

Randwick Campus Redevelopment Stage 1 Biodiversity Development Assessment Report

Health Infrastructure c/o PwC Australia



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Executive Summary

Eco Logical Australia Pty Ltd (ELA) was engaged by PwC Australia to prepare a Biodiversity Development Assessment Report (BDAR) for a proposed redevelopment within the area bound by Hospital Road, Botany, Magill and High Streets Randwick (the development site) in the Randwick City Council local government area (LGA). This redevelopment forms part of the proposed Randwick Campus Redevelopment. This report has been prepared to meet the requirements of the Biodiversity Assessment Method (BAM) established under Section 6.7 of the NSW *Biodiversity Conservation Act 2016*.

No approval to remove vegetation is being sought under the State Significant Development Application (SSD 9113). No remnant vegetation has been identified within the development site. The preparation of a BDAR is a requirement of the Secretary's Environmental Assessment Requirements (SEARs).

ELA prepared an application requesting a waiver of the BDAR based on the following justifications:

- absence of remnant native vegetation and predominance of planted native and exotic horticultural species
- biodiversity values highly limited in the development site
- application did not trigger a Significant impact under the 5-Part test
- development site is not located within the Biodiversity Values Map.

The Office of Environment and Heritage (OEH) and NSW Department of Planning & Environment (DPE) rejected the application for a waiver as submitted by NSW Health Infrastructure on 5 June 2018, for a BDAR for this project on 3 August 2018. The DPE stated that it could not be determined from the request to waiver that the development will not have any significant impact on biodiversity values with advice that a BDAR must be prepared and accompany the Environmental Impact Statement (EIS). A BDAR has been prepared to assess the biodiversity values of the development site in accordance with the BAM. It is to be noted that due to the constraints of the development site, slight adjustments were made to the configuration of the BAM vegetation plots as the development site is comprised of a series of small house lots separated by tall fences. Further, it is also to be noted that ELA consulted with OEH regarding the most appropriate Plant Type Community (PCT) to assign to the vegetation in the development site, due to the absence of remnant native vegetation and predominance of planted native and exotic horticultural species.

The development site is approximately 1.87 ha, bounded by part Eurimbla Avenue to the north, Hospital Road to the east, Botany Street to the west and Magill Street to the south. The development site was subject to vegetation disturbance as a result of past clearing for residential dwellings in the early 20th century.

There are no remnant vegetation occurring within the development site. A PCT was allocated to the planted vegetation based on its geographic distribution within the landscape. This PCT is a highly disturbed form of PCT1793 *Smooth-barked Apple - Bangalay / Tuckeroo - Cheese Tree open forest on coastal sands of the Sydney basin*. According to the BioNet Vegetation Classification System, PCT 1793 corresponds to the BC Act listed threatened ecological community (TEC) *Bangalay Sand Forest of the Sydney Basin and South East Corner bioregion – endangered ecological community*. However, given the

planted nature of the vegetation, and the developed, highly disturbed urbanised setting, it is concluded that the PCT within the development site does not correspond to the TEC listed under the BC Act.

No threatened flora or fauna were recorded within the development site.

This BDAR outlines the measures taken to avoid, minimise and mitigate impacts to the vegetation and species habitat present within the development site and methodologies to minimise impacts during construction and operation of the development. Following consideration of all the above aspects, the residual unavoidable impacts of the project were calculated in accordance with the BAM by utilising the Biodiversity Assessment Method Credit Calculator (BAMC).

A small amount of vegetation within the development site will be removed, resulting in the clearing of 0.55 ha of low condition PCT 1793. As noted earlier, that approval to remove all vegetation on the site has been sought under separate planning approval pathways. This BDAR has been prepared in response to the Biodiversity SEAR issued for the EIS at the request of OEH and DPE. The BAMC generated a vegetation integrity score of 12.8. Under the BAM, PCTs with a vegetation integrity score of less than 22 (that are not critically endangered or endangered ecological communities, or provide threatened species habitat) do not require an offset. Hence no ecosystem credits were generated and therefore there is no requirement for an offset for ecosystem credit species. No habitat for candidate species credit species was recorded in the study area, therefore no species credits were generated and therefore there is no requirement for an offset for species credit species.

Serious and Irreversible Impacts (SAII) values have been considered in this assessment. No SAII candidate entities are present in the development site, therefore it is considered unlikely that the development would result in an SAII.

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Abbreviations

Abbreviation	Description
BAM	Biodiversity Assessment Method
BAMC	Biodiversity Assessment Method Credit Calculator
BC Act	NSW Biodiversity Conservation Act 2016
BDAR	Biodiversity Development Assessment Report
DoEE	Commonwealth Department of Environment and Energy
DPE	NSW Department of Planning and Environment
ELA	Eco Logical Australia Pty Ltd
EP&A Act	NSW Environmental Planning and Assessment Act 1979
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act 1999
FM Act	NSW Fisheries Management Act 1994
GIS	Geographic Information System
IBRA	Interim Biogeographic Regionalisation for Australia
LGA	Local Government Area
LLS	Local Land Service
NOW	NSW Office of Water
OEH	NSW Office of Environment and Heritage
PCT	Plant Community Type
SEPP	State Environmental Planning Policy
SSD	State Significant Development
TEC	Threatened Ecological Community
VI	Vegetation Integrity
VIS	Vegetation Information System
WM Act	NSW Water Management Act 2000

1. Stage 1: Biodiversity assessment

1.1 Introduction

This Biodiversity Development Assessment Report (BDAR) has been prepared by Mike Lawrie, Belinda Failes and Nicole McVicar who is an Accredited Person (BAAS18077) under the NSW *Biodiversity Conservation Act 2016* (BC Act). It is to be noted that approval to remove all vegetation on the site has been sought under separate planning approval pathways. This BDAR has been prepared in response to the Biodiversity SEAR issued for the EIS at the request of OEH and DPE. The contents of this BDAR complies with the minimum requirements outlined in Table 25 of the Biodiversity Assessment Methodology (BAM: OEH, 2017).

The proposed Randwick Campus Redevelopment will be assessed under the following legislative pathways:

- State Significant Development (SSD) under the Part 4, Division 4.7 of NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) for the construction and operation of the proposed new Acute Services Building
- Development Application (DA) under Part 4, Division 4.1 of the EP&A Act for the demolition of 92 buildings and ancillary structures, removal of vegetation and site remediation
- Review of Environmental Factors (REF) under Part 5, Division 5.1 of the EP&A Act for services diversions (sewer and stormwater) and tree removal along High, Botany and Magill Streets.
- REF under Part 5, Division 5.1 of the EP&A Act for the demolition of Eurimbla Avenue road and pavements, tree removal and other works to Eurimbla Avenue.

The preparation of a BDAR is a requirement of Item 7 Secretary's Environmental Assessment Requirements (SEARs) issued for SSD 9913 SSD (Figure 1).

1.1.1 General description of the development site

The development site is located within a square footprint which is composed of 52 lots within the following lots in the Randwick City Council local government area (LGA). They are:

- DCP 167106 Lot A - D
- DP13997 Lot 7
- DP 12909 Lot 13 & 14
- DP 441943 Lot A & B
- DP 1182570 Lot 1 & 2
- DP 434935 Lot 23A & 23B
- DP 522596 Lot 1 & 2
- DP513339 Lot 3 & 4
- DP7745 Lot 18, 19 & 52
- DP33161 Lot A - F
- DP13995 Lots 2-12
- DP741639 Lot 1
- DP1134643 Lot 2
- DP439101 Lot A & B
- DP302329 Lot 3
- DP307266 Lot 1
- DP806091 Lot 11 & 12
- DP74860 Lot 1

- DP975640 Lot 7
- DP11351 Lot 1-3.

This report includes two base maps, the Site Map (Figure 1) and the Location Map (Figure 2). The development site comprises an area of 1.87 ha which is bounded by Botany Road to the west, part Eurimbla Avenue to the north, Hospital Road to the east and Magill Street to the south.

The development site is strategically positioned between the existing Prince of Wales Hospital to the east and the University of NSW (UNSW) to the west. Ownership of the development site is a combination of Health Infrastructure, UNSW and private lands. An acquisition program is currently well advanced to bring all lots into the ownership of Health Administration Corporation. This includes residential dwellings and non-residential buildings such as medical practices. The buildings are interspersed with planted native and non-native vegetation. There are mature trees in the public domain along Botany and Magill Streets. Their management is addressed in the Arborist Report which is Appendix L to the EIS.

No remnant vegetation occurs within the development site. Furthermore, the planted native vegetation does not correlate to any known Plant Community Type (PCT). Previous vegetation mapping has not recorded any native vegetation within the development site or in the adjacent parcels of land. The closest patch of native vegetation has been mapped approximately 1.5 km away from the development site which consists of East Coast Banksia Scrub (OEH 2016).

ELA received advice from the Office of Environment and Heritage OEH in April 2018 stating that planted native species should be assigned a 'best-fit' PCT to calculate offsetting. As a result, a conservative approach has been taken and planted vegetation has been assigned a 'best fit'. For the assessment, PCT 1793 – *Smooth-barked Apple - Bangalay / Tuckeroo - Cheese Tree open forest on coastal sands of the Sydney basin* has been used to represent planted vegetation.

There are no threatened ecological communities (TECs) recorded within the development site.

1.1.2 Development site footprint

The development site (Figure 1) proposed footprint comprises of 52 residential dwellings and non-residential buildings such as medical practices.

1.1.3 Sources of information used

- Biodiversity Assessment Methodology Calculator
- BioNet Vegetation Classification System
- BioNet / Atlas of NSW Wildlife 5 km database search (OEH 2018a)
- *Environment Protection and Biodiversity Conservation Act 1999* EPBC Act Protected Matters Search Tool 5 km database search (DotEE 2018)
- The Native Vegetation of the Sydney Metropolitan Area (OEH 2016)
- Aerial mapping (SIXMaps)
- Additional GIS datasets including soil, topography, geology and drainage
- Existing reports (ELA 2017, ELA 2018).



Figure 1: Site Map

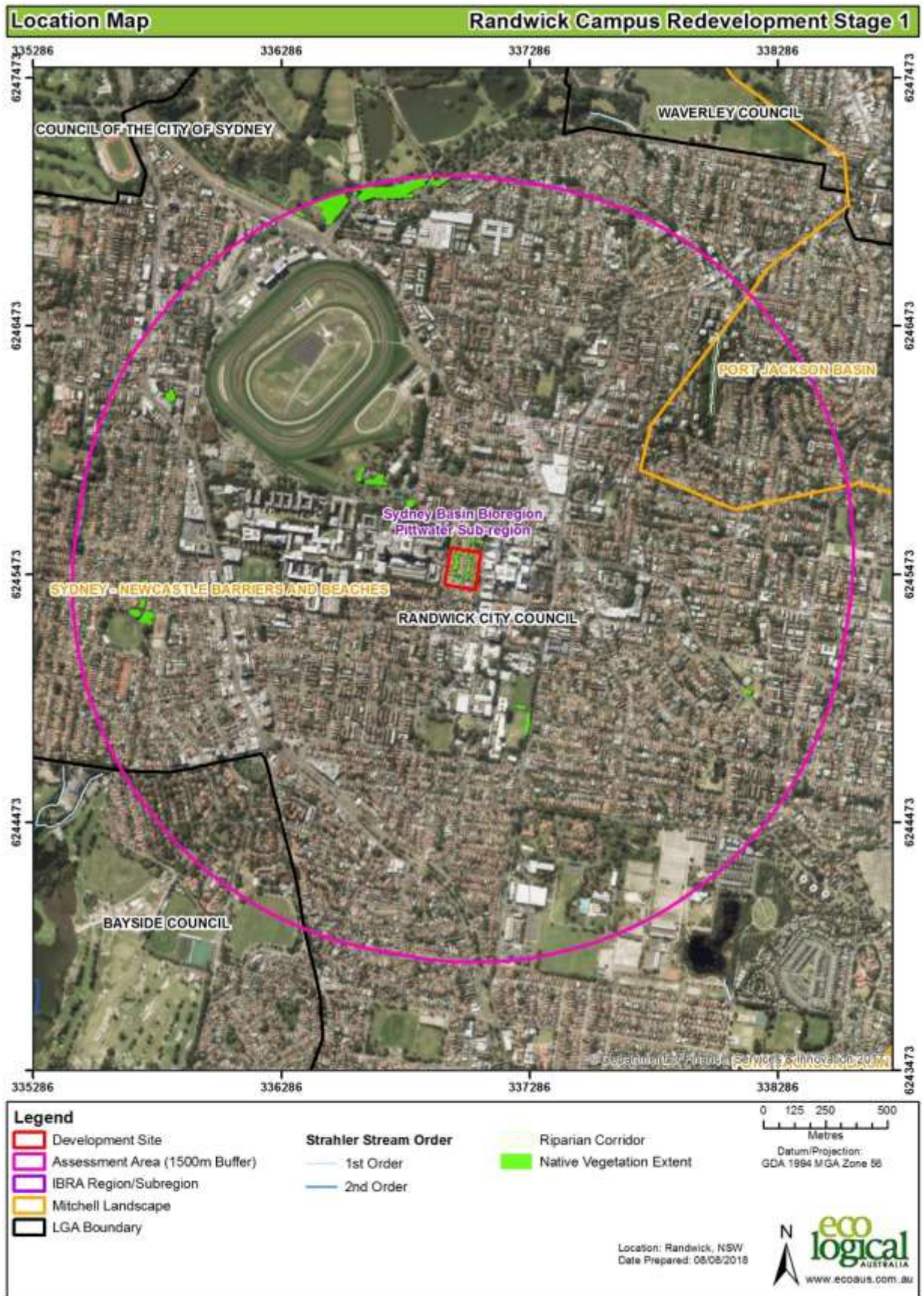


Figure 2: Location Map

1.2 Legislative context

Table 1: Legislative context

Name	Relevance to the project
Commonwealth	
<i>Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)</i>	Matters of national Environmental Significance have not been identified on the development site. This report does not further assess impacts to MNES under the EPBC Act.
NSW	
<i>Biodiversity Conservation Act 2016 (BC Act)</i>	The proposed development requires submission of a BDAR (i.e. this report) under the BC Act.
<i>Environmental Planning and Assessment Act 1979 (EP&A Act)</i>	The proposed development requires consent under the EP&A Act.
<i>Fisheries Management Act 1994 (FM Act)</i>	The development does not involve impacts to Key Fish Habitat, does not involve harm to marine vegetation, dredging, reclamation or obstruction of fish passage. A permit or consultation under the FM Act is not required.
<i>Local Land Services Amendment Act 2016 (LLS Act)</i>	The LLS Act does not apply to this development.
<i>Water Management Act 2000 (WM Act)</i>	The project does not involve works on waterfront land. A Controlled Activity Approval under s91 of the WM Act is not required.
Planning Instruments	
SEPP Coastal Management 2018	This SEPP does not apply to the development site
SEPP 44 – Koala Habitat Protection	This SEPP does not apply to the development site
SEPP (Vegetation in Non-Rural Areas)	This SEPP applies to development that does not require consent. As this project requires consent under the EP&A Act, the Vegetation SEPP is not relevant.
Randwick City Council Local Environment Plan 2012	<p>The development site is zoned R2 – Low Density Residential under the Randwick LEP. The recent amendment to State Environmental Planning Policy (infrastructure) 2007 provides that the R2 zone is a “Prescribed Zone” within which development for the purposes of Health Care Facilities are permissible with consent.</p> <p>The LEP 2012 contains a clause (6.5) pertaining to protecting terrestrial biodiversity. The proposed works do not impact upon any mapped areas of biodiversity within the development site under this LEP.</p>
Randwick City Council Development Control Plan 2013 (DCP 2013)	The DCP 2013 has been reviewed for additional biodiversity provisions that may relate to the development site. No additional provisions were identified.

1.3 Landscape features

1.3.1 IBRA regions and subregions

The development site falls within the Sydney Basin IBRA region and Pittwater subregion.

1.3.2 Mitchell Landscapes

The development site falls within the Sydney Basin Coastal Barriers in the Sydney – Newcastle Barriers and Beaches Mitchell Landscapes as outlined in Table 2.

Table 2: Mitchell Landscapes (Mitchell 2002)

Mitchell landscape	Description
Sydney Newcastle Barriers and Beaches	– Quaternary coastal sediments on long recurved quartz sand beaches between rocky headlands backed by sand dunes and intermittently closed and open lagoons. Includes areas of more extensive high dunes often located on top of the headlands. General elevation 0 to 30m, local relief 10m. Cliff top dunes may be found as high as 90m above sea level. Distinct zonation of vegetation and increasing soil development from the beach to the inland dunes. At the beach; spinifex (<i>Spinifex hirsutus</i>), spiky mat-rush (<i>Lomandra longifolia</i>), coast wattle (<i>Acacia longifolia</i> ssp. <i>sophorae</i>) and coast tea-tree (<i>Leptospermum laevigatum</i>) colonise the frontal dune in which there is little soil development. Coast banksia (<i>Banksia integrifolia</i>) and old man banksia (<i>Banksia serrata</i>) are found on the second dunes and these merge with more complex forest containing blackbutt (<i>Eucalyptus pilularis</i>), red bloodwood (<i>Corymbia gummifera</i>), grass trees (<i>Xanthorrhoea</i> sp.) and numerous understorey shrubs on deep sands that have an organic rich A horizon, a bleached A2 horizon and the initial development of weak iron or organic pans in the sandy subsoil. Well-developed, deep podsol profiles are present in cliff top dunes with swampy swales indicating that these forms are probably older than the coastal dunes.

1.3.3 Rivers and streams

The development site does not contain any rivers or streams.

1.3.4 Wetlands

The development site does not contain any wetlands.

1.3.5 Connectivity features

The development site is highly fragmented. Connectivity of planted vegetation is disrupted by major roads, residential dwellings and commercial areas. The vegetation within the development site is of low conservation and connectivity value on a local scale.

1.3.6 Areas of geological significance and soil hazard features

The development site contains the areas of geological significance and soil hazard features as outlined in Table 3. The development site falls under the Tuggerah aeolian soil landscape. This landscape is characterised by undulating coastal dunefields on Quaternary (Holocene and Pleistocene) comprised of marine quartz sands (Chapman and Murphy 1989).

Vegetation occurring within this landscape is almost completely cleared for residential development and would have comprised of dry sclerophyll eucalypt and apple woodland (Chapman and Murphy 1989). This soil group has extreme wind erosion hazard, highly permeable soils and very low fertility (Chapman and Murphy 1989).

Table 3: Areas of geological significance and soil hazard features

Area of geological significance or soil hazard feature	Feature type
Erosion Hazard	Soil erosion hazard for concentrated flows is very high to extreme.
Surface Movement Potential	The sandy soil materials are stable.

1.3.7 Site context

1.3.7.1 Method applied

The site based method has been applied to this development.

1.3.7.2 Percent native vegetation cover in the landscape

The current percent native vegetation cover in the landscape was assessed in a Geographic Information System (GIS) using aerial imagery sourced from SIX Maps (LPI 2015). The percent native vegetation cover within the 1,500 m buffer area is 0.56% (4.39 ha). This is displayed in Figure 2.

1.3.7.3 Patch size

Patch size was calculated using mapping specifically developed for this project that enabled vegetation to be mapped for all patches of intact native vegetation on and adjoining the development site. The patch size falls within the class of <5 ha.

1.4 Native vegetation

The initial site inspection was conducted on 29 November 2017 by Mike Lawrie which involved validation of vegetation communities and assessment of habitat features in the development site. An additional vegetation survey was undertaken on 7 August 2018 by Mike Lawrie which involved collection of vegetation plot data in accordance with the BAM.

The vegetation within the development site is comprised of planted street trees in the public domain along footpaths and adjacent to busy roads with horticultural plantings in segregated residential backyards. Patches of vegetation were typically small and full sized BAM plots (20 x 50m) could not be undertaken.

Therefore, an alternative plot configuration was utilised. The traditional 20 x 50 m BAM plots were scaled down to 30 x 12m vegetation integrity plots and 12 x 12m full-floristic plots. All required condition attributes were recorded within the reduced plot size. Whilst only one plot was required to comply with the BAM, three plots were undertaken to identify PCTs (**Table 4**). This was considered necessary to account for the high variability of planted vegetation within the development site resulting from mixed plantings between different properties and the variation of ground surfaces ranging from maintained lawns through to bare soil and concrete. One PCT was mapped across the development site. This PCT was not split into separate vegetation zones.

Table 4: Full-floristic and vegetation integrity plots

Veg Zone	PCT ID	PCT Name	Condition	Ancillary Code	Area within development site (ha)	Plots required	Plots surveyed
1	1793	<i>Smooth-barked Apple - Cheese Bangalay / Tuckeroo - Cheese Tree open forest on coastal sands of the Sydney basin</i>	Poor	Planted	0.55	1	3

1.4.1 Plant Community Types present

One PCT was identified within the development site (Table 5, Table 6, Figure 3). Due to the fact that only planted vegetation was recorded within the development site, no quantitative analysis was conducted and this type of analysis was considered impractical to define the PCT in this instance.

Whilst vegetation in the development site lacks consistency with any PCT based on floristic components, ELA received advice from OEH in April 2018 stating that planted native species should be assigned a best-fit PCT to calculate offsetting. Advice has been sought from OEH on which PCT to assign in the absence of any remnant vegetation, however, advice had not yet been provided at the time of submission of this report. Therefore, ELA identified potential PCTs using IBRA, subregion and Randwick LGA as suitable filters in the OEH BioNet Vegetation Classification online tool. A total of eight PCTs were identified as potential candidates for the planted native vegetation recorded within the development site. ELA reviewed each PCT and has provided justifications for the suitability of each PCT below in Table 6 and **Section 1.4.1.1**.

Information including soil type, geographic location, surrounding vegetation and landscape position were also utilised. The most consistent PCT was selected and delineated into a single vegetation zone (Figure 3, **Figure 4**).

Table 5: Plant Community Types

PCT ID	PCT Name	Vegetation Class	Vegetation Formation	Area within development site (ha)	Percent cleared
1793	<i>Smooth-barked Apple - Bangalay / Tuckeroo - Cheese Tree open forest on coastal sands of the Sydney basin</i>	South Coast Sands Dry Sclerophyll Forests	Dry Sclerophyll Forests (Shrubby sub-formation)	0.55	40%

Table 6: PCT selection justification

PCT ID	PCT Name	Selection criteria	Justifications
664	<i>Banksia heath on aeolian sands of eastern Sydney suburbs, Sydney Basin Bioregion</i>	IBRA region, subregion, Randwick LGA, Tuggerah landscape	The development site occurs on Tuggerah soil landscapes which are associated with dry sclerophyll forest and woodlands rather than heath vegetation description for this PCT. Additionally, this PCT corresponds to the TEC Eastern Suburbs Banksia Scrub. ELA considers the profile for this community is not the 'best-fit' PCT for the development site.
771	<i>Coast Banksia - Coast Tea-tree low moist forest on coastal sands and headlands, Sydney Basin Bioregion and South East Corner Bioregion</i>	IBRA region, subregion, Randwick LGA, Tuggerah landscape and geographic distribution	The development site occurs on Tuggerah soil landscapes which are associated with dry sclerophyll forest and therefore, does not conform to the heath vegetation description for this PCT. Additionally, the development site is not considered to be located along headlands. ELA considers the profile for this community is not the 'best-fit' PCT for the development site.
1775	<i>Smooth-barked Apple - Old-man Banksia - Red Bloodwood open forest on pleistocene sand dunes around Sydney and the Central Coast</i>	IBRA region, subregion, Randwick LGA,	The development site occurs on Tuggerah soil landscapes which are associated with dry sclerophyll forest and therefore, does not conform to the heath description for this PCT. Additionally, the development site is not

PCT ID	PCT Name	Selection criteria	Justifications
		Tuggerah landscape	considered to be located along sand dunes. ELA considers the profile for this community is not the 'best-fit' PCT for the development site.
1793	<i>Smooth-barked Apple - Bangalay / Tuckeroo - Cheese Tree open forest on coastal sands of the Sydney basin</i>	IBRA region, subregion, Randwick LGA, Tuggerah landscape	This PCT has been accepted as best fit PCT for the planted native vegetation recorded within the development site. This PCT also corresponds to the TEC Bangalay Sand Forest of the Sydney Basin and South East Bioregion. Although this PCT has been considered as 'best-fit' for the development site, it has been determined that the planted native vegetation does not conform to the listing for this TEC according to the description in the final determination.
1809	<i>Crimson Bottlebrush - Banksia - Melaleuca / Baumea woody sedgeland in dune swales of the Sydney basin</i>	IBRA region, subregion, Randwick LGA, Tuggerah landscape	The development site occurs on Tuggerah soil landscapes which are associated with dry sclerophyll forest and therefore, does not conform to the heath/sedgeland description for this PCT. Additionally, the development site is not considered to be located along coastal swamps. This PCT has been mapped as Freshwater Wetlands under Keith vegetation formation and Coastal Heath Swamps under Keith vegetation class. ELA considers the profile for this community is not the 'best-fit' PCT for the development site.
1810	<i>Coast Rosemary - Heath Myrtle - Tree Broom-heath woody marshland on coastal cliffline seepages of the Sydney area</i>	IBRA region, subregion, Randwick LGA, Tuggerah landscape	The development site occurs on Tuggerah soil landscapes which are associated with dry sclerophyll forest and therefore, does not conform to the heath/marshland description for this PCT. Additionally, the development site is not considered to be located along clifflines or in moist depressions (seepages). ELA considers the profile for this community is not the 'best-fit' PCT for the development site.
1822	<i>Heath-leaved Banksia - Scrub She-oak heath on sandstone headlands in the Sydney basin</i>	IBRA region, subregion, Randwick LGA, Tuggerah landscape	The development site occurs on Tuggerah soil landscapes which are associated with dry sclerophyll forest and therefore, does not conform to the heath description for this PCT. ELA considers the profile for this community is not the 'best-fit' PCT for the development site.
1823	<i>Bracelet Honey-myrtle - Heath-leaved Banksia - Scrub She-oak coastal cliffline scrub in the Sydney basin</i>	IBRA region, subregion, Randwick LGA, Tuggerah landscape	The development site occurs on Tuggerah soil landscapes which are associated with dry sclerophyll forest and therefore, does not conform to the heath description for this PCT. ELA considers the profile for this community is not the 'best-fit' PCT for the development site.

1.4.1.1 PCT selection justification

The field survey found that no remnant vegetation from a native PCT was present within the development site. Vegetation comprised of a mixture of native and exotic planted trees and garden vegetation.

In determining the PCT for the development site, various attributes were considered in combination to assign vegetation to the best fit PCT. Given the absence of remnant native vegetation, flora species could not be utilised to accurately assign a PCT. As an alternative details of the development site including LGA, IBRA region and IBRA subregion were entered into the BioNet Vegetation Classification system. As discussed, this produced eight potential PCT matches. These PCTs were further filtered based on soil type and landscape position. It was determined that the best-fit PCT for all vegetation in the development site is *PCT 1793 - Smooth-barked Apple - Bangalay / Tuckeroo - Cheese Tree open forest on coastal sands of the Sydney basin*.

1.4.1.2 Threatened Ecological Communities Justification

The BioNet Vegetation Classification lists PCT 1793 as a component of Bangalay Sand Forest of the Sydney Basin and South East Bioregions. Bangalay Sand Forest is listed as endangered ecological community under the BC Act.

A review of the final determination for this TEC and profile description has determined that the native planted vegetation within the development site does not conform to the TEC. This is due to the lack of remnant native vegetation within the development site, and a low probability of an existing soil seed bank due to the fact that the landscape has been entirely altered and is no longer associated with coastal sand plains of marine or aeolian origin. Furthermore, this TEC is not known to occur within the Pittwater IBRA subregion.

1.4.2 Vegetation integrity assessment

A vegetation integrity assessment using the Credit Calculator (BAMC) was undertaken and the results are outlined in Table 7. Approximately 0.55 ha of native vegetation will be cleared for the building footprint.

Table 7: Vegetation integrity

Veg Zone	PCT ID	Condition	Ancillary Code	Impact Area (ha)	Composition Condition Score	Structure Condition Score	Function Condition Score	Current vegetation integrity score
1	1793	Low	Planted	0.55	5.6	22.7	16.5	12.8

1.4.3 Use of local data

Use of local data instead of benchmark integrity scores is not proposed.



Figure 3: Plant Community Type



Figure 4: Vegetation Zone and BAM Plots

1.5 Threatened species

1.5.1 Ecosystem credit species

Ecosystem credit species predicted to occur at the development site, their associated habitat constraints, geographic limitations and sensitivity to gain class (i.e. sensitivity of species to be impacted by the development) is included in Table 8.

Table 8: predicted ecosystem credit species

Species	Common Name	Sensitivity to gain class	BC Act	EPBC Act
<i>Anthochaera phrygia</i>	Regent Honeyeater	High Sensitivity to Potential Gain	Critically Endangered	Critically Endangered
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	High Sensitivity to Potential Gain	Vulnerable	Endangered
<i>Glossopsitta pusilla</i>	Little Lorikeet	High Sensitivity to Potential Gain	Vulnerable	Not Listed
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	High Sensitivity to Potential Gain	Vulnerable	Not Listed
<i>Lathamus discolor</i>	Swift Parrot	Moderate Sensitivity to Potential Gain	Endangered	Critically Endangered
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	High Sensitivity to Potential Gain	Vulnerable	Not Listed
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	High Sensitivity to Potential Gain	Vulnerable	Not Listed
<i>Pandion cristatus</i>	Eastern Osprey	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	High Sensitivity to Potential Gain	Vulnerable	Vulnerable

1.6 Species credit species

1.6.1 Candidate Species credit species

Species credit species predicted to occur at the development site (i.e. candidate species), their associated habitat constraints, geographic limitations and sensitivity to gain class are shown in Table 9. Habitat assessments were undertaken during the field surveys in November 2017 and August 2018 to determine the likelihood of threatened species occurring within the development site on an intermittent or permanent basis. This included assessing habitat trees comprising both exotic and native species and searching for large old structures potentially utilised as roosts for microbats and any other microhabitat features.

Table 9: Candidate Species Credit Species

Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	BC Act	EPBC Act
<i>Anthochaera phrygia</i>	Regent Honeyeater			High	Critically Endangered	Critically Endangered
<i>Chamaesyce psammogeton</i>	Sand Spurge	Dunes; Fore-dunes or exposed headlands	Fore-dunes and headlands	High	Endangered	Not Listed

Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	BC Act	EPBC Act
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle			High	Vulnerable	Not Listed
<i>Lathamus discolor</i>	Swift Parrot (Breeding)			Moderate	Endangered	Critically Endangered
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat (Breeding)			Very High	Vulnerable	Not Listed
<i>Pandion cristatus</i>	Eastern Osprey (Breeding)			Moderate	Vulnerable	Not Listed
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox (Breeding)			High	Vulnerable	Vulnerable
<i>Senecio spathulatus</i>	Coast Groundsel			Moderate	Endangered	Not Listed
<i>Syzygium paniculatum</i>	Magenta Lilly Pilly			Moderate	Endangered	Not Listed

An assessment of those candidate Species credit species identified in Table 9 was undertaken to determine likelihood of those species to occur based on the absence of necessary habitat components or habitat constraints in accordance with BAM sections 6.4.1.10 and 6.4.1.17. The justification for exclusion of these species is presented in Table 10.

Table 10: Justification for exclusion of candidate species credit species

Species	Common Name	NSW listing status	EPBC Listing status	Justification for exclusion of species
<i>Anthochaera phrygia</i>	Regent Honeyeater (Breeding)	Critically Endangered	Critically Endangered	Habitat is substantially degraded such that this species is unlikely to utilise the development site.
<i>Chamaesyce psammogeton</i>	Sand Spurge	Endangered	Not Listed	Specific habitat constraints (dunes, foredunes, exposed headlines) listed for this species are not present in the development site.
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle (Breeding)	Vulnerable	Not Listed	Habitat is substantially degraded such that this species is unlikely to utilise the development site. No large nests observed within development site.
<i>Lathamus discolor</i>	Swift Parrot (Breeding)	Endangered	Critically Endangered	Habitat is substantially degraded such that this species is unlikely to utilise the subject land.
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat (Breeding)	Vulnerable	Not Listed	This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. No cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding are present in the development site.
<i>Pandion cristatus</i>	Eastern Osprey (Breeding)	Vulnerable	Not Listed	Specific habitat constraint (living and dead trees (>15m) or artificial structures within 100m of a floodplain for nesting) not present. Habitat is substantially degraded such that this species is unlikely to utilise the development site. No suitable nests observed in development site.

Species	Common Name	NSW listing status	EPBC Listing status	Justification for exclusion of species
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox (Breeding)	Vulnerable	Vulnerable	No known breeding camps are present in the development site. Habitat is substantially degraded such that this species is unlikely to breed within the development site.
<i>Senecio spathulatus</i>	Coast Groundsel	Endangered	Not Listed	Habitat is substantially degraded such that this species is unlikely to utilise the development site. Suitable habitat (frontal dunes) not present in development site.
<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	Endangered	Not Listed	Habitat is substantially degraded such that this species is unlikely to utilise the development site. Preferred habitat (littoral rainforest) not present in development site.

1.6.1.1 Targeted surveys

Due to the high level of modification of vegetation within the development site and lack of potential habitat, targeted surveys were not conducted for species credit species. Justification for the exclusion of species credit species is provided in Table 10.

1.6.2 Use of local data

The use of local data is not proposed.

1.6.3 Expert reports

Expert reports have not been prepared as part of this BDAR.

2. Stage 2: Impact Assessment

2.1 Avoiding impacts

The development site is small and contains small and fragmented patches of planted vegetation. The development has been located in a way which avoids and minimises impacts as outlined in Table 11 and Table 12.

2.1.1 Locating a project to avoid and minimise impacts on vegetation and habitat

Table 11: Locating a project to avoid and minimise impacts on vegetation and habitat

Approach	How addressed	Justification
locating the project in areas where there are no biodiversity values	The project has been located predominantly in areas with no biodiversity values or where biodiversity values are low.	The majority of the development site comprises buildings and urban surfaces which do not contain biodiversity values. Biodiversity values present are low, with no remnant native vegetation present.
locating the project in areas where the native vegetation or threatened species habitat is in the poorest condition	The project has been located in areas where no remnant native vegetation is present, the vegetation integrity score is low and habitat for threatened species is limited to marginal foraging habitat for highly mobile species.	Native vegetation within the study area is in poor condition with a vegetation integrity score of 12.8. Habitat for threatened species is limited.
locating the project in areas that avoid habitat for species and vegetation in high threat categories (e.g. an EEC or CEEC), indicated by the biodiversity risk weighting for a species	The project has been located in areas that avoid impacting on vegetation and threatened species in high threat categories. .	No vegetation communities in high threat categories (EEC or CEEC) will be impacted. Habitat for species in high threat categories is limited to marginal foraging habitat for highly mobile species.
locating the project such that connectivity enabling movement of species and genetic material between areas of adjacent or nearby habitat is maintained	The project does not significantly impact on connectivity values surrounding the development site. The development site is within a fragmented landscape. Marginal connectivity for mobile species is available, however, the development would not prevent movement of these species across the landscape.	The development site is located within a fragmented, urbanised landscape. No large areas of habitat are present adjacent to the site. Marginal connectivity through street trees is available, however, species likely to use such connections would be highly mobile, such as Grey-headed Flying-fox. The development would not prevent such mobile species from moving across the landscape. Grey-headed Flying-fox is an important pollinator which can move genetic material between areas of habitat. The development is unlikely to disturb any significant connecting habitat that would prevent highly mobile species moving genetic material between large areas of habitat.

2.1.2 Designing a project to avoid and minimise impacts on vegetation and habitat

Table 12: Designing a project to avoid and minimise impacts on vegetation and habitat

Approach	How addressed	Justification
reducing the clearing footprint of the project	The clearing footprint cannot be reduced, as the development will utilise the entirety of the development site.	The project will result in removal of only a small amount of planted vegetation (0.55 ha). No remnant native vegetation will be removed.
locating ancillary facilities in areas where there are no biodiversity values	Ancillary facilities will be located within cleared areas or areas with low biodiversity value.	No additional biodiversity values will be impacted for ancillary features.
locating ancillary facilities in areas where the native vegetation or threatened species habitat is in the poorest condition (i.e. areas that have a lower vegetation integrity score)	Ancillary features will be located within cleared areas or areas with a low vegetation integrity score.	Vegetation in the development site has a low vegetation integrity score (12.8). No additional vegetation will be removed as a result of ancillary features.
locating ancillary facilities in areas that avoid habitat for species and vegetation in high threat status categories (e.g. an EEC or CEEC)	Ancillary features are not located in areas containing species habitat or vegetation in high threat status categories.	Ancillary features will be located within the operational footprint and will not impact on additional native vegetation or threatened species habitat in high threat status categories.
providing structures to enable species and genetic material to move across barriers or hostile gaps	Not deemed necessary as connectivity is limited within the development site and only available to those highly mobile avian species or GHFF.	The development site is located within a fragmented and urbanised landscape. No connectivity exists between areas of habitat in the locality except for highly mobile species.
making provision for the demarcation, ecological restoration, rehabilitation and/or ongoing maintenance of retained native vegetation habitat on the development site.	Proponent to protect all remaining vegetation outside of the development site footprint.	The proponent will demarcate all areas outside the development site boundary to be retained as no go areas to avoid impacts occurring to adjacent street trees to be retained.

2.1.3 Prescribed biodiversity impacts

The list of potential prescribed biodiversity impacts as per the BAM is provided below:

- Occurrences of karst, caves, crevices and cliffs - none occur within the development site
- Occurrences of rock - no rock outcrops or scattered rocks occur within the development site
- Occurrences of human made structures and non-native vegetation - as the development site is located in a heavily urbanised area almost the entire study area contains human made structures. Consideration was given during literature review to buildings or structures that could potentially be utilised as a roosting resource by microchiropteran bats (microbats). Non-native vegetation was identified and assessed for any potential to provide habitat for threatened flora and fauna species
- Hydrological processes that sustain and interact with the rivers, streams and wetlands - none occur within the development site.
- Proposed development for a wind farm and use by species as a flyway or migration route - the project does not involve any wind farm development.

The development site has the prescribed biodiversity impacts outlined in Table 13.

Table 13: Prescribed biodiversity impacts

Prescribed biodiversity impact	Description in relation to the Development Site	Threatened species or ecological communities affected.
Impacts of the development on the habitat of threatened species or ecological communities associated with human made structures	The development site is in a highly urbanised area and involves the removal of several houses.	Potential roosting habitat for <i>Saccolaimus flaviventris</i> (Yellow-bellied Sheath-tail Bat)
Impacts of development on the habitat of threatened species or ecological communities associated with non-native vegetation	The removal of planted non-native vegetation will be required within the development site.	<i>Pteropus poliocephalus</i> (Grey-headed Flying Fox (GHFF)) potential foraging habitat.
Impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range must:	The development will result in marginal impacts to connectivity for mobile species.	Grey-headed Flying-fox and Yellow-bellied Sheath-tail Bat.

2.1.3.1 Locating a project to avoid and minimise prescribed biodiversity impacts

The development has been located in a way which avoids and minimises prescribed biodiversity impacts as outlined in Table 14.

Table 14: Locating a project to avoid and minimise prescribed biodiversity impacts

Approach	How addressed	Justification
Locating the envelope of surface works to avoid direct impacts on the habitat features	Habitat features including foraging habitat for GHFF and marginal roosting habitat for Yellow-bellied Sheath-tail-bat within the development site will be removed.	The potential foraging habitat for GHFF is limited to native and non-native planted trees and garden vegetation. Similar foraging resources are abundant in the locality. Marginal roosting habitat for Yellow-bellied Sheath-tail-bat within houses will be removed.

2.1.3.2 Designing a project to avoid and minimise prescribed biodiversity impacts

The development has been designed in a way which avoids and minimises prescribed biodiversity impacts as outlined in Table 15.

Table 15: Designing a project to avoid and minimise prescribed biodiversity impacts

Approach	How addressed	Justification
Design of the project to maintain environmental processes critical to the formation and persistence of habitat features not associated with native vegetation	Habitat features including foraging habitat for GHFF within the development site will be removed. Yellow-bellied Sheath-tail-bat within the development site will be removed.	The potential foraging habitat for GHFF is limited to native and non-native planted trees and garden vegetation. Similar foraging resources are abundant in the locality. Marginal roosting habitat for Yellow-bellied Sheath-tail-bat within houses

Approach	How addressed	Justification
		will be removed. Similar habitat is abundant in the locality. Hospital building structures may provide similar roosting habitat.

2.2 Assessment of impacts

2.2.1 Direct impacts

The direct impacts on native vegetation are outlined in **Table 16**. There will be no direct impacts on TECs.

Table 16: Direct impacts to native vegetation

PCT ID	PCT Name	Vegetation Class	Vegetation Formation	Direct impact area (ha)
1793	<i>Smooth-barked Apple - Bangalay / Tuckeroo - Cheese Tree open forest on coastal sands of the Sydney basin</i>	South Coast Sands Dry Sclerophyll Forests	Dry Sclerophyll Forests (Shrubby sub-formation)	0.55

2.2.2 Change in vegetation integrity

The change in vegetation integrity as a result of the development is outlined in **Table 17**. The future vegetation integrity score of 0 for the 0.55 ha portion of the development site reflects the clearing of all native vegetation within the development site.

Table 17: Change in vegetation integrity

Veg Zone	PCT ID	Condition	Area (ha)	Current vegetation integrity score	Future vegetation integrity score	Change in vegetation integrity
1	1793	Poor	0.55	12.8	0	-12.8

2.2.3 Indirect impacts

The indirect impacts of the development are outlined in Table 18.

Table 18: Indirect impacts

Indirect impact	Project phase	Nature	Extent	Frequency	Duration	Timing
Sedimentation and contaminated and/or nutrient rich run-off	Construction	Runoff during construction works	Adjacent to development site.	During heavy rainfall or storm events	During rainfall events	Short-term impacts
Inadvertent impacts on adjacent habitat or vegetation	Construction	Damage to adjacent habitat or vegetation	Adjacent to development site.	Daily, during construction works	Throughout construction period	Short-term impacts
Transport of weeds and pathogens from the site to adjacent vegetation	Construction	Spread of weed seed or pathogens	Adjacent to development site.	Daily, during construction works	Sporadic throughout construction period	Short-term impacts
Trampling of threatened flora species	Construction / operation	No threatened flora present	N/A	N/A	N/A	N/A
Bush rock removal and disturbance	Construction / operation	No bush rock present	N/A	N/A	N/A	N/A
Increase in predatory species populations	Construction / operation	Negligible likelihood of impact due to highly urbanised environment.	N/A	N/A	N/A	N/A
Increase in pest animal populations	Construction / operation	Negligible likelihood of impact due to highly urbanised environment.	N/A	N/A	N/A	N/A

2.2.4 Prescribed biodiversity impacts

An assessment of impacts of the development on prescribed biodiversity impacts is outlined in Table 19 in accordance with Section 9.2.1 of the BAM.

Table 19: Direct impacts on prescribed biodiversity impacts

BAM Criteria	Assessment
9.2.1.3 The assessment of the impacts of the development on the habitat of threatened species or ecological communities associated with human made structures	
a) identify the human made structures with potential to be habitat for threatened species of ecological communities	Development site is located within a highly urbanised area. 52 houses will be removed which provide potential roosting habitat for threatened species.

BAM Criteria	Assessment
<p>b) identify the species and ecological communities likely to use the habitat</p>	<p>The structures within the development site provide potential roosting habitat for <i>Saccolaimus flaviventris</i> (Yellow-bellied Sheathtail-bat) which is known to roost in buildings. There is one record of Yellow-bellied Sheathtail-bat within 5km of the development site, approximately 2km to the south-west at Eastlakes golf course.</p>
<p>c) describe the nature, extent and duration of short and long-term impacts</p>	<p>The impact involves the permanent removal of 52 houses providing potential roosting habitat for Yellow-bellied Sheathtail-bat, resulting in a long-term loss of potential roosting habitat for this species. It is possible that the proposed hospital buildings would also provide potential roosting habitat for the Yellow-bellied Sheathtail-bat.</p>
<p>d) describe, with reference to relevant literature the importance within the bioregion of the habitat of these species or ecological communities</p>	<p>Preferred roosting habitat of the Yellow-bellied Sheathtail-bat is within tree hollows, however they have been recorded in buildings before. Considering the limited number of records within proximity to the development site (1 record approximately 2 km away), and the overall degraded habitat within the study area it is considered unlikely that this species within the locality and bioregion is reliant on secondary roosting habitat within houses in the development site.</p>
<p>e) predict the consequences of the impacts for the local and bioregional persistence of the suite of threatened species and communities likely to use these areas as habitat, with reference to relevant literature and other published sources of information.</p>	<p>While this species has been known to utilise human structures for roosting, preferred roosting habitat for this species is tree hollows. One record for this species is present approximately 2km from the development site in a more vegetated area at Eastlakes Golf Course. The study area provides marginal foraging habitat for this species and marginal secondary roosting habitat in the form of buildings it is considered unlikely that a significant population would be reliant on this secondary roosting habitat. It is unlikely that the development would have significant impacts on the local and bioregional persistence of the Yellow-bellied Sheathtail-bat. The Priority Action Statement for the Yellow-bellied Sheathtail-bat lists several recommended actions for help in the recovery of this species, those pertaining to retention of roosting habitat focus on the retention of large hollow-bearing trees and retention of vegetated areas. Given the lack of hollow-bearing trees and high level of fragmentation of the local landscape, the habitat within the study area is unlikely to be important for this species.</p>
<p>9.2.1.4 The assessment of the impacts of development on the habitat of threatened species or ecological communities associated with non-native vegetation</p>	
<p>a) identify the species and ecological communities likely to use the habitat</p>	<p>Several non-native tree species are present in the development site which have been planted within residential gardens or are invasive weeds. Non-native species which have been identified as potential foraging species for Grey-headed Flying fox are <i>Syagrus romanzoffiana</i> (Cocos Palm), <i>Liquidambar styraciflua</i>, <i>Ligustrum lucidum</i> (Broad-leaved Privet) and <i>Ligustrum sinense</i> (Small-leaved Privet).</p>
<p>(b) describe the nature, extent and duration of short and long-term impact</p>	<p>The proposed development will result in the permanent removal of a small number of non-native trees (listed above) which provide potential foraging habitat for Grey-headed Flying-fox and marginal foraging habitat for the Yellow-bellied Sheathtail-bat.</p>
<p>(c) describe, with reference to relevant literature and other reliable published sources of</p>	<p>These non-native foraging species are in relatively low abundance within the development site and most species would provide only</p>

BAM Criteria	Assessment
<p>information, the importance within the bioregion of the habitat to these species or ecological communities</p>	<p>small amounts of secondary foraging habitat. The native species <i>Lophostemon confertus</i> (Brush Box), <i>Angophora costata</i> (Smooth-barked Apple) and <i>Callistemon</i> sp. would more likely be utilised for foraging resources by Grey-headed Flying-fox.</p> <p><i>Syagrus romanzoffiana</i> is known to cause injury and death to flying-foxes due to toxicity of the green fruits and bats becoming entangled in the flower sheaths and frond leaves which can cause death, injury and distress. The removal of this species would be beneficial to the species.</p>
<p>(d) predict the consequences of the impacts for the local and bioregional persistence of the suite of threatened species and communities likely to use these areas as habitat, with reference to relevant literature and other published sources of information.</p>	<p>The consequences of the permanent removal of those species listed above for the local and bioregional persistence of the Grey-headed Flying-fox is predicted to be negligible.</p> <p>Several of the non-native species to be removed (<i>Syagrus romanzoffiana</i>, <i>Ligustrum sinense</i>, <i>Ligustrum lucidum</i>) are listed as environmental weeds in the Greater Sydney Regional Strategic Weed Management Plan (2017-2022). There is an abundance of similar habitat within the locality and bioregion, and an abundance of higher quality habitat in the locality and bioregion.</p>
<p>9.2.1.5 The assessment of the impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range must:</p>	
<p>(a) identify the area/s of connectivity joining different areas of habitat that intersect with the subject land and the areas of habitat that are connected according to Paragraph 4.2.1.3</p>	<p>East from the development site, habitat is very similar, consisting of street trees and garden vegetation until the coast. No large areas of foraging habitat are present. Larger areas of suitable habitat in the locality are present in Centennial Park (approximately 1.4 km north), Australia Golf Course (approximately 1.7 km west) and Eastlakes Golf Course (approximately 1.6 km south-west). On a local scale these areas are likely to provide more suitable and abundant foraging resources for the Grey-headed Flying-fox and Yellow-bellied Sheathtail-bat.</p>
<p>(b) identify the species and ecological communities likely to benefit from the connectivity</p>	<p>The species most likely to utilise the connectivity would be Grey-headed Flying-fox. Marginal habitat also exists for Yellow-bellied Sheathtail-bat.</p>
<p>(c) describe the nature, extent and duration of short and long-term impacts</p>	<p>The proposed development will result in the permanent removal of 0.55 ha of potential connecting habitat which provides potential foraging resources for Grey-headed Flying-fox.</p>
<p>(d) describe, with reference to relevant literature and other reliable published sources of information, the importance of the area of connectivity within the bioregion</p>	<p>The connectivity is considered limited except for highly mobile species which easily move across disturbed landscapes. The connecting habitat provides potential foraging habitat for the above listed species, which is part of a fragmented network of urban vegetation within the eastern suburbs. Within the Sydney Basin Bioregion, 0.55 ha of street trees and garden vegetation is considered to provide negligible connectivity on a landscape scale. The removal of connecting habitat would not prevent the highly mobile Grey-headed Flying-fox or microchiropteran bat from moving across the landscape in search of foraging resources.</p> <p>The removal of 0.55 ha of connecting habitat from the development site is unlikely to be of importance to any threatened species within the bioregion considering the limited level of connectivity and that there is no direct connection to any large areas of foraging habitat.</p>

BAM Criteria	Assessment
<p>(e) predict the consequences of the impacts for the bioregional persistence of the suite of threatened species and communities currently benefitting from the connectivity with reference to relevant literature and other published sources of information and taking into consideration mobility, abundance, range and other relevant life history factors.</p>	<p>The habitat to be removed forms part of a network of street trees within the local landscape, however, it does not provide any direct connectivity to larger areas of foraging habitat. Threatened species likely to use the habitat would be highly mobile such as Grey-headed Flying-fox and Yellow-bellied Sheathtail-bat. Considering the ability of these species to fly large distances, the removal of a small amount of connecting habitat providing potential foraging habitat would be unlikely to impact the persistence of these species within the bioregion.</p>

2.2.5 Mitigating and managing impacts

Measures proposed to minimise impacts at the development site before, during and after construction are outlined in Table 20.

Table 20: Measures proposed to minimise impacts

Measure	Risk before mitigation	Risk after mitigation	Action	Outcome	Timing	Responsibility
Protection of resident fauna	Minor	Negligible	Following field assessment of habitat values, no trees within the development site contained suitable hollows or nests for fauna habitation. As such, trees should be removed in accordance with best practise methods. In the event that fauna are injured during tree removal works a qualified ecologist/licensed wildlife handler should be contacted.	Relocation of fauna in a sensitive manner	Prior to and during clearing works	Project Manager
Clearing protocols that identify vegetation to be retained, prevent inadvertent damage and reduce soil disturbance	Moderate	Minor	Install tree protection fencing around trees proposed for retention.	Trees to be retained not disturbed/impacted	Tree protection fencing to be set up prior to any works occurring on site and to remain throughout duration of construction works	Project Manager
Sediment barriers or sedimentation ponds to control the quality of water released from the site into the receiving environment	Minor	Negligible	Appropriate controls will be utilised to manage exposed soil surfaces and stockpiles to prevent sediment discharge into waterways.	Erosion and sedimentation will be controlled	For the duration of construction works	Project Manager
Noise barriers or daily/seasonal timing of construction and operational activities to reduce impacts of noise	Minor	Negligible	Considering the highly urbanised nature of the development site, the project is unlikely to result in impacts on wildlife resulting from noise Daily timing of construction activities is recommended in accordance with Table 1 of Interim Noise Guidelines (2009)	Noise impacts associated with the development will be managed in accordance with guidelines	For the duration of construction works	Project Manager
Adaptive dust monitoring programs to control air quality	Minor	Negligible	Dust suppression measures will be implemented during construction works to limit dust on site Commence revegetation as soon as practicable to minimise areas likely to create dust	Mitigate dust created during construction activities	For the duration of construction works	Project Manager

Measure	Risk before mitigation	Risk after mitigation	Action	Outcome	Timing	Responsibility
Hygiene protocols to prevent the spread of weeds or pathogens between infected areas and uninfected areas	Moderate	Minor	Priority weeds present within the development site listed under the NSW <i>Biosecurity Act 2015</i> for the Greater Sydney Region will be removed. Weeds present include: <ol style="list-style-type: none"> 1. <i>Olea europaea</i> subsp. <i>cuspidata</i> (African Olive) 2. <i>Asparagus aethiopicus</i> (Ground Asparagus) 3. <i>Asparagus plumosus</i> (Climbing Asparagus Fern) 	Prevent spread of weeds or pathogens	For the duration of construction works	Project Manager
Use of indigenous species from locally occurring plant community for landscape plantings in the development site	Minor	Negligible	No remnant native vegetation is present within the site that would be suitable for restoration and rehabilitation. Native vegetation present on site consists of street trees and garden plantings and is in general not representative of an indigenous PCT. It is recommended that landscape plantings be undertaken as part of the development using a minimum 50% locality derived native species in accordance with Randwick DCP (Part B4 Clause 3.2) increasing the presence of locally indigenous species.	Areas within the development site will be landscaped using appropriate species	Throughout construction and following completion of construction activities	Project Manager

2.2.6 Serious and Irreversible Impacts (SAII)

The development site does not contain any Serious and Irreversible Impact (SAII) candidate entities.

2.3 Risk Assessment

A risk assessment has been undertaken for any residual impacts likely to remain after the mitigation measures (Table 20) have been applied. Likelihood criteria, consequence criteria and the risk matrix are provided in **Table 21**, **Table 22** and **Table 23** respectively and the risk assessment outcome is presented in **Table 24**.

Table 21: Likelihood criteria

Likelihood criteria	Description
Almost certain (Common)	Will occur, or is of a continuous nature, or the likelihood is unknown. There is likely to be an event at least once a year or greater (up to ten times per year). It often occurs in similar environments. The event is expected to occur in most circumstances.
Likely (Has occurred in recent history)	There is likely to be an event on average every one to five years. Likely to have been a similar incident occurring in similar environments. The event will probably occur in most circumstances.
Possible (Could happen, has occurred in the past, but not common)	The event could occur. There is likely to be an event on average every five to twenty years.
Unlikely (Not likely or uncommon)	The event could occur but is not expected. A rare occurrence (once per one hundred years).
Remote (Rare or practically impossible)	The event may occur only in exceptional circumstances. Very rare occurrence (once per one thousand years). Unlikely that it has occurred elsewhere; and, if it has occurred, it is regarded as unique.

Table 22: Consequence criteria

Consequence category	Description
Critical (Severe, widespread long-term effect)	Destruction of sensitive environmental features. Severe impact on ecosystem. Impacts are irreversible and/or widespread. Regulatory and high-level government intervention/action. Community outrage expected. Prosecution likely.
Major (Wider spread, moderate to long term effect)	Long-term impact of regional significance on sensitive environmental features (e.g. wetlands). Likely to result in regulatory intervention/action. Environmental harm either temporary or permanent, requiring immediate attention. Community outrage possible. Prosecution possible.
Moderate (Localised, short-term to moderate effect)	Short term impact on sensitive environmental features. Triggers regulatory investigation. Significant changes that may be rehabilitated with difficulty. Repeated public concern.
Minor (Localised short-term effect)	Impact on fauna, flora and/or habitat but no negative effects on ecosystem. Easily rehabilitated. Requires immediate regulator notification.
Negligible (Minimal impact or no lasting effect)	Negligible impact on fauna/flora, habitat, aquatic ecosystem or water resources. Impacts are local, temporary and reversible. Incident reporting according to routine protocols.

Table 23: Risk matrix

Consequence	Likelihood				
	Almost certain	Likely	Possible	Unlikely	Remote
Critical	Very High	Very High	High	High	Medium
Major	Very High	High	High	Medium	Medium
Moderate	High	Medium	Medium	Medium	Low
Minor	Medium	Medium	Low	Low	Very Low
Negligible	Medium	Low	Low	Very Low	Very Low

Table 24: Risk assessment

Potential impact	Project phase	Risk (pre-mitigation)	Risk (post mitigation)
sedimentation and contaminated and/or nutrient rich run-off	Construction	Medium	Very Low
inadvertent impacts on adjacent habitat or vegetation	Construction	Low	Very Low
transport of weeds and pathogens from the site to adjacent vegetation	Construction	Low	Very Low
trampling of threatened flora species	N/A	N/A	N/A
bush rock removal and disturbance	N/A	N/A	N/A
increase in predatory species populations	Construction and operational	Very Low	Very Low
increase in pest animal populations	Construction and operational	Very Low	Very Low

2.4 Adaptive management strategy

This section is required for those impacts that are infrequent, cumulative or difficult to predict. Impacts associated with the proposed development have been considered and addressed **Section 2.2.5** and no further impacts are required to be addressed.

2.5 Impact Summary

2.5.1 Serious and Irreversible Impacts (SAIL)

As discussed in Section 2.2.6, no candidate entities for SAIL are present in the development site or likely to be impacted by the development. Therefore, it is unlikely that the development would result in an SAIL.

2.5.2 Impacts requiring offsets

The development will not result in impacts requiring offset. The vegetation integrity score for PCT 1793 (12.8) is lower than the threshold required for offsetting in accordance with Section 3.1.1.3 of the BAM.

2.5.3 Impacts not requiring offset

The development will result in the removal of 0.55 ha of PCT 1793 which does not require offsetting as the vegetation integrity score is lower than the threshold required to offset native vegetation and threatened species habitat in accordance with Section 3.1.1.3 of the BAM.

2.5.4 Areas not requiring assessment

Areas not requiring assessment comprises buildings and urban surfaces. There are no biodiversity values present that do not require assessment.

2.5.5 Credit summary

A summary of the credit report generated by the BAMC is outlined in **Table 25**. Native vegetation is below the vegetation integrity score threshold and does not require offsetting. No candidate species credit species or likely habitat was recorded within the development site; hence no species credits are required to offset the development. A full biodiversity credit report is included in **Appendix D**.

Table 25: Ecosystem credits required

PCT ID	PCT Name	Vegetation Formation	Direct impact (ha)	Credits required
1793	<i>Smooth-barked Apple - Bangalay / Tuckeroo - Cheese Tree open forest on coastal sands of the Sydney basin</i>	Dry Sclerophyll Forests (Shrubby sub-formation)	0.55	0



Figure 5: Areas not requiring offset

3. References

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Appendix A: Definitions

Terminology	Definition
Biodiversity credit report	The report produced by the Credit Calculator that sets out the number and class of biodiversity credits required to offset the remaining adverse impacts on biodiversity values at a development site, or on land to be biodiversity certified, or that sets out the number and class of biodiversity credits that are created at a biodiversity stewardship site.
BioNet Atlas	The BioNet Atlas (formerly known as the NSW Wildlife Atlas) is the OEH database of flora and fauna records. The Atlas contains records of plants, mammals, birds, reptiles, amphibians, some fungi, some invertebrates (such as insects and snails) and some fish
Broad condition state:	Areas of the same PCT that are in relatively homogenous condition. Broad condition is used for stratifying areas of the same PCT into a vegetation zone for the purpose of determining the vegetation integrity score.
Connectivity	The measure of the degree to which an area(s) of native vegetation is linked with other areas of vegetation.
Credit Calculator	The computer program that provides decision support to assessors and proponents by applying the BAM, and which calculates the number and class of biodiversity credits required to offset the impacts of a development or created at a biodiversity stewardship site.
Development	Has the same meaning as development at section 4 of the EP&A Act, or an activity in Part 5 of the EP&A Act. It also includes development as defined in section 115T of the EP&A Act.
Development footprint	The area of land that is directly impacted on by a proposed development, including access roads, and areas used to store construction materials.
Development site	An area of land that is subject to a proposed development that is under the EP&A Act.
Ecosystem credits	A measurement of the value of EECs, CEECs and threatened species habitat for species that can be reliably predicted to occur with a PCT. Ecosystem credits measure the loss in biodiversity values at a development site and the gain in biodiversity values at a biodiversity stewardship site.
High threat exotic plant cover	Plant cover composed of vascular plants not native to Australia that if not controlled will invade and outcompete native plant species.
Hollow bearing tree	A living or dead tree that has at least one hollow. A tree is considered to contain a hollow if: (a) the entrance can be seen; (b) the minimum entrance width is at least 5 cm; (c) the hollow appears to have depth (i.e. you cannot see solid wood beyond the entrance); (d) the hollow is at least 1 m above the ground. Trees must be examined from all angles.
Important wetland	A wetland that is listed in the Directory of Important Wetlands of Australia (DIWA) and SEPP 14 Coastal Wetlands
Local population	The population that occurs in the study area. In cases where multiple populations occur in the study area or a population occupies part of the study area, impacts on each subpopulation must be assessed separately.
Local wetland	Any wetland that is not identified as an important wetland (refer to definition of Important wetland).
Mitchell landscape	Landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1:250,000.
Multiple fragmentation impact development	Developments such as wind farms and coal seam gas extraction that require multiple extraction points (wells) or turbines and a network of associated development including roads, tracks, gathering systems/flow lines, transmission lines
Operational Manual	The Operational Manual published from time to time by OEH, which is a guide to assist assessors when using the BAM
Patch size	An area of intact native vegetation that: a) occurs on the development site or biodiversity stewardship site, and b) includes native vegetation that has a gap of less than 100 m from the next

Terminology	Definition
	area of native vegetation (or ≤ 30 m for non-woody ecosystems). Patch size may extend onto adjoining land that is not part of the development site or stewardship site.
Proponent	A person who intends to apply for consent to carry out development or for approval for an activity.
Reference sites	The relatively unmodified sites that are assessed to obtain local benchmark information when benchmarks in the Vegetation Benchmarks Database are too broad or otherwise incorrect for the PCT and/or local situation. Benchmarks can also be obtained from published sources.
Regeneration	The proportion of over-storey species characteristic of the PCT that are naturally regenerating and have a diameter at breast height < 5 cm within a vegetation zone.
Remaining impact	An impact on biodiversity values after all reasonable measures have been taken to avoid and minimise the impacts of development. Under the BAM, an offset requirement is calculated for the remaining impacts on biodiversity values.
Retirement of credits	The purchase and retirement of biodiversity credits from an already-established biobank site or a biodiversity stewardship site secured by a biodiversity stewardship agreement.
Riparian buffer	Riparian buffers applied to water bodies in accordance with the BAM
Sensitive biodiversity values land map	Development within an area identified on the map requires assessment using the BAM.
Site attributes	The matters assessed to determine vegetation integrity. They include: native plant species richness, native over-storey cover, native mid-storey cover, native ground cover (grasses), native ground cover (shrubs), native ground cover (other), exotic plant cover (as a percentage of total ground and mid-storey cover), number of trees with hollows, proportion of over-storey species occurring as regeneration, and total length of fallen logs.
Site-based development	a development other than a linear shaped development, or a multiple fragmentation impact development
Species credits	The class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. Species that require species credits are listed in the Threatened Biodiversity Data Collection.
Subject land	Is land to which the BAM is applied in Stage 1 to assess the biodiversity values of the land. It includes land that may be a development site, clearing site, proposed for biodiversity certification or land that is proposed for a biodiversity stewardship agreement.
Threatened Biodiversity Data Collection	Part of the BioNet database, published by OEH and accessible from the BioNet website.
Threatened species	Critically Endangered, Endangered or Vulnerable threatened species as defined by Schedule 1 of the BC Act, or any additional threatened species listed under Part 13 of the EPBC Act as Critically Endangered, Endangered or Vulnerable.
Vegetation Benchmarks Database	A database of benchmarks for vegetation classes and some PCTs. The Vegetation Benchmarks Database is published by OEH and is part of the BioNet Vegetation Classification.
Vegetation zone	A relatively homogenous area of native vegetation on a development site, land to be biodiversity certified or a biodiversity stewardship site that is the same PCT and broad condition state.
Wetland	An area of land that is wet by surface water or ground water, or both, for long enough periods that the plants and animals in it are adapted to, and depend on, moist conditions for at least part of their life cycle. Wetlands may exhibit wet and dry phases and may be wet permanently, cyclically or intermittently with fresh, brackish or saline water
Woody native vegetation	Native vegetation that contains an over-storey and/or mid-storey that predominantly consists of trees and/or shrubs

Appendix B: Vegetation plot data

Table 26: Species matrix (species recorded by plot)

Stratum	Form	Species name	Common name	Exotic	High Threat Weed	Plot 1		Plot2		Plot 3	
						Cover (%)	Abundance	Cover (%)	Abundance	Cover (%)	Abundance
G		<i>Acer spp.</i>		*	0			0.1	2		
G		<i>Agapanthus spp.</i>	African Lily	*	0	2	20				
M	Other (OG)	<i>Archontophoenix cunninghamiana</i>	Bangalow Palm		0	0.1	1				
G		<i>Asparagus aethiopicus</i>	Ground Asparagus	*	1	0.2	2				
G		<i>Asparagus plumosus</i>	Climbing Asparagus Fern	*	1			0.1	2		
M		<i>Bauhinia spp.</i>		*	0	2	5				
G		<i>Buxus spp.</i>		*	0	2	20				
M	Shrub (SG)	<i>Callistemon rigidus</i>	Stiff Bottlebrush		0	0.2	1	3	1		
M		<i>Camellia spp.</i>		*	0			1	1		
M		<i>Cestrum parqui</i>	Green Cestrum	*	1			0.1	1		
G		<i>Chamaedorea spp.</i>		*	0			0.2	1		
G		<i>Chlorophytum comosum</i>	Spider Plant	*	1			0.3	10	1	10
G		<i>Conyza bonariensis</i>	Flaxleaf Fleabane	*	0	0.1	5	0.2	10	0.1	5
U	Tree (TG)	<i>Corymbia maculata</i>	Spotted Gum		0	20	1				
G		<i>Cotoneaster glaucophyllus</i>	Glaucous Cotonoeaster	*	0	0.2	2				
G		<i>Crassula spp.</i>		*	0	5	50				

Stratum	Form	Species name	Common name	Exotic	High Threat Weed	Plot 1	Plot 2	Plot 3			
M		<i>Cupressus spp.</i>		*	0	0.5	2				
G	Grass & grasslike (GG)	<i>Cyperus gracilis</i>	Slender Flat Sedge		0		0.1	2			
G	Other (OG)	<i>Doryanthes excelsa</i>	Gynea Lily		0	0.2	2				
G		<i>Ehrharta erecta</i>	Panic Veldt Grass	*	1	15	100	15	100	0.5	20
G		<i>Epipremnum spp.</i>		*	0	0.1	1	0.2	10		
U	Tree (TG)	<i>Eucalyptus punctata</i>			0	5	1				
G	Tree (TG)	<i>Ficus macrophylla</i>			0			0.3	2		
G		<i>Hypochoeris radicata</i>		*	0	0.1	5			0.2	5
G		<i>Jacaranda mimosifolia</i>	Jacaranda	*	0	0.1	2				
M	Shrub (SG)	<i>Leptospermum spp.</i>			0	0.2	1				
G		<i>Ligustrum lucidum</i>	Large-leaved Privet	*	1			0.3	1		
G		<i>Ligustrum sinense</i>	Small-leaved Privet	*	1	0.1	1				
G		<i>Lilium spp.</i>		*	0			0.1	1		
U	Other (OG)	<i>Livistona australis</i>			0			2	2		
G		<i>Lonicera japonica</i>		*	1	0.3	5	0.2	2		
U	Tree (TG)	<i>Lophostemon confertus</i>			0					25	2
G		<i>Monstera deliciosa</i>		*	0	15	1	2	1		

Stratum	Form	Species name	Common name	Exotic	High Threat Weed	Plot 1	Plot2	Plot 3			
M		<i>Nandina spp.</i>		*	0		0.3	1			
G	Fern (EG)	<i>Nephrolepis cordifolia</i>			0		1	50	2	100	
G		<i>Ochna serrulata</i>		*	1	0.1	10				
G		<i>Parietaria judaica</i>		*	0			0.2	5		
G		<i>Pennisetum clandestinum</i>		*	1			2	50		
M		<i>Pinus spp.</i>		*	0	10	1				
G		<i>Plantago lanceolata</i>		*	0			0.1	3		
G		<i>Salvia spp.</i>		*	0	0.3	20				
M		<i>Schefflera spp.</i>		*	0		0.2	1			
G		<i>Sedum praealtum</i>		*	0	0.2	5	0.1	2	0.1	1
G		<i>Stellaria media</i>		*	0			0.1	10		
G		<i>Stenotaphrum secundatum</i>		*	1	10	100	3	20		
U		<i>Syagrus spp.</i>		*	0		10	3			
U	Shrub (SG)	<i>Syzygium spp.</i>			0	1	1	40	1		
G		<i>Tradescantia fluminensis</i>		*	1		1	10			
G	Shrub (SG)	<i>Trema tomentosa var. aspera</i>			0	0.1	1				
G		<i>Trifolium repens</i>		*	0	0.1	2				
M		<i>Yucca spp.</i>		*	0		3	1			

Tree (TG), Shrub (SG), Grass & Grasslike (GG), Forb (FG), Fern (EG), Other (OG)

Table 27: Vegetation integrity data (Composition, Structure and function)

Plot location data						
Plot no.	PCT	Condition	Eastings	Northings	Bearing (°)	
1	1793	Poor	337068	6245456	10	
2	1793	Poor	336995	6245515	190	
3	1793	Poor	336955	6245497	180	

Composition (number of species)						
Plot no.	Tree	Shrub	Grass	Forb	Fern	Other
1	2	4	0	0	0	2
2	1	2	1	0	1	1
3	1	0	0	0	1	0

Structure (Total cover)						
Plot no.	Tree	Shrub	Grass	Forb	Fern	Other
1	25	1.5	0	0	0	0.3
2	0.3	43	0.1	0	1	2
3	25	0	0	0	2	0

Function											
Plot no.	Large Trees	Hollow trees	Litter Cover	Length Fallen Logs	Tree Stem 5-9	Tree Stem 10-19	Tree Stem 20-29	Tree Stem 30-49	Tree Stem 50-79	Tree Regen	High Threat Weed Cover
1	1	0	27	0		1		1	1	0	26
2	1	0	25.4	0			1		1	0	17
3	1	0	1	0				1	1	0	7

Appendix C: Plot photos



Plate 1: Plot 1 transect start



Plate 2: Plot 1 transect end



Plate 3: Plot 2 transect start



Plate 4: Plot 2 transect end



Plate 5: Plot 3 transect start



Plate 6: Plot 3 transect end

Appendix D: Biodiversity credit report



BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00011841/BAAS18077/18/00011842	8609_RandwickCampus_SSD	24/02/2018
Assessor Name	Report Created	BAM Data version *
Nicole Helen McVicar	13/08/2018	3
Assessor Number	* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.	
BAAS18077		

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

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Candidate SAI	Ecosystem credits
Smooth-barked Apple - Bangalay / Tuckeroo - Cheese Tree open forest on coastal sands of the Sydney basin								
1	1793_Planted	12.8	0.6	0.25	High Sensitivity to Potential Gain	1.50		0
							Subtotal	0
							Total	0



BAM Credit Summary Report

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Candidate SAI	Species credits
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