John Fisher Park Telecommunications Facility - Flora and Fauna Assessment and Biodiversity Management Plan

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Abbreviations

Abbreviation	Description
BC Act	*Biodiversity Conservation Act 2016*
BC Regulation	*Biodiversity Conservation Regulation 2017*
BAM	Biodiversity Assessment Methodology
BDAR	Biodiversity Development Assessment Report
BMP	Biodiversity Management Plan
BOS	Biodiversity Offset Scheme
BV Map	Biodiversity Values Map
CAA	Controlled Activity Approval
CM Act	*Coastal Management Act 2016*

Abbreviation	Description
DA	Development Application
DotEE	Department of the Environment and Energy
ELA	Eco Logical Australia Pty Ltd
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
FFA	Flora and Fauna Assessment
HBT	Hollow bearing tree
LGA	Local Government Area
MNES	Matters of National Environmental Significance
NRAR	National Resources Access Regulator
OEH	Office of Environment and Heritage
PCT	Plant Community Type
SAII	Serious and Irreversible Impacts
SEPP	State Environmental Planning Policy
SMCMA	Sydney Metropolitan Catchment Management Authority
TEC	Threatened Ecological Community
WDCP	Warringah Development Control Plan
WLEP	Warringah Local Environmental Plan

1. Introduction

Eco Logical Australia Pty Ltd (ELA) was engaged by Urbis to prepare a Flora and Fauna Assessment (FFA) to form part of a Development Application (DA) for the development of a telecommunications facility in John Fisher Park, Curl Curl. Urbis propose to submit a DA to Northern Beaches Council on behalf of Optus, under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The telecommunications facility is proposed to be constructed on Lot 7356 DP1167221.

This report outlines the methods undertaken to assess ecological values present within the study area, and results of the site inspection. It assesses the impacts of the proposed works on ecological values within the study area. This report has been prepared in accordance with the Northern Beaches Council (Warringah) document *Flora and Fauna Assessment Guidelines* and relevant State and Commonwealth legislation.

1.1 Study area

The study area is located within John Fisher Park, Lot 7356 DP1167221, on Abbott Road, North Curl Curl (Figure 1). The land is zoned as RE1 Public Recreation Zone in the *Warringah Council Local Environmental Plan 2011* (WLEP). The study area is mapped as containing the following ecological constraints in the *Warringah Council Development Control Plan 2011* (WDCP):

- Native Vegetation (Figure 2)
- Threatened and High Conservation Habitat (Figure 3)
- Wildlife Corridor (Figure 4)
- Waterways and Riparian Lands (Figure 5).

Estuarine Swamp Oak Forest and Estuarine Reedland have been mapped by OEH within the study area (Figure 1). Both of these vegetation communities are part of the Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions community, an Endangered Ecological Community under the *Biodiversity and Conservation Act 2016* (BC Act) and listed as Endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The construction of the telecommunications facility is proposed to take place in a historically disturbed area. The study area is adjacent to mown grass sports fields and was an area that was previously a Council landfill site.

1.2 Scope of works

The DA will involve the following works:

- Construction of an Optus base station (including construction of an equipment shelter), a 25 m monopole (that will replace the existing light pole within the study area), power supply, feeder cable, fencing and access gate.
- Planting of screening vegetation around the base station.
- Replacement of any removed or damaged tubestock located adjacent to the study area.

1.3 Key definitions

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

- Proposed works –the proposed telecommunications facility and associated infrastructure.
- Subject site - the area directly affected by the proposal as per the definitions in the Threatened Species Assessment Guidelines (DECC 2007).
- Study area – this includes the subject site and any additional areas which are likely to be affected by the proposal (directly or indirectly) (as per DECC 2007 definitions).

Figure 1: Study area and OEH mapped vegetation

Figure 2 Warringah DCP Native Vegetation map layer

Figure 3 Warringah DCP mapped Threatened and High Conservation Habitat

Figure 4 Warringah DCP Wildlife Corridor map layer

Figure 5 Warringah DCP Waterways and Riparian Land map layer

2. Legislative context

Table1: Legislative context

Name	Relevance to the project	Report Section
Commonwealth		
Environment Protection and Biodiversity Conservation Act 1999 **(EPBC Act)**	Matters of National Environmental Significance (MNES) have been identified on or near the development site. This report assesses impacts to MNES and concludes that the development is not likely to have a significant impact on MNES.	Section 5.6
State		
Environmental Planning and Assessment Act 1979 **(EP&A Act).**	The proposed development requires development consent under Part 4 of the EP&A Act.	Section 5
Biodiversity Conservation Act 2016 **(BC Act)**	The BC Act outlines the assessment requirements to determine whether proposed development (Part 4 of the EP&A Act) or activity (Part 5 of the EP&A Act) is likely to significantly affect threatened species or ecological communities, or their habitats under section 7.3, and whether the Biodiversity Offsets Scheme (BOS) will be triggered. Works that exceed the BOS thresholds as set out in Part 7 of the Act and Part 7 of the *Biodiversity Conservation Regulation 2017* (BC Regulation), are required to undertake the ecological assessment in accordance with the Biodiversity Assessment Method (BAM), including the preparation of a Biodiversity Development Assessment Report (BDAR). The proposed development does not exceed the BAM threshold, is not mapped on the Biodiversity Values Map (see below) and is unlikely to result in a significant impact to threatened species. Therefore, the BOS is not triggered and a BDAR is not required.	Section 5.5
Biodiversity Conservation Regulation 2017 **(BC Regulation)**	The Biodiversity Values Map (BV Map) identifies land with high biodiversity value, as defined by the BC Regulation. The study area does not contain land identified on the BV Map (accessed 21 June 2019).	Section 4.1.5
Biosecurity Act 2016	Under the *Biosecurity Act 2015*, Priority weeds have been identified for local government areas and assigned strategies to contain, remove or manage. Occupiers of land (this includes owners of land) have responsibility for taking appropriate action for priority weeds on the land they occupy. The site contains weeds listed under the *Biosecurity Act 2015*.	Section 4.2.3
Fisheries Management Act 1994 **(FM Act)**	The FM Act is the principal piece of legislation protecting aquatic habitat in NSW. The Act aims to conserve fish stocks, key fish habitat, aquatic vegetation, and threatened species, populations and communities. Threatened aquatic species, populations and communities are listed under Schedules 4, 4A and 5 of the FM Act, while key threatening processes are listed under Schedule 6. Curl Curl Lagoon is mapped as Key Fish Habitat by DPI Fisheries. The proposed development would not involve works within the waterway, harm to marine vegetation, obstruction of fish passage or involve dredging and/or reclamation of the creek bank, therefore there is no requirement for a Permit under Part 7 of the FM Act to be obtained as part of these works.	N/A

Name	Relevance to the project	Report Section
Water Management Act 2000 **(WM Act)**	The proposed development is located within waterfront land (defined as being located within 40 m of the top of bank of a creek, river or estuary) and therefore will require a Controlled Activity Approval (CAA) under s91 of the WM Act from the Natural Resources Access Regulator (NRAR). A separate Waterways Impact Statement has been prepared for the proposed works.	Section 4.2.6
Planning Instruments		
State Environmental Planning Policy **(SEPP) (Coastal Management) 2018**	The *State Environmental Planning Policy (Coastal Management) 2018* (Coastal Management SEPP) gives effect to the objectives of the *Coastal Management Act 2016* (CM Act) from a land use planning perspective, by defining the four coastal management areas listed in the CM Act and specifying the assessment criteria that are tailored for each coastal management area. Part 2 of the CM Act identifies objectives related to four coastal management areas of the 'coastal zone': • Coastal wetlands and littoral rainforests area; • Coastal vulnerability area; • Coastal environment area; and • Coastal use area. The proposed development is located on land mapped as Coastal Environment Area and Coastal Use Area.	Section 4.1.6
SEPP 44 – Koala Habitat Protection	The proposed development is located within the Northern Beaches Council LGA, which is made up of the former Pittwater, Warringah and Manly LGAs. The former Pittwater LGA is a local government area to which SEPP 44 applies, but it does not apply to the former Warringah LGA, where the proposed development is located.	N/A
Warringah Local Environmental Plan 2011	The subject site is zoned 'RE1 – Public Recreation' under the Warringah LEP. The objectives of the zone are: • To enable land to be used for public open space or recreational purposes. • To provide a range of recreational settings and activities and compatible land uses. • To protect and enhance the natural environment for recreational purposes. • To protect, manage and restore public land that is of ecological, scientific, cultural or aesthetic value. • To prevent development that could destroy, damage or otherwise have an adverse effect on those values.	Section 5.7
Warringah Development Control Plan 2011	A number of controls under the Warringah DCP apply to the subject site. The site is mapped as Waterways and Riparian Lands. The requirements of this control are as follows: • The applicant shall submit a Waterways Impact Statement. • Developments shall comply with the requirements of Council's Protection of Waterway and Riparian Land Policy and Water Management Policy. • Infrastructure such as roads, drainage, stormwater structures, services, etc. should be located outside land identified as Waterways and Riparian Land.	Section 5.8

Name	Relevance to the project	Report Section
	• The Asset Protection Zone must not extend into land identified as Waterways and Riparian Land. Refer to NSW Rural Fire Service for site assessment methodology. The site is mapped as 'Threatened Species and High Conservation Habitat'. The requirements of this zone are as follows: • The applicant must demonstrate that the objectives have been achieved through a Flora and Fauna Assessment prepared in accordance with Council guidelines • The applicant must demonstrate that the objectives have been achieved through a Biodiversity Management Plan prepared in accordance with Council guidelines that will protect, manage and where appropriate promote the recovery of threatened species, populations and ecological communities and areas of high conservation habitat on the subject property. The site is mapped as within a 'Wildlife Corridor'. The requirements of this zone are as follows: • For modification of native vegetation where the area of land supporting the vegetation to be modified is greater than 50 m^2 or the land supporting the vegetation to be modified forms part of an allotment where vegetation has been modified in the last five years: o The applicant must demonstrate that the objectives have been achieved through a Flora and Fauna Assessment prepared in accordance with Council guidelines. o The applicant must demonstrate that the objectives have been achieved through a Biodiversity Management Plan prepared in accordance with Council guidelines that will protect, manage and enhance wildlife corridors, and where appropriate reconstruct wildlife corridor areas on the subject property. • For modification of native vegetation in all other cases, the applicant must demonstrate that the objectives have been achieved. The site is mapped as within the 'Native Vegetation' layer. The requirements of this control are as follows: • For modification of native vegetation where the area of land supporting the vegetation to be modified is greater than 100 m^2 or the land supporting the vegetation to be modified forms part of an allotment where vegetation has been modified in the last five years: o The applicant must demonstrate that the objectives have been achieved through a Flora and Fauna Assessment prepared in accordance with Council guidelines. o The applicant must demonstrate that the objectives have been achieved through a Biodiversity Management Plan prepared in accordance with Council guidelines that will protect native vegetation on the subject property. • For modification of native vegetation in all other cases, the applicant must demonstrate that the objectives have been achieved.	Section 5.8 Section5.8 Section 5.8

3. Methods

3.1 Literature review and database search

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

Databases and vegetation mapping that were reviewed included:

- BioNet (Atlas of NSW Wildlife) database search (5 km) for threatened species, populations and ecological communities listed under the BC Act (OEH 2018) (Accessed 7 May 2019)
- EPBC Act Protected Matters Search Tool (5 km) for threatened and migratory species, populations and ecological communities listed under the Commonwealth *EPBC* Act (Department of the Environment and Energy (Accessed 7 May 2019)
- Fisheries NSW Spatial Portal
- Office of Environment and Heritage (OEH) 2016 vegetation mapping
- Aerial photography
- Review of relevant planning instruments, documentation, and information relating to biodiversity values and threatened habitat.

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

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

3.2 Field inspection

3.2.1 Ecology survey

The site inspection was undertaken by Claire Wheeler on 9 May 2019 over three field hours to identify the biodiversity values of the study area, including validating the extent and condition of the native vegetation communities and identifying threatened flora and fauna species and habitat for threatened fauna species within the study area. The field survey was also conducted to determine if a BDAR was required.

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

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

Table2: Weather conditions on day of field survey

Date	Min Temp (° C)	Max Temp (° C)	Max Wind (km/hr) and direction	Rainfall (mm)
9 May 2019	7	19.4	22 N	0

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

3.3 Survey limitations

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

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

The level of survey effort was considered appropriate for the size of the site and the modified nature of the habitat present. The site survey revealed that the study area is adjacent to mown grass playing fields and had recently been extensively cleared of exotic vegetation between the edge of the playing fields and the edge of the lagoon. Planting of native tubestock species had recently taken place within the study area.

Hollows within trees were detected via visual survey. Only hollows that were visible from the ground were detected. There may be other hollows present that were not visible from the ground.

4. Results

4.1 Data audit and literature review

4.1.1 Vegetation communities

The literature review found the presence of three mapped vegetation communities on the site (OEH, 2016) (Figure 1):

- Estuarine Swamp Oak Forest
- Estuarine Reedland
- Weeds and exotics.

4.1.2 Estuarine Swamp Oak Forest (PCT 1234 Swamp Oak Swamp Forest Fringing Estuaries, Sydney Basin and South East Corner)

In the zonation from mangroves to terrestrial sclerophyll and mesophyll forests and woodlands, Estuarine Swamp Oak Forest occurs immediately above the tidal influence. It fringes the margins of saline waterbodies that include rivers, lagoons and tidal lakes. *Casuarina glauca* (Swamp oak) forms dense monospecific stands above a thick ground cover of salt tolerant herbs, rushes and sedges. The shrub layer is low-growing and sparse, comprising a mix of terrestrial species while others typical of wetlands. It is a community of relatively low species diversity. Estuarine Swamp Oak Forest is widespread along the coast of the Sydney basin where it is rarely found at more than two metres above sea level (OEH, 2016).

4.1.3 Estuarine Reedland (PCT 1808: Estuarine Reedland)

Estuarine Reedland is characterised by tall dense swards of *Phragmites australis* (Common reed). It is found in environments inundated by saline or brackish water. These include low-lying swamps on riverbanks, riverflat depressions, and banks on coastal lagoons that are open to tidal influence. This community is commonly encountered on the landward side of saltmarsh flats. Several salt-tolerant species are shared with saltmarshes including *Juncus kraussii* (Sea rush), *Baumea juncea* (Bare twig-rush) and the small herb creeping *Samolus repens* (Brookweed) (OEH, 2016).

The Estuarine Swamp Oak Forest and Estuarine Reedland vegetation communities align with the *Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*, an Endangered Ecological Community under the BC Act and Endangered under the EPBC Act.

Figure 6 ELA Validated vegetation 2019

4.1.4 Threatened species

23 flora species, and 86 threatened/migratory fauna species, including marine fauna were previously recorded or have been identified as having potential to occur within 5 km of the study area (DotEE 2019, OEH 2019). Likelihood of occurrence in the study area and surrounds was assessed prior to the site inspection (Appendix A). Marine mammals listed under the EPBC Act such as *Megaptera novaeangliae* (Humpback Whale), marine turtle species such as *Chelonia mydas* (Green Turtle) and pelagic bird species listed under the EPBC Act (such as Albatrosses) were excluded from further assessment due to absence of relevant habitat.

The closest recorded threatened fauna species was *Hydroprogne caspia* (Caspian Tern) (listed as migratory species under Japan-Australia Migratory Bird Agreement) recorded in 1991 approximately 100 m south of the proposed works area. *Pteropus poliocephalus* (Grey-headed Flying-fox) (Vulnerable under the BC and EPBC Acts), was recorded in 2007 within John Fisher Park approximately 300 m from the study area. There were two records from 2007 of *Burhinus grallarius* (Bush Stone-curlew) within the riparian areas of Greendale Creek approximately 500 m west of the study area and a record of *Miniopterus schreibersii oceanensis* (Eastern Bentwing-bat) from 2007 within *Casuarina glauca* dominated vegetation on the southern side of the lagoon. The closest recorded threatened flora species was *Senecio spathulatus* (Coast Groundsel), recorded in 1916 approximately 700 m to the east of the study area. *Acacia terminalis* subsp*. terminalis* (Sunshine Wattle) was located in 2009 within bushland reserves approximately 1 km south-west of the study area.

During the literature review process and site inspection, it was determined that habitat for these particular threatened species in the study area was unlikely, especially due to recent vegetation clearing and that impact to their habitat within the study area was also unlikely, due to the minimal amount of tubestock vegetation to be removed. These tubestock species had only recently been planted and not yet developed into a size that would form habitat for threatened fauna. Therefore, no further impact assessment was undertaken. A map showing threatened species previously recorded within John Fisher Park is shown in Figure 7.

Figure 7 Threatened Species previously located within John Fisher Park (OEH, 2019).

4.1.5 Soils and topography

The site is located on the Warriewood soil landscape. It is characterised by Holocene silty to peaty quartz sand and medium to fine marine sand with podzols. Typically, land on this soil landscape has been extensively cleared. Remaining native tree species include *Melaleuca quinquenervia* (Broadleaved paperbark), *Banksia integrifolia* (Coastal banksia), *Casuarina glauca* and *Eucalyptus robusta* (Swamp Mahogany) (Chapman and Murphy 1989). The topography of the study area and surrounding sports fields are relatively flat, being at the bottom of the Curl Curl Lagoon catchment.

4.1.6 Biodiversity Values Land Map

A search of the online Biodiversity Values map (BV Map) showed that the study site is not located in an area of high biodiversity value.

4.1.7 SEPP (Coastal Management) 2018

The site is mapped in the Coastal Environment Area and Coastal Use Area under the SEPP (Coastal Management).

The SEPP (Coastal Management) outlines development controls for development within these coastal management areas. These impact of the proposed works on these areas have been assessed in Table3 and Table4 below.

Table3 Development controls for Coastal Environment Area

13 Development on land within the coastal environment area	Sub-clause	Impact assessment
(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 proposed development will not have an impact on the integrity of the environment, as minimal planted vegetation is to be removed and the proposed works will not impact on hydrological processes due to the minimal nature of the activity.
	(b) coastal environmental values and natural coastal processes,	As the proposed development is located on the edge of Curl Curl Lagoon inland from the coast, there will be no impact to coastal processes or coastal values.
	(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	Water quality would not be impacted, and Curl Curl Lagoon is listed under 'other coastal lakes' under Schedule 1 of the SEPP Coastal Management, rather than 'sensitive coastal lakes'.
	(d) marine vegetation, native vegetation and fauna and their habitats, undeveloped headlands and rock platforms,	No marine vegetation is to be impacted as a result of the proposed works.
	(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,	A very small area of public open space will be impacted as part of the proposed works, however it is within an area where large areas of public open space are available. Access to the lagoon foreshore would not be restricted once the proposed works are completed.
	(f) Aboriginal cultural heritage, practices and places,	Aboriginal heritage has not been assessed as part of this Flora and Fauna Assessment
	(g) the use of the surf zone.	As the works are proposed to take place inland from the beach, there would be no impact on the nearby surf zone.

Table4: Development Controls for Coastal Use Area

14 Development on land within the coastal use area	**Sub-clause**	**Impact assessment**
(1) Development consent must not be granted to development on land that is within the coastal use area unless the consent authority 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,*	A very small area of public open space will be impacted as part of the proposed works, however it is within an area where large areas of public open space are available. Access to the lagoon foreshore would not be restricted once the proposed works are completed.
	(ii) overshadowing, wind funnelling and the loss of views from public places to foreshores,	Overshadowing, wind funnelling and/or visual impacts are likely to occur from the proposed telecommunications facility as the monopole that is to be constructed is going to replace the existing light pole that is within the subject site and be of very similar bulk and scale to what is already in place.
	(iii) the visual amenity and scenic qualities of the coast, including coastal headlands,	Visual amenity and scenic qualities of the coast would not be impacted due to the bulk and scale of the development being similar to what is already located on the site.
	(iv) Aboriginal cultural heritage, practices and places,	Aboriginal heritage has not been assessed as part of this Flora and Fauna Assessment.
	(v) cultural and built environment heritage	Cultural and built heritage has not been assessed as part of this Flora and Fauna Assessment.

The proposed works have been designed and sited in order to reduce impacts to any aspect of the coastal environment and coastal use area and therefore no mitigation measures are required to reduce impacts to these coastal management areas.

4.2 Field survey results

4.2.1 Vegetation communities

4.2.1.1 Study area vegetation

The field survey identified that the predominantly exotic vegetation within the study area had recently been removed and native tubestock had been recently planted (Figure 8) as part of a grant-funded revegetation program managed by Northern Beaches Council. Species planted included *Juncus usitatus, Juncus krausii* (Sea Rush)*, Leptospermum laevigatum* (Coast Tea-tree)*, Melaleuca nodosa* (Prickly-leaved Paperbark)*, Myoporum boninense* (Boobialla)*, Acacia sophorae* (Coastal Wattle)*, Baloskion tetraphyllum* (Plume Rush)*, Gahnia siebierana* (Red-fruit Saw-sedge)*, Correa alba* (White Correa)*, Melaleuca hypericifolia* (Hillock Bush)*, Westringia fruticosa* (Coastal Rosemary), *Lomandra longifolia, Dianella caerulea* (Blue Flax Lily)*, Eucalyptus robusta* (Swamp Mahogany) and *Banksia integrifolia* (Coast Banksia).

While it was evident that exotic species had been treated and removed from the subject site, there were some species that were regrowing or had been missed as part of preparing the site for rehabilitation activities, including *Erythrina* sp. (Coral Tree) (Figure 9), *Ipomoea cairica* (Coastal Morning Glory), *Parietaria judaica* (Asthma Weed) and *Lantana camara.*

The area where the proposed works are to be located is directly adjacent to this recently-cleared and revegetated area (Figure 10 and Figure 11). Areas where the WDCP mapping identified Threatened and High Conservation Habitat (Figure 3) has only a single *Banksia integrifolia* and recently planted tubestock (Figure 12) which are not yet mature enough to provide habitat for fauna species.

The area where native tubestock had been planted was bordered on the western side of the study area by large thickets of *Lantana camara* and *Cestrum parqui* (Green cestrum) (Figure 13) and on the eastern side by native species that were likely planted within the last five years, including *Casuarina glauca* (Swamp Oak), *Lomandra longifolia* and *Commelina cyanea.* Along the fringe of Curl Curl Lagoon some small clumps of *Phragmites australis* were observed growing within the water. Herbaceous exotic grasses between the edge of the playing fields and the revegetation area had recently been sprayed to create a buffer between the mown grass area and native plant revegetation.

Despite the disturbed nature and extensive recent revegetation within the subject site, it is considered likely that the vegetation community is revegetated Estuarine Swamp Oak Forest, which aligns with Swamp Oak Floodplain Forest Endangered Ecological Community, listed under the BC and EPBC Acts.

Figure 8 Recently planted vegetation, looking west

Figure 9 Resprouting Coral Tree

Figure 10 Location of proposed works, looking west

Figure 11 View towards proposed works area, looking west

Figure 12 Area where Threatened and High Conservation Habitat is mapped in WDCP

Figure 13 Vegetation adjacent to study area, looking west

4.2.2 Flora species

A total of 38 flora species were identified within the study area (Appendix B). There were no threatened flora species recorded within the study area.

4.2.3 Priority weeds

The Greater Sydney Regional Strategic Weed Management Plan 2017-2022 (LLS, 2017) identifies weeds to be managed to improve the region's biosecurity. Of the weeds identified during field surveys, three species are listed as State priority weeds, one weed is listed as a Regional Priority Weed and the remaining seven weeds are listed as other weeds of regional concern. The weeds present, their priority listing under the *Biosecurity Act 2017*, their associated asset / value at risk and whether they are Weeds of National Significance (WoNS), are presented in Table 5.

Table 5 Priority weed species located within study area as per Greater Sydney Regional Strategic Weed Management Plan

Scientific name	Common name	WoNS	Priority weed obligations
State level priority weeds			
Anredera cordifolia	Madeira Vine	Yes	Asset protection
Asparagus aethiopicus	Ground Asparagus	Yes	Asset protection
Lantana camara	Lantana	Yes	Asset protection
Regional Priority			
Cestrum parqui	Green Cestrum	No	Asset protection
Other Weeds of Regional Concern			
Acetosa sagittata	Turkey Rhubarb	No	Environment
Cenchrus clandestinus	Kikuyu	No	Environment
Coprosma repens	Mirror Bush	No	Environment
Erythrina x sykesii	Coral Tree	No	Environment
Ipomoea cairica	Coastal Morning Glory	No	Environment
Parietaria judaica	Asthma Weed	No	Environment, Human Health
Phoenix canariensis	Phoenix Palm	No	Environment

Asset protection: These Weeds are widely distributed in some areas of the State. As Weeds of National Significance, their spread must be minimised to protect priority assets. **Environment**: weeds that impact ecological communities and biodiversity, including natural urban and peri-urban environments. **Human Health**: weeds that impact human health, livelihood, lifestyle, cultural values, recreation and landscape amenity.

4.2.4 Fauna species and their habitat

There were no threatened fauna species identified during the field survey. Additionally, the subject site contains limited habitat features due to recent clearing. However, nearby *Lantana camara* bushes could provide habitat for small birds and areas of adjacent instream vegetation are likely to provide habitat for wading and water birds. A pair of Purple Swamphens was seen within a patch of adjacent *Phragmites australis.*

Five fauna species were observed during the survey (see list in Appendix B). Scats, burrows and scratchings of *Oryctolagus corniculatus* (European Rabbit) were observed in the study area. A number of bird species were also observed during the field survey. The birds observed were ubiquitous urban tolerant species typical of this type of peri-urban environment.

A list of habitat features recorded in the study area is available below inTable6.

Table6: Habitat features recorded in the study area

Habitat feature	Associated species	Presence
Native vegetation	Birds, microchiropteran bats (microbats), megachiropteran bats (fruit bats), arboreal mammals, reptiles	Present. *Banksia integrifolia* are present to the west of the study area and mature *Casuarina glauca* trees are present to the east and west of the study area.
Other vegetation	Small birds	The riparian areas to the east and west of the study area have dense understoreys of exotic species providing habitat for small birds.
Nectar producing species	Arboreal mammals/birds and fruit bats	Present in the study area as planted canopy and tall shrubs, and remnant mature trees
Coarse woody debris (fallen logs)	Terrestrial mammals, reptiles, invertebrates	Present. Piles of woody debris were observed in the study area, likely to be dead Coral Tree limbs.
Water body	Amphibians, reptiles, microbats	Present to the south of the proposed works area. Curl Curl Lagoon is a large open water body.
Rocky outcrops	Microbats, reptiles	Absent

4.2.5 Threatened fauna species

No threatened fauna were observed during the field survey. In the greater context of Curl Curl Lagoon, densely vegetated areas on the edge of the lagoon could provide potential habitat for threatened fauna such as *Ixobrychus flavicollis* (Black Bittern). However, after inspecting the study area, it was considered that no threatened fauna are likely to use the study area as foraging habitat, due to the recent clearing and the fact that the replanted vegetation has not matured to a point where it can provide habitat for threatened species. No feed species for threatened species such as glossy Black Cockatoos (*Casuarina glauca*) are to be removed as part of the proposed works.

4.2.6 Riparian corridor

The proposed works are to take place within the riparian buffer zone and on waterfront land as defined under the WM Act. The proposed works would require a CAA via an Integrated Development Application. Potential impacts to the mapped Waterways and Riparian Land have been assessed as part of a separate Waterways Impact Statement (ELA, 2019).

5. Impact assessment

5.1 Summary of impacts

Both direct and indirect impacts on the flora and fauna of the study area during the construction and operation of the proposed works have been considered in the assessment below. The construction of the proposed telecommunications facility will result in the removal of recently planted native vegetation within the study area. The impacts of the proposal to selected threatened species and communities listed under the BC and EPBC Act have been assessed. Requirements under the BC Act for triggering the BOS and application of the BAM are also assessed to determine if the development application requires a BDAR (see Section 5.5).

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

Direct impacts:

- Clearing of vegetation
- Loss/modification to threatened species habitat
- Modification or fragmentation of vegetation

Indirect impacts

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

5.2 Direct impacts

5.2.1 Clearing of vegetation

The proposed works would result in the clearing of recently planted native tubestock. A total of 0.0035 ha of vegetation would be impacted within the study area.

Table7: Assessment of vegetation impacted

Vegetation community	Direct Impact	Potential Indirect Impacts
PCT 1234 (CFSMF)	0.0035 ha	0.0085 ha
PCT 1808	0 ha	0
TOTAL	0.0035 ha	0.085

A small area of recently planted native vegetation (0.0035 ha) will be directly impacted. Indirect impacts associated with shadowing and weeds are assessed below. All of the vegetation to be removed, despite being considered part of a threatened ecological community, has been recently planted. Landscaping works will be required within the study area as part of the DA and should include a mix of locally

indigenous species representative of PCT 1234 and species from the list of plants recently planted in the area provided by Northern Beaches Council. The impact to this vegetation community is unlikely to be significant as no remnant vegetation of this community is to be removed.

5.2.2 Loss / modification of threatened species habitat

The proposed works would result in the removal of only recently planted tubestock-sized species that are not yet mature enough to provide habitat to fauna species. Therefore, it is unlikely that habitat for threatened species would be lost or modified as a result of the proposed works. The species to be removed do not include flowering canopy trees or shrubs that are of the maturity to produce nectar.

5.2.3 Modification or fragmentation of vegetation

Despite the removal of 0.0035 ha of vegetation, these tubestock species are on the edge of the riparian vegetation and the area would be replanted as part of the required Biodiversity Management Plan. Therefore, there is no potential for vegetation within the study area to become further fragmented.

5.3 Impacts to riparian corridor

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

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

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

5.4 Indirect impacts

Indirect impacts are those impacts that do not directly affect habitat and individuals but that have the potential to interfere through indirect action. Indirect impacts considered for this assessment are site impacts (noise, dust, vibrations, compaction and weed invasion) and downwind impacts (sedimentation, dust, accidental spills and leaks). These impacts result from the operation of heavy machinery to install the communication station. The area subject to indirect impacts is small at 0.0085 ha.

Without mitigation, sediment runoff could impact Curl Curl Lagoon. Potential impacts of sediment to the lagoon should be managed via an appropriate sediment and erosion control plan. This will need to be implemented during any construction or facilitation of the works and following construction. Impacts to threatened species and native vegetation are unlikely to occur. There is a potential for weed species to spread into areas of retained native vegetation or newly revegetated areas. A sediment fence should be installed along the edge of the direct impact area to act as exclusion fencing for workers and machinery as well as prevent spread of weed propagules.

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

5.5 Biodiversity Conservation Act 2016

In November 2016 the NSW parliament passed the BC Act. This new legislation replaced the *Threatened Species Conservation Act 1995* (TSC Act) and took effect 25 August 2017. Among other things, the BC

Act introduces new requirements for biodiversity assessment and requires proponents to offset certain biodiversity impacts through the purchase and retirement of biodiversity credits. However, there are thresholds for triggering the Biodiversity Offsets Scheme (BOS) and BAM, and if triggered, a BDAR is required.

Triggers for the BOS and the BAM, include:

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

5.5.1 Biodiversity Offset Scheme – area clearing threshold

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

A total area of 0.0035 ha of recently planted native vegetation will be removed as part of the proposed works. As the land is zoned as recreational, there is no minimum lot size. In this case, the actual lot size is used instead of the minimum lot size. The actual lot size for this development is 0.5 ha. Therefore, according to this, the BOS would not be triggered by the area clearing threshold for the minimum lot size (Table8).

Table8: Area clearing threshold

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

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

5.5.2 Offset Scheme Thresholds – Biodiversity Values Map

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

5.5.3 BC Act – Test of Significance

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

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

No threatened fauna species were recorded in the study area during the survey. Furthermore, suitable foraging habitat for threatened fauna species was non-existent within the study area due to the lack of mature native vegetation present. The removal of the small area of planted vegetation for the proposed development is considered negligible on a local scale and would not result in a long-term decline in the population of any fauna species. As such, no Tests of Significance were prepared for any species as part of the proposed works.

No 5-part tests were performed for the Estuarine Swamp Oak Forest vegetation community located on site, despite the fact that the tubestock species to be removed are considered part of this community. This is because none of the plants to be removed are mature species or have created habitat for fauna species.

5.5.4 Key threatening processes

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

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

Clearing of native vegetation on this site is not considered a KTP as the vegetation is not remnant and has been planted in the last few months. Given the lack of residential properties nearby to the study area, it is unlikely that escaped garden plants would affect the native biodiversity of the study area.

5.5.5 Serious and Irreversible Impacts

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

5.6 EPBC Act – Assessment of Significance

The EPBC Act establishes a process for assessing the environmental impact of activities and developments where 'Matters of National Environmental Significance' may be affected. Under the Act any action which "has, will have, or is likely to have a significant impact on a Matter of National Environmental Significance" is defined as a "controlled action", and requires approval from the Commonwealth Department of the Environment and Energy (DotEE) which is responsible for administering the EPBC Act. No Assessment of Significance were undertaken for EPBC Act listed species due to the lack of suitable habitat within the study area. No Assessments of Significance were undertaken for EPBC Act listed vegetation communities due to the highly disturbed and revegetated nature of the vegetation within the study area.

5.7 Warringah LEP

As outlined in Table1 the study area is zoned RE1 Public Recreation. The proposed works would not prohibit the land from being used for public open space and recreational activities, as it has been located in an area outside of the location of marked soccer and baseball fields. The proposed development is also not located on any walking paths or tracks. The actions in the Biodiversity Management Plan outline the ways that the natural environment in the study area can be enhanced.

5.8 Warringah DCP

There are a number of WDCP controls that apply to the study area. The land is mapped as within Waterways and Riparian Land (Figure 5). A Waterways Impact Statement (ELA, 2019) has been prepared for the proposed works that addresses potential impacts to Curl Curl Lagoon and its riparian zone as a result of the works and outlines mitigation measures to ensure that the impacts are not significant.

The study area is mapped as containing patches of Threatened and High Conservation Habitat (Figure 3). As a result of the recent clearing and revegetation using tubestock-sized species, there are no habitat features within the study area that would be affected by the proposed works, including clearing of any vegetation.

The study area is mapped as a wildlife corridor (Figure 4). Dense vegetation to the east and west of the study area is not being impacted as part of the proposed works. The vegetation within the study area has been recently revegetated and at the time of inspection, wasn't providing a protected corridor to be used by fauna species. Therefore, there would be no impact on the mapped wildlife corridor as part of the proposed works.

The study area is also mapped as containing Native Vegetation (Figure 2). Prior to the clearing of vegetation and revegetation within the study area, the species within the area were predominantly exotic, hence the lack of any native vegetation within the study area following the works. The revegetation of the area with tubestock has utilised native species endemic to the study area, however they are still immature plants and can be readily replaced where removed. Therefore, there is unlikely to be a significant impact to mapped Native Vegetation within the study area as a result of the proposed works.

6. Recommendations

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

Species / sensitive area	Potential impact	Appropriate mitigation measure
Native vegetation	Compaction of soil Accidental damage/clearing	Pre-construction: • Install temporary barrier fencing to prevent entry into adjacent vegetation and appropriate 'no-go zone' signage. • Installation of tree protection measures around trees to be retained in the study area. Structures should be adequate to prevent machinery from entering within the drip zone. During construction: • Maintain temporary fencing to prevent access into the revegetated areas Post construction: • Stabilise all disturbed areas, implement vegetation protection measures as required • Revegetation of native vegetation consistent with the relevant vegetation communities.
Water quality	Increase in sediment flow into waterways Modification of hydrological flow rate Reduction in water quality	During-construction: • No stockpiling of rubbish or storage of chemicals to occur near native vegetation or waterways. • The use of fuel, chemicals, herbicides should be limited near waterways and other sensitive areas • Implementation of Council-approved Erosion and Sediment Control Plan
Sediments and erosion control	Increase in sediment flow into water control Runoff should be directed away from bushland or threatened flora/fauna species habitat	Pre-construction: • An Erosion and Sediment Control Plan is required prior to any on-ground work. • Soil and erosion control measures such as sediment fencing must be installed prior to on-ground works. These are to be inspected and maintained regularly (weekly), with more frequent inspections during rain periods to ensure structures are in proper working order. Post-construction: • Bare areas should be mulched, following clearance works to prevent erosion or soil damage. Alternatively, erosion prone areas,

Species / sensitive area	Potential impact	Appropriate mitigation measure
		when not in use, may be covered with biodegradable weed matting or similar product.
Threatened species and habitat	Loss or modification of foraging habitat	Post construction • Revegetation works would be required within the BMP area. Works should be done in liaison with Council's Biodiversity Officer. Revegetation works must use appropriate species of Swamp Oak Floodplain Forest.
Spread of weeds and disease	Introduction or spread of weeds or disease into bushland or threatened species habitat	Pre-construction: • All equipment must be thoroughly cleaned of soil and weed propagules prior to entry into the study area • Priority weeds listed in Section 4.2.3 should be removed using best management practices prior to removal of native vegetation. Weed propagules are to be removed off site During construction • The use of chemicals should be limited, due to the indirect impacts to threatened fauna and native vegetation and proximity to the waterway. Post construction: • All weed propagules are to be bagged and removed offsite, preferably the same day and disposed of at designated green waste facility.
Adjacent riparian corridor	Overshadowing of vegetation resulting in changes in species composition increase spread of weeds	Post Construction • Implementation of a Biodiversity Management Plan and revegetation works is required for the adjacent riparian corridor along Curl Curl Lagoon following the completion of works • Landscaping within the study area should include local indigenous plant species • Revegetation works adjacent to Curl Curl Lagoon must only use provenance species which represents PCT 1234. • Revegetation works should incorporate shade tolerant plants into the revegetation works adjacent to the riparian corridor.

7. Flora and Fauna Assessment Conclusion

This assessment was concerned with the direct and indirect impacts of the proposal on the identified TECs within the study area and the adjacent subject site and any threatened flora or fauna likely to be

found within the subject site and study area. As a result of the recent clearing of exotic vegetation and recent revegetation with tubestock-sized species, the assessment concluded that the proposal is unlikely to result in a significant impact to TECs, threatened flora and threatened fauna likely to be found within the study area. Recommended mitigation measures have been provided to further reduce the impact of the proposal on and adjacent vegetation.

8. Biodiversity Management Plan

This Biodiversity Management Plan for the remediation of disturbed areas as part of the installation of the telecommunications facility is to be read in conjunction with the Flora and Fauna Assessment (Sections 1 -7) prepared for the proposed works. The description of the site is outlined in Section 4.2 of this report and identification of potential impacts to biodiversity are assessed in Sections 5.2 and 5.3 of this report.

As the area to be managed under the BMP is Council-managed land, it is recommended that Optus or its designated consultant responsible for implementing the BMP liaise with Northern Beaches Council staff regarding the required revegetation and maintenance of the BMP area to ensure that the works are in accordance with Council's long-term planning for the management of the area.

This BMP has been prepared by an environmental consultant with ten years' experience in conservation and land management, including participating in and planning for bush regeneration activities. The report has been technically-reviewed by a BAM-accredited senior ecologist.

8.1 Objectives of the Biodiversity Management Plan

The objectives for this Biodiversity Management Plan (BMP) are summarised below:

- prevent encroachment into neighbouring native vegetation during construction
- reduce sediment during and post construction
- provide recommendations for native plants to be used as screening around the proposed facility and provide a maintenance schedule.

These guidelines lines have been prepared in accordance with the Warringah (Northern Beaches) Council *Biodiversity Management Plan Report Guidelines.* The scope of this BMP is commensurate with the size, type and location of the development proposal. The location of the area covered by the BMP is shown in Figure 14.

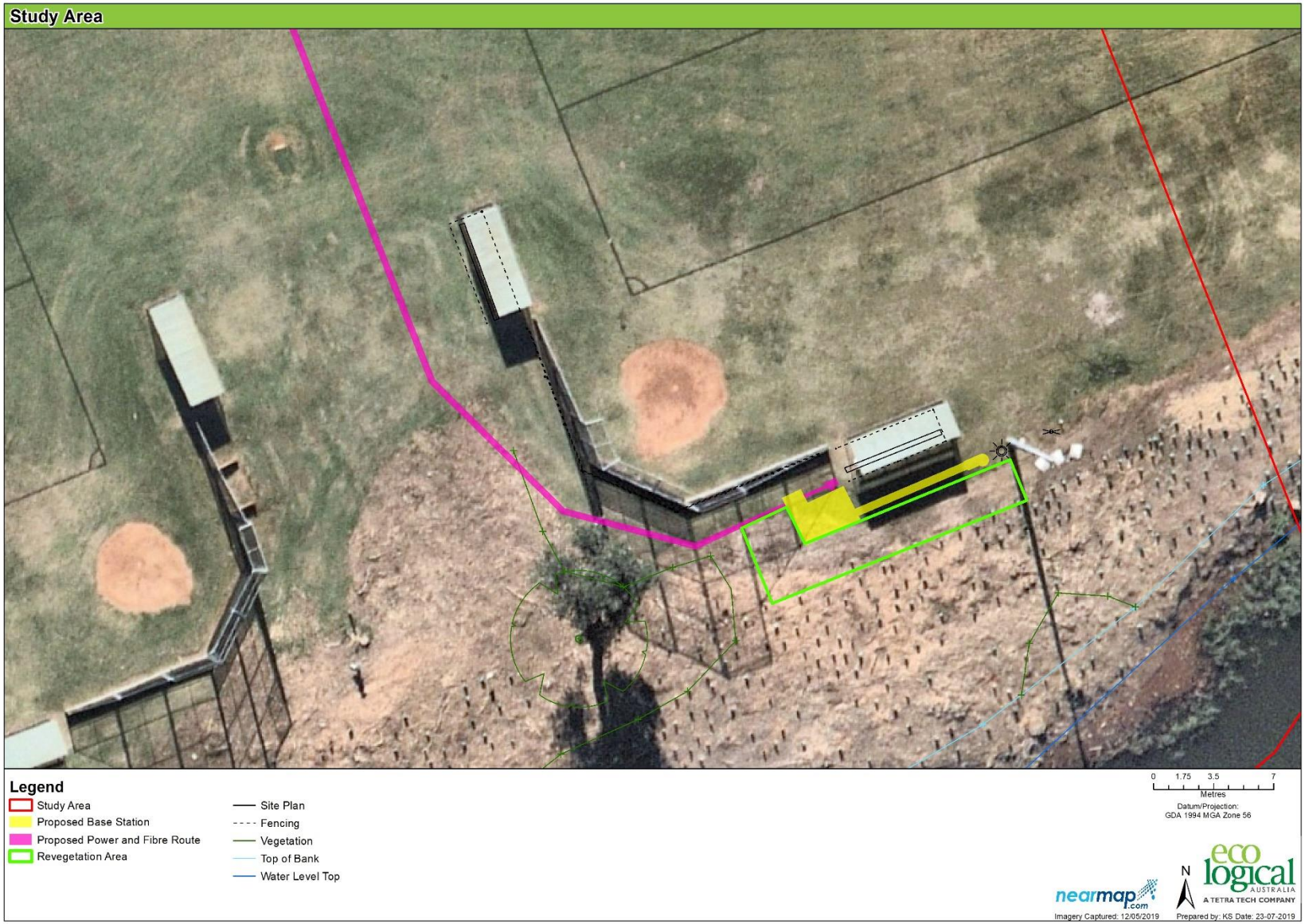

Figure 14 Area covered by BMP

8.2 Implementation of work

A suitably qualified and experienced landscaping or bush regeneration contractor is required to implement the recommendations of this BMP, as outlined in the *Biodiversity Management Plan Report Guidelines.*

9. Preliminary works and Construction

Construction and preliminary works are to occur either before or whilst development is occurring onsite. All works outlined below are assumed to be undertaken by the developer or the civil construction company.

9.1 Fencing

Temporary fencing is to be erected along the southern side of the subject site prior to commencement of works to prevent encroachment of civil machinery into areas of native vegetation. Temporary construction fencing generally consists of star pickets with highly visible plastic mesh or similar. Sediment fencing will also be required to prevent sediment movement into the revegetation area. Temporary fencing may be removed once construction has been completed.

9.2 Erosion and sediment control

An Erosion and Sediment Control Plan (ESCP), preferably as part of a Construction Environmental Management Plan (CEMP), should be developed and implemented. This should be in accordance with current best management practice guidelines.

10. Vegetation Management

10.1 Management overview

An assessment of the native resilience and weed densities were conducted during the site inspection. Planted native vegetation is present to the south of the proposed works area and very limited habitat exists for any flora or fauna within the study area. In the area of native vegetation adjacent to the study area, the ground layer is extensively modified, covered in mulch, mostly cleared and recently planted. The southern area of the study site therefore requires minor intervention during and after construction works. This will involve reestablishment of existing soil and returning mulch to these disturbed areas. It has been proposed to revegetate the western boundary of the base station with screening vegetation once construction of the base station has been completed. ELA has provided recommendations for plant species, planting densities and a maintenance schedule for this work (see Section 11).

11. Revegetation

11.1 Site preparation

Site preparation works are necessary for the successful establishment of revegetation works. These areas tend to be significantly degraded due to past landfill and other past land disturbances.

Preparation works should be undertaken prior to revegetation. Areas that have received significant soil disturbance will require site preparation works before they are suitable for revegetation. The soil may require ripping before revegetation works if it has been compacted by construction machinery. Spot spraying may be used to treat herbaceous weeds within the revegetation area.

11.2 Planting

Revegetation should be conducted in the shoulder months (early spring or early autumn) to prevent shock to young saplings and reduce exposure to frost or drought conditions. Prior to planting, each sapling should be soaked in a plant tonic (e.g. Seasol™) for at least 1-2 hours to reduce transplant shock. Water crystals or wetting agents should be added to each plant hole. This will increase the water holding capacity of the soil and reduce watering schedules. All plants will be irrigated when installed to increase survival rates of revegetation. Depending on the weather, irrigation needs to be undertaken for at least 4-6 weeks following planting to aid establishment of the plants

Tree guards may need to be installed on each plant to protect seedlings from extreme weather herbivorous grazing and herbicide drift during maintenance. The requirement for tree guards will be determined by the contractor at the end of the establishment phase. It is noted that the Council revegetation program has utilised tree guards to protect their newly planted native species. If used, bio-degradable tree guards are recommended to protect the seedlings.

Planting of tube-stock for trees and shrubs species and *Hiko* or *Viro* cells for grasses and other groundcover species is the preferred method for revegetation works. Plant seed/cutting material used should be sourced from local provenance nurseries using seed collected from the local northern beaches area. A recommended planting list as provided by Northern Beaches Council is provided below in Table 9.

It is recommended canopy species are planted with approximately 4-5 metres of lineal spacing. Shrubs may be planted at a density of approximately 1 per square metre. Ground covers may be planted at a density of 3-4 per square metre. All species should be spread evenly across the revegetation area.

A thin layer of native woodchip mulch may be spread throughout the planted area to assist with weed control and soil moisture retention. This may be done prior to planting.

Table 9 Species to be used in revegetation of BMP area and screening of telecommunication facility

Life form	Scientific Name	Common Name
Tree (to 15m)	*Banksia integrifolia*	Coastal Banksia
	Eucalyptus robusta	Swamp Mahogany
Shrub (to 6m)	*Leptospermum laevigatum*	Coastal Tea Tree
	Myoporum boninense	Boobialla
	Melaleuca nodosa	Prickly-leaved Tea-tree
	Melaleuca hypericifolia	Hillock Bush
	Correa alba	White Correa
	Acacia longifolia var sopharae	Sydney Golden Wattle
	Westringia fruticosus	Coastal Rosemary

Life form	Scientific Name	Common Name
	Baloskion tetraphyllum	Plume Rush
	Gahnia siebierana	Saw-Sedge
Groundcover (to 1m)	*Lomandra longifolia*	Spiny-headed Mat Rush
	Dianella caerulea	Blue Flax Lily
	Juncus krausii	
	Juncus usitatus	Sea Rush

11.3 Weed Control

Control of the weeds within the revegetation area can be undertaken by manual hand removal and spot spraying with herbicide. Cyclical maintenance visits 8 times in the first year, then 6 times per year for the implementation period. This will be is sufficient to remove minor weed infestations and control new outbreaks. These visits can occur every 4-6 weeks from September to March and once over the Autumn/Winter period.

12. Implementation schedule

An indicative implementation schedule for the initial three years has been provided in Table 10. Responsibilities have been identified as below:

Key	Civil construction activities
	Vegetation management works

Table 10 BMP Implementation schedule

Treatment	Year 1				Year 2				Year 3			
	1	2	3	4	1	2	3	4	1	2	3	4
Civil works												
Install construction fencing												
Install sediment fencing												
Install informational signage												
Revegetation												
Seed collection, cleaning, storage												
Site Preparation												
Install mulch												
Tubestock, supply and install												
Replacement tubestock, supply and install												
Irrigation												
Weed control												
Maintenance												
Other works												
Monitoring and reporting												

13. Monitoring and reporting

The contractor will monitor the vegetation for changes over time as a result of vegetation management works.

The contractor should establish photo monitoring points and prepare the initial report template to record the progress of their work and demonstrate compliance with the BMP. This will be undertaken during the establishment phase. The requirements of monitoring and reporting are described in detail in the sections below.

13.1 Photo monitoring

Photo monitoring points should be established in the planting area to highlight changes in the vegetation through time. The initial photos must be taken prior to works commencing (i.e. the before shot) with subsequent photos being taken after significant works (e.g. planting, mulching) and then annually.

For each photo:

- Mark the location of the photo point/s and take a compass bearing of the direction of photo.
- Label each digital image with a unique reference number that indicates where the photo was taken (i.e. the photo monitoring point) and the date it was taken.

13.2 Reporting

A brief report outlining work undertaken by the contractor on behalf of Optus will be prepared after each visit and annually. These reports will be submitted to the Council. Reports will include:

- A summary of works carried out within the period
- An approximation of the time spent on each task
- Any observations and any problems which impact on the implementation of the BMP
- Any recommendations for future works and/or actions.
-

13.3 Review of the Biodiversity Management Plan

The implementation of this BMP will be reviewed as part of the annual monitoring report for the life of this BMP. A review of this BMP should evaluate the effectiveness of the current management strategy and consider appropriate recommendations, for example supplementary planting if required. This review and reports will be made available to the Council's Natural Environment and Climate Change Unit on request.

14. References

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Appendix A Likelihood of occurrence table

The table below provides the collated results from the 10 km database searches (buffered around the study site) of the NSW Wildlife Atlas and the EPBC Protected Matters Search Tool. An assessment of likelihood of occurrence was made for threatened and migratory species identified from the database searches. Five terms for the likelihood of occurrence of species are used in this report. This assessment was based on database or other records, presence or absence of suitable habitat, features of the proposal site, results of the field survey and professional judgement. The terms for likelihood of occurrence are defined below:

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

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

Scientific name	Common name	BC Act	EPBC Act	Habitat associations	Number of records	Likelihood
Flora						
Acacia terminalis subsp. *terminalis*	Sunshine Wattle	E	E	*Acacia terminalis* subsp. *terminalis* has a very limited distribution, mainly in near-coastal areas from the northern shores of Sydney Harbour south to Botany Bay, with most records from the Port Jackson area and the eastern suburbs of Sydney. It occurs in coastal scrub and dry sclerophyll woodland on sandy soils (OEH 2014).	167	No – no suitable habitat
Asterolasia elegans		E	E	*Asterolasia elegans* is restricted to a few localities on the NSW Central Coast north of Sydney, in the Baulkham Hills, Hawkesbury and Hornsby LGAs. It is found in sheltered forests on mid- to lower slopes and valleys, in or adjacent to gullies (OEH 2014).	N/A	No – no suitable habitat
Caladenia tessellata	Thick Lip Spider Orchid	E	V	*Caladenia tessellata* occurs in grassy sclerophyll woodland, often growing in well-structured clay loams or sandy soils south from Swansea, usually in sheltered moist places and in areas of increased sunlight (OEH 2014). It flowers from September to November (OEH 2014).	N/A	No – no suitable habitat
Chamaesyce psammogeton	Sand Spurge	E	-	Sand Spurge is found sparsely along the coast from south of Jervis Bay (at Currarong, Culburra and Seven Mile Beach National Park) to Queensland (and Lord Howe Island). Populations have been recorded in Wamberal Lagoon Nature Reserve, Myall Lakes National Park, Moonee Beach Nature Reserve and Bundjalung National Park. Grows on fore-dunes, pebbly strandlines and exposed headlands, often with Spinifex (*Spinifex sericeus*) and Prickly Couch (*Zoysia macrantha)* (OEH 2014).	3	No – no suitable habitat
Epacris purpurascens var. *purpurascens*		V	-	*Epacris purpurascens* var. *purpurascens* has been recorded between Gosford in the north to Avon Dam in the south, in a range of habitats, but most have a strong shale soil influence (OEH 2014).	2	No – no suitable habitat
Genoplesium baueri	Bauer's Midge Orchid	E	-E	*Genoplesium baueri* grows in dry sclerophyll forest. The species has been recorded at locations now likely to be within the following conservation reserves: Berowra Valley Regional Park, Royal National	N/A	No – no suitable habitat

Scientific name	Common name	BC Act	EPBC Act	Habitat associations	Number of records	Likelihood
				Park and Lane Cove National Park. May occur in the Woronora, O'Hares, Metropolitan and Warragamba Catchments (OEH 2014).		
Grevillea caleyi	Caley's Grevillea	E	E	The natural distribution of *Grevillea caleyi* is centred approximately on the northern Sydney suburb of Terrey Hills and also includes the areas of Duffys Forest, Belrose and Ingleside (OEH 2014). Occurs on the ridgetop between elevations of 170 to 240 m asl, in association with laterite soils and a vegetation community of open forest, generally dominated by *Eucalyptus sieberi* and *E. gummifera* (OEH 2014). Occasionally, *G. caleyi* occurs at the boundaries of the laterite soils in low open forests of *E. gummifera* and *E. haemastoma* (OEH 2014). A recent record from Middle Brother near Port Macquarie is thought to be a cultivated specimen and recent searches have failed to find any *G. caleyi* near this record (OEH 2014).	1	No – no suitable habitat
Melaleuca biconvexa	Biconvex Paperbark	V	V	*Melaleuca biconvexa* occurs in coastal districts and adjacent tablelands from Jervis Bay north to the Port Macquarie district. It grows in damp places often near streams (PlantNet 2011).	N/A	No – no suitable habitat
Melaleuca deanei	Deane's Paperbark	V	V	Found in heath on sandstone (OEH 2014), and also associated with woodland on broad ridge tops and slopes on sandy loam and lateritic soils (Benson and McDougall 1998).	N/A	No – no suitable habitat
Persoonia hirsuta	Hairy Geebung	E	E	*Persoonia hirsuta* occurs from Singleton in the north, south to Bargo and the Blue Mountains to the west (OEH 2014). It grows in dry sclerophyll eucalypt woodland and forest on sandstone.	26	No – no suitable habitat
Pimelea curviflora var. *curviflora*		V	V	*Pimelea curviflora var. curviflora* is confined to the coastal area of Sydney between northern Sydney in the south and Maroota in the north-west. It grows on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands (OEH 2014).	23	No – no suitable habitat
Prostanthera marifolia	Seaforth Mintbush	CE	CE	Occurs on deeply weathered clay-loam soils associated with ironstone and scattered shale lenses, a soil type which only occurs on ridge tops and has been extensively urbanised (OEH 2014).	74	No – no suitable habitat; and north of known range

Scientific name	Common name	BC Act	EPBC Act	Habitat associations	Number of records	Likelihood
Syzygium paniculatum	Magenta Lilly Pilly	E	V	This species occupies a narrow coastal area between Bulahdelah and Conjola State Forests in NSW. On the Central Coast, it occurs on Quaternary gravels, sands, silts and clays, in riparian gallery rainforests and remnant littoral rainforest communities (Payne 1997). In the Ourimbah Creek valley, *S. paniculatum* occurs within gallery rainforest with *Alphitonia excelsa*, *Acmena smithii*, *Cryptocarya glaucescens*, *Toona ciliata*, *Syzygium oleosum* with emergent *Eucalyptus saligna*. At Wyrrabalong NP, *S. paniculatum* occurs in littoral rainforest as a co-dominant with *Ficus fraseri*, *Syzygium oleosum*, *Acmena smithii*, *Cassine australe*, and *Endiandra sieberi*. Payne (1991) reports that the species appears absent from Terrigal formation shales, on which the gully rainforests occur. *S. paniculatum* is summer flowering (November-February), with the fruits maturing in May (OEH 2014).	22	No – no suitable habitat; no rainforest on site
Tetratheca glandulosa		V	V	Associated with ridgetop woodland habits on yellow earths also in sandy or rocky heath and scrub (NPWS 1997). Often associated with sandstone / shale interface where soils have a stronger clay influence (NPWS 1997). Flowers July to November.	45	No – no suitable habitat
Fish						
Epinephelus daemelii	Black Cod	-	V	Black cod generally inhabit near-shore rocky and offshore coral reefs at depths down to 50 m, but are occasionally recorded from deeper waters. In coastal waters adult black cod are found in rock caves, rock gutters and on rock reefs (DoE 2014).	N/A	No –no suitable habitat
Macquarie australasica	Macquarie Perch	E (under FM Act)	E	Habitat for the Macquarie perch is bottom or mid-water in slow-flowing rivers with deep holes, typically in the upper reaches of forested catchments with intact riparian vegetation. Macquarie perch also do well in some upper catchment lakes. In some parts of its range, the species is reduced to taking refuge in small pools which persist in midland–upland areas through the drier summer periods.	N/A	No – although a creek is present, the water quality appeared poor

Scientific name	Common name	BC Act	EPBC Act	Habitat associations	Number of records	Likelihood
Prototroctes maraena	Australian Grayling	-	V	Historically, this species occurred in coastal streams from the Grose River southwards through NSW, VIC and TAS. On mainland Australia, this species has been recorded from rivers flowing east and south of the main dividing ranges. This species spends only part of its lifecycle in freshwater, mainly inhabiting clear, gravel-bottomed streams with alternating pools and riffles, and granite outcrops but has also been found in muddy-bottomed, heavily silted habitat. Grayling migrate between freshwater streams and the ocean and as such it is generally accepted to be a diadromous (migratory between fresh and salt waters) species.	N/A	Unlikely – poor quality waterbody
Frogs						
Heleioporus australiacus	Giant Burrowing Frog	V	V	Forages in woodlands, wet heath, dry and wet sclerophyll forest (Ehmann 1997). Associated with semi-permanent to ephemeral sand or rock based streams (Ehmann 1997), where the soil is soft and sandy so that burrows can be constructed (Environment Australia 2000).	9	No – no suitable habitat
Litoria aurea	Green and Golden Bell Frog	E	V	This species has been observed utilising a variety of natural and man-made waterbodies (Pyke & White 1996) such as coastal swamps, marshes, dune swales, lagoons, lakes, other estuary wetlands, riverine floodplain wetlands and billabongs, stormwater detention basins, farm dams, bunded areas, drains, ditches and any other structure capable of storing water (OEH 2014). Fast flowing streams are not utilised for breeding purposes by this species (Mahony 1999). Preferable habitat for this species includes attributes such as shallow, still or slow flowing, permanent and/or widely fluctuating water bodies that are unpolluted and without heavy shading (OEH 2014). Large permanent swamps and ponds exhibiting well-established fringing vegetation (especially bulrushes–Typha sp. and spikerushes–Eleocharis sp.) adjacent to open grassland areas for foraging are preferable (Ehmann 1997; Robinson 1993). Ponds that are typically	2	Unlikely – not known from this area

Scientific name	Common name	BC Act	EPBC Act	Habitat associations	Number of records	Likelihood
				inhabited tend to be free from predatory fish such as Mosquito Fish (*Gambusia holbrooki*) (OEH 2014).		
Mixophyes balbus	Stuttering Frog	E	V	A variety of forest habitats from rainforest through wet and moist sclerophyll forest to riparian habitat in dry sclerophyll forest (OEH 2014) that are generally characterised by deep leaf litter or thick cover from understorey vegetation (Ehmann 1997). Breeding habitats are streams and occasionally springs. Not known from streams disturbed by humans (Ehmann 1997) or still water environments (NSW Scientific Committee 2002).	N/A	No – lack of leaf litter at subject site
Pseudophryne australis	Red crowned toadlet	V			55	No – no suitable habitat
Reptiles						
Varanus rosenbergi	Rosenberg's Goanna	V	-	Associated with Sydney sandstone woodland and heath land. Rocks, hollow logs and burrows are utilised for shelter (Environment Australia 2000).	23	No – no suitable habitat
Diurnal birds						
Anthochaera Phrygia (aka *Xanthomyza phrygia*)	Regent Honeyeater	E	E, M	Associated with temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts, and riparian forests of *Casuarina cunninghamiana* (River Oak) (Garnett 1993). Areas containing *Eucalyptus robusta* (Swamp Mahogany) in coastal areas have been observed to be utilised (NPWS 1997). The Regent Honeyeater primarily feeds on nectar from box and ironbark eucalypts and occasionally from banksias and mistletoes (NPWS 1995). As such it is reliant on locally abundant nectar sources with different flowering times to provide reliable supply of nectar (Environment Australia 2000).	2	Unlikely – may be occasional visitor to more intact areas of vegetation. No records within 5 km
Botaurus poiciloptilus	Australasian Bittern	V	-E	Terrestrial wetlands with tall dense vegetation, occasionally estuarine habitats (Marchant & Higgins 1993). Reedbeds, swamps, streams, estuaries (Simpson & Day 1999).	N/A	Unlikely within study area due to recent clearing, no

Scientific name	Common name	BC Act	EPBC Act	Habitat associations	Number of records	Likelihood
						records within 5 km of site
Burhinus grallarius	Bush Stone-curlew	E	-	Associated with dry open woodland with grassy areas, dune scrubs, in savanna areas, the fringes of mangroves, golf courses and open forest / farmland (Pittwater Council 2000; Marchant & Higgins 1993). Forages in areas with fallen timber, leaf litter, little undergrowth and where the grass is short and patchy (Environment Australia 2000; Marchant & Higgins 1993). Is thought to require large tracts of habitat to support breeding, in which there is a preference for relatively undisturbed in lightly disturbed.	8	Unlikely in study area due to recently cleared riparian vegetation
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	Associated with a variety of forest types containing *Allocasuarina* species, usually reflecting the poor nutrient status of underlying soils (Environment Australia 2000; NPWS 1997; OEH 2014). Intact drier forest types with less rugged landscapes are preferred (OEH 2014). Nests in large trees with large hollows (Environment Australia 2000).	19	Unlikely in study area due to no preferred foraging trees and no suitable HBTs
Dasyornis brachypterus	Eastern Bristlebird	E	E	Habitat is characterised by dense, low vegetation including heath and open woodland with a heathy understorey; in northern NSW occurs in open forest with tussocky grass understorey; all of these vegetation types are fire prone. Age of habitat since fires (fire-age) is of paramount importance to this species; Illawarra and southern populations reach maximum densities in habitat that has not been burnt for at least 15 years; however, in the northern NSW population a lack of fire in grassy forest may be detrimental as grassy tussock nesting habitat becomes unsuitable after long periods without fire; northern NSW birds are usually found in habitats burnt five to 10 years previously.	N/A	No – no suitable habitat
Glossopsitta pusilla	Little Lorikeet	V	-	In New South Wales Little Lorikeets are distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. Little Lorikeets mostly occur in dry, open eucalypt	4	No – lack of good quality forage species

Scientific name	Common name	BC Act	EPBC Act	Habitat associations	Number of records	Likelihood
				forests and woodlands. They have been recorded from both old-growth and logged forests in the eastern part of their range, and in remnant woodland patches and roadside vegetation on the western slopes. They feed primarily on nectar and pollen in the tree canopy, particularly on profusely-flowering eucalypts, but also on a variety of other species including Melaleucas and mistletoes. On the western slopes and tablelands *Eucalyptus albens* (White Box) and *E. melliodora* (Yellow Box) are particularly important food sources for pollen and nectar respectively.		
Haematopus fuliginosus	Sooty Oystercatcher	V	-	A coastal species that inhabits rock coastlines, coral cays, reefs and occasionally sandy beaches and Marchant & Higgins 1993; Simpson & Day 1999).	17	No – no suitable habitat
Hieraaetus morphnoides	Little Eagle	V	-	Utilises open eucalypt, sheoak and acacia forest, woodland or open woodland. Uses tall trees for nesting, with a large stick nest being built. Lays eggs in spring, and young fledge in early summer. Preys on birds, reptiles and mammals, and occasionally feeds on large insects or carrion.	1	Unlikely – no nests observed and limited canopy species
Ixobrychus flavicollis	Black Bittern	V	-	Occurs in both terrestrial and estuarine wetlands generally in areas of permanent water and dense vegetation (OEH 2014). In areas with permanent water it may occur in flooded grassland, forest, woodland, rainforest and mangroves (OEH 2014).	5	Unlikely in study area due to recent clearing of riparian vegetation
Lathamus discolor	Swift Parrot	E	E	Breeds in Tasmania between September and January. Migrates to mainland in autumn, where it forages on profuse flowering Eucalypts (Hence, in this region, autumn and winter flowering eucalypts are important for this species. Favoured feed trees include winter flowering species such as *Eucalyptus robusta* (Swamp Mahogany), *Corymbia maculata* (Spotted Gum), *C. gummifera* (Red Bloodwood), *E. sideroxylon* (Mugga Ironbark), and *E. albens* (White Box) (OEH 2014).	6	area due to recent clearing of riparian vegetation and no *Eucalyptus robusta* within study area

Scientific name	Common name	BC Act	EPBC Act	Habitat associations	Number of records	Likelihood
Neophema pulchella	Turquoise Parrot	V	-	Steep rocky ridges and gullies, rolling hills, valleys and river flats and the plains of the Great Dividing Range compromise the topography inhabited by this species (Marchant & Higgins 1993). Spends much of the time on the ground foraging on seed and grasses (OEH 2014). It is associated with coastal scrubland, open forest and timbered grassland, especially low shrub ecotones between dry hardwood forests and grasslands with high proportion of native grasses and forbs (Environment Australia 2000).	1	No – lack of suitable forage species
Pandion cristatus	Eastern Osprey	V	-	Associated with waterbodies including coastal waters, inlets, lakes, estuaries, beaches, offshore islands and sometimes along inland rivers (Olsen 1995). Osprey may nest on the ground, on sea cliffs or in trees (Olsen 1995). Osprey generally prefer emergent trees, often dead or partly dead with a broken off crown (Olsen 1995).	5	Unlikely – no nests observed, unlikely to hunt in the subject site
Rostratula australis	Australian Painted Snipe	E	V	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber (OEH 2014). Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds (ibid.). Breeding is often in response to local conditions; generally occurs from September to December (OEH 2014). Roosts during the day in dense vegetation (NSW Scientific Committee 2004). Forages nocturnally on mud-flats and in shallow water (OEH 2014). Feeds on worms, molluscs, insects and some plant-matter (ibid.).	N/A	Unlikely – lack of suitable habitat. No records within 5 km of site
Sterna albifrons	Little Tern	E	-	Almost exclusively coastal, preferring sheltered areas (OEH 2014), however may occur several kilometres inland in harbours, inlets and rivers (Smith 1990). Australian birds breed on sandy beaches and sand spits (Simpson & Day 1999).	2	Unlikely – lack of suitable habitat
Sternula nereis nereis	Australian Fairy Tern	-	V	Within Australia, the Fairy Tern occurs along the coasts of Victoria, Tasmania, South Australia and Western Australia; occurring as far north as the Dampier Archipelago near Karratha. The subspecies has been known from New South Wales (NSW) in the past, but it is unknown if it persists there (DoE 2014).	N/A	Unlikely – lack of suitable habitat. No records within 5 km

Scientific name	Common name	BC Act	EPBC Act	Habitat associations	Number of records	Likelihood
Nocturnal birds						
Ninox connivens	Barking Owl	V	-	Associated with a variety of habitats such as savanna woodland, open eucalypt forests, wetland and riverine forest. The habitat is typically dominated by Eucalypts (often Redgum species), however often dominated by Melaleuca species in the tropics (OEH 2014). It usually roosts in dense foliage in large trees such as *Allocasuarina cunninghamiana* (River She-oak), other Casuarina and Allocasuarina, eucalypts, Angophora, Acacia and rainforest species from streamside gallery forests. It usually nests near watercourses or wetlands. in large tree hollows with entrances averaging 2-29 m above ground, depending on the forest or woodland structure and the canopy height (Debus 1997).	16	Unlikely – no suitable nesting trees present
Ninox strenua	Powerful Owl	V	-	Powerful Owls are associated with a wide range of wet and dry forest types with a high density of prey, such as arboreal mammals, large birds and flying foxes (Environment Australia 2000, Debus & Chafer 1994). Large trees with hollows at least 0.5m deep are required for shelter and breeding (Environment Australia 2000).	151	Unlikely – although there are many records, the site lacks the understorey or hollows of a sufficient density to support prey species
Mammals (excluding bats)						
Cercartetus nanus	Eastern Pygmy-possum	V	-	Found in wet and dry eucalypt forest, subalpine woodland, coastal banksia woodland and wet heath (Menkhorst & Knight 2004). Pygmy-Possums feed mostly on the pollen and nectar from banksias, eucalypts and understorey plants and will also eat insects, seeds and fruit (Turner & Ward 1995). The presence of Banksia sp. and Leptospermum sp. are an important habitat feature (OEH 2014). Small tree hollows are favoured as day nesting sites, but nests have	30	No – no suitable habitat

Scientific name	Common name	BC Act	EPBC Act	Habitat associations	Number of records	Likelihood
				also been found under bark, in old birds nests and in the branch forks of tea-trees (Turner & Ward 1995).		
Dasyurus maculatus *Dasyurus maculatus maculatus*	Spotted-tailed Quoll Spotted-tailed Quoll (SE Mainland Population)	V -	- E	The Spotted-tailed Quoll inhabits a range of forest communities including wet and dry sclerophyll forests, coastal heathlands and rainforests (Mansergh 1984; OEH 2014j), more frequently recorded near the ecotones of closed and open forest. This species requires habitat features such as maternal den sites, an abundance of food (birds and small mammals) and large areas of relatively intact vegetation to forage in (OEH 2014). Maternal den sites are logs with cryptic entrances; rock outcrops; windrows; burrows (Environment Australia 2000).	7	No – no suitable habitat
Isoodon obesulus	Southern Brown Bandicoot	E	E1	This species is associated with heath, coastal scrub, heathy forests (Menkhorst & Knight 2004), shrubland and woodland on well drained soils. This species is thought to display a preference for newly regenerating heathland and other areas prone to fire (Menkhorst & Seebeck 1990).	15	No – no suitable habitat
Petaurus norfolcensis	Squirrel Glider	V	-	The species is widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria. The squirrel glider inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas (OEH 2014).	1	No – no suitable habitat
Petaurus norfolcensis	Squirrel Glider on Barrenjoey Penninsula, north of Bushrangers Hill	E2	-	The endangered population is within the Pittwater Local Government Area on the Barrenjoey Peninsula, north of Bushrangers Hill (OEH 2014).	1	No – no suitable habitat
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	Rocky areas in a variety of habitats, typically north facing sites with numerous ledges, caves and crevices (Strahan 1998).	N/A	No – no suitable habitat

Scientific name	Common name	BC Act	EPBC Act	Habitat associations	Number of records	Likelihood
Phascolarctos cinereus	Koala	V	V	Associated with both wet and dry Eucalypt forest and woodland that contains a canopy cover of approximately 10 to 70% (Reed et al. 1990), with acceptable Eucalypt food trees. Some preferred Eucalyptus species are: *Eucalyptus tereticornis*, *E. punctata, E. cypellocarpa, E. viminalis*	65	No – no suitable habitat, lack of feed trees
Phascolarctos cinereus	Koala in the Pittwater Local Government Area	E2	-	The endangered population occurs within the Pittwater Local Government Area, with most recent records occurring on the Barrenjoey Peninsula (OEH 2014).	65	No – no suitable habitat, lack of feed trees
Potorous tridactylus *Potorous tridactylus tridactylus*	Long-nosed Potoroo Long-nosed Potoroo (SE Mainland Population)	V -	- V	Associated with dry coastal heath and dry and wet sclerophyll forests (Strahan 1998) with dense cover for shelter and adjacent more open areas for foraging (Menkhorst & Knight 2004).	N/A	No – no suitable habitat
Pseudomys novaehollandiae	New Holland Mouse	-	V	A small burrowing native rodent with a fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Inhabits open heathlands, open woodlands with a heathland understorey and vegetated sand dunes. A social animal, living predominantly in burrows shared with other individuals. The home range of the New Holland Mouse ranges from 0.44 ha to 1.4 ha and the species peaks in abundance during early to mid stages of vegetation succession typically induced by fire (DoE 2014)	N/A	No – no suitable habitat
Mammals (bats)						
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	The Large-eared Pied Bat has been recorded in a variety of habitats, including dry sclerophyll forests, woodland, sub-alpine woodland, edges of rainforests and wet sclerophyll forests (Churchill 1998; OEH 2014). This species roosts in caves, rock overhangs and disused mine shafts and as such is usually associated with rock outcrops and cliff faces (Churchill 1998; OEH 2014).	N/A	No – no suitable habitat
Miniopterus australis	Little Bentwing-bat	V	-	Prefers well-timbered areas including rainforest, wet and dry sclerophyll forests, Melaleuca swamps and coastal forests (Churchill 1998). This species shelter in a range of structures including culverts, drains, mines and caves (Environment Australia 2000). Relatively	11	Unlikely in study area due to recent

Scientific name	Common name	BC Act	EPBC Act	Habitat associations	Number of records	Likelihood
				large areas of dense vegetation of either wet sclerophyll forest, rainforest or dense coastal banksia scrub are usually found adjacent to caves in which this species is found (OEH 2014). Breeding occurs in caves, usually in association with *M. schreibersii* (Environment Australia 2000, OEH 2014).		vegetation clearing
Miniopterus schreibersii oceanensis	Eastern Bentwing- Bat	V	-	Associated with a range of habitats such as rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grassland (Churchill 1998). It forages above and below the tree canopy on small insects (AMBS 1995, Dwyer 1995). Will utilise caves, old mines, and stormwater channels, under bridges and occasionally buildings for shelter (Environment Australia 2000, Dwyer 1995).	32	Unlikely in study area due to recent vegetation clearing
Mormopterus norfolkensis	Eastern Freetail Bat	V	-	Most records of this species are from dry eucalypt forest and woodland east of the Great Dividing Range (Churchill 1998). Individuals have, however, been recorded flying low over a rocky river in rainforest and wet sclerophyll forest and foraging in clearings at forest edges (Environment Australia 2000; Allison & Hoye 1998). Primarily roosts in hollows or behind loose bark in mature eucalypts, but have been observed roosting in the roof of a hut (Environment Australia 2000; Allison & Hoye 1998).	1	Unlikely – lack of hollows
Myotis macropus	Southern Myotis	V	-	The Southern Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 km inland, except along major rivers. Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage (OEH 2014).	15	Potential – may use trees and area to the south of subject site. Not likely in study area due to recent vegetation clearing.
Pteropus poliocephalus	Grey-headed Flying-Fox	V	V	Inhabits a wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests and cultivated	36	Unlikely within study area due

Scientific name	Common name	BC Act	EPBC Act	Habitat associations	Number of records	Likelihood
				areas (Churchill 1998, Eby 1998). Camps are often located in gullies, typically close to water, in vegetation with a dense canopy (Churchill 1998).		to lack of nectar producing species
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	Associated with moist gullies in mature coastal forest, or rainforest, east of the Great Dividing Range (Churchill, 1998), tending to be more frequently located in more productive forests (Hoye & Richards 1998). Within denser vegetation types use is made of natural and man made openings such as roads, creeks and small rivers, where it hawks backwards and forwards for prey (Hoye & Richards 1998).	3	Unlikely – lack of breeding structures and vegetation on the subject site not dense enough
Migratory marine species listed under EPBC Act						
Apus pacificus	Fork-tailed Swift	-	M	Sometimes travels with Needletails. Varied habitat with a possible tendency to more arid areas but also over coasts and urban areas (Simpson & Day 1999).	N/A	Unlikely – too far east
Haliaeetus leucogaster	White-bellied Sea-Eagle	-	M	Forages over large open fresh or saline waterbodies, coastal seas and open terrestrial areas (Marchant & Higgins 1993, Simpson & Day 1999). Breeding habitat consists of tall trees, mangroves, cliffs, rocky outcrops, silts, caves and crevices and is located along the coast or major rivers. Breeding habitat is usually in or close to water, but may occur up to a kilometre away (Marchant & Higgins 1993).	N/A	Unlikely – no suitable breeding habitat
Hirundapus caudacutus	White-throated Needletail	-	M	Forages aerially over a variety of habitats usually over coastal and mountain areas, most likely with a preference for wooded areas (Marchant & Higgins 1993; Simpson & Day 1999). Has been observed roosting in dense foliage of canopy trees, and may seek refuge in tree hollows in inclement weather (Marchant & Higgins 1993).	N/A	No – no suitable habitat
Merops ornatus	Rainbow Bee-eater	-	M	Resident in coastal and subcoastal northern Australia; regular breeding migrant in southern Australia, arriving September to October, departing February to March, some occasionally present April to May. Occurs in open country, chiefly at suitable breeding places in areas of sandy or loamy soil: sand-ridges, riverbanks, road-	N/A	No – no suitable habitat

Scientific name	Common name	BC Act	EPBC Act	Habitat associations	Number of records	Likelihood
				cuttings, sand-pits, occasionally coastal cliffs (ibid). Nest is a chamber a the end of a burrow, up to 1.6 m long, tunnelled in flat or sloping ground, sandy back or cutting (*ibid*).		
Monarcha melanopsis	Black-faced Monarch	-	M	Rainforest and eucalypt forests, feeding in tangled understorey (Blakers et al. 1984).	N/A	Unlikely – lack of suitable complex vegetation in study area
Monarcha trivirgatus	Spectacled Monarch	-	M	Wet forests, mangroves (Simpson and Day 1999).	N/A	No – no suitable habitat
Myiagra cyanoleuca	Satin Flycatcher	-	M	Wetter, denser forest, often at high elevations (Simpson & Day 2004).	N/A	No – no suitable habitat
Rhipidura rufifrons	Rufous Fantail	-	M	The Rufous Fantail is a summer breeding migrant to southeastern Australia (Morcombe, 2004). The Rufous Fantail is found in rainforest, dense wet eucalypt and monsoon forests, paperbark and mangrove swamps and riverside vegetation (Morcombe, 2004). Open country may be used by the Rufous Fantail during migration (Morcombe, 2004).	N/A	No – no suitable habitat
Xanthomyza phrygia	Regent Honeyeater	E	E, M	SEE DIURNAL BIRDS ABOVE		As above
Migratory wetland species listed under EPBC Act						
Ardea alba	Great Egret	-	M	The Great Egret is common and widespread in Australia (McKilligan, 2005). It forages in a wide range of wet and dry habitats including permanent and ephemeral freshwaters, wet pasture and estuarine mangroves and mudflats (McKilligan, 2005).	N/A	No – no suitable habitat
Ardea ibis	Cattle Egret	-	M	Cattle Egrets forage on pasture, marsh, grassy road verges, rain puddles and croplands, but not usually in the open water of streams or lakes and they avoid marine environments (McKilligan, 2005). Some individuals stay close to the natal heronry from one nesting season to the next, but the majority leaves the district in autumn and	N/A	No – no suitable habitat

Scientific name	Common name	BC Act	EPBC Act	Habitat associations	Number of records	Likelihood
				return the next spring. Cattle Egrets are likely to spend the winter dispersed along the coastal plain and only a small number have been recovered west of the Great Dividing Range (McKilligan, 2005).		
Gallinago hardwickii	Latham's Snipe	-	M	A variety of permanent and ephemeral wetlands, preferring open fresh water wetlands with nearby cover (Marchant and Higgins 1993). Occupies a variety of vegetation around wetlands (Marchant and Higgins 1993) including wetland grasses and open wooded swamps (Simpson and Day 1999). Latham's Snipe sometimes occur in habitats that have saline or brackish water, such as saltmarsh, mangrove creeks, around bays and beaches, and at tidal rivers (Frith et al. 1977; Naarding 1983; Patterson 1991). These habitats are most commonly used when the birds are on migration (Frith et al. 1977). They are regularly recorded in or around modified or artificial habitats including pasture, ploughed paddocks, irrigation channels and drainage ditches, ricefields, orchards, saltworks, and sewage and dairy farms (Frith et al. 1977; Lane & Jessop 1985; Naarding 1982, 1983). They can also occur in various sites close to humans or human activity (e.g. near roads, railways, airfields, commercial or industrial complexes) (Frith et al. 1977; Naarding 1983).	1	Unlikely, one individual recorded within 5 km of study area
Rostratula australis (aka. *R. benghalensis*)	Painted Snipe (Australian subspecies)	E	V, M	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber (OEH 2014). Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds (ibid.). Breeding is often in response to local conditions; generally occurs from September to December (OEH 2014). Roosts during the day in dense vegetation (NSW Scientific Committee 2004). Forages nocturnally on mud-flats and in shallow water (OEH 2014). Feeds on worms, molluscs, insects and some plant-matter (ibid.).	N/A	Unlikely, no species recorded within 5 km

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

Appendix B Flora and fauna species list

Scientific Name	Common name	Native/Exotic
Acacia sophorae	Coastal Wattle	N
Acetosa sagittata	Turkey Rhubarb	E
Anredera cordifolia	Madeira Vine	E
Asparagus aethiopicus	Ground Asparagus	E
Baloskion tetraphyllum	Plume Rush	N
Banksia integrifolia	Coastal Banksia	N
Callistemon viminalis	Weeping Bottlebrush	N
Casuarina glauca	Swamp Oak	N
Cenchrus clandestinus	Kikuyu Grass	E
Cerastium sp.*	Chickweed	E
*Cestrum parqui**	Green Cestrum	E
Commelina cyanea	Commelina	N
Conyza bonariensis	Fleabane	E
Coprosma repens	Mirror Bush	E
Correa alba	White Correa	N
Cynodon dactylon	Couch	E
Dianella caerulea	Blue Flax Lily	N
Ehrharta erecta	Panic Veldt Grass	E
Erythrina x sykesii	Coral Tree	E
Eucalyptus robusta	Swamp Mahogany	N
Gahnia siebierana	Red-fruit Saw-sedge	N
Juncus usitatus		N
Juncus krausii	Sea Rush	N
Hydrocotyle bonariensis	Largeleaf Pennywort	E
Ipomoea cairica	Coastal Morning Glory	E
Leptospermum laevigatum	Coast Tea-tree	N
Ligustrum lucidum	Broad-leaved Privet	E
Lomandra longifolia	Spiny-head Mat-rush	N
Melaleuca hypericifolia	Hillock Bush	N
Myoporum boninense	Boobialla	N
Paspalum dilatatum	Paspalum	E
Phoenix canariensis	Phoenix Palm	E
Phragmites australis	Common Reed	N

Scientific Name	Common name	Native/Exotic
Ricinus communis	Castor Oil	E
Sida rhombifolia	Paddy's Lucerne	E
Solanum nigrum	Blackberry Nightshade	E
Sonchus oleraceus	Common Sowthistle	E
Westringia fruticosa	Coastal Rosemary	N

Scientific Name	Common Name	Observation
Anthochaera carunculata	Red Wattlebird	Observed in study area
Cygnus atratus	Black Swan	Pair in study area
Grallina cyanoleuca	Magpie Lark	Observed in study area
Porphyrio porphyrio	Purple Swamphen	Observed in study area
Rhipidura leucophrys	Willie Wagtail	Observed in study area

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