaping has been designed to include buffer zones that will protect Fern Creek, that passes along the western boundary of Buffer Sector 3, and Warriewood Wetlands that are located in proximity to the southern boundary of the site.

A proposed shared bicycle/pedestrian path meanders through the western, southern and south-western boundaries of the subject site. As a result, it occurs in all zones described below at some point. This path will link within similar paths on adjoining land in Sector 11 and within the Warriewood Wetlands and will comprise a raised boardwalk. The *Arboricultural Assessment/Vegetation Management Report* (TALC 2008) recommends that boardwalk piers required to be installed within or near TPZs in any zones to be dug by hand or light machinery and that any excavation for construction within a TPZ is to be monitored by the consulting Arborist. This will minimise potential damage to the root zones of trees to be retained. Due to the raised nature of the boardwalk, it is highly unlikely that this shared bicycle/pedestrian path will impede current surface flows, restrict fauna movement or contribute to sedimentation or erosion to the creek.

Public Riparian Zone

The Public Riparian Zone is 50m and consists of two inner 25 metre-wide (measured from the top of the creek bank) "multi-function corridor" located on either side of Fern Creek. This buffer is required under the P21 DCP Section C6.7 and will be protected and managed in accordance with the specifications of P21 DCP. This 50 metre-wide multi-function corridor is to be dedicated to public ownership under Council control. Rehabilitation works within this area will be carried out by Council and will involve substantial reconstruction of the creek profile, the construction of new creek banks, and possibly re-alignment of the creek. Weed infestations and exotic trees will be removed and erosion controls installed. The retention of native trees within this Zone, predominately *Casuarina glauca* Swamp Oak (TALC 2009, Landscape Direst 2008) will be supplement by the introduction of indigenous plant stock along the riparian zone of the creek, which will create a dense narrow band of native vegetation linking other areas of bushland to the Warriewood Wetlands.

Private Buffer Strip

The 25 metre-wide Private Buffer Strip will directly adjoin the Public Riparian Zone (Map 3, Appendix B), so called as it will remain in private ownership. This buffer strip will be rehabilitated and will contain open space areas, landscaped gardens and a shared bicycle/pedestrian path. Native species to be planted within this buffer strip may include *Acmena smithii, Backhousia myrtifolia, Casuarina glauca, Eucalyptus robusta, Ficus rubignosa* and *Livistonia australis.* Once established, many of these species will offer foraging, nesting and roosting habitat to common, protected and threatened fauna species.

Core Riparian Zone (CRZ)

The CRZ comprises a 20 metre-wide vegetated buffer along the southern boundary of the site, as requested by Pittwater Council (from the pre Development Application meeting for the previous proposal held on the 17th March 2008). Riparian zones support many important ecosystem functions, including stabilising stream banks, minimising sedimentation and nitrification of the stream, providing flora and fauna habitat and connectivity between areas of fauna habitat (DWE 2008). Ultimately, a CRZ should comprise "fully structure native vegetation (including groundcovers, shrubs and trees)", necessary components in the maintenance of these many functions.

Some native trees will be retained within this Zone, predominately *Casuarina glauca* Swamp Oak (TALC 2009, Landscape Direst 2008). Rehabilitation of this zone will largely comprise removal of environmental and noxious weeds currently occurring in high densities in places. The removal of weeds will allow for the regeneration of native species from the soil seedbank, supplemented by revegetation where necessary.

10m Buffer Zone

The 10 metre-wide buffer zone will be established along the southern boundary of the site, to directly adjoin the CRZ to the north. This buffer is to protect the boundary of Warriewood Wetland and is referred to under the Pittwater 21 Development Control Plan (P21 DCP) Section B4.14. This buffer was negotiated between Council and the former DIPNR (now DECCW) in 2003 and is to be maintained in the current proposal (as requested by Pittwater Council in the pre Development Application meeting for the previous proposal held on the 17th March 2008).

The 10m buffer zone is also contained within the larger Asset Protection Zone. As a result, canopy cover cannot exceed 30%. The understory is to consist of managed grasslands, low growing shrubs and groundcovers. Tree species proposed to be planted include *Acmena smithii, Acmena smithii, Backhousia myrtifolia, Ficus rubignosa* and *Livistonia australis.* Shrubs proposed to be planted include *Bauera rubiodes, Callistemon citrinus, Cyathea australis, Leptospermum juniperinum* and *Melaleuca linarifolia.* Proposed ground species will comprise sedges, rushes and groundcovers such as *Carex appressa, Dianella caerulea, Gahnia sieberana, Isolepis nodosa, Lomandra longifolia* and *Juncus usitatus.*

Asset Protection Zone (APZ)

The APZ will be established along the southern boundary of the site which will comprises the 10m Buffer Zone and an additional 15m Inner Protection Zone (IPZ). This is a requirement of the Rural Fire Service (RFS) as the site has been identified as bushfire prone land. Whilst care will be taken to ensure planting in this zone do not create a fire path to infrastructure or dwellings, vegetation will predominately consist of managed grasses with a tree canopy of no greater than 15% cover.

10.2 General Measures

10.2.1 Environmental Management Measures to be implemented before and during Construction

- Inspection (by a qualified biologist) of hollow-bearing trees and dense shrub thickets for fauna habitation, prior to their felling and removal. Where animals are located, they would be carefully released at the time, or captured for later release. Captured animals would generally be released into the edges of the Warriewood Wetlands at dusk, and injured fauna would be transferred to the care of WIRES;
- The retention of hollow-bearing trees and native trees, as far as possible. This may possibly includes several Poplars located in the southwestern and southern parts of the site. Trees identified for retention will be inspected by a qualified arborist to assess their safety, longevity and suitability for retention within a future residential subdivision. The Poplars would only be retained in the short term as an interim measure, and if it is considered that their retention would result in less impact than having to return and remove them at a later date as they continue to senesce and become unsafe. Under Section B4.4 of P21 DCP there is to be no net loss of native canopy trees as a result of the development;
- Installation of nest boxes of varying sizes within retained vegetation in close proximity to previous Poplar plantations;
- Seed collection and establishment of provenance species suitable for use in the revegetation works;
- Installation of temporary exclusion fencing along the outer boundaries of the buffer zones, including the 10m Buffer Strip, Public Riparian Zone and remnant native vegetation areas, prior to construction. Appendix 4 of P21 DCP addresses the protection of existing vegetation, and states that "The existing vegetation, to be retained, should be protected from root compaction, root, trunk and limb damage, soil contamination and changes in surface level that may affect the health of each specimen. Protection measures are to be installed prior to the commencement of any earthworks. It is suggested that a manproof chain wire fence be erected 1 metre beyond the dripline of each specimen for the full circumference of all vegetation to be protected";
- Preparation of a Vegetation Management Plan (VMP), demonstrating the "the protection of the adjoining Fern Creek, Warriewood Wetland and riparian corridor in respect of the Stage 1 proposal and the Concept Plan", in accordance with the Director General's requirements. The VMP should include a description of proposed regeneration, rehabilitation and restoration methodologies, planting layout and densities, including a list of appropriate species for use in revegetation in any rehabilitation areas and provide a maintenance program for a minimum period of 2 years after the completions of works, including monitoring and reporting responsibilities;
- The retention of all mapped 'Swamp Oak Forest' (except for the area proposed for removal) should occur, and areas that will be impacted indirectly should be minimised. The retention of the 'Swamp Oak Forest' vegetation adjacent to the proposed buildings close to Boondah Rd may require additional bushfire protection measures are incorporated into the building design in addition to APZ to achieve a satisfactory level of protection to residents, emergency workers and buildings in the event of a fire. Native canopy species in this area should be retained in particular;

- All stands of 'Swamp Oak Forest' adjacent to the development footprint that will be retained will be protected by erecting temporary man-proof exclusion fencing during construction in accordance with the Arborists recommendations;
- Monitoring of retained stands of 'Swamp Oak Forest' and the riparian zones for the presence of threatened birds species during their breeding season that may nest within this type of habitat. This would include *Ixobrychus flavicollis* Black Bittern.
- A program of weed control and bush regeneration should be implemented for all conservation areas to be retained on-site, with preference to areas of 'Swamp Oak Forest' and riparian zones, in accordance with the approved management plan to enhance the quality of the remaining vegetation;
- Revegetation of the proposed buffer zones along the southern and western boundaries with locally indigenous plant species. Species selection will be based on a achieving a target community similar in structure and diversity to the 'Swamp Oak Forest' Complex community. Appropriate and inappropriate species are listed in the Appendices of P21 DCP;
- Revegetation within the 25 metre Asset Protection Zone must be designed so that the function of the APZ is not compromised by the landscaping works. This will require careful selection of species, creation of gaps in the canopy and separation of the ground and canopy fuel layers. The on-going management of this zone will be required;
- Landscaping around the entrance way at Boondah Road, and in the other areas of the development that required removal of 'Swamp Oak Forest', (the south eastern section of the site) should consist of species diagnostic of this community.
- The DCP specifies requirements for 80% of landscaped species to comprise locally native species (Section B4.14), and 60% of the area not covered by buildings to comprise native vegetation (Section B4.4). The program will include the control or removal of noxious weeds in accordance with the *Noxious Weeds Act 1993.* Planting of native canopy species can be used in order to insure there is not net loss of native canopy species as required under Section B4.4 of the P21 DCP. All plantings are to maximise linkages to the wildlife corridor identified (Section B4.4 and B4.14);
- The location of material stockpiles and vehicle parking areas must be on already cleared and disturbed land, well away from vegetation to be retained on the site and the boundary close to the wetlands;
- Chipping of felled trees and other vegetation (excluding noxious or invasive weeds) from the site for use as mulch in rehabilitation works is recommended;
- Installation of appropriate erosion control measures during the construction phase of the development (eg silt fences, sediment ponds etc), to protect terrestrial habitats on-site and wetland habitats downslope of the site. These will conform to *Managing Urban Stormwater - Soils and Construction* (NSW Department of Housing 1998), and will be maintained throughout the construction period.
- Management of stormwater, wastewater and runoff as per the P21 DCP and design plans in relation to the sites proximity to a significant wetland; and
- Management of construction materials, fuels and wastes should be controlled to minimise the potential for any discharge of chemicals or contaminants (such as concrete or other building materials) impacting upon adjacent areas of native vegetation or waterways.

10.2.2 Environmental Management Measures to be implemented before Occupation

- All temporary exclusion fencing along the buffer strip, creekline corridor areas, and remnant native vegetation is to be replaced with permanent fencing (that is fire proof and allows for the passage of fauna) upon completion of construction to prevent human and vehicle access in order to protect these areas;
- The program of weed control and bush regeneration in all conservation areas retained on-site is to continue, with preference to areas of 'Swamp Oak Forest' and the riparian zones, in

accordance with the approved management plan to enhance the quality of the remaining vegetation;

- Material stockpiles and vehicle parking areas that have been created on site are to be removed and made good upon completion of the construction works;
- Non-permanent erosion control measures (e.g. silt fencing, sediment ponds) implemented during the construction phase of the development are to be carefully removed following completion and stabilisation of the works; and
- Management of stormwater, wastewater and runoff will continue as per the project design and P21 DCP in relation to the sites proximity to a significant wetland.

11 CONCLUSION

As previously reported, no threatened species, populations, or ecological communities or their habitats were identified on the site during the 2003 study. This previous report noted that despite this absence it was 'theoretically possible that mobile, nomadic or migratory threatened species could occur on the site on a temporary or occasional basis, including several threatened birds (*eg* the Swift Parrot, Regent Honeyeater, or Powerful Owl), microchiropteran bats (*eg* the Eastern Bent-wing Bat) and megachiropteran bats (*ie* the Grey-headed Flying Fox). As a result the author of the previous report conducted a collective 'assessment of significance' addressing the superseded 'eight factors of s.5A of the EP&A Act' with respect to threatened fauna previously recorded in the locality. The author concluded that the proposed development of Buffer Sector 3 was not "likely" to impose "a significant effect" on any "threatened species, populations or ecological communities, or their habitats". Therefore there was no requirement for the preparation of a Species Impact Statement to accompany the previous development application (TEC, 2004).

Recent amendments to the TSC Act and Section 5A (s.5A) of the *Environmental Planning & Assessment Act 1979* have modified the so called 8-part test to a 7-part test. The 7-part test lists seven factors that "must be taken into account" by a consent or determining authority in the administration of Sections 78A, 79C and 112 of the Act when considering a development proposal or DA. The aim of s.5A is to determine "whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats", as listed under Schedules 1 and 2 of the TSC Act, and hence whether a *Species Impact Statement* (SIS) is required. Whilst there has been modification to the nature of the assessment of significance since the previous flora and fauna survey and assessment in 2003/04, the aims, intent and general content of the 7-part test remain consistent with the previous 8-part test.

In light of the review of direct or indirect impacts on threatened species and habitats related to the proposed actions no referral to the Australian Government Department of the Environment, Water, Heritage and the Arts for approval from the Federal Environment Minister under the EP&BC Act is required.

As described previously in this report, one endangered ecological community was recorded during the survey and assessment in March 2008. The 'Swamp Oak Forest' community present represents an intergrade between coastal floodplain communities including Swamp Oak Floodplain Forest and Swamp Sclerophyll Forest (DECC, 2007a and b). The 'SOF' was assessed for the level of impact from the proposed actions under the *TSC Act* s5A Assessment (7-part test).

According to the latest Department of Environment, Climate Change and Water *Recommended Environmental Assessment* (EA) requirements the following threatened or endangered species have been recently recorded within 500m of the subject site, and have therefore been assessed as part of the s5A Assessment (7-part test) (Appendix C);

- Barking Owl *Ninox connivens*
- Powerful Owl *Ninox strenua*

- Swift parrot *Lathamus discolor**
- Grey-headed Flying-fox *Pteropus poliocephalus*
- Regent Honeyeater *Xanthomyza Phrygia**
- Black Bittern *Ixobrychus flavicollis**
- Lesser Sand Plover *Charadrius mongolus**

* *Denotes species listed as threatened under the EP&BC Act and assessed at a National level for the Assessment of Significant.*

The above assessments have concluded that the current proposal is unlikely to result in a significant effect on the threatened biodiversity recorded on site, or their habitats. The subject site is a highly modified semi-rural landscape with very limited natural resources; no critical habitat was assessed within the site. The proposed actions to supplement the removal of exotic Poplar trees with potential feed trees, the removal of exotic weeds and the rehabilitation of Fern Creek and the wetland buffer are significant ecological improvements on the current biodiversity within the subject site. The low native floristic assemblage represented within the subject site is the result of anthropogenic practices and extensive weed infestation. The proposed improvements will provide food and foraging substrata for local and migrating threatened species.

The subject site does not support extensive areas of native flora and fauna, however, the site could potentially provide habitat for a limited number of threatened species, most of which are highly mobile with large home ranges. No viable threatened population utilises the subject site and as such the proposed actions will not directly increase the risk of extinction to local threatened populations or species. Public reserves either adjoin the subject site or are located nearby within the locality, and as a consequence provide far better habitat for threatened species than that of the subject site. Retention of native vegetation on the subject site where possible, creation of buffer zones, habitat, and linkages with adjacent natural areas has been recommended in this report, which is in line with the relevant Environmental Planning Instruments. The risks associated with changes to overshadowing, stormwater and groundwater flows and habitat connectivity are considered to be low, and the threats to the biodiversity located on the site, and to the adjoining Warriewood Wetland are not significant.

The areas of highest biodiversity value include the southern and south-western corners as these areas contain native riparian vegetation and are in close proximity to the Warriewood Wetlands. While the proposal includes clearing of a small part of the vegetation at the south eastern section of the site, retention and enhancement of the vegetation in this area will be maximised to provide for the preservation of habitat for threatened species in the locality. This area also forms the corridor and flora and fauna habitat as mapped by Pittwater Council. Potential direct and indirect impacts of the proposal to these areas will be mitigated via the implementation of the designed buffer areas and through adherence to the above recommendations. Careful integration of biodiversity and bushfire protection measures will be required in the area of ‘Swamp Oak Forest’ close to Boondah Road.

This report concludes that the impacts of the proposed development of the site are not likely to be significant at a local, regional or national level, given the biodiversity significance of the site as assessed previously in 2003/04, 2006, March 2008 , September 2008 and currently in January 2010. There for a Species Impact Statement or a Referral to the Federal Environment Minister is not required.

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Appendix A

Flora and Fauna Species Inventory

Warriewood STP Buffer Area 3
Proposed Residential Development

General Status	
*	Exotic (not native to Australia)
N	Noxious weeds as listed on the *NSW Noxious Weeds Act 1993* for the Pittwater LGA
ni	Non - indigenous native species (does not naturally occur at this locality)
(?)	Uncertain identification
Conservation Status	
CE	Critically Endangered - listed under Schedule 1A of the TSC Act
E	Endangered - listed under Schedule 1 of the TSC Act
V	Vulnerable - listed under Schedule 2 of the TSC Act
LOC	Locally Significant
Abundance	
c	Common, species occur all over the site
o	Occasional, species occur over the survey area but not in large numbers at any occurrence
uc	Uncommon, species occur only once or twice during the survey
p	Present
Community	
2004 Survey	P Present in 2004 Survey
PF	Poplar Forest
CD	Cleared and Disturbed
SOF	'Swamp Oak Forest'

Cons Status	Weed	Family	Genus	species	sub.sp/variety	Common Name	2004 Survey	PF	CD	SOF
	*	Alliaceae	*Nothoscordum*	*borbonicum*		Onion Weed	p			
		Amaranthaceae	*Alternanthera*	*denticulata*		Lesser Joyweed				uc
		Apiaceae	*Centella*	*asiatica*		Indian Pennywort		c		c
	*	Apiaceae	*Hydrocotyle*	*bonariensis*			p	c		c
	*	Apocynaceae	*Araujia*	*sericifera*		Moth Vine				uc
	*	Apocynaceae	*Nerium*	*oleander*		Oleander	p			
		Apocynaceae	*Parsonsia*	*straminea*		Common Silkpod	p			
	*	Araceae	*Monstera*	*deliciosa*		Fruit Salad Plant	p			

Cons Status	Weed	Family	Genus	species	sub.sp/variety	Common Name	2004 Survey	PF	CD	SOF
	*	Araceae	*Zantedeschia*	*aethiopica*		Arum Lily	p			uc
	*	Araliaceae	*Hedera*	*helix*		English Ivy	p			
		Araliaceae	*Polyscias*	*sambucifolia*		Elderberry Panax				uc
	ni	Araliaceae	*Schefflera*	*actinophylla*		Umbrella Tree	p		uc	
LOC		Arecaceae	*Livistona*	*australis*		Cabbage Fan-palm	p	uc		
	*	Arecaceae	*Phoenix*	*canariensis*		Canary Island Date Palm	p			
	*	Arecaceae	*Syagrus*	*romanzoffiana*		Cocos Palm			uc	
	N (4)	Asparagaceae	*Asparagus*	*aethiopicus*		Asparagus Fern	p	o		c
		Aspleniaceae	*Asplenium*	*australasicum*		Birds Nest Fern	p			
	*	Asteraceae	*Ageratina*	*adenophora*		Crofton Weed	p	uc		
	*	Asteraceae	*Aster*	*subulatus*		Wild Aster				o
	*	Asteraceae	*Bidens*	*pilosa*		Cobblers Pegs	p	c	c	c
	*	Asteraceae	*Conyza*	*bonariensis*		Flaxleaf Fleabane	p	c	c	c
	*	Asteraceae	*Erechtites*	*valerianifolia*		Brazilian Fireweed	p			
	*	Asteraceae	*Hypochaeris*	*radicata*		Catsear	p			
		Asteraceae	*Ozothamnus*	*diosmifolius*		Rice Flower				uc
	*	Asteraceae	*Senecio*	*madagascariensis*		Fireweed	p			uc
	*	Asteraceae	*Sonchus*	*oleraceus*		Common Sowthistle	p			
	*	Asteraceae	*Taraxacum*	*officinale*		Dandelion		o		uc
	*	Bignoniaceae	*Jacaranda*	*mimosifolia*		Jacaranda	p			
		Blechnaceae	*Blechnum*	*cartilagineum*		Gristle Fern	p			
	*	Cannaceae	*Canna*	*x generalis*		Canna Lily			o	
	*	Caprifoliaceae	*Lonicera*	*japonica*		Japanese Honeysuckle	p			uc
		Casuarinaceae	*Allocasuarina*	*littoralis*		Black She-oak	p			
		Casuarinaceae	*Casuarina*	*glauca*		Swamp Oak	p			c
		Commelinaceae	*Commelina*	*cyanea*		Scurvey Weed	p	o		o
	*	Commelinaceae	*Tradescantia*	*fluminensis*		Wandering Jew	p			
	N (4)	Convolvulaceae	*Ipomoea*	*indica*		Morning Glory	p	o	uc	o
	*	Cupressaceae	*Cupressus*	*lusitanica*		Mexican Cypress				uc
		Cyperaceae	*Baumea*	*juncea*			p			
		Cyperaceae	*Carex*	*appressa*		Tall Sedge	p			

Cons Status	Weed	Family	Genus	species	sub.sp/variety	Common Name	2004 Survey	PF	CD	SOF
	*	Cyperaceae	*Cyperus*	*brevifolius*			p			
		Cyperaceae	*Cyperus*	*sp*				o		
		Cyperaceae	*Gahnia*	*clarkei*		Tall Saw-sedge				uc
		Cyperaceae	*Gahnia*	*sieberiana*		Red-fruit Saw-sedge	p			
	*	Cyperaceae	*Isolepis*	*prolifera*				uc		
		Cyperaceae	*Lepidosperma*	*laterale*			p			
	ni	Davalliaceae	*Nephrolepis*	*cordifolia*		Fishbone Fern	p			
		Dennstaedtiaceae	*Pteridium*	*esculentum*		Common Bracken	p	c		c
		Dicksoniaceae	*Calochlaena*	*dubia*		Soft Bracken	p	c		c
	*	Ericaceae	*Arbutus*	*unedo*		Irish Strawberry Tree	p			uc
		Euphorbiaceae	*Breynia*	*oblongifolia*		Coffee Bush				o
	*	Euphorbiaceae	*Euphorbia*	*peplus*		Petty Spurge	p			
		Euphorbiaceae	*Glochidion*	*ferdinandi*	*var ferdinandi*	Cheese Tree	p	uc		
		Euphorbiaceae	*Homalanthus*	*populifolius*		Bleeding Heart	p			uc
	*	Fabaceae - Caesalpinioideae	*Senna*	*pendula*	*var glabrata*		p	c		c
	*	Fabaceae - Faboideae	*Erythrina*	*sykesii*		Coral Tree	p			
		Fabaceae - Faboideae	*Glycine*	*clandestina*				o		
		Fabaceae - Faboideae	*Kennedia*	*rubicunda*		Dusky Coral Pea	p	o		o
	*	Fabaceae - Faboideae	*Trifolium*	*repens*		White Clover	p		c	
	*	Fabaceae - Faboideae	*Vicia*	*sativa*		Vetch	p	o		
		Fabaceae - Mimosoideae	*Acacia*	*longifolia*	*longifolia*	Sydney Golden Wattle	p	o		
		Fabaceae - Mimosoideae	*Acacia*	*myrtifolia*		Red-stemmed Wattle	p			
	*	Fabaceae - Mimosoideae	*Acacia*	*podalyriifolia*		Queensland Silver Wattle	p			
	*	Fabaceae - Mimosoideae	*Acacia*	*saligna*		Golden Wreath Wattle	p			
		Fabaceae - Mimosoideae	*Acacia*	*suaveolens*		Sweet Wattle	p			
		Gyrostemonaceae	*Codonocarpus*	*cotinifolius*		Native Poplar		c		
		Hemerocallidaceae	*Phormium*	*tenax*		New Zealand Flax	p			
	*	Iridaceae	*Crocosmia*	*x*	*crocosmiiflora*	Montbretia		c		c
	*	Iridaceae	*Dietes*	*grandiflora*					o	
		Juncaceae	*Juncus*	*sp*				uc	uc	

Cons Status	Weed	Family	Genus	species	sub.sp/variety	Common Name	2004 Survey	PF	CD	SOF
		Lauraceae	*Cassytha*	*glabella*			p			
		Lauraceae	*Cassytha*	*pubescens*						O
	*	Lauraceae	*Cinnamomum*	*camphora*		Camphor Laurel	p	uc		
	*	Liliaceae	*Lilium*	*formosanum*		Formosan Lily	p	c		o
		Lobeliaceae	*Pratia*	*purpurascens*		Whiteroot		o		o
		Lomandraceae	*Lomandra*	*longifolia*		Spiny-headed Mat-rush	p	o		o
	*	Lythraceae	*Lagerstroemia*	*indica*		Crepe Myrtle	p			uc
		Malvaceae	*Hibiscus*	*sp*		Hibiscus	p		uc	
	*	Malvaceae	*Sida*	*rhombifolia*		Paddy's Lucerne	p	c	c	
	*	Moraceae	*Ficus*	*elastica*		Rubber Tree	p			
	*	Musaceae	*Musa*	*sp*		Banana	p			
		Myrtaceae	*Angophora*	*costata*		Sydney Red Gum	p	o		o
		Myrtaceae	*Callistemon*	*citrinus*		Crimson Bottlebrush	p		c	
		Myrtaceae	*Callistemon*	*viminalis*		Weeping Bottlebrush	p			
		Myrtaceae	*Eucalyptus*	*bicostata*		Southern Blue Gum	p			
		Myrtaceae	*Eucalyptus*	*botryoides*		Bangalay				uc
LOC		Myrtaceae	*Eucalyptus*	*robusta*		Swamp Mahogany	p			
E		Myrtaceae	*Eucalyptus*	*scoparia*		Wallangarra White Gum	p			
		Myrtaceae	*Kunzea*	*ambigua*		Tick Bush	p			
		Myrtaceae	*Melaleuca*	*armillaris*		Bracelet Honey-myrtle	p			
		Myrtaceae	*Melaleuca*	*ericifolia*		Swamp Paperbark	p			
		Myrtaceae	*Melaleuca*	*quinquenervia*		Broad-leaved Paperbark	p			
	ni	Myrtaceae	*Metrosideros*	*excelsa*		Pohutukawa, NZ Christmas Tree	p			
		Myrtaceae	*Syncarpia*	*glomulifera*		Turpentine	p			
		Myrtaceae	*Tristaniopsis*	*laurina*		Water Gum	p			
	*	Ochnaceae	*Ochna*	*serrulata*		Mickey Mouse Plant		o		uc
	N (4)	Oleaceae	*Ligustrum*	*lucidum*		Large Leaved Privet	p	uc		
	N (4)	Oleaceae	*Ligustrum*	*sinense*		Small Leaved Privet	p	c		o

Cons Status	Weed	Family	Genus	species	sub.sp/variety	Common Name	2004 Survey	PF	CD	SOF
		Oleaceae	*Olea*	*europaea*	*cuspidata*	Olive	p			
	N (3)	Onagraceae	*Ludwigia*	*peruviana*			p			
		Phormiaceae	*Dianella*	*caerulea*		Blue Flax-lily	p	o		o
	*	Pinaceae	*Pinus*	*radiata*		Radiata Pine	p		uc	
		Pittosporaceae	*Billardiera*	*scandens*		Hairy Apple Berry				o
		Pittosporaceae	*Pittosporum*	*undulatum*		Sweet Pittosporum	p		o	
	*	Plantaginaceae	*Plantago*	*lanceolata*		Lamb's Tongues	p			uc
	*	Poaceae	*Andropogon*	*virginicus*		Whisky Grass	p	c		c
	N (3)	Poaceae	*Cortaderia*	*selloana*		Pampas Grass	p		uc	
		Poaceae	*Cynodon*	*dactylon*		Couch	p	c	c	
	*	Poaceae	*Digitaria*	*ciliaris*		Summer Grass		o	o	o
	*	Poaceae	*Echinochloa*	*crusgalli*		Barnyard Grass				uc
	*	Poaceae	*Ehrharta*	*erecta*		Panic Veldtgrass	p			
	*	Poaceae	*Eleusine*	*indica*		Crowsfoot Grass				uc
		Poaceae	*Entolasia*	*marginata*		Bordered Panic	p			
		Poaceae	*Entolasia*	*stricta*		Wiry Panic	p			uc
		Poaceae	*Imperata*	*cylindrica*		Blady Grass	p	c		c
		Poaceae	*Microlaena*	*stipoides*	*var stipoides*	Weeping Grass	p			
	*	Poaceae	*Paspalum*	*dilatatum*		Paspalum	p		c	c
	*	Poaceae	*Pennisetum*	*clandestinum*		Kikuyu Grass	p	c	c	
		Poaceae	*Phragmites*	*australis*		Common Reed	p	o		o
	*	Poaceae	*Phyllostachys*	*sp*		Bamboo sp	p			
	*	Poaceae	*Setaria*	*pumila*		Pale Pigeon Grass	p			o
	*	Poaceae	*Stenotaphrum*	*secundatum*		Buffalo Grass	p		o	
		Poaceae	*Themeda*	*australis*		Kangaroo Grass				uc
	N (4)	Polygonaceae	*Acetosa*	*sagittata*		Rambling Dock	p			
		Polygonaceae	*Persicaria*	*decipiens*		Slender knotweed	p	uc		
		Polygonaceae	*Persicaria*	*strigosa*				o		o
		Proteaceae	*Banksia*	*integrifolia*	*integrifolia*	Coast Banksia	p			uc
		Ranunculaceae	*Ranunculus*	*inundatus*		River Buttercup	p			uc
	N (4)	Rosaceae	*Rubus*	*fruticosus*	*agg sp*	Blackberry	p	c	o	

Cons Status	Weed	Family	Genus	species	sub.sp/variety	Common Name	2004 Survey	PF	CD	SOF
	*	Rutaceae	*Citrus*	*sp*		Citrus	p		uc	
	*	Rutaceae	*Murraya*	*paniculata*			p			
	*	Salicaceae	*Populus*	*alba*		White Poplar	p		c	
	N (3)	Solanaceae	*Cestrum*	*parqui*		Green Poisonberry	p			
	*	Solanaceae	*Solanum*	*mauritianum*						Uc
	*	Solanaceae	*Solanum*	*nigrum*		Black-berry Nightshade	p			O
	*	Strelitziaceae	*Strelitzia*	*reginae*		Bird of Paradise		uc		
	*	Theaceae	*Camelia*	*sp*		Camelia	p			
		Typhaceae	*Typha*	*orientalis*		Broadleaf Cumbungi	p			
	N (4)	Urticaceae	*Parietaria*	*judaica*		Asthma Weed	p			
	N (5)	Verbenaceae	*Lantana*	*camara*			p	c		C
	*	Verbenaceae	*Verbena*	*bonariensis*			p	o	c	C

General Status	
*	Exotic/introduced species
(?)	Uncertain identification
Conservation Status	
CE	Critically Endangered - listed under Schedule 1A of the TSC Act
E	Endangered - listed under Schedule 1 of the TSC Act
V	Vulnerable - listed under Schedule 2 of the TSC Act
Record Type	
Fl	Flying over the site
Vi	Visual observation
Au	Aural (call recognition)
Ul	Ultrasonic call recognition (Anabat)
Sc	Scat or scent
T	Tracks
Scr	Scratch marks on tree trunks or other
D	Diggings
N	Nest
B	Burrow
H	Hollows (in trees, trunks or other)
F	Fur or feathers
E	Eggs or juvenille morphs
A	Anecdotal

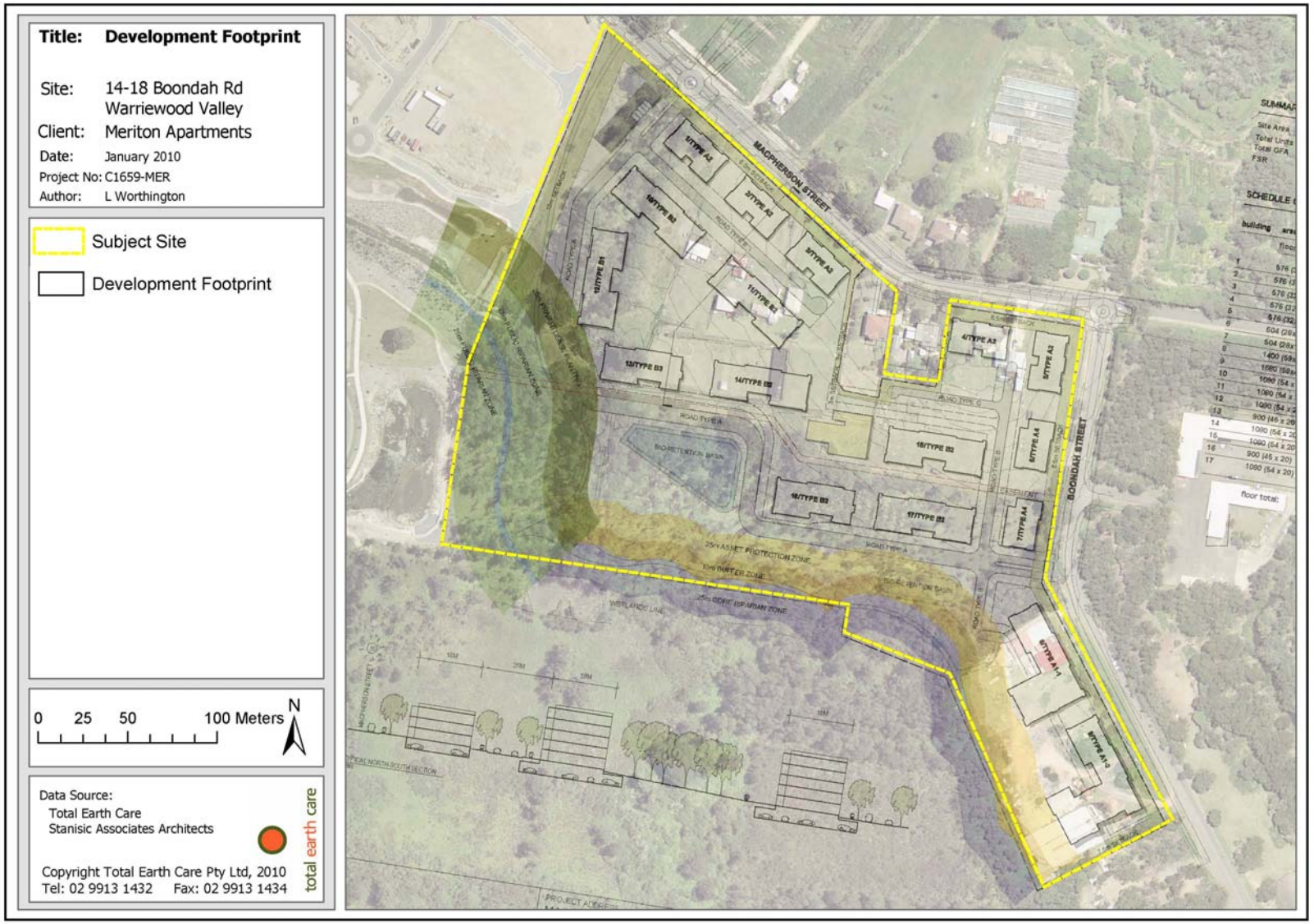
Status	Group	Family	Genus	species	Common Name	Obs Type	Year
P	Amphibian	Hylidae	*Litoria*	*fallax*	Eastern Dwarf Tree Frog	Au	2006
P	Ave	Accipitridae	*Haliastur*	*sphenurus*	Whistling Kite	Vi	2006
P	Ave	Anatidae	*Anas*	*superciliosa*	Pacific Black Duck	Vi	2006
P	Ave	Anatidae	*Chenonetta*	*jubata*	Australian Wood Duck	Vi	2008
P	Ave	Artamidae	*Cracticus*	*torquatus*	Grey Butcherbird	Vi	2008
P	Ave	Artamidae	*Gymnorhina*	*tibicen*	Australian Magpie	Vi	2008
P	Ave	Artamidae	*Strepera*	*graculina*	Pied Currawong	Vi, Au	2006
P	Ave	Cacatuidae	*Cacatua*	*galerita*	Sulphur-crested Cockatoo	Vi	2008
P	Ave	Cacatuidae	*Eolophus*	*roseicapillus*	Galah	Vi	2008
P	Ave	Charadriidae	*Vanellus*	*miles*	Masked Lapwing	Vi	2006, 2008
U	Ave	Columbidae	*Columba*	*livia*	Rock Dove	Vi	2008
U	Ave	Columbidae	*Streptopelia*	*chinensis*	Spotted Turtle-Dove	Vi	2006, 2008
P	Ave	Corvidae	*Corvus*	*coronoides*	Australian Raven	Vi	2008
P	Ave	Dicruridae	*Grallina*	*cyanoleuca*	Magpie-lark	Au	2006
P	Ave	Dicruridae	*Rhipidura*	*albiscapa*	Grey Fantail	Vi	2006
P	Ave	Dicruridae	*Rhipidura*	*leucophrys*	Willie Wagtail	Vi	2008
P	Ave	Eupetidae	*Psophodes*	*olivaceus*	Eastern Whipbird	Au	2006
P	Ave	Halcyonidae	*Dacelo*	*novaeguineae*	Laughing Kookaburra	Au	2006, 2008
P	Ave	Hirundinidae	*Hirundo*	*neoxena*	Welcome Swallow	Vi	2008
P	Ave	Maluridae	*Malurus*	*cyaneus*	Superb Fairy-wren	Vi	2006
P	Ave	Meliphagidae	*Anthochaera*	*carunculata*	Red Wattlebird	Au	2008
P	Ave	Meliphagidae	*Manorina*	*melanocephala*	Noisy Miner	Au	2008
P	Ave	Meliphagidae	*Meliphaga*	*lewinii*	Lewin's Honeyeater	Au	2008
P	Ave	Meliphagidae	*Phylidonyris*	*nigra*	White-cheeked Honeyeater	Vi	2006
P	Ave	Meliphagidae	*Phylidonyris*	*novaehollandiae*	New Holland Honeyeater	Vi	2006
P	Ave	Psittacidae	*Trichoglossus*	*haematodus*	Rainbow Lorikeet	Vi	2006, 2008
P	Ave	Rallidae	*Gallinula*	*tenebrosa*	Dusky Moorhen	Vi, Au	2006
P	Ave	Rallidae	*Porphyrio*	*porphyrio*	Purple Swamphen	Vi	2008

Status	Group	Family	Genus	species	Common Name	Obs Type	Year
V	Ave	Strigidae	*Ninox*	*strenua*	Powerful Owl	Vi, Au	2008
P	Ave	Zosteropidae	*Zosterops*	*lateralis*	Silvereye	Vi	2006
U	Mammal	Equidae	*Equus*	*caballus*	Horse	Vi	2006, 2008
U	Mammal	Leporidae	*Oryctolagus*	*cuniculus*	Rabbit	Sc, D	2006, 2008
P	Mammal	Peramelidae	*Perameles*	*sp.*	unidentified Bandicoot	D	2008
P	Mammal	Peramelidae	*Perameles*	*nasuta*	Long-nosed Bandicoot	Vi, Au, D	2006
P	Mammal	Phalangeridae	*Trichosurus*	*vulpecula*	Common Brushtail Possum	Vi	2006, 2008
P	Mammal	Pseudocheiridae	*Pseudocheirus*	*peregrinus*	Common Ringtail Possum	Vi	2006

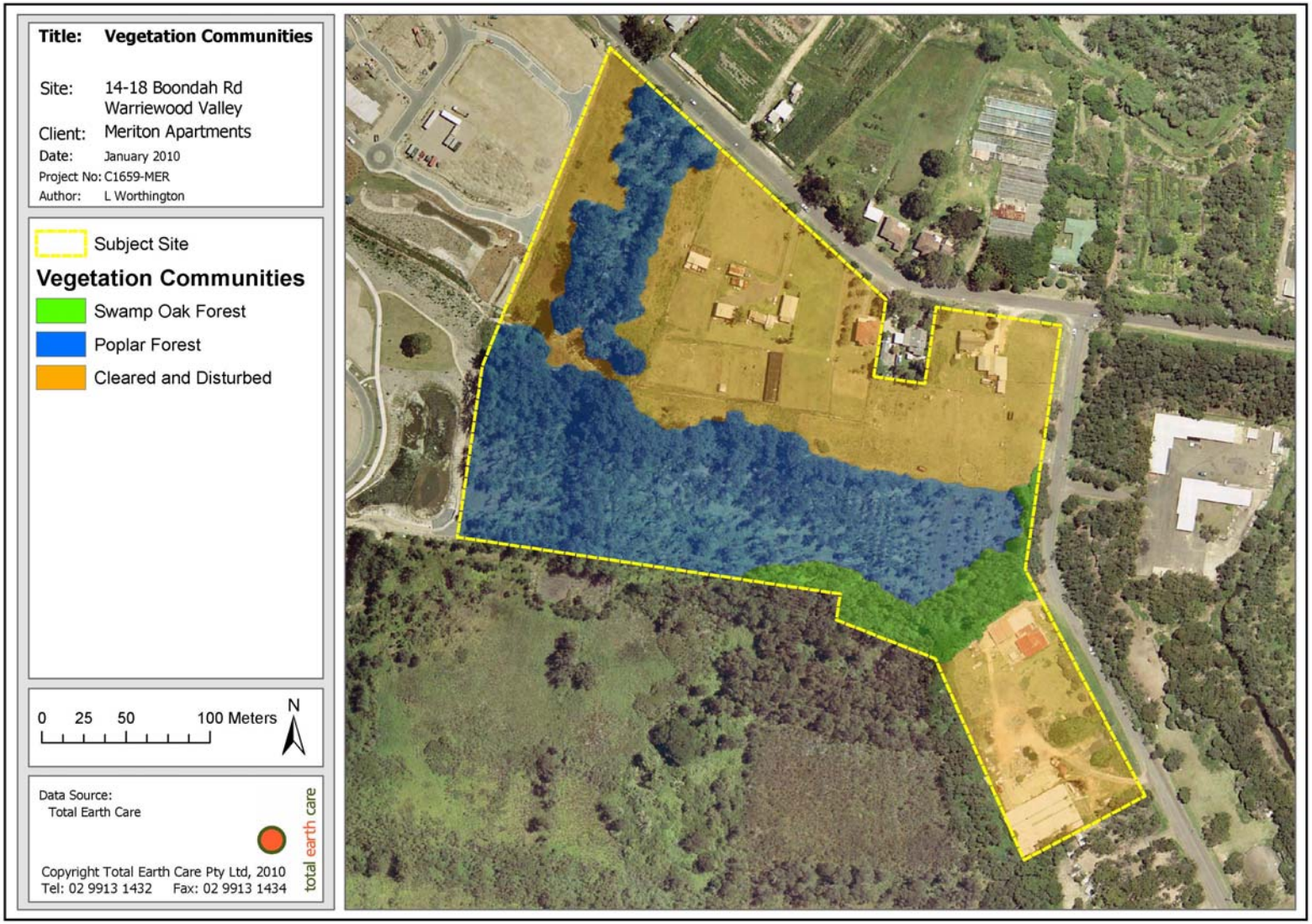
Appendix B

Maps

Warriewood STP Buffer Area 3
Proposed Residential Development

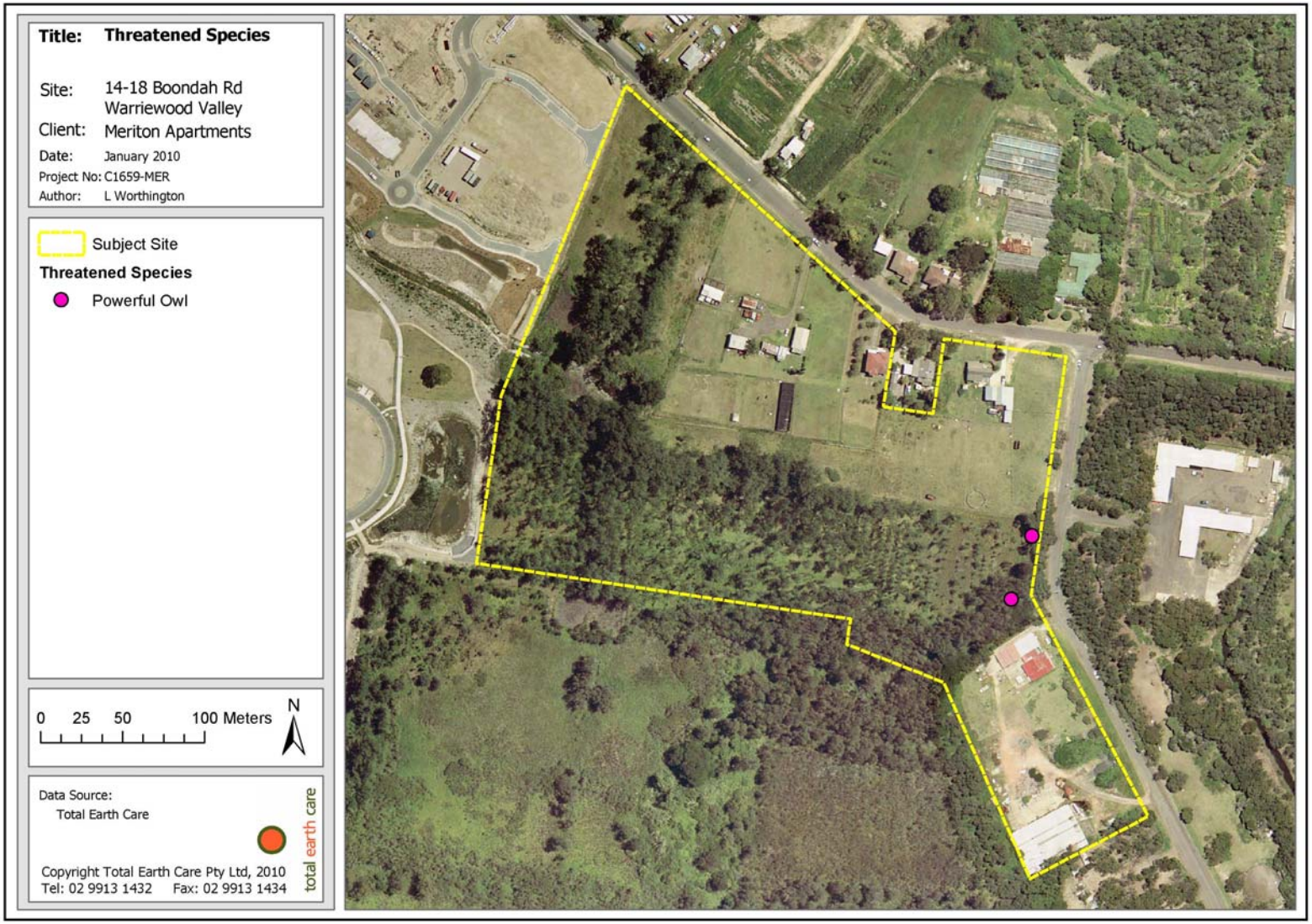


Map 1: Proposed Development Footprint



Map 2: Vegetation communities identified from the subject site

Map 3: Buffer zones proposed for the protection of Fern Creek, the Riparian Corridor and Warriewood Wetlands



Map 4: Threatened species identified from the subject site (March 2008)

Appendix C

Assessments of Significance

Warriewood STP Buffer Area 3
Proposed Residential Development

Powerful Owl (*Ninox strenua*)

1 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

Ninox strenua (Powerful Owl) is found in the coastal areas and adjacent ranges of eastern Australia from South Australia to around Rockhampton in Queensland, generally within 200km from the coast. Within NSW, Powerful Owls are distributed throughout the length of the Great Dividing Range, which is their stronghold, and extend from the coast to the western slopes where they occur in much lower numbers. The Powerful Owl inhabits a wide range of vegetation types from wet Eucalypt forests with a Rainforest understorey to Dry Open Forests and Woodlands (DECC, 2006). The species has been recorded utilising disturbed habitats such as exotic pine plantations and large trees in parks and gardens. The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands (DECC, 2006).

The Powerful Owl is the largest predator of nocturnal forest-dwelling animals in Australian forests. Major prey species in NSW forests are the Greater Glider, Common Ringtail Possum, Sugar Glider, Grey-headed Flying-fox, and several species of diurnal birds, including the Pied Currawong, Magpie and Lorikeets. As most prey species require hollows and a shrub layer, these are important habitat components for the owl (DECC, 2006).

It rests during the day amid thick foliage, often grasping food-remains. The male of the species employs a slow, far-carrying ‘whoo-hoo’ call, more deliberate than the females call, which is higher pitched with the second note slightly higher than the first. Powerful Owls nest in a slight depression in the wood-mould on the base of a cavity in a large old tree, sometimes in excess of 25 metres above the ground. The breeding season of the Powerful Owl is highly synchronised, being strictly winter breeders. One or two young are produced, although some pairs do not breed in every year. Pairs appear to mate for life and occupy exclusive territories which range from 400-1450 hectares (DECC, 2006). During the breeding season, the male Powerful Owl roosts in a "grove" of up to 20-30 trees, situated within 100-200 metres of the nest tree where the female shelters.

The Powerful Owl has been recorded in many National Parks and State Forests throughout NSW (DECC, 2006). There have been 25 records of the species occurring within 10 km of the subject site. One individual of this species was recorded on the subject site in the current survey. The individual was observed roosting in the Casuarina trees located adjacent to Boondah Rd. The subject site is considered to have moderate to high foraging habitat, and moderate to high roosting habitat potential.

The areas of habitat within the subject site include the ‘Swamp Oak Forest’ and some sections of the Poplar Forest and the Cleared and Disturbed areas. While a small section of the ‘Swamp Oak Forest’ is proposed to be cleared, the majority of the community will be preserved within the buffer areas under the current proposal, as is a section of the Poplar Forest. These areas form the best habitat on-site for this species as they support roosting areas and foraging areas. In particular, the hollows within some of the Poplar trees provide important shelter areas for prey species such as possums.

It is highly unlikely that a “viable local population” inhabits the site on a permanent basis, given the very large home range of this species and availability of suitable habitat in the locality. Also, important aspects of this species biology will not be affected by this proposal including foraging and roosting. A local population of the Powerful Owl is not likely to be significantly or adversely affected by the proposed works, given:

- the species has a very large home range and can utilise the suitable habitat in adjoining areas, and may not inhabit the site on a permanent basis;
- areas of roosting and foraging habitat are to be preserved; and

- the species is highly mobile, which means that the probability of harm to individuals during construction works is negligible.

On the basis of the above factors, the proposed activity is not likely to disrupt the lifecycle, place at risk, or cause the extinction of a "viable local population" of the Powerful Owl.

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

The TSC Act defines an "endangered population" as "a population specified in Part 2 of Schedule 1" of the Act. The Powerful Owl is not part of an "endangered population", as defined under the TSC Act.

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

a) 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

b) 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 TSC Act defines an "endangered ecological community" as "a community specified in Part 3 of Schedule 1" of the Act, and a "critically endangered ecological" as "a community specified in Part 2 of Schedule 1a of the Act. The Powerful Owl does not form part of an "endangered ecological community", as defined under the TSC Act.

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

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

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

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

Currently, the majority of potential habitat for the Powerful Owl is restricted to conservation reserves and State forests; although they also occur within large areas of forest on other public lands and on private land, including suburban bushland. The Powerful Owl has been recorded in many national parks and State forests throughout its range in NSW (DEC, 2006).

Aspects of the current proposal which may modify or remove Powerful Owl habitat include loss of potential foraging habitat through removal or modification of native and exotic species. However, areas of potential foraging habitat will also be retained in the current proposal in the riparian buffer areas along the southern and south-western boundaries of the subject site.

Considering the proximity of the proposal to an urban area, the mobility of the species and the relatively small areas of habitat in question, it is considered unlikely that the proposal will result in known or potential habitat becoming isolated from currently interconnecting or proximate areas of habitat. While the proposed development will result in the removal of a very small area of potential foraging habitat for this species, large areas of similar habitat are available within the nearby Garigal National Park, Ku-ring Gai National Park, and the Warriewood Wetlands. The proposed development will not have any impact on the local or regional habitat of the Powerful Owl and the long-term survival of the species will not be impacted.

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

The TSC Act defines "critical habitat" as "habitat declared to be critical habitat under Part 3 of the Act. No critical habitat has been listed for the Powerful Owl and there is no critical habitat of relevance to the subject site.

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

There is a Recovery Plan for Large Forest Owls (DECC, 2006) which includes the Powerful Owl. The proposed development is not inconsistent with the objectives of these plans. This Recovery Plan discusses the need to mitigate the effects of development on significant habitat for these owls, and due to the large areas of nearby habitat this objective is not considered relevant to this proposal. Importantly, much of the area in which the individual was located on the subject site is to be preserved under the current proposal, in its current state along the southern and south-western boundary. As such, the proposal has implemented measures in order to reduce adverse affects on the species.

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

A "threatening process" is defined under the TSC Act as "a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities". Further to that, "key threatening processes" are threatening processes specified in Schedule 3 of the Act.

The following Key Threatening Processes are considered relevant to the Powerful Owl:

- Clearing of native vegetation;
- Removal of dead wood and dead trees;
- Loss of hollow bearing trees;
- Competition from feral honeybees;
- Predation by the fox and the feral cat; and
- Ecological consequences of high frequency fires.

Clearing of native vegetation for the purposes of construction will occur as part of the current proposal, as will the removal of dead wood and dead trees, and hollow bearing trees. The Recovery Plan lists vegetation clearing as a threat. However, clearing of vegetation as part of the current proposal will mostly be limited to exotic planted species with a small amount of native vegetation to be removed. Development will be restricted to minimise harm to any hollow bearing trees. The remaining vegetation

within the riparian area will be conserved and may also act as suitable foraging and roosting habitat for this species.

High frequency fire is not part of the proposal for the subject site. Hazard reduction burns and/or bushfires may have occurred in the past in this area, and may have already altered the habitat to varying degrees. Creation of a APZ, as described in the body of the report, will act to mitigate the effect of fire on the vegetation of the site.

Predation and competition will not be increased by the current proposal.

Conclusion

In light of the consideration of the above seven factors (a to g), the proposed activity on the subject site is not "likely" to impose "a significant effect" on the vulnerable species Powerful Owl, as:

- the proposal will not compromise the viability of a "local population" through impact on the species;
- the proposal will not involve the removal or modification, fragmentation or isolation of a "significant area of known habitat" for the species; and
- the proposal will not involve the removal of substantial roosting habitat, and the removal of potential habitat will be limited in the study area or subject site.

Barking Owl (*Ninox connivens*)

1 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

Ninox connivens Barking Owl is listed as a Vulnerable species under Part 1 of Schedule 1 of the *Threatened Species Conservation Act 1995* (TSC Act).

The Barking Owl is sparsely distributed throughout Australia. Its population is concentrated to the north and radically declines to the south. Barking Owls are restricted to coastal plains and woodlands, preferring mature woodland and forests, rich in biodiversity. They are absent within the central arid habitats and in dense wet forests along the coast particularly in South Australia. Barking Owls inhabit dense understorey canopy along creek lines, roosting in Casuarina and Acacia species. Large eucalyptus trees are used as foraging substrata for prey items, gliders & possums, hollows are used for nesting. Prey items may also consist of invertebrates and ground mammals, even pest species such as the rabbit.

Barking Owls have a large territory, ranging from 30 to 200 hectares depending if a pair or sole owl is present. Fauna surveys within Pittwater Council have identified 9 recordings of Barking Owls utilising Coastal Valley Grassy Woodlands dominated by Grey Box, Forest Red Gum and Melaleuca species.

The subject site is considered to have moderate to high foraging capacity for Barking Owls and a moderate to high roosting habitat potential. Under the current proposal 714 trees are designated for removal; 646 form a remnant Poplar plantation, of which, some are labelled as potential hollow bearing trees, a further 43 *Casuarina glauca* beyond the core riparian zone are destined for removal, these contribute towards an EEC, the Swamp Oak Forest.

The Swamp Oak Forests is capable of supporting roosting sites for Barking Owls. Poplar tree hollows are an adequate substitute provided the absence of large eucalyptus hollows for nesting. Appropriate nesting locations are available outside the subject site. Lane Cove and Ku-ring-gai National Parks contain extensive continuous habitats suitable for nesting opportunities for the Barking Owl. The presence of Barking Owls within 5km of the subject site assumes foraging potential within the surrounding urban location.

40 Poplar trees have significant habitat potential these will be marked by fluro tape. A qualified wildlife handler will inspect hollows prior to removal. The removal of such trees is significant for arboreal species, in particular the prey items, gliders and possums.

It is highly unlikely that a “viable local population” inhabits the site on a permanent basis, given the very large home range of this species and availability of suitable habitat in the locality. Also, important aspects of this species biology will not be affected by this proposal including foraging and roosting. A local population of the Barking Owl is not likely to be significantly or adversely affected by the proposed works.

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

The TSC Act defines an “endangered population” as “a population specified in Part 2 of Schedule 1” of the Act. The Barking Owl is not part of an “endangered population”, as defined under the TSC Act.

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

a) 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

b) 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 TSC Act defines an "endangered ecological community" as "a community specified in Part 3 of Schedule 1" of the Act, and a "critically endangered ecological" as "a community specified in Part 2 of Schedule 1a of the Act. The Barking Owl does not form part of an "endangered ecological community", as defined under the TSC Act.

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

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

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

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

The proposed removal of over-mature Poplar trees and selected *Casuarina glauca* from the Swamp Oak Forest does not amount to significant potential habitat for the Barking Owl. Barking Owls require a large continuous woodland or forest habitat with large eucalyptus species and a dense understorey for roosting. The study area is predominately exotic grasslands and fragmented Casuarina species along a narrow degraded riparian corridor.

Foraging opportunities in disturbed environments attract predator species such as the Barking Owl. Appropriate habitat is selected on the availability of food items and sheltering opportunities. Common prey identified during the current nocturnal survey include; Common Ringtail and Brushtail Possums and Rabbits. Suitable nesting and sheltering opportunities are located within protected reserves and parks in close proximity to the subject site. The removal of the Casuarina and Poplar trees has to potential to reduce foraging opportunities in the area with the displacement of its prey items and foraging substrata. The retention of the core riparian buffer vegetation is significant for foraging opportunities for the Barking Owl.

Barking Owls patrol a large foraging territory of fragmented and continuous habitats. The core buffer zone adjacent to Fern Creek assists in the movement of fauna species between habitats. Removal of the Poplar and Casuarina trees will not impact on this core riparian zone and cause fragmentation of habitats.

The proposed actions will not cause the fragmentation of habitats or impact the long-term survival of the Barking Owl.

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

The TSC Act defines "critical habitat" as "habitat declared to be critical habitat under Part 3 of the Act. No critical habitat has been listed for the Barking Owl and there is no critical habitat of relevance to the subject site.

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

A Draft Recovery Plan was issued by the NPWS (1993) for the Barking Owl (NPWS, 1993) under the TSC Act 1995. The Recovery Plan was indorsed after the significant reduction in Barking Owls population within NSW (NPWS, 1993). An updated recover plan was issued in 2006. Priority action plans include the understanding of the ecology, habitat requirements and protection of known or potential habitat, in particular tree hollows in woodland and forest habitat. The construction plans are not consistent with the establishment of habitat and retention of hollow bearing trees. It is not appropriate to consider the poplar trees deemed for removal capable of offering the appropriate habitat requirements for the Barking Owls. The same can be considered for the removal of Casuarina trees with a significant strand to be retained and enhanced for continual riparian corridor establishment throughout the site. As previously mentioned, the habitat requirements for the Barking Owl were not identified within the subject site. Appropriate habitat is located outside the subject site within protected areas.

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

A “threatening process” is defined under the TSC Act as “a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities”. Further to that, “key threatening processes” are threatening processes specified in Schedule 3 of the Act.

The following Key Threatening Processes are considered relevant to the Barking Owl:

- Clearing of native vegetation;
- Removal of dead wood and dead trees;
- Loss of hollow bearing trees;
- Competition from feral honeybees;
- Forest Eucalyptus dieback associated with over abundant psyllids and Bell-miners;
- Predation by the fox and the feral cat; and
- Ecological consequences of high frequency fires.

Clearing of native vegetation for the purposes of construction will occur as part of the current proposal as will the removal of dead wood and dead trees, and hollow bearing trees. The Recovery Plan lists vegetation clearing as a threat. However, clearing of vegetation as part of the current proposal will mostly be limited to exotic planted species with a small amount of native vegetation to be removed. Development will be restricted to minimise harm to any hollow bearing trees. The remaining vegetation within the riparian area will be conserved and may also act as suitable foraging and roosting habitat for this species.

High frequency fire is not part of the proposal for the subject site. Hazard reduction burns and/or bushfires may have occurred in the past in this area, and may have already altered the habitat to varying degrees. Creation of a APZ, as described in the body of the report, will act to mitigate the effect of fire on the vegetation of the site.

Predation and competition will not be increased by the current proposal.

Conclusion

In light of the consideration of the above seven factors (a to g), the proposed activity on the subject site is not “likely” to impose “a significant effect” on the vulnerable species Barking Owl, as:

- the proposal will not compromise the viability of a “local population” through impact on the species;
- the proposal will not involve the removal or modification, fragmentation or isolation of a “significant area of known habitat” for the species; and
- the proposal will not involve the removal of substantial roosting habitat, and the removal of potential habitat will be limited in the study area or subject site.

Swift Parrot (*Lathamus discolor*)

1 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

Lathamus discolour Swift Parrot is listed as an Endangered species under Part 1 of Schedule 1 of the *Threatened Species Conservation Act 1995* (TSC Act) and federally under the EPBC Act.

The Swift Parrot is a migratory bird, commuting between its breeding grounds in Tasmania to its winter feeding locations along the coast of south-eastern Australia. Its mainland distribution has been mapped as a narrow band along coastal Victoria to southern Queensland and an isolated location within eastern South Australia. The Swift Parrot is a resident of the NSW region, preferring the inland slopes of the Great Dividing Range and occasionally occurs in the Sydney region and Wollongong and the northern and southern coasts (Garnett and Crowley 2000, Swift Parrot Recovery Team 2001, DECC 2009).

The Swift Parrots semi-nomadic distribution reflects the flowering patterns of eucalyptus species; *Eucalyptus robusta* Swamp Mahogany, *Corymbia maculata* Spotted Gum, *C. gummifera* Red Bloodwood, *Eucalyptus moluccana* Grey Box and *E. pilularis* Blackbutt (Higgins 1999, Garnett and Crowley 2000, Swift Parrot Recovery Team 2001). Habitat supporting Swift Parrots are described as box-ironbark forest and woodland inland of the Great Dividing Range. Dominant canopy trees *Eucalyptus microcarpa* Grey Box and Mugga Ironbark *Eucalyptus sideroxylon* within these habitats provide essential prolific flowering and lerp (sap-suckers) feeding opportunities. Habitat distributions within lowland coastal environments relies on *Eucalyptus robusta* Swamp Mahogany, *Corymbia maculata* Spotted Gum and *Corymbia gummifera* Red Bloodwood.

Nesting occurs in within 8km of the coast in small hollow bearing eucalyptus species in mature old growth forest dominated by *E. globulus* Tasmanian Blue Gum, although foraging is preferred within grassy/shrubby habitats.

Mainland foraging strategies are consistent with larger eucalyptus trees providing abundant nectar supplies (Swift Parrot Recovery Team 2001). Occasionally the Swift Parrot forages on the ground for fallen seeds and to drink (Higgins 1999). Reliable documentation of routine feeding cycles within Ku-ring-gai and Lane Cove National Park are consistent with flowering availability. Street and trees within privately owned lands are also substituted for the foraging as land clearing practices have impacted on this species.

NPWS records have indicated seven sighting of Swift Parrots within a 5km radius of the Subject Site. The removal of Casuarina and Poplar trees in light of the literature review are not considered significant habitat or foraging trees for the Swift Parrot. The proposed actions for tree removal and development plans are highly unlikely to have an adverse effect on the life cycle of the Swift Parrot such that a viable local population is likely to be placed at risk of extinction.

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

The TSC Act defines an “endangered population” as “a population specified in Part 2 of Schedule 1” of the Act. The Swift Parrot is not part of an “endangered population”, as defined under the TSC Act.

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

a) 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

b) 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 TSC Act defines an "endangered ecological community" as "a community specified in Part 3 of Schedule 1" of the Act, and a "critically endangered ecological" as "a community specified in Part 2 of Schedule 1a of the Act. The Swift Parrot does not form part of an "endangered ecological community", as defined under the TSC Act.

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

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

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

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

The fragmentation and degradation of the riparian habitat adjacent to and at the south-east corner of the subject site contains a medium level of potential habitat or foraging trees suitable for the Swift Parrot. Removal of the native and exotic plantation trees (i.e. Casuarina and Poplar) is highly unlikely to impact the foraging opportunities or sheltering for Swift Parrots. As previously mentioned foraging has been observed within Ku-ring-gai and Lane Cove National Park and in garden eucalyptus trees. Of the three native species recorded on site *Eucalyptus botryoides* Bangalay, *Angophora costata* Sydney Red Gum and *Casuarina glauca* to be removed, none are considered as critical foraging trees. As a result, the long-term survival of the Swift Parrot in the locality is unlikely to be affected as a result of the proposed action.

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

The TSC Act defines "critical habitat" as "habitat declared to be critical habitat under Part 3 of the Act. No critical habitat has been listed for the Swift Parrot and there is no critical habitat of relevance to the subject site.

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

The overall objectives of the *Swift Parrot Recovery Plan* (Swift Parrot Recovery Team 2001) are "to change the conservation status of the swift parrot from endangered to vulnerable within 10 years" and "to achieve a demonstrable sustained improvement in the quality of swift parrot habitat to increase carrying capacity".

The removal of the Casuarina and Poplar trees do not comprise a significant area of winter foraging habitat for the species within the locality, and is therefore not inconsistent with the objective of this management plan.

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

The TSC Act defines a 'key threatening process' as 'a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities'. Schedule 3 of the TSC Act provides a list of the 'key threatening processes' (KTP). Of the KTP's listed in Schedule 3 of the TSC Act the following will occur as a result of the proposed action and may impact the Swift Parrot:

- *Clearing of native vegetation*. The destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation. This may result in habitat degradation of loss, population fragmentation and habitat disturbance facilitating the establishment of weeds. Clearing of native vegetation has been identified as a threat to the Swift Parrot

As mentioned previously, the proposed action includes the removal of native species for the construction of the proposed development is not considered critical feed trees for Swift Parrots. The trees proposed to be removed do not comprise "sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation". The removal of these trees is unlikely to result in the habitat degradation or loss, population fragmentation or habitat disturbance for the Swift Parrot.

Conclusion

In light of the consideration of the above seven factors (1 -7), the proposed activity on the subject site is not likely to have "a significant effect" on the Swift Parrot on the subject site or wider locality as a result of the current proposal, as:

- The proposal will not adversely affect the lifecycle of the species;
- the proposal will not compromise the viability of a "local population" through impact on the species;
- The proposal will not remove, modify or further fragment or isolate a significant area of habitat for the species; and
- The proposal does not significantly contribute to any KTP threatening the species.

Consequently, a Species Impact Statement is not required to be prepared.

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

1 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

Pteropus poliocephalus Grey-Headed Flying-Fox is listed as a Vulnerable species under Part 1 of Schedule 2 of the *Threatened Species Conservation Act 1995* (TSC Act) and as Vulnerable at a National level under the EPBC Act.

Pteropus poliocephalus Grey-headed Flying-fox is distributed within 200km from the east Australian coastline, from Bunderberg in Queensland to the north to Melbourne in Victoria to the south. Locations are generally restricted to the eastern slopes of the Great Dividing Range within subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps habitats. In urban areas the Grey-headed Flying-fox regularly utilises cultivated fruit crops and metropolitan gardens.

Grey-headed Flying-foxes form 'bat camps' along gullies in close proximity to creeks and rivers to rear their young and daily roosting. Camps may number up to tens of thousand and are dependent on a reliable source within 20km. However, foraging distances of 50km recorded by individuals in one night.

Diet typically comprises a wide variety of flowering and fruiting plants (Tidemann 1995, Churchill 1998), in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines. Non-indigenous and exotic tree species introduced to the urban landscape provide additional foraging habitat for this species within the locality; where previously existed a period of reduced availability of native food resource during the winter months, non-native species now supply food resources throughout the year (Parry-Jones & Augee 2001, Williams et al 2006).

The Grey-Headed Flying Fox occurring within 10km the subject site were obtained from the Department of Environment and Climate Change (DECC) Wildlife Atlas database. This high incidence is most likely due to the close proximity of the nearest known roosting camp to the subject site.

The closest known roosting camp to the subject site is located at located at Gordon, approximately 15km to the south-west of the subject site. Other roosting camps are located within the Botanic Gardens at Farm Cove to the south-east, and Cabramatta Creek in Cabramatta to the south-west. Habitat features of the subject site which may support the Grey-Headed Flying-Fox include some potential foraging habitat provided by a number of exotic and native trees located on the subject site. The subject site does not support roosting habitat for this species. The proposed actions include the removal of four possible feed trees *Angophora costata* Sydney Red Gum and *Eucalyptus botryoides* Bangalay.

The trees proposed to be removed however do not comprise a significant area of foraging habitat within the locality for the Grey-Headed Flying Fox. Sheldon Forest, Rofe Park, Lane Cove National Park together with smaller parks and reserves in the locality contain an abundance and diversity of potential foraging habitat for the Grey-Headed Flying-Fox. Street and garden trees in the locality offer further foraging habitat to the species. As a result, the proposed actions are highly unlikely to have an adverse effect on the life cycle of the Grey-Headed Flying-Fox such that a viable local population is likely to be placed at risk of extinction.

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

The TSC Act defines an "endangered population" as "a population specified in Part 2 of Schedule 1" of the Act. The Grey-headed Flying-fox is not part of an "endangered population", as defined under the TSC Act.

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

a) 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

b) 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 TSC Act defines an "endangered ecological community" as "a community specified in Part 3 of Schedule 1" of the Act, and a "critically endangered ecological" as "a community specified in Part 2 of Schedule 1a of the Act. The Grey-headed Flying-fox does not form part of an "endangered ecological community", as defined under the TSC Act.

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

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

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

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

The proposed actions involve large scale removal of exotic poplar plantations and native trees located on the subject site. Four native feed trees are also proposed for removal for the construction actions and five planted *Callistemon viminalis* shrubs.

The Grey-headed Flying-fox is a regular visitor to landscaped gardens to supplement their diet. Foraging in highly fragmented urban environments is an important requirement when native alternatives are not available. Foraging opportunities are available within Sheldon Forest, Rofe Park, Lane Cove National Park and other nature reserves in close proximity to the Gordon colony. The proposed removal of the flower producing trees from the subject site is not likely to further fragment or isolate foraging habitat of this species as such trees do not comprise a significant area of foraging habitat within the locality.

The long-term survival of the Grey-Headed Flying Fox in the locality is unlikely to be affected by the removal of native and exotic trees from the subject site that may offer an occasional foraging resource. The trees proposed to be removed do not comprise a significant area of foraging habitat within the locality.

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

The TSC Act defines "critical habitat" as "habitat declared to be critical habitat under Part 3 of the Act.

No area has been designated as 'critical habitat' under Part 3 of the TSC Act 1995 for the Grey-Headed Flying-Fox.

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

There is currently no Recovery Plan in place for the Grey-Headed Flying-Fox. There are no Threat Abatement Plans currently in operation for any Key Threatening Processes threatening the Grey-Headed Flying-Fox.

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

The TSC Act defines a 'key threatening process' as 'a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities'. Schedule 3 of the TSC Act provides a list of the 'key threatening processes' (KTP). Of the KTP's listed in Schedule 3 of the TSC Act the following will occur as a result of the proposed action and may impact the Grey-Headed Flying-Fox:

- *Clearing of native vegetation*. The destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation. This may result in habitat degradation of loss, population fragmentation and habitat disturbance facilitating the establishment of weeds. Clearing of native vegetation has been identified as a threat to the Grey-Headed Flying-Fox.

As mentioned previously, the proposed action includes the removal of several trees (exotic and native species), some of which may offer an occasional foraging resource to this species. The trees proposed to be removed do not comprise "sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation". The subject site does not support any stand or party or fully structured native vegetation as such. The removal of such trees is unlikely to result in his may result in habitat degradation or loss, population fragmentation or habitat disturbance for the Grey-Headed Flying-Fox.

Conclusion

In light of the consideration of the above seven factors (1 -7), the proposed activity on the subject site is not likely to have "a significant effect" on the Grey-Headed Flying-Fox on the subject site or wider locality as a result of the current proposal, as:

- The proposal will not adversely affect the lifecycle of the species;
- The proposal will not remove, modify or further fragment or isolate a significant area of habitat for the species; and
- The proposal does not significantly contribute to any KTP threatening the species.

Consequently, a Species Impact Statement is not required to be prepared.

Regent Honeyeater (*Xanthomyza phrygia*)

1 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

Xanthomyza phrygia (Regent Honeyeater) is listed as an Endangered species under the *Threatened Species Conservation Act* in NSW and EPBC Act at a National Conservation status.

The distribution of the Regent Honeyeater has declined considerably in the last 30 years. The current distribution of the Regent Honeyeater is contained to the inland slopes of south-east Australia from Kangaroo Island to Rockhampton in Queensland (Slater et al, 1990). Breeding is patchy across Capertee Valley and the Bundarra-Barraba region NSW. The Regent Honeyeaters specific habitat preference for Box-Ironbark species restricts its distribution to temperate woodlands and open forests. Additionally *Casuarina cunninghamiana* dominated riparian forests are also a preferred habitat.

Non-breeding nomadic flocks congregate at coastal woodlands and forests travelling 100km from their nesting locations. Critical habitat occurs along the Central Coast and Hunter Valley regions providing essential food during drought periods (DEWHA, 2009).

Foraging for nectar is generally from eucalyptus and mistletoe species, substituted by lerp and honeydew. Larger eucalyptus trees are selected to yield optimal amounts of flowers. Foraging occurs within the upper branches and a general strategy of selecting one large feed tree over several smaller trees is observed (DEWHA 2009). Preference for abundant mistletoe species limits the distribution of the Regent Honeyeater to mature forests with a high canopy cover and a rich floristic assemblage. Dense undergrowth is considered important for foraging Regent Honeyeaters for additional food resources and shelter.

The Regent Honeyeater nesting preference is partial to fork trees or horizontal branches of mature eucalyptus or Casuarina species. Locations are typically contained within shrubby understorey suitable for protection, nesting material and food availabilities.

The proposed actions include the removal of flowering producing species; five *Callistemon viminalis* species, not considered indigenous to the vegetation community and a single *Eucalyptus botryoides* Bangalay. These species offer limited foraging opportunities to individuals and not considered suitable for a viable local population.

After investigation into the habitat requirements of the Regent Honeyeater and the habitat present within the subject site it is considered that the area does not support a significant area in the life cycle of the species. An absence of eucalyptus trees and mistletoe will not sustain a local viable population or assist in foraging opportunities for populations within the wider region. Alternative food sources such as lerp and honeydew are not present on site given the absence of box eucalyptus species. The proposed actions are highly unlikely to adversely effect the life-cycle of the Regent Honeyeater such that the local viable population leads to extinction.

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

The TSC Act defines an “endangered population” as “a population specified in Part 2 of Schedule 1” of the Act. The Regent Honeyeater is not part of an “endangered population”, as defined under the TSC Act.

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

a) 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

b) 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 TSC Act defines an "endangered ecological community" as "a community specified in Part 3 of Schedule 1" of the Act, and a "critically endangered ecological" as "a community specified in Part 2 of Schedule 1a of the Act. The Regent Honeyeater does not form part of an "endangered ecological community", as defined under the TSC Act.

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

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

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

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

As previously mentioned, the proposed actions involves; the removal of a significant number of exotic Poplar trees, a small grove of *Casuarina glauca*, three *Angophora costata* Sydney Red Gum, one *Eucalyptus botryoides* Bangalay and limited other exotic species. The foraging potential of the subject site is limited; habitat is described as poor, degraded and the majority has been previously cleared. A large percentage of the standing trees were planted and a high level of weed infestation was identified during floristic surveys.

The subject site is currently fragmented from other habitats through current land practices and housing development, although some connection with the wetlands, the Fern Creek corridor and the site to the east across Boondah Rd persists. The Warriewood Wetlands located on the adjacent site is considered a regionally significant habitat and remains interlinked with other habitats through Fern Creek. A 20m Core Riparian Zone will be retained along Fern Creek to minimise the risk of fragmentation between habitats and aid in the dispersal of flora and fauna species. The removal of the trees according to the proposal would not impend on these interlinking habitats and cause the fragmentation or the isolation of Regent Honeyeater populations.

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

The TSC Act defines "critical habitat" as "habitat declared to be critical habitat under Part 3 of the Act. No critical habitat has been listed for the Regent Honeyeater and there is no critical habitat of relevance to the subject site.

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

A recovery plan for the Regent Honeyeater has priorities 40 strategic action plans for the protection and management of the species. The main objective is to better manage critical habitats and establish

co-operative agreements with land owners. A high priority is an understanding of the species migratory patterns during foraging. Relevant priorities include;

- ensure Regent Honeyeater habitat on Public Land is managed appropriately;
- promote best practise natural resource management throughout the range of the species; and
- protect and enhance habitat containing 'significant habitat'.

The removal of the Casuarina and Poplar trees do not comprise a significant area of winter foraging habitat for the species within the locality, and is not inconsistent with the objective of this management plan.

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

A "threatening process" is defined under the TSC Act as "a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities". Further to that, "key threatening processes" are threatening processes specified in Schedule 3 of the Act.

The following Key Threatening Processes are considered relevant to the Regent Honeyeater:

- Clearing of native vegetation;
- Removal of dead wood and dead trees;
- Loss of hollow bearing trees;
- Competition from feral honeybees;
- Predation by the fox and the feral cat; and
- Ecological consequences of high frequency fires.

The removal and clearing of trees and hollows for the proposed construction footprint occurs beyond the breeding habitats of the Regent Honeyeater. Therefore it does not constitute towards the removal of breeding habitats, a key threatening process on the survival of the Regent Honeyeater. The risk of European Red Fox (*Vulpis vulpis*) predation is not considered to increase with the proposed construction.

Conclusion

In light of the consideration of the above seven factors (1 -7), the proposed activity on the subject site is not likely to have "a significant effect" on the Swift Parrot on the subject site or wider locality as a result of the current proposal, as:

- The proposal will not adversely affect the lifecycle of the species;
- The proposal will not remove, modify or further fragment or isolate a significant area of habitat for the species; and
- The proposal does not significantly contribute to any KTP threatening the species.

Consequently, a Species Impact Statement is not required to be prepared.

Black Bittern (*Ixobrychus flavicollis*)

1 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

Ixobrychus flavicollis Black Bittern is listed as a Vulnerable species under Part 1 of Schedule 2 of the *Threatened Species Conservation Act 1995* (TSC Act).

The Black Bittern inhabits terrestrial wetlands and estuaries from southern NSW to Cape York in the north and north-west across to the Kimberley (Marchant & Higgins, 1990). Sighting of the Black Bittern in Sydney coastal areas are rare, with limited sightings recorded beyond Sydney to the south or inland (DECC 2009). Dense riparian vegetation fringing permanent water-bodies provides opportunistic foraging; they appear to display a distinct avoidance toward open areas. Habitat varies between billabongs, woodland rivers and swamps, grasslands, mangroves and rainforests (Marchant & Higgins, 1990).

The Black Bittern is a solitary hunter outside the breeding season. Adult birds will pair during December to March with both parents contributing towards the feeding and nesting responsibilities. Large nests are built from a collection of reeds and sticks on branches over hanging the water-body and typically three to five young are raised. Diet consists primarily of aquatic species; frogs, reptiles, fish and invertebrates. Foraging is usually conducted at dusk and continues into the night, while daylight hours are spent roosting in trees or in reeds.

The distribution of the Black Bittern has significantly declined in the past 50 years. Changes to the natural flow regime and clearing of riparian vegetation are a major contributing factor. The behaviour of this species is still not fully understood with some scientists speculating a possible migratory pattern although most populations display a sedentary lifestyle (Marchant & Higgins, 1990).

Populations have been identified within 10km of the subject site with recordings concentrated around the Warriewood Wetlands, Narrabeen Lagoon and its tributaries, although no formal sightings were within Fern Creek. Degradation and infestation of exotic species within Fern Creeks riparian corridor does not contribute towards a suitable foraging or nesting habitat for the Black Bittern. Preference for dense reeds for foraging and sheltering may deter the Black Bittern from utilising the creek. The proposed clearing of vegetation within the construction footprint will not remove possible roosting trees. If a viable population of the Black Bittern exists within the locality, it is considered that the proposed actions, including vegetation removal and construction will not place the population at risk of extinction. The suitable habitat within the riparian areas adjoining the site will be protected, and mitigation measures include monitoring for the presence of pairs during the breeding season, and the regeneration and reconstruction of buffer areas between the wetland and the development footprint.

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

The TSC Act defines an “endangered population” as “a population specified in Part 2 of Schedule 1” of the Act. The Black Bittern is not part of an “endangered population”, as defined under the TSC Act.

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

a) 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

b) 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 TSC Act defines an "endangered ecological community" as "a community specified in Part 3 of Schedule 1" of the Act, and a "critically endangered ecological" as "a community specified in Part 2 of Schedule 1a of the Act. The Black Bittern does not form part of an "endangered ecological community", as defined under the TSC Act.

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

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

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

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

As previously mentioned the habitat criteria for the Black Bittern requires dense reeds and fringing trees adjoining a permanent water-body. Thick bordering vegetation along tidal zones is also considered suitable habitat. Overhanging branches are important for nesting and retreat when startled. Nesting occurs in a secluded location and both parents will roost in nearby trees during the day.

Floristic surveys within the riparian vegetation described the habitat as disturbed with a dominant canopy of *Casuarina glauca* and understorey of exotic species. The presence of *Typha orientalis* provides suitable foraging and sheltering opportunities for the Black Bittern.

The Black Bittern is a known visitor the Warriewood Wetlands. Clearing and development within the subject site may possibly create fragmentation of the riparian corridor for movement of the Black Bittern between habitats. Temporary disturbance from construction noise may occur during nesting opportunities. It is unclear whether the Black Bittern breeds within the wetlands or substitutes its foraging areas with Warriewood Wetlands.

The proposed removal of *Casuarina glauca* will not occur within the core buffer zone. Removal of fringing native vegetation along Fern Creek will not occur as part of the proposed construction. A core wetland buffer zone of 20m, a requirement under the *Water Management Act 2000*, and the Fern Creek Public and Private corridor will assist in protection of more suitable habitat located within the wetlands away from the subject site. Assessment of the 'Swamp Oak Forest' trees within the subject site confirmed that there is an absence of branches overhanging the wetland, the habitat preferred by the Black Bittern. The long-term survival of the Black Bittern will not be adversely impacted with the selective removal of some trees outside the core riparian zone.

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

The TSC Act defines "critical habitat" as "habitat declared to be critical habitat under Part 3 of the Act. No critical habitat has been listed for the Black Bittern and there is no critical habitat of relevance to the subject site.

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

The priority action plan for the Black Bittern recommends that riparian habitat and vegetation should be retained and managed accordingly. The proposed actions will retain a core riparian zone of 20m in the south as requested by Pittwater Council and an additional 10m Buffer zone to protect the riparian vegetation and Fern Creek. No construction or removal of native vegetation is proposed within this location. The monitoring of the 'Swamp Oak Forest' habitat is recommended during the breeding season (December to March) to survey for the presence of this species.

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

A "threatening process" is defined under the TSC Act as "a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities". Further to that, "key threatening processes" are threatening processes specified in Schedule 3 of the Act.

The following Key Threatening Processes are relevant for the Black Bittern;

- Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands
- Clearing of native vegetation;
- Invasion and establishment of exotic vines and scramblers;
- Invasion, establishment and spread of *Lantana camara;*
- Invasion of native plant communities by exotic perennial grasses;
- Predation by *Gambusia holbrooki* Girard, 1859 (plague minnow or mosquito fish); and
- Predation by the European Red Fox (*Vulpes vulpes*).

Changes to riparian corridors are a threat to the Black Bittern population. Human-induced impacts have contributed towards changes in hydrological flow regimes and the establishment of invasive weeds within riparian corridors. Clearing of vegetation for construction and the introduction of pest species are also a key threatening process. Predation by the European Red Fox is a well documented concern for indigenous species. Pittwater Council regularly controls the local fox population through baiting programs and a trapping program held late 2009.

As mentioned previously, the proposed action includes the removal of several trees (exotic and native species), some of which contribute towards the riparian corridor. Removal of the trees is primarily limited to exotic species with some avoidable native species included. A buffer zone of 20m is to be retained for core riparian habitat.

Feral cats are also a threat to this species, and the control of feral cats within the Warriewood area should be part of an overall strategy for the locality.

Conclusion

In light of the consideration of the above seven factors (1 -7), the proposed activity on the subject site is not likely to have "a significant effect" on the Black Bittern on the subject site or wider locality as a result of the current proposal, as:

- The proposal will not adversely affect the lifecycle of the species;
- The proposal will not remove, modify or further fragment or isolate a significant area of habitat for the species; and
- The proposal does not significantly contribute to any KTP threatening the species.

Consequently, a Species Impact Statement is not required to be prepared.

Lesser Sand Plover (*Charadrius mongolus*)

1 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

Charadrius mongolus Lesser Sand Plover is listed as a Vulnerable species under Part 1 of Schedule 2 of the *Threatened Species Conservation Act 1995* (TSC Act).

The Lesser Sand Plover is a coastal migratory species, breeding in central and north east Asia. Arrival to Australia coincides with winter as the plovers traverse the east coast of Australia (Nielsen, 1971) stretching along the southern coastline. Higher densities occur within the Gulf of Carpentaria, Queensland and north NSW (DECC, 2007h). The presence of the Lesser Sand Plover within the southern NSW coast is increasingly rare event (Marchant & Higgins, 1993), with the Shoalhaven estuary the southern extent (DECC, 2007h). Their epic return journey is triggered by the onset of March with records of two waves of departure occurring, the second scheduled for early April (Marchant & Higgins, 1993).

The Lesser Sand Plover forages for molluscs, worms and crustaceans along sheltered beaches, estuaries and harbours with intertidal sand and mudflats (Marchant & Higgins, 1993; DECC, 2007h). Ground roosting above the high tide mark on sandy shores the Lesser Sand Plover is a highly sociable species gathering in excess of 100 individuals although foraging can be a solo event.

The Lesser Sand Plover distribution is restricted to rockplatforms, coral reefs, sandy shores and mudflats. One confirmed sighting of the Lesser Sand Plover within a 10km radius of the study site was located within the Long Reef Marine Reserve (NPWS, 2009). Another possible sighting recently recorded foraging within the Warriewood Wetlands, adjacent to the subject site. Warriewood Wetlands offers suitable foraging opportunities for the Lesser Sand Plover, although habitat within the study site is potentially low.

The proposed removal of exotic and native trees are not likely to have an adverse impact on the population of the Lesser Sand Plover or place the population at risk of extinction. Implementation of appropriate management strategies during the construction works for the proposed development will reduce the likelihood of any adverse impacts from sedimentation within Fern Creek and indirect impact on the population.

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

The TSC Act defines an “endangered population” as “a population specified in Part 2 of Schedule 1” of the Act. The Lesser Sand Plover is not part of an “endangered population”, as defined under the TSC Act.

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

a) 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

b) 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 TSC Act defines an "endangered ecological community" as "a community specified in Part 3 of Schedule 1" of the Act, and a "critically endangered ecological" as "a community specified in Part 2 of Schedule 1a of the Act. The Lesser Sand Plover does not form part of an "endangered ecological community", as defined under the TSC Act.

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

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

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

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

As previously mentioned, mapping of the study site did not identify estuarine environments suitable for the Lesser Sand Plover. The removal of 43 Casuarina species within the classified endangered ecological community, poplar plantation and other exotic species does not constitute potential habitat for the Lesser Sand Plover.

Indirect impacts on the Lesser Sand Plover populations through the increase in sedimentation and nutrient input from the proposed construction requires appropriate management strategies. Fern Creek meanders through the study site; it is a major tributary for the Narrabeen Lagoon which in turn is a regionally significant area. No recording of the Lesser Sand Plover have been recorded within the lagoon with issues of water quality, habitat degradation and high level of human traffic an issue for the population.

Implementation of the VMP will address issues of surface water runoff and sedimentation into Fern Creek. The *Water Management Act 2000* addresses the impact of proposed works within 40m of an estuary. The establishment of a 25m Private Buffer Stripe is a requirement of Pittwater 21 Development Control Plan along Fern Creek to reduce long-term impacts on the eec vegetation community and water quality within Fern Creek. Possible indirect impacts from sedimentation and nutrient enrichment from the proposed construction is not likely to adversely impact the habitat or feeding locations of the Lesser Sand Plover.

The proposed construction is not likely to impact the identified habitat of the Lesser Sand Plover, nor will it contribute to fragmentation of potential habitats or remove habitat suitable for the Lesser Sand Plover.

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

The TSC Act defines "critical habitat" as "habitat declared to be critical habitat under Part 3 of the Act. No critical habitat has been listed for the Lesser Sand Plover and there is no critical habitat of relevance to the subject site.

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

Three strategies have been identified for the Lesser Sand Plover within the PAS, the priority actions are as follows;

- Increase community awareness and understanding of migratory waders via promotion of the DEC threatened species website and other educational materials (e.g.. signage, brochures) and through the use of media. – LOW Priority

- Minimise human disturbance at identified key foraging sites (disturbance from 4WDs, recreational users, dog-walkers, fishermen etc.). – HIGH Priority

- Review survey data to identify key foraging sites for the Lesser Sand-plover along the NSW coast. AND Undertake regular 2-yearly coordinated survey to assess Lesser Sand-plover distribution and population size - MEDIUM Priority.

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

A "threatening process" is defined under the TSC Act as "a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities". Further to that, "key threatening processes" are threatening processes specified in Schedule 3 of the Act.

The following Key Threatening Processes are considered relevant to the Lesser Sand Plover:

- Clearing of native vegetation;
- Predation by the fox and the feral cat;
- Anthropogenic climate change; and

Particularly relevant is the loss of habitat from foreshore development and hydrological changed to estuaries as identified by the DECC (2009).

Conclusion

In light of the consideration of the above seven factors (a to g), the proposed activity on the subject site is not "likely" to impose "a significant effect" on the vulnerable species Lesser Sand Plover, as:

- The proposal will not adversely affect the lifecycle of the species;
- The proposal will not remove, modify or further fragment or isolate a significant area of habitat for the species; and
- The proposal does not significantly contribute to any KTP threatening the species.

Consequently, a Species Impact Statement is not required to be prepared.

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

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

The TSC Act defines a "threatened species" as "a species specified in Part 1 or 4 of Schedule 1 or in Schedule 2" of the Act. Swamp Oak Floodplain Forest and Swamp Sclerophyll Forest are not a "threatened species", as defined under the TSC Act.

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

The TSC Act defines an "endangered population" as "a population specified in Part 2 of Schedule 1" of the Act. Swamp Oak Floodplain Forest and Swamp Sclerophyll Forest are not an "endangered population", as defined under the TSC Act.

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

a) 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

b) 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 majority of the construction works to occur during the development of the proposed housing will affect the Cleared and Disturbed and the Poplar Forest plant communities. The current development footprint will encroach on the northern boundary with the construction of dwellings and through the middle of the Boondah Road patch of the mapped 'Swamp Oak Forest' with the construction of the entrance way and internal roads. It has been recommended by this report that the native vegetation present in this area be preserved as much as possible so that the proposed development will minimise the impacts. It is recommended that native canopy be retained where practicable and that only species diagnostic of the community be used in landscaping in the area beside the roads and dwellings.

In order to mitigate negative impacts to the community from the proposal it has also been recommended that fencing be installed along the boundary of the areas of this community that are to be retained prior to construction to preserve the vegetation and control potential erosion and sedimentation. The compilation of a management plan has been recommended in order to properly manage this high conservation area including provisions for the careful management of the vegetation in relation to APZ works, and revegetation to improve the corridor values present. The northern edge and a narrow strip through the middle of this community will be directly impacted on by construction; however with revegetation of the southern portion of the community the overall extent of the community should not be significantly impacted.

The local occurrence of the community within the subject site is already at risk of extinction due to its isolated nature and location near such an urbanised centre. Any indirect impacts of the proposal will not be significant to the extent that the local occurrence of the community is likely to be placed at greater risk of extinction than is already apparent.

The proposed development is unlikely to have a substantial or adverse effect on the composition of the community such that its local occurrence is likely to be placed at risk of extinction. The construction works will not involve removal of any large area of existing native species and will not result in any significant indirect impacts. It has been recommended this area be revegetated with species diagnostic of this community. Fauna species that may currently utilise the area for foraging and feeding, such as birds, will be able to continue to utilise the area of vegetation within Warriewood Wetland and on the opposite side of Boondah Rd within the STP.

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

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

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

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

It is estimated that Coastal Floodplain Wetlands (which include Swamp Oak Floodplain Forest and Swamp Sclerophyll Forest) currently cover less than 30% of its original distribution. As these two subunits are a small component of Coastal Floodplain Wetlands it can be assumed that these communities currently occupy an even smaller area of land (NSW Scientific Committee, 2004a and b).

A narrow strip of 'Swamp Oak Forest' present along the southern boundary of the site and adjacent to Boondah Rd is to be directly impacted on through clearing for the construction of an entranceway, roads, and dwellings. The remainder of this community is to be preserved inside the proposed buffer areas. It has been recommended that the removal of 'Swamp Oak Forest' be minimised as much as practicable as part of the development and that the areas that are to be retained be fenced off for the duration of construction. The area to be impacted is minimal, and with the implementation of various management measures, the impacts to this community on site will be minimised. In addition, no indirect impacts on the endangered community within the subject site, or the surrounding locality, are expected with the implementation of appropriate mitigation measures and proposed buffer widths.

The existing cover of the community will be altered due to the removal of vegetation in the area of the development footprint. The majority of the vegetation to be cleared is within the Cleared and Disturbed and Poplar Forest communities, with only a small proportion of the 'Swamp Oak Forest' proposed for removal. The nature of the development footprint is such that there will be some fragmentation of the current 'Swamp Oak Forest' community and consequently some level of isolation of habitats on site. The proposed roadways will divide the community into three separate stands. The width of the proposed roadways is 14.5 metres which means that canopy connectivity will be fragmented. At a locality scale there will only be slight increases in the fragmentation or isolation of this particular stand of 'Swamp Oak Forest' as it currently exists in a relatively fragmented landscape.

The stand of 'Swamp Oak Forest' proposed for clearing located adjacent to Boondah Rd is highly disturbed due to previous clearing that has reduced the size of the stand allowing for the recruitment of exotic woody weeds. Due to the heavy invasion of exotic species such as *Lantana camara*, and the low numbers or absence of native understorey species, the viability of this community can be considered moderate to low. It has been recommended that the areas not marked for removal are regenerated and/or revegetated in order to increase the native species present, and strengthen

corridor values. As such, the long term survival of this community in the locality will be increased as a result of recommended management actions.

While this community has a highly fragmented nature on the NSW floodplain, the proposed development will not increase the fragmentation beyond what has already occurred due to past urbanisation. The fragmentation that will occur will only be minor, and the effects of which will not be a new occurrence on site as the area has already been subject to fragmentation in the past. No new detrimental effects are likely to be seen on the bushland as it is already heavily impacted by 'edge effects' and other effects of fragmentation. The isolation of sections of this stand of 'Swamp Oak Forest' is not likely to be important to the long term survival of this ecological community in the locality, as larger relatively undisturbed stands exist nearby.

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

No area has been designated as 'critical habitat' under Part 3 of the TSC Act 1995 for Swamp Oak Floodplain Forest or Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions.

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

There was no Threat Abatement Plan or Recovery Plan created by the DECC for Swamp Oak Floodplain Forest of Swamp Sclerophyll Forest to assist in the recovery of this community before amendments to the TSC Act removed the mandatory requirements for their preparation. There are however 12 and 11 strategies identified by the DECC in their Priorities Action Statement for Swamp Sclerophyll Forest and Swamp Oak Floodplain Forest respectively to help in the recovery of these communities and in threat abatement to abate Key Threatening Processes. The proposed development is not inconsistent with the strategies and actions listed in the Priority Action Statement.

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

The TSC Act defines "threatening process" as "a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities". Schedule 3 of the TSC Act provides a list of the "key threatening processes" (KTP). Of the KTP's listed in Schedule 3 of the TSC Act and in the context of the current and continuing land use, it is considered that the following KTP's are relevant to Swamp Oak Floodplain Forest and Swamp Sclerophyll Forest:

- Invasion and spread of *Lantana camara*;
- Habitat degradation by Feral Pigs;
- Clearing of native vegetation;
- Alteration to the natural flow regime of rivers, streams, floodplains and wetlands; and
- Ecological consequences of high frequency fire.

Clearing of native vegetation for the purposes of construction will occur as part of the current proposal. However, clearing of vegetation as part of the current proposal will be limited mainly to exotic planted species and will only involve the removal of a small section of degraded 'Swamp Oak Forest'. The remaining vegetation within the riparian area will be conserved and enhanced under the recommendations of this report. Such management will lead to the control of *Lantana camara* present

on-site, and as such, will not increase the threat of this process. Other recommendations in relation to fencing and erosion control will aid to mitigate any effects to the natural flow regimes of the site.

High frequency fire is not part of the proposal for the subject site. Hazard reduction burns and/or bushfires may have occurred in the past in this area, and may have already altered the habitat to varying degrees. Creation of an APZ, as described in the body of the report, will act to mitigate the effect of fire on the vegetation of the site.

Habitat degradation by feral pigs will not be increased by the current proposal.

Conclusion

In light of the consideration of the above seven factors (a to g), the proposed activity on the subject site is not "likely" to impose "a significant effect" on the ecological communities, as:

- the proposal is not likely to compromise the extent of the local occurrence such that it is likely to be placed at the risk of extinction;
- the proposal is not likely to substantially and adversely modify the composition of the community such that its local occurrence is likely to be placed at the risk of extinction;
- the proposal will only involve the removal of a small portion of habitat, and will result in the minor fragmentation and isolation of an already fragmented and isolated stand of the community not considered critical to its long term survival in the locality;
- the proposal will result in the enhancement of retained areas of 'Swamp Oak Forest' adjacent to the development footprint;
- The proposal is not inconsistent with the objectives of the Priorities Action Statement for the community; and
- the proposal will not substantially increase the operation of key threatening processes occurring at the subject site.

Appendix D

Nationally Listed Species

Warriewood STP Buffer Area 3
Proposed Residential Development

EPBC Significant Impact Assessment
Lathamus discolour - Swift Parrot

1 EPBC Significant Impact Assessment – *Lathamus discolor*

An action has, will have, or is likely to have a significant impact on an Endangered species if it does, will, or is likely to:

(a) lead to a long-term decrease in the size of a population

The Swift Parrot is a migratory species; commuting to Tasmania to breed and returning in winter to the east coast of Australia. Migration along the mainland coast coincides with the prolific flowering of eucalyptus species, namely; *Eucalyptus robusta* Swamp Mahogany, *Corymbia maculata* Spotted Gum, *C. gummifera* Red Bloodwood*, Eucalyptus moluccana* Grey Box and *E. pilularis* Blackbutt (Higgins 1999, Garnett and Crowley 2000, Swift Parrot Recovery Team 2001). Foraging within Sheldon Forest, Rofe Park, Lane Cove National Park has sustained a viable food supply within the northern Sydney district. Swift Parrots have been observed utilising street and urban planted trees within metropolitan areas.

Clearing of native vegetation is a key threatening process to the survival of the Swift Parrot. Removal of exotic and native species for the proposed construction does not contribute towards the decline of significant foraging trees. Limited foraging opportunities are present within the site. One preferred feed tree *Eucalyptus robusta* Swamp Mahogany set for removal may offer some nectar opportunities. Other flowering trees for removal include *Angophora costata* (3), *Eucalyptus botryoides* (1) and a *Callistemon viminalis* (1). The foraging capacity of the subject site does not support a viable population. Removal of the identified feed species does not significantly contribute towards the decline in the species or adversely impact on the available food availabilities within the study area.

(b) reduce the area of occupancy of the species

Winter foraging habitat within the locality may be offered by flowering eucalypts contained within Ku-ring-gai and Lane Cove National Park and smaller parks and reserves in the locality. Preferred feed trees that occur as street and garden trees within the locality offer further foraging habitat. The only available feed tree, *E. robusta,* within the subject site occurs within the construction footprint. Given the insignificance of this isolated tree the impact of its removal on the foraging capacity for the area would not amount to much. The Swift Parrots main foraging locations are protected and their semi-nomadic pattern along the coast provides suitable foraging trees.

(c) fragment an existing population into two or more populations

The subject site and the wider locality are not known to support an important population of Swift Parrot. Migration of Swift Parrots along the coastline corresponds with eucalyptus flowering patterns. Flocks are highly mobile travelling long distances to new foraging locations. Removal of the *Eucalyptus robusta* Swamp Mahogany from the local area will not fragment the population into two.

(d) adversely affect habitat critical to the survival of a species

Winter foraging habitat within the locality may be offered by flowering eucalypts contained within Ku-ring-gai and Lane Cove National Park and smaller parks and reserves in the locality. Preferred feed trees that occur as street and garden trees within the locality offer further foraging habitat to the species. The single preferred feed trees proposed to be removed from the subject site do not comprise habitat critical to the survival of the Swift Parrot. As such a significant area of foraging habitat will not be adversely affected by the action.

(e) disrupt the breeding cycle of a population

The Swift Parrot breeds exclusively in Tasmania, migrating to NSW in winter in order to forage on flowering eucalypts. The action will not disrupt the lifecycle of an important population of the Swift Parrot.

(f) modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The subject site provides some winter foraging foraging habitat by means of a single preferred feed trees located on the site. Foraging habitat of the Swift Parrot is already highly fragmented and modified across the urban landscape of the locality. The removal of the tree from the subject site will not further modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the Swift Parrot is likely to decline.

(g) result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species' habitat

The action will not lead to an increase in invasive species harmful to the Swift Parrot on the site, within the local or wider area.

(h) introduce disease that may cause the species to decline

Psittacine beak and feather disease (PBFD) is a significant threat to the survival of the Swift Parrot population. Contraction of PBFD is through direct contact from feeding surfaces and faecal material, inhalation or ingestion or aerosols (Avian Biotech International, 2009).

The spread of PBFD is attributed to unclean surfaces in locations of high concentrations of artificial feeding areas, such as at veterinarian clinic or captive species. The introduction of PBFD is highly unlikely during the proposed development. Inspection of tree hollows prior to the removal of trees within the construction footprint will be conducted by an experienced wildlife handler. As a precaution strict hygiene protocols will be implemented within the VMP.

(i) interfere with the recovery of the species

The overall objectives of the *Swift Parrot Recovery Plan* (Swift Parrot Recovery Team 2001) are “to change the conservation status of the swift parrot from endangered to vulnerable within 10 years” and “to achieve a demonstrable sustained improvement in the quality of swift parrot habitat to increase carrying capacity”.

The removal of the single preferred feed tree does not comprise a significant area of winter foraging habitat for the species within the locality, is not inconsistent with the objectives of this management plan. The removal of the single tree will therefore not interfere substantially with the recovery of the species.

Conclusion

Under the EPBC Act an action requires approval from the Australian Government Minister for the Environment, Water, Heritage and the Arts (the Minister) if the action has, will have, or is likely to have, a significant impact on a matter of national environmental significance such as the Swift Parrot. The assessment above concludes that the action will not have a significant impact on the Swift Parrot and as such the action does not require referral to the DEWHA for a decision by the Minister on whether further assessment and approval is required under the EPBC Act.

EPBC Significant Impact Assessment
Pteropus poliocephalus Grey-headed Flying-fox – vulnerable

1 EPBC Significant Impact Assessment – Pteropus poliocephalus

An action has, will have, or is likely to have a significant impact on a vulnerable species if it does, will, or is likely to:

(a) lead to a long-term decrease in the size of an important population of the species

The *Pteropus poliocephalus* (Grey-headed Flying-fox) is a highly sociable mammal roosting in bat 'camps' of 100 to 10,000 individuals. The largest permanent camp is located at Gordon, within 15km from the subject site. Roosting sights are established along a creek line and within 20km of reliable food sources. Individuals will source alternative fruit or nectar travelling 50km a night.

Thousands of Grey-headed Flying-foxes depart their daytime roosts at dusk to forage. Opportunistic feeding and an acute sense of smell attract the Grey-headed Flying-fox to urban and street trees surrounding their urban roosting location. Preferred and idealistic foraging is contained within Sheldon Forest, Rofe Park and Lane Cove National Park.

Four possible feed trees *Angophora costata* Sydney Red Gum (3) and *Eucalyptus botryoides* Bangalay (1) currently stand within the proposed construction zone. Foraging within these trees is not considered a critical habitat for the Grey-headed Flying-fox. The subject site is not suitable for permanent roosting or as a maternity camp. It is highly unlikely that the removal of these trees would reduce the population size from displacement and a reduction in the availability of food.

(b) reduce the area of occupancy of an important population

Three important roosting camps for the Grey-headed Flying-fox are located within a 40km radius of the subject site. Foraging behaviour by the Grey-headed Flying-fox can accommodate individuals from any of these bat camps. The greater the foraging opportunities the higher the significance and more individuals gather to the feeding trees. Of the canopy trees located within the construction footprint 714 are exotic Poplar species and 43 are Casuarina. Foraging opportunities are therefore restricted to four trees within the construction footprint. Therefore the removal of native and exotic species from the subject site will not reduce the area of occupancy available for an important population of the species.

(c) fragment an existing important population into two or more populations

The nearest important population of the Grey-headed Flying-fox is located at Gordon, 12km from the subject site with two other important roosting camps within a 40km radius of the subject site. The Grey-headed Flying-fox is capable of distances of 20 – 50km in search of suitable foraging locations and movement between populations. The construction proposal will not contribute to the fragmentation of the populations into smaller populations.

(d) adversely affect habitat critical to the survival of a species

Clearing and degradation of critical habitat for the Grey-headed Flying-fox has been identified as a key threatening process. Large riparian trees and flowering eucalyptus and fruiting trees provide critical habitats for the Grey-headed Flying-fox. Roosting camps within the Sydney region are protected as Botanic Gardens or National Parks and Reserves. Critical foraging locations are contained within Lane Cove and Ku-ring-gai National Parks and surrounding nature reserves and council parks. Alternative exotic and native fruiting and flowering species are available on private land or street trees. The later are not considered critical habitat given the limited foraging opportunities they provide.

Removal of four feed trees are not considered critical habitat. The removal of these trees and the non-feed trees, Poplar and Casuarina species does not adversely impact the survival of the Grey-headed Flying-fox.

(e) disrupt the breeding cycle of an important population

The nearest known maternity colony of the species is 12km away at Gordon. The NPWS (2001) has stated that *Pteropus poliocephalus* (Grey-headed Flying-fox) camps are usually located in close proximity to a regular food source (20 km or less) and are often in stands of riparian rainforest or commonly in gullies, close to water, in vegetation with a dense canopy. The Grey-Headed Flying-Fox most likely utilises the site on occasion during foraging activities and there is no preferred permanent roosting camp habitat on the subject site. The removal of trees from the subject site will not disrupt the breeding cycle of a local, regional or other population by impacts on potential roosting and maternity camp habitat or foraging habitat.

(f) modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

Quality habitat for the Grey-headed Flying-fox is located within the maternity bat camps and foraging within the National Parks and reserves. Urban and remnant habitats are highly fragmented outside these protected reserves and contribute towards foraging opportunities.

Removal of trees for the proposed development will not impend on the species ability to move between habitats or located food sources. The removal of the trees within the subject site will not further modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the Grey-Headed Flying-Fox is likely to decline.

(g) result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

The action will not lead to an increase in invasive species harmful to the Grey-headed Flying-fox on the site, within the local or wider area.

(h) introduce disease that may cause the species to decline

The proposed construction does not directly come into contact with individual Grey-headed Flying-foxes, their roosting camps or feeding grounds. Removal of preferred feed trees will not contaminate remaining feed trees and indirectly introduce disease into the population. As a protocol strict hygiene protocols will be implemented for the construction and development of the proposed action.

(i) interferes substantially with the recovery of the species

No federal or state recovery plan is currently in place for the Grey-headed Flying-fox. However the DECC (2008b) have identified at total of 10 recovery strategies accompanied by 31 priority actions to assist in the recovery of the species in NSW. The proposed action is not inconsistent with relevant recovery strategies and priority actions identified by the DECC (2009b). The removal of over 700 trees (exotic and native species) do not comprise a significant area of foraging habitat for this species and will therefore not interfere substantially with the recovery of the species.

Conclusion

Under the EPBC Act an action requires approval from the Australian Government Minister for the Environment, Water, Heritage and the Arts (the Minister) if the action has, will have, or is likely to have, a significant impact on a matter of national environmental significance such as the Grey-headed

Flying-fox. The assessment above concludes that the action will not have a significant impact on the Grey-headed Flying-fox and as such the action does not require referral to the DEWHA for a decision by the Minister on whether further assessment and approval is required under the EPBC Act.

EPBC Significant Impact Assessment

Xanthomyza Phrygia - Regent Honeyeater

An action has, will have, or is likely to have a significant impact on an Endangered species if it does, will, or is likely to:

(a) lead to a long-term decrease in the size of a population

The Regent Honeyeater is a migratory species, with three known breeding regions within Australia (DEWHA, 2009);

Capertee Valley, NSW;
The Bundarra-Barraba area, NSW; and
Around Chiltern, Victoria

Non-breeding flocks migrating 100km east to coastal woodlands to forage for nectar from eucalyptus species and mistletoe. Newport and Narrabeen, adjacent to the study area, previously recorded the Regent Honeyeater as a regular visitor; today sporadic sightings occur in the area. Three records are documented as reliable within 10km of the subject site (DECC 2007f). It is thought that movement to coastal habitats is a necessity when food sources are scare in breeding locations and not an annual cycle migration (DEWHA, 2009). Supplement food is obtained through lerp exudates and invertebrates.

Habitats vary from dry iron-bark eucalyptus woodland and dry sclerophyll forests in the western breeding grounds to wet lowland coastal forest dominated by *Eucalyptus robusta* Swamp Mahogany or *Corymbia maculata* Spotted Gum (DEWHA, 2009). Riparian habitats with *Casuarina cunninghamiana* River Sheoak species also provide suitable foraging inland.

The proposed activities are not contained within breeding locations or known critical foraging habitats. The development is highly unlikely to impact the Regent Honeyeaters ability to migrate between habitats and utilise optimal feed trees. In essence the proposal will not adversely impact on the biology of the Regent Honeyeater and directly or indirectly impact the size of the population.

(b) reduce the area of occupancy of the species

No permanent occupancy for Regent Honeyeaters occurs in a given location. Rare occasions have located individuals prolonging their temporary residency at breeding grounds when food availability is sustainable. A general pattern of eastward migration outside the breeding season distributes the population into small nomadic flocks along the coastline. Coastal woodlands dominated by *E. robusta* or *C. maculata* species are preferred foraging habitats, although no formal foraging pattern has been observed between habitat migration.

According to mapping conducted by the Birdlife International GIS the Regent Honeyeaters occupancy has declined with an estimated current range of 300 000 km^2 (DEWHA, 2009). Regular migrations of individuals disperse throughout Canberra, the Central Coast, Hunter Valley and Warrumbungle National Park. Dispersal along the coast is also scattered from Moruya to Nowra and the Illawarra and to the north to the Northern Rivers and Mid-north Coastal Regions. Regent Honeyeaters are assumed extinct in South Australia and western Victoria (DEWHA, 2009).

An overall description of the study area was mapped as disturbed and fragmented. The current degradation of the study area does not provide suitable coastal woodland habitat or feed trees to attract or sustain individuals in the area. Irregular observations of Regent Honeyeaters adjacent to the subject site are presumably foraging while utilising the available habitat within Bouddi and Ku-ring-gai National Parks and vegetation adjoining Middle and Deep Creek tributaries.

The proposed development involves the removal of exotic and native species. The habitat contained within the subject site does not support primary foraging habitat for Regent Honeyeaters due to the

absence of food trees. In effect the removal of exotic and native trees does not have the capacity to reduce the area of occupancy for the Regent Honeyeater.

(c) fragment an existing population into two or more populations

As previously mentioned the current subject site is described as highly fragmented and disturbed vegetation community, dominated by a mature Poplar plantation. No current Regent Honeyeater population occurs within the location or permanent residency. Large populations gather at their breeding locations in Capertee Valley and Bundarra-Barraba NSW annually during May (DEWHA, 2009). Small nomadic flocks will then disperse in March travelling over 100km to foraging in coastal woodlands.

It is highly unlikely that the proposed actions will fragment the populations into two or more populations. The removal of 714 poplar trees and 43 Casuarina trees is either habitat or foraging species required by the Regent Honeyeater. Potential foraging opportunities are available within Bouddi and Ku-ring-gai National Park in close proximity to the study area. Further secondary habitats within the Warringah LGA contain suitable coastal vegetation adjacent to Middle and Deep Creek tributaries into Narrabeen Lagoon.

(d) adversely affect habitat critical to the survival of a species

Critical habitat for the Regent Honeyeater is essentially large eucalyptus species dominated by *Eucalyptus robusta* and *Corymbia maculata* within coastal woodland. Major tributaries within the Narrabeen Catchment, Deep and Middle Creek in Warringah LGA and the surrounding vegetation within Bouddi and Ku-ring-gai National Parks are examples of critical habitat for the Regent Honeyeater. Abundant feed trees are available and sheltering opportunities for the species.

The proposed actions are not considered within habitat critical for the survival of the Regent Honeyeater. Irregular sighing of the Regent Honeyeater during drought and low food availabilities has force species to utilise urban trees to supplement their diet. Available feed trees are protected within adjacent National Parks and reserves and utilised by the Regent Honeyeater. The proposed removal of the exotic and native trees are not considered feed trees or habitat for the Regent Honeyeater.

(e) disrupt the breeding cycle of a population

Breeding occurs annually during the months of May to March, flocks converge to the western slopes of NSW and Victoria. Three locations are identified as primary breeding locations with large communal roosting observed during the initial phase. Two locations within NSW are at Capertee Valley, outside Mudgee and around the Bundarra-Barraba area. Nesting patterns are highly dependant on the availability of tree hollows and food supplies. Recent studies using colour banding located breeding Regent Honeyeater's utilising nests up to 45km from previous years nesting locations (DEWHA, 2009).

The proposed development is locality outside the critical habitat breeding locations. Disruption to the breeding cycle also includes the migration patterns and non-breeding feeding locations. The proposed site is not located within significant feeding locations for the Regent Honeyeaters. It is assumed that the proposed development actions will not adversely disrupt the breeding cycle of the Regent Honeyeaters.

(f) modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The current subject site is located within a highly fragmented habitat dominated by an exotic Poplar plantation and an understorey of weed species. The proposed removal of these species and an additional strand of Swamp Oak Forest Casuarina species have not been identified as critical habitat

during fauna surveys or desktop review. Mapping by Benson and Howell (1994) described the subject site as disturbed habitat.

The site does not hold foraging potential for the Regent Honeyeater. A total of 714 exotic Poplar planted trees contribute towards the available habitat within the site and have been identified within the proposed removal. A further 43 *Casuarina glauca*, 3 *Angophora costata* and 1 *Eucalyptus botryoides* are also proposed. A buffer riparian zone adjacent to Fern Creek to the east of the subject site will be retained for the dispersal requirements of flora and fauna species. This vegetation will aid in threatened and common species to utilise favourable habitats and reduce the level of fragmentation. From the understanding of the ecological requirements of the Regent Honeyeater it is highly unlikely that the removal of these trees and the construction of the new development will adversely impact the Regent Honeyeater and directly cause the species to decline.

(g) result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species' habitat

The action will not lead to an increase in invasive species harmful to the Regent Honeyeater on the site, within the local or wider area.

(h) introduce disease that may cause the species to decline

The action will not lead to the introduction of disease that has the potential to cause a decline in the current population on the site or within the local or wider area.

(i) interferes substantially with the recovery of the species

The overall objectives of the *Regent Honeyeaters Recovery Plan 1999 – 2003* (DNRE 1999) are "to ensure that the species persists in the wild" and "achieve a down-listing from nationally endangered to vulnerable by stabilising the population and securing habitat extent and quality in the main areas of occupancy".

The removal of the Poplar and Casuarina strands and a small number of other exotic and native trees does not comprise a significant area of foraging habitat for the species within the locality. The proposed actions are not inconsistent with the objectives of this Recovery Management plan for the Regent Honeyeater. However, the removal of the trees within the subject site is not considered habitat or breeding areas for the Regent Honeyeater. Therefore the proposed actions do not interfere substantially with the recovery of the species.

Conclusion

Under the EPBC Act an action requires approval from the Australian Government Minister for the Environment, Water, Heritage and the Arts (the Minister) if the action has, will have, or is likely to have, a significant impact on a matter of national environmental significance such as the Regent Honeyeater. The assessment above concludes that the action will not have a significant impact on the Regent Honeyeater and as such the action does not require referral to the DEWHA for a decision by the Minister on whether further assessment and approval is required under the EPBC Act.

Migratory Impact Assessment Criteria

I. substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species;

The Regent Honeyeater migrates from foraging along the coastline in winter 100km to the western slopes of NSW and Victoria to breed. The Regent Honeyeater is known to inhabit National Parks

within the Wollemi, Hunter Valley and Central Coast regions during its semi-nomadic foraging cycle. The subject site is not considered potential habitat for the Regent Honeyeater and no records of the species foraging or sheltering within the site has been obtained.

Warriewood Valley is a subject to periodic flooding. The Hydrologeogical Report by the Geotechnications measured the ground water within the subject site as 'high' and consequential development must consider the implications of the groundwater (Jerrery and Katauskas, 2010). Pittwater Council requires all construction within the Warriewood Valley to implement flood mitigation measures and submit a flood management plan for the proposed development. The proposed actions include the redirection of surface and ground water and the establishment of a sediment basin within the subject site prior to diversion to the Warriewood Wetlands. The VMP will offer more information as to the management practices regarding groundwater and flood mitigation measures.

Fire regimes within the Warriewood Valley have significantly altered since European establishment within the subject area. The proposed development will not alter the current fire management practices.

The impact of the development on fragmentation and the retained Core Riparian Zones has been discussed thoroughly above.

The proposed actions are likely to impact on the hydrological flow over the subject site but will not impact the flow into Warriewood Wetlands a regionally significant area. The changes to the subject site is not considered to adversely impact the migration of the Regent Honeyeater.

II. result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species; or

The subject area or the wider locality is not considered important habitat for the Regent Honeyeater. The proposed actions will not result in the invasion of species that may potentially impact on the Regent Honeyeaters ability to establish within their important habitat.

III. seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

As the previous assessment has identified, the Regent Honeyeaters breeding occurs within western NSW and Victoria. Foraging occurs within mature coastal woodland with abundant eucalyptus flowering trees. The subject site does not offer potential foraging opportunities for the Regent Honeyeater and as such the proposed development is highly unlikely to seriously disrupt aspects of its lifecycle.

1 EPBC Significant Impact Assessment

Charadrius mongolus - Lesser Sand Plover

An action has, will have, or is likely to have a significant impact on a Vulnerable species if it does, will, or is likely to:

(a) lead to a long-term decrease in the size of an important population of a species

The Lesser Sand Plover is a vulnerable, migratory species. Offshore breeding occurs annually in remote north east Asia. Two large flocks depart the Queensland coastline in March and early April. The return trip coincides with the Australian winter where flocks disperse along the eastern Australian coastline. The Lesser Sand Plover, like many migratory birds, must increase their body weight by up to 70% to sustain their long distance commutes (DEH 2004). This requires a habitat rich in food resources to provide for the high energy demands.

The Lesser Sand Plover typically forages for invertebrates along estuaries and intertidal sand and mudflats. Nocturnal roosting takes place between small rock crevices within rockplatforms or sandy shorelines. The Lesser Sand Plover habitat is restricted to the coastline.

The proposed actions do not directly impact the habitat required by the Lesser Sand Plover. The proposed construction is not directly linked to breeding grounds near Asia or intertidal foraging and roosting habitats. Fern Creek located within the western and southern boundaries in the subject site is subject to tidal changes. The portion of Fern Creek that dissects the subject site supports a degraded riparian vegetated habitat, not suitable as a mud or sandy foraging habitat required by the Lesser Sand Plover.

After an extensive investigation of the habitat requirements of the Lesser Sand Plover and the actions proposed within the proposed construction it is highly unlikely the development and the removal of native and exotic trees will impact on the Lesser Sand Plover and decrease the size of the population in light of the following;

- breeding occurs in the south east of Asia
- no current population resides within 10km of the subject site
- the site does not support roosting or foraging habitats for the Lesser Sand Plover
- the Lesser Sand Plover does not utilise trees for sheltering, foraging or protection
- the construction will be monitored and protected against an increase in sediment and runoff

The proposed action is highly unlikely to adversely impact the population of Lesser Sand Plovers.

(b) reduce the area of occupancy of an important population

The subject site does not provide foraging or sheltering habitat opportunities for the Lesser Sand Plover. Suitable habitat is available to the along the sandy coastline and within the Narrabeen, Dee Why and Long Reef lagoons within 10km of the study area. According to the NSW NPWS Wildlife Atlas only one reliable sighting of the Lesser Sand Plover occurs within 10km of the study site at Long Reef Marine Reserve (DECC, 2007f). On a wider scale sightings are limited within the northern Sydney region; to the north an isolated record was obtained at Davidstown on the Central Coast and in the south regular sightings are concentrated within Botany Bay inlet.

The subject site does not assume that the proposed development will reduce the area of occupancy for the Lesser Sand Plover.

(c) fragment an existing important population into two or more populations

The subject site and the wider locality are not known to support an important population of Lesser Sand Plovers. Migration of Lesser Sand Plovers along the coastline corresponds with the Australian winter and dispersal to suitable foraging habitat. Removal of the Poplar and native trees within the study area is not considered an adverse impact likely to directly fragment an existing population into two or more populations.

(d) adversely affect habitat critical to the survival of a species

The subject site is not considered habitat critical for the Lesser Sand Plover. Suitable habitat requirements are protected within the Long Reef Marine Reserve and within three Lagoon systems in the adjacent Warringah LGA. The proposed actions will not adversely remove or impact on habitat considered critical to the survival of the Lesser Sand Plover.

(e) disrupt the breeding cycle of an important population

The Lesser Sand Plover is a migratory species, choosing to winter in Australia. Breeding occurs within remote locations to the south east of Asia. The proposed actions are not considered significant to impact the Lesser Sand Plover during its foraging within Australia and result in a disruption to the breeding cycle.

(f) modify, destroy, remove or isolate or decrease the available or quality of habitat to the extent that the species is likely to decline

As previously mentioned the subject site is not considered valuable foraging habitat for the Lesser Sand Plover. Suitable foraging is available within 10km of the site within a protected Marine Reserve at Long Reef. To date, only one record of the Lesser Sand Plover utilising this habitat has been recorded within the NPWS Wildlife Atlas.

(g) results in invasion species that are harmful to a vulnerable species becoming established in the vulnerable species habitat

The action will not lead to an increase in invasive species harmful to the Swift Parrot on the site, within the local or wider area.

(h) introduce disease that may cause the species to decline

Strict hygiene protocols will be implemented within all aspects of construction and development as a precautionary against the introduction of diseases.

(i) interfere substantially with the recovery of the species

The "*Wildlife Conservation Plan for Migratory Shorebirds*" is an international partnership as part of the *Asia Pacific Migratory Waterbird Conservation Strategy* to protect a defined flyway for migratory shorebirds such as the Lesser Sand Plover. The strategy includes the possible rehabilitation of degraded wetlands and the creation of new artificial sites to replace those lost during development. Additionally four priority actions are described under the Recovery Plan for the Lesser Sand Plover;

- increase community awareness of the significance of migratory waders
- minimise human disturbance to key foraging locations
- management of habitat through the use of fencing and signage

- survey/mapping and habitat assessment of key foraging sites for the Lesser Sand Plover along the NSW coast (DECC, 2007h).

The proposed actions are not likely to increase the level of disturbance to foraging locations for the Lesser Sand Plover. The proposed actions are therefore not interfering substantially within the recovery of the species.

Conclusion

Under the EPBC Act an action requires approval from the Australian Government Minister for the Environment, Water, Heritage and the Arts (the Minister) if the action has, will have, or is likely to have, a significant impact on a matter of national environmental significance such as the Lesser Sand Plover. The assessment above concludes that the action will not have a significant impact on the Lesser Sand Plover and as such the action does not require referral to the DEWHA for a decision by the Minister on whether further assessment and approval is required under the EPBC Act.

Migratory Impact Assessment Criteria

I. substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species;

The Lesser Sand Plover is protected under the migratory agreement between Australia and China and Japan. Migration to their remote breeding locations within south east China is triggered by the onset of the Australian Winter. Dispersal of the Lesser Sand Plover is concentrated to the north and south of Sydney. One recording within the Long Reef Marine Reserve has occurred within 10km of the subject site. The habitat requirements for the Lesser Sand Plover are not contained within the subject site.

Possible changes to the habitat through the redirection of flood and ground waters are sustained by the implementation of redirection structures during construction. These will reduce impact hydrological alteration and possible nutrient and sediment on the Warriewood Wetlands and the Narrabeen Lagoon tributaries.

The proposed development will not cause substantial modification to a important habitat for the Lesser Sand Plover.

II. result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species; or

The proposal will not result in the establishment of invasive species within important habitat for the Lesser Sand Plover.

III. seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

The proposed actions will not seriously disrupt the lifecycle of the Lesser Sand Plover.