Tallawarra Lands Concept Plan
Approval Modification

APPENDIX G

BIODIVERSITY ASSESSMENT REPORT

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Biodiversity Assessment Report

Framework for Biodiversity Assessment

Lot 1 // DP 543285, Lot 1 // DP 551658, Lot 102 // DP 716727Lot 15 // DP 1050255, Lot 30 // DP 1175058 and Lots 7 and 8 // DP 1049520, Tallawarra Lands, Yallah

Proposed Residential Development (MP09_0131)

Prepared for Cardno Pty Ltd

11 August 2017

PROJECT NUMBER	2017-030	
PROJECT NAME	Biodiversity Assessment Report, Framework for Biodiversity Assessment – Tallawarra Lands	
PROJECT ADDRESS	Lot 1 // DP 543285, Lot 1 // DP 551658, Lot 102 // DP 716727Lot 15 // DP 1050255, Lot 30 // DP 1175058 and Lots 7 and 8 // DP 1049520, Tallawarra Lands, Yallah.	
PREPARED FOR	Cardno Pty Ltd	
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REVIEW	Lucas McKinnon	
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Glossary and abbreviations

Acronym	Description
BAR	Biodiversity Assessment Report
BCF	Biodiversity Conservation Fund
BCT	Biodiversity Conservation Trust
DA	Development Application
DoEE	Department of the Environment and Energy
DPE	NSW Department of Planning and Environment
Study area	Lot 1 // DP 543285, Lot 1 // DP 551658, Lot 102 // DP 716727Lot 15 // DP 1050255, Lot 30 // DP 1175058 and Lots 7 and 8 // DP 1049520, Tallawarra Lands, Yallah Bay Road, Yallah
Subject site	Development areas – central and northern precincts
EEC	Endangered Ecological Community
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
FBA	Framework for Biodiversity Assessment
ha	hectare(s)
IBRA	Interim Bioregionalisation of Australia
km	kilometre
LGA	Local Government Area
LPI	Land and Property Information
masl	Metres above sea level
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
PCT	Plant community type, as defined by OEH (2017)
SEARs	Secretary's Environmental Assessment Requirements
SSD	State Significant Development
TSC Act	NSW *Threatened Species Conservation Act 1995*
*	Denotes exotic species

1. Introduction

1.1 Background

This Biodiversity Assessment Report (BAR) has been undertaken to accompany a modification to a Concept Plan, approved under Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act), relating to the proposed mixed-use development over 3 precincts on the Tallawarra Lands. The development is categorised into three different precincts, including the Central (210 ha), Northern (110 ha) and Lake Side Precincts (215 ha) on the Tallawarra Lands. This report has been prepared in accordance with the Framework for Biodiversity Assessment (FBA) and relates to the development of the Central and Northern precincts.

The proposal will consist of residential lots, a neighbourhood centre, industrial and light industrial warehouses, a 200 dwelling retirement village, open space and environmental management areas. The study area for this BAR covers an area of 219.02 ha, and includes those lands referred to as the 'Tallawarra lands'. The subject site for this FBA, for which credits are calculated, includes the Northern precinct and Central precinct (development lands) and totals 101.32 ha.

The proposed development is considered a State Significant Development (SSD), and as such Secretary's Environmental Assessment Requirements (SEARS) have been issued by the Department of Planning and Environment (DPE). The SEARs state the following regarding the assessment of biodiversity impacts:

> *"The modification request shall include an assessment of biodiversity impacts in accordance with the 'avoid, minimise and offset hierarchy', the NSW Biodiversity Offsets Policy for Major Projects, using an appropriate biodiversity assessment methodology such as the Framework for Biodiversity Assessment 2014, and the Environmental Protection and Biodiversity Conservation Act 1999 (Cth)."*

The Flora and Fauna SEAR also outlines a number of additional requirements that are either covered off by this BAR, are not applicable to this proposal or are not relevant to this modification stage of the proposal. These requirements and responses are outlined in **Table** 1.1.

Table 1.1: Secretary's Environmental Assessment Requirements and associated responses.

Secretary's Environmental Assessment Requirements (SEARS) – Key Issue 7 (Flora and Fauna)	Response
Include an assessment of biodiversity impacts in accordance with the "avoid, minimise and offset hierarchy", the NSW Biodiversity Offsets Policy for Major Projects, using an appropriate biodiversity assessment methodology such as the Framework for Biodiversity Assessment 2014, and the *Environment Protection and Biodiversity Conservation Act 1999*.	A Framework for Biodiversity Assessment (2014) has been completed for the proposed development.
Provide a field survey of the site in accordance with the Threatened Species Assessment Guideline, including: • an assessment and evaluation of the likely impacts on threatened species and their habitat; and • a description of proposed actions to avoid or mitigate impacts or compensate for unavoidable impacts on threatened species and their habitat.	A field survey has been conducted, and assessments made of the likely impacts on threatened species and their habitat (see **Section 5** and **6**). Where impacts were not avoidable, mitigated measures and offsets are provided (see **Section 5**, **6** and **7**).
Outline the measures for conservation/management of high environmental value and biodiversity corridor lands identified in the Illawarra Shoalhaven Regional Plan 2015, any vegetation with connective importance, and to protect and manage the riparian corridor and adjacent aquatic habitat.	The study area is not identified as a biodiversity corridor under the Illawarra Shoalhaven Regional Plan 2015. The proposal will not result in the fragmentation or isolation of other remnants, as it does not act as an intermediary patch between two (or more) areas of habitat. The vegetation in the subject site mostly consists of fragmented patches of disturbed vegetation and edges of larger patches of bushland. Therefore, the vegetation in the subject site is not of connective importance. No riparian corridors are located within the subject site.
Provide an updated Environmental Management Strategy (EMS) which addresses potential impacts (during all phases of development) on aquatic and terrestrial flora and fauna and their habitats (within the meaning of the *Threatened Species Conservation Act 1995* and the *Fisheries Management Act 1994*), in accordance with the OEH Threatened Species Survey and Assessment Guidelines, and DPI Fisheries' Policy and Guidelines for Fish Habitat Conservation and Management 2013. Provide details of monitoring programs designed to assess impacts on water quality, water flow and aquatic and riparian environments downstream of the proposal area.	Consideration of potential indirect impacts that may be incurred during all phases of development will be managed through the CEMP (see **Section 5.2.2**). An EMS may form a component of the CEMP and will be more appropriately prepared at DA or detailed design stage when potential indirect impacts are more readily defined. It is noted that survey for terrestrial flora and fauna and their habitats has been completed in accordance with the TSSA Guidelines. No fisheries considerations have been identified.

Secretary's Environmental Assessment Requirements (SEARS) – Key Issue 7 (Flora and Fauna)	Response
Address the potential impacts of the proposed modification on wetlands, including hydrologic regime/groundwater recharge, water quality and loss/degradation of habitat, and measures to minimise impacts.	Field assessment determined there to be no wetlands within the subject site. Several constructed farm dams located where identified within the subject site, however have been mapped by NPWS (2002), as artificial wetlands, and have since been field validated as constructed waterbodies.
Provide updated details of the presence and distribution of Groundwater Dependent Ecosystems (GDEs) and identify any potential impacts on GDEs.	The Groundwater Dependent Ecosystems (GDE) Atlas identifies Terrestrial GDEs within the study area (see **Appendix E**). These areas are specific to vegetated areas of the site, including areas consisting predominantly of woody weed species. High and moderate potential GDEs have been identified in the study area based on regional studies. A small amount of impacts will be incurred to terrestrial GDEs within the study area, with all unavoidable impacts offset in accordance with the Framework for Biodiversity Assessment (2014).
Provide updated investigations and mapping of Endangered Ecological Communities and justify/detail any impacts on the approved widths of riparian buffers, including to Lake Illawarra in the Northern precinct, any other proposed conservation methods on the site, and mitigation measures.	Endangered Ecological Communities in the study area were mapped and all unavoidable impacts to these communities were calculated (see **Section 3**). The proposal is situated outside of the riparian buffers associated with Lake Illawarra (**Section 2.2**).

This BAR has been prepared by Lucas McKinnon, an Accredited BioBanking Assessor (No. 76) under Part 7A of the TSC Act, and is consistent with the FBA (OEH 2014). This BAR, therefore, satisfies the requirements of the SEARs.

Four native vegetation types were identified in the study area. These communities include:

- Sydney Blue Gum X Bangalay – Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion (PCT1245).
- Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion (PCT838)
- Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion (PCT1300)
- Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion (PCT1232)

Three of these communities are listed as Threatened Ecological Communities (TEC) either under the NSW *Threatened Species Conservation Act 1995* (TSC Act) (NSW SC 2014) or the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) (CoA 2010).

A large majority of the study area consists of 'cleared land' and 'weeds and exotics' with vegetation in a highly modified condition. The native vegetation communities identified in the study area occur in a modified – highly modified condition, as a result of weed invasion, underscrubbing and grazing of livestock. As such, a majority of the native vegetation in the study area has been allocated a condition class of 'underscrubbed' or 'Lantana'.

Direct impacts to the ecological values of the development site are limited, as a majority of the development is associated with cleared land. However, direct impacts will occur to small areas of native vegetation. The total impact to native vegetation within the subject site (development lands) is 4.24 ha, and these proposed impacts have been assessed using the FBA (OEH 2014).

Sources of information for this report included:

- NSW Planning Viewer (NSW Dept. of Planning and Environment 2017)
- BioNet Atlas of NSW Wildlife (NSW Office of Environment and Heritage 2017)
- Protected Matters Search Tool (Commonwealth Dept. of the Environment and Energy 2017)
- Native vegetation of the Illawarra Escarpment and Coastal Plain (NPWS 2002)
- Soil Landscapes of the Wollongong-Port Hacking 1:100,000 Sheet map and report, Soil Conservation Service of NSW, Sydney (Hazelton and Tille 1990)
- SIX Maps (LPI 2017)

Plot based vegetation survey data, which was collected in accordance with FBA, were captured and used for this assessment. Targeted threatened species survey was also conducted.

1.2 Location and site identification

The study area for this BAR covers the areas known as the 'Tallawarra lands' and is a total area of 219.02 ha. The study area includes Lot 1 // DP 543285, Lot 1 // DP 551658, Lot 102 // DP 716727Lot 15 // DP 1050255, Lot 30 // DP 1175058 and Lots 7 and 8 // DP 1049520, Tallawarra Lands, Yallah Bay Road, Yallah (**Figure 1.1**). The subject site includes the full extent of the planned development, which includes the Northern and Central precincts. The size of the Northern and Central precincts is 101.32 ha in total (Central Precinct – 64.50 ha, Northern Precinct 36.82 ha) (**Figure 1.2**). **Figure 1.3** contains the footprint of the proposed development.

The study area is bounded by Lake Illawarra to the east, the Tallawarra Power Station and lands in various land zones to the south (including RE1 Public Recreation, IN1 General Industrial and E2 Environmental Conservation), the existing suburbs of Dapto and Koonawarra and Mount Brown Reserve a large area of land zoned E2 Environmental Conservation to the north, and Cormack Avenue and the Princes Motorway corridor to the west.

The study area is situated approximately 10-80 metres above sea level (masl). The highest point of the site occurs in the central parts of the site. The majority of the site is mapped as the Shellharbour soil landscape, which is characterised by rolling low hills with long sideslopes and broad drainage plains on Budgong Sandstone (Hazelton and Tille 1990). The northern (and steepest) part of the study area is mapped as the Gwynneville soil landscape, which comprises undulating to steep hills on Illawarra Coal Measures and Dapto Latite Member on the Coastal Plain (Hazelton and Tille 1990). The far south-western corner of the study area is mapped as the Fairy Meadow soil landscape, which includes alluvial plains, floodplains, valley flats and terraces below the Illawarra Escarpment (Hazelton and Tille 1990).

1.3 Land use history

The study area is generally dominated by cleared land and areas of weed and exotic cover, occur in areas that have been extensively cleared in the past, and subject to grazing pressures. The areas of native vegetation remain weedy or degraded, and are predominantly located along the northern boundary of the study area adjacent to a large patch of vegetation off-site.

The land use surrounding the study area consists of land zoned as B1 – Neighbourhood Centre, E3 Environmental Management, IN1 General Industrial, IN2 Light Industrial, R2 Low Density Residential and R5 Large Lot Residential (**Figure 1.4**).

Figure 1.1: Study area location.

Figure 1.2: Site map.

Figure 1.3: Proposed development footprint.

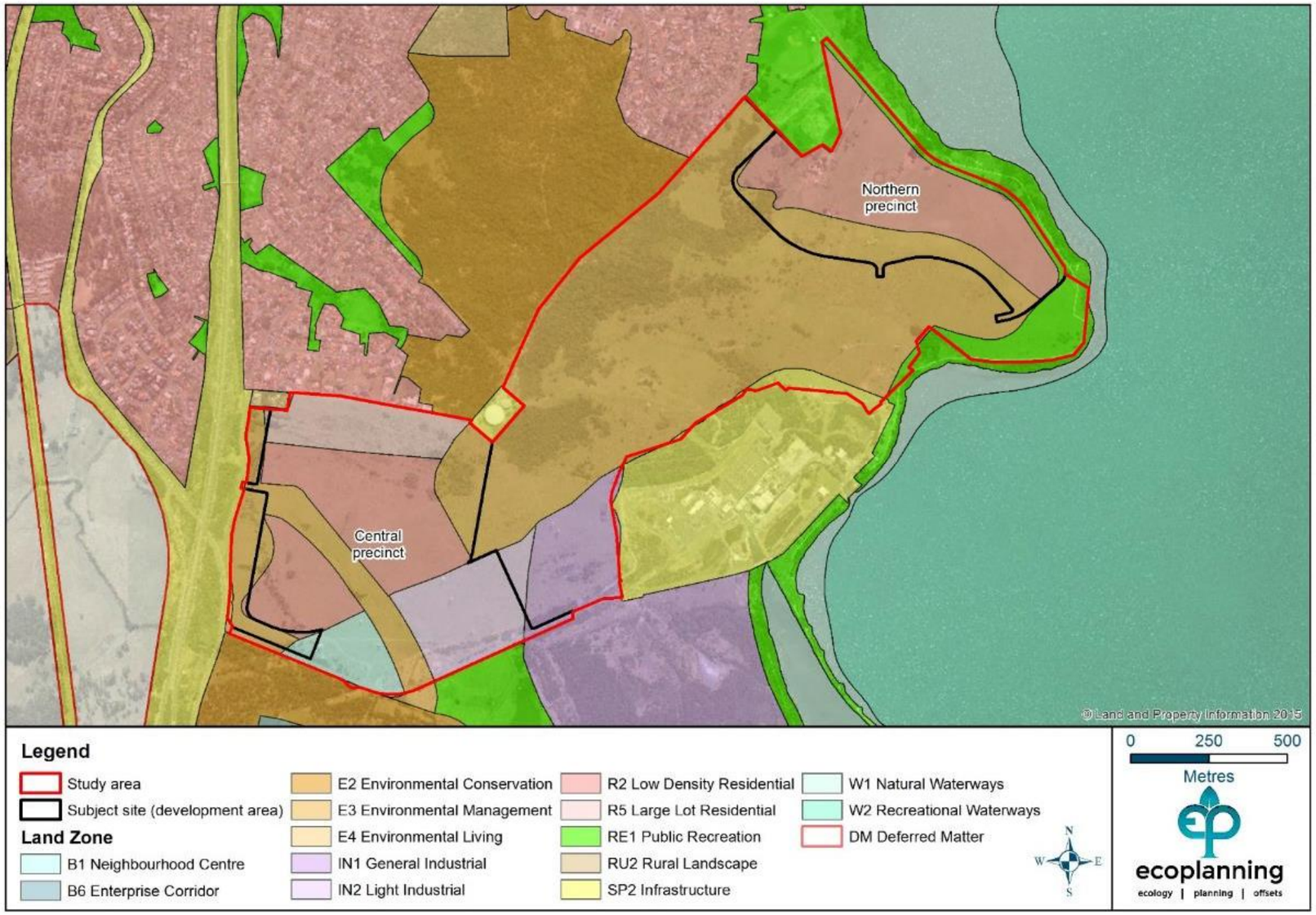

Figure 1.4: Subject site land zoning.

2. Landscape features

In accordance with the FBA, a number of features are assessed within and surrounding the study area and subject site (development lands) in order to describe the landscape features and to calculate the final landscape score. Provided below are details related to IBRA region and subregion, NSW landscape regions (Mitchell Landscapes), rivers, streams, estuaries and wetlands, surrounding native vegetation extent and the existence of state or regionally significant biodiversity values.

2.1.1 IBRA bioregions and IBRA subregions

The subject site is located entirely within the Illawarra IBRA subregion (Version 7) and within the NSW Sydney Basin IBRA region (version 7).

The Illawarra IBRA subregion was entered into the credit calculator.

2.1.2 NSW landscape regions (Mitchell Landscapes)

The subject site occurs across two NSW Mitchell Landscape (Mitchell Landscapes V3), being:

- *Dapto - Wollongong Coastal Slopes*
- *Lake Illawarra Alluvial Plains*

No other landscapes occur within the outer assessment circle. The development areas are dominated by the Dapto - Wollongong Coastal Slopes landscape, with 90.9 % of the development lands covered by this landscape (**Figure 2.1 and Table 2.1**).

Table 2.1: Mitchell Landscapes and areas.

Mitchell Landscape (ML)	Area of ML within subject site (ha)	% of subject site
Dapto - Wollongong Coastal Slopes	92.1	90.9
Lake Illawarra Alluvial Plains	9.2	9.1
Total	**101.3**	**100**

2.1.3 Rivers, streams and estuaries

There are several minor rivers mapped both within the study area and subject site. No estuaries are identified within the study area or subject site, although Lake Illawarra (a mapped estuary) does lie directly to the east of the study area and subject site (**Figure 2.2**).

2.1.4 Local and important wetlands

There are a number of important wetlands within the 1,000 ha assessment circle. Lake Illawarra lies directly to the east of the study area and subject site, and is listed on the Directory of Important Wetlands in Australia (DIWA). A SEPP 14 wetland also occurs approximately one kilometre south of the subject site (**Figure 2.2**).

2.1.5 Native vegetation extent

A layer of native vegetation cover is required for each assessment circle (100 ha and 1,000 ha) to assess the impact of the development to native vegetation. The extent of native vegetation on the subject site and immediate surrounds was mapped using the Native Vegetation of the Illawarra Escarpment and Coastal Plain (NPWS 2002). Areas of weeds, cleared land and artificial dams were removed from the layer before the vegetation extent was clipped to the outer and inner assessment circles. Edits were then made to the layer to refine the cover identified.

The native vegetation cover was mapped for both the 100 ha and 1,000 ha circles (**Figure 2.1**). The proposed footprint of the development will impact on 4.24 ha, and the calculations related to future native vegetation cover include this proposed impact.

2.1.6 State, regional and local biodiversity links

The site does not incorporate a state, regional or local biodiversity link.

2.1.7 Other landscape features

There are no other landscape features identified in the SEARs.

2.2 Landscape value score components

2.2.1 Percent native vegetation cover in the landscape

The area of native vegetation within the inner and outer circles (**Figure 2.1**), and the impact of the development, which requires the removal of 4.24 ha of native vegetation in the outer circle and 2.36 ha within the inner circle, was assessed consistent with Table 9 in FBA (OEH 2014). The results of the analysis are shown in **Table 2.2**. Due to the relatively minor amount of clearing proposed, no change in future score is recorded for this variable.

Table 2.2: Estimates of native vegetation and scores in the inner and outer assessment circles.

Assessment circle	Current (ha)	Current (%)	Current (score)	Future (ha)	Future (%)	Future (score)
Inner (100 ha)	12.8	11 - 15	2.25	10.44	11 - 15	2.25
Outer (1,000 ha)	157.11	16 - 20	3.75	152.87	16 - 20	3.75

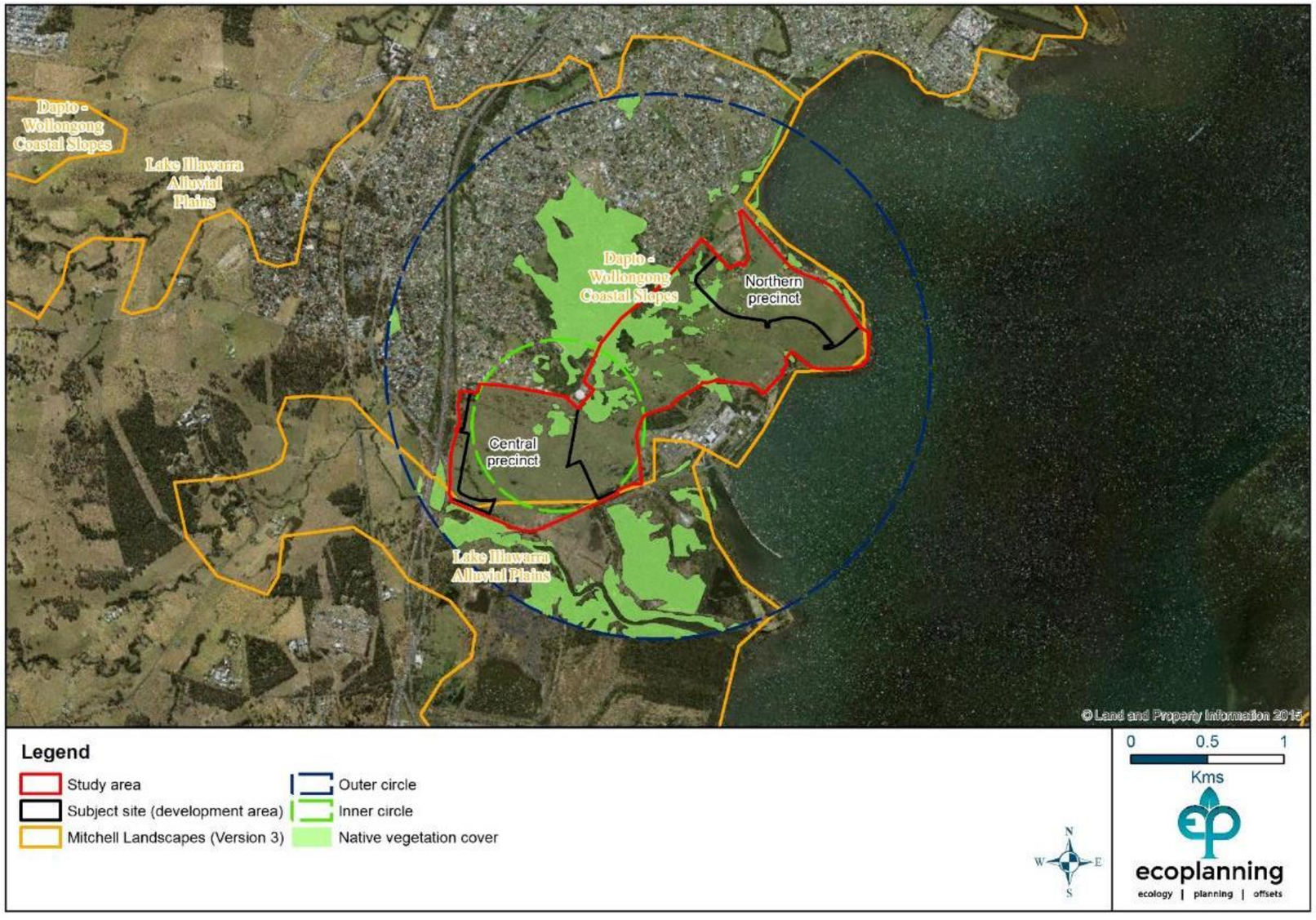

Figure 2.1: Location map.

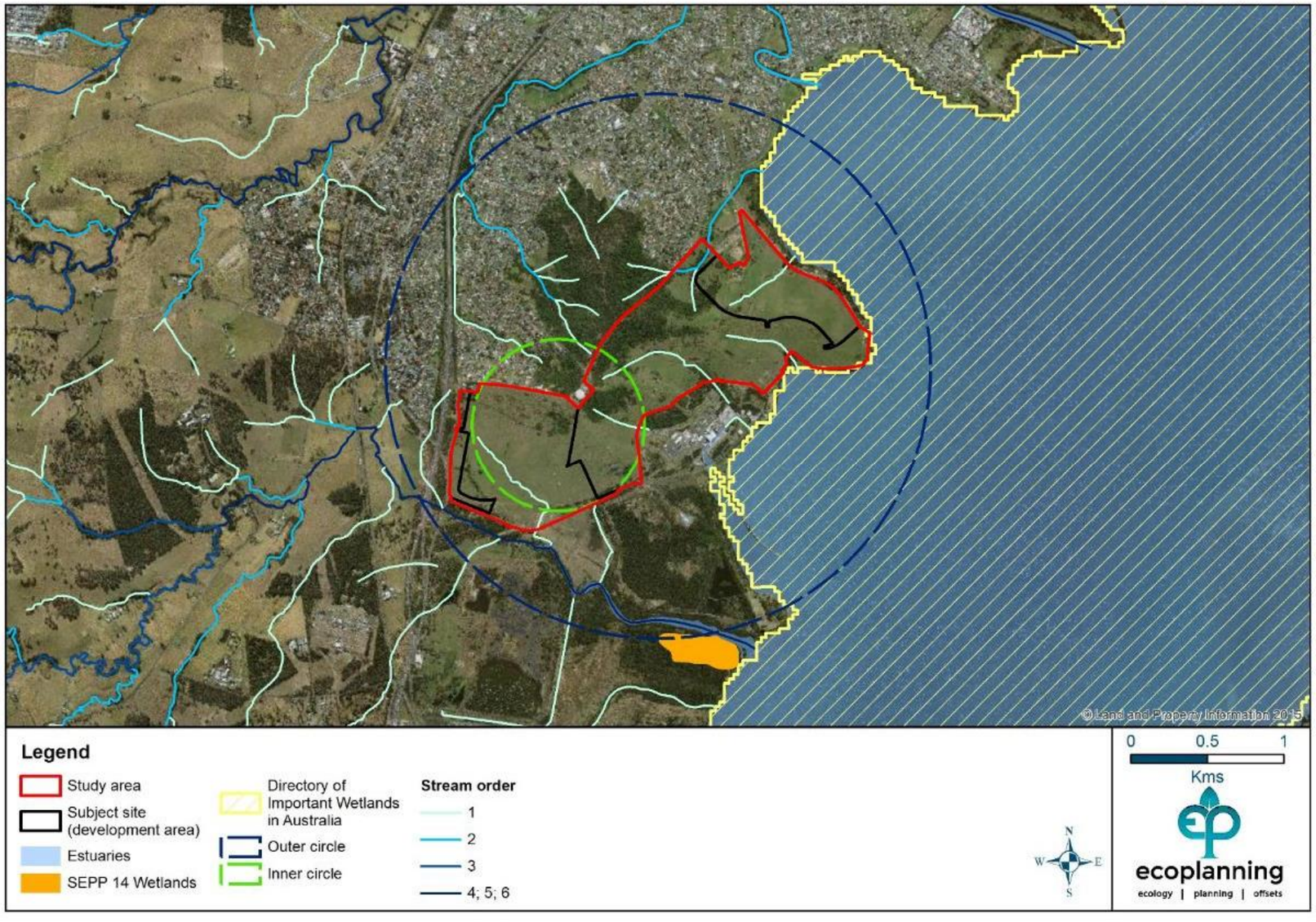

Figure 2.2: Estuaries, important wetlands and drainage.

2.2.2 Connectivity value

The subject site is not part of a State or Regionally Significant Biodiversity Link, as identified by the 'connectivity value classes' in Table 10 of Appendix 4 in the FBA.

Within the outer assessment circle is both a mapped estuary (Lake Illawarra), and two mapped important wetlands (Lake Illawarra and a mapped SEPP 14 wetland). The study area lies within 50 m of the mapped area of Lake Illawarra (as defined by DIWA) and only 3 m from the mapped estuary extent of Lake Illawarra. However, the study area does not represent the development area being assessed by this FBA, and is therefore not relevant for the assessment of connectivity.

A Near Analysis was conducted to determine the distance from the subject site (development areas) to the nearest mapped polygon for both the DIWA and estuary extents of Lake Illawarra. The Near Analysis revealed that the subject site lies 57 m from the DIWA mapped extent of Lake Illawarra, with the subject site lying 51 m from the mapped estuary extent of Lake Illawarra. As the subject site lies outside the 50 m buffer for both layers a full connectivity assessment was not required.

The subject site is generally poorly connected, with some connectivity to the large patch of vegetation to the north, however little connectivity remains from vegetation currently on site to the east, west or south. The site is therefore the end of a corridor, rather than providing connectivity itself.

As only a small area of native vegetation is to be impacted, and the site performs no corridor role, no impacts to connectivity are expected. This includes no changes to either the minimum width, or the overall condition, of the link.

Based on the above the following was entered into the credit calculator:

- **Connectivity width:** 100 - 500 m before development and after development;
- **Connectivity over storey condition:** PFC > 25% of benchmark before development and after development;
- **Connectivity mid storey/ground cover condition:** PFC of mid-storey/ground cover > 50% benchmark before development and after development.

As there was no change in the current or future connectivity scores, no score was recorded for this variable.

2.2.3 Patch size

Patch size as defined by the FBA as *'an area of native vegetation that:*

a) Occurs on the development site or offset site, and
b) Is in moderate to good condition, and
c) Includes native vegetation that has a gap of <100 m from the next area of moderate to good condition native vegetation (or ≤ 30 m for non-woody vegetation)

Patch size may extend onto adjoining land that is not part of the development site.'

Patch size was calculated for the vegetation on the development site using the field validated map of vegetation types identified and the NPWS 2002 Illawarra vegetation map referred to

earlier. As described above the site is connected to the north, but has little connection to the east, south and west. The total patch size calculated was 85.0 ha.

2.3 Landscape value score

Using the above data, the final landscape score was calculated to be **9** (**Table 2.3**).

Table 2.3: Landscape score components.

Landscape score component	Score Awarded
Change in connectivity score	0
Decrease in native vegetation cover (inner assessment circle) score	0
Decrease in native vegetation cover (outer assessment circle) score	0
Patch size area score	9
Total	**9**

3. Native vegetation

3.1 Plant community types (PCTs) and threatened ecological communities

Desktop assessment determined the following native vegetation communities to be present in the study area (NPWS 2002):

- Moist Box-Red Gum Foothills Forest (MU13)
- Coastal Grassy Red Gum Forest (MU23)
- Lowland Woollybutt-*Melaleuca* Forest (MU24)
- Coastal Swamp Oak Forest (MU36)
- Lowland Dry-subtropical Rainforest (MU4)

Field assessment confirmed the presence of three of the five communities, including Moist Box Red Gum Foothills Forest (MU13), Coastal Grassy Red Gum Forest (MU23) and Coastal Swamp Oak Forest in the study area. These communities occur in a range of condition classes, which are discussed in more detail below and in **Section 3.2.1**.

Moist Box-Red Gum Foothills Forest (MU13) (NPWS 2002) is equivalent to the PCT, *Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion* (SR652, PCT1245) (OEH 2017). The Moist Box-Red Gum Foothills Forest vegetation in the study area is not currently listed as a TEC under the EPBC or TSC Acts. Two distinct condition classes of this community occur in the study area, including 'Lantana' and 'underscrubbed'. The vegetation in the west of the study area has been categorised as 'underscrubbed' due to the removal *Lantana* camara (Lantana), evidence of grazing and the lack of native midstorey species. The 'Lantana' condition class of Moist Box-Red Gum Foothills Forest (MU13) contains a high cover of *Lantana camara*, which dominates the midstorey.

Coastal Grassy Red Gum Forest (MU23) is equivalent to the PCT, *Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion* (SR545; PCT838) (OEH 2017). The Coastal Grassy Red Gum Forest in the study area is a component of Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion, which is a listed Endangered Ecological Community (EEC) under the TSC Act and a Critically Endangered Ecological Community (CEEC) under the EPBC Act. Three distinct condition classes of this community occur in the study area, including 'Lantana', 'underscrubbed' and 'Scattered Paddock Trees (SPT)'. Areas of 'underscrubbed' vegetation are floristically similar to the 'Lantana' condition class, however generally contains less cover of *Lantana* camara and other woody weeds, such as *Senna pendula* var. *glabrata* and *Ochna serrulata* (Mickey Mouse Plant). Furthermore, the 'underscrubbed' vegetation has a lower native species richness, particularly of native midstorey species. The vegetation in a 'SPT' condition contains scattered midstorey and canopy species, with a grazed groundlayer with a high proportion of exotic species.

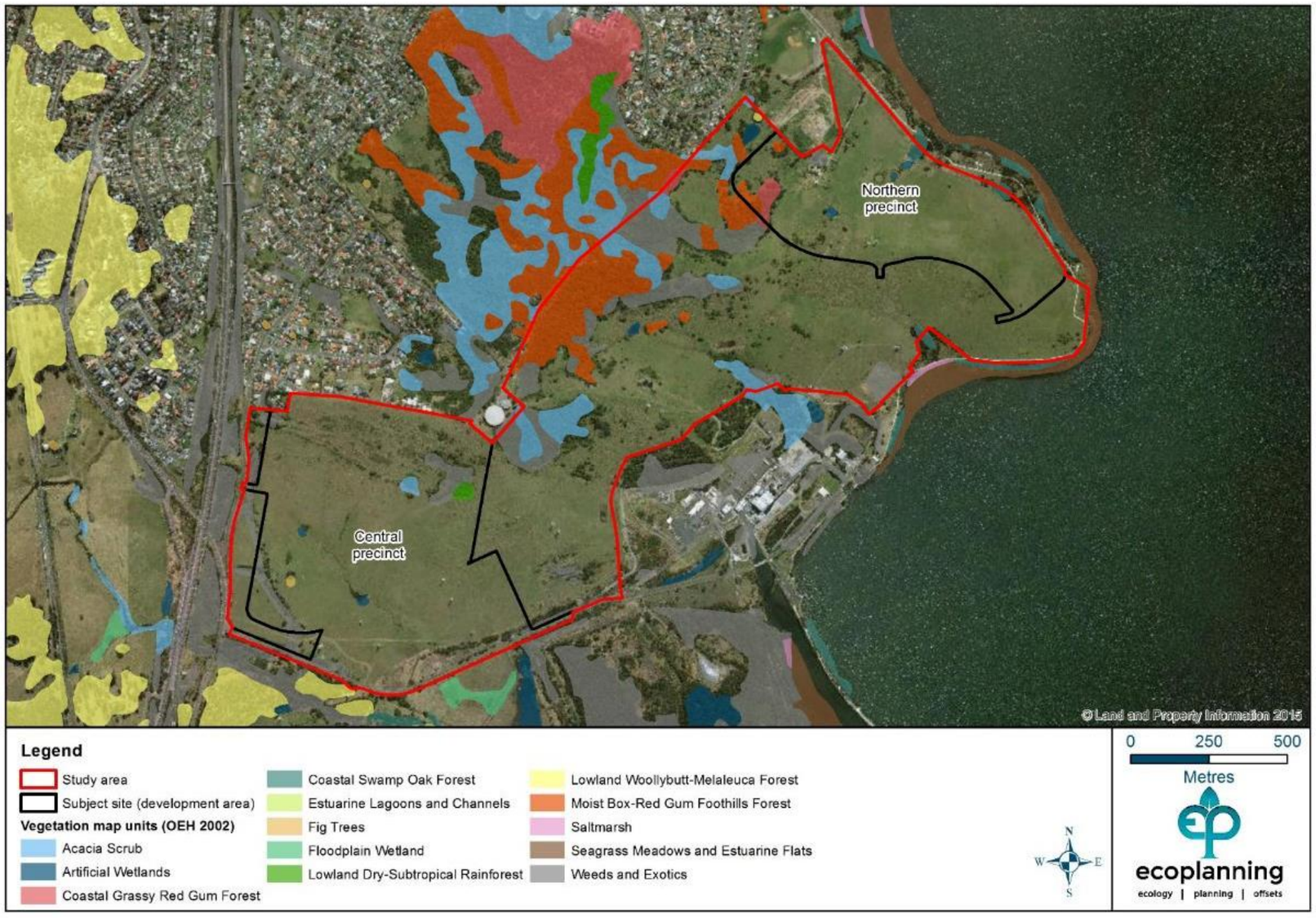

Figure 3.1: Vegetation map units (OEH 2002)

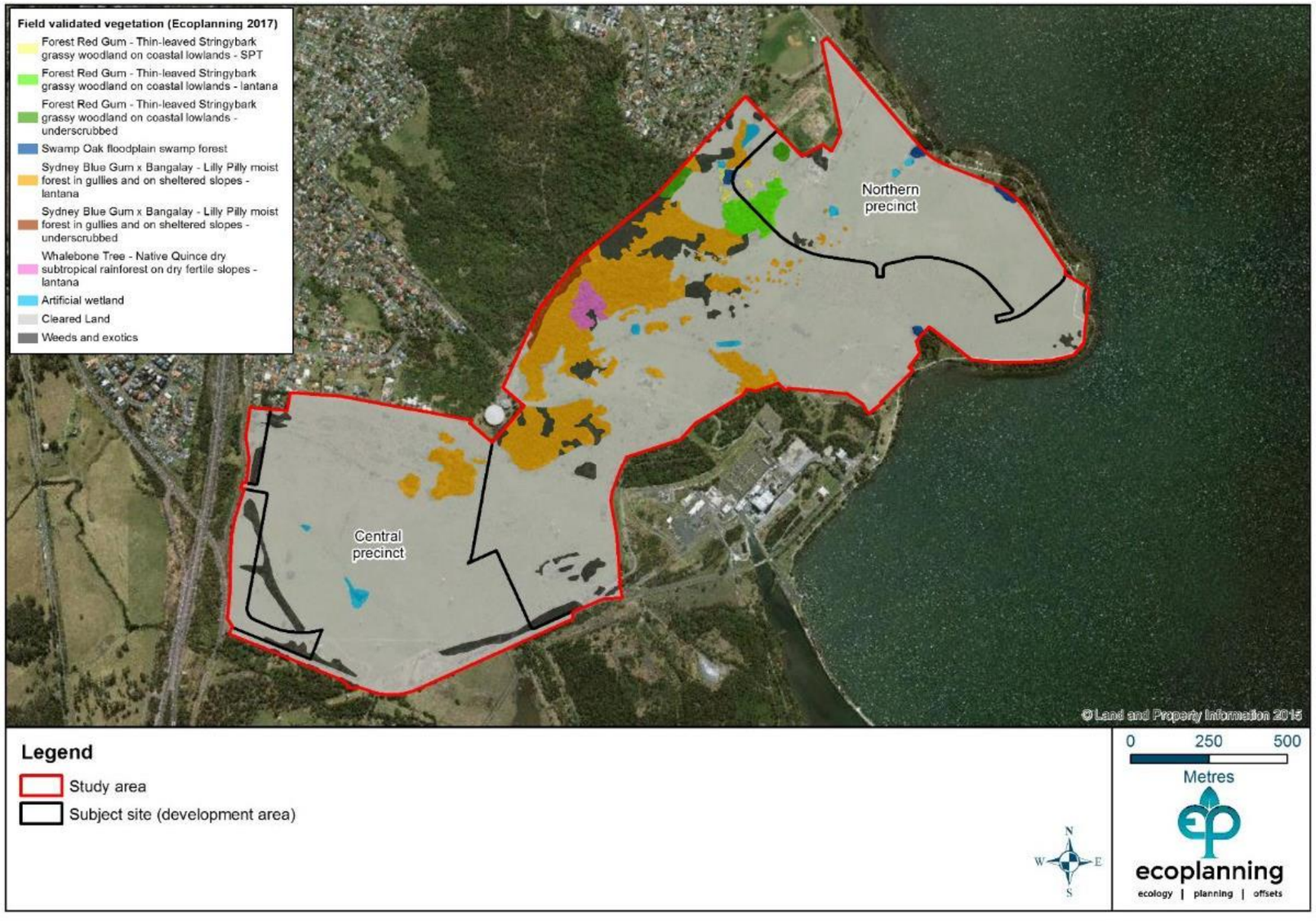

Figure 3.2: Field validated vegetation (Ecoplanning 2017).

An area of Lowlands Dry-Subtropical Rainforest (MU4) has been mapped in the western portion of the northern precinct. This vegetation occurs in the condition class 'Lantana' and is surrounded by an extensive area of Moist Box-Red Gum Foothills Forest. The remainder of the study area consists of 'cleared land', which is mostly comprised of exotic grasses and herbaceous weeds. Occasional native groundlayer species, such as *Carex longebrachiata* are scattered throughout the cleared land, which otherwise contains a low cover and richness of native flora species. As such, this community does not constitute Derived Native Grassland (DNG), and a Plant Community Type (PCT) cannot be prescribed. Additional parts of the study area have been mapped as 'Weeds and exotics', which consists of exotic woody weeds species, including *Lantana camara*, *Schinus areira* (Peppercorn Tree), *Senna pendula* var. *glabrata* and *Solanum mauritianum* (Wild Tobacco). Similarly, these areas could not be allocated a PCT, as the areas of the site mapped as 'Weeds and exotics' are highly degraded and consists almost exclusively of woody weeds species.

Other vegetation (cleared land, weeds and exotics and artificial wetland) constitute 191.03 ha, or 87.2% of the study area. Within the subject site (development lands) 97.07 ha are identified as other vegetation, which equates to 95.8% of the development lands.

Native vegetation occupies 12.8% (27.99 ha) of the study area. Within the subject site (development lands) Sydney Blue Gum x Bangalay - Lilly Pilly moist forest is mapped over 2.55 ha (2.5% of the development site), Forest Red Gum - Thin-leaved Stringybark grassy woodland is mapped over 1.36 ha (1.3% of the development site) and Swamp Oak floodplain swamp forest mapped over 0.33 ha (0.3% of the development site). Whalebone Tree - Native Quince dry subtropical rainforest is not mapped within the subject site, with only 1.1 ha identified within the study area. Additional information on the four vegetation types in the study area is provided below. The total area of each vegetation type is displayed in **Table 3.1**.

Table 3.1: Vegetation types and zones and the total area within the study area and subject site.

Vegetation type (NPWS 2002)	Plant community type (OEH 2017)	Threatened ecological communities		Condition (Ancillary code)	Area within study area (ha)	Area within subject site (development lands) (ha)
		EPBC Act	TSC Act			
Moist Box-Red Gum Foothills Forest (MU13)	PCT 1245 - Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion (SR652)	N	N	Under-scrubbed	0.89	0.00
				Lantana	22.20	2.55
Coastal Grassy Red Gum Forest (MU23)	PCT 838 - Forest Red Gum - Thin-leaved Stringybark grassy woodland	CEEC	EEC	Under-scrubbed	0.71	0.25
				Lantana	2.22	0.99

Vegetation type (NPWS 2002)	Plant community type (OEH 2017)	Threatened ecological communities		Condition (Ancillary code)	Area within study area (ha)	Area within subject site (development lands) (ha)
		EPBC Act	TSC Act			
	on coastal lowlands, southern Sydney Basin Bioregion (SR545)			Scattered Paddock Trees	0.30	0.12
Lowland Dry-Subtropical Rainforest (MU4)	PCT 1300 - Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion (SR662)	N	EEC	Lantana	1.10	0.00
Coastal Swamp Oak Forest (MU36)	PCT 1232 - Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion (SR649)	N	EEC	Under-scrubbed	0.57	0.33
-	-	N/A	N/A	Cleared Land	178.84	93.67
	-	N/A	N/A	Weeds and Exotics	11.11	2.81
	-	N/A	N/A	Artificial wetland	1.08	0.59
Total					**219.02**	**101.31**

3.1.1 Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion (SR652; PCT1245)

This vegetation type is located along the western boundary of the northern precinct and is the dominant vegetation community in the study area. A majority of the community retains direct connectivity with Mount Brown Reserve. However, several isolated patches of vegetation are also mapped in the east and north of the northern precinct, adjacent to the drainage lines and artificial wetlands. This community is characterised by an open forest with an established overstorey of *Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus quadrangulata* (White-topped Box) and *Eucalyptus saligna* x *botryoides* (Wollongong Woollybutt). This vegetation community has been separated from Coastal Grassy Red Gum Forest based on an increase in the abundance of *E. quadrangulata* and mesic shrub species. *E. tereticornis* is a dominant

canopy species in the vegetation mapped as Sydney Blue Gum x Bangalay - Lilly Pilly moist forest and Forest Red Gum - Thin-leaved Stringybark grassy woodland. As such, *E. tereticornis* did not provide a good indication of extents of the two communities.

A majority of the vegetation type has a moderate – high cover of woody weeds in the midstorey and has been mapped under the condition class 'Lantana' (**Figure 3.3**). A small strip of vegetation along the western boundary of the study area has been mapped as 'underscrubbed'. This vegetation contains minimal *Lantana camara*,* which has likely been removed in the past adjacent to the access road (**Figure 3.4**). This has allowed cattle to access and graze in the vegetation zone, thus preventing the establishment of native midstorey species. All patches of Sydney Blue Gum x Bangalay - Lilly Pilly moist forest occur in a degraded condition, with few intact areas, due to weed infiltration, grazing and past clearing. Some sections of the vegetation type contain a low – moderate abundance and cover of herbaceous weeds and exotic grasses, including *Bidens pilosa** (Cobblers Peg), *Chloris gayana** (Rhodes Grass), *Cirsium vulgare** (Spear Thistle), *Ehrharta erecta** (Panic Veldtgrass), *Senecio madagascariensis** (Fireweed) and *Sida rhombifolia** (Paddy's Lucerne).

A low mesic native shrub layer is present through portions of the vegetation zone, including *Notelaea venosa* (Veined Mock-olive), *Alectryon subcinereus* (Native Quince), *Backhousia myrtifolia* (Grey Myrtle), *Breynia oblongifolia* (Coffee Bush), *Clerodendrum tomentosum* (Hairy Clerodendrum), *Myrsine variabilis*, and *Streblus brunonianus* (Whalebone Tree). The groundlayer includes native groundcovers, grasses and ferns, such as *Carex longebrachiata, Galium murale* (Small Bedstraws), *Oplismenus imbecillis* (Creeping Beard Grass), *Pellaea falcata* (Sickle Fern), *Pseuderanthemum variable* (Pastel Flower), *Microlaena stipoides* var. *stipoides* (Weeping Grass) and *Nyssanthes diffusa* (Barbwire Weed). A dense cover and abundance of mesic midstorey species, such as those listed above supports the classification of this vegetation as Sydney Blue Gum x Bangalay - Lilly Pilly moist forest as opposed to Forest Red Gum - Thin-leaved Stringybark grassy woodland (TSSC 2016). A summary of the PCT profile for this vegetation type in the Vegetation Information System (VIS) (OEH (2017) is provided in **Table 3.2**. Species recorded onsite within this patch are highlighted in **bold text**.

Figure 3.3: Sydney Blue Gum x Bangalay - Lilly Pilly moist forest 'Lantana' in the west of the study area.

Figure 3.4: Sydney Blue Gum x Bangalay - Lilly Pilly moist forest 'underscrubbed' in the north west of the study area.

Table 3.2: VIS plant community type profile (OEH 2017) – Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion (SR652; PCT1245).

Plant community type (PCT)	Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion
PCT and BioMetric veg type (BVT) ID	PCT 1245 / BVT: HN597, ME044 and SR652
Vegetation formation	Wet Sclerophyll Forests (Shrubby sub-formation)
Vegetation class	North Coast Wet Sclerophyll Forests
Upper stratum	*Acmena smithii* (Lilly Pilly), *Livistona australis* (Cabbage Gum), *Synoum glandulosum* (Scentless Rosewood), *Pittosporum undulatum* (Sweet Pittosporum), *Cryptocarya glaucescens* (Jackwood), *Eucalyptus saligna* (Sydney Blue Gum), ***Eucalyptus quadrangulata*** **(White-topped Box)**, *Eucalyptus pilularis* (Blackbutt) and *Syncarpia glomulifera* (Turpentine).
Middle stratum	***Notelaea venosa*** **(Vined Mock-olive),** ***Clerodendrum tomentosum*** **(Hairy Clerodendrum)** and *Eupomatia laurina* (Bolwarra).
Ground stratum	*Doodia aspera* (Prickly Rasp Fern), **Pseuderanthemum variable (Pastel Flower)**, ***Oplismenus imbecillis****, Gymnostachys anceps* (Settler's Twine), *Blechnum cartilagineum* (Gristle Fern), *Adiantum formosum* (Giant Maidenhair) and *Calochlaena dubia* (Rainbow Fern).
Landscape position	Occurs on sheltered slopes in gullies and on escarpments with loamy soils below 400m south from the Illawarra to near Batemans Bay. (In relation to HN), Occurs on sheltered slopes in gullies and on escarpments with loamy soils below 400m south from the Illawarra.
Profile source	WSF p110 (Tozer et al. 2006)
Full reference details	Tozer, M.G., Turner, K., Simpson, C., Keith, D.A., Beukers, P., MacKenzie, B., Tindall, D. & Pennay, C., 2010 Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. Version 1.0;OEH (2013) The Native Vegetation of the Sydney Metropolitan Area Version 2.0 NSW Office of Environment and Heritage Sydney.
Estimate remaining pre-European extent rounded to nearest 5%	60% total (Southern Rivers (SR652 – 45%))
TEC Name (Listing status)	TSC Act: Not listed EPBC Act: Not listed

3.1.2 Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion(SR545; PCT838)

This vegetation type is located in the north of the study area, and has been mapped in two condition classes across several distinct patches. It is characterised by dry grassy forest with an established overstorey of *E. tereticornis*, similar to the Sydney Blue Gum x Bangalay - Lilly Pilly moist forest. However, generally contains a lower cover of mesic midstorey species and occurs in more exposed areas and in lower elevations within the study area. *Lantana camara* dominates the midstorey through a majority of the vegetation community (**Figure 3.5**), with exception for two small patches mapped as 'underscrubbed' (**Figure 3.6**). The 'underscrubbed' vegetation contains a low abundance and cover of exotic species, including *Anagallis arvensis, Axonopus fissifolius* (Narrow-leafed Carpet Grass)*, Ehrharta erecta, Lantana camara, Olea europaea* subsp. *cuspidata*, Paspalum *dilatatum* (Paspalum) and *Verbena bonariensis* (Purpletop).

Native midstorey species are present, although occur in low abundance and cover. The midstorey consists of native shrubs and small trees, including *Acacia maidenii* (Maiden's Wattle)*, Breynia oblongifolia*, *Callistemon salignus* (Willow Bottlebrush), *Cryptocarya microneura* (Murrogun), *Abutilon oxycarpum* (Straggly Lantern-bush), *Melaleuca styphelioides* (Prickly-leaved Tea Tree), *Melia azedarach* and *Streblus brunonianus.* The groundlayer is dominated by native forbs, grasses and scramblers, including *Carex longebrachiata*, *Chloris ventricosa* (Plump Windmill Grass), *Commelina cyanea* (Native Wandering Jew)*, Desmodium varians* (Slender Tick-trefoil), *Dichondra repens* (Kidney Weed), *Microlaena stipoides* var. *stipoides*, and *Sporobolus elongatus* (Slender Rat's Tail Grass). The 'underscrubbed' vegetation is not fenced, thus is still regularly grazed by cattle. The 'Lantana' condition class shows signs of grazing, however cattle are partly impeded by the dense *Lantana camara* midstorey.

Sections of the vegetation type have been cleared, particularly of their early mature - mature *Eucalyptus* spp., such as *E. tereticornis.* Areas of the study area where this has occurred has been classified under the condition class scattered paddock trees 'SPT'. This condition class is mostly confined to the north of the large patch of Forest Red Gum - Thin-leaved Stringybark grassy woodland mapped as the 'Lantana' condition class (**Figure 3.7**). Canopy species, including *E. tereticornis* are present in this area, however the canopy mostly consists of large *Melaleuca styphelioides.*

A summary of the PCT profile for this vegetation type in the Vegetation Information System (VIS) (OEH (2017) is provided in **Table 3.3**. Species recorded onsite within this patch are highlighted in **bold text**.

Figure 3.5: Forest Red Gum - Thin-leaved Stringybark grassy woodland 'Lantana' in the north of the development site.

Figure 3.6: Forest Red Gum - Thin-leaved Stringybark grassy woodland 'underscrubbed' in the north of the development site.

Figure 3.7: Forest Red Gum - Thin-leaved Stringybark grassy woodland 'SPT' in the north of the development site

Table 3.3: VIS plant community type profile (OEH 2017) – Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion (SR545; PCT838).

Plant community type (PCT)	Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion
PCT and BioMetric veg type (BVT) ID	PCT 838/ BVT: SR545
Vegetation formation	Grassy Woodlands
Vegetation class	Coastal Valley Grassy Woodlands
Upper stratum	*Eucalyptus eugenioides* (Thin-leaved Stringybark) and ***Eucalyptus tereticornis*** **(Forest Red Gum)**
Middle stratum	***Breynia oblongifolia*** **(Coffee Bush)**, *Eustrephus latifolius* (Wombat Berry), ***Geitonoplesium cymosum*** **(Scrambling Lily)**, *Myrsine variabilis,* ***Pandorea pandorana*** **(Wonga Wonga Vine)** and *Pittosporum undulatum* (Sweet Pittosporum)
Ground stratum	***Carex longebrachiata, Commelina cyanea*** **(Native Wandering Jew)**, ***Desmodium gunnii*** **(Slender Tick-trefoil)**, ***Dichondra repens*** **(Kidney Weed)**, ***Microlaena stipoides*** **var.** ***stipoides*** **(Weeping Grass)**, ***Oplismenus imbecillis****, Poa labillardierei* var. *labillardierei* (Tussock), *Pratia purpurascens* (Whiteroot) and *Themeda australis* (Kangaroo Grass)
Landscape position	Occurs on lower slopes in coastal rainshadow valleys, below 350m ASL, from Wollongong to Milton and west to Yalwal.
Profile source	GW p34 (Tozer et al. 2006)
Full reference details	Tozer, M.G., Turner, K., Keith, D.A., Tindall, D., Pennay, C., Simpson, C., MacKenzie, B., Beukers, M. and Cox, S. (2010) Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. Cunninghamia 11(3): 359-406.
Estimate remaining pre-European extent rounded to nearest 5%	85%
EEC Name (Listing status)	Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion. TSC Act: EEC EPBC Act: CEEC

3.1.3 Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion (SR662; PCT1300)

This vegetation type is located on the eastern facing slope in the in the west of the northern precinct. Areas of Sydney Blue Gum x Bangalay - Lilly Pilly moist forest surround the vegetation type, which occurs in areas with greater exposure and at higher elevations. The community is characterised by a tall closed forest with a dense canopy, including *Acmena smithii* (Lilly Pilly), *Toona ciliata* (Red Ash), *Dendrocnide excelsa* (Giant Stinging Tree), *Diploglottis australis* (Native Tamarind) and *Melicope micrococca* (Hairy-leaved Doughwood) (**Figure 3.8**) Native vines are established in the midstorey and overstorey, including *Eustrephus latifolius* (Wombat Berry) *Geitonoplesium cymosum* (Scrambling Lily), *Cayratia clematidea* (Native Grape), *Pandorea pandorana* (Monkey Rope), and *Smilax australis* (Lawyer Vine). This vegetation is likely to have occurred over a larger area than identified, however, now mostly consists of Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in a 'Lantana' condition class.

A sparse mesic native shrub layer is present, including *Alectryon subcinereus, Clerodendrum tomentosum*, *Croton verreauxii* (Green Native Cascarilla), *Cryptocarya microneura*, *Melicope micrococca, Elaeodendron australe, Streblus brunonianus* and *Syzygium australe* (Brush Cherry). The groundlayer predominantly consists of ferns, such as *Adiantum formosum* (Black Stem), with occasional forbs and grasses, including *Oplismenus imbecillis*, *Pseuderanthemum variable* and *Urtica incisa* (Stinging Nettle). Lowlands Dry Subtropical Rainforest (MU4), as described by NPWS (2002) typically consists of a low dense forest of small shrubs and trees, and usually lacks the presence of dominant rainforest canopy species, such as *Toona ciliata, Dendrocnide excelsa* and *Diploglottis australis*. However, in deeper gully lines, the rainforest can become taller and subtropical species, including *Toona ciliata* and *Dendrocnide excelsa* can become more pronounced, and appear as characteristic canopy species (NPWS 2002).

A summary of the PCT profile for this vegetation type in the Vegetation Information System (VIS) (OEH (2017) is provided in (**Table 3.4**). Species recorded onsite within this patch are highlighted in **bold text**.

Table 3.4: VIS plant community type profile (OEH 2017) – Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion (SR662; PCT1300).

Plant community type (PCT)	Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion
PCT and BioMetric veg type (BVT) ID	PCT 1300/ BVT: SR545 and HN608
Vegetation formation	Rainforests
Vegetation class	Dry Rainforests
Upper stratum	***Streblus brunonianus* (Whalebone Tree)**, ***Alectryon subcinereus* (Native Quince)**, *Pittosporum undulatum* (Sweet Pittosporum), *Diospyros australis* (Black Plum), *Alphitonia excelsa* (Red Ash), ***Acacia maidenii* (Maiden's Wattle)** and *Pouteria australis* (Black Apple).
Middle stratum	*Backhousia myrtifolia* (Grey Myrtle), *Guioa semiglauca* (Guioa), *Breynia oblongifolia* (Coffee Bush), ***Clerodendrum tomentosum* (Hairy Clerodendrum)**, ***Croton verreauxii* (Green Native Cascarilla)**, ***Eustrephus latifolius* (Wombat Berry)**, ***Geitonoplesium cymosum* (Scrambling Lily)**, *Maclura cochinchinensis* (Cockspur Thorn) and ***Marsdenia rostrata* (Milk Vine)**.
Ground stratum	*Asplenium flabellifolium* (Necklace Fern), *Doodia aspera* (Prickly Rasp Fern), *Gymnostachys anceps* (Settler's Twine), ***Oplismenus imbecillis, Pellaea falcata* (Sickle Fern)** and ***Pseuderanthemum variable* (Pastel Flower)**.
Landscape position	Occurs mainly on dry slopes on fertile soils below about 300m in the Illawarra-Kiama and Milton areas.
Profile source	Suballiance 23 (Floyd 1990); Vegetation Group 167 (Gellie 2005); RF p111 (Tozer at al. 2006)
Full reference details	Floyd A (1990). Australian Rainforest in New South Wales. Volume 2. Surrey Beatty & Sons Pty Ltd. Gellie, N.J.H. (2005) Native Vegetation of the Southern Forests: South-east Highlands, Australian Alps, South-west Slopes and SE Corner bioregions. Cunninghamia 9(2): 219-254 Tozer, M.G., Turner, K., Simpson, C., Keith, D.A., Beukers, P., MacKenzie, B., Tindall, D. & Pennay, C. (2006) Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. Version 1.0
Estimate remaining pre-European extent rounded to nearest 5%	10%
EEC Name (Listing status)	Illawarra Sub-tropical Rainforest in the Sydney Basin Bioregion TSC Act: EEC EPBC Act: N/A

Figure 3.8: Whalebone Tree - Native Quince dry subtropical rainforest ‘Lantana’ in the north west of the development site.

3.1.4 Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion (SR649; PCT1232)

This vegetation type is defined by several patches in the northern precinct, mostly adjacent to ephemeral drainage lines and the perimeter of the study area in proximity of Lake Illawarra. The canopy is exclusively dominated by *Casuarina glauca* (Swamp Oak), which defines the mapped extent of the community (**Figure 3.9**). The native midstorey is poorly represented, however occasional shrubs, such as *Myoporum acuminatum* (Boobialla) are present. The groundlayer lacks species, such as *Selliera radicans* (Swamp Weed), *Suaeda australis* and *Sarcocornia quinqueflora* (Samphire), typical of this community, where levels of salinity in the groundwater are higher. As such, the groundlayer mostly consists of species representative of less saline conditions, including *Alternanthera denticulata* (Lesser Joyweed), *Commelina cyanea, Cynodon dactylon* (Common Couch), *Nyssanthes diffusa*. This vegetation type consists of one condition class, which has been described as 'disturbed/shrubby'.

The groundlayer contains a reasonable proportion of exotic grasses and herbaceous weeds, including *Bidens pilosa**, *Digitaria sanguinalis** (Summer Grass), *E. erecta*, Paspalum dilatatum*, Senecio madagascariensis*, Solanum nigrum** and *Tradescantia fluminensis** (Wandering Jew). Exotic vines, including *Delairea odorata* (Cape Ivy) are present through the vegetation zone in low quantities. It is noted that a mixture of planted and remnant *Casuarina glauca* and *Melaleuca quinquenervia* (Broad-leaved Paperbark) is present between the study area and the edge of Lake Illawarra outside of the study area. Nevertheless, the Swamp Oak Floodplain Forest in the study area has been assessed as remnant vegetation.

A summary of the PCT profile for this vegetation type in the Vegetation Information System (VIS) (OEH (2017) is provided in **Table 3.5**. Species recorded onsite within this patch are highlighted in **bold text**.

Table 3.5: VIS plant community type profile (OEH 2017) – Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion (SR649; PCT1232).

Plant community type (PCT)	Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion
PCT and BioMetric veg type (BVT) ID	PCT 1232/ BVT: HN594, ME026 and SR649
Vegetation formation	Forested Wetlands
Vegetation class	Coastal Swamp Forest
Upper stratum	***Casuarina glauca*** **(Swamp Oak)** and *Melaleuca quinquenervia* (Broad-leaved Paperbark)
Middle stratum	***Myoporum*** **spp. (Boobialla)**, *Melaleuca ericifolia* (Swamp Paperbark) and *Melaleuca styphelioides* (Prickly-leaved Paperbark)
Ground stratum	*Juncus kraussii* (Sea Rush), *Samolus repens* (Creeping Brookweed), *Sarcocornia quinqueflora, Suaeda australis, Baumea juncea,* ***Cynodon dactylon*** **(Common Couch)**, ***Alternanthera denticulata*** **(Lesser Joyweed)**, *Carex appressa* (Tall Sedge), *Centella asiatica* (Indian Pennywort), ***Commelina cyanea*** **(Native Wandering Jew)** and *Phragmites australis* (Common Reed)
Landscape position	Occurs on sandy saline sediments fringing the high tide mark in coastal estuaries below 5m.
Profile source	FoW p105 (Tozer at al. 2006);
Full reference details	Tozer, M.G., Turner, K., Simpson, C., Keith, D.A., Beukers, P., MacKenzie, B., Tindall, D. & Pennay, C., 2010 Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. Version 1.0
Estimate remaining pre-European extent rounded to nearest 5%	5%
EEC Name (Listing status)	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions TSC Act: EEC EPBC Act: N/A

Figure 3.9: Swamp Oak floodplain swamp forest 'disturbed/shrubby' in the north of the development site.

3.1.5 Other vegetation

Three other distinct vegetation assemblages are recorded within the development site, but none are remnant native vegetation types. These vegetation assemblages include:

Cleared land

This vegetation zone includes all cleared areas of the site and is dominated by exotic grasses and herbaceous weeds (**Figure 3.10**). Cleared areas of the site are currently grazed by horses and cattle and are heavily degraded.

Weeds and exotics

This vegetation zone consists predominantly of woody weeds, which comprise 95 – 100% of the vegetation cover in the zone (**Figure 3.11**). Dominant woody weed species in this vegetation zone include *Lantana camara*, Olea europaea* subsp. *cuspidata** and *Senna pendula* var. *glabrata**. A majority of the vegetation mapped as 'weeds and exotics' is interspersed amongst the Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies in the west of the study area.

Artificial Wetlands

Includes all of the permanent waterbodies within the study area. Several artificial wetlands are located in the central and northern precinct, some of which contain macrophyte vegetation and were observed to contain a reasonable number of waterbirds.

Figure 3.10: Other vegetation ‘cleared land’ in the subject site.

Figure 3.11: Vegetation containing portions of 'weeds and exotics' in the south west of the study area.

3.2 Vegetation zones

3.2.1 Condition classes, subcategories and areas

The PCTs and condition classes described above were restricted to the subject site (development land) to identify vegetation zones for credit calculation purposes. Due to differences between the study area and subject site boundaries some vegetation zones identified within the broader study area were not within the subject site (development land).

One vegetation zone was mapped for the *Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion,* being the 'Lantana' zone. This zone predominantly occurs within the Central precinct, with a small area in the western and southern parts of the Northern precinct.

The *Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion* was identified as three distinct zones, being 'Underscrubbed', 'Lantana' and 'Scattered Paddock Trees'. The majority of this PCT is mapped as 'Lantana', however one patch of 'underscrubbed' condition occurs in the Northern precinct. A small area of 'Scattered Paddock Trees' is impacted within the Northern precinct. Due to the extremely small impact (0.12 ha) and the very small patches of this vegetation zone, it is proposed that the impact to this vegetation zone be combined with the 'Lantana' zone for credit calculation purposes. This approach is outlined in the BioBanking Assessment Methodology and Credit Calculator Operational Manual (DECC 2008) and has been applied to previous FBA assessments (see Ecoplanning 2016).

The small area of *Swamp Oak FloodplainForest, Sydney Basin Bioregion and South East Corner Bioregion* occurs under one vegetation zone, which has been classified as 'underscrubbed'. A number of patches of this zone are impacted within the Northern precinct.

The PCT *Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion* occurs in the west of the study area and does not occur within the subject site. Therefore, no impacts are recorded for this PCT and a vegetation zone for this PCT has not been entered into the credit calculator.

The impacts to native vegetation are caused by the construction of both the Central and Northern precincts. The total footprint is 101.32 ha, however, much of this area is already mapped as cleared land, weeds and exotics and artificial wetlands. The total impact to native vegetation is 4.24 ha across the subject site.

Figure 3.12 shows the spatial arrangement of the vegetation zones within the study site and associated plots and transects. **Figure 3.13** shows those vegetation zones impacted by the proposal.

Table 3.6 describes the zone mapped and total impacts.

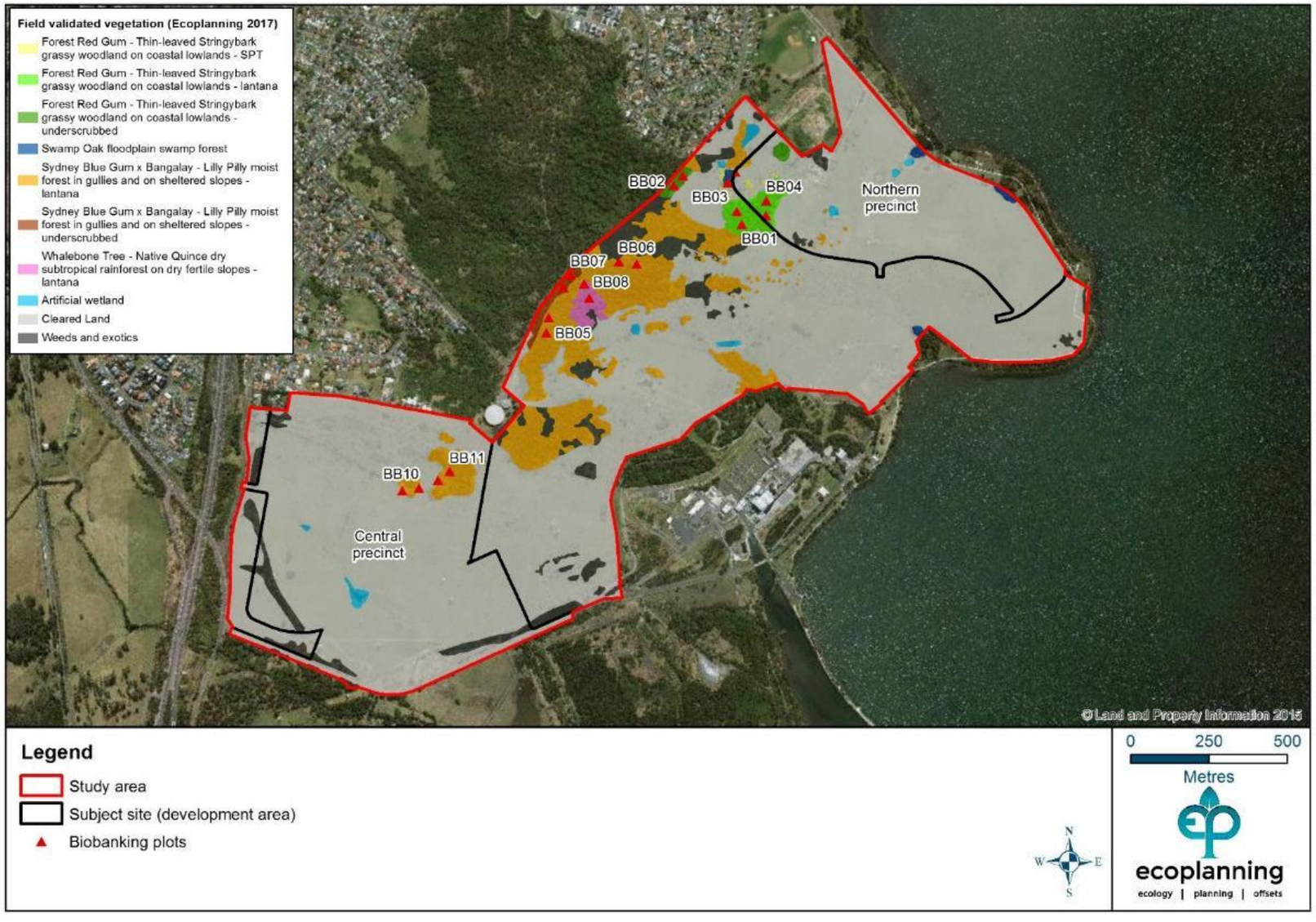

Figure 3.12: Vegetation zones and plot and transect locations.

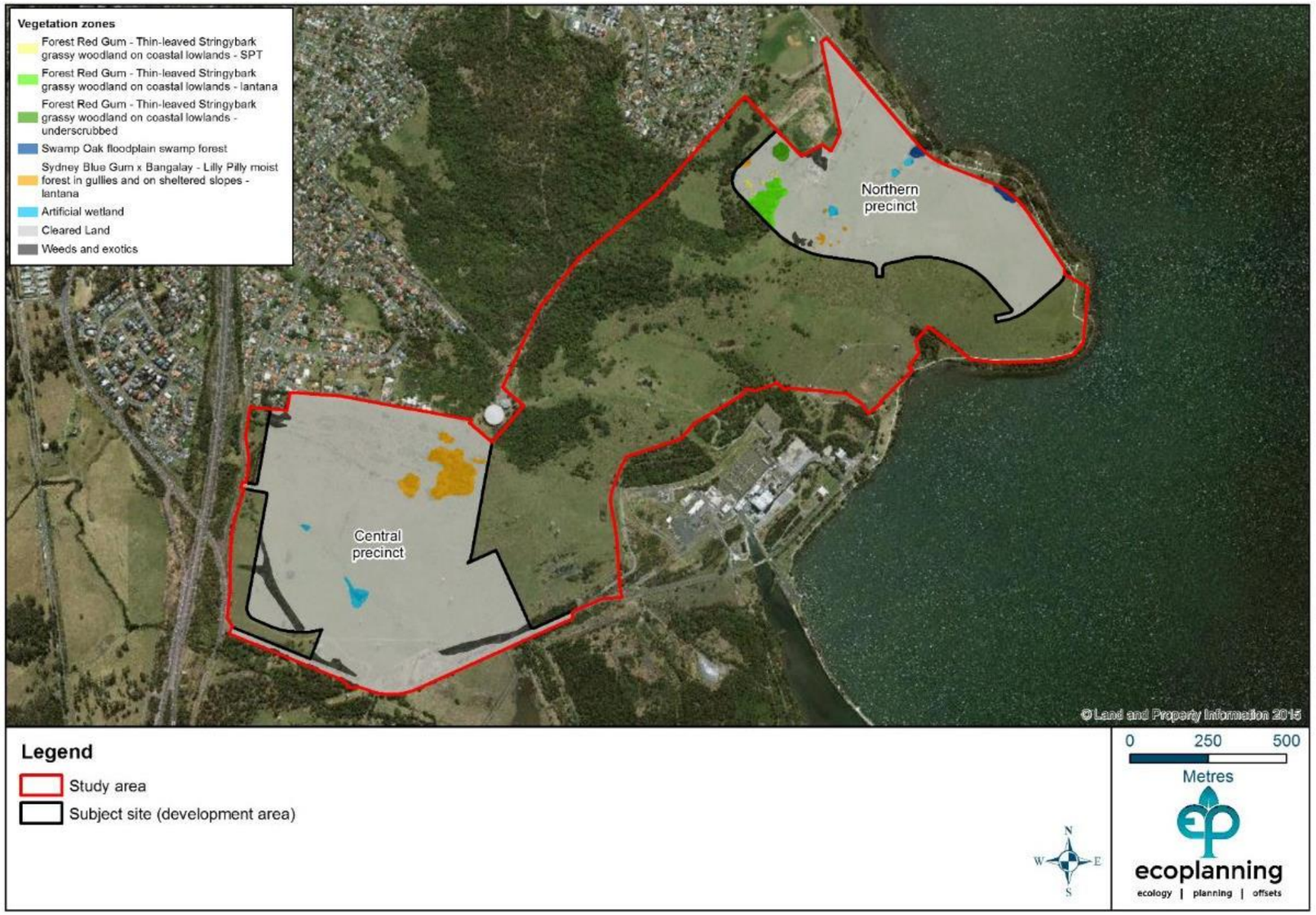

Figure 3.13: Vegetation zones impacted by the proposal.

Table 3.6: Vegetation zones.

Vegetation zone number	Plant community type	Condition	Ancillary code	Total impact on vegetation zone (ha)	Total impact entered into credit calculator (ha)
1	Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	Moderate / Good - Medium	Under-scrubbed	0.25	0.25
2	Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	Moderate / Good- Other	Lantana Scattered Paddock Trees	0.99 0.12^	1.11
3	Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion	Moderate / Good	Under-scrubbed	0.33	0.33
4	Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basi2.55n Bioregion	Moderate / Good	Lantana	2.55	2.55
Total		**N/A**	**N/A**	**4.24**	**4.24**

^ Note: due to the total area of impact being than 0.25 ha (total impact is 0.12 ha) the SPT vegetation zone has been combined with the Lantana zone for credit calculation purposes.

3.2.2 Plots and transects

Ten plot and transect surveys were completed across the study area (**Figure 3.12**). Plots were completed across the study area (both within and outside the subject site) to account for:

- The very small patch sizes of some vegetation zones within the subject site, where the capture of adequate plot data was not possible
- The variation in vegetation condition across the study area.

As some plots were completed in vegetation zones that are not impacted by the proposed development only eight plots were entered into the credit calculator, with plot 7 and plot 8 not

utilised. All plots were conducted in accordance with the FBA methodology (see **Appendix A** for field data sheet) with the number captured meeting (and in some cases exceeding) the minimum requirements of the methodology. The plot data captured is provided in **Table 3.7**.

Table 3.7: Plot and transect results.

Plot ID	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Veg Zone	Easting	Northing
BB01	30	21.5	0	84	0	30	61	0	1	35	2	298710	6178547
BB02	17	34	0	48	0	12	50.8	0	1	0	1	298493	6178672
BB03	23	36	0	4	4	14	77.5	0	0.5	35	3	298665	6178680
BB04	27	18.5	0	52	2	20	62	1	1	46	2	298788	6178623
BB05	47	42.5	1.5	42	8	58	118.5	3	0.5	25	4	298084	6178201
BB06	40	37	10.5	20	14	14	60	3	0.5	15	4	298316	6178428
BB07	31	27.5	11	84	6	72	34	3	1	50	N/A	298163	6178385
BB08	25	78.5	0	4	4	48	6.5	1	0.5	31	N/A	298206	6178357
BB10	22	12.5	16	8	4	22	83	1	0.5	25	4	297669	6177687
BB11	35	0	4	22	8	60	114.5	0	0.5	0	4	297776	6177756

3.2.3 Current and future site value scores

A range of site values were recorded for the vegetation zones assessed. Site value scores of between 36.46 – 62.5 were recorded. As the proposed development requires the complete removal of native vegetation within each zone mapped, the default future site value score of 0 has been maintained.

Table 3.8: Site values before and after development.

Vegetation zone	Plant community type	Area impacted (ha)	Site value score before development	Site value score after development
1	Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	0.25	36.46	0
2	Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	1.11	62.5	0
	Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion			0
3	Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion	0.33	43.75	0
4	Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion	2.55	51.91	0

4. Threatened species

4.1 Identifying threatened species for assessment

4.1.1 Ecosystem credit species

Ecosystem credit species are predicted based on habitat surrogates, and a number of ecosystem credit species are predicted on site. The ecosystem credit species predicted on site are provided in **Table 4.1**: Ecosystem credit species predicted on site.

Common Name	Scientific Name	TSC Act Status*	EPBC Act Status*	On site	For 'N' - Justification
Barking Owl	*Ninox connivens*	V	-	N	A majority of the subject site consists of cleared land. No hollow bearing trees were identified in the subject site. Therefore, the subject site provides marginal foraging habitat at best.
Bush Stone-curlew	*Burhinus grallarius*	E	-	N	A majority of the subject site consists of cleared land, thus providing minimal shelter and foraging habitat for the species. The subject site contains few habitat features, such as fallen logs.
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	V	-	Y	-
Eastern Freetail-bat	*Mormopterus norfolkensis*	V	-	Y	-
Flame Robin	*Petroica phoenicea*	V	-	N	Not common to the Illawarra, no records within 10 km of site.

Common Name	Scientific Name	TSC Act Status*	EPBC Act Status*	On site	For 'N' - Justification
Gang-gang Cockatoo	*Callocephalon fimbriatum*	V	-	N	A majority of the subject site consists of cleared land. No hollow bearing trees were identified in the subject site. Sufficient foraging habitat in the form of large *Eucalyptus* spp. and fruit bearing trees are scarce in the subject site.
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	V	-	N	A majority of the subject site consists of cleared land. No hollow bearing trees were identified in the subject site. The subject site contains minimal foraging habitat (i.e. does not support the preferred *Allocasuarina* spp. or *Casuarina* spp.)
Golden-tipped Bat	*Kerivoula papuensis*	V	-	N	Not known from the Illawarra. Foraging and roosting habitat for the species includes rainforest gullies or sclerophyll forest on mid to upper slopes, usually in close proximity to creeks and drainage lines. The subject site does not contain any hollow bearing trees and does not constitute foraging or breeding habitat for the species.
Greater Broad-nosed Bat	*Scoteanax rueppellii*	V	-	Y	-
Little Eagle	*Hieraaetus morphnoides*	V	-	Y	-
Little Lorikeet	*Glossopsitta pusilla*	V	-	Y	-

Common Name	Scientific Name	TSC Act Status*	EPBC Act Status*	On site	For 'N' - Justification
Masked Owl	*Tyto novaehollandiae*	V	-	N	A majority of the subject site consists of cleared land. No hollow bearing trees were identified in the subject site. Therefore, the subject site provides marginal foraging habitat at best.
Orange-bellied Parrot	*Neophema chrysogaster*	CE	CE	N	Only known as a vagrant to the Illawarra, primarily occurs in Tasmania and Victoria from a very small population size. Typical foraging habitat for the species consists of low samphire herblands, open grassy or heathland within 3km of the coast.
Scarlet Robin	*Petroica boodang*	V	-	Y	Recent nearby records (2015, 0.69 km from subject site.
Spotted Harrier	*Circus assimilis*	V	-	N	Not common in the locality, only 1 record within the past 25 years within 5km radius of subject site.
Spotted-tailed Quoll	*Dasyurus maculatus*	V	E	N	A majority of the subject site consists of cleared land, thus providing minimal shelter and foraging habitat for the species. The subject site contains few habitat features, such as fallen logs. Small caves, boulder piles or rock crevices.
Square-tailed Kite	*Lophoictinia isura*	V	-	Y	-

Common Name	Scientific Name	TSC Act Status*	EPBC Act Status*	On site	For 'N' - Justification
Swift Parrot	*Lathamus discolor*	E	CE	N	A majority of the subject site consists of cleared land. Few canopy species are present in the subject site. The vegetation in the subject site is unlikely to provide sufficient blossom to attract the species to forage in the site. This species is known to return to foraging site, however has not been recorded in the locality (5 km) since the 13/08/1990, approximately 3.75 km from the subject site (OEH 2017).
Turquoise Parrot	*Neophema pulchella*	V	-	N	Very uncommon in the Illawarra. Not recorded in past 25 years within 5 km of site. A majority of the subject site consists of cleared land. No hollow bearing trees were identified in the subject site. The species is known to utilise woodland or open forest and adjoining open areas, including grassland and a shrubland up to 250 m from vegetation that has a canopy cover no less than 50%. The vegetated areas of the subject site typically have a canopy cover of <30%.

Common Name	Scientific Name	TSC Act Status*	EPBC Act Status*	On site	For 'N' - Justification
Varied Sittella	*Daphoenositta chrysoptera*	V	-	N	Not common in the Illawarra. Not known from within 5km of the site in the past 25 years.
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	V	-	Y	-

* E- Endangered, V- Vulnerable

Table 4.1: Ecosystem credit species predicted on site.

Common Name	Scientific Name	TSC Act Status*	EPBC Act Status*	On site	For 'N' - Justification
Barking Owl	*Ninox connivens*	V	-	N	A majority of the subject site consists of cleared land. No hollow bearing trees were identified in the subject site. Therefore, the subject site provides marginal foraging habitat at best.
Bush Stone-curlew	*Burhinus grallarius*	E	-	N	A majority of the subject site consists of cleared land, thus providing minimal shelter and foraging habitat for the species. The subject site contains few habitat features, such as fallen logs.
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	V	-	Y	-
Eastern Freetail-bat	*Mormopterus norfolkensis*	V	-	Y	-
Flame Robin	*Petroica phoenicea*	V	-	N	Not common to the Illawarra, no records within 10 km of site.
Gang-gang Cockatoo	*Callocephalon fimbriatum*	V	-	N	A majority of the subject site consists of cleared land. No hollow bearing trees were identified in the subject site. Sufficient foraging habitat in the form of large *Eucalyptus* spp. and fruit bearing trees are scarce in the subject site.

Common Name	Scientific Name	TSC Act Status*	EPBC Act Status*	On site	For 'N' - Justification
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	V	-	N	A majority of the subject site consists of cleared land. No hollow bearing trees were identified in the subject site. The subject site contains minimal foraging habitat (i.e. does not support the preferred *Allocasuarina* spp. or *Casuarina* spp.)
Golden-tipped Bat	*Kerivoula papuensis*	V	-	N	Not known from the Illawarra. Foraging and roosting habitat for the species includes rainforest gullies or sclerophyll forest on mid to upper slopes, usually in close proximity to creeks and drainage lines. The subject site does not contain any hollow bearing trees and does not constitute foraging or breeding habitat for the species.
Greater Broad-nosed Bat	*Scoteanax rueppellii*	V	-	Y	-
Little Eagle	*Hieraaetus morphnoides*	V	-	Y	-
Little Lorikeet	*Glossopsitta pusilla*	V	-	Y	-
Masked Owl	*Tyto novaehollandiae*	V	-	N	A majority of the subject site consists of cleared land. No hollow bearing trees were identified in the subject site. Therefore, the subject site provides marginal foraging habitat at best.

Common Name	Scientific Name	TSC Act Status*	EPBC Act Status*	On site	For 'N' - Justification
Orange-bellied Parrot	*Neophema chrysogaster*	CE	CE	N	Only known as a vagrant to the Illawarra, primarily occurs in Tasmania and Victoria from a very small population size. Typical foraging habitat for the species consists of low samphire herblands, open grassy or heathland within 3km of the coast.
Scarlet Robin	*Petroica boodang*	V	-	Y	Recent nearby records (2015, 0.69 km from subject site.
Spotted Harrier	*Circus assimilis*	V	-	N	Not common in the locality, only 1 record within the past 25 years within 5km radius of subject site.
Spotted-tailed Quoll	*Dasyurus maculatus*	V	E	N	A majority of the subject site consists of cleared land, thus providing minimal shelter and foraging habitat for the species. The subject site contains few habitat features, such as fallen logs. Small caves, boulder piles or rock crevices.
Square-tailed Kite	*Lophoictinia isura*	V	-	Y	-

Common Name	Scientific Name	TSC Act Status*	EPBC Act Status*	On site	For 'N' - Justification
Swift Parrot	*Lathamus discolor*	E	CE	N	A majority of the subject site consists of cleared land. Few canopy species are present in the subject site. The vegetation in the subject site is unlikely to provide sufficient blossom to attract the species to forage in the site. This species is known to return to foraging site, however has not been recorded in the locality (5 km) since the 13/08/1990, approximately 3.75 km from the subject site (OEH 2017).
Turquoise Parrot	*Neophema pulchella*	V	-	N	Very uncommon in the Illawarra. Not recorded in past 25 years within 5 km of site. A majority of the subject site consists of cleared land. No hollow bearing trees were identified in the subject site. The species is known to utilise woodland or open forest and adjoining open areas, including grassland and a shrubland up to 250 m from vegetation that has a canopy cover no less than 50%. The vegetated areas of the subject site typically have a canopy cover of <30%.

Common Name	Scientific Name	TSC Act Status*	EPBC Act Status*	On site	For 'N' - Justification
Varied Sittella	*Daphoenositta chrysoptera*	V	-	N	Not common in the Illawarra. Not known from within 5km of the site in the past 25 years.
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	V	-	Y	-

* E- Endangered, V- Vulnerable

4.1.2 Species credit species

Geographic and habitat features

Species credit species are predicted following assessment of geographic and habitat features in the credit calculator, such as site location (IBRA subregion), PCTs and condition, patch size and the area of surrounding vegetation within the 1,000 ha circle. **Table 4.2** provides the answer to each question for the development site. Where the answer is 'yes', the species is retained in the assessment.

Question: *Do any of the following features occur on the area to be assessed? Tick the box wherever the feature occurs, or is likely to occur in the area to be assessed. Leave blank if the feature does not occur*.

Table 4.2: Assessment of geographic/habitat features.

Common name	Scientific name	Feature	Impact?
Giant Burrowing Frog	*Heleioporus australiacus*	land within 40 m of heath, woodland or forest with sandy or friable soils	Y
Large-eared Pied Bat	*Chalinolobus dwyeri*	land containing escarpments, cliffs, caves, deep crevices, old mine shafts or tunnels	N
Black Bittern	*Ixobrychus flavicollis*	land within 40 m of freshwater and estuarine wetlands, in areas of permanent water and dense vegetation or emergent aquatic vegetation	Y
Eastern Osprey	*Pandion cristatus*	land within 40 m of fresh/brackish/saline waters of larger rivers or creeks; estuaries, coastal lagoons, lakes and/or inshore marine waters	Y
Green and Golden Bell Frog	*Litoria aurea*	land within 100 m of emergent aquatic or riparian vegetation	Y
Australasian Bittern	*Botaurus poiciloptilus*	land containing brackish or freshwater wetlands	Y
Red-crowned Toadlet	*Pseudophryne australis*	heath or eucalypt forest on sandstone with a build-up of litter or other debris and containing, or within 40 m of, ephemeral or intermittent drainage lines	N
Stuttering Frog	*Mixophyes balbus*	rainforest or tall open wet forest with understorey and/or leaf litter and within 100 m of streams	N
Pink Robin	*Petroica rodinogaster*	land within 40 m of gullies in eucalypt forests	Y

Table 4.3: Species credit species requiring further assessment.

Common name	Scientific name	TSC Act Status*	EPBC Act Status*	Threatened Species Profile Database survey period	Surveyed required (Y/N)	Survey effort	Survey result
Australasian Bittern	*Botaurus poiciloptilus*	E	E	All year	Y	Surveys were conducted in and around the artificial wetlands in the northern and central precinct.	Not present
Black Bittern	*Ixobrychus flavicollis*	V	-	All year	Y	Surveys were conducted in and around the artificial wetlands in the northern and central precinct.	Not present
Chorizema parviflorum Benth. (a shrub) population, Wollongong and Shellharbour local government areas	*Chorizema parviflorum* Benth. (a shrub) population, Wollongong and Shellharbour local government areas	E	-	September - December	Y	The species was surveyed in the subject site in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	Not present
Eastern Osprey	*Pandion cristatus*	V	-	All year	N	-	**Not present** See section 6.5.1.3 (a) and section 6.5.1.3 (c) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B

Common name	Scientific name	TSC Act Status*	EPBC Act Status*	Threatened Species Profile Database survey period	Surveyed required (Y/N)	Survey effort	Survey result
Eastern Pygmy-possum	*Cercartetus nanus*	V	-	January – April and September - December	N	-	**Not present** See section 6.5.1.3 (a) and section 6.5.1.3 (d) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B
Giant Burrowing Frog	*Heleioporus australiacus*	V	V	January – May and September to December	N	-	**Not present** See section 6.5.1.3 (a) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B
Green and Golden Bell Frog	*Litoria aurea*	E	V	January – March and August - December	N	-	**Low** See section 6.5.1.3 (a) and (d) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B
Illawarra Greenhood	*Pterostylis gibbosa*	E	E	June - September	Y	The species was surveyed in the subject site during flowering time in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	Low

Common name	Scientific name	TSC Act Status*	EPBC Act Status*	Threatened Species Profile Database survey period	Surveyed required (Y/N)	Survey effort	Survey result
Illawarra Irene	*Irenepharsus trypherus*	E	E	February - June	N	-	**Not present** See section 6.5.1.3 (a) and (d) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B
Illawarra Socketwood	*Daphnandra johnsonii*	E	E	All year	Y	The species was surveyed in the subject site in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	Not present
Illawarra Zieria	*Zieria granulata*	E	E	All year	Y	The species was surveyed in the subject site in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	Not present
Koala	*Phascolarctos cinereus*	V	V	All year	N	-	**Not present** See section 6.5.1.3 (a) and section 6.5.1.3 (d) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B

Common name	Scientific name	TSC Act Status*	EPBC Act Status*	Threatened Species Profile Database survey period	Surveyed required (Y/N)	Survey effort	Survey result
Lespedeza juncea subsp. *sericea* population, Wollongong Local Government Area	*Lespedeza juncea* subsp. *sericea* - endangered population	E	-	December – May	Y	The species was surveyed in the subject site during flowering time in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	Not present
Pimelea curviflora var. *curviflora*	*Pimelea curviflora* var. *curviflora*	V	V	February - December	Y	The species was surveyed in the subject site during flowering time in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	Not present
Pink Robin	*Petroica rodinogaster*	V	-	All year	N	Not targeted, not known from the Illawarra and no records from previous 25 years.	**Not present** See section 6.5.1.3 (a), (c) and (d) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B
Rainforest Cassia	*Senna acclinis*	E	-	All year	Y	The species was surveyed in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	Not present

Common name	Scientific name	TSC Act Status*	EPBC Act Status*	Threatened Species Profile Database survey period	Surveyed required (Y/N)	Survey effort	Survey result
Regent Honeyeater	*Anthochaera phrygia*	CE	CE	All year	N	Not targeted, rare vagrant to the Illawarra.	**Not present** See section 6.5.1.3 (a), (c) and (d) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B
Solanum celatum	*Solanum celatum*	E	-	September - November	Y	The species was surveyed in the subject site in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	**Not present** See section 6.5.1.3 (a) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B Note: This species was recorded in the study area, but not within the subject site
Southern Brown Bandicoot (eastern)	*Isoodon obesulus* subsp. *obesulus*	E	E	All year	N	-	**Not present** See section 6.5.1.3 (a) and (d) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B
Spiked Rice-flower	*Pimelea spicata*	E	E	All year	Y	The species was surveyed in the subject site in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	Not present

Common name	Scientific name	TSC Act Status*	EPBC Act Status*	Threatened Species Profile Database survey period	Surveyed required (Y/N)	Survey effort	Survey result
Squirrel Glider	*Petaurus norfolcensis*	V	-	All year	N	-	**Not present** See section 6.5.1.3 (a) and (d) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B
White-flowered Wax Plant	*Cynanchum elegans*	E	E	All year	Y	The species was surveyed in the subject site in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	**Not present** See section 6.5.1.3 (a) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B
White-footed Dunnart	*Sminthopsis leucopus*	V	-	All year	N	-	**Not present** See section 6.5.1.3 (a) and (d) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B

* CE- Critically Endangered; E- Endangered, Ex- Extinct; V- Vulnerable

provides the list of species credit species identified by the Tool as 'candidate species'. In accordance with Section 6.5.1.3(a) of the FBA, each species was assessed to determine whether the species is likely to occupy the site based on habitat features and quality.

To do this threatened species, populations and migratory species recorded within 5 km of the development site (the locality) were obtained from a search of the Atlas of NSW Wildlife (OEH 2017) and their likelihood of occurrence was assessed by:

- review of location and date of recent (<5 years) and historical (>5-20 years) records
- review of available habitat within the development site and surrounding areas
- review of the scientific literature pertaining to each species and population
- applying expert knowledge of each species

The potential for each threatened species, population and/or migratory species to occur was then considered following review of available habitat within the development site. The potential for species to utilise the site and to be affected directly or indirectly by the proposed action were considered as either:

- "Recent record" = species has been recorded in the development site within the past 5 years
- "High" = species has previously been recorded in the development site (>5 years ago) or in close proximity (for mobile species), and/or habitat is present that is likely to utilised by a local population
- "Moderate" = suitable habitat for a species is present onsite but no evidence of a species detected and relatively *high* number of recent records (5-20 years) in the locality or species is highly mobile
- "Low" = suitable habitat for a species is present onsite but limited or highly degraded, no evidence of a species detected and relatively *low* number of recent records in the locality
- "Not present" – suitable habitat for the species is not present onsite or adequate survey has determined species does not occur in the development site

The likelihood of occurrence assessment (**Appendix B**) determined some of the candidate species (listed in **Table 4.3**: Species credit species requiring further assessment.

Common name	Scientific name	TSC Act Status*	EPBC Act Status*	Threatened Species Profile Database survey period	Surveyed required (Y/N)	Survey effort	Survey result
Australasian Bittern	*Botaurus poiciloptilus*	E	E	All year	Y	Surveys were conducted in and around the artificial wetlands in the northern and central precinct.	Not present
Black Bittern	*Ixobrychus flavicollis*	V	-	All year	Y	Surveys were conducted in and around the artificial wetlands in the northern and central precinct.	Not present

Common name	Scientific name	TSC Act Status*	EPBC Act Status*	Threatened Species Profile Database survey period	Surveyed required (Y/N)	Survey effort	Survey result
Chorizema parviflorum Benth. (a shrub) population, Wollongong and Shellharbour local government areas	*Chorizema parviflorum* Benth. (a shrub) population, Wollongong and Shellharbour local government areas	E	-	September - December	Y	The species was surveyed in the subject site in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	Not present
Eastern Osprey	*Pandion cristatus*	V	-	All year	N	-	**Not present** See section 6.5.1.3 (a) and section 6.5.1.3 (c) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B
Eastern Pygmy-possum	*Cercartetus nanus*	V	-	January – April and September - December	N	-	**Not present** See section 6.5.1.3 (a) and section 6.5.1.3 (d) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B
Giant Burrowing Frog	*Heleioporus australiacus*	V	V	January – May and September to December	N	-	**Not present** See section 6.5.1.3 (a) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B

Common name	Scientific name	TSC Act Status*	EPBC Act Status*	Threatened Species Profile Database survey period	Surveyed required (Y/N)	Survey effort	Survey result
Green and Golden Bell Frog	*Litoria aurea*	E	V	January – March and August - December	N	-	**Low** See section 6.5.1.3 (a) and (d) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B
Illawarra Greenhood	*Pterostylis gibbosa*	E	E	June - September	Y	The species was surveyed in the subject site during flowering time in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	Low
Illawarra Irene	*Irenepharsus trypherus*	E	E	February - June	N	-	**Not present** See section 6.5.1.3 (a) and (d) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B
Illawarra Socketwood	*Daphnandra johnsonii*	E	E	All year	Y	The species was surveyed in the subject site in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	Not present

Common name	Scientific name	TSC Act Status*	EPBC Act Status*	Threatened Species Profile Database survey period	Surveyed required (Y/N)	Survey effort	Survey result
Illawarra Zieria	*Zieria granulata*	E	E	All year	Y	The species was surveyed in the subject site in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	Not present
Koala	*Phascolarctos cinereus*	V	V	All year	N	-	**Not present** See section 6.5.1.3 (a) and section 6.5.1.3 (d) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B
Lespedeza juncea subsp. *sericea* population, Wollongong Local Government Area	*Lespedeza juncea* subsp. *sericea* - endangered population	E	-	December – May	Y	The species was surveyed in the subject site during flowering time in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	Not present
Pimelea curviflora var. *curviflora*	*Pimelea curviflora* var. *curviflora*	V	V	February - December	Y	The species was surveyed in the subject site during flowering time in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	Not present

Common name	Scientific name	TSC Act Status*	EPBC Act Status*	Threatened Species Profile Database survey period	Surveyed required (Y/N)	Survey effort	Survey result
Pink Robin	*Petroica rodinogaster*	V	-	All year	N	Not targeted, not known from the Illawarra and no records from previous 25 years.	**Not present** See section 6.5.1.3 (a), (c) and (d) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B
Rainforest Cassia	*Senna acclinis*	E	-	All year	Y	The species was surveyed in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	Not present
Regent Honeyeater	*Anthochaera phrygia*	CE	CE	All year	N	Not targeted, rare vagrant to the Illawarra.	**Not present** See section 6.5.1.3 (a), (c) and (d) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B
Solanum celatum	*Solanum celatum*	E	-	September - November	Y	The species was surveyed in the subject site in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	**Not present** See section 6.5.1.3 (a) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B Note: This species was recorded in the study area, but not within the subject site

Common name	Scientific name	TSC Act Status*	EPBC Act Status*	Threatened Species Profile Database survey period	Surveyed required (Y/N)	Survey effort	Survey result
Southern Brown Bandicoot (eastern)	*Isoodon obesulus* subsp. *obesulus*	E	E	All year	N	-	**Not present** See section 6.5.1.3 (a) and (d) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B
Spiked Rice-flower	*Pimelea spicata*	E	E	All year	Y	The species was surveyed in the subject site in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	Not present
Squirrel Glider	*Petaurus norfolcensis*	V	-	All year	N	-	**Not present** See section 6.5.1.3 (a) and (d) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B
White-flowered Wax Plant	*Cynanchum elegans*	E	E	All year	Y	The species was surveyed in the subject site in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	**Not present** See section 6.5.1.3 (a) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B

Common name	Scientific name	TSC Act Status*	EPBC Act Status*	Threatened Species Profile Database survey period	Surveyed required (Y/N)	Survey effort	Survey result
White-footed Dunnart	*Sminthopsis leucopus*	V	-	All year	N	-	**Not present** See section 6.5.1.3 (a) and (d) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B

* CE- Critically Endangered; E- Endangered, Ex- Extinct; V- Vulnerable

) as “not present” within the development site. This was dependent on several factors, including whether the habitat for the species was absent or substantially modified, whether species were observed a long distance from the development site, occur in relatively low numbers or were not recorded in the locality. This assessment of likelihood corresponds to 6.5.1.4, which states that “*a candidate species that is not considered to be present on the development site in accordance with Paragraph 6.5.1.3 does not require further assessment*”. As such, no formal survey was conducted for these candidate species, however, informal survey was opportunistically conducted whilst surveying for other threatened species.

Remaining candidate species were assessed under Step 3 of the FBA (OEH 2014), as detailed in **Table 4.3**: Species credit species requiring further assessment.

Common name	Scientific name	TSC Act Status*	EPBC Act Status*	Threatened Species Profile Database survey period	Surveyed required (Y/N)	Survey effort	Survey result
Australasian Bittern	*Botaurus poiciloptilus*	E	E	All year	Y	Surveys were conducted in and around the artificial wetlands in the northern and central precinct.	Not present
Black Bittern	*Ixobrychus flavicollis*	V	-	All year	Y	Surveys were conducted in and around the artificial wetlands in the northern and central precinct.	Not present

Common name	Scientific name	TSC Act Status*	EPBC Act Status*	Threatened Species Profile Database survey period	Surveyed required (Y/N)	Survey effort	Survey result
Chorizema parviflorum Benth. (a shrub) population, Wollongong and Shellharbour local government areas	*Chorizema parviflorum* Benth. (a shrub) population, Wollongong and Shellharbour local government areas	E	-	September - December	Y	The species was surveyed in the subject site in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	Not present
Eastern Osprey	*Pandion cristatus*	V	-	All year	N	-	**Not present** See section 6.5.1.3 (a) and section 6.5.1.3 (c) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B
Eastern Pygmy-possum	*Cercartetus nanus*	V	-	January – April and September - December	N	-	**Not present** See section 6.5.1.3 (a) and section 6.5.1.3 (d) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B
Giant Burrowing Frog	*Heleioporus australiacus*	V	V	January – May and September to December	N	-	**Not present** See section 6.5.1.3 (a) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B

Common name	Scientific name	TSC Act Status*	EPBC Act Status*	Threatened Species Profile Database survey period	Surveyed required (Y/N)	Survey effort	Survey result
Green and Golden Bell Frog	*Litoria aurea*	E	V	January – March and August - December	N	-	**Low** See section 6.5.1.3 (a) and (d) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B
Illawarra Greenhood	*Pterostylis gibbosa*	E	E	June - September	Y	The species was surveyed in the subject site during flowering time in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	Low
Illawarra Irene	*Irenepharsus trypherus*	E	E	February - June	N	-	**Not present** See section 6.5.1.3 (a) and (d) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B
Illawarra Socketwood	*Daphnandra johnsonii*	E	E	All year	Y	The species was surveyed in the subject site in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	Not present

Common name	Scientific name	TSC Act Status*	EPBC Act Status*	Threatened Species Profile Database survey period	Surveyed required (Y/N)	Survey effort	Survey result
Illawarra Zieria	*Zieria granulata*	E	E	All year	Y	The species was surveyed in the subject site in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	Not present
Koala	*Phascolarctos cinereus*	V	V	All year	N	-	**Not present** See section 6.5.1.3 (a) and section 6.5.1.3 (d) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B
Lespedeza juncea subsp. *sericea* population, Wollongong Local Government Area	*Lespedeza juncea* subsp. *sericea* - endangered population	E	-	December – May	Y	The species was surveyed in the subject site during flowering time in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	Not present
Pimelea curviflora var. *curviflora*	*Pimelea curviflora* var. *curviflora*	V	V	February - December	Y	The species was surveyed in the subject site during flowering time in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	Not present

Common name	Scientific name	TSC Act Status*	EPBC Act Status*	Threatened Species Profile Database survey period	Surveyed required (Y/N)	Survey effort	Survey result
Pink Robin	*Petroica rodinogaster*	V	-	All year	N	Not targeted, not known from the Illawarra and no records from previous 25 years.	**Not present** See section 6.5.1.3 (a), (c) and (d) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B
Rainforest Cassia	*Senna acclinis*	E	-	All year	Y	The species was surveyed in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	Not present
Regent Honeyeater	*Anthochaera phrygia*	CE	CE	All year	N	Not targeted, rare vagrant to the Illawarra.	**Not present** See section 6.5.1.3 (a), (c) and (d) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B
Solanum celatum	*Solanum celatum*	E	-	September - November	Y	The species was surveyed in the subject site in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	**Not present** See section 6.5.1.3 (a) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B Note: This species was recorded in the study area, but not within the subject site

Common name	Scientific name	TSC Act Status*	EPBC Act Status*	Threatened Species Profile Database survey period	Surveyed required (Y/N)	Survey effort	Survey result
Southern Brown Bandicoot (eastern)	*Isoodon obesulus* subsp. *obesulus*	E	E	All year	N	-	**Not present** See section 6.5.1.3 (a) and (d) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B
Spiked Rice-flower	*Pimelea spicata*	E	E	All year	Y	The species was surveyed in the subject site in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	Not present
Squirrel Glider	*Petaurus norfolcensis*	V	-	All year	N	-	**Not present** See section 6.5.1.3 (a) and (d) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B
White-flowered Wax Plant	*Cynanchum elegans*	E	E	All year	Y	The species was surveyed in the subject site in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	**Not present** See section 6.5.1.3 (a) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B

Common name	Scientific name	TSC Act Status*	EPBC Act Status*	Threatened Species Profile Database survey period	Surveyed required (Y/N)	Survey effort	Survey result
White-footed Dunnart	*Sminthopsis leucopus*	V	-	All year	N	-	**Not present** See section 6.5.1.3 (a) and (d) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B

* CE- Critically Endangered; E- Endangered, Ex- Extinct; V- Vulnerable

. Survey effort within and surrounding the development site is displayed in **Figure 4.1**, which included threatened flora survey in accordance with *NSW Guide to Surveying Threatened Plants* (OEH 2016).

Table 4.3: Species credit species requiring further assessment.

Common name	Scientific name	TSC Act Status*	EPBC Act Status*	Threatened Species Profile Database survey period	Surveyed required (Y/N)	Survey effort	Survey result
Australasian Bittern	*Botaurus poiciloptilus*	E	E	All year	Y	Surveys were conducted in and around the artificial wetlands in the northern and central precinct.	Not present
Black Bittern	*Ixobrychus flavicollis*	V	-	All year	Y	Surveys were conducted in and around the artificial wetlands in the northern and central precinct.	Not present
Chorizema parviflorum Benth. (a shrub) population, Wollongong and Shellharbour local government areas	*Chorizema parviflorum* Benth. (a shrub) population, Wollongong and Shellharbour local government areas	E	-	September - December	Y	The species was surveyed in the subject site in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	Not present
Eastern Osprey	*Pandion cristatus*	V	-	All year	N	-	**Not present** See section 6.5.1.3 (a) and section 6.5.1.3 (c) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B
Eastern Pygmy-possum	*Cercartetus nanus*	V	-	January – April and September - December	N	-	**Not present** See section 6.5.1.3 (a) and section 6.5.1.3 (d) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B

Common name	Scientific name	TSC Act Status*	EPBC Act Status*	Threatened Species Profile Database survey period	Surveyed required (Y/N)	Survey effort	Survey result
Giant Burrowing Frog	*Heleioporus australiacus*	V	V	January – May and September to December	N	-	**Not present** See section 6.5.1.3 (a) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B
Green and Golden Bell Frog	*Litoria aurea*	E	V	January – March and August - December	N	-	**Low** See section 6.5.1.3 (a) and (d) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B
Illawarra Greenhood	*Pterostylis gibbosa*	E	E	June - September	Y	The species was surveyed in the subject site during flowering time in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	Low
Illawarra Irene	*Irenepharsus trypherus*	E	E	February - June	N	-	**Not present** See section 6.5.1.3 (a) and (d) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B

Common name	Scientific name	TSC Act Status*	EPBC Act Status*	Threatened Species Profile Database survey period	Surveyed required (Y/N)	Survey effort	Survey result
Illawarra Socketwood	*Daphnandra johnsonii*	E	E	All year	Y	The species was surveyed in the subject site in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	Not present
Illawarra Zieria	*Zieria granulata*	E	E	All year	Y	The species was surveyed in the subject site in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	Not present
Koala	*Phascolarctos cinereus*	V	V	All year	N	-	**Not present** See section 6.5.1.3 (a) and section 6.5.1.3 (d) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B
Lespedeza juncea subsp. *sericea* population, Wollongong Local Government Area	*Lespedeza juncea* subsp. *sericea* - endangered population	E	-	December – May	Y	The species was surveyed in the subject site during flowering time in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	Not present

Common name	Scientific name	TSC Act Status*	EPBC Act Status*	Threatened Species Profile Database survey period	Surveyed required (Y/N)	Survey effort	Survey result
Pimelea curviflora var. *curviflora*	*Pimelea curviflora* var. *curviflora*	V	V	February - December	Y	The species was surveyed in the subject site during flowering time in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	Not present
Pink Robin	*Petroica rodinogaster*	V	-	All year	N	Not targeted, not known from the Illawarra and no records from previous 25 years.	**Not present** See section 6.5.1.3 (a), (c) and (d) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B
Rainforest Cassia	*Senna acclinis*	E	-	All year	Y	The species was surveyed in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	Not present
Regent Honeyeater	*Anthochaera phrygia*	CE	CE	All year	N	Not targeted, rare vagrant to the Illawarra.	**Not present** See section 6.5.1.3 (a), (c) and (d) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B

Common name	Scientific name	TSC Act Status*	EPBC Act Status*	Threatened Species Profile Database survey period	Surveyed required (Y/N)	Survey effort	Survey result
Solanum celatum	*Solanum celatum*	E	-	September - November	Y	The species was surveyed in the subject site in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	**Not present** See section 6.5.1.3 (a) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B Note: This species was recorded in the study area, but not within the subject site
Southern Brown Bandicoot (eastern)	*Isoodon obesulus* subsp. *obesulus*	E	E	All year	N	-	**Not present** See section 6.5.1.3 (a) and (d) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B
Spiked Rice-flower	*Pimelea spicata*	E	E	All year	Y	The species was surveyed in the subject site in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	Not present
Squirrel Glider	*Petaurus norfolcensis*	V	-	All year	N	-	**Not present** See section 6.5.1.3 (a) and (d) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B

Common name	Scientific name	TSC Act Status*	EPBC Act Status*	Threatened Species Profile Database survey period	Surveyed required (Y/N)	Survey effort	Survey result
White-flowered Wax Plant	*Cynanchum elegans*	E	E	All year	Y	The species was surveyed in the subject site in areas of potential habitat. Survey was conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016).	**Not present** See section 6.5.1.3 (a) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B
White-footed Dunnart	*Sminthopsis leucopus*	V	-	All year	N	-	**Not present** See section 6.5.1.3 (a) and (d) of the *Framework for Biodiversity Assessment* (OEH 2014) and Appendix B

* CE- Critically Endangered; E- Endangered, Ex- Extinct; V- Vulnerable

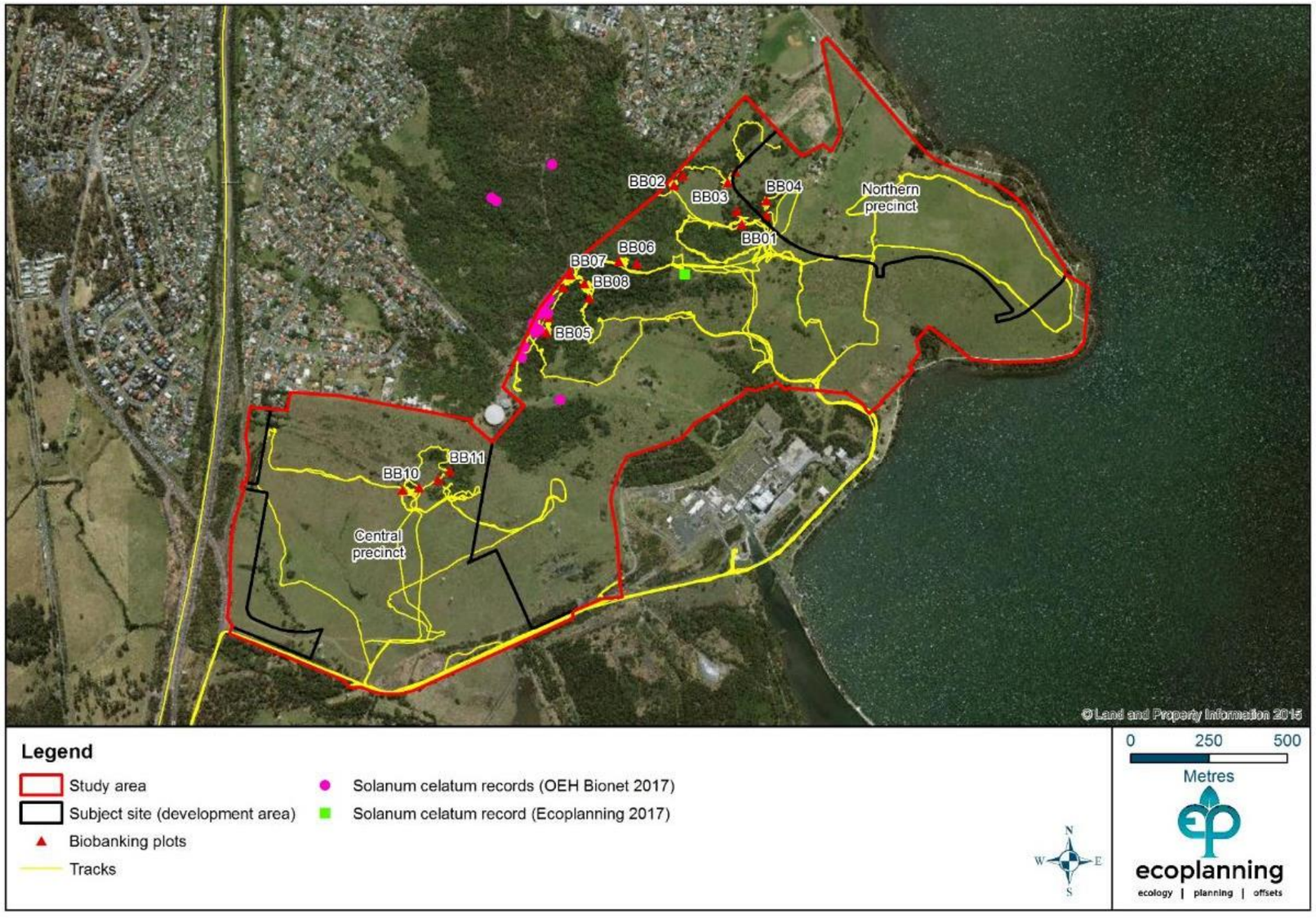

Figure 4.1: Survey effort and threatened species records.

5. Avoid and minimise impacts on biodiversity values

The following section sets out the assessment of direct and indirect impacts on biodiversity values at the development site. This is set out in accordance with Section 8 of the FBA (OEH 2014). The reporting requirements are set out in accordance to Appendix 7 of the FBA (OEH 2014).

5.1 Assessment of direct and indirect impacts

5.1.1 Direct impact – vegetation clearing

The proposed development consists of residential lots, a neighbourhood centre, industrial and light industrial warehouses, a 200 dwelling retirement village, open space and environmental management areas within the areas defined as the Central and Northern precincts. The clearing of 4.24 ha of native vegetation for the proposed development represents just 4.2% of the development site, or 15.5% of the total native vegetation mapped within the study area.

The impacts occur to three mapped PCTs across five mapped vegetation zones. The impacts for the Scattered Paddock Tree zone (0.11 ha) have been combined with the Lantana zone for Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion for credit calculation purposes **Table 5.1**.

Table 5.1: Vegetation zones.

Vegetation zone	Plant community type	Ancillary code	Total impact entered into credit calculator (ha)
1	Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	Underscrubbed	0.25
2	Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	Lantana	1.11
	Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	Scattered Paddock Trees	
3	Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion	Underscrubbed	0.33
4	Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion	Lantana	2.55
Total		**N/A**	**4.24**

Completely avoiding impacts to native vegetation within the development site is, in this case, not considered feasible. The most significant patches of native vegetation within the study area, on the northern boundary of the site, have been avoided and will not be impacted by this proposal. This retained vegetation is contiguous with a substantial remnant of native vegetation, which is zoned E2 Environmental Conservation.

The placement of the development precincts to avoid these large, contiguous patches, has lead to impacts on smaller, less viable patches of native vegetation. The vast majority of the Central and Northern precincts are mapped as cleared land or weeds and exotics, with 97.07 ha (95.8%) of the 101.32 ha development footprint mapped as non-native vegetation. The high proportion of non-native vegetation within the development footprint demonstrates the avoidance of impacts on site.

5.1.2 Direct impact – loss of fauna habitat

The proposal will remove potential foraging and roosting/sheltering/breeding habitatfor fauna. The likelihood of the majority of threatened fauna utilising the study is generally low based on site assessment, expert opinion and analysis of the likelihood of occurrence from Atlas records over the past 20 years (see **Section 4.1** and **Appendix B**).

5.1.3 Indirect impacts

It is difficult to quantify indirect impacts of the proposed development, but these may include impacts such as noise and/or erosion associated with the construction phase of the project. These impacts will be managed through the development of a Construction Environmental Management Plan.

The site is already predominantly cleared with significant areas of cleared land and areas of high weed cover. The proposed development has been designed to impact on non-native vegetation predominantly.

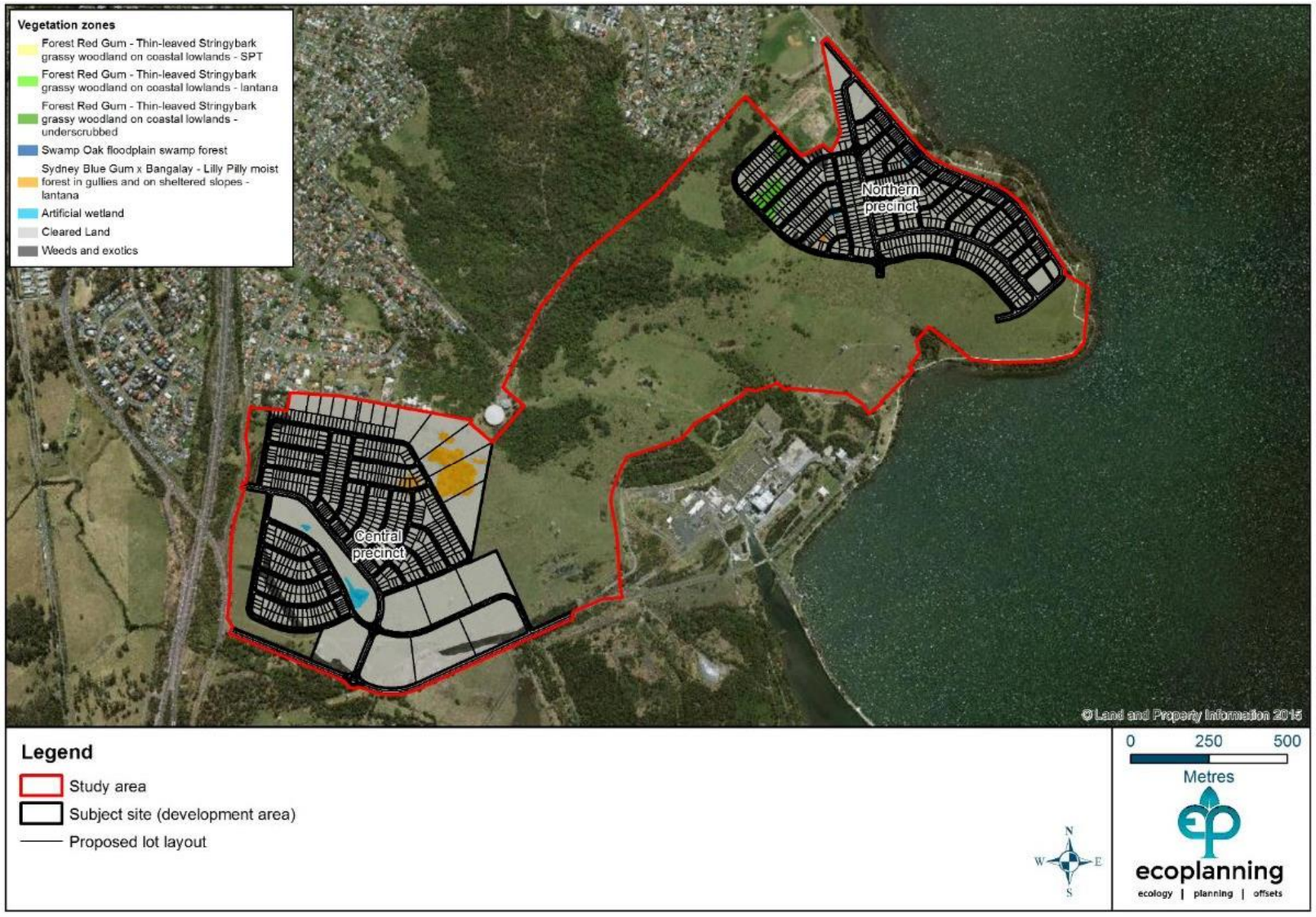

Figure 5.1: Field validated vegetation (Ecoplanning 2017) and proposed footprint.

5.2 Onsite measure to avoid and minimise direct and indirect impacts

As described above, the complete avoidance of impacts was not possible, with the largest patches of native vegetation avoided. Smaller, less viable patches of native vegetation are proposed to be impacted. Several measures will be implemented to reduce impacts where possible. Details are provided below.

5.2.1 Loss of fauna habitat

A number of non-threatened fauna species such as birds, arboreal mammals and amphibians are likely to be present at the development site. Appropriate pre-clearance protocols will be put in place at the time of construction to avoid and mitigate any potential harm or injury to these individuals. These protocols should be included as a component of the Construction Environmental Management Plan (see **Section 5.2.2**).

5.2.2 Construction Environmental Management Plan (CEMP)

To avoid potential indirect offsite impact during construction, an appropriate erosion and sedimentation control plan should be in place following best practice protocols such as Landcom (2004). It is recommended that this is included in a site specific Construction Environmental Management Plan (CEMP), prior to any construction works taking place.

The CEMP will be required to span the pre, during and post-construction period, and will include the above pre-clearance and fauna management protocols.

6. Impact summary

6.1 Thresholds for assessment and offsetting of unavoidable impacts of development

Section 9 (Table 4) of the FBA (OEH 2014) defines thresholds to be applied by the accredited assessor related to the assessment and offsetting of unavoidable impacts caused by development. A number of thresholds are defined, including:

1. impacts that the assessor is required to identify for further consideration by the consent authority;
2. impacts for which the assessor is required to determine an offset;
3. impacts for which the assessor is not required to determine an offset;
4. impacts that do not require further assessment by the assessor.

Point (2) applies due to the:

- Status of vegetation zones 1, 2 and 3 as EECs under the NSW TSC Act
- Association of vegetation zones 1, 2, 3 and 4 to threatened species habitat, with site value scores exceeding 16 (i.e. 17 or greater).

Offsets have, therefore, been determined for the total impact to native vegetation of 4.24 ha. Please note that vegetation zones 1 and 2 (Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion) meet the definition of the Critically Endangered Ecological Community (CEEC) *Illawarra and south coast lowland forest and woodland* listed under the federal *Environmental Protection and Biodiversity Conservation* (EPBC) Act. Whilst the FBA is a component of the Bi-lateral Agreement under the EPBC Act, it is still necessary to make a Referral to the Commonwealth for impacts with the potential for significant impacts on Matters of National Environmental Significance.

6.2 Ecosystem credits and species credits

6.2.1 Change in landscape value score

The loss in landscape score following the proposed development is **9** (**Table 6.1**). See **Section 2** for more information.

Table 6.1: Landscape score components.

Landscape score component	Score Awarded
Change in connectivity score	0
Increase in native vegetation cover (inner assessment circle) score	0
Increase in native vegetation cover (outer assessment circle) score	0
Patch size area score	9
Total	**9**

6.2.2 Current and future site value score

The current and future site value scores were calculated for the proposal. A range of site values were recorded for the vegetation zones assessed. Site value scores of between 36.46 – 62.5 were recorded. As the proposed development requires the complete removal of native vegetation within each zone mapped, the default future site value score of 0 has been maintained (**Table 6.2**).

Table 6.2: Site values before and after development.

Vegetation zone	Plant community type	Area impacted (ha)	Site value score before development	Site value score after development
1	Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	0.25	36.46	0
2	Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	1.11	62.5	0
	Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion			0
3	Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion	0.33	43.75	0
4	Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion	2.55	51.91	0

6.2.3 Required ecosystem credits

The total number of ecosystem credits required is **153 credits**.

6.2.4 Required species credits

There are no species credits required for the proposal.

7. Biodiversity Credit Report

7.1 Credit profiles

7.1.1 Ecosystem credits

The ecosystem credits required to offset the proposal are provided in **Table 7.1**. The final credit report produced by the credit calculator is provided in **Appendix D**.

Table 7.1: Ecosystem credits summary and credit profiles.

Plant community type (impact)	Impact area (ha)	Credits required	Plant community type (offset options)	IBRA sub-region
Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	1.36	62	1. Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin (SR545) 2. Forest Red Gum - Rough-barked Apple - White Stringybark grassy woodlands on hills in dry valleys, southern South East Corner (SR544) 3. Woollybutt - White Stringybark - Forest Red Gum grassy woodland on coastal lowlands, southern Sydney Basin and South East Corner (SR669)	Illawarra IBRA subregion (and any IBRA subregion that adjoins the IBRA subregion in which the development occurs)
Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion	0.33	12	1. Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion (SR649) 2. Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner (SR650)	
Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion	2.55	79	1. Sydney Blue GumXBangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin (SR652) 2. Blackbutt - Turpentine - Bangalay moist open forest on sheltered slopes and gullies, southern Sydney Basin (SR516)	
Total	**4.24**	**153**	**N/A**	**N/A**

7.1.2 Species credits

No species credits were required for this assessment.

7.2 Biodiversity Offset Strategy

As described in **Section 7.1**, 153 credits are required to offset the proposed development. A number of options exist for the credit requirement to be satisfied, including:

- The purchase of matching credits from the Biobank market
- The use of residual lands (as an offset site to generate the required credits, with the land being secured under a Biobank Agreement (or equivalent)
- Payment into the proposed Biodiversity Conservation Fund (BCF) which is to be administered by the soon to be created Biodiversity Conservation Trust (BCT). This option would allow the payment of funds to satisfy the offset obligation, with the BCT required to obtain the biodiversity credits to satisfy the offset requirement.

It is noted that a number of credits meeting the requirements of the project are currently available in the Biobanking market. The proponent may seek to further investigate the Expression of Interest (EOI) register and may also utilise the Credits Wanted register in the future to source other credits. The final offset solution to be used will be determined as the development application process proceeds.

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Appendix A: Field Data Sheets

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BioMetric plota data sheet

Site name	Tallawarra	Recorders	Thomas Harlum, Brian Towle	Date	15/06/17
Wapoint/ Plot ID	BB01	Easting *	St:	Northing*	St:
			End:		End:
		Photo no. (Camera)	St: BB01 (start)	xPlot orient/ Slope/Aspect	≈ 336° (Plot orientation)
			End: BB01 (end)		5° / 330° (NNW)

Plant Community Type	Coastal Grassy Red Gum Forest (MU25)
Ancillary code	Lantana
Condition (Low or Mod-Good)	

20 x 20m Quadrat		Number of native plant species											(NPS)
NATIVE	50m Transect – 10 Points	Native over-storey cover (%)	40	35	20	10	30	10	20	25	0	25	21.5 % (NOS) Sum / 10
		Native mid-storey cover (%)	0	0	0	0	0	0	0	0	0	0	0 % (NMS) Sum / 10
	50m Transect – 50 Points	Native ground cover (tally/50 points) – Grasses	44	44	44	44	44	44	44	44	44	11	84 % (NGCG) Double score out of 50 to get %
		Native ground cover (tally/50 points) – Shrubs				N/A							0 % (NGCS) Double score out of 50 to get %
		Native ground cover (tally/50 points) – other	44	44	44								30 % (NGCO) Double score out of 50 to get %
EXOTIC	50m Transect – 10 points + 50 points	Overstorey (% @ 10 points)	60	0	50	45	5	60	5	0	0	40	165 (a) Sum/10
		Midstorey (% @ 10 points)	40	0	10	10	25	10	5	10	20	15	105 (b) Sum/10
		Ground (tally/50 points)	44	44	44	11							34 (c) Double score

Sum exotic cover (%) from (a)+(b)+(c): 61 %

20m x 50m Quadrat	Number of trees with hollows	0	Total length fallen logs >10cm width (m) 35m

Whole Veg. Zone	Over-storey regeneration	All canopy spp. in Veg Zone	Regen (Y/N) (indiv. <5cm?)	Proportion
		Eucalyptus tereticornis	Y	E
		Melaleuca		

Strata	Form	Species	Height range	PFC
Upper 1		Eucalyptus tereticornis	4-14m	35%
Upper 2		N/A	–	–
Mid 1		Melaleuca Styphelioide	10-12m	2%
Mid 2		Abutilon oxycarpum	0.5-1m	1%
Lower 1		Microlaena stipoides	0.2m	25-30%
Lower 2		Oplismenus sp.	0.1-0.2	5%

Form: (T) Tree; (M) Mallee tree; (S) Shrub; (G) Tussock Grass (Poa/Themeda); (d) Sod grass (Couch/Kikuyu); (L) Vine/climber/scrambler; (V) Sedge (Cyperoid); (R) Rush (Restioid, Juncaceae); (F) Forb; (E) Fern; (P) Palm; (A) Cycad

1

BB01

Site name	Tallawarra	Plot no.	~~BB01~~	Date	15/6/17
PCT	Red Gum Grassy Woodland	Ancillary	Lantana.		

	Natives (20m Quadrat)	F	C	A	Exotics (20m Quadrat)	F	C	A
	OVERSTOREY							
1	Eucalyptus tereticornis		35	20				
2	~~Melaleuca styphelioides~~							
3	Ficus rubig? in canopy		<1	1				
4								
5								
6								
7								
8								
	MIDSTOREY							
1	Maclura cochi		<1	3	Olea europaea cuspid		10	6
2	Acacia maideni ?		<1	5	Lantana camara		10	50
3	Melia azerdach.		<1	2	Senna pendula glab		<1	20
4	Shrub ficus? (E)		<1	6	Ligustrum sinense		<1	1
5	Melaleuca styphelioides		~~1~~ 2	2	Ligustrum lucidum		<1	5
6	= Cryptocarya microneura							
7								
8								
9	Rumex brownii		<1	1				
10	Ajuga sp.		<1	1				
	GROUNDCOVER / other							
1	Entolasia stricta		10	7000	Ehrharta erecta		2	100
2	Strebulus brunonianus		<1	10	Araujia sericifera		<1	20
3	Dichondra repens		<1	100	Senecio madagascar		<1	10
4	Oplismenus aemulus.		15	1000	Cirsium vulgare		<1	3
5	Murdaena stipoides		15	1000	Sida rhombifolia		<1	5
6	Abutilon oxycarpum		<1	20	Gomphocarpus fruticosus		<1	5
7	Commelina cyanea		2	500	Conyza sp.		<1	3
8	Desmodium gunnii		<1	3	Setaria parviflorum		<1	1
9	Chloris ventricosa.		<1	20	Ochna serrul.		<1	2
10	* Bidens pilosa. *		<1	50	Plantago lanceolata.		<1	3
11	~~Eragrostis brownii~~							
12	Centroplesium cymosum		<1	10				
13	Glycine clandestina		<1	1				
14	~~Glycine tabacina~~ =P. varians		<1	1				
15	Glycine tabacina		<1	5				
16	Pandorea pandorana		<1	2				
17	Geranium solanderi		<1	3				
18	Breynia oblongifolia		<1	4				
19	~~Euphorbia sp~~? (E)		<1	1	= Celastrus australis			
20	Nyssanthes diffusa		<1	1				
21	Cayratia clemat		<1	3				
22	Aleuryon subcinereus ? (E) ✓		<1	1				
23	Carex longebrach		<1	2				

* **Cover (C)**: Estimate of the appropriate cover measure for each recorded species; from 1–5 and then to the nearest 5%;. **Abundance (A)**: A relative measure of the number of individuals or shoots of a species within the plot. Use the following intervals, 1,2,3,4,5,6,7,8,9,10,20,50,100,500,1000 or specify a number greater than 1000 if required.

Form: * (T) Tree; (M) Mallee tree; (S) Shrub; (G) Tussock Grass (Poa/Themeda); (d) Sod grass (Couch/Kikuyu); (L) Vine/climber/scrambler; (V) Sedge (Cyperoid); (R) Rush (Restioid, Juncaceae); (F) Forb; (E) Fern; (P) Palm; (A) Cycad

Braun-blanquet: 1=<5% (rare, <3 individuals); 2=<5% (uncommon, scattered/localised); 3=<5% (common, consistent thru plot); 4a=<5% (very abundant, many individuals thru plot); 4b=5-25%; 5=25-50%; 6=50-75%; 7=75-100%

* Note: Cover and Abundance should be collected unless otherwise stated, as per Native Veg. Interim Type Standard (Sivertsen 2009)

2

BioMetric plota data sheet

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Site name	BB02	Recorders	BT + TH	Date	15/06/17
Wapoint/ Plot ID	BB02 S→E	Easting *	St: ~~56~~ 298493	Northing*	St: 298521
			End: 6178672		End: 6178703
		Photo no. (Camara) BT. phone	St: 110845	xPlot orient/ Slope/Aspect	25°
			End: 112731		3° / 25°

Plant Community Type	Red Gum Grassy Woodland
Ancillary code	Under-scrubbed / Condition (Low or Mod-Good): Mod - Good

20 x 20m Quadrat		Number of native plant species											(NPS)
NATIVE	50m Transect – 10 Points	Native over-storey cover (%)	35	25	30	25	35	46	20	45	35	50	% (NOS) Sum / 10
		Native mid-storey cover (%)	0	0	0	0	0	0	0	0	0	0	% (NMS) Sum / 10
	50m Transect – 50 Points	Native ground cover (tally/50 points) – Grasses	24										48 % (NGCG) Double score out of 50 to get % 48
		Native ground cover (tally/50 points) – Shrubs											0 % (NGCS) Double score out of 50 to get % 0
		Native ground cover (tally/50 points) – other	6										12 % (NGCO) Double score out of 50 to get % 12
EXOTIC	50m Transect – 10 points + 50 points	Overstorey (% @ 10 points)										(a) Sum/10	Sum exotic cover (%) from (a)+(b)+(c)
		Midstorey (% @ 10 points)	0	0	5	1	2	0	0	0	0	0	0.8 (b) Sum/10 — 50.8 %
		Ground (tally/50 points)	25									50 (c) Double score	

20m x 50m Quadrat	Number of trees with hollows	0	Total length fallen logs >10cm width (m): 0

		All canopy spp. in Veg Zone	Regen (Y/N) (indiv. <5cm?)	Proportion
Whole Veg. Zone	Over-storey regeneration	Eucalyptus tereticornis	Y	

Strata	Form	Species	Height range	PFC
Upper 1	T	Eucalyptus tereticornis	8 - 16	30 %
Upper 2		—		
Mid 1		—		
Mid 2		—		
Lower 1	G	Microlaena stipoides	0 - 0.3	15
Lower 2	V	Carex longebrachiata	0 - 0.75	5

Form: (T) Tree; (M) Mallee tree; (S) Shrub; (G) Tussock Grass (Poa/Themeda); (d) Sod grass (Couch/Kikuyu); (L) Vine/climber/scrambler; (V) Sedge (Cyperoid); (R) Rush (Restioid, Juncaceae); (F) Forb; (E) Fern; (P) Palm; (A) Cycad

1

6

Site name	Tallawarra	Plot no.	BB02	Date	15/06/17
PCT	1	Ancillary	Understorey		

	Natives (20m Quadrat)	F	C	A	Exotics (20m Quadrat)	F	C	A
	OVERSTOREY							
1	Eucalyptus tereticornis	T	25	50				
2								
3								
4								
5								
6								
7								
8								
	MIDSTORREY							
1	Ficus Shrub (10)	S	10	2	Senna pendula var glabrata	S	1	20
2					Lantana camara	S		
3								
4								
5								
6					Asparagus aethiopicus	F	1	1
7					Rubus fruticosus	L	1	1
8					Bidens pilosa	F	1	5
9					Chloris gayana	G	1	2
10					Lolium	G	4	200
	GROUNDCOVER / other				Stellaria media	F	1	50
1	Dichondra repens	F	5	200	Sida rhombifolia	F	1	20
2	Carex longebrachiata	V	5	200	Plantago lanceolata	F	2	100
3	Oplismenus	G	3	250	Lantana camara	S	1	5
4	Botriochloa macra	G	1	5	Paspalum dilatatum	G	3	200
5	Glycine tl clandestina	L	1	50	Senecio madagascariensis	F	1	50
6	Cyperus gracilis	V	1	100	Cynodon dactylon	G	5	100
7	Sporobolus creber	G	1	20	Verbena rigida	F	1	10
8	Chloris ventricosa	G	1	10	Cirsium vulgare	F	1	5
9	Desmodium varians	L	1	20	Axonopus fissifolius	G	2	50
10	Microlaena stipoides	G	15	500	Olea europaea	S	1	5
11	Rumex brownii	F	1	5	Gamphocarpus fruticosus	F	1	10
12	Glycine tabacina	L	1	50	Pennisetum clandestinum	G	1	5
13	Geranium homeanum	F	1	20	Araujia sericifera	L	1	10
14	Breynia oblongifolia	S	1	5	Taraxacum officinale	F	1	5
15	Commelina cyanea	F	1	50	Conyza sp	F	1	2
16					Verbena bonariensis	F	1	2
17					Sporobolus africanus	G	1	1
18					Gomphocarpus fruticosus	F	1	10
19					Anagallis arvensis	F	1	20
20					Ehrharta erecta	G	1	100
21					Trifolium repens	F	1	10
22					Gnaphalium oleaefolium	F	1	1
23					Parthenium hysterophorus	F	1	10

* **Cover (C)**: Estimate of the appropriate cover measure for each recorded species; from 1–5 and then to the nearest 5%;.
Abundance (A): A relative measure of the number of individuals or shoots of a species within the plot. Use the following intervals, 1,2,3,4,5,6,7,8,9,10,20,50,100,500,1000 or specify a number greater than 1000 if required.

Form: * (T) Tree; (M) Mallee tree; (S) Shrub; (G) Tussock Grass (Poa/Themeda); (d) Sod grass (Couch/Kikuyu); (L) Vine/climber/scrambler; (V) Sedge (Cyperoid); (R) Rush (Restioid, Juncaceae); (F) Forb; (E) Fern; (P) Palm; (A) Cycad

Braun-blanquet: 1=<5% (rare, <3 individividuals); 2=<5% (uncommon, scattered/localised); 3=<5% (common, consistent thru plot); 4a=<5% (very abundant, many individuals thru plot); 4b=5-25%; 5=25-50%; 6=50-75%; 7=75-100%

* Note: Cover and Abundance should be collected unless otherwise stated, as per Native Veg. Interim Type Standard (Sivertsen 2009)

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BioMetric plota data sheet

Site name	Tallawarra	Recorders	Thomas Hickman / Brian Towle	Date	15/06/17
Wapoint/ Plot ID	BB03	Easting *	St:	Northing*	St:
			End:		End:
		Photo no. (Camera)	St: BB03 (start)	xPlot orient/ Slope/Aspect	25° (NE)
			End: BB03 (end		NW (296°) / 10° slope
Plant Community Type			- Coastal Swamp Oak Forest		
Ancillary code	Disturbed Shrubby		Condition (Low or Mod-Good)		Low

20 x 20m Quadrat		Number of native plant species											(NPS)
NATIVE	50m Transect – 10 Points	Native over-storey cover (%)	25	25	95	35	25	30	80	80	15	0	36 % (NOS) Sum / 10
		Native mid-storey cover (%)	0	0	0	0	0	0	0	0	0	0	0 % (NMS) Sum / 10
	50m Transect – 50 Points	Native ground cover (tally/50 points) – Grasses	11										4 % (NGCG) Double score out of 50 to get %
		Native ground cover (tally/50 points) – Shrubs	11										4 % (NGCS) Double score out of 50 to get %
		Native ground cover (tally/50 points) – other	4HT 11										14 % (NGCO) Double score out of 50 to get %
EXOTIC	50m Transect – 10 points + 50 points	Overstorey (% @ 10 points)	0	0	0	0	0	0	0	0	0	0	0 (a) Sum/10
		Midstorey (% @ 10 points)	5	10	5	5	0	0	30	10	0	0	35 (b) Sum/10
		Ground (tally/50 points)	4HT 4HT 4HT 4HT 4HT 4HT 4HT 4HT 4HT 4HT 11										74 (c) Double score

Sum exotic cover (%) from (a)+(b)+(c): 77·5 %

20m x 50m Quadrat	Number of trees with hollows	0	Total length fallen logs >10cm width (m)	35m

Whole Veg. Zone	Over-storey regeneration	All canopy spp. in Veg Zone	Regen (Y/N) (indiv. <5cm?)	Proportion
		Casuarina glauca	Y	0·5
		Melaleuca styphelioides	N	

Strata	Form	Species	Height range	PFC
Upper 1	T	Casuarina glauca	7-9m	
Upper 2	T	Melaleuca styphelioides	7-8m	
Mid 1				
Mid 2				
Lower 1				
Lower 2				

Form: (T) Tree; (M) Mallee tree; (S) Shrub; (G) Tussock Grass (Poa/Themeda); (d) Sod grass (Couch/Kikuyu); (L) Vine/climber/scrambler; (V) Sedge (Cyperoid); (R) Rush (Restioid, Juncaceae); (F) Forb; (E) Fern; (P) Palm; (A) Cycad

1

Site name	Tallawarra	Plot no.	BB03	Date	15/06/17
PCT	Swamp Oak forest	Ancillary	disturbed shrubby.		

	Natives (20m Quadrat)	F	C	A	Exotics (20m Quadrat)	F	C	A
	OVERSTOREY							
1	Casuarina glauca		25	20				
2	Melaleuca styphelioides		10	1				
3								
4								
5								
6								
7								
8								
	MIDSTOREY							
1	~~Melaleuca stypheloides~~				Lantana camara		5	10
2	Strobulus brunonianus		<1	3	Senna pendula glab		<1	1
3	Notelaea venosa.		<1	1	Ligustrum sinense		<1	3
4					Olea europea cuspid		<1	1
5								
6								
7								
8								
9					Vobera sp. / quadrident		<1	1
10					Sporobolus africanus		<1	3
	GROUNDCOVER / other							
1	Cotula australis		<1	10	Senecio madagasc		<1	20
2	Rumex brownii		<1	5	Cerastium glomeratum		<1	50
3	Pasnora stramnea		<1	3	Stellaria media.		<1	20
4	Nyssanthes diffusa		<1	20	Ehrharta erecta.		35	1000
5	Centonopleurum cymosum		<1	1	Cirsium vulgare		<1	1
6	* Cynodon dactylon *		<1	50	Sida rhombifolia.		<1	20
7	Dichondra repens		<1	100	Lolium perren		<1	50
8	Microlaena stipoides		2	100	Paspalum dilat		1	50
9	Oplismenus aemulus		~~2~~ 1	100	Aragia sericifera		<1	20
10	Carex longebrach		<1	10	Conyza sp.		<1	3
11	Commelina cyanea.		<1	10	Delatio odarata.		1	10
12	Pratia purpurescens		<1	3	Taraxicum officinale		<1	1
13	Euadia polygonoides		<1	1	Bidens pilosa.		<1	1
14	Melia azedach		<1	1	Sonchus oleraceus		<1	10
15	Pseuderanthemum variable		<1	20	~~Cirsium vulgare~~			
16	Glycine clandestina		<1	2	Plantago lanceolata		<1	50
17	Euadia hastata		<1	1	Tradescantia albiflora		10	50
18	Echinopogan ovatus		<1	1	* Asteraceae sp. photos		<1	1
19	Alternanthera denticul		<1	5	Gomphocarpus fruticosus		<1	1
20	~~Eu~~				Hypochaeris radicata		<1	1
21					Cenchrus clandestinus		<1	1
22					Digitaria ~~sangui~~ sp. ©		<1	1
23					Solanum nigrum		<1	1

Eurgops chrysanthem

*** Cover (C)**: Estimate of the appropriate cover measure for each recorded species; from 1–5 and then to the nearest 5%;.
Abundance (A): A relative measure of the number of individuals or shoots of a species within the plot. Use the following intervals, 1,2,3,4,5,6,7,8,9,10,20,50,100,500,1000 or specify a number greater than 1000 if required.

Form: * (T) Tree; (M) Mallee tree; (S) Shrub; (G) Tussock Grass (Poa/Themeda); (d) Sod grass (Couch/Kikuyu); (L) Vine/climber/scrambler; (V) Sedge (Cyperoid); (R) Rush (Restioid, Juncaceae); (F) Forb; (E) Fern; (P) Palm; (A) Cycad

Braun-blanquet: 1=<5% (rare, <3 individividuals); 2=<5% (uncommon, scattered/localised); 3=<5% (common, consistent thru plot); 4a=<5% (very abundant, many individuals thru plot); 4b=5-25%; 5=25-50%; 6=50-75%; 7=75-100%

* Note: Cover and Abundance should be collected unless otherwise stated, as per Native Veg. Interim Type Standard (Sivertsen 2009)

2

BioMetric plota data sheet Tallawarra

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Site name	BB04	Recorders	BT	Date	15/06/2017
Wapoint/ Plot ID	BB04	Easting *	St: 298788	Northing*	St:
			End: 6178623		End:
		Photo no. (Camera) BT Phone	St: 134150	xPlot orient/ Slope/Aspect	175°
			End:		8° @ 310°

Plant Community Type	Red Gum Grassy Woodland
Ancillary code	Lantana.

Condition (Low or Mod-Good):

20 x 20m Quadrat		Number of native plant species										(NPS)
NATIVE	50m Transect – 10 Points	Native over-storey cover (%)	20	30	40	35	5	10	20	5	5	15	% (NOS) Sum / 10
		Native mid-storey cover (%)										0	% (NMS) Sum / 10
	50m Transect – 50 Points	Native ground cover (tally/50 points) – Grasses	26										52 % (NGCG) Double score out of 50 to get %
		Native ground cover (tally/50 points) – Shrubs	1										2 % (NGCS) Double score out of 50 to get %
		Native ground cover (tally/50 points) – other	10										20 % (NGCO) Double score out of 50 to get %
EXOTIC	50m Transect – 10 points + 50 points	Overstorey (% @ 10 points)										(a) Sum/10	Sum exotic cover (%) from (a)+(b)+(c) %
		Midstorey (% @ 10 points)	45	75	55	5	35	10	85	65	80	85	(b) Sum/10
		Ground (tally/50 points)										8	(c) Double score

20m x 50m Quadrat	Number of trees with hollows	1	Total length fallen logs >10cm width (m) 46

Whole Veg. Zone	Over-storey regeneration	All canopy spp. in Veg Zone		Regen (Y/N) (indiv. <5cm?)	Proportion
		Eucalyptus tereticornis	Y		

Strata	Form	Species	Height range	PFC
Upper 1		Eucalyptus tereticornis		
Upper 2				
Mid 1		Melaleuca styphelioides		
Mid 2		* Lantana / Olive	1 – 7	
Lower 1		Microlaena stipoides	0-0.3	
Lower 2		* Ehrharta erecta	0-0.3	

Form: (T) Tree; (M) Mallee tree; (S) Shrub; (G) Tussock Grass (Poa/Themeda); (d) Sod grass (Couch/Kikuyu); (L) Vine/climber/scrambler; (V) Sedge (Cyperoid); (R) Rush (Restioid, Juncaceae); (F) Forb; (E) Fern; (P) Palm; (A) Cycad

1

BioMetric plota data sheet

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Site name	Tallawarra	Recorders	Thomas Hockman, Brian Towle	Date	16/06/17
Wapoint/ Plot ID	BB05	Easting *	St:	Northing*	St:
			End:		End:
		Photo no. (Camera)	St: BB05 (start)	xPlot orient/ Slope/Aspect	North (0°)
			End: BB05 (end)		Easterly (90°) Slope=25°

Plant Community Type	Moist Box (MU5)		
Ancillary code	Lantana	Condition (Low or Mod-Good)	

20 x 20m Quadrat	Number of native plant species												(NPS)
NATIVE: 50m Transect – 10 Points	Native over-storey cover (%)	40	60	50	45	25	40	45	45	35	35	/	42.5 % (NOS) Sum / 10
	Native mid-storey cover (%)	0	0	0	6	0	0	0.5	0	10	0	/	1.5 % (NMS) Sum / 10
NATIVE: 50m Transect – 50 Points	Native ground cover (tally/50 points) – Grasses	44	44	44	44	44	1						42 % (NGCG) Double score out of 50 to get %
	Native ground cover (tally/50 points) – Shrubs	11	1										8 % (NGCS) Double score out of 50 to get %
	Native ground cover (tally/50 points) – other	44	44	44	44	44	44	1111					58 % (NGCO) Double score out of 50 to get %
EXOTIC: 50m Transect – 10 points + 50 points	Overstorey (% @ 10 points)	0	0	0	0	0	0	0	30	0	15	4.5 (a) Sum/10	Sum exotic cover (%) from (a)+(b)+(c)
	Midstorey (% @ 10 points)	15	10	15	15	40	55	65	85	55	55	42 (b) Sum/10	118.5 %
	Ground (tally/50 points)	44	44	44	44	44	44	44	44	44	44	72 (c) Double score	
		44	44	44	44	44	44	44	44	44	44		
		44	44	44	44	44	44	44	44	44	44		
		44	44	44	44	44	44	44	44	44	44		
		44	44	44	44	44	44	44	44	44	44		
		44	44	44	44	44	44	44	44	44	44		
		44	44	44	44	44	44	44	44	44	44		
		44	44	44	44	44	44	44	44	44	44		
		44	44	44	44	44	44	44	44	44	44		
		44	44	44	44	44	44	44	44	44	44		

20m x 50m Quadrat	Number of trees with hollows	3	Total length fallen logs >10cm width (m)	25m

		All canopy spp. in Veg Zone	Regen (Y/N) (indiv. <5cm?)	Proportion
Whole Veg. Zone	Over-storey regeneration	Eucalyptus tereticornis	Y	TBC
		E. quadrangulata	Y	
		E. bosistoana?		

Strata	Form	Species	Height range	PFC
Upper 1		Eucalyptus tereticornis	8-12	15%
Upper 2		Eucalyptus quadrangulata	6-8	5%
Mid 1		Rapanea variabilis	4-5	1%
Mid 2		Melaleuca styphelioides	6-7	<1%
Lower 1		Poa labillardierei	0.2-0.4	2%
Lower 2		Commelina cyanea	0.1-0.2	2%

Form: (T) Tree; (M) Mallee tree; (S) Shrub; (G) Tussock Grass (Poa/Themeda); (d) Sod grass (Couch/Kikuyu); (L) Vine/climber/scrambler; (V) Sedge (Cyperoid); (R) Rush (Restioid, Juncaceae); (F) Forb; (E) Fern; (P) Palm; (A) Cycad

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Site name	Tallawarra	Plot no.	BBO5	Date	16/06/2017
PCT	MU13 - Moist Box - ?	Ancillary	Lantana		

	Natives (20m Quadrat)	F	C	A	Exotics (20m Quadrat)	F	C	A
	OVERSTOREY							
1	Eucalyptus tereticornis	T	15	6				
2	Eucalyptus quadrangulata	T	5	1				
3	Eucalyptus bosistoana	T	10	1				
4								
5	Parsonsia straminea	L	<1	1				
6	Nyssanthes diffusa.	S	<1	1				
7	Xerochrysum bracteata?	F	<1	1				
8	Pellaea falcata	E	<1	50				
	MIDSTOREY							
1	Acacia maideni	T	<1	2	Lantana camara	S	20	50
2	Notelea venosa	T	<1	1	Senna pendula glabrata	S	<1	5
3	Myrsine howittiana	T	#1	3	Olea europeaea cuspid	S	<1	1
4	Streblus brunonianus	S	<1	10				
5	Melaleuca styphel	T	<1	1				
6	Maclura cochinensis	S	1	1				
7	Brachychiton populneus	T	<1	1				
8	Clerodendrum tomentos	S	<1	1				
9	Melia azerdach.	S	<1	1				
10	Breynia oblongifolia	S	<1	3				
	GROUNDCOVER / other							
1	Galium murale	F	<1	50	Euphorbia peplus	F	<1	50
2	Indigofera australis	S	<1	3	Delaria odorata	L	#2	20
3	Veronica plebia	F	<1	10	Chloris gayiana.	G	5	100
4	Abutilon oxycarp	S	<1	3	Stellaria media? (c)	F	<1	20
5	Geitnoplesium cymosum	L	<1	10	Passiflora sp. (s)	L	<1	10
6	Cayratia clematidea	L	<1	16	Conyza sp. Suberosa	F	<1	10
7	Dichondra repens	F	5	1000	Opuntia stricta	S	<1	3
8	Pseuderanthemum variable	F	<1	50	Solanum nigrum	F	<1	3
9	Chloris ventricosa	G	5	100	Araujia sericifera	L	<1	10
10	Oplismenus aemulus	G	10	1000	Cirsium vulgare	F	<1	1
11	Microlaena stipoides	G	10	1000	Gamphocarpos fruticosus	S	<1	5
12	Cyperaceae sp.	V	<1	1	Anagalis arvensis	F	<1	1
13	Asteraceae sp. "discolor	F	<1	20	Setaria parviflora	G	<1	1
14	Commelina cyanea	F	2	500	Senecio madagasc	F	<1	3
15	Eustrephus latifolius	L	<1	1				
16	Plectranthus parviflorus	F	<1	3	NATIVES T30			
17	Austrodanthonia racemosum	G	<1	10	Ajuga australis	F	<1	1
18	Desmodium gunnii	F	<1	30	Ovidoa semiglauca	S	<1	1
19	Glycine clandestina	L	<1	3	Rumex brownii	F	<1	1
20	Carex longebrachiata	V	<1	20	Bothriochloa macra.	G	<1	3
21	Pandorea pandorana	L	<1	1	Desmodium varians	F	<1	1
22	Poa labillardieri	G	2	500	Carex inversa	V	<1	10
23	Geranium ~~homeanum~~ solanderi	F	<1	1	Wahlenbergia sp.	F	<1	10

Erechtos japonicus → Asteraceae sp. "discolor

*** Cover (C)**: Estimate of the appropriate cover measure for each recorded species; from 1–5 and then to the nearest 5%;.
Abundance (A): A relative measure of the number of individuals or shoots of a species within the plot. Use the following intervals, 1,2,3,4,5,6,7,8,9,10,20,50,100,500,1000 or specify a number greater than 1000 if required.

Form: * (T) Tree; (M) Mallee tree; (S) Shrub; (G) Tussock Grass (Poa/Themeda); (d) Sod grass (Couch/Kikuyu); (L) Vine/climber/scrambler; (V) Sedge (Cyperoid); (R) Rush (Restioid, Juncaceae); (F) Forb; (E) Fern; (P) Palm; (A) Cycad

Braun-blanquet: 1=<5% (rare, <3 individividuals); 2=<5% (uncommon, scattered/localised); 3=<5% (common, consistent thru plot); 4a=<5% (very abundant, many individuals thru plot); 4b=5-25%; 5=25-50%; 6=50-75%; 7=75-100%

* Note: Cover and Abundance should be collected unless otherwise stated, as per Native Veg. Interim Type Standard (Sivertsen 2009)

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BioMetric plota data sheet

Site Identifier	BBO6	Recorders	BT + TH	Date	16 / 07 / 2017
Project Identif.	Tallawarra	Transect start (site)	E: 298316	Transect end	E: 298373
			N: 6178428		N: 6178421
GPS datum	GDA-94	Photo no. (Camera)	St: 103227	Trans. orient/ Slope/Aspect	e.g. no. 90
			End: 105818		e.g. 6° / e 180

* Record from Easting and Northing from both ends of the 50m transect. Point holed rib of star picket along transect line.

Vegetation Zone Identification and Characteristics

Biometric Vegetation Type (Create a standard short version)	Moist Box Woodland	Soil Texture	Clay loam
Ancillary Code (Usually condition description)	Lantana.	Soil Colour	brown.
Condition (Low or Mod-Good)		Habitat Features	e.g. cliff, rock shelves, cobble, gilgai, tussock count >200 / 0.1 ha
Patch Size – within 100 m (select)	< 0.1 0.1-0.5 0.5-1 1-2 2-5 5+ ha	Mostly same / different type?	

		All canopy spp. in vegetation zone	Regen Y/N (< 5 cm DBH)	Proportion
Whole vegetation Zone	Over-storey regeneration	Euca teret ✓		
		Euca quadrang		
		Euca bosisto		

		Use species list over page (full Id is not required when guaranteed native) (sum up all counts from the site floristics sheet)											(NPS)
20 x 20m Quadrat	Number of **NSW native** plant spp.												
50m Transect at 10 Points	**Native over-storey** cover (%)	25	35	50	40	30	55	60	5	10	60	Sum / 10	'%' (NOS)
	Native mid-storey cover (pfc % /1m²)	80	25	0	0	0	0	0	0	0	0	Sum / 10	10.5 '%' (NMS)
NATIVE GROUND COVER 50m Transect 50 Points Record **all** 'hits'	**Native ground cover - Grasses** (hits / 50 points)	++++ ++++										Double score out of 50 to get '%' 10	20 '%' (NGCG)
	Native ground cover - Shrubs (hits / 50 points)	++++ | |										Double score out of 50 to get '%' 7	14 '%' (NGCS)
	Native ground cover - Other (hits / 50 points)	++++ | |										Double score out of 50 to get '%' 7	14 '%' (NGCO)
EXOTIC along 50m Transect	Overstorey (10 pts)											(a) 0	Sum exotic cover from (a)+(b)+(c) '%'
	Midstorey (10 pts)	15	10	15	25	55	15	40	25	40	80	(b)	
10 ÷ 50 points	Ground cover (score at 50 pts)	++++ ++++ |||										28 (c) double score	
transect	Other intercepts influencing %age	Count of bare ground soil, litter/pit			rock incl. lichen / moss on rock			Soil crust, mosses + fungi, algae + lichens				L ++++ ++++ 4	
20m x 50m Quadrat	Number of trees with hollows	||| 3					Total length fallen logs >10cm width (m)					13 15	

Strata	**Growth Form/s**	Up to 4 Species per stratum in quadrat at scale: Nominate/circle: 0.04 ha (e.g. 20 x 20) or 0.1 ha (e.g. 20 x 50)	Height range (m)	**Projected Cover** (%)
Upper 1		Euca teret	6 - 18	10
Upper 2		Euca bosistoana	18 - 18	10
Uppermost / Canopy percentage **crown cover** (select)		0-5 5-9.9 10-29 30-49 50-69 70-90 90+		
Mid 1		Alectryon subcinereus.	5 - 5	2
Mid 2		* Lantana camara	1 - 3	60
Understorey woody percentage **crown cover** (select)		0-5 5-9.9 10-29 30-49 50-69 70-90 90+		
Lower 1		Microlaena stipoides	0 - 0.3	20
Lower 2		Chloris truncata	0 - 0.5	2
Perennial native groundcover **cr. cover** %age (select)		0-5 5-9.9 10-29 30-49 50-69 70-90 90+		

Growth Form: e.g. (T) Tree; (M) Mallee tree; (S) Shrub; (G) Tussock Grass (Poa/Themeda); (D) Sod grass (Couch / Kikuyu); (V) Sedge (Cyperoid); (R) Rush (incl. Juncaceae, Lomandra); (F) Forb; (E) Fern; (L) Vine/climber/scrambler; (P) Palm; (A) Cycad; (X) Xanthorrhoea

Height range is to the upper edge of the elements of that stratum. **Crown cover** treats canopy elements as solid polygons. **Projected Cover** includes all foliage and other structures that will intercept light to a plane below that stratum.

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Thomas Thielman

Plot#	BB026	Project Identifier	Bream Orchid	Date	16/06/17

Natives (20m Quadrat)	P	F	C	A	Exotics (20m Quadrat)	P	F	C	A
OVERSTOREY (Tallest stratum >1 m tall when mature)									
1 Eucalyptus tereticornis	Y	T	10	10					
2 Eucalyptus quadrangulata	Y	T	15	1					
3 Eucalyptus	Y	T	10	1					
4	Y								
5	Y								
MIDSTOREY (>1 m when mature, generally woody)									
1 Adiantum oxycarpum	Y	S	2	100	Lantana camara	S		60	100
2 Alectryon subcinereus	Y	S	12	1	Sida rhombifolia	F		1	2
3 Maclura	Y	L	1	2	Senna pendula	S		1	20
4	Y				Olea europea	S		1	20
5	Y								
6	Y								
7	Y								
8	Y								
9	Y								
10	Y								

GROUNDCOVER / other (All herbaceous species and woody and less than 1 m when mature; also lithophytes)									
1 Microlaena stipoides	G	F	20	500	Ehrharta erecta	G	F	C	A
2 Dichondra repens	F		1	100	Araujia sericifera	L		10	500
3 Chloris ventricosa	G		2	50	Delairea odorata	L		5	100
4 Nyssanthes diffusa	F		2	100	Bromus catharticus	G		1	50
5 Poa labillardieri	G		1	50	Conyza sp.	F		1	20
6 Commelina cyanea	F		1	20	Bidens pilosa	F		1	10
7 Breynia oblongifolia	S		1	5	Verbena bonariensis	F		1	5
8 Oplismenus aemulus	G		1	50	Chloris gayana	G		1	20
9 Glycine clandestina	L		1	50	Anagallis arvensis	F		1	5
10 Kaysatria clematidea	L		1	20	Asparagus aethiopicus	F		1	1
11 Echinopogon ovatus	G		1	20	Solanum nigrum	F		1	1
12 Desmodium	L		1	1	Solanum pseudopaseo	F		1	10
13 Austrostipa ramosissima	G		2	20	Passiflora	L		1	1
14 Pandorea pandorana	L		1	5					
15 Geranium homeanum	F		1	20					
16 Dianella caerulea	G		1	1					
17 Meliope microcacca	S		1	1					
18 Pseuderanthemum ramadae	F		1	20					
19 Oplismenus imbecillis	G		1	20					
20 Solanum (Prickly)	F		1	5					
21 Rumex brownii	F		1	10					
22 Glycine tabacina	L		1	50					
23 Carex longebrachiata	V		1	20					
24 Panicum sp.?	G		1	2					
25 Einadia trigonos/polyc	F		2	20					
26 Einadia hastata	F		1	5					
27 Clematis aristata	L		1	1					
28 Geitoplesium cymosum	L		1	3					
29 Parsonsia straminea	L		1	1					
30 Streblus brunonianus	S		1	5					
31 Marsdenia Melia azedarach	T		1	1					
32 Tylophora barbata	L		1	5					
33 Myrsine howittiana	S		1	1	Ficus Shrub?				

Perennial: lifecycle of more than 2 growing seasons – not critical; **Form:** (as above): e.g. T, M, S, G, D, F, E, V, R, L, P, A, X – not critical

*** COVER (C):** Estimate of the appropriate **CROWN COVER** for each recorded species; from 0.1–5% and then to the nearest 5%. 1% = 2 m x 2 m square; 0.1% = 64 cm square, estimates should be done by mentally clustering each species. >>100% sum is okay.
ABUNDANCE (A): A relative measure of the number of individuals or shoots of a species within the plot. Use the following intervals, 1,2,3,4,5,6,7,8,9,10,20,50,100,500,1000 or specify a number greater than 1000 if required.

* Note: Cover and Abundance should be collected unless otherwise stated, as per Native Veg. Interim Type Standard (Sivertsen 2009)

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White Throated Treecreeper

BioMetric plota data sheet

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Site Identifier	Tallawarra	Recorders	Brigitte Towle	Date	d/6/06/17
Project Identif.	Project name BBO7 Code:	Transect start (site)	E:	Transect end	E:
			N:		N:
GPS datum	e.g. UTM + Zone	Photo no. (Camera)	St: BBO7 (start)	Trans. orient/ Slope/Aspect	e.g. SW (220°)
			End: BBO7 (end)		e.g. 5° / e.g. 160

* Record from Easting and Northing from both ends of the 50m transect. Point holed rib of star picket along transect line.

Vegetation Zone Identification and Characteristics

Biometric Vegetation Type (Create a standard short version)	MU13 – Moist Box	Soil Texture	Sandy silty clay loam earth peat
Ancillary Code (Usually condition description)	Underscrubbed	Soil Colour	yellow brown red orange black grey
Condition (Low or Mod-Good)		Habitat Features	e.g. cliff, rock shelves, cobble, gilgai, hollow, stag, bluegum count >200 / 0.1 ha
Patch Size – within 100 m (select)	< 0.1 0.1-0.5 0.5-1 1-2 2-5 5+ ha	Mostly same / different type? (select)	

Whole vegetation Zone	Over-storey regeneration	All canopy spp. in vegetation zone		Regen Y/N (< 5 cm DBH)		Proportion
		Eucalyptus fibrosa	Y			1
		E. quadrangulata	Y			

20 x 20m Quadrat	Number of **NSW native** plant spp.	Use species list over page (full Id is not required when guaranteed native) (sum up all counts from the site floristics sheet) (NPS)											
50m Transect at 10 Points	**Native over-storey** cover (%)	25	25	10	20	40	30	25	40	40	20	Sum / 10	27.5 '%' (NOS)
	Native mid-storey cover (pfc % /1m²)	5	5	40	25	5	5	5	15	5	0	Sum / 10	11.0 '%' (NMS)
NATIVE GROUND COVER 50m Transect 50 Points Record **all** 'hits'	**Native ground cover - Grasses** (hits / 50 points)	Grasses & sedges (Poa, Themeda, Carex, Lomandra)										Double score out of 50 to get '%'	84 '%' (NGCG)
	Native ground cover - Shrubs (hits / 50 points)	Cassinia & Melaleuca and less 'native' shrubs										Double score out of 50 to get '%'	6 '%' (NGCS)
	Native ground cover - Other (hits / 50 points)	Native forbs, ferns, vines, native grasses not in the above, logs, rocks, caterpillars & sedges etc										Double score out of 50 to get '%'	72 '%' (NGCO)
EXOTIC along 50m Transect 10 + 50 points	Overstorey (10 pts)	0	0	0	0	0	0	0	0	0	0	0 (a) Sum/10	Sum exotic cover from (a)+(b)+(c) 34 '%'
	Midstorey (10 pts)	0	0	0	0	0	0	0	0	0	0	0 (b) Sum/10	
	Ground cover (score at 50 pts)	Exotic herbaceous species, introduced grasses, annuals										34 (c) Double score	
transect	Other intercepts influencing %age	Count of bare ground (soil intercepts		rock incl. lichen / moss on rock		Soil crust: mosses + fungi + algae + lichens		Litter / woody debris					
20m x 50m Quadrat	Number of trees with hollows	Count each HBT rooted in or on the boundary of site: 5		Total length fallen logs >10cm width (m)		Ecm dia. 50 cm long and 10 cm diameter (fauna habitat) 5 x 50							

Strata	Growth Form/s	Up to 4 Species per stratum in quadrat at scale: Nominate/circle: 0.04 ha (e.g. 20 x 20) or 0.1 ha (e.g. 20 x 50)	Height range (m)	Projected Cover (%)
Upper 1		Eucalyptus tereticornis	5-12m	15%
Upper 2		N/A	N/A	N/A
Uppermost / Canopy percentage **crown cover** (select)		0-5 5-9.9 10-29 30-49 50-69 70-90 90+		
Mid 1		Breynia oblongifolia	0.5-1	5%
Mid 2		Abutilon oxycarpum	0.5-1.5	2%
Understorey woody percentage **crown cover** (select)		0-5 5-9.9 10-29 30-49 50-69 70-90 90+		
Lower 1		Microlaena stipoides	0-0.2	35%
Lower 2		Ehrharta erecta	0-0.2	35%
Perennial native groundcover **cr. cover** %age (select)		0-5 5-9.9 10-29 30-49 50-69 70-90 90+		

Growth Form: e.g. (T) Tree; (M) Mallee tree; (S) Shrub; (G) Tussock Grass (Poa/Themeda); (D) Sod grass (Couch / Kikuyu); (V) Sedge (Cyperoid); (R) Rush (incl. Juncaceae, Lomandra); (F) Forb; (E) Fern; (L) Vine/climber/scrambler; (P) Palm; (A) Cycad; (X) Xanthorrhoea

Height range is to the upper edge of the elements of that stratum. **Crown cover** treats canopy elements as solid polygons. **Projected Cover** includes all foliage and other structures that will intercept light to a plane below that stratum.

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Moist - Box - Under-scrubbed

Plot#	BBO7	Project Identifier	Tallawarra	Date	16/05/17

	Natives (20m Quadrat)	P	F	C	A	Exotics (20m Quadrat)	P	F	C	A
OVERSTOREY (Tallest stratum >1 m tall when mature)										
1	Eucalyptus tereticornis	Y	T	15	8					
2		Y								
3		Y								
4		Y								
5		Y								
MIDSTOREY (>1 m when mature, generally woody)										
1	Abutilon oxycarpum	Y	S	1	20	Lantana camara		S	<1	1
2	Acacia mearnsii	Y	T	2	1					
3	Acacia maidenii	Y	T	1	1					
4		Y								
5		Y								
6		Y								
7		Y								
8		Y								
9		Y								
10		Y								
GROUNDCOVER / other (All herbaceous species and woody and less than 1 m when mature. also Lithophytes)										
1	Breynia oblong		S	35	100	Ehrharta erecta		G	35	1000
2	sigesbeckia orientalis		S	<1	20	Conyza sp.		F	<1	10
3	Urtica incisa		S	<1	20	Stellaria media		F	1	100
4	Microlaena stipoides		G	35	1000	Acetosa sagittatum.		F	<1	3
5	Oplismenus aemulus		G	5	500	Euphorbia peplus		F	<1	10
6	Commelina cyanea. unknown		F	<1	100	Cerastium glomerata		F	1	100
7	Eremophila debilis? sp. aff.		F	<1	1	Eleusine tristachya		G	<1	3
8	Cayratia clematidea		L	<1	1	Sida rhombifolia.		S	<1	10
9	Dichondra repens		F	<1	100	Bromus catharticus		G	<1	1
10	Einadia polygonoides		C	<1	20	Araujia sericifera.		L	<1	10
11	Pandorea pandorana.		L	<1	10	Solanum nigrum		S	<1	1
12	Nyssanthes diffusa.		S	<1	10	Senecio madagascarien		F	<1	7
13	Rumex brownii		F	<1	10	Bidens pilosa		S	<1	6
14	Juncus sp. usitatus? ✓		V	<1	2	Cenchrus clandestinus		G	<1	20
15	Echinopogon ovatus		G	<1	5	Delaria odorata		L	<1	1
16	Cotula australis		F	<1	1	Paronychia brasiliensis		F	<1	10
17	Eragrostis leptostachys ✓		G	2	500	Plantago lanceolata		F	<1	1
18	Oxalis sp.? perrenans ✓		F	<1	5	Chloris gayiana		G	<1	8
19	Cyperus gracilis		V	<1	1	Setaria parviflorum		G	<1	1
20	Xerochrysum bracteatum		F	<1	2	Paspalum dilatatum		G	<1	3
21	Desmodium varians		F	<1	3					
22	Geranium homeanum		F	<1	20					
23	Melia azerdach		S	<1	1					
24	Carex longebrachi		V	<1	1					
25	Plectranthus parviflorus		F	<1	1					
26	Glycine clandestina.		L	<1	1					
27	Sarcopetalum harveyanum		L	<1	1					
28										
29										
30										
31										
32										
33										

Perennial: lifecycle of more than 2 growing seasons – not critical; **Form:** (as above): e.g. T, M, S, G, D, F, E, V, R, L, P, A, X – not critical

* **COVER (C):** Estimate of the appropriate **CROWN COVER** for each recorded species; from 0.1–5% and then to the nearest 5%. 1% = 2 m x 2 m square; 0.1% = 64 cm square, estimates should be done by mentally clustering each species. >>100% sum is okay.
ABUNDANCE (A): A relative measure of the number of individuals or shoots of a species within the plot. Use the following intervals, 1,2,3,4,5,6,7,8,9,10,20,50,100,500,1000 or specify a number greater than 1000 if required.

* Note: Cover and Abundance should be collected unless otherwise stated, as per Native Veg. Interim Type Standard (Sivertsen 2009)

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BioMetric plota data sheet

Site Identifier	BBO8	Recorders	BT + [illegible]	Date	06 / 06 / 2017
Project Identif.	Tallawarra	Transect start (site)	E: 298206 N: 6178357	Transect end	E: 298222 N: 6178312
GPS datum	GDA 94	Photo no. (Camera)	St: 125650 End: 131328	Trans. orient/ Slope/Aspect	e.g. nort 140 e.g. 16 / e.g. 140

* Record from Easting and Northing from both ends of the 50m transect. Point holed rib of star picket along transect line.

Vegetation Zone Identification and Characteristics

Biometric Vegetation Type (Create a standard short version)	Subtropical Rainforest	Soil Texture	Sandy silty clay loam earth peat
Ancillary Code (Usually condition description)	Lantana	Soil Colour	yellow brown red orange black grey
Condition (Low or Mod-Good)		Habitat Features	e.g cliff, rock shelves, cobble, gilgai, bueapock count >200 / 0.1 ha
Patch Size – within 100 m (select)	< 0.1 0.1-0.5 0.5-1 1-2 2-5 5+ ha	Mostly same / different type? (select)	

		All canopy spp. in vegetation zone		Regen Y/N (< 5 cm DBH)		Proportion
Whole vegetation Zone	Over-storey regeneration	Toona ciliata	✓	Abrophyll ornans		
		Melicope micro	✓	Acmena smithii		
		Dendroc excel	✓	Diploglottis australis		

20 x 20m Quadrat	Number of **NSW native** plant spp.	Use species list over page (full Id is not required when guaranteed native) 'sum up all' counts from the site floristics sheet) (NPS)											
50m Transect at 10 Points	**Native over-storey** cover (%)	90 (5)	75 (10)	75 (15)	85 (20)	90 (25)	90 (30)	75 (35)	65 (40)	60 (45)	80 (50)	Sum / 10	'%' (NOS)
	Native mid-storey cover (pfc % /1m²)											Sum / 10	0 '%' (NMS)
NATIVE GROUND COVER 50m Transect 50 Points Record **all** 'hits'	**Native ground cover - Grasses** (hits / 50 points)	Grasses = NSW native (LADE45 only)										Double score out of 50 to get '%' 2	4 '%' (NGCG)
	Native ground cover - Shrubs (hits / 50 points)	Shrubs are woody and less than 1 m tall										Double score out of 50 to get '%' 2	4 '%' (NGCS)
	Native ground cover - Other (hits / 50 points)	Everything in the groundcover [illegible] categories incl. sedges etc										Double score out of 50 to get '%' 24	48 '%' (NGCO)
EXOTIC along 50m Transect 10 + 50 points	Overstorey (10 pts)											(a) Sum/10	Sum exotic cover from (a)+(b)+(c)
	Midstorey (10 pts)							5				0.5 (b) Sum/10	6.5 '%'
	Ground cover (score at 50 pts)	Exotic herbaceous plants and those < 1 m when mature										6 (c) Double score	
transect	Other intercepts influencing %age	Count of bare ground (soil) intercepts 1		rock incl. lichen / moss on rock 11				Soil crust mosses + fungi + algae + lichens					
20m x 50m Quadrat	Number of trees with hollows	Count each HBT rooted in or on the boundary of site 1				Total length fallen logs >10cm width (m)		Each min 50 cm long and 10 cm diameter fauna habitat 31					

Strata	**Growth Form/s**	Up to 4 Species per stratum in quadrat at scale: Nominate/circle: 0.04 ha (e.g. 20 x 20) or 0.1 ha (e.g. 20 x 50)	Height range (m)	**Projected Cover** (%)
Upper 1		Toona ciliata	8 - 18	45
Upper 2		Dendrocnide excel	4 - 18	30
Uppermost / Canopy percentage **crown cover** (select)		0-5 5-9.9 10-29 30-49 50-69 70-90 90+		
Mid 1		Strebulus brunonianus	1-6	5
Mid 2		Alectryon subcinereus	1-6	5
Understorey woody percentage **crown cover** (select)		0-5 5-9.9 10-29 30-49 50-69 70-90 90+		
Lower 1		Adiantum formosum.	0 - 0.5	35
Lower 2		Pseuderanthem variable	0 - 0.1	<1
Perennial **native** groundcover **cr. cover** %age (select)		0-5 5-9.9 10-29 30-49 50-69 70-90 90+		

Growth Form: e.g. (T) Tree; (M) Mallee tree; (S) Shrub; (G) Tussock Grass (Poa/Themeda); (D) Sod grass (Couch / Kikuyu); (V) Sedge (Cyperoid); (R) Rush (incl. Juncaceae, Lomandra); (F) Forb; (E) Fern; (L) Vine/climber/scrambler; (P) Palm; (A) Cycad; (X) Xanthorrhoea

Height range is to the upper edge of the elements of that stratum. **Crown cover** treats canopy elements as solid polygons. **Projected Cover** includes all foliage and other structures that will intercept light to a plane below that stratum.

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Plot#	BB08	Project Identifier	Tallawarra	Date	16/06/17

	Natives (20m Quadrat)	P	F	C	A	Exotics (20m Quadrat)	P	F	C	A
OVERSTOREY (Tallest stratum >1 m tall when mature)										
1	Toona ciliata	Y	T	45	5					
2	Dendrocnide excelsa	Y	T	30	3					
3	Abrophyllum ornans	Y	T	70	2					
4	Melicope australis	Y	T	5	10					
5	Acmena smithii	Y	T	3	1					
MIDSTOREY (>1 m when mature, generally woody)										
1	Streblus brunonianus	Y	S	5	50	Lantana camara		S	3	20
2	Cissus antarctica	Y	L	5	10	Solanum mauritianum		S	1	2
3	Acmena smithii	Y								
4	Parsonsia straminea	Y	L	2	10					
5	Citriobatus pauciflorus	Y	S	1	20					
6	Melicope micrococca	Y								
7	Croton verreauxii	Y	S	<1	10					
8	Cassine australis	Y	S	<1	1					
9	Alectryon subcinereus	Y	S	1	3	Cinnamomum camphora		S	1	5
10	Archontophoenix cunninghamiana	Y								
GROUNDCOVER / other (All herbaceous species and woody and less than 1 m when mature; also lithophytes)										
1	Adiantum		L	70	500	Delairea odorata		L	1	10
2	Smilax australis		L	1	10	Araujia sericifera		L	1	5
3	Marsdenia		L	1	10	Senna pendula		S	1	5
4	Pseuderanthemum variabile		F	1	10					
5	Gentnoplesium cymosum		L	1	10					
6	Cierodendrum tomentosum		S	1	1					
7	Kaysatia clematidea		L	1	10					
8	Unjica incisa		F	1	10					
9	Oplismenus imbecillis		G	1	50					
10	Pandorea pandorana		L	1	2					
11	Eustrephus latifolius		L	1	1					
12	Abutilon oxycarpum		S	1	4					
13	Ficus sp.		L	1	1					
14										
15										
16										
17										
18										
19										
20										
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22										
23										
24										
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28										
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30										
31										
32										
33										

Perennial: lifecycle of more than 2 growing seasons – not critical; **Form:** (as above): e.g. T, M, S, G, D, F, E, V, R, L, P, A, X – not critical

*** COVER (C):** Estimate of the appropriate **CROWN COVER** for each recorded species; from 0.1–5% and then to the nearest 5%. 1% = 2 m x 2 m square; 0.1% = 64 cm square, estimates should be done by mentally clustering each species. >>100% sum is okay.
ABUNDANCE (A): A relative measure of the number of individuals or shoots of a species within the plot. Use the following intervals, 1,2,3,4,5,6,7,8,9,10,20,50,100,500,1000 or specify a number greater than 1000 if required.

* Note: Cover and Abundance should be collected unless otherwise stated, as per Native Veg. Interim Type Standard (Sivertsen 2009)

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BioMetric plota data sheet

Site name	Tallawarra	Recorders	LJM / AJB	Date	18/11/17
Wapoint/ Plot ID	BB10	Easting*	St: 297669 End: 297616	Northing*	St: 6177687 End: 6177679
		Photo no. (LJ's photos)	St: 95049 95045 End: 101658 101702	xPlot orient/ Slope/Aspect	255 12 / 210

Plant Community Type	Syd Blue Gum x Bang
Ancillary code	D/shrubby — Condition (Low or Mod-Good): M-G

20 x 20m Quadrat		Number of native plant species											(NPS)
NATIVE	50m Transect – 10 Points	Native over-storey cover (%)	15	10	50	50	0	0	0	0	0	0	0	12.5 % (NOS) Sum / 10
		Native mid-storey cover (%)	0	10	50	50	50	0	0	0	0	0	0	16 % (NMS) Sum / 10
	50m Transect – 50 Points	Native ground cover (tally/50 points) – Grasses	III											8 % (NGCG) Double score out of 50 to get %
		Native ground cover (tally/50 points) – Shrubs	II											4 % (NGCS) Double score out of 50 to get %
		Native ground cover (tally/50 points) – other	IIII IIII I											22 % (NGCO) Double score out of 50 to get %
EXOTIC	50m Transect – 10 points + 50 points	Overstorey (% @ 10 points)											0 (a) Sum/10	Sum exotic cover (%) from (a)+(b)+(c) 83 %
		Midstorey (% @ 10 points)	5	5	5	5	5	5	0	0	0	0	3 (b) Sum/10	
		Ground (tally/50 points)	IIII IIII IIII IIII IIII IIII IIII IIII										80 (c) Double score	

20m x 50m Quadrat	Number of trees with hollows	1	Total length fallen logs >10cm width (m) IIII IIII IIII IIII IIII

Whole Veg. Zone	Over-storey regeneration	All canopy spp. in Veg Zone	Regen (Y/N) (indiv. <5cm?)	Proportion
		E. quad M. styphelioides		

Strata	Form	Species	Height range	PFC
Upper 1	T	E. quad, M. Styphelioides	12-16	20
Upper 2				
Mid 1	S	Lantana, Strebulus	1-3	10
Mid 2				
Lower 1	G	Kikuyu, Carex	0-0.2	90
Lower 2				

Form: (T) Tree; (M) Mallee tree; (S) Shrub; (G) Tussock Grass (Poa/Themeda); (d) Sod grass (Couch/Kikuyu); (L) Vine/climber/scrambler; (V) Sedge (Cyperoid); (R) Rush (Restioid, Juncaceae); (F) Forb; (E) Fern; (P) Palm; (A) Cycad

1

Site name	Tallawarra	Plot no.	BB10	Date	18/7/2017
PCT	MU13	Ancillary	Lantana / Dist. shrubby. 697451		

	Natives (20m Quadrat)	F	C	A	Exotics (20m Quadrat)	F	C	A
	OVERSTOREY							
1	Euc grad	T	10	1				
2	Melaleuca stypheloides	T	10	3				
3								
4								
5								
6								
7								
8								
	MIDSTOREY							
1	Streb brimo	S	5	10	Dovyallis caffra	S	1	3
2					Rubus fruticosus		<1	5
3					~~Ligustrum sinense~~			
4					Lantana camara		5	10
5					Sherardia arvensis		<1	100
6					Tagetes minuta		<1	2
7					Bromus catharticus		<1	1
8					Solanum pseudocap		<1	1
9					Euphorbia peplus		<1	50
10					Solanum nigrum		<1	1
	GROUNDCOVER / other							
1	Carex longebrachiata		2	50	Cenchrus clandestinus		20	1000
2	~~Gahnia sp. prop?~~		<1	100	Paspalum dilatatum		10	500
3	Bothriochloa macra		<1	50	Plantago lanceolata		<1	10
4	Glycine clandestina		<1	10	Arthropodium fissifolius		10	500
5	Stellaria flaccida		<1	1	Senecio madagascarensis		<1	50
6	Geranium solanderi		<1	20	Plantago lanceolata.		<1	50
7	Dichondra repens		<1	50	Cynodon dactylon.		35	1000
8	Veronica plebeia.		<1	10	Sida rhombifolia.		<1	20
9	Oplismenus aemulus		<1	20	Hypochaeris radicata.		<1	20
10	Gentianopsis cymosum		<1	10	Anagallis arvensis		<1	3
11	Microlaena stipoides		2	100	Sporobolus africanus		2	100
12	Juncus usitatus		<1	5	Linum usitis		<1	1
13	Echinopogon caespitosus		<1	1	Taraxacum officinale.		<1	2
14	~~Einadia nutans~~				Cirsium vulgare		<1	20
15	Rumex sp. brownii?		<1	10	Bidens pilosa.		<1	2
16	Alternanthera denticulata		<1	1	Verbena quadridentata		<1	2
17	Nyssanthes diffusa		<1	20	Gomphocarpus fruticosus		<1	10
18	Pseuderanthemum variable		<1	20	Conyza sp.		<1	20
19	Maclura cochinensis		<1	2	Oxalis sp.		<1	20
20	Einadia trigonos		<1	2	Trifolium repens		<1	1
21	Poaceae sp. ~~Panicum simile~~		<1	1	Setaria parviflora.		<1	16
22					~~Forb~~ Ranunculus sp. repens		2	100
23					~~Forb~~ Prunella sp.? vulgaris		<1	20.

* **Cover (C)**: Estimate of the appropriate cover measure for each recorded species; from 1–5 and then to the nearest 5%;.
Abundance (A): A relative measure of the number of individuals or shoots of a species within the plot. Use the following intervals, 1,2,3,4,5,6,7,8,9,10,20,50,100,500,1000 or specify a number greater than 1000 if required.

Form: * (T) Tree; (M) Mallee tree; (S) Shrub; (G) Tussock Grass (Poa/Themeda); (d) Sod grass (Couch/Kikuyu); (L) Vine/climber/scrambler; (V) Sedge (Cyperoid); (R) Rush (Restioid, Juncaceae); (F) Forb; (E) Fern; (P) Palm; (A) Cycad

Braun-blanquet: 1=<5% (rare, <3 individividuals); 2=<5% (uncommon, scattered/localised); 3=<5% (common, consistent thru plot); 4a=<5% (very abundant, many individuals thru plot); 4b=5-25%; 5=25-50%; 6=50-75%; 7=75-100%

* Note: Cover and Abundance should be collected unless otherwise stated, as per Native Veg. Interim Type Standard (Sivertsen 2009)

2

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BioMetric plota data sheet

Site name	Tallawarra	Recorders	LJM / AJD	Date	18/7/17
Wapoint/ Plot ID	BB11	Easting *	St: 297726 End: 297739	Northing*	St: 6177756 End: 6177728
		Photo no. (L Photo)	St: 112610 112617 End: 114344 114349	xPlot orient/ Slope/Aspect	200° 20 / 200°

Plant Community Type	Syd BG x Bara
Ancillary code	Acacia

Condition (Low or Mod-Good): M-G

20 x 20m Quadrat		Number of native plant species											(NPS)
NATIVE	50m Transect – 10 Points	Native over-storey cover (%)	0	0	0	0	0	0	0	0	0	0	0 % (NOS) Sum / 10
		Native mid-storey cover (%)	40	0	0	0	0	0	0	0	0	0	4 % (NMS) Sum / 10
	50m Transect – 50 Points	Native ground cover (tally/50 points) – Grasses	11 111 1										22 % (NGCG) Double score out of 50 to get %
		Native ground cover (tally/50 points) – Shrubs	1111										8 % (NGCS) Double score out of 50 to get %
		Native ground cover (tally/50 points) – other	111 111 111 111 111 1111										60 % (NGCO) Double score out of 50 to get %
EXOTIC	50m Transect – 10 points + 50 points	Overstorey (% @ 10 points)	0	0	0	0	0	0	0	0	0	0	0 (a) Sum/10
		Midstorey (% @ 10 points)	40	15	20	40	50	50	30	20	20	20	30.5 (b) Sum/10
		Ground (tally/50 points)	111 111 111 111 111 111 111 111 11										89 (c) Double score

Sum exotic cover (%) from (a)+(b)+(c): 114.5 %

20m x 50m Quadrat	Number of trees with hollows	0	Total length fallen logs >10cm width (m): 0

Whole Veg. Zone	Over-storey regeneration	All canopy spp. in Veg Zone	Regen (Y/N) (indiv. <5cm?)	Proportion

Strata	Form	Species	Height range	PFC
Upper 1				
Upper 2	T	Scallopia	8	10
Mid 1	M	Stebus, Lantana	1-3	50
Mid 2				
Lower 1	G	Cynodon, Kikuyu, Carex	0-1	70
Lower 2				

Form: (T) Tree; (M) Mallee tree; (S) Shrub; (G) Tussock Grass (Poa/Themeda); (d) Sod grass (Couch/Kikuyu); (L) Vine/climber/scrambler; (V) Sedge (Cyperoid); (R) Rush (Restioid, Juncaceae); (F) Forb; (E) Fern; (P) Palm; (A) Cycad

SN Ibis — Red brown finch
E. whip
White-faced Heron

Site name	Tallawarra	Plot no.	BB11	Date	18/7/17
PCT	MU13	Ancillary	Acacia scrub.		

	Natives (20m Quadrat)	F	C	A	Exotics (20m Quadrat)	F	C	A
	OVERSTOREY							
1								
2								
3								
4								
5								
6	Notelaea venosa	S	<1	1				
7	Echinopogon ovatus.	G	<1	1				
8	Climber sp. as @ BBO1	L	<1	1	→=Celastrus australis (native)			
	MIDSTOREY							
1	Acacia meamsii	S	5	3	Lantana camara	S	30	50
2	Scalopia bow	S	10	1	Rubus frut	S	<1	1
3	Elaeden orstale	S	3	4	Doryg caffra	S	<1	4
4	Streblus brun	S	<1	10				
5	Croton verreaux	S	<1	10				
6	Pitto m/t	S	<1	20				
7	Cryptocarya micro	S	<1	1				
8	Carex inversa	V	<1	20				
9	Euchiton japonicus	F	<1	50				
10	Myrsine variab	S	<1	2				
	GROUNDCOVER / other							
1	Carex long	V	5	50	Setaria par	G	<1	20
2	Asplenium flab	E	2	100	Anagallis ar	F	<1	50
3	Oplismenus aem	G	<1	100	Conyza sp	F	<1	50
4	Aeltanop cymo	L	<1	10	Cirsium vla	F	<1	50
5	Pseudo variable	F	<1	20	Gamoch americ	F	<1	10
6	Desmod gunnii	F	<1	1	Cerastium glom	F	<1	20
7	Rubus parv	S	<1	1	Viola sodva	F	<1	1
8	Breynia obl	S	2	20	Vob bon	F	<1	4
9	Pandorea pand	L	<1	1	Sompho frut	F	<1	20
10	Geranium sol	F	<1	50	Aster (rosette) Oiphy.	F	<1	1
11	Sporob elong	G	2	50	Androp vira	G	<1	1
12	Pellea falcata	E	<1	20	Plant lance	F	<1	50
13	Wahl sp	F	<1	10	Ageratina adeno	F	<1	10
14	Dichond rep	F	<1	50	Plantago lanceo	F	<1	20
15	Calum sp. @	F	<1	50	Sonchus asper	F	<1	3
16	Microlaena stip	G	10	500	Euphorbia peplus	F	<1	1
17	Oxalis perr	F	<1	1	Sonchus oleraceus	F	<1	1
18	Rytidos penculata	G	<1	20	Brica minor	G	<1	1
19	Cynodon dact	G	20	1000	Passiflora subpeltata	L	<1	1
20	Dichelac a micr	G	<1	10	Paspalum dilatatum	G	25	100
21	Cragrostis leptо	G	<1	10	Axon fiss	G	5	100
22	Madura cochin	S	<1	1				
23	Veronica plebeia	F	<1	1				

= * Sherardia arvensis (exotic)

Eurybs chrysanthemoides

* **Cover (C)**: Estimate of the appropriate cover measure for each recorded species; from 1–5 and then to the nearest 5%; **Abundance (A)**: A relative measure of the number of individuals or shoots of a species within the plot. Use the following intervals, 1,2,3,4,5,6,7,8,9,10,20,50,100,500,1000 or specify a number greater than 1000 if required.

Form: * (T) Tree; (M) Mallee tree; (S) Shrub; (G) Tussock Grass (Poa/Themeda); (d) Sod grass (Couch/Kikuyu); (L) Vine/climber/scrambler; (V) Sedge (Cyperoid); (R) Rush (Restioid, Juncaceae); (F) Forb; (E) Fern; (P) Palm; (A) Cycad

Braun-blanquet: 1=<5% (rare, <3 individividuals); 2=<5% (uncommon, scattered/localised); 3=<5% (common, consistent thru plot); 4a=<5% (very abundant, many individuals thru plot); 4b=5-25%; 5=25-50%; 6=50-75%; 7=75-100%

* Note: Cover and Abundance should be collected unless otherwise stated, as per Native Veg. Interim Type Standard (Sivertsen 2009)

Grey fantail Fantailed Cuckoo
SFW 2 R wattle
A Magpie Lewin HE

Appendix B: Likelihood Table

Scientific Name Common Name	Legal status	Number of records	Closest record and date	Most recent and proximity	Likelihood of occurrence	
					Prior to field assessment	Post field assessment
KINGDOM: Animalia; CLASS: Mammalia						
Heleioporus australiacus Giant Burrowing Frog	TSC Act: V EPBC Act: V	0	N/A	N/A	Low	Not present
Litoria aurea Green and Golden Bell Frog	TSC ACT: E EPBC Act: V	0	N/A	N/A	Low	Low
KINGDOM: Animalia; CLASS: Aves						
Actitis hypoleucos Common Sandpiper	EPBC Act: C, J, K	1	3.18km (14/02/2017)	14/02/2017 (3.18km)	Low	Not present
Anthochaera phrygia Regent Honeyeater	TSC Act: CE EPBC Act: CE	0	N/A	N/A	Not present	Not present
Apus pacificus Fork-tailed Swift	EPBC Act: C, J, K	2	3.44km (14/02/2017)	14/02/2017 (3.44km)	Low	Low
Ardea ibis Cattle Egret	EPBC Act: C, J	28	0.44km (27/04/2015)	31/07/2016 (0.69km)	High	Recent record
Ardenna pacificus Wedge-tailed Shearwater	EPBC Act: J	3	1.51km (28/12/1998)	(28/12/1998) 1.51km	Low	Not present
Artamus cyanopterus cyanopterus Dusky Woodswallow	TSC Act: V	3	3.77km (28/08/2011)	29/11/2013 (4.59km)	Low	Not present
Botaurus poiciloptilus Australasian Bittern	TSC Act: E1 EPBC ACT: E	1	0.69km (7/06/2016)	7/06/2016 (0.69km)	Moderate	Low

Scientific Name Common Name	Legal status	Number of records	Closest record and date	Most recent and proximity	Likelihood of occurrence	
					Prior to field assessment	Post field assessment
Calidris acuminata Sharp-tailed Sandpiper	EPBC Act: C, J, K	24	0.69km (12/03/2016)	16/02/2017 (3.05km)	Moderate	Low
Calidris ferruginea Curlew Sandpiper	TSC Act: E1 EPBC Act: CE, C, J, K	1	3.05km (15/02/2017)	15/02/2017 (3.05km)	Low	Not present
Calidris melanotos Pectoral Sandpiper	EPBC Act: J, K	1	3.99km (28/02/2007)	28/02/2007 (3.99km)	Low	Not present
Circus assimilis Spotted Harrier	TSC ACT: V	1	3.13km (18/10/2013)	18/10/2013 (3.13km)	Low	Low
Diomedea exulans Wandering Albatross	TSC Act: E1 EPBC Act: E, J	2	4.71km (26/10/1999)	26/10/1999 (4.71km)	Not present	Not present
Epthianura albifrons White-fronted Chat	TSC Act: V	1	3.86km (3/04/1992)	3/04/1992 (3.86km)	Low	Not present
Gallinago hardwickii Latham's Snipe	EPBC Act: C, J, K	12	0.69km (4/03/2016)	4/03/2016 (0.69km)	Moderate	Low
Haliaeetus leucogaster White-bellied Sea-Eagle	EPBC Act: C	27	0.51km (22/05/2015)	10/03/2017 (3.54km)	High	Moderate
Hieraaetus morphnoides Little Eagle	TSC Act: V	2	0.69km (24/06/2016)	24/06/2016 (0.69km)	Moderate	Moderate
Hirundapus caudacutus White-throated Needletail	EPBC Act: C, J, K	3	0.69km (28/02/2016)	14/02/2017 (3.44km)	Moderate	Moderate
Hydroprogne caspia Caspian Tern	EPBC Act: C, J	25	0.51km (15/08/2015)	16/02/2017 (3.05km)	Low	Not present
Ixobrychus flavicollis Black Bittern	TSC ACT: V	5	3.03km (15/09/2002)	15/02/2017 (3.06km)	Moderate	Low

Scientific Name Common Name	Legal status	Number of records	Closest record and date	Most recent and proximity	Likelihood of occurrence	
					Prior to field assessment	Post field assessment
Lathamus discolor Swift Parrot	TSC ACT: E1 EPBC Act: CE	1	3.75km (13/08/1990)	13/08/1990 (3.75km)	Low	Not present
Limosa lapponica Bar-tailed Godwit	EPBC Act: C, J, K	13	3.05km (16/02/2017)	16/02/2017 (3.05km)	Low	Not present
Lophoictinia isura Square-tailed Kite	TSC Act: V	2	0.69km (24/06/2016)	24/06/2016 (0.69km)	Moderate	Moderate
Ninox strenua Powerful Owl	TSC Act: V	1	2.21km (14/11/2012)	14/11/2012 (2.21km)	Low	Not present
Numenius madagascariensis Eastern Curlew	EPBC Act: CE, C, J, K	9	3.05km (16/02/2017)	10/03/2017 (3.54km)	Low	Not present
Numenius phaeopus Whimbrel	EPBC Act: C, J, K	2	3.05km (16/02/2017)	16/02/2017 (3.05km)	Low	Not present
Oxyura australis Blue-billed Duck	TSC Act: V	39	0.51km (9/05/2014)	24/06/2016 (0.69km)	High	Moderate
Pandion cristatus Eastern Osprey	TSC Act: V	29	0.04km (16/03/2013)	24/08/2016 (3.18km)	High	Moderate
Petroica boodang Scarlet Robin	TSC Act: V	1	0.69km (15/08/2015)	15/08/2015 (0.69km)	Moderate	Moderate
Petroica rodinogaster Pink Robin	TSC Act: V	1	1.15km (31/07/1996)	31/07/1996 (1.15km)	Low	Low
Plegadis falcinellus Glossy Ibis	EPBC Act: C	3	0.69km (4/02/2015)	4/02/2015 (0.69)	Moderate	Moderate
Sternula albifrons Little Tern	TSC Act: E1 EPBC Act: C, J, K	46	3.29km (3/02/2008)	18/03/2009 (4.71km)	Low	Not present

Scientific Name Common Name	Legal status	Number of records	Closest record and date	Most recent and proximity	Likelihood of occurrence	
					Prior to field assessment	Post field assessment
Stictonetta naevosa Freckled Duck	TSC Act: V	38	0.69km (10/06/2016)	10/06/2016 (0.69km)	High	Moderate
Tringa brevipes Grey-tailed Tattler	EPBC Act: C, J, K	1	3.54km (23/01/1998)	23/01/1998 (3.54km)	Low	Not present
Tringa nebularia Common Greenshank	EPBC Act: C, J, K	5	3.62km (2/02/2014)	2/02/2014 (3.62km)	Low	Not present
Tringa stagnatilis Marsh Sandpiper	2/02/2014	2	1.15km (28/09/1992)	15/02/2017 (3.05km)	Low	Low
Tyto novaehollandiae Masked Owl	TSC Act: V	1	3.49km (27/06/2016)	27/06/2016 (3.49km)	Low	Low
KINGDOM: Animalia; CLASS: Mammalia						
Cercartetus nanus Eastern Pygmy-possum	TSC Act: V	0	N/A	N/A	Not present	Not present
Chalinolobus dwyeri Large-eared Pied Bat	TSC Act: V EPBC Act: V	5	0.13km (31/12/1996)	26/03/2015 (3.43km)	Moderate	Moderate
Falsistrellus tasmaniensis Eastern False Pipistrelle	TSC Act: V	9	0.96km (30/01/2015)	4/03/2015 (1.46km)	High	Moderate
Isoodon obesulus subsp. obesulus Southern Brown Bandicoot (eastern)	TSC Act: E EPBC Act: E	0	N/A	N/A	Not present	Not present
Miniopterus australis Little Bentwing-bat	TSC Act: V	13	0.96km (30/01/2015)	26/03/2015 (3.43km)	High	Moderate
Miniopterus schreibersii oceanensis Eastern Bentwing-bat	TSC Act: V	16	0.13km (31/12/1996)	26/03/2015 (3.43km)	High	Moderate

Scientific Name Common Name	Legal status	Number of records	Closest record and date	Most recent and proximity	Likelihood of occurrence	
					Prior to field assessment	Post field assessment
Mormopterus norfolkensis Eastern Freetail-bat	TSC Act: V	14	0.89km (9/04/2015)	9/04/2015 (0.89km)	High	Moderate
Myotis macropus Southern Myotis	TSC Act: V	1	4.59km (10/09/2012)	10/09/2012 (4.59km)	Low	Low
Petaurus norfolcensis Squirrel Glider	TSC Act: V	0	N/A	N/A	Not present	Not present
Pteropus poliocephalus Grey-headed Flying-fox	TSC Act: V EPBC Act: V	14	0.12km (20/07/2014)	10/03/2017 (3.54km)	High	Moderate
Saccolaimus flaviventris Yellow-bellied Sheathtail-bat	TSC Act: V	8	0.96km (30/01/2015)	15/02/2015 (3.04km)	Moderate	Moderate
Scoteanax rueppellii Greater Broad-nosed Bat	TSC Act: V	11	0.96km (30/01/2015)	20/02/2015 (1.5km)	High	Moderate
Sminthopsis leucopus White-footed Dunnart	TSC Act: V	0	N/A	N/A	Not present	Not present
KINGDOM: Plantae						
Chorizema parviflorum	TSC Act: E2	110	0.5km (30/06/1995)	2/09/2014 (4.27km)	High	Not present
Cynanchum elegans White-flowered Wax Plant	TSC Act: E1 EPBC Act: E	17	3.45km (8/06/1997)	14/03/2012 (4.91km)	Moderate	Not present
Daphnandra johnsonii Illawarra Socketwood	TSC Act: E EPBC Act: E	0	N/A	N/A	Low	Not present
Irenepharsus trypherus Illawarra Irene	TSC Act: E EPBC Act: E	0	N/A	N/A	Low	Not present
Lespedeza juncea subsp. *sericea*	TSC Act: E2	3	0.79km (3/12/2004)	4/04/2014 (0.86km)	Moderate	Low

Scientific Name Common Name	Legal status	Number of records	Closest record and date	Most recent and proximity	Likelihood of occurrence	
					Prior to field assessment	Post field assessment
Phascolarctos cinereus Koala	TSC Act: V EPBC Act: V	0	N/A	N/A	Not present	Not present
Pimelea curviflora var. curviflora	TSC Act: V EPBC Act: V	12	4.07km (2/09/2014)	2/09/2014 (4.07km)	Low	Not present
Pimelea spicata Spiked Rice-flower	TSC Act: E1 EPBC Act: E	3	3.77km (1/09/1993)	1/09/2005 (3.87km)	Low	Not present
Pterostylis gibbosa Illawarra Greenhood	TSC Act: E1 EPBC Act: E	11	0.91km (17/09/2003)	27/09/2015 (4.63km)	Moderate	Low
Senna acclinis Rainforest Cassia	TSC Act: E	0	N/A	N/A	Low	Not present
Solanum celatum	TSC Act: E1	15	0km (7/10/2016)	19/12/2016 (0.29km)	High	Not present Note: This species was found in the northern precinct to the west of the development area.
Zieria granulata Illawarra Zieria	TSC Act: E1 EPBC Act: E	8	2.61km (9/08/2016)	9/08/2016 (2.61km)	Moderate	Not present

Unless other stated, text is taken from the OEH Threatened Species (http://www.environment.nsw.gov.au/threatenedspecies/); Legal Status codes from the Atlas of NSW Wildlife: V = Vulnerable, E1 = Endangered, E2 = Endangered Population, E4A = Critically Endangered, C = China and Australia Migratory Bird Agreement (CAMBA), J = Japan and Australia Migratory Bird Agreement (JAMBA); TSC Act = NSW *Threatened Species Conservation Act 1995,* EPBC Act = Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*

Appendix C: Flora and fauna species inventories

Flora

Family	Genus	Species	Common name	Native/Exotic
Alliaceae	*Agapanthus*	*praecox*	African Lily	Exotic
Anthericaceae	*Caesia*	*parviflora* var. *parviflora*	Pale Grass-lily	Native
Apiaceae	*Actinotus*	*minor*	Lesser Flannel Flower	Native
Apiaceae	*Actinotus*	*helianthi*	Flannel Flower	Native
Apiaceae	*Platysace*	*lanceolata*	Shrubby Platysace	Native
Apiaceae	*Xanthosia*	*tridentata*	Rock Xanthosia	Native
Araliaceae	*Polyscias*	*sambucifolia*	Elderberry Panax	Native
Asparagaceae	*Asparagus*	*aethiopicus*	Ground Asparagus	Exotic
Aspleniaceae	*Asplenium*	*flabellifolium*	Necklace Fern	Native
Asteraceae	*Bidens*	*pilosa*	Cobblers Peg	Exotic
Blechnaceae	*Blechnum*	sp.		Native
Casuarinaceae	*Allocasuarina*	*littoralis*	Black She-oak	Native
Cunoniaceae	*Ceratopetalum*	*gummiferum*	New South Wales Christmas-bush	Native
Cyperaceae	*Caustis*	*flexuosa*	Curly Wig	Native
Cyperaceae	*Cyathochaeta*	*diandra*		Native
Cyperaceae	*Lepidosperma*	*filiforme*		Native
Cyperaceae	*Lepidosperma*	*laterale*		Native
Cyperaceae	*Ptilothrix*	*deusta*		Native
Cyperaceae	*Schoenus*	*apogon*	Common Bog-rush	Native
Dicksoniaceae	*Calochlaena*	*dubia*	Rainbow Fern	Native
Dilleniaceae	*Hibbertia*	*aspera*	Rough Guinea Flower	Native
Dilleniaceae	*Hibbertia*	*dentata*	Trailing Guinea Flower	Native
Elaeocarpaceae	*Elaeocarpus*	*reticulatus*	Blueberry Ash	Native
Euphorbiaceae	*Homalanthus*	*populifolius*	Bleeding Heart	Native
Fabaceae - Caesalpiniodeae	*Senna*	*pendula* var. *glabrata*		Exotic

Family	Genus	Species	Common name	Native/Exotic
Fabaceae - Faboideae	*Bossiaea*	*heterophylla*	Variable Bossiaea	Native
Fabaceae - Faboideae	*Bossiaea*	*scolopendria*		Native
Fabaceae - Faboideae	*Desmodium*	sp.		Native
Fabaceae - Faboideae	*Dillwynia*	*retorta*		Native
Fabaceae - Faboideae	*Mirbelia*	*rubifolia*	Heathy Mirbelia	Native
Fabaceae - Faboideae	*Pultenaea*	*tuberculata*	Wreath Bush-pea	Native
Fabaceae - Mimosoideae	*Acacia*	*suaveolens*	Sweet Wattle	Native
Fabaceae - Mimosoideae	*Acacia*	*irrorata*	Green Wattle	Native
Fabaceae - Mimosoideae	*Acacia*	*terminalis*	Sunshine Wattle	Native
Fabaceae - Mimosoideae	*Acacia*	*longifolia* subsp. *longifolia*	Sydney Golden Wattle	Native
Goodeniaceae	*Goodenia*	*heterophylla*		Native
Haloragaceae	*Gonocarpus*	*teucrioides*	Raspwort	Native
Iridaceae	*Patersonia*	*sericea*	Silky Purple-flag	Native
Lauraceae	*Cassytha*	*pubescens*		Native
Lauraceae	*Cinnamomum*	*camphora*	Camphor Laurel	Exotic
Lomandraceae	*Lomandra*	*filiformis*	Wattle Mat-rush	Native
Lomandraceae	*Lomandra*	*longifolia*	Spiny-headed Mat-rush	Native
Lomandraceae	*Lomandra*	*obliqua*		Native
Lomandraceae	*Lomandra*	*multiflora*	Many-flowered Mat-rush	Native
Lomariopsidaceae	*Nephrolepis*	*cordifolia*	Fishbone Fern	Exotic
Luzuriagaceae	*Eustrephus*	*latifolius*	Wombat Berry	Native
Malvaceae	*Lasiopetalum*	*ferrugineum*		Native
Moraceae	*Morus*	*alba*	White Mulberry	Exotic
Myrtaceae	*Angophora*	*costata*	Sydney Red Gum	Native
Myrtaceae	*Angophora*	*crassifolia*		Native
Myrtaceae	*Callistemon*	sp.		Native
Myrtaceae	*Corymbia*	*gummifera*	Red Bloodwood	Native
Myrtaceae	*Eucalyptus*	*piperita*	Sydney Peppermint	Native
Myrtaceae	*Eucalyptus*	*grandis*	Flooded Gum	Native
Myrtaceae	*Eucalyptus*	*haemastoma*	Scribbly Gum	Native

Family	Genus	Species	Common name	Native/Exotic
Myrtaceae	*Leptospermum*	*trinervium*	Flaky-barked Tea-tree	Native
Myrtaceae	*Leptospermum*	sp.		Native
Ochnaceae	*Ochna*	*serrulata*	Mickey Mouse Plant	Exotic
Oleaceae	*Ligustrum*	*lucidum*	Large-leaved Privet	Exotic
Oleaceae	*Ligustrum*	*sinense*	Small-leaved Privet	Exotic
Orchidaceae	*Acianthus*	sp.		Native
Orchidaceae	*Cryptostylis*	*subulata*	Large Tongue Orchid	Native
Orchidaceae	*Cryptostylis*	*erecta*	Bonnet Orchid	Native
Orchidaceae	*Pterostylis*	*acuminata*	Pointed Greenhood	Native
Pastel Flower	*Pseuderanthemum*	*variable*	Pastel Flower	Native
Phormiaceae	*Dianella*	*caerulea* var. *producta*		Native
Phyllanthaceae	*Billardiera*	*scandens*	Hairy Apple Berry	Native
Phyllanthaceae	*Glochidion*	*ferdinandi*	Cheese Tree	Native
Phyllanthaceae	*Phyllanthus*	*tenellus*	Hen and Chicken	Exotic
Phyllanthaceae	*Phyllanthus*	*hirtellus*	Thyme Spurge	Native
Phyllanthaceae	*Pittosporum*	*undulatum*	Native Daphne	Native
Picrodendraceae	*Micrantheum*	*ericoides*		Native
Poaceae	*Andropogon*	*virginicus*	Whisky Grass	Exotic
Poaceae	*Anisopogon*	*avenaceus*	Oat Speargrass	Native
Poaceae	*Entolasia*	*marginata*	Bordered Panic	Native
Poaceae	*Entolasia*	*stricta*	Wiry Panic	Native
Poaceae	*Microlaena*	*stipoides* subsp. *stipoides*	Weeping Grass	Native
Poaceae	*Oplismenus*	*aemulus*	Australian Basket Grass	Native
Poaceae	*Panicum*	*simile*	Two-colour Panic	Native
Proteaceae	*Banksia*	*serrata*	Old-man Banksia	Native
Proteaceae	*Banksia*	*marginata*	Silver Banksia	Native
Proteaceae	*Grevillea*	*speciosa*	Red Spider Flower	Native
Proteaceae	*Hakea*	*sericea*	Needlebush	Native
Proteaceae	*Lambertia*	*formosa*	Mountain Devil	Native
Proteaceae	*Persoonia*	*pinifolia*	Pine-leaved Geebung	Native

Family	Genus	Species	Common name	Native/Exotic
Proteaceae	*Persoonia*	*levis*	Broad-leaved Geebung	Native
Proteaceae	*Petrophile*	*pulchella*	Conesticks	Native
Rosaceae	*Rubus*	*fruticosus*	Blackberry	Exotic
Rubiaceae	*Opercularia*	*hispida*	Hairy Stinkweed	Native
Rutaceae	*Zieria*	*smithii*	Sandfly Zieria	Native
Sapindaceae	*Alectryon*	sp.		Exotic
Sapindaceae	*Dodonaea*	*triquetra*	Large-leaf Hop-bush	Native
Smilacaceae	*Smilax*	*glyciphylla*	Sweet Sarsaparilla	Native
Solanaceae	*Solanum*	*mauritianum*	Wild Tobacco Bush	Exotic
Solanaceae	*Solanum*	*nigrum*	Black-berry Nightshade	Exotic
Stylidiaceae	*Stylidium*	*productum*		Native
Thymelaeaceae	*Pimelea*	*linifolia*	Slender Rice Flower	Native
Vitaceae	*Cayratia*	*clematidea*	Native Grape	Native
Xanthorrhoeaceae	*Xanthorrhoea*	*arborea*		Native
Xanthorrhoeaceae	*Xanthorrhoea*	*media*	Grass Tree	Native

Fauna

Class	Family	Scientific name	Common name	Native/ Exotic
Amphibia	Myobatrachidae	*Crinia signifera*	Common Eastern Froglet	Native
Aves	Anatidae	*Anas superciliosa*	Pacific Black Duck	Native
Aves	Anatidae	*Chenonetta jubata*	Australian Wood Duck	Native
Aves	Ardeidae	*Ardea ibis*	Cattle Egret	Native
Aves	Ardeidae	*Egretta novaehollandiae*	White-faced Heron	Native
Aves	Artamidae	*Cracticus tibicen*	Australian Magpie	Native
Aves	Artamidae	*Cracticus torquatus*	Grey Butcherbird	Native
Aves	Cacatuidae	*Calyptorhynchus funereus*	Yellow-tailed Black-Cockatoo	Native
Aves	Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike	Native
Aves	Charadriidae	*Vanellus miles*	Masked Lapwing	Native
Aves	Columbidae	*Ocyphaps lophotes*	Crested Pigeon	Native
Aves	Corvidae	*Corvus coronoides*	Australian Raven	Native
Aves	Eupetidae	*Psophodes olivaceus*	Eastern Whipbird	Native
Aves	Halcyonidae	*Dacelo novaeguineae*	Laughing Kookaburra	Native
Aves	Hirundinidae	*Hirundo neoxena*	Welcome Swallow	Native
Aves	Maluridae	*Malurus cyaneus*	Superb Fairy-wren	Native
Aves	Meliphagidae	*Acanthorhynchus tenuirostris*	Eastern Spinebill	Native
Aves	Meliphagidae	*Anthochaera carunculata*	Red Wattlebird	Native
Aves	Meliphagidae	*Manorina melanocephala*	Noisy Miner	Native
Aves	Meliphagidae	*Meliphaga lewinii*	Lewin's Honeyeater	Native
Aves	Monarchidae	*Grallina cyanoleuca*	Magpie-lark	Native
Aves	Motacillidae	*Anthus novaeseelandiae*	Australasian Pipit	Native
Aves	Oriolidae	*Oriolus sagittatus*	Olive-backed Oriole	Native
Aves	Pachycephalidae	*Colluricincla harmonica*	Grey Shrike-thrush	Native
Aves	Pardalotidae	*Pardalotus punctatus*	Spotted Pardalote	Native
Aves	Pelecanidae	*Pelecanus conspicillatus*	Australian Pelican	Native
Aves	Petroicidae	*Eopsaltria australis*	Eastern Yellow Robin	Native
Aves	Phalacrocoracidae	*Phalacrocorax carbo*	Great Cormorant	Native
Aves	Phalacrocoracidae	*Phalacrocorax sulcirostris*	Little Black Cormorant	Native
Aves	Podicipedidae	*Tachybaptus novaehollandiae*	Australasian Grebe	Native
Aves	Ptilonorhynchidae	*Ptilonorhynchus violaceus*	Satin Bowerbird	Native
Aves	Pycnonotidae	*Pycnonotus jocosus**	Red-whiskered Bulbull*	Exotic
Aves	Rhipiduridae	*Rhipidura albiscapa*	Grey Fantail	Native
Aves	Rhipiduridae	*Rhipidura leucophrys*	Willie Wagtail	Native
Aves	Sturnidae	*Sturnus vulgari**	Common Starling*	Exotic
Aves	Threskiornithidae	*Threskiornis molucca*	Australian White Ibis	Native
Aves	Timaliidae	*Zosterops lateralis*	Silvereye	Native
Mammalia	Canidae	*Vulpes vulpes**	European Red Fox*	Exotic

Observation type = O (seen), W (heard call), OW (seen and heard)

Appendix D: Biodiversity Credit Report

Biodiversity credit report

This report identifies the number and type of biodiversity credits required for a major project.

Date of report: 25/07/2017 Time: 11:49:48AM Calculator version: v4.0

Major Project details

Proposal ID:	0076/2017/4513MP
Proposal name:	Tallawarra FBA assessment
Proposal address:	Yallah Road Dapto NSW 2530
Proponent name:	Bridgehill Group
Proponent address:	3 Rider Boulevard Rhodes NSW 2138
Proponent phone:	(02) 8732 8600
Assessor name:	Lucas McKinnon
Assessor address:	29 Munni Street Newtown NSW 2042
Assessor phone:	0421 603 549
Assessor accreditation:	0076

Summary of ecosystem credits required

Plant Community type	Area (ha)	Credits created
Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	1.36	61.93
Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion	0.33	11.57
Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion	2.55	79.00
Total	4.24	153

Credit profiles

1. Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion, (SR652)

Number of ecosystem credits created	79
IBRA sub-region	Illawarra

Offset options - Plant Community types	Offset options - IBRA sub-regions
Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion, (SR652) Blackbutt - Turpentine - Bangalay moist open forest on sheltered slopes and gullies, southern Sydney Basin Bioregion, (SR516)	Illawarra and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

2. Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion, (SR545)

Number of ecosystem credits created	62
IBRA sub-region	Illawarra

Offset options - Plant Community types	Offset options - IBRA sub-regions
Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion, (SR545) Forest Red Gum - Rough-barked Apple - White Stringybark grassy woodlands on hills in dry valleys, southern South East Corner Bioregion, (SR544) Woollybutt - White Stringybark - Forest Red Gum grassy woodland on coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion, (SR669)	Illawarra and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

3. Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion, (SR649)

Number of ecosystem credits created	12
IBRA sub-region	Illawarra

Offset options - Plant Community types	Offset options - IBRA sub-regions
Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion, (SR649) Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion, (SR650)	Illawarra and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

Appendix E: Groundwater Dependent Ecosystems