

**12A John Street**

**Flora and Fauna Report**

*By Ecological Consultants Australia Pty Ltd TA*

*Kingfisher Urban Ecology and Wetlands*

**October 2019**





## About this document

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### Statement of Authorship

*This study and report was undertaken by Ecological Consultants Australia at Studio 1/33 Avalon Parade, Avalon. The author of the report is Geraldene Dalby-Ball with qualifications BSc. majoring in Ecology and Botany with over 20 years' experience in this field, Lisa Jones and Julian Reyes with qualifications BSc. Majoring in Ecology.*

### Limitations Statement

Information presented in this report is based on an objective study undertaken in response to the brief provided by the client. Any opinions expressed in this report are the professional, objective opinions of the authors and are not intended to advocate any particular proposal or pre-determined position.

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Signed: Geraldene Dalby-Ball – Director of Ecological Consultants Australia

## Executive Summary

### Introduction

- The development will consist of the construction of a residential dwelling.
- Arborist recommendations will be provided to reduce the likelihood of impact and mitigate loss.

### Methods

- On-ground survey took place in February 2019 by Senior Ecologist Geraldene Dalby-Ball and Tina Feodoroff.
- Flora and fauna observations were recorded on-site using binoculars and physical examination. Notes, photos and samples of flora species were taken to assess ecological health and value of the site.
- Bionet searches were performed for flora, fauna and endangered populations to identify if there were previous records of threatened species occurring within the local area using a 10km radius around the site.

### Results

- The footprint of the proposed dwelling covers approximately two thirds of the site with the easterly end of the site adjacent to the creek being left as garden.
- The site is adjacent to the the Threatened Ecological Community PCT1234 Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion
- The site may be providing habitat for threatened fauna species. Foraging habitat is available for the Large Forest Owls, Microbats, Grey-headed Flying-fox and Bush Stone-curlew thus requiring a Test of Significance (also known as 5-Part Test);
- No threatened flora or fauna species were found on-site during on site searches;
- The ratio of tree replacement for no-net loss is 10:1 and these trees can be planted off-site.
- Installation of nest boxes to encourage native wildlife.

### Mitigation Measures

#### Before works:

- Tree Protection as per Arborist report by Naturally trees.
- Removal of Weeds to prevent spread of seed.
- Effective site management to ensure sediment doesn't enter the waterway

#### During works:

- Care must be given to preserve and protect key native species.
- Bush hygiene protocols should be followed to prevent the spread of pathogens including *Phytophthora*.

#### After completion of works:

- Revegetation works will be conducted as per Landscaping Plan for flora species and should include species from PCT1234 to mitigate threats associated with this PCT including altered hydrology and clearing.
- Management of the sites interface with Careel Creek to reduce sediment build-up and improve water quality.

Legislation: Various pieces of legislation apply to this location and the proposed works are in keeping with the objective of the Acts. Key acts are listed below.

- *Cwlth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).*
- *Environmental Planning and Assessment Act 1979 (EP&A Act).*
- *Biodiversity Conservation Act 2016 (BC Act).*
- *Fisheries Management Act 1994 (FM Act).*
- *National Parks & Wildlife Act 1974 (NP&W Act).*
- *Biosecurity Act (superseding the Noxious Weed Act 1993) (NW Act).*
- *Coastal Management Act 2016*

#### **Conclusions and Recommendations**

- Weed removal and landscaping can enhance the riparian zone buffer.
- Exotic species are presently habitat and replacement of these species with native species that fall within the PCT1234 plant community will assist in mitigating habitat loss.
- Arborist report recommendations to be applied.
- Microbat nest boxes (x 2) are recommended)
- The installation of a living retainer wall established with native vegetation to stabilize the wetland environment/ development site interface will assist ecological integrity
- Public awareness of best practice in waterway management to mitigate erosion and water pollution respectively thus maintaining the integrity of the coastal zone.

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# 1 Introduction

Ecological Consultants Australia (ECA) has been contracted by Tim West to provide a “Flora and Fauna Assessment” to assess potential direct and indirect impacts on any threatened species, populations and communities as per section 5A of the Environmental Planning & Assessment Act 1979. The ‘Assessment of Significance’ has been undertaken in accordance with the NSW Department of Environment & Climate Change ‘Threatened species assessment guidelines’.

## 1.1 Site Location

The study area is 12 John St, Avalon Beach NSW 2107, Australia (see Figure 1).



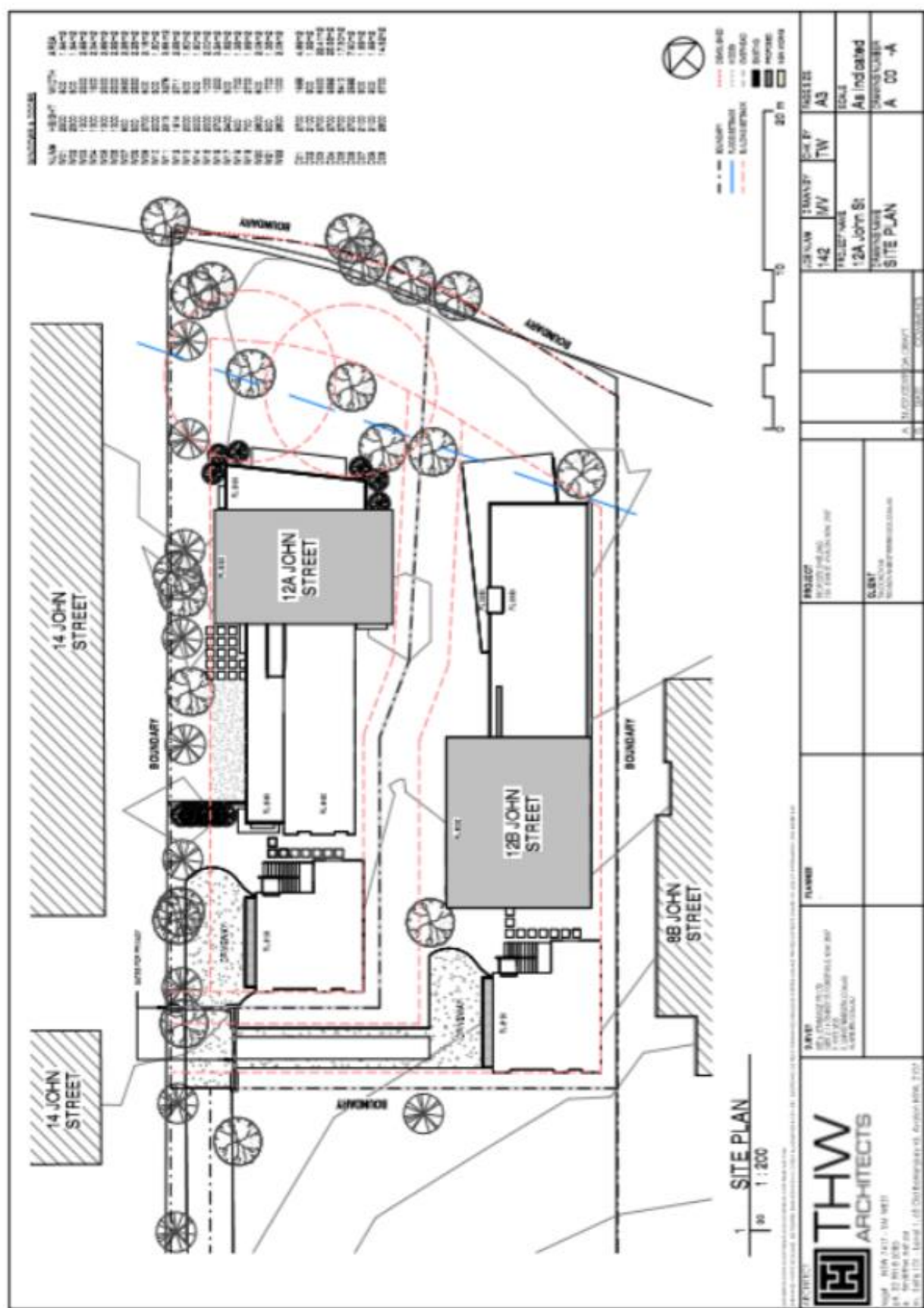
Figure 1. Location of the site. Source: Six Maps 2019.

# 2 Proposed Actions

The proposed actions involve the construction of a two story residential dwelling (See Figure 2a-e below).

Flora and Fauna Impact Assessment report to meet DA Council conditions.

**Figure 2a D.A plans for John Street. Source THW Architects**



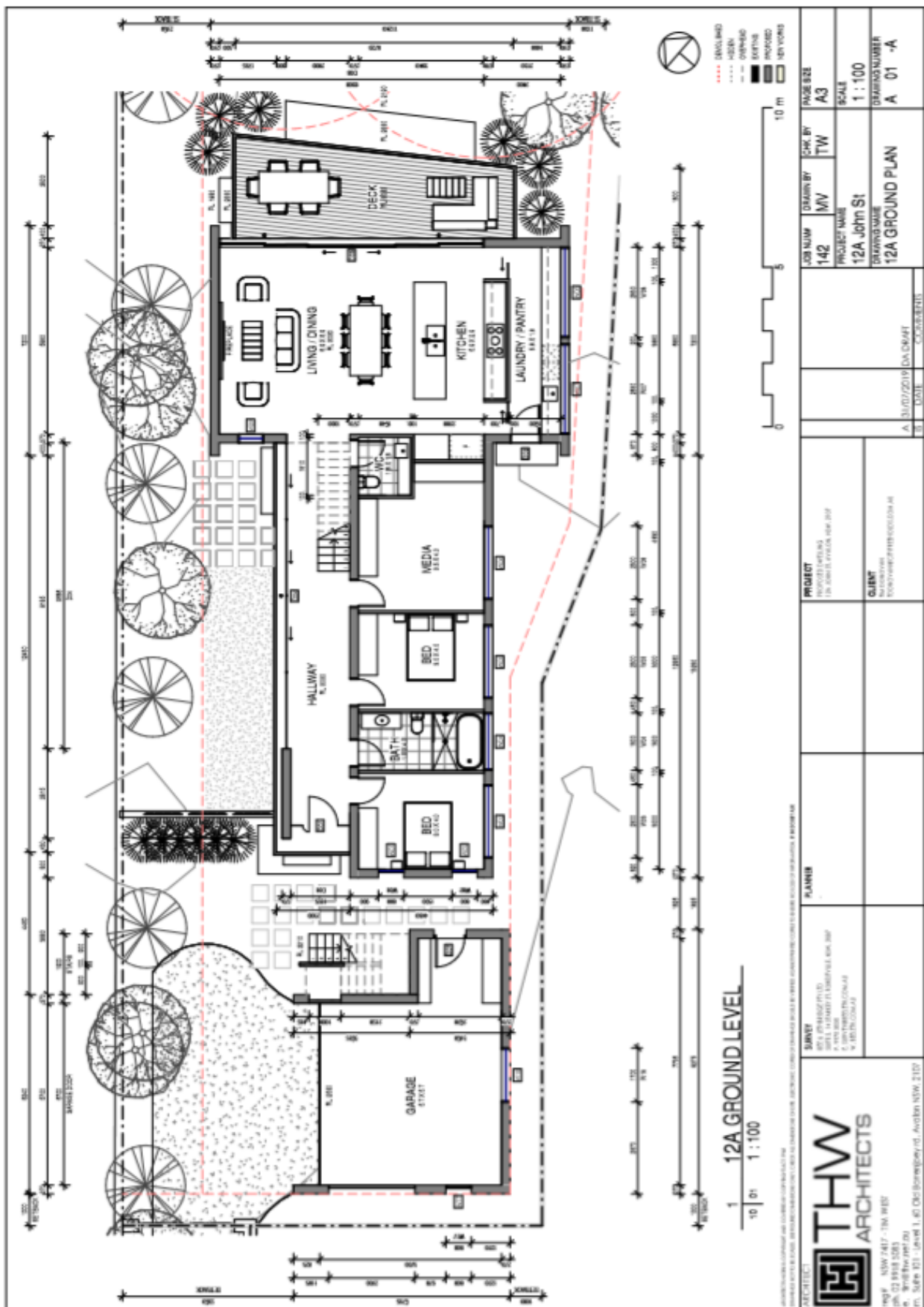


Figure 2b D.A plans for John Street. Source THW Architects

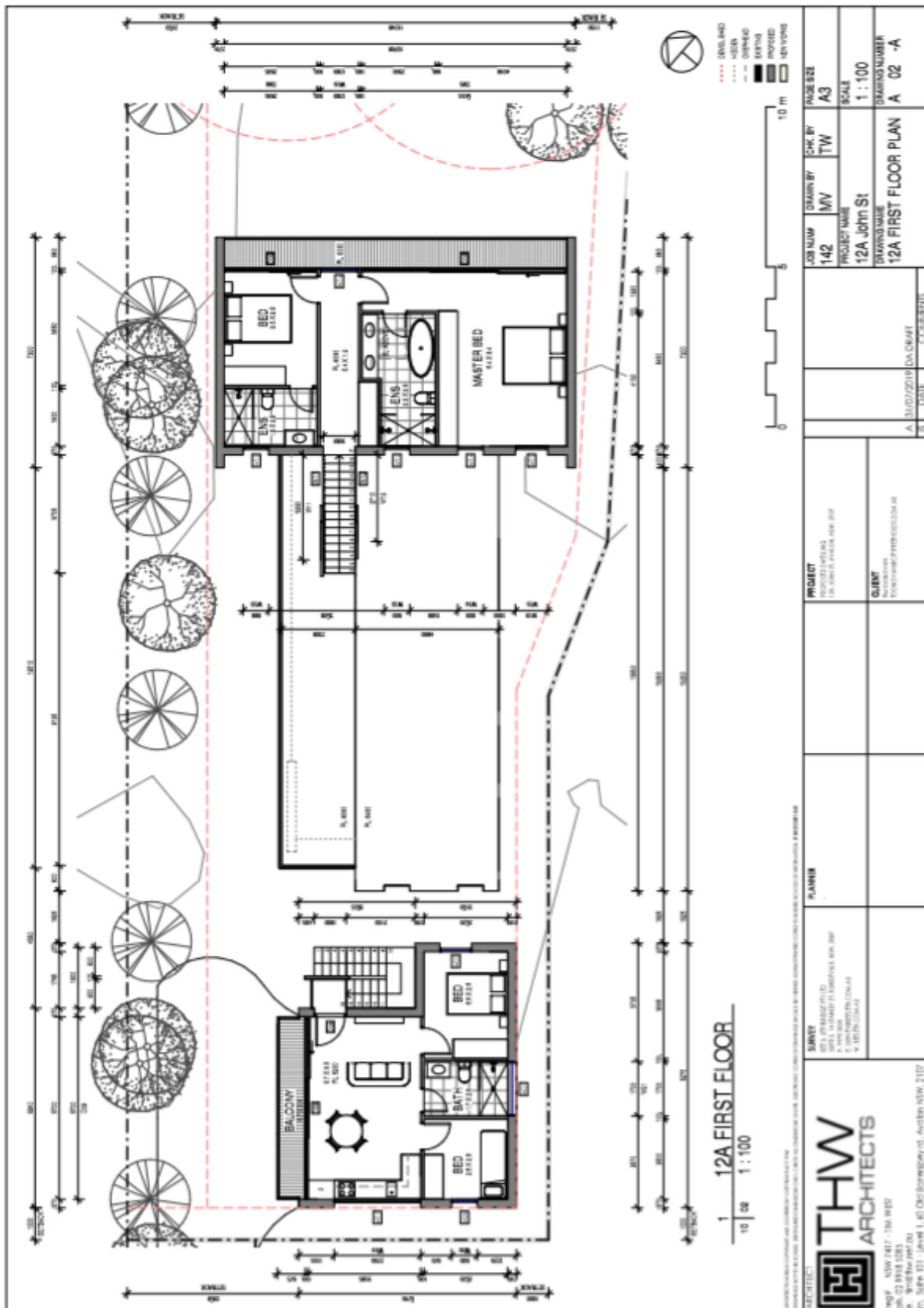
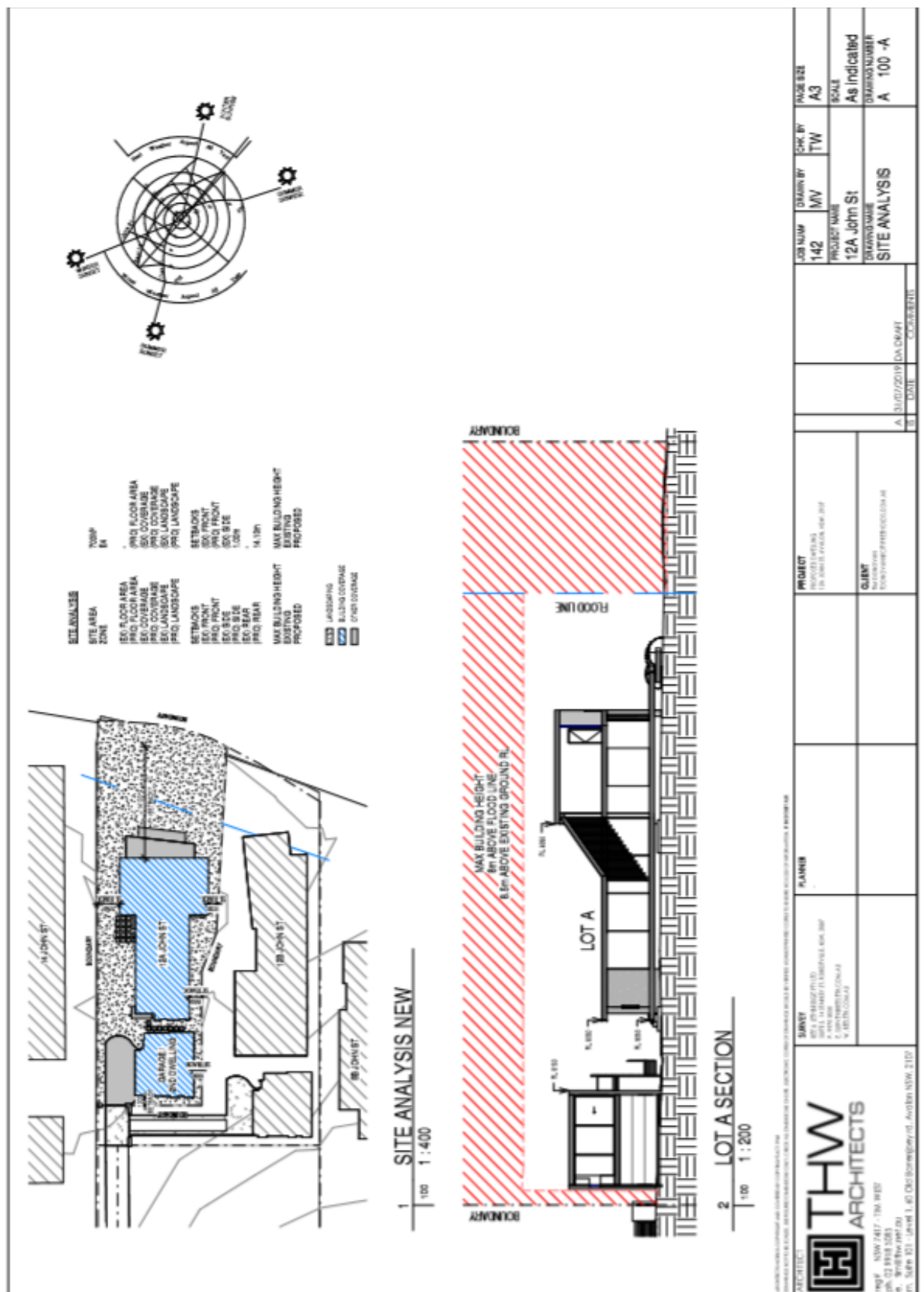


Figure 2c D.A plans for John Street. Source THW Architects

**Figure 2d D.A plans for John Street. Source THW Architects**



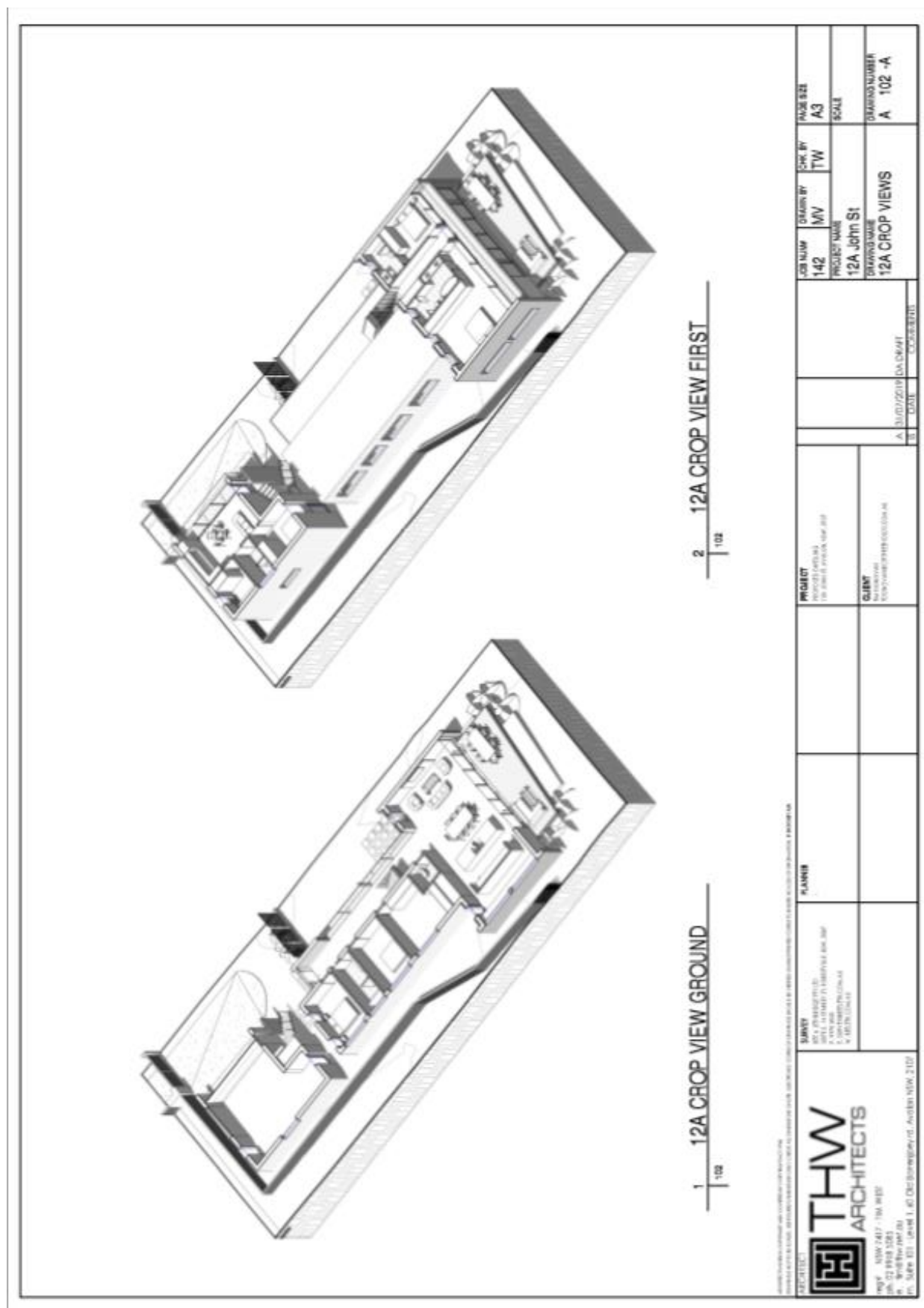


Figure 2e D.A plans for John Street. Source THW Architects

## 2.1 Legislation and policy

The implications for the proposal were assessed in relation to key biodiversity legislation and policy including:

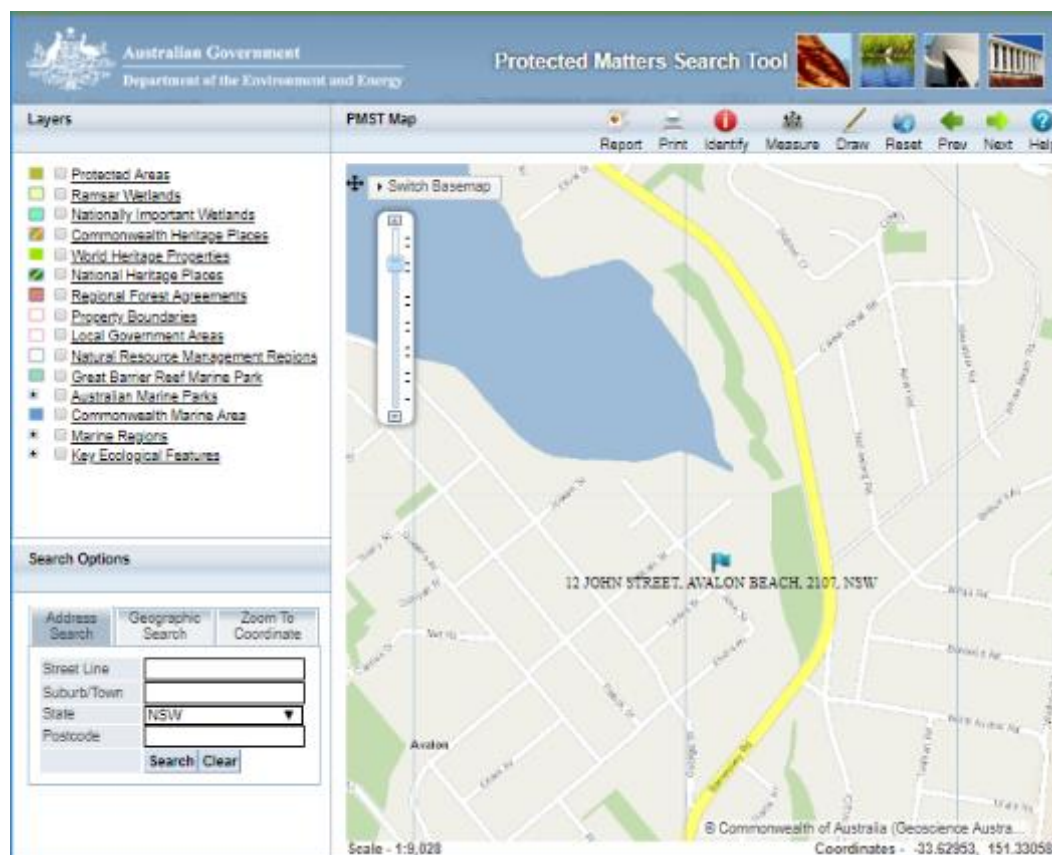
- *Cwlth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).*

A Protected Matters Search was conducted.

[Coastal Swamp Oak \(Casuarina glauca\) Forest of New South Wales and South East Queensland ecological community](#)  
[Coastal Upland Swamps in the Sydney Basin Bioregion](#)  
[Posidonia australis seagrass meadows of the Manning-Hawkesbury ecoregion](#)  
[Subtropical and Temperate Coastal Saltmarsh](#)

- 1) Coastal Swamp Oak Forest is onsite and adjoining (Figure 6.4)
- 2) Coastal Upland Swamps Sydney – adjacent to the site
- 3) Posidonia australis seagrass meadows of the Manning-Hawkesbury ecoregion– Site sits up stream of the zone (Figure 7)
- 4) Subtropical and temperate Coastal Saltmarsh near the site

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## Summary

### Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that relate to the area you nominated. Further information is available by scrolling or following the links below. If you are concerned about a significant impact on one or more matters of national environmental significance, see [Administrative Guidelines on Significance](#).

<a href="#">World Heritage Properties:</a>	None
<a href="#">National Heritage Places:</a>	None
<a href="#">Wetlands of International Importance:</a>	None
<a href="#">Great Barrier Reef Marine Park:</a>	None
<a href="#">Commonwealth Marine Area:</a>	None
<a href="#">Listed Threatened Ecological Communities:</a>	4
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<a href="#">Listed Migratory Species:</a>	57

### Listed Threatened Ecological Communities

### [ Resource Information ]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
<a href="#">Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community</a>	Endangered	Community likely to occur within area
<a href="#">Coastal Upland Swamps in the Sydney Basin Bioregion</a>	Endangered	Community may occur within area
<a href="#">Posidonia australis seagrass meadows of the Manning-Hawkesbury ecoregion</a>	Endangered	Community likely to occur within area
<a href="#">Subtropical and Temperate Coastal Saltmarsh</a>	Vulnerable	Community likely to occur within area

Frogs		
<a href="#">Heleioporus australiacus</a> Giant Burrowing Frog [1973]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Litoria aurea</a> Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Litoria littlejohni</a> Littlejohn's Tree Frog, Heath Frog [64733]	Vulnerable	Species or species habitat may occur within area
Mammals		
<a href="#">Balaenoptera musculus</a> Blue Whale [36]	Endangered	Species or species habitat may occur within area
<a href="#">Chalinolobus dwyeri</a> Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Dasyurus maculatus maculatus (SE mainland population)</a> Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
<a href="#">Eubalaena australis</a> Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
<a href="#">Isodon obesulus obesulus</a> Southern Brown Bandicoot (eastern), Southern Brown Bandicoot (south-eastern) [68050]	Endangered	Species or species habitat likely to occur within area
<a href="#">Megaptera novaeangliae</a> Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Petrogale penicillata</a> Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)</a> Koala (combined populations of Queensland, New	Vulnerable	Species or species

- *Environmental Planning and Assessment Act 1979 (EP&A Act).*

The EPA Act requires that the assessing body, in this case local government, consider the impact of the development on the surroundings – with respect to this ecology report the impacts on the environment are assessed. No significant impact on threatened species, populations or communities is indicated if recommendations are followed

- *Coastal Management Act 2016*

The Coastal Management SEPP <https://legislation.nsw.gov.au/#/view/EPI/2018/106/id23> replaced the State Environmental Planning Policy No 71—Coastal Protection (SEPP 71). The Coastal Management SEPP divides every part of the 'coastal zone' into one of four management areas. These are:

- the coastal wetlands and littoral rainforests area,
- the coastal vulnerability area,
- the coastal environment area,
- the coastal use area.

*The purpose of a coastal management program is to 'set the long-term strategy for the coordinated management of land within the coastal zone'. The focus of a program is to achieve the objectives of the Coastal Management Act. These objectives are wide-ranging and include:*

- *to protect and enhance natural coastal processes and coastal environmental values including natural character, scenic value, biological diversity and ecosystem integrity and resilience;*
- *to recognise the coastal zone as a vital economic zone and to support sustainable coastal economies;*
- *to facilitate ecologically sustainable development in the coastal zone and promote sustainable land use planning decision-making;*
- *to promote integrated and co-ordinated coastal planning, management and reporting; and*
- *to facilitate the identification of land in the coastal zone for acquisition by public or local authorities in order to promote the protection, enhancement, maintenance and restoration of the environment of the coastal zone.*

Proposed works were also assess based on the objective in the *Coastal Management Manual*.

Relevant Clauses of the Act have been addressed:

### **2.1.1 Division 1 Coastal wetlands and littoral rainforests area**

The site is within the Coastal Wetlands Mapping (Figure 5.1) and within 10m of the nearest Mangrove

10 Development on certain land within coastal wetlands and littoral rainforests area

(1) The following may be carried out on land identified as "coastal wetlands" or "littoral rainforest" on the Coastal Wetlands and Littoral Rainforests Area Map only with development consent:

- (a) the clearing of native vegetation within the meaning of Part 5A of the [Local Land Services Act 2013](#),
- (b) the harm of marine vegetation within the meaning of Division 4 of Part 7 of the [Fisheries Management Act 1994](#),
- (c) the carrying out of any of the following:
  - (i) earthworks (including the depositing of material on land),
  - (ii) constructing a levee,
  - (iii) draining the land,
  - (iv) environmental protection works,
- (d) any other development.

Note.

Clause 17 provides that, for the avoidance of doubt, nothing in this Part:

- (a) permits the carrying out of development that is prohibited development under another environmental planning instrument, or

(b) permits the carrying out of development without development consent where another environmental planning instrument provides that the development may be carried out only with development consent.

(2) Development for which consent is required by subclause (1), other than development for the purpose of environmental protection works, is declared to be designated development for the purposes of the Act.

(3) Despite subclause (1), development for the purpose of environmental protection works on land identified as “coastal wetlands” or “littoral rainforest” on the Coastal Wetlands and Littoral Rainforests Area Map may be carried out by or on behalf of a public authority without development consent if the development is identified in:

(a) the relevant certified coastal management program, or

(b) a plan of management prepared and adopted under Division 2 of Part 2 of Chapter 6 of the [Local Government Act 1993](#), or

(c) a plan of management approved and in force under Division 6 of Part 5 of the [Crown Lands Act 1989](#).

(4) A consent authority must not grant consent for development referred to in subclause (1) unless the consent authority is satisfied that sufficient measures have been, or will be, taken to protect, and where possible enhance, the biophysical, hydrological and ecological integrity of the coastal wetland or littoral rainforest.

(5) Nothing in this clause requires consent for the damage or removal of a priority weed within the meaning of clause 32 of Schedule 7 to the [Biosecurity Act 2015](#).

(6) This clause does not apply to the carrying out of development on land reserved under the [National Parks and Wildlife Act 1974](#) if the proposed development is consistent with a plan of management prepared under that Act for the land concerned.

#### 11 Development on land in proximity to coastal wetlands or littoral rainforest

Note.

The Coastal Wetlands and Littoral Rainforests Area Map identifies certain land that is inside the coastal wetlands and littoral rainforests area as “proximity area for coastal wetlands” or “proximity area for littoral rainforest” or both.

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

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

Development will not significantly impact on the integrity of the biophysical, hydrological and ecological features of the adjacent coastal wetland. The biophysical and hydrological integrity can be maintained through the retaining of key on-site native flora and the revegetation of removed native plants. The installation of a living retainer wall established with native vegetation to stabilize the wetland environment/ development site interface will assist ecological integrity. Additionally, the planting of native

trees felled and not revegetated on-site at a similar but separate habitat at another location will ensure no net loss of habitat.

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

Development will not significantly impact on the quantity and quality of surface and groundwater flows to and from the adjacent coastal wetland or littoral rainforest. Pre-existing council approved drain outlets are in operation and public awareness on the best practice management of healthy drains will prevent significant impacts to surface and groundwater flows. Public awareness of Landcare and Bushcare groups that work at Careel Creek will also mitigate significant impact caused by higher density development.

**(2) This clause does not apply to land that is identified as “coastal wetlands” or “littoral rainforest” on the Coastal Wetlands and Littoral Rainforests Area Map.**

The development site is not identified as coastal wetlands on the Coastal Wetlands and Littoral Rainforests Area Map. Additionally, there is no littoral rainforest present.

### **2.1.2 Division 3 Coastal environment area**

(NB Coastal Area has been used as the site is not Coastal wetlands and littoral rainforests area and this division is the next highest category. NB Vulnerability areas are not yet official.

#### **13 Development on land within the coastal environment area**

*(1) Development consent must not be granted to development on land that is within the coastal environment area unless the consent authority has considered whether the proposed development is likely to cause an adverse impact on the following:*

*(a) the integrity and resilience of the biophysical, hydrological (surface and groundwater) and ecological environment,*

The ecological environment is considered in this report. Concluded: no significant impact.

*(b) coastal environmental values and natural coastal processes,*

The coastal environmental values and natural coastal processes will not be significantly altered from current conditions. Concluded: no significant impact.

*(c) the water quality of the marine estate (within the meaning of the Marine Estate Management Act 2014), in particular, the cumulative impacts of the proposed development on any of the sensitive coastal lakes identified in Schedule 1, No change expected. No coastal lakes.*

*(d) marine vegetation, native vegetation and fauna and their habitats, undeveloped headlands and rock platforms,*

Assessed in this report including EPBC Act and BC Act and locally native species. Concluded: no significant impact.

*(e) existing public open space and safe access to and along the foreshore, beach, headland or rock platform for members of the public, including persons with a disability,*

There will be no change in accessibility and an overall increased desire to be in this space.

*(f) Aboriginal cultural heritage, practices and places,*

None specifically listed for this location. The whole of the Estuary is a place of resources and spiritual connection, there are middens within the estuary banks and areas of importance to The First People – this site however has no middens or obvious meeting, cultural area or caves/ overhangs or trees of specific importance. AHIMS Search shown no specific places within the site or immediate surrounds.

*(g) the use of the surf zone.*

NA

*(2) Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that:*

*(a) the development is designed, sited and will be managed to avoid an adverse impact referred to in subclause (1), or*

*(b) if that impact cannot be reasonably avoided—the development is designed, sited and will be managed to minimise that impact, or*

*(c) if that impact cannot be minimised—the development will be managed to mitigate that impact.*

The development is designed and will be managed to avoid and/or minimize any adverse impact.

### **2.1.3 Division 4 Coastal use area**

14 Development on land within the coastal use area

(1) Development consent must not be granted to development on land that is within the coastal use area unless the consent authority:

(a) has considered whether the proposed development is likely to cause an adverse impact on the following:

(i) existing, safe access to and along the foreshore, beach, headland or rock platform for members of the public, including persons with a disability,

No impact

(ii) overshadowing, wind funnelling and the loss of views from public places to foreshores,

No impact

(iii) the visual amenity and scenic qualities of the coast, including coastal headlands,

No impact

(iv) Aboriginal cultural heritage, practices and places,

No impact

(v) cultural and built environment heritage, and

No impact

(b) is satisfied that:

(i) the development is designed, sited and will be managed to avoid an adverse impact referred to in paragraph (a), or

Satisfied

(ii) if that impact cannot be reasonably avoided—the development is designed, sited and will be managed to minimise that impact, or

Satisfied

(iii) if that impact cannot be minimised—the development will be managed to mitigate that impact, and

Satisfied

(c) has taken into account the surrounding coastal and built environment, and the bulk, scale and size of the proposed development.

Been accounted for

(2) This clause does not apply to land within the Foreshores and Waterways Area within the meaning of [Sydney Regional Environmental Plan \(Sydney Harbour Catchment\) 2005](#).

#### 2.1.4 Division 5 of the Coastal Act

##### **15 Development in coastal zone generally—development not to increase risk of coastal hazards**

*Development consent must not be granted to development on land within the coastal zone unless the consent authority is satisfied that the proposed development is not likely to cause increased risk of coastal hazards on that land or other land.*

The development does not increase coastal hazards – the installation of the living retainer wall and public awareness of best practice waterway management mitigates erosion and water pollution respectively thus maintaining the integrity of the coastal zone.

##### **16 Development in coastal zone generally—coastal management programs to be considered**

*Development consent must not be granted to development on land within the coastal zone unless the consent authority has taken into consideration the relevant provisions of any certified coastal management program that applies to the land.*

No certified coastal management programs were identified on this land.

##### **17 Other development controls not affected**

*Subject to clause 7, for the avoidance of doubt, nothing in this Part:*

*(a) permits the carrying out of development that is prohibited development under another environmental planning instrument, or*

(b) permits the carrying out of development without development consent where another environmental planning instrument provides that the development may be carried out only with development consent.

a) the development is permitted

b) development consent is being sought



**Figure 4 The activity site sitting within the Proximity Area for Coastal wetlands and the Coastyal environment Area Map and sitting adjacent to coastal wetlands. Source: SEED Portal, Department of Planning and Environment (DPE), State Environment Planning Policy (Coastal Management) 2019**

- *Biodiversity Conservation Act 2016 (BC Act).*

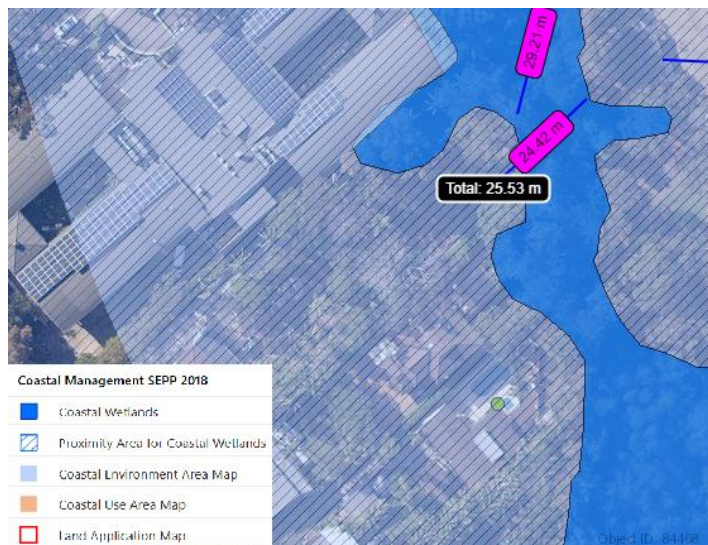
Recently replacing the Threatened Species Conservation Act this includes the test of significance for impacts on threatened species, communities. The test of significance have been conducted (Appendix 4) and the proposal was found to not have a significant impact on the current ecology of the site, providing the Mangroves are protected and stormwater is well managed. The proposed development is compliant with the BC Act.

- *Fisheries Management Act 1994 (FM Act).*
- No altering of the geomorphology of the waterway will occur that results in altered flow or volume of water. The installation of a retaining wall will protect mangrove (Figure 5.6) and seagrass vegetation (Figure 5.7) that populations and ecological communities of fish and marine life live in. Additionally, it will enable ecosystem processes to occur that support the health of these ecological

communities. Stormwater from on-site will be managed such that there is to be a positive or neutral impact on the receiving water. See Stormwater Plan for details.

- *Water Management Act*

The development site sits 10m from Careel Creek (Figure 5.). Careel Creek is a first order waterway as a result of town drainage systems and as such development will not have a significant impact on the waterbody due to the installation of a green retainer wall and community awareness of waterway management and Bush and Landcare groups.



**Figure 5 Setback from waterway.** Source: SEED Portal, Department of Planning and Environment (DPE), State Environment Planning Policy (Coastal Management) 2019.



**Figure 6. Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion.** Source: *SEEDPortal The Native Vegetation of the Sydney Metropolitan Area - Version 3.1 (OEH, 2016)* VIS\_ID 4489



**Figure 7. Proximity to Seagrass. Source: SEEDPortal The Native Vegetation of the Sydney Metropolitan Area - Version 3.1 (OEH, 2016) VIS\_ID 4489**

- *National Parks & Wildlife Act 1974 (NP&W Act).*

The proposed development is compliant with the NP&W Act.

- *Biosecurity Act (superseding the Noxious Weeds Act 1993) (NW Act).*

The Biosecurity Act replaced the Noxious Weeds Act and the objectives of this Act is to manage, and eradicate and Weeds that cause a high level of environmental, economic or social harm. With the removal of Pampas Grass and management of weeds in the riparian zone, as per the VMP, then the sites works will be compliant with the objectives of this Act.

## 2.2 Scope of works

To provide a flora and fauna assessment for assessing the potential direct and indirect impacts of any threatened species, populations and communities on the site. The assessment will also include assessing other ecological impacts and providing recommendations for mitigating these. Including the following:

Flora and Fauna Impact Assessment – with test of significance for threatened species.

The objectives of this Flora and Fauna Impact Assessment are to:

- Identify any native vegetation communities, significant species or significant habitat features present within the study area.
- Identify any known or potential habitat for threatened species.
- Review the implications of relevant biodiversity legislation and policy.
- Identify potential impacts on significant ecological communities, species or habitats from the proposed development and provide recommendations to assist with the mitigation of those potential impacts during the construction and operation stages.
- Targeted searches for significant species are based on the authors' knowledge of the site.

Works included a site survey/assessment, review of project design the arborist assessments and any additional reports and review of available literature to produce site specific ecological and environmental effects report.

## 2.1 Limitations of the Study

Limitations of the study may arise where certain cryptic species of plants may occur as soil-stored seed or as subterranean vegetative structures. Some species are identifiable above-ground only after particular environmental circumstances related to factors such as periodic fire frequency, intensity or seasonality, soil moisture regime, biological life-cycle patterns as in the case of small plants such as species of orchids etc. No specific invertebrate surveys were conducted.

Surveys at one time of the year cannot be expected to detect the presence of all species occurring, or likely to occur, in the study area. This is because some species may (a) occur seasonally, (b) utilise different areas periodically (as a component of a more extensive home range), or (c) become dormant during specific periods of the year. Rather, the survey provides the opportunity to sample the area, search specifically for species likely to be encountered within the available time frame and assess the suitability of habitat for particular species.

Considering the site and habitat availability Kingfisher are confident that this survey is representative of the likely species and vegetation community and that future studies at other times would not change the conclusions in this report.

## 3 Methods

### 3.1 Site Inspections

Senior Ecologist Geraldene Dalby-Ball assessed the site with ecologist Tina Feodoroff

Weather was fine and sunny during time of visit. Tidal condition was low.

During site visits, notes and photos were taken of the important vegetation types, flora and fauna present. Due to the small area of proposed impacts, detailed or systematic surveys were not performed. Surveys were general and opportunistic in nature and were performed by traversing the site. Surveys included one diurnal bird and fauna survey, a single vegetation survey and a general habitat survey in which fauna habitat resources were identified.

## 3.2 Previous studies

Bionet, previous studies and the author's knowledge of the local area, were used to determine the possible occurrence of endangered ecological communities and threatened plant species on-site. The Bionet records accessed cover a 10km<sup>2</sup> area extending from the site and include recordings from 1993 to the present day.

Records from the following databases were collated and reviewed:

- Atlas of NSW Wildlife (Bionet). New South Wales, Office of Environment and Heritage (OEH).
- NSW Threatened Species Information (OEH).
- VIS – Vegetation Mapping information NSW.
- PlantNET (The Royal Botanic Gardens and Domain Trust 2014).
- Protected Matters Search Tool of the Australian Government Department of the Environment (DoE) for matters protected by the Cwlth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

Other sources of biodiversity information:

- Relevant vegetation mapping, including:
  - Vegetation Information System, VIS Mapping (OEH).

The following reports were also reviewed:

- Arboricultural Impact Assessment Naturally Trees by Andrew Scales 20 September 2019
- THW Architect plans 31/07/2019

### 3.2.1 Arborist report findings

Fifty four (54) trees were individually assessed onsite, 49 located within the subject site and 5 adjacent to it, on public and private property. The proposed development will necessitate the removal of 13 high category trees. These trees are considered moderate to high significance and display good health and condition. Seven (7) high category trees could be potentially adversely affected through TPZ disturbance (Table 1)

Eleven (11) low category trees could successfully be retained under the current design. Twenty three (23) trees of low and very low retention value will necessitate removal. (See Figure 4 over page)

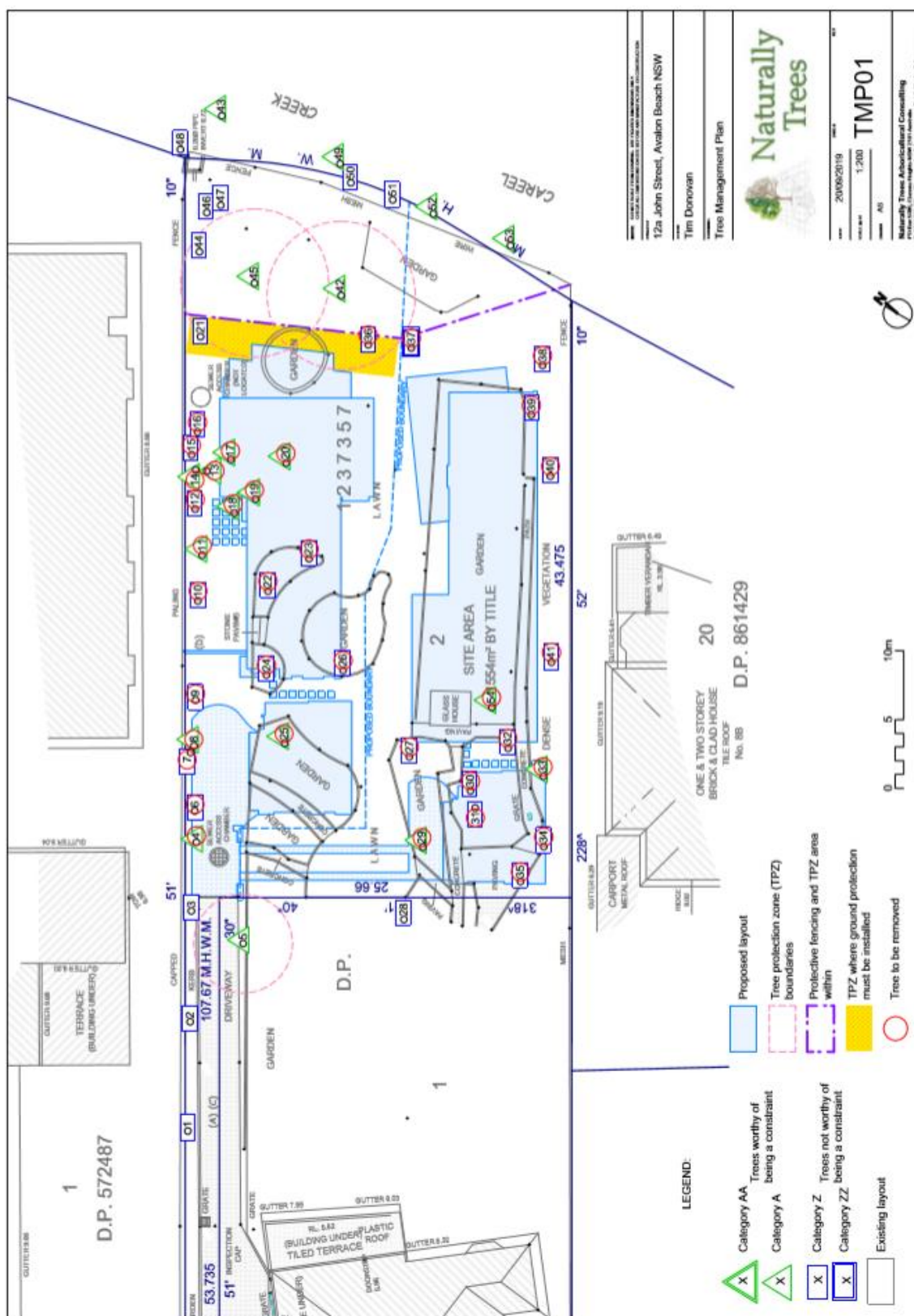


Figure 4. Trees marked for removal Source Naturally Trees 2019

Other trees will require protection during works and construction to keep and protect the roots. See Arborist report for details. Over the page is a table from the arborist report detailing trees necessitating retention and removal

**Table 1. List of trees marked for removal (red)**

NOTE: Colour annotation is AA & A trees with green background; Z & ZZ trees with blue background; trees to be removed in red text.

No.	Genus species	Height	Spread	DBH	TPZ	Foliage %	Age class	Defects/Comment	Location	Services	Significance	Tree AZ
1	<i>Archontophoenix alexandrae</i>	10	3	250	3.0	90%	M	Nil	Garden	Adjacent driveway	M	Z3
2	<i>Archontophoenix alexandrae</i>	10	3	250	3.0	90%	M	Nil	Garden	Adjacent driveway	M	Z3
3	<i>Archontophoenix alexandrae</i>	10	3	250	3.0	90%	M	Nil	Garden	Adjacent driveway	M	Z3
4	<i>Melaleuca quinquenervia</i>	10	6	350	4.2	80%	M	Nil	Garden	Nil	M	A1
5	<i>Glochidion ferdinandi</i>	8	5	300	3.6	80%	S	Nil	Garden	Adjacent driveway	M	A1
6	<i>Archontophoenix alexandrae</i>	10	3	250	3.0	90%	M	Nil	Garden	Adjacent driveway	M	Z3
7	<i>Syagrus romanzoffiana</i>	7	3	300	3.6	80%	M	Nil	Garden	Nil	M	Z3
8	<i>Eucalyptus robusta</i>	14	10	400	4.8	80%	M	Co-dominant	Garden	Nil	M	A1
9	<i>Archontophoenix alexandrae</i>	10	3	250	3.0	90%	M	Nil	Garden	Nil	M	Z3
10	<i>Archontophoenix alexandrae</i>	10	3	250	3.0	90%	M	Nil	Garden	Nil	M	Z3
11	<i>Casuarina glauca</i>	18	7	300	3.6	80%	M	Nil	Grass	Nil	M	A1
12	<i>Archontophoenix alexandrae</i>	10	3	250	3.0	90%	M	Nil	Garden	Nil	M	Z3
13	<i>Casuarina glauca</i>	18	8	400	4.8	80%	M	Nil	Grass	Nil	M	A1
14	<i>Casuarina glauca</i>	18	8	400	4.8	80%	M	Nil	Grass	Nil	M	A1
15	<i>Strelitzia nicolai</i>	5	3	100	2.0	80%	M	Nil	Grass	Nil	L	Z3
16	<i>Archontophoenix alexandrae</i>	10	3	250	3.0	90%	M	Nil	Garden	Nil	M	Z3
17	<i>Casuarina glauca</i>	18	8	450	5.4	80%	M	Nil	Grass	Nil	M	A1
18	<i>Casuarina glauca</i>	18	9	400	4.8	80%	M	Nil	Grass	Nil	M	A1
19	<i>Casuarina glauca</i>	18	8	350	4.2	80%	M	Nil	Grass	Nil	M	A1
20	<i>Casuarina glauca</i>	18	8	400	4.8	80%	M	Nil	Grass	Nil	M	A1
21	<i>Archontophoenix alexandrae</i>	10	3	250	3.0	90%	M	Nil	Garden	Nil	M	Z3
22	<i>Syzygium paniculatum</i>	8	6	250	3.0	60%	O	Dieback	Garden	Nil	M	Z4
23	<i>Jacaranda mimosifolia</i>	10	7	350	4.2	80%	M	Nil	Garden	Nil	M	Z3
24	<i>Jacaranda mimosifolia</i>	9	6	200	2.4	90%	M	Co-dominant	Garden	Nil	L	Z3
25	<i>Liriodendron tulipifera</i>	18	12	450	5.4	80%	M	Nil	Garden	Nil	M	A1
26	<i>Archontophoenix alexandrae</i>	10	3	250	3.0	90%	M	Nil	Garden	Nil	M	Z3
27	<i>Magnolia × soulangeana</i>	6	7	200	2.4	80%	M	Nil	Garden	Nil	L	Z1
28	<i>Washingtonia robusta</i>	22	4	450	5.4	80%	M	Nil	Garden	Nil	M	Z3
29	<i>Glochidion ferdinandi</i>	8	5	300	3.6	80%	S	Nil	Garden	Adjacent driveway	M	A1
30	<i>Strelitzia nicolai</i>	5	3	100	2.0	80%	M	Nil	Garden	Nil	L	Z3
31	<i>Trachycarpus fortunei</i>	4	2	150	2.0	90%	M	Nil	Garden	Nil	L	Z3
32	<i>Hymenosporum flavum</i>	9	4	250	3.0	70%	M	Nil	Garden	Nil	L	Z12
33	<i>Banksia integrifolia</i>	12	9	500	6.0	80%	M	Nil	Garden	Nil	M	A1
34	<i>Strelitzia nicolai</i>	5	3	100	2.0	80%	M	Nil	Garden	Nil	L	Z3
35	<i>Macadamia indica</i>	6	4	200	2.4	80%	S	Nil	Garden	Nil	L	Z1
36	<i>Jacaranda mimosifolia</i>	6	5	250	3.0	70%	S	Nil	Grass	Nil	L	Z3
37	<i>Ficus carica</i>	3	3	40	2.0	70%	S	Nil	Grass	Nil	L	Z21
38	<i>Grevillea robusta</i>	18	10	400	4.8	80%	M	Failures	Garden	Nil	M	Z3
39	<i>Brachychiton acerifolius</i>	16	9	450	5.4	80%	M	Nil	Garden	Nil	M	Z3
40	<i>Strelitzia nicolai</i>	5	3	100	2.0	80%	M	Nil	Garden	Nil	L	Z3
41	<i>Schinus areira</i>	8	6	300	3.6	60%	M	Co-dominant	Garden	Nil	L	Z12
42	<i>Eucalyptus robusta</i>	16	10	450	5.4	70%	M	Co-dominant	Grass	Nil	M	A1
43	<i>Avicennia marina</i>	9	9	300	3.6	80%	M	Nil	Natural ground	Nil	M	A1
44	<i>Archontophoenix alexandrae</i>	10	3	250	3.0	90%	M	Nil	Garden	Nil	M	Z3
45	<i>Eucalyptus robusta</i>	16	10	450	5.4	70%	M	Co-dominant	Grass	Nil	M	A1
46	<i>Casuarina glauca</i>	14	5	250	3.0	60%	S	Slender habit	Grass	Nil	L	Z9
47	<i>Grevillea robusta</i>	18	10	400	4.8	80%	M	Nil	Grass	Nil	M	Z3
48	<i>Casuarina glauca</i>	9	5	200	2.4	60%	S	Nil	Natural ground	Nil	L	Z1
49	<i>Casuarina glauca</i>	12	6	350	4.2	80%	M	Nil	Natural ground	Nil	M	A1
50	<i>Casuarina glauca</i>	12	6	350	4.2	80%	M	Cavity in base	Natural ground	Nil	M	Z9
51	<i>Casuarina glauca</i>	9	5	200	2.4	60%	S	Nil	Natural ground	Nil	L	Z1
52	<i>Casuarina glauca</i>	12	6	350	4.2	80%	M	Nil	Natural ground	Nil	M	A1
53	<i>Casuarina glauca</i>	12	6	350	4.2	80%	M	Nil	Natural ground	Nil	M	A1
54	<i>Carya illinoensis</i>	18	14	600	7.2	80%	M	Co-dominant	Garden	Nil	H	A1

## 4 Flora

The purpose of the flora work was an investigation to determine the flora composition of the site, particularly vulnerable and endangered species. It also included an assessment of the flora as habitat. Furthermore, an assessment of potential impact of the development with a determination of native ground and shrub was conducted.

### 4.1 Site Vegetation – mapping

The site itself is comprised of primarily exotic species however canopy species associated with PCT1234 Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion are on-site indicating the plant community previous to disturbance was PCT1234. Furthermore, the eastern end of the site runs adjacent to the remnant PCT1234 along Careel Creek (Figures 5-6).

PCT 1234 Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions is a Threatened Ecological Community (TEC). This community is found on the coastal floodplains of NSW. It has a dense to sparse tree layer in which *Casuarina glauca* (swamp oak) is the dominant species northwards from Bermagui.

Other trees including *Acmena smithii* (lilly pilly), *Glochidion spp.* (cheese trees) and *Melaleuca spp.* (paperbarks) may be present as subordinate species, and are found most frequently in stands of the community northwards from Gosford. Tree diversity decreases with latitude, and *Melaleuca ericifolia* is the only abundant tree in this community south of Bermagui.

The understorey is characterised by frequent occurrences of vines, *Parsonsia straminea*, *Geitonoplesium cymosum* and *Stephania japonica var. discolor*, a sparse cover of shrubs, and a continuous groundcover of forbs, sedges, grasses and leaf litter. The composition of the ground stratum varies depending on levels of salinity in the groundwater. Under less saline conditions prominent ground layer plants include forbs such *Centella asiatica*, *Commelina cyanea*, *Persicaria decipiens* and *Viola banksii*; graminoids such as *Carex appressa*, *Gahnia clarkei*, *Lomandra longifolia*, *Oplismenus imbecillis*; and the fern *Hypolepis muelleri*.

On the fringes of coastal estuaries, where soils are more saline, the ground layer may include the threatened grass species, *Alexfloydia repens* as well as *Baumea juncea*, *Juncus kraussii*, *Phragmites australis*, *Selliera radicans* and other saltmarsh species.

Threats to this TEC include:

- 1) Hydrological disturbance, Changes to hydrological regimes. (e.g. increased and decreased periods of inundation and changes to salinity). These include draining associated with ditching, levees and dykes; infill, altered inundation conditions
- 2) Habitat loss; Loss of key habitat; Clearing and habitat degradation from urban, rural, agricultural, and forestry development and/or activities
- 3) Weed; Mixed weeds; Changes in species diversity, soil chemistry, fire frequency, vegetation structure and loss of ecological function caused by weeds. This includes woody weeds (e.g. groundsel bush, lantana,

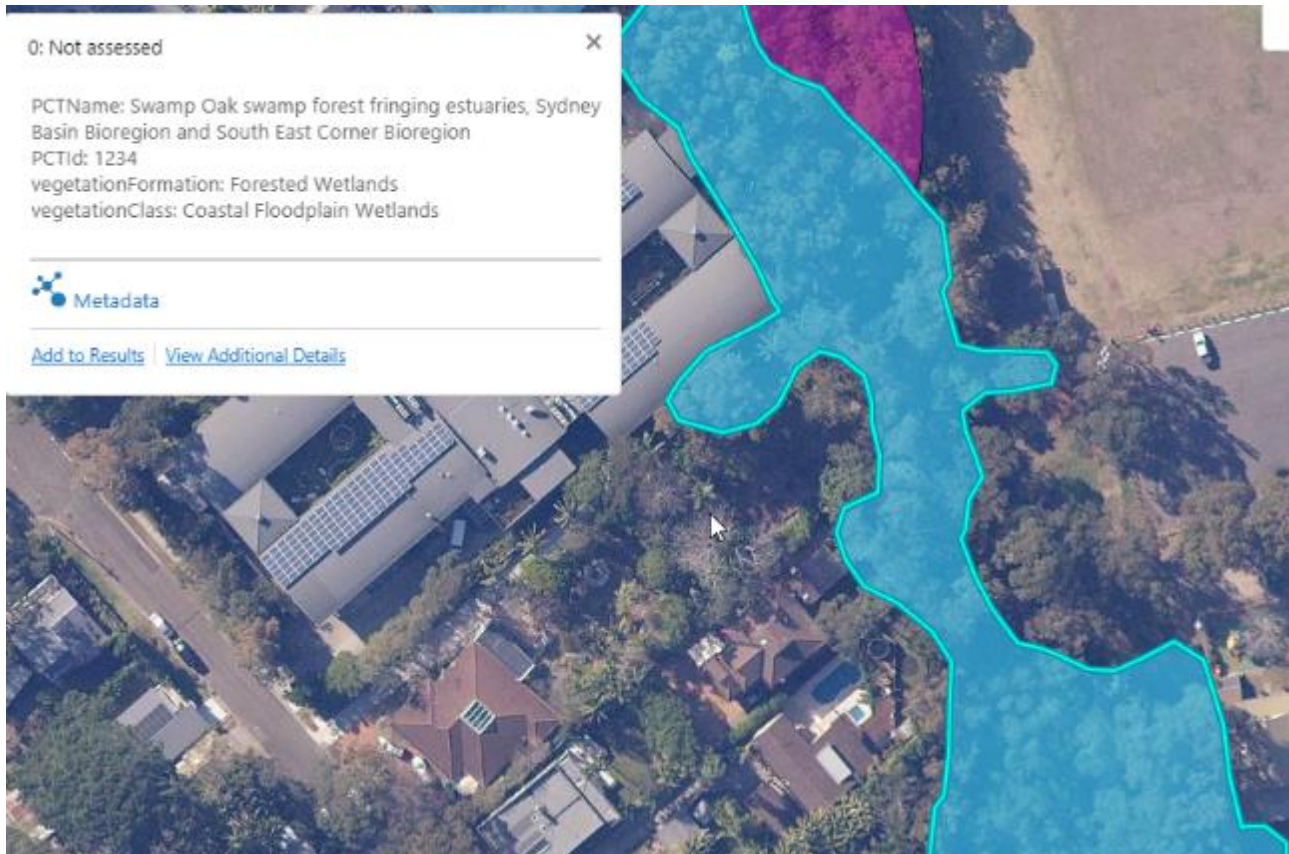
camphor laurel and bitou bush), Exotic vines & scramblers, Invasive grasses & other weeds (including aquatics)

4) Fire; Inappropriate fire regime; Altered fire regimes

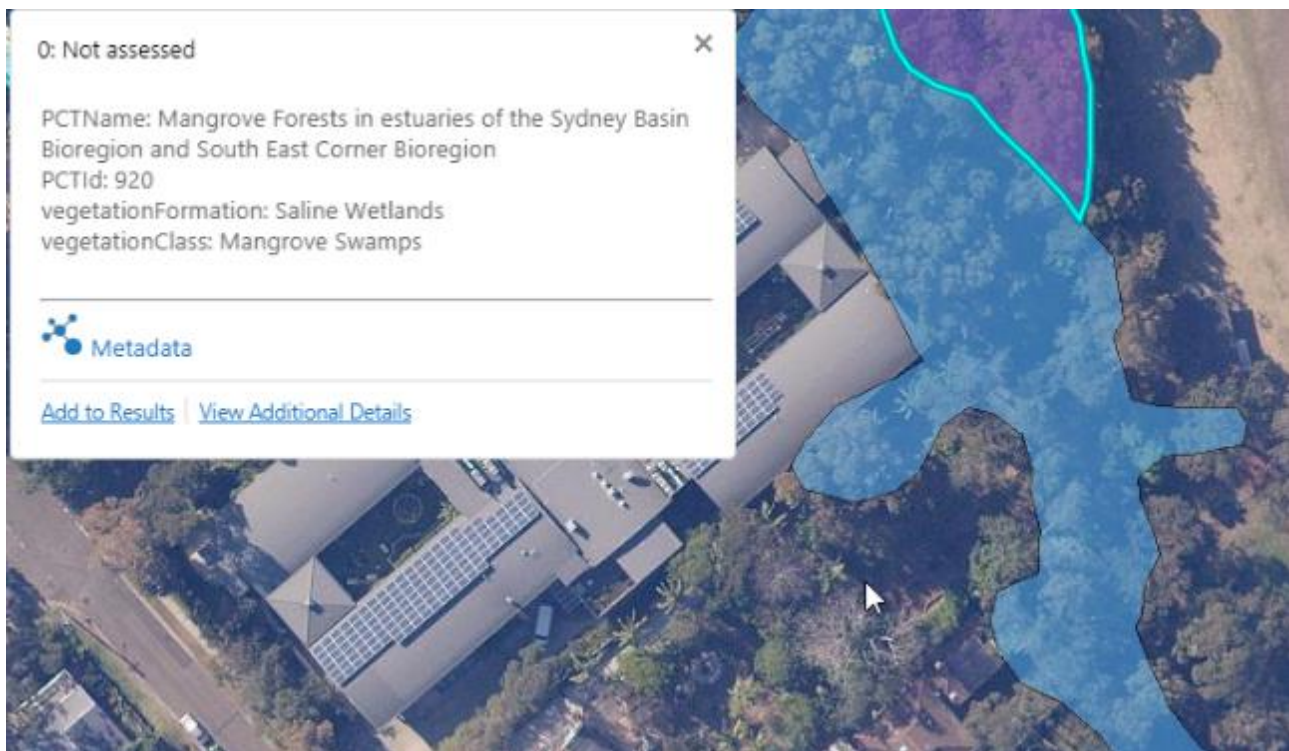
5) Climate change; Inundation/sea-level rise; Climate change including sea level rise.



**Figure 5 Site (arrow) within landscape context Source SEED 2019**



**Figure 6 PCT1234: Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion in relation to the development sight (arrow) Source SEED 2019**



**Figure 7 PCT920: Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion in relation to the development sight (Arrow) Source SEED 2019**

## 4.2 Threatened flora

Bionet flora sightings recorded within 10km of the study site according to BioNet records since 1993. Eight species are currently listed as vulnerable or endangered under state and/or commonwealth legislation. The vulnerable and endangered species to focus on-site searches for can be seen in Table X below, this is based on likelihood of occurrence.

NB: species whose habitat doesn't occur on site have been omitted from this list – those with marginal habitat have been retained on the list

**Table 2. Threatened flora recorded within a 10km radius since 1993. Source: NSW OEH Bionet 2019.**

Family	Scientific Name	Common Name	NSW status	Comm. status	Records
Euphorbiaceae	<i>Chamaesyce psammogeton</i>	Sand Spurge	E1		1
Myrtaceae	<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	E1	V	16
Rutaceae	<i>Asterolasia elegans</i>		E1	E	1
Orchidaceae	<i>Genoplesium baueri</i>	Bauer's Midge Orchid	E1,P,2	E	1
Proteaceae	<i>Persoonia hirsuta</i>	Hairy Geebung	E1,P,3	E	3
Myrtaceae	<i>Rhodamnia rubescens</i>	Scrub Turpentine	E4A		4
Myrtaceae	<i>Eucalyptus nicholii</i>	Narrow-leaved Black Peppermint	V	V	3
Myrtaceae	<i>Callistemon linearifolius</i>	Netted Bottle Brush	V,3		3

**Note:** E = Endangered, V = Vulnerable, P = Protected.

## 4.3 Flora Findings from Site Investigations

### 4.3.1 Threatened plant species findings

No threatened plant species were found during site assessments.

### 4.3.2 Observed Flora

During the site visit a variety of native and exotic flora was observed. Below are photos of the site showing the maintained grounds.



**Plate 1**



**Plate 2**



**Plate 3**



**Plate 4 Mangroves adjacent to the property**



**Plate 5 Lawn with mix of exotics and natives south easterly facing.**



**Plate 6 Lawn with a mix of exotics and natives north westerly facing.**

#### **4.3.3 Disturbances to Flora**

##### **Remnant Bushland zone**

The vegetation is primarily exotics however canopy species of the PCT 1234 Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion are on-site indicating this was the PCT of the development site before disturbance.

##### **Notable weeds**

Weeds of Environmental Significance (Biosecurity Act) observed including:

- There were no weeds of National significance found on the site

##### **Tree Removal**

Thirty six (36) trees were proposed for removal as per the Arborist Report. The trees proposed for removal don't contain any hollows, nor were any nests sighted during site inspection.

## 5 Fauna

Below are a series of figures (Figures 8-16) showing listed species sightings recorded around the development site via SEED. They include the Grey-headed flying fox, Bush Stone-curlew, Large Bent-winged bat, Eastern coastal free-tailed bat, Little Bent-winged bat and the large eared pied bat. Bionet listings include these species (Table 3)

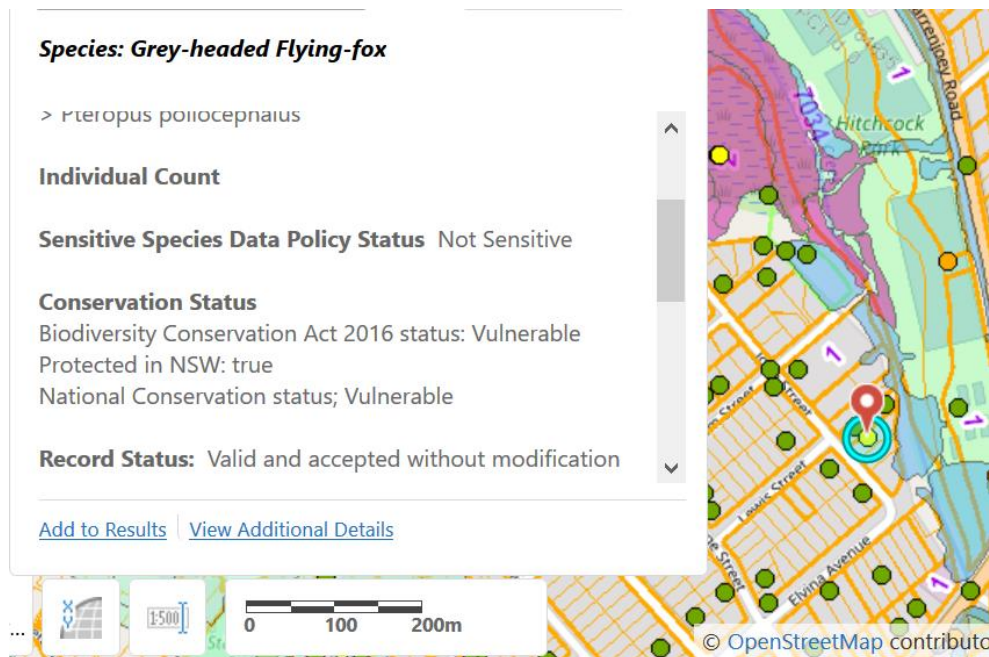


Figure 8 Bionet recorded sighting of Grey-headed flying fox Event date 2016-11-06 Source SEED 2019

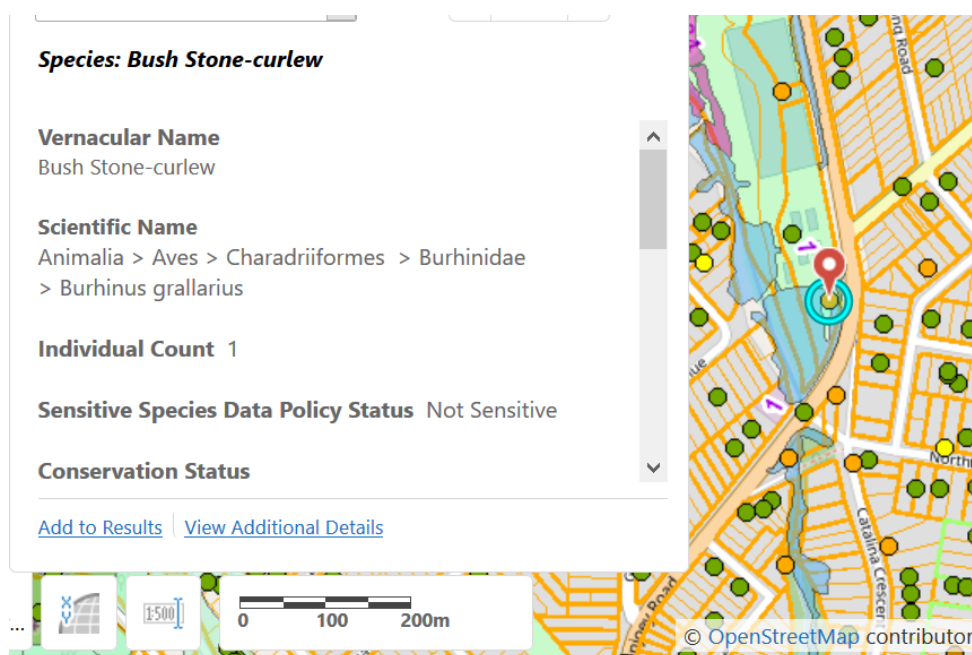
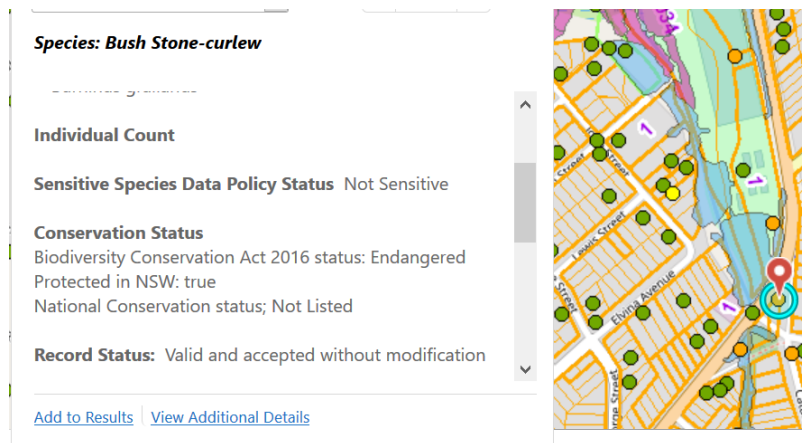
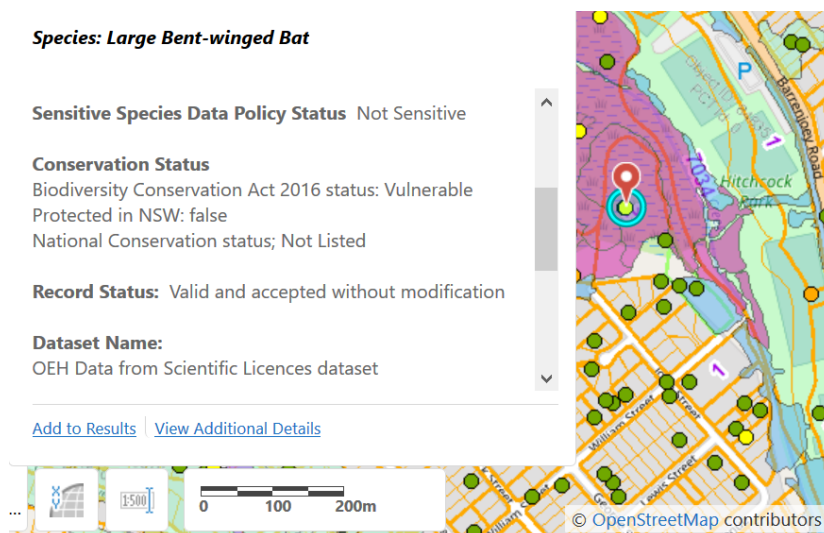


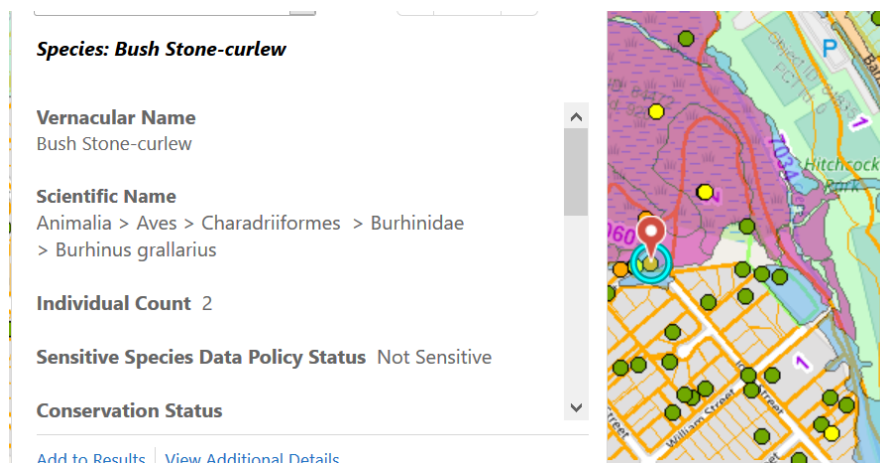
Figure 9 Bionet recorded sighting of Bush Stone-curlew Event date 2012-10-26 Source: SEED 2019



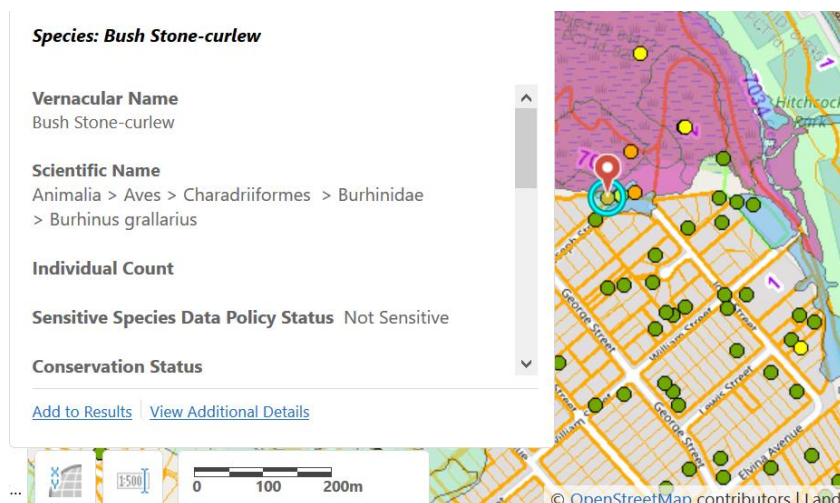
**Figure 10 Bionet recorded sighting of Bush Stone-curlew Event date 2012-10-18 Source: SEED 2019**



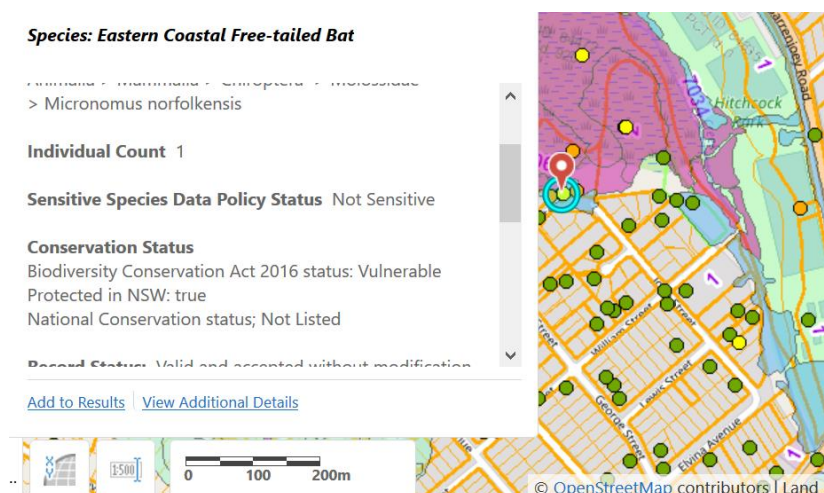
**Figure 11 Bionet recorded sighting of Large Bent-wing Bat Event date 2014-06-14 Source: SEED 2019**



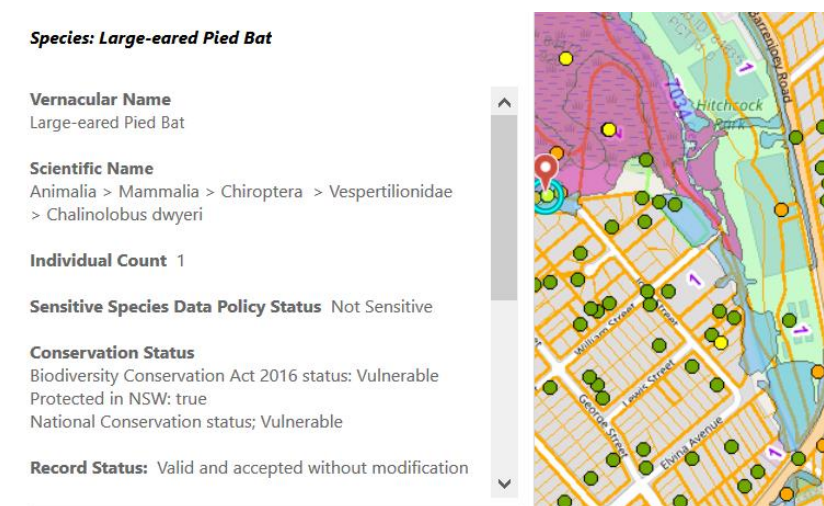
**Figure 12 Bionet recorded sighting of Bush Stone-curlew Event date 2018-03-16 Source: SEED 2019**



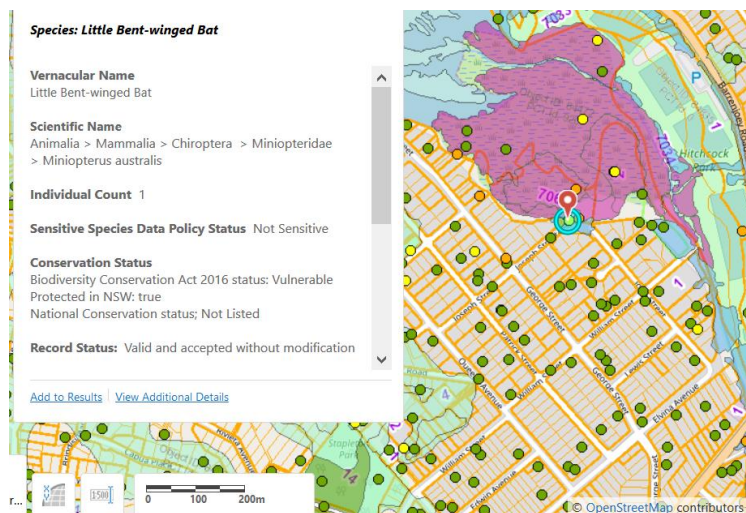
**Figure 13 Bionet recorded sighting of Bush Stone-curlew Event date 2008-11-17 Source: SEED 2019**



**Figure 14 Bionet recorded sighting of Eastern Coastal Free-tailed Bat Event date 2018-03-11 Source: SEED 2019**



**Figure 15 Bionet recorded sighting of Large-eared Pied Bat Event date 2018-03-11 Source: SEED 2019**



**Figure 16 Bionet recorded sighting of Little Bent-winged Bat Event date 2018-03-11 Source: SEED 2019**

#### Threatened fauna via Bionet Atlas

A total of 294 fauna species have been recorded within 10km of the study site according to BioNet records since 1993. Of these, 35 species are currently listed as vulnerable or endangered under state and/or commonwealth legislation. The vulnerable and endangered species to focus on-site searches for can be seen in Table 4 below, this is based on likelihood of occurrence (Table 3).

NB: species whose habitat doesn't occur on site have been omitted from this list – those with marginal habitat have been retained on the list.

**Table 3. Threatened fauna observed in previous ecological surveys within a 10km radius since 1993. Source: NSW OEH Bionet 2019.**

Class	Scientific Name	Common Name	NSW status	Comm. status	Records
<b>Amphibia</b>	<i>Heleioporus australiacus</i>	Giant Burrowing Frog	V,P	V	2
<b>Amphibia</b>	<i>Pseudophryne australis</i>	Red-crowned Toadlet	V,P		18
<b>Reptilia</b>	<i>Varanus rosenbergi</i>	Rosenberg's Goanna	V,P		3
<b>Aves</b>	<i>Ptilinopus regina</i>	Rose-crowned Fruit-Dove	V,P		1
<b>Aves</b>	<i>Ptilinopus superbus</i>	Superb Fruit-Dove	V,P		2
<b>Aves</b>	<i>Diomedea exulans</i>	Wandering Albatross	E1,P	E,J	4
<b>Aves</b>	<i>Diomedea gibsoni</i>	Gibson's Albatross	V,P	V	1

Class	Scientific Name	Common Name	NSW status	Comm. status	Records
<b>Aves</b>	<i>Thalassarche cauta</i>	Shy Albatross	V,P	V	3
<b>Aves</b>	<i>Thalassarche melanophris</i>	Black-browed Albatross	V,P	V	1
<b>Aves</b>	<i>Ardenna carneipes</i>	Flesh-footed Shearwater	V,P	J,K	1
<b>Aves</b>	<i>Macronectes giganteus</i>	Southern Giant Petrel	E1,P	E	1
<b>Aves</b>	<i>Ixobrychus flavicollis</i>	Black Bittern	V,P		1
<b>Aves</b>	<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	V,P	C	36
<b>Aves</b>	<i>Hieraaetus morphnoides</i>	Little Eagle	V,P		2
<b>Aves</b>	<i>Lophoictinia isura</i>	Square-tailed Kite	V,P,3		1
<b>Aves</b>	<i>Pandion cristatus</i>	Eastern Osprey	V,P,3		5
<b>Aves</b>	<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	V,P,3		1
<b>Aves</b>	<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo	V,P,2		27
<b>Aves</b>	<i>Glossopsitta pusilla</i>	Little Lorikeet	V,P		3
<b>Aves</b>	<i>Lathamus discolor</i>	Swift Parrot	E1,P,3	CE	1
<b>Aves</b>	<i>Ninox connivens</i>	Barking Owl	V,P,3		15
<b>Aves</b>	<i>Ninox strenua</i>	Powerful Owl	V,P,3		201
<b>Aves</b>	<i>Tyto novaehollandiae</i>	Masked Owl	V,P,3		2
<b>Aves</b>	<i>Dasyornis brachypterus</i>	Eastern Bristlebird	E1,P,2	E	1
<b>Aves</b>	<i>Anthochaera phrygia</i>	Regent Honeyeater	E4A,P	CE	3
<b>Aves</b>	<i>Artamus cyanopterus cyanopterus</i>	Dusky Woodswallow	V,P		1
<b>Aves</b>	<i>Petroica boodang</i>	Scarlet Robin	V,P		1
<b>Mammalia</b>	<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V,P	E	3

Class	Scientific Name	Common Name	NSW status	Comm. status	Records
<b>Mammalia</b>	<i>Isodon obesulus obesulus</i>	Southern Brown Bandicoot (eastern)	E1,P	E	19
<b>Mammalia</b>	<i>Phascolarctos cinereus</i>	Koala	V,P	V	73
<b>Mammalia</b>	<i>Phascolarctos cinereus</i>	Koala in the Pittwater Local Government Area	E2,V,P	V	73
<b>Mammalia</b>	<i>Cercartetus nanus</i>	Eastern Pygmy-possum	V,P		22
<b>Mammalia</b>	<i>Petaurus norfolcensis</i>	Squirrel Glider	V,P		3
<b>Mammalia</b>	<i>Petaurus norfolcensis</i>	Squirrel Glider on Barrenjoey Peninsula, north of Bushrangers Hill	E2,V,P		1
<b>Mammalia</b>	<i>Petauroides volans</i>	Greater Glider	P	V	1
<b>Mammalia</b>	<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V,P	V	99
<b>Mammalia</b>	<i>Micronomus norfolkensis</i>	Eastern Coastal Free-tailed Bat	V,P		3
<b>Mammalia</b>	<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V,P	V	2
<b>Mammalia</b>	<i>Myotis macropus</i>	Southern Myotis	V,P		6
<b>Mammalia</b>	<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V,P		4
	<i>Miniopterus australis</i>	Little Bent-winged Bat	V,P		12
<b>Mammalia</b>	<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	V		19
<b>Aves</b>	<i>Burhinus grallarius</i> <i>Burhinidae</i>	Bush Stone-curlew	E		

**Note:** E = Endangered, V = Vulnerable, P = Protected. Species in bold have been identified as having appropriate habitat present on-site.

### Likelihood of occurrence

The habitat suitability is a broad categorisation used by Kingfisher to indicate the potential for a species to occur within the study area. It is based on expert opinion and implies the relative value of a study area for a particular species. See Appendix II for rational lists of what threatened fauna species may occur on site due to habitat preferences and whether the site offers these habitat features.

During the survey, none of the above threatened species were observed on-site. However, marginal foraging habitat and refugee habitat for the Grey-headed Flying-fox, Little Eagle and Large Forest Owls were recorded within the study area. Other marginal habitats identified for various Microbat species (see Figures 14, 15, 16 and table 3) were also recorded. Therefore, a Test of Significance (7-Part Test) will be used to assess the impacts of works on these species.

## 5.1 Endangered populations

Two (2) endangered populations have been recorded to occur within 10km of the site through Bionet. Table X outlines these populations. The two populations mentioned have not been sighted within the development proposal site nor is the vegetation for these species adequate or available for these populations to use as nesting or foraging habitat.

**Table 4. Endangered Populations in the LGA. Source NSW OEH Bionet 2017.**

Class	Family	Scientific Name	Common Name	NSW status	Comm. status	Records
Mammalia	Phascolarctidae	<i>Phascolarctos cinereus</i>	Koala in the Pittwater Local Government Area	E2,V,P	V	73
Mammalia	Petauridae	<i>Petaurus norfolcensis</i>	Squirrel Glider on Barrenjoey Peninsula, north of Bushrangers Hill	E2,V,P		1

## 5.2 Fauna findings from site assessment

No fauna was found on the sight during the sight inspection,

### 5.2.1 Fauna habitat

No nests or hollows rock features, woody debris on the ground layer or burrows were sighted that would indicate primary habitat for species.

## 5.3 Habitat Corridors

Study of aerial imagery of the site and the surrounding landscape and land use suggest that the site is being used by fauna as a habitat corridor by highly mobile and aerial species (see Figure 17). The vegetation surrounding the site is highly urbanised.

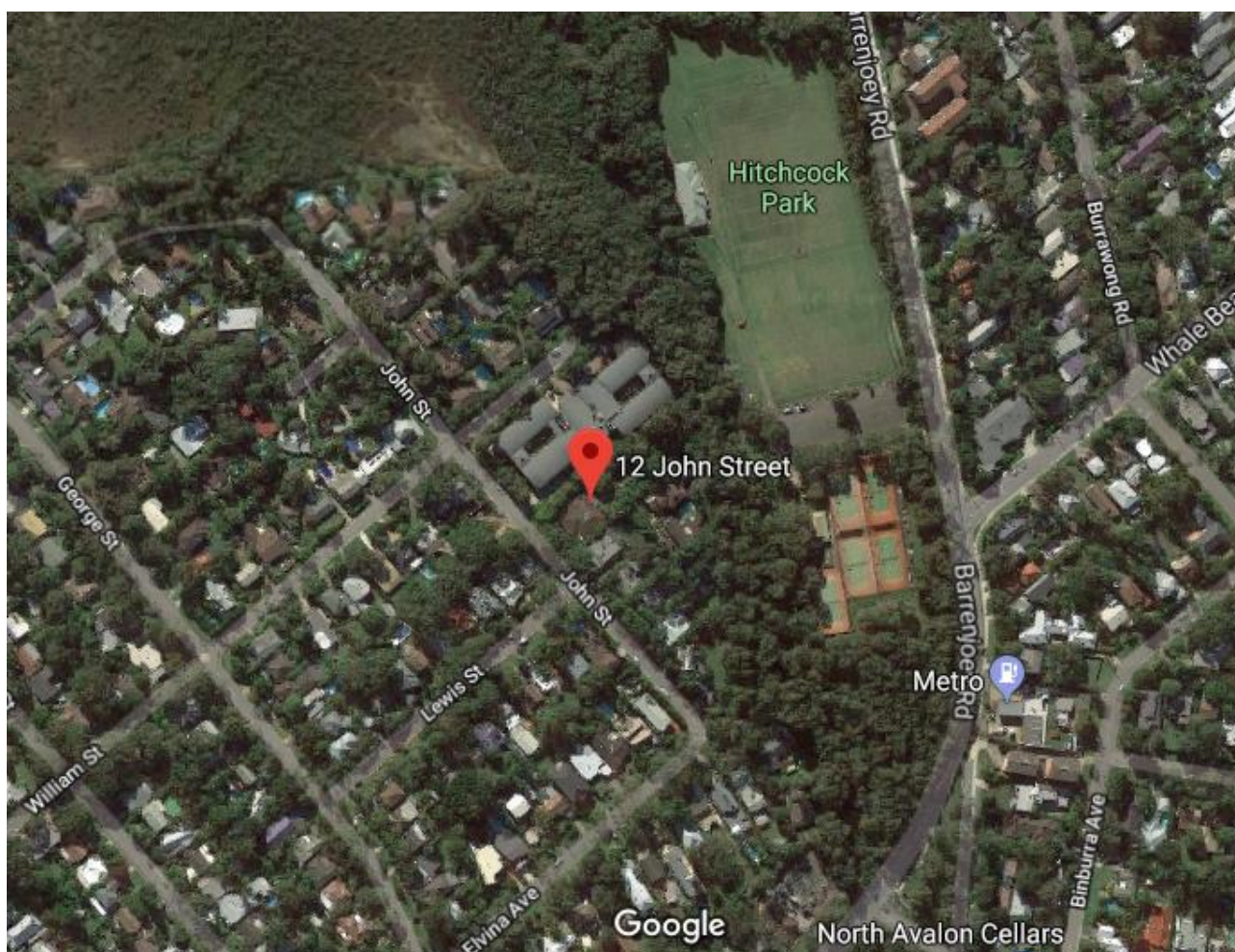


Figure 17. Habitat Corridor Connectivity in the wider area. Source: Google Maps 2019.

## 6 Impacts

### 6.1 Direct Impacts

#### 6.1.1 Vegetation disturbance and loss

Tree removal as per the Arborist report is up to 36 trees on the development footprint. The flowering Eucalypts provide foraging resources for the threatened Grey Headed Flying Fox, microbats and nectivorous birds. The flowers attract insects fed on by microbats. See Landscape Plan for further information.

### 6.2 Indirect Impacts

The proposed actions may result in a range of indirect impacts affecting species or communities.

#### 6.2.1 Weed growth and invasion

Weed species may arise within the direct works zone and surrounding remnant bushland through soil disturbance or by being brought in as seed on work machinery, tools, equipment and worker clothes (e.g. boots). Soil disturbance combined with the elevated nutrients and increased light exposure may result in increased weed growth, aggravated by the high abundance of weeds present pre-works.

### 6.2.2 Introduction of pathogens

The introduction of pathogens may occur into the site, and surrounding remnant bushland, via machinery, tools, equipment and worker clothing (e.g. boots). Diseases to watch out for include Phytophthora (also known as Root Rot – type of water mold) and Myrtle Rust (*Puccinia psidii* – type of fungus). See Appendix for methods to control selected pathogens.

### 6.2.3 Construction Noise

The proposed actions may result in a large amount of construction noise which may result in minor disturbance to sensitive fauna in the local canopy and adjacent bushland nearby. Construction disturbance may also result in fewer aerial fauna species frequenting the site for the duration of works.

## 6.3 Assessment of Significance (5-part tests) Summary

See Appendix IV for full 5-Part Tests.

### Bush-Stone Curlew

Level 1 Endangered

### Large Forest Owls

The threatened species populations Large Forest Owls (Powerful owl, Barking owl) were identified as having potential foraging habitat within the site. The site offers habitat for arboreal prey species particularly the Eucalyptus trees. This habitat may be disturbed during proposed works. Loss of these trees would have little effect on arboreal prey species which would have little effect on food availability for the Large Forest Owls.

### Mircobats

Threatened Microbat species (Eastern Freetail-bat, Yellow-bellied Sheathtail Bat, Eastern False Pipistrelle, Eastern Bentwing-bat and Southern Myotis) were identified as having potential foraging habitat within the site. Proposed trees to be removed do not contain hollows, flaking bark or other roosting habitat for microbat species. These trees may contain marginal foraging habitat for species which feed on insects in or above the canopy. This habitat may be disturbed during proposed works, tree removal does lower insect species numbers and therefore removed trees should be replaced at a ratio of 10:1 and species that encourage insects populations.

### Grey-headed Flying-Fox

The threatened Grey-headed Flying-Fox (*Pteropus poliocephalus*) was identified as having potential foraging habitat within the site. There are no endangered populations of Grey-headed Flying-foxes existing at near the site

### Bush Stone-curlew.

There have been sightings of the Bush Stone-curlew around the activity area however no nests were sighted during the site inspection nor have there been any sightings of the species within the sight. In saying this tree

removal does lower insect species numbers and therefore removed trees should be replaced at a ratio of 10:1 and species that encourage insect populations.

## 7 Recommendations

### 7.1 Mitigation Measures

#### 7.1.1 Delineation of work areas

During construction, impacts on the site and adjacent vegetation should be minimized by the delineation of works zones. Access to the site would be best restricted to small passageways avoiding native vegetation to prevent soil disturbance in general and in particular, damage to native vegetation. Access will be restricted to disturbed open areas and in accordance to Arborist report in a line with tree protection measures.

#### 7.1.2 Vegetation clearing control measures

Most of the vegetation planned for clearing (areas within the footprints of driveways and building envelopes) are trees, turf and weeds. In this case, no vegetation clearing control measures are necessary other than tree removal. Refer to Arborist report.

#### 7.1.3 Tree Protection

Tree protection will be consistent with the Arborist report. Main trees to be managed are trees within close proximity to building works. NB: see final arborist report for details of works and tree numbers.

#### 7.1.4 Weed management, bush regeneration and planting

Weed management, landscaping and bush regeneration will occur as per Landscaping Plan. (See Landscaping Plan)

#### 7.1.5 Weed Removal Techniques

Weed removal proposed for the site will consist of hand removal techniques, manual/mechanical removal using bush regenerator tools and winter thermal (flame) weeding. This approach will reduce the amount of herbicide used and reduce the amount of off-target damage through spot on application.

Woody perennial weeds less than 2 metres in height will require cut and paint or scrape and paint bush regenerator techniques based on the germinating/epicormic behaviour of the plant (especially plants that tend to coppice or sucker).

It is recommended that seed heads are removed prior to commencement of primary works. This would be best performed carefully by hand with secateurs with the aim of avoiding the spread flowers or seeds into planting zones.

See Appendix III for further details. For key weed photo guide see Appendix VIII.

#### 7.1.6 Native Seed Collection

Any native trees or shrubs being removed for the construction works should be checked for seeds during removal works. If seeds are present, they should be collected and used off-site, location to be determined with council.

#### 7.1.7 Landscaping

Landscaping will follow the Landscaping Plan.

#### 7.1.8 Nest boxes

Although it is not critical, installation of a single nest box designed for microbats should be added to the site to replace potential loss of roosting habitat.

Image from: [nestboxes.com.au](http://nestboxes.com.au)



#### 7.1.9 Pathogen prevention

To prevent the introduction of pathogens, Bushland Hygiene Protocols outlined in Appendix V should be followed. The site is considered to be an area which may promote the spread of *Phytophthora* (a group of fungus-like diseases affecting plants) due to its moist soil and proximity to water. It is recommended that Bushland Hygiene Protocols be followed closely.



Phytophthora infected vegetation. (Image by Rasbak, licensed under the Creative Commons Attribution-Share Alike 3.0 Unported, 2.5 Generic, 2.0 Generic and 1.0 Generic license.)



Myrtle Rust generally infects new leaf growth. (Image by John Tann, licensed under the Creative Commons Attribution 2.0 Generic license.)

#### 7.1.10 Vertebrate Pests

Vertebrate pests (cats, dogs, foxes) would not be considered a significant problem at the site and no actions are suggested for their control.

## 7.2 Appendix I – Threatened Species Habitat Preferences

### Rationale for Likelihood of Occurrence

#### Flora

Scientific Name	Common Name	Habitat Requirements	Likelihood of occurrence
<i>Chamaesyce psammogeton</i>	Sand Spurge	Sand Spurge is a herb that forms mats to 1 m across. Grows on fore-dunes and exposed headlands, often with Spinifex ( <i>Spinifex sericeus</i> ).	No flora bearing the key identifying features of this species was seen within the site. No likelihood of occurrence.
<i>Callistemon linearifolius</i>	Netted Bottle Brush	For the Sydney area, recent records are limited to the Hornsby Plateau area near the Hawkesbury River. Was more widespread across its distribution in the past. There are currently only 5-6 populations in the Sydney area, of the 22 populations recorded in the past. Three of these are reserved in Ku-ring-gai Chase National Park, Lion Island Nature Reserve, and Spectacle Island Nature Reserve. Further north it has been recorded from Yengo National Park. Grows in dry sclerophyll forest on the coast and adjacent ranges.	No flora bearing the key identifying features of this species was seen within the site. No likelihood of occurrence.
<i>Eucalyptus nicholii</i>	Narrow-leaved Black Peppermint	A medium-sized tree 15 - 20 m tall with rough, thick, grey-brown bark which extends to the larger branches. This species is widely planted as an urban street tree and in gardens but is quite rare in the wild	No flora bearing the key identifying features of this species was seen within the site. No likelihood of occurrence.
<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	A tree to 15 m tall, but is generally 3–8 m high and shrubby in form. Found in rainforest on sandy soils or stabilised Quaternary sand dunes at low altitudes in coastal areas. Rainforests are often remnant stands of littoral or gallery rainforest.	No flora bearing the key identifying features of this species was seen within the site. No likelihood of occurrence.
<i>Genoplesium baueri</i>	Bauer's Midge Orchid	A terrestrial orchid 6-15 cm high, fleshy, brittle, yellowish-green or reddish. Grows in sparse sclerophyll forest and moss gardens over sandstone	No flora bearing the key identifying features of this species was seen

			within the site. No likelihood of occurrence.
<b><i>^Persoonia hirsuta</i></b>	Hairy Geebung	The Hairy Geebung is found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone from near sea level to 600m altitude. It is usually present as isolated individuals or very small populations	No flora bearing the key identifying features of this species was seen within the site. No likelihood of occurrence.
<b><i>Asterolasia elegans</i></b>		A tall, thin shrub to 3 m high. Occurs north of Sydney, in the Baulkham Hills, Hawkesbury and Hornsby local government areas. Also likely to occur in the western part of Gosford local government area. Known from only seven populations, only one of which is wholly within a conservation reserve. Occurs on Hawkesbury sandstone. Found in sheltered forests on mid- to lower slopes and valleys, e.g. in or adjacent to gullies which support sheltered forest.	No flora bearing the key identifying features of this species was seen within the site. No likelihood of occurrence.
<b><i>Boronia umbellata</i></b>	Orara Boronia	Orara Boronia is an open shrub, 1 – 2 m tall, with upright branches. This boronia grows as an understorey shrub in and around gullies in wet open forest. Occurs in coastal ranges, in sclerophyll forest on sandstone & metasediments at 100-600 m altitude. It also occurs in (or is likely to occur in) heath, mainly at low to medium altitudes. Variable geology and soils are favoured.	No flora bearing the key identifying features of this species was seen within the site. No likelihood of occurrence.

## Fauna

Scientific Name	Common Name	Habitat Preferences	Site Suitability
<b><i>Burhinus grallarius</i></b>	Bush Stone-curlew	Inhabits open forests and grassy woodlands. Fallen branches and logs are key habitat features that provides camouflage for the bird as well as areas for foraging. It is found in all states, except for Tasmania. Feeds at night on insects and small vertebrates including frogs, lizards, snakes and mice.	The site presents low quality and low potential for the species to occur within the site. No further assessment or consideration is required.

Scientific Name	Common Name	Habitat Preferences	Site Suitability
<i>Rostratula australis</i>	Australian Painted Snipe	Inhabits fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds. Forages nocturnally on mud-flats and in shallow water. Feeds on worms, molluscs, insects and some plant-matter.	The site presents low quality and low potential for the species to occur within the site. No further assessment or consideration is required.
<i>Isoodon obesulus obesulus</i>	Southern Brown Bandicoot (eastern)	Species 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 hypogaeous (underground-fruited) fungi.	The site presents low quality and low potential for the species to occur within the site. No further assessment or consideration is required.
<i>Lathamus discolor</i>	Swift Parrot	Migratory species occurring in south-eastern Australia from March to October. Occurs in areas of flowering Eucalyptus or abundant lerp invertebrates. Preferred tree species include Swamp Mahogany, Spotted Gums, Red Bloodwoods, Mugga Ironbarks and White Box.	There is low to moderate potential for the species to occur within the site. No further assessment is required.
<i>Anthochaera phrygia</i>	Regent Honeyeater	The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. This species has been seen foraging in flowering coastal Swamp Mahogany and Spotted Gum forests.	The site presents low quality and low potential for the species to occur within the site. No further assessment or consideration is required.

Scientific Name	Common Name	Habitat Preferences	Site Suitability
<i>Heleioporus australiacus</i>	Giant Burrowing Frog	Sites must have native vegetation. The species has not been found on cleared land. Occurs in hanging swamps on sandstone shelves and along perennial creeks. The species is not restricted to watercourses.	The site presents low quality and no potential habitat within the site or in the immediate vicinity. Low potential for the species to occur within the site. No further assessment or consideration is required.
<i>Pseudophryne australis</i>	Red-crowned Toadlet	Occurs in open forests on Hawkesbury and Narrabeen Sandstones. Inhabits ephemeral drainage lines below sandstone ridges. Requires shelter in the form of rocks, dense vegetation and thick leaf litter.	Low potential for the species to occur within the site due to low quality of the site. No further assessment or consideration is required.
<i>Varanus rosenbergi</i>	Rosenberg's Goanna	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. 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.	The site presents low quality and no potential habitat within the site or in the immediate vicinity. Low potential for the species to occur within the site. No further assessment or consideration is required.
<i>Ptilinopus superbis</i>	Superb Fruit-Dove	The species is found in rainforests, rainforest margins, mangroves, wooded stream-margins, and even isolated figs, lilly pillies and pittosporums. The Superb Fruit-Dove may migrate to New Guinea in winter, but little is known of its movements, or the reasons for its sometimes southerly flights as far as Tasmania. Feeds almost exclusively on fruit, mainly in large trees.	There is low potential for the species to occur within the site. No further assessment is required.

Scientific Name	Common Name	Habitat Preferences	Site Suitability
<i>Ixobrychus flavicollis</i>	Black Bittern	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.	The site presents low quality and no potential habitat within the site or in the immediate vicinity. Low potential for the species to occur within the site. No further assessment or consideration is required.
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	Occurs along the coastline and occasionally larger waterways.	Records of this species were recorded > 3 km away. Moderate potential for the species to occur within the site. No further assessment or consideration is required.
<i>Hieraaetus morphnoides</i>	Little Eagle	Occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter. Lays two or three eggs during spring, and young fledge in early summer. Preys on birds, reptiles and mammals, occasionally adding large insects and carrion.	Records of this species were recorded > 3 km away. Moderate potential for the species to occur within the site. No further assessment or consideration is required.
<i>Haematopus fuliginosus</i>	Sooty Oystercatcher	Inhabits 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 site presents low quality and low potential for the species to occur within the site. No further assessment or consideration is required.

Scientific Name	Common Name	Habitat Preferences	Site Suitability
<i>Glossopsitta pusilla</i>	Little Lorikeet	Prefers open Eucalypt forest and woodlands. Primarily feeds within the canopy of Eucalyptus, Angophora and Melaleuca trees. Prefers riparian areas but may visit isolated trees in open or cleared land.	The site presents low quality and low potential for the species to occur within the site. No further assessment or consideration is required.
<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (eastern subspecies)	Occupies upper canopies of dry open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (Eucalyptus sideroxylon), White Box (E. albens), Inland Grey Box (E. microcarpa), Yellow Box (E. melliodora), Blakely's Red Gum (E. blakelyi) and Forest Red Gum (E. tereticornis). Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks, river sheoaks (nesting habitat) and tea-trees. Feeds on insects, nectar and honeydew.	The site presents low quality and low potential for the species to occur within the site. No further assessment or consideration is required.
<i>Daphoenositta chrysoptera</i>	Varied Sittella	Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees and small branches and twigs in the tree canopy.	The site presents low quality and low potential for the species to occur within the site. No further assessment or consideration is required.
<i>Artamus cyanopterus cyanopterus</i>	Dusky Woodswallow	Migratory bird primarily inhabit dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris. Feeds on invertebrates, mainly insects.	The site presents low quality and low potential for the species to occur within the site. No further assessment or consideration is required.

Scientific Name	Common Name	Habitat Preferences	Site Suitability
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	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. Individual animals use hollow-bearing trees, fallen logs, small caves, rock outcrops and rocky-cliff faces as den sites. Mostly nocturnal animal feeding on medium-sized (500g-5kg) mammals.	The site presents low quality and low potential for the species to occur within the site. No further assessment or consideration is required.
<i>Phascolarctos cinereus</i>	Koala	Inhabit eucalypt woodlands and forests. Feeds on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species.	The site presents low quality and low potential for the species to occur within the site. No further assessment or consideration is required.
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	Found in rainforests communities to sclerophyll (including Box-Ironbark) forests, woodland and heath. Feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes, soft fruits are eaten when flowers are unavailable and insects.	The site presents low quality and low potential for the species to occur within the site. No further assessment or consideration is required.
<i>Petaurus norfolcensis</i>	Squirrel Glider	Inhabits mature or old growth Blackbutt-Bloodwood forests with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia midstorey. Requires abundant tree hollows for refuge and nest sites. Diet varies seasonally and consists of Acacia gum, eucalypt sap, nectar, honeydew and manna, with invertebrates and pollen providing protein.	The site presents low quality and low potential for the species to occur within the site. No further assessment or consideration is required.
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	<b>Occurs within tall sclerophyll forests and woodlands, heath, swamp subtropical and temperate rainforests, and urban areas. Occurs within</b>	<b>Potential habitat occurs within the site and in the surrounding areas. The species would be expected to</b>

Scientific Name	Common Name	Habitat Preferences	Site Suitability
		<b>20km of a significant food source. May be found close to gullies and water within vegetation with a dense canopy.</b>	utilize the remnant vegetation within the site as foraging habitat. Specifically, the species would be expected to utilise the vegetation canopy for invertebrate foraging resources.
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	Prefers to roost in tree hollows but may roost under flaking bark or in man-made structures. Occurs east of the Great Dividing Range throughout dry sclerophyll forest, woodlands, swamp forest and mangrove forests.	Potential habitat within the site and in the immediate vicinity. Moderate potential for the species to occur within the site. Further assessment or consideration is required.
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	Roosts in caves, cliff crevices, mine shafts and in old nests of the Fairy Martin. Typically inhabits low to mid elevation well-timbered dry open forests and woodlands in close proximity to suitable nesting. Prefers areas containing gullies.	No records of this species recorded onsite or nearby areas No further assessment or consideration is required.
<i>Miniopterus australis</i>	Little Bentwing-bat	Roosts in tree hollows, caves, tunnels, mine shafts, stormwater drains, culverts, bridges and buildings. Forages for insects in the tree canopy in densely vegetated areas. Prefers moist eucalyptus forests, rainforests, vine thickets, wet and dry sclerophyll forests, Melaleuca swamps, dense coastal forests and banksia scrub. Prefers well-timbered areas.	No records of this species recorded onsite or nearby areas No further assessment or consideration is required.

Scientific Name	Common Name	Habitat Preferences	Site Suitability
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	Primarily roosts in caves but will utilise mine shafts, storm-water tunnels, buildings and other man-made structures. Forms colonies within a maternity cave and disperse within a 300km range. Forage in forested areas in the tree canopy.	Potential habitat occurs within the site and in the surrounding areas. The species would be expected to utilize the remnant vegetation within the site as foraging habitat. Specifically, the species would be expected to utilize the vegetation canopy for invertebrate foraging resources.
<i>Myotis macropus</i>	Southern Myotis	Roosts in groups of 10-15 in areas close to water. Will utilise caves, mine shafts, tree hollows, storm water drains, buildings, bridges and dense foliage. Forages over water bodies catching insects and small fish.	Potential habitat occurs within the site and in the surrounding areas. The species would be expected to utilize the remnant vegetation within the site as foraging habitat. Specifically, the species would be expected to utilize the vegetation canopy for invertebrate foraging resources.
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	Roosts in tree hollows but may be found in buildings. Primarily found in gullies and river systems that drain the Great Dividing Range. Occurs in a range of habitats including woodlands to moist or dry eucalypt forest, rainforest with greatest preference for tall wet forests. Forages along creeks and river corridors.	Potential habitat occurs within the site and in the surrounding areas. The species would be expected to utilize the remnant vegetation within the site as foraging habitat. Specifically, the species would be expected to utilize the vegetation

Scientific Name	Common Name	Habitat Preferences	Site Suitability
			<b>canopy for invertebrate foraging resources.</b>
<i>Calyptorhynchus lathamii</i>	Glossy Black-Cockatoo	Lives in coastal woodlands and drier forest areas, open inland woodlands or timbered watercourses where casuarinas (or sheoaks), its main food trees, are common. Glossy black-cockatoos occasionally eat seeds from eucalypts, angophoras, acacias and hakeas, as well as eating insect larvae.	The site presents low quality and low potential habitat within the site or in the immediate vicinity. Low potential for the species to occur within the site. No further assessment or consideration is required.
<i>Lophoictinia isura</i>	Square-tailed Kite	Inhabits dry woodlands and open forests, particularly along timbered watercourses. Specialist hunter of passerines, especially honeyeaters, and most particularly nestlings, and insects in the tree canopy, picking most prey items from the outer foliage.	The site presents low quality and low potential habitat within the site or in the immediate vicinity. Low potential for the species to occur within the site. No further assessment or consideration is required.
<i>Pandion cristatus</i>	Eastern Osprey	Inhabits coastal areas, especially the mouths of large rivers, lagoons and lakes. Feeds on fish over clear, open water. Breed from July to September in NSW. Nests are made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea.	The site presents low quality and low potential habitat within the site or in the immediate vicinity. Low potential for the species to occur within the site. No further assessment or consideration is required.

Scientific Name	Common Name	Habitat Preferences	Site Suitability
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	In spring and summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In autumn and winter, the species often moves to lower altitudes in drier more open eucalypt forests and woodlands, particularly box-gum and box-ironbark assemblages, or in dry forest in coastal areas and often found in urban areas. Favours old growth forest and woodland attributes for nesting and roosting. Nests are located in hollows that are 10 cm in diameter or larger and at least 9 m above the ground in eucalypts.	The site presents low quality and low potential habitat within the site or in the immediate vicinity. Low potential for the species to occur within the site. No further assessment or consideration is required.
<i>Ninox connivens</i>	Barking Owl	Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g. western NSW) due to the higher density of prey on these fertile soils. Roost in shaded portions of tree canopies, including tall midstorey trees with dense foliage such as Acacia and Casuarina species. During nesting season, the male perches in a nearby tree overlooking the hollow entrance. Preferentially hunts small arboreal mammals such as Squirrel Gliders and Ringtail Possums, but when loss of tree hollows decreases these prey populations the owl becomes more reliant on birds, invertebrates and terrestrial mammals such as rodents and rabbits.	Potential foraging habitat occurs within the site and in the surrounding areas. The species would be expected to utilize the remnant vegetation within the site as foraging habitat. Specifically, the species would be expected to hunt small mammals from the outer canopy.  There is moderate potential for the species to occur within the site. Further assessment is required.
<i>Ninox strenua</i>	Powerful Owl	The species requires large tracts of forest or woodland, however fragmented landscapes can contribute to their range. Breeds in forests and woodlands but may forage in open areas. Mainly preys upon medium sized arboreal mammals. Requires tree hollows for breeding.	Potential foraging habitat occurs within the site and in the surrounding areas. The species would be expected to utilize the remnant vegetation within the site as foraging habitat. Specifically,



Scientific Name	Common Name	Habitat Preferences	Site Suitability
			<p>the species would be expected to hunt small mammals from the outer canopy.</p> <p>There is moderate potential for the species to occur within the site. Further assessment is required.</p>
<i>Tyto novaehollandiae</i>	Masked Owl	The species prefers dry eucalypt forests and woodlands and hunts along the edges and forests and roadsides. Mainly preys upon arboreal and ground mammals, primarily rats. Requires tree hollows in moist gullies for breeding.	<p>Potential foraging habitat occurs within the site and in the surrounding areas. The species would be expected to utilize the remnant vegetation within the site as foraging habitat. Specifically, the species would be expected to hunt small mammals from the outer canopy.</p> <p>There is moderate potential for the species to occur within the site. Further assessment is required.</p>
<i>Phascolarctos cinereus</i>	Koala in the Pittwater Local Government Area	Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Inactive for most of the day, feeding and moving mostly at night. Spend most of their time in trees, but will descend and traverse open ground to move between trees. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size.	No kola has been seen within the site. Low potential for the species to occur within the site. No further assessment or consideration is required



Scientific Name	Common Name	Habitat Preferences	Site Suitability
<i>Petaurus norfolcensis</i>	Squirrel Glider on Barrenjoey Peninsula, north of Bushrangers Hill	<p>The availability of a year-round supply of carbohydrates (nectar, sap, gum, and honeydew) appears to be an important habitat feature. In NSW, this corresponds to a high diversity of tree and shrub species, including a high nectar producing species and one or more winter flowering species.</p> <p>In Pittwater, important food sources are likely to be the winter flowering Coast Banksia (<i>Banksia integrifolia</i>) and Spotted Gum (<i>Corymbia maculata</i>) and the summer flowering Old Man Banksia (<i>B. serrata</i>) and Grey Ironbark (<i>Eucalyptus paniculata</i>). Other likely food sources include <i>Angophora costata</i>, <i>Banksia spinulosa</i>, <i>Corymbia gummifera</i>, <i>Eucalyptus botryoides</i>, <i>E. punctata</i>, <i>E. robusta</i>, <i>Melaleuca quinquernervia</i>, mistletoes and <i>Xanthorrhoea</i> species.</p> <p>This animal will gouge and lick incisions on the trunks and main branches of <i>Eucalyptus</i>, <i>Corymbia</i> and <i>Angophora</i> trees to feed on sap and on <i>Acacia</i> trees and shrubs to feed on gum, especially when nectar is in short supply.</p>	No sightings nor markings were present on the trunks of foraging trees. No further assessment or consideration is required


Note: Species in **bold** have been assumed as having appropriate habitat present on-site.

### 7.3 Appendix II– Key Weed Removal Methods

#### Physical removal

Technique	Method	Equipment
<b>Hand Removal</b> 	<p>Seedlings and smaller weed species where appropriate will be pulled out by hand, without risk of injury to workers. The size that this can occur varies throughout the treatment area. Generally, it ranges from post seed to approximately 300mm in height.</p> <p>Rolling and raking is suitable for larger infestations of Wandering Jew. The weed can be raked and stems and plants parts rolled. The clump of weed material can then be bagged and removed from site.</p>	<p>Tools: Gloves, Rakes, Knife and Weed Bags</p>
<b>Crowning</b> 	<p>Plants that possess rhizomes or bulbs might not respond to various removal techniques and may need to be treated with crowning.</p> <p>A knife, mattock or trowel is to be driven into the soil surrounding the bulb or rhizome at an angle of approximately 45 degrees with surrounding soil, so as to cut any roots that may be running off. This is to occur in 360 degrees around the bulb/rhizome. The rhizome or bulb is to be bagged and removed from the site and disposed of at an appropriate waste recycling facility</p> <p>Soil disturbance is to be kept to a minimum when using this technique.</p>	<p>Tools: Knife, mattock, trowel, impervious gloves, and all other required P.P.E.</p>

Technique	Method	Equipment
<p>Cut and Paint Stems</p> 	<p>Weed species deemed unsuitable for hand removal shall be cut. Those that have persistent or vigorous growth will be cut and painted with Roundup® Biactive Herbicide or equivalent.</p> <p>Juvenile and smaller weed species will be cut with secateurs at base of plant, and herbicide applied via applicator bottle. Stem to be cut horizontally as close to the ground as possible, using secateurs, loppers or a pruning saw. Horizontal cuts to be made on top of stem to prevent the herbicide running off the stump.</p> <p>Apply herbicide to the cut stem immediately, within 10-20 seconds, before the plant cells close and the translocation of the herbicide is limited. Herbicide is not to reach sediment or surrounding non-targeting plants.</p>	<p>Tools: loppers, secateurs, pruning saw, herbicide applicator/sprayer, impervious gloves, Roundup® Biactive Herbicide and all other required P.P.E.</p>
<p>Scrape and Painting</p> 	<p>More resilient weed species, where other techniques are less reliable are to be scraped with a knife or chisel and painted with undiluted Roundup® Biactive Herbicide. Works to be carried out by a contractor with a current herbicide license.</p> <p>Weed species will be scraped with a knife or chisel up the length of the trunk, and herbicide applied via applicator bottle. Scrape the trunk from as close to the ground as possible to approximately ¾ of the plants height. Where trunk diameters exceed approximately 5 cm a second scrape shall be made on the other side of the trunk.</p> <p>Apply undiluted herbicide to the cut trunk immediately, within 10-20 seconds, before the plant cells close and the translocation of the herbicide is limited. All care must be taken by the contractor not to spill herbicide onto sediment or surrounding non-targeting plants.</p> <p>Follow up treatment may be required. If plants resprout, scrape and paint the shoots using the same method after sufficient regrowth has occurred.</p>	<p>Tools: knife, chisel, protective clothing, safety glasses herbicide applicator/sprayer, impervious gloves, Roundup® Biactive Herbicide, and all other required P.P.E.</p>

Technique	Method	Equipment
<p>Cut with a Chainsaw and Paint</p> 	<p>Larger size weed species, too large for cutting with hand tools, shall be cut with a chainsaw and painted with undiluted Roundup® Biactive Herbicide. Works to be carried out by a contractor with a current chainsaw and herbicide license.</p> <p>Larger weed species will be cut with a chainsaw at base of plant, and herbicide applied via applicator bottle. Cut the stem horizontally as close to the ground as possible, using the chainsaw. Remove upper branches to reduce bulk of plant.</p> <p>If cutting at the base is impractical, cut higher to get rid of the bulk of the weed, then cut again at the base and apply herbicide. Make cuts horizontal to prevent the herbicide running off the stump. Apply undiluted herbicide to the cut trunk immediately, within 10-20 seconds, before the plant cells close and the translocation of the herbicide is limited. Ensure there is no runoff of poison. All care must be taken by the contractor not to spill herbicide into water, onto sediment, or surrounding non-targeting plants.</p> <p>Follow up treatment will be required. If plants resprout, cut and paint the shoots using the same method.</p>	<p>Tools: chainsaw, ear muffs, protective clothing, safety glasses herbicide applicator/sprayer, impervious gloves, Roundup® Biactive Herbicide, and all other required P.P.E.</p>
Spot Spraying	<p>Spot spraying involves spraying non-seeding annuals and grasses, and for regrowth of weeds once an area has been cleared or brushcut. Works to be carried out by a contractor with a current herbicide license.</p> <p>Herbicide will be mixed up according to the manufacturer's directions for the particular weed species being targeted. Mixed herbicide shall be applied to the targeted weed species with a backpack sprayer. All care must be taken by the contractor not to spill herbicide onto sediment or surrounding non-targeting plants.</p>	<p>Tools: protective clothing, safety glasses, herbicide sprayer, impervious gloves, Herbicide, and all other required P.P.E.</p>

## Flame Weeding

Thermal (flame) weeding is a method where high temperatures are applied to weeds, causing the plant to die. Thermal weeding is particularly useful in situations where conservation or health considerations are high and weed density is low such as waterways where herbicide use is not permitted.

While flame weeding is not suited to most streetscapes due to the fire hazard nor can it be used on materials such as soft fall and similar playground equipment it is noted that 'flame' weeding in waterways allows weed management in areas where herbicides are not permitted.

Also for native vegetation areas thermal weeding, with a flame weeder, has been shown to stimulate germination of native plants while killing the seeds of annual weeds such as Devils Pitchfork, *Bidens pilosa*. Flame weeding is also effective in killing persistent weeds like Mother of Millions.

Best results are obtained when follow up weed control is undertaken 4-6 weeks after treatment. In addition, weed control should be conducted periodically after that for example to control weeds over a period of a year it is likely that between 3-5 applications will be necessary, depending on rainfall and the extent of the weed seed bank. This method is most effective on young annual weeds and least effective on older perennial weeds. In some cases, control of perennial weeds will be ineffective however this depends on the species present and its age.

### FLAME WEEDER – ECO BURN

Case Study: Weed  
Mgt and Eco-burn  
Glenorie in the  
Hills Shire Council



Images provided by Dragonfly  
Environmental

Flame weeding should be undertaken outside of the fire seasons. Flame weeding allows for the mimicking of a burn in areas where a control burn could not be undertaken. See native plants regenerating after flame weeding.





## 7.4 Appendix III– Bushland Hygiene Protocols for Phytophthora (Hornsby Council Recommendations)

- Always assume that the area you are about to work in is free of the disease and therefore needs to be protected against infection.
- And, always assume that the activity you are about to undertake has the potential to introduce the disease.
- Arrive at site with clean shoes, i.e.: no dirt encrusted on them.
- If you arrive with shoes that are encrusted with dirt, they will have to be completely soaked in metho or disinfectant and allow a few minutes to completely soak in. NEVER scrape untreated dirt off your shoes onto the ground.
- Before you move onto the site spray the bottom of your shoes with 70 % metho. Bleach solution (1% strength) or household/commercial disinfectant (as per label) are also suitable.
- Check all tools and equipment that comes in contact with soil are clean before entering the area (they should have been cleaned on site at the end of the previous work session). If there is any dirt on them, spray them with 70% metho.
- Clean all tools at the end of each work session while still on site ensuring this is done away from drainage lines and adjacent work areas. Knock or brush off encrusted dirt and completely spray with 70 % metho. Replace in storage/transport containers.
- Preferably compost all weed material on site.
- Never drag vegetation with exposed roots and soil through bushland.
- When removing weeds from site, remove as much soil as possible from them in the immediate work area and carefully place vegetative material into plastic bags.
- Try not to get the bag itself dirty; don't put it on/in a muddy area.
- Always work from the lower part of a slope to the upper part.
- Always work in areas known to be free of the pathogen before working in infected areas.
- Minimise activities wherever possible when the soil is very wet.
- Vehicles should not be driven off track or into reserves (unless vehicle decontamination is carried out before and after entering a single work site)
- Only accredited supplies of plants/mulch to be used.

**Kit should contain:** 1 bucket, 1 scrubbing brush, 1 spray bottle (metho 70% solution), 1 bottle tap water, 1 bottle methylated spirits.

### Facts about Phytophthora

*Phytophthora cinnamomi* (Phytophthora) is a microscopic, soil borne, water-mould that has been implicated in the death of remnant trees and other plants in Australian bushland. Phytophthora is not native to Australia. It is believed to have been introduced sometime after European settlement. Phytophthora is a national problem and is listed as a key threatening process under the Commonwealth's Environmental Protection and Biodiversity Conservation Act 1999.

#### *Symptoms including Dieback*

"Dieback" simply means dying or dead plants. There are many causes of dieback; Phytophthora is just one of them. Often dieback is the result of a combination of factors such as; changed drainage patterns and nutrient loads (e.g.: increased stormwater run-off) or changed soil conditions (e.g.: dumped fill or excavation of/near root zone). Plants that are stressed are more vulnerable to Phytophthora.

Initial symptoms of Phytophthora include; wilting, yellowing and retention of dried foliage, loss of canopy and dieback. Infected roots blacken and rot and are therefore unable to take-up water and nutrients. Severely infected plants will eventually die. Symptoms can be more obvious in summer when plants may be stressed by drought. If you suspect that Phytophthora is on your site, please contact the Bushcare team to collect a soil sample to be lab tested. This is usually done in the warmer months where conditions are optimum for the disease.

### *Infection*

There is no way of visually telling if Phytophthora is present in the soil as its structures and spores are microscopic (invisible to the naked eye). Phytophthora requires moist soil conditions and warm temperatures for infection, growth and reproduction. Spores travel through moist soil and attach to plant roots. Once Phytophthora has infected a host plant it can grow inside plant root tissue independent of external soil moisture conditions. After infection, Phytophthora grows through the root destroying the tissue which is then unable to absorb water and nutrients.

## 7.5 Appendix IV – Test of Significance

### 7.5.1 Bush Stone Curlew

#### 5-Part Test

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

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

The works are not expected to adversely affect the life cycle of Bush Stone-Curlew such that a local population would become extinct. No nest was sighted during the site study

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

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

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

The proposed development will not 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, nor 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, as there was no nest present on-site nor have there been sightings within the site

- c) In relation to the habitat of a threatened species or ecological community:*

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

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

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

No core habitat will be removed or modified as a result of the proposed development.

No areas of habitat will become fragmented or isolated from other areas of habitat as a result of the proposed action. Areas of bushland (as of Sep 2017) are being retained.

The proposed vegetation removal will take out trees that encourage insects however this would not be considered primary foraging habitat and therefore the habitat is not important.

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

Declared areas of outstanding biodiversity value have not yet been declared in this area.

- e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.*

Land clearing is a key threatening process for the Bush Stone-curlew however the proposed development will not result in clearing of Bush Stone-curlew species breeding or roosting habitat. Tree removals will reduce foraging habitat availability for Bush Stone-curlew species thus it is recommended that trees be replaced at a ratio of 10:1.

#### Conclusion:

This proposal is not likely to significantly affect Populations of Bush Stone-curlew. No breeding habitat was observed, or previously recorded, on-site. While foraging habitat would be reduced no known breeding habitat would be lost so the proposal is not likely to put the local population at risk of extinction. Revegetation is required) so that there is habitat for prey species and no-nett loss of habitat long-term.

### **7.5.2 Large forest owls (Powerful and Barking Owl)**

#### 5-Part Test

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

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



The works are not expected to adversely affect the life cycle of Large Forest Owls such that a local population would become extinct. Impacts are potentially from the removal of trees. No trees have hollows suitable for owls to breed in however the trees are habitat for Owl prey species.

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

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

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

The proposed development will not 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, nor 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 due to no sightings of nests during site study, and no recorded Bionet sightings (SEED 2019)

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

- (iv) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and*
- (v) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and*
- (vi) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,*

No core habitat will be removed or modified as a result of the proposed development.

No areas of habitat will become fragmented or isolated from other areas of habitat as a result of the proposed action. Areas of bushland (as of Sep 2017) are being retained.

The proposed vegetation removal will take out prey habitat but is not expected, on its own, to significantly influence the long-term survival of PO in the locality.

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

Declared areas of outstanding biodiversity value have not yet been declared in this area.

*j) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.*

Land clearing is a key threatening process for the Powerful Owls. The proposed development will not result in clearing of Large Forest Owl species breeding or roosting habitat. Tree removals will reduce habitat availability for Powerful Owl prey species.

#### Conclusion:

This proposal is not likely to significantly affect Populations of Large forest Owls. No breeding habitat was observed, or previously recorded, on-site. While foraging habitat and prey species would be reduced no known breeding habitat would be lost so the proposal is not likely to put the local population at risk of extinction. Revegetation is required at a ratio of 10:1 (will need to include off-site planting) so that there is habitat for prey species and no-net loss of habitat long-term.

### 7.5.3 Microbats

Species of microbat were assessed as having the potential to occur within the study area based on Bionet records. The following species have the potential to occur in the site or surrounding bushland:

- Eastern Freetail-bat (*Mormopterus norfolkensis*)
- Yellow-bellied Sheath-tail-bat (*Saccolaimus flaviventris*)
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)
- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)
- Little Bentwing-bat (*Miniopterus australis*)
- Large-eared Pied Bat (*Chalinolobus dwyeri*)
- Greater Broad-nosed Bat (*Scoteanax rueppellii*)
- Southern Myotis (*Myotis macropus*)



Microbats are mobile but do tend to use and re-use suitable areas and roost trees. Although these species have differing habitat requirements, they have been assessed together as the trees to be removed are habitat either directly for roosting (cracks, crevices, hollows) or indirectly for food (flying insects) for all eight species.

#### 5-Part Test

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

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

The trees that may need to be removed were not observed to be bearing hollows suitable for tree roosting micro-bat species including the Eastern Free-tail-bat. The low number of recorded sightings tree roosting species suggest that the area is not currently being used as primary breeding habitat (Bionet, 2018). This indicates a low potential for the life cycles of local populations to be put at risk as the site may be used primarily for foraging resources. The proposed actions would be expected to have a lesser impact upon cave dwelling species including the Eastern Bentwing-bat and the Southern Myotis. Trees do not comprise breeding habitat for these species and would not impact their life cycles. The Eastern Freetail Bat, the Eastern Bentwing Bat and the Southern Myotis have relatively higher recorded sightings within a 10km are surrounding the site (Bionet, 2018). This indicates that the site may be used frequently for foraging resources by these species and that the proposed actions would not impact the life-cycles of cave dwelling species.

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

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

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

Microbats are not an EEC but they do live within EECs and re key pollinators of some species so to that extent they are part of the EEC.

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

- (i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and*
- (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and*
- (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,*

Trees may contain marginal foraging habitat for species which feed on insects in or above the canopy.

Removal of habitat by way of crevices/hollows/loosebark in trees and this may have an adverse effect on the life cycles of individual microbats however this site alone is not expected to result in the loss of local populations.

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

Declared areas of outstanding biodiversity value have not yet been declared in this area.

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

Vegetation removal is part of a key threatening process as it results in the loss of habitat for microbats.

Conclusion

The proposed actions may remove habitat by way of crevices/hollows/loosebark in trees and this may have an adverse effect on the life cycles of individual microbats however this site alone is not expected to result in the loss of local populations.

## Grey-headed Flying-Fox (*Pteropus poliocephalus*)

### Species Description

TSC-V

Grey-headed Flying-foxes are generally found within 200 km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. In times of natural resource shortages, they may be found in unusual locations. Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Annual mating commences in January and conception occurs in April or May; a single young is born in October or November. Can travel up to 50 km to forage; commuting distances are more often <20 km. Feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines.



### 5-Part Test

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

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

The proposed development is unlikely to have an adverse effect on the life cycle of this threatened species' viable population or bring it at risk of extinction. Grey-headed Flying-foxes feast on a traditional diet such as nectar and pollen, and fruits from native trees/shrubs. The two eucalypts on the activity site would be marginal foraging habitat as a result of the low numbers.

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

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

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

Not an EEC

- c) In relation to the habitat of a threatened species or ecological community:*

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

The proposed action is expected to have a low immediate impact on Flying Foxes (FF) as the trees, flowering, would be used as an occasionally or opportunistic food source. There are no FF roosts in the trees proposed for removal. Tree loss on a landscape scale does remove food sources for FF and this loss would contribute to cumulative loss and hence tree replanting is required at a 10 to 1 ratio – minimum (570 tube stock locally native trees).

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

The proposal will not result in the creation of any barriers to the movement of these highly mobile, aerial species. The available habitat on site will be not become fragmented or isolated from other areas of habitat as a result of the proposed developments.

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

The habitat being removed or modified is not significant towards the long-term survival of the species as it is considered to be marginal habitat, only to be used occasionally or opportunistically.

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

Declared areas of outstanding biodiversity value have not yet been declared in this area.

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

The proposed action includes tree removal which contributes to habitat loss which is a KTP. There are no FF roosts in the trees proposed for removal. Tree loss does remove food sources for FF and this loss would contribute to cumulative loss and hence tree replanting is required at a 10 to 1 ratio

## 7.6 Appendix V Species attributed to PCT 1234

Scientific Name	Common Name (Range)
<b>Tree Canopy Species (&gt;6m)</b>	
<i>Alphitonia excelsa</i>	Red Ash (N-Sho)
<i>Casuarina glauca</i>	Swamp Oak +
<i>Cupaniopsis anacardioides</i>	Tuckeroo (N-Sho)
<i>Lophostemon suaveolens</i>	Swamp Turpentine (N-Coffs)
<i>Melaleuca ericifolia</i>	Swamp Paperbark + (S-P-Mac)
<i>Melaleuca quinquenervia</i>	Broad leaved Paperbark (N-Syd)
<i>Melaleuca styphelioides</i>	Prickly-leaved Tea Tree (N-Sho)
<b>Small Trees / Shrub Species (1.5-6m)</b>	
<i>Acmena smithii</i>	Lilly Pilly
<i>Callistemon salignus</i>	Sweet Willow Bottlebrush
<i>Glochidion ferdinandi</i>	Cheese Tree +
<i>Glochidion sumatranum</i>	Umbrella Cheese Tree (N-Coffs)
<i>Homalanthus populifolius</i>	Bleeding Heart
<i>Melaleuca alternifolia</i>	Narrow-leaved paperbark (N-Gra)
<i>Myoporum acuminatum</i>	Boobialla
<b>Groundcover Species (0-1.5m) &amp; Vines/Scramblers</b>	
<b>Herbs / Ferns</b>	
<i>Alternanthera denticulata</i>	Lesser Joyweed
<i>Blechnum indicum</i>	Swamp Water-fern (N-J-Bay)
<i>Centella asiatica</i>	Indian Pennywort + (N-Illa)
<i>Commelina cyanea</i>	Commelina + (N-Nar)
<i>Enydra fluctuans</i>	An Enydra (N-Syd)
<i>Hypolepis muelleri</i>	Harsh Ground Fern
<i>Lobelia anceps</i> (formerly <i>L. alata</i> )	Angled Lobelia
<i>Persicaria decipiens</i>	Slender Knotweed
<i>Persicaria strigosa</i>	Prickly Smartweed
<i>Selliera radicans</i>	Swamp Weed (S-Gos)
<i>Viola banksii</i>	A Violet

Scientific Name	Common Name (Range)
<b>Rushes / Grasses</b>	
<i>Baumea juncea</i>	Bare Twig Rush
<i>Carex appressa</i>	Tall Sedge +
<i>Cynodon dactylon</i>	Sand Couch +
<i>Crinum pedunculatum</i>	Swamp Lily (N-J-Bay)
<i>Dianella caerulea</i>	Blue Flax Lily
<i>Entolasia marginata</i>	Bordered Panic
<i>Gahnia clarkei</i>	Tall Saw-sedge
<i>Imperata cylindrica</i> var. <i>major</i>	Blady Grass
<i>Isolepis inundata</i>	Swamp Club-sedge
<i>Juncus kraussii</i> subsp. <i>australiensis</i>	Sea Rush +
<i>Juncus planifolius</i>	A Rush
<i>Juncus usitatus</i>	Common Rush
<i>Lomandra longifolia</i>	Ribbon Grass
<i>Maundia triglochinos</i>	Water Ribbons (N-Gos)
<i>Oplismenus imbecillis</i>	Basket Grass
<i>Phragmites australis</i>	Common Reed +
<b>Vines</b>	
<i>Parsonsia straminea</i>	Common Silkpod + (N-Sho)
<i>Stephania japonica</i> var. <i>discolor</i>	Snake Vine
<i>Flagellaria indica</i>	Whip Vine (N-Illa)

+ = Key indicator species; N = North of; S = South of; Coffs = Coffs Harbour; Gos = Gosford; Gra = Grafton; Illa = Illawarra; J-Bay = Jervis Bay; Nar = Narooma; P-Mac = Port Macquarie; Sho = Shoalhaven; Syd = Sydney.

For further help with plant identification see:  
[plantNET.rbg.gov.au/search/simple.htm](http://plantNET.rbg.gov.au/search/simple.htm)

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## 8 Expertise of authors

With over 20 years wetland and urban ecology experience, a great passion for what she does, and extensive technical and on-ground knowledge make Geraldene a valuable contribution to any project.

Geraldene has over 8 years local government experience as manager of environment and education for Pittwater Council. Geraldene presented papers on the topic at the NSW Coastal Conference, Sydney CMA and Hawkesbury Nepean forums. Geraldene is a Technical Advisor Sydney Olympic Park Wetland Education and Training (WET) panel.

Geraldene has up to date knowledge of environmental policies and frequently provides input to such works. Geraldene was a key contributor to the recent set of Guidelines commissioned by South East Queensland Healthy Waterways Water Sensitive Urban Design Guidelines. Geraldene's role included significant contributions and review of the Guideline for Maintaining WSUD Assets and the Guideline for Rectifying WSUD Assets.

Geraldene is a frequent contributor to many community and professional workshops on ecological matters particularly relating to environmental management. She is an excellent Project Manager.

Geraldene is a joint author on the popular book Burnum Burnum's Wildthings published by Sainty and Associates. Author of the Saltmarsh Restoration Chapter Estuary Plants of East Coast Australia published by Sainty and Associates (2013). Geraldene's early work included 5 years with Wetland Expert Geoff Sainty of Sainty and Associates. Geraldene is an expert in creating and enhancing urban biodiversity habitat and linking People with Place.

### Geraldene Dalby-Ball DIRECTOR



#### SPECIALISATIONS

- Urban Ecology – and habitat rehabilitation and re-creation.
- Urban waterway management – assessing, designing and supervising rehabilitation works
- Saltmarsh and Wetland re-creation and restoration – assessment, design and monitoring
- Engaging others in the area of environmental care and connection
- Technical Advisor – environmental design, guidelines and policies
- Sound knowledge and practical application of experimental design and statistics
- Project management and supervision
- Grant writing and grant assessment
- Budget estimates and tender selection
- Expert witness in the Land and Environment Court

#### CAREER SUMMARY

- **Director and Ecologist**, Ecological Consultants Australia. 2014-*present*
- **Director and Ecologist**, Dragonfly Environmental. 1998-*present*
- **Manager** Natural Resources and Education, Pittwater Council 2002-2010
- **Wetland Ecologist** Sainty and Associates 1995-2002

#### QUALIFICATIONS AND MEMBERSHIPS

- **Bachelor of Science with 1st Class Honors**, Sydney University
- WorkCover WHS General Induction of Construction Industry NSW White Card.
- Senior First Aid Certificate.
- **Practicing member and vice president** Ecological Consultants Association of NSW

