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Brian Moran
BlueScope
Supplied by email

30 June 2020

Re: Ecological Constraints Assessment, Lot 1 // DP 588140, Lot 1 // 588140, Lots 2 // DP 230137 and Lot 1002 // D P1192327, Kembla Grange, NSW

Dear Brian,

Please find below an outline of the methods and results of an Ecological Constraints Assessment (ECA) completed for BlueScope to inform a Neighbourhood Plan and Planning Proposal for lands bounded by Paynes Road, Farm Road, Sheaffes Road, Darkes Road and West Dapto Road in Kembla Grange (hereafter referred to as the 'study area' (**Figure 1**). The subject titles are:

- Lot 1 DP588139
- Lot 1 DP588140
- Lot 2 DP 230137
- Lot 1002 DP 1192327

Background and purpose of the report

This letter provides an assessment of the ecological constraints and values of the study area, which is wholly located within the Wollongong Local Government Area (LGA). The study area is split into two by West Dapto Road and is 217.49 ha. An existing BioBank site (39.40 is located within the western portion of the study area (see Ecoplanning 2018). The study area is zoned E2 – Environmental Conservation, E3 – Environmental Management, R2 – Low Density Residential, IN2 – Light Industrial, IN3 – Heavy Industrial and RE2 – Private Recreation under the Wollongong Local Environmental Plan (WLEP) 2009.

This ECA utilises field survey data collected following the Biodiversity Assessment Methodology (BAM) (OEH 2017), to provide an indication of the credit outcomes of a proposed subdivision and potential Biodiversity Stewardship Site within the study area. In this scenario, the credits generated by the existing BioBank site and proposed Biodiversity Stewardship Site are utilised to offset the development impacts.

Site description

The current proposal consists of a Neighbourhood Plan, comprising residential lots, access roads, on-site detention basins and associated infrastructure. A potential Biodiversity Stewardship Site comprising 48.51 ha is proposed in the native vegetation to the north of the existing and Biobank, and to the east of West Dapto Road (**Figure 2**).

The study area is situated between 5-60 metres above sea level. Native vegetation within 5 km of the study area was assessed using desktop GIS analysis (**Figure 3**). Vegetation mapping by Tozer et al. (2010) revealed that native vegetation within 5 km of the study area is primarily associated with the Illawarra escarpment, west of the study area.

The Terrestrial Biodiversity Map (WLEP 2009), Riparian Lands Map (WLEP 2009), and the Biodiversity Values (BV) Map (V10; DPIE 2020) have been reviewed (**Figure 4**). Several large patches of vegetation within the study area are mapped on the Terrestrial Biodiversity Map. Terrestrial Biodiversity also comprises most of the vegetation to the west of West Dapto Road, as well as the vegetation in the south east of the eastern portion of the study area. Most watercourses within the study area are mapped as Riparian Lands. The riparian corridors associated with Sheaffes and Dapto Creek's are identified on the Biodiversity Values Map (BVM).

Methods

Literature review and database analysis

A site-specific literature and database review was undertaken prior to the field survey and the preparation of this report. This included desktop analysis of aerial photography and review of regional scale information from the follow data sources:

- NSW Planning Viewer (DPIE 2020b),
- BioNet Atlas of NSW Wildlife (DPIE 2020a),
- Protected Matters Search Tool (DAWE 2020)
- National Flying-fox Monitoring Viewer (DoE 2020)
- SIX Maps (LPI 2019)
- Native Vegetation of South East NSW (Tozer et al. 2010),
- Native vegetation of the Illawarra Escarpment and Coastal Plain (NPSW 2002), and,
- NSW Vegetation Information System (OEH 2019b).

Additional literature relied upon to inform this ECA can be found in the References section of this report.

Threatened species, populations and migratory species recorded within 5 km of the subject site were consolidated in a search of the Atlas of NSW Wildlife (BioNet) (DPIE 2020a). 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 study area and surrounding areas,
- Review of the scientific literature pertaining to each species and population,
- Applying expert knowledge of each species.

Following a review of available habitat within the study area, the potential for each threatened species, population, and/or migratory species to occur was considered. The potential for species to use the study area and to be affected directly or indirectly by the proposed action were considered as either:

- "Recent record" = species has been recorded in the study area within the past 5 years
- "High" = species has previously been recorded in the study area (>5 years ago) or in proximity to (for mobile species), and/or habitat is present that is likely to be used 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) within 5 km of the study area 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 within 5 km of the study area
- "Not present" – suitable habitat for the species is not present onsite or adequate survey has determined species does not occur in the study area

The study area has been inspected on numerous occasions by Lucas McKinnon (Principal Ecologist) over the past 8 years (see Ecoplanning 2018a,b, 2017; ELA 2014), including plot based surveys and stag watching of large hollow bearing trees on the R2 land on 18 October 2018 by Ecoplanning staff, Lucas McKinnon (Principal Ecologist), Kieren Northam (Ecologist), Justin Merdith (Ecologist), and Wollongong City Council staff, Brett Morrisey (Environment Strategy Officer) and Rene Winsor (Team Leader – Environment). Supplementary field surveys were undertaken 20 November 2018 by Lucas McKinnon and Angela Bibby (Ecologist) (Ecoplanning 2018b).

Additional site specific information to inform this ECA was collected by Tom Hickman (Ecologist) and Kieren Northam (Ecologist) on 6 March 2019, by Lucas McKinnon (Principal Ecologist) and Stephanie Cerato (Ecologist) on 23 October 2019 and by Lucas McKinnon on 26 February 2020. The purpose of these inspections was to validate the regional vegetation mapping (Tozer et al 2006/2010; NPWS (2002), assess the structure and condition of vegetation within the study area and to determine the extent of vegetation impacted by the proposed Neighbourhood Plan. Additionally, fauna habitat features (i.e. hollows, stags decorticating bark, mature / old growth trees, winter flowering eucalypts) and indirect signs of fauna use (i.e. scats, owl pellets, fur, bones, tracks, bark scratches, foliage chew marks and chewed capsules) were recorded.

During field surveys undertaken to inform this ECA, the condition of the vegetation within the study area was sampled within eight survey plots in accordance with the BAM (OEH 2017). Using the plot data, a Vegetation Integrity (VI) Score for several vegetation zones within the study area was calculated and utilised to inform estimates of biodiversity credit requirements.

Results

Vegetation communities – desktop assessment

NPWS (2002) regional vegetation mapping identified three native vegetation communities in the study area (**Figure 5**). These were Moist Coastal White Box Forest (MU9), Coastal Grassy Red Gum Forest (MU23) and Lowland Woollybutt – *Melaleuca* Forest (MU24). Native vegetation is mapped throughout the site, with large patches within the existing BioBank site, in the north west and on the southern side of West Dapto Road. Most of the vegetation within the study area consists of Weeds and Exotics (MU56c) and Cleared land (MU56d). The native vegetation communities within the study area, their Plant Community Type (PCT) (DPIE 2020c) equivalents and threatened status under the *NSW Biodiversity Conservation Act* 2016 (BC Act) and Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) are shown in **Table 1**.

Vegetation mapping by Tozer et al (2006; 2010) identified four native communities within the study area (**Figure 6**). These were, Coastal Sand Swamp Forest, Illawarra Lowland Swamp Woodland, South Coast Grassy Woodland and Warm Temperate Layered forest. As with NPWS (2002), most of the mapped vegetation occurs within the existing BioBank site and along the eastern side of West Dapto Road.

Table 1: Mapped native vegetation communities (NPSW 2002) and their Plant Community Type (PCT) equivalent.

NPWS (2002)	PCT (DPIE 2020c)	BC Act	EPBC Act
Lowland Woollybutt – *Melaleuca* Forest (MU24)	Woollybutt - White Stringybark - Forest Red Gum grassy woodland on coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion (PCT 1326)	EEC: Illawarra Lowlands Grassy Woodland (ILGW)	CEEC: Illawarra and South Coast lowland forest and woodland
Moist Coastal White Box Forest (MU9)	Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion (PCT 1245)	No	No
Coastal Grassy Red Gum Forest (MU23)	Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion (PCT 838)	EEC: Illawarra Lowlands Grassy woodland	CEEC: Illawarra and South Coast lowland forest and woodland
Acacia Scrub (MU56a)	NA	-	-
Weeds and Exotics (MU56c)	NA	-	-
Fig Trees (MU57f)	NA	-	-

EEC = Endangered Ecological Community, CEEC = Critically Endangered Ecological Community.

Vegetation communities – field survey

Following field surveys, the native vegetation mapping was revised to consist of four native vegetation communities as well as isolated Fig trees (*Ficus* spp.) (**Figure 7**). PCTs identified on site, their condition class and the area of each zone is summarised in

Table 2. Field survey also identified several non-native vegetation types comprising cleared land, woody weeds, dams, and existing infrastructure.

Table 2: Plant Community Types (PCTs) within the study area, excluding the biobank site.

PCT (OEH 2020c)	Condition Class	Area (ha)
Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion (PCT 781)	Disturbed	3.86
Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands southern Sydney Basin (PCT 838)	Disturbed	1.00
	Underscrubbed	0.08
Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes southern Sydney Basin Bioregion (PCT 1245)	Disturbed	0.87
Woollybutt - White Stringybark - Forest Red Gum grassy woodland on coastal lowlands southern Sydney Basin Bioregion and South East Corner Bioregion (PCT 1326)	Acacia regrowth	4.79
	DNG	8.74
	Lantana	20.26
	SPT	0.12
Total Native vegetation		**39.72**
Other	Cleared	122.35
	Dam	1.10
	Woody Weeds	18.81
	Fig trees	0.35
	Infrastructure	0.14
Total		**182.48**

Coastal Freshwater lagoons (PCT 781) occurs within the eastern end of the study area. This zone is found in a 'disturbed' condition class. It contains a mix of native sedges including *Carex appressa* (Tall Sedge) and *Juncus prismatocarpus* and a high portion of exotic species including *Cenchrus clandestinus** (Kikuyu), which is also dominates in the surrounding cleared land.

Forest Red Gum - Thin-leaved Stringybark grassy woodland (PCT 838) occurs on the western margin of the study area with a small patch also occurring in the north east. This zone contains canopy species dominated by *Eucalyptus tereticornis* (Forest Red Gum) and *E. eugenioides* (Thin-leaved Stringybark). It occurs in two condition classes, 'disturbed' and 'underscrubbed'. The 'underscrubbed' zone occurs on the western margin on the study area and contains

several hollow bearing trees. The 'disturbed' zone contains a midstorey species that is dominated by *Lantana camara** (Lantana).

Sydney Blue Gum x Bangalay - Lilly Pilly moist forest (PCT 1245) occurs in the small patch of retained land north of the existing BioBank site. It occurs in a 'disturbed' condition class. Dominant canopy species include *E. botryoides X saligna* (Sydney Blue Gum), *E. quadrangulata* (White-topped Box) and *Syncarpia glomulifera* (Turpentine). Like PCT 838, the midstorey is dominated by *L. camara**.

Woollybutt - White Stringybark - Forest Red Gum grassy woodland (PCT 1326) occurs throughout the study area. It occurs in several condition classes, comprising 'Acacia regrowth', 'Derived Native Grassland (DNG)', 'Lantana' and 'Scattered paddock trees (SPT)'. The majority of the PCT 1326 occurs within the 'Lantana' condition class. This zone has a canopy species comprising *E. longifolia* (Woollybutt), *E. tereticornis* (Forest Red Gum) and *Melaleuca decora*. The midstory is dominated by *L. camara**. The 'Acacia regrowth' condition class contains a canopy dominated by regenerating *Acacia* spp. and is typically found within the riparian corridors. Scatter Paddock Trees (SPT) condition class occurs within mostly cleared land as isolated canopy species with an exotic understorey. The 'DNG' zone contains minimal canopy and midstorey species but maintains a high proportion of native understorey species. This zone is dominated by the native grass *Microlaena stipoides* subsp. *stipoides* (Weeping Grass).

A large proportion of the study area consists of 'Cleared land' and is dominated by pasture grasses such *C. clandestinus** (Kikuyu) and *Paspalum dilatatum** (Paspalum). This area has been predominantly managed by grazing.

Woody weeds occur in patches throughout the study area and has been mapped in areas where exotic species such as *Erythrina x sykesii** (Coral Tree), *Ligustrum* spp.* (Privets), *Ochna serrulata** (Mickey Mouse Plant), *Celtis americanum** (Celtis) and *L. camara** dominate. This area occurs along eastern ends of Dapto Creek and Sheaffes Creek. Whilst these creek lines retain some native midstorey and understorey species, they are predominantly dominated by woody exotic species. There is minimal native understorey within this region.

Threatened ecological communities

The study area contains several threatened ecological communities (TECs), PCT 781, PCT 838 and PCT 1326 are all listed under the BC Act. PCT 781 is listed as a Freshwater Wetlands on Coastal Floodplains as an endangered ecological community (EEC) under the BC Act. It is not listed under the EPBC Act. Both PCT 838 and PCT 1326 are listed as Illawarra Lowlands Grassy Woodland (ILGW) EEC under the BC Act, and Illawarra and South Coast Lowland Forest Wnd woodland (ISCLFW), a critically endangered ecological community (CEEC) under the EPBC Act. Additional surveys should be undertaken for any future development proposals to determine patches of either of these vegetation types meet the condition thresholds for a Matter of National Environment Significance (MNES) under the EPBC Act.

Threatened species

No threatened flora and fauna species listed under the BC Act or EPBC Act were recorded during the site inspection. Flora and fauna species lists are provided in **Appendix A**. A search of a 5 km radius from the study area using Atlas of NSW Wildlife (DPIE 2020a) identified 42

threatened species (nine flora and 33 fauna, three amphibians, fifteen birds, nine microbats, one megabat, four arboreal mammals and one ground dwelling mammal) (**Figure 8**). Several threatened species have previously been recorded as occurring within the study area, including a temporary Grey-headed Flying Fox camp along Dapto Creek. The analysis did not include migratory or marine species. No threatened flora species were recorded during field surveys and due to the degraded nature of the study area threatened flora species were assessed as 'low' likelihood of occurrence.

Following field inspection, twelve threatened fauna species were considered to have a 'moderate' or 'high' likelihood of occurrence within the study area. These species comprise:

- Dusky Woodswallow (*Artamus cyanopterus cyanopterus*) – BC Act: V
- White-bellied Sea-Eagle (*Haliaeetus leucogaster*) – BC Act: V, EPBC Act: C
- Square-tailed Kite (*Lophoictinia isura*) – BC Act V
- Little Eagle (*Hieraaetus morphnoides*) – BC Act: V
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) – BC Act: V
- Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*) – BC Act: V
- Little Bent-winged Bat (*Miniopterus australis*) – BC Act: V
- Large Bent-winged Bat (*Miniopterus orianae oceanensis*) – BC Act: V
- Southern Myotis (*Myotis macropus*) – BC Act: V
- Greater Glider (*Petauroides volans*) – EPBC Act: V
- Grey-headed Flying-fox (*Pteropus poliocephalus*) – BC Act: V, EPBC Act: V
- Yellow-bellied Sheathtail-Bat (*Saccolaimus flaviventris*) – BC Act: V
- Greater Broad-nosed Bat (*Scoteanax rueppellii*) – BC Act: V

Targeted survey will need to be completed for the Southern Myotis to determine if this species is still utilising the site, and species credits will be required. Similarly, species credits may to be generated for this species if it determined to still be utilising the site. Grey-headed Flying Fox is also a species credit, and consideration of managing the heavily weed affected riparian corridor around the existing camp location will be required.

Fauna habitat values identified during in the study area were those associated with woodland, such as mature canopy trees, hollow bearing trees (HBTs), those associated with the riparian corridors, wetlands and areas of open grassland. Field survey identified seven HBTs within the proposed development zones of the study (R and In zoning) area which provide valuable nesting, roosting and breeding habitat for native fauna. Based on the habitat values within the study area, a suite of fauna species are likely to use the study area for foraging, roosting and nesting purposes. The habitat features relevant to each fauna group likely to use the subject site are in **Table 3**.

Table 3: Fauna habitat features present across the study area.

Habitat features	Fauna species
Native woodland	Mammals, birds, reptiles, amphibians, gastropod
Open grassland	Terrestrial mammals, birds, amphibians and reptiles
HBTs	Hollow dependent birds, reptiles and microbats
Riparian corridors	Reptiles, amphibians and microbats
Wetlands/Farm Dams	Reptiles, amphibians and microbats

Given the fragmented and degraded condition of the native vegetation onsite, several species were assessed as either 'not present', or as having a 'low' likelihood of occurring in the subject site. However, due to the presence of HBTs, farm dams and riparian corridors, threatened microchiropteran bat species and hollow-dependent bird species are considered to have potential to use native vegetation within the subject site for foraging and breeding purposes. All threatened microbat species (Eastern False Pipistrelle, Eastern Coastal Free-tailed Bat, Little Bent-winged Bat, Large Bent-winged Bat, Southern Myotis, Yellow-bellied Sheathtail-bat and Greater Broad-nosed Bat) have been determined to have a 'moderate' or 'high' likelihood of occurrence within the study area. It is noted that no cave habitat is present for Bentwing bats. All these microbat species have previously been recorded either within the study area, or within 200 m of the study area. The White-bellied Sea-Eagle, also has a 'moderate' likelihood of species foraging near the site, in the more open waters of Mullet Creek and Lake Illawarra. Little Eagle has been previously recorded on site in 2014, 2016 and 2018, and has a 'high' likelihood of potentially foraging at the site, however no stick nests have been observed during survey over the past 10 years. Similarly, this species has never been observed by the author in West Dapto. Dusky Woodswallow was considered to have a 'high' likelihood of occurring in the study area, having previously been recorded on site in 2016.

The study area contains a known Grey-headed Flying-fox (GHFF) roosting camp. This roosting camp is situated within the proposed stewardship site (**Figure 7**). Consequently, the proposed stewardship site constitutes breeding habitat for the GHFF. Grey-headed Flying-fox is considered to have a 'high' likelihood of occurrence.

All other records of threatened species are considered unlikely to occur within the study area. No threatened flora species were identified during field survey and the nine species recorded in the locality were assessed as 'not present' within the study area. All threatened fauna species assessed as having a 'low' likelihood of occurrence may use the study area on an intermittent or transient basis. Any future development applications will need an assessment of potential impact to any threatened species with a 'moderate' or 'high' likelihood of occurrence within the study area (**Appendix B**). Species credit species may require targeted surveys as required by the BAM. It is noted that the assessment of species likely to occur may change following any targeted surveys.

Riparian corridors.

Several watercourses have been mapped within the study area (**Figure 9**). Sheaffes Creek (4th order) and Dapto Creek (5th order), both flow through the centre of the study area in a south-easterly direction, towards Lake Illawarra. Sheaffes Creek flows into Robins Creek (5th order) before merging into Dapto Creek along the southern boundary of the study area. An unnamed 3rd order watercourse flows along the northern boundary of the study area before merging with Sheaffes Creek. Several additional 1st and 2nd order watercourses join these major watercourses, all which flow in a south-easterly direction.

The *Guidelines for Riparian Corridors on Waterfront Land* (NRAR 2018) outlines the requirements for maintaining, establishing or rehabilitating a riparian corridor, or vegetated riparian zone (VRZ), as part of an application for a controlled activity approval. The area of the VRZ is related to the stream order and is measured from the top of bank (ToB). First (1st) order watercourses require a 10 m VRZ either side, with 20 m for 2nd order, 30 m for 3rd order and 40 m for 4th order and above. Several VRZs intersect with the proposed neighbourhood plan. Under the NSW *Water Management Act 2000* (WM Act), any works or development proposed within 40 m from the top of the bank of a watercourse require a 'controlled activity approval'.

Conservation values within the study area

The native vegetation in the study area comprises four native vegetation communities, of which three are listed as TECs. These zones were assessed with vegetation integrity plots to determine if any impacts to them require offsetting. PCT 1326 and PCT 838 are listed as Illawarra Grassy Woodland EEC under the BC Act. Further assessment is also needed to determine if it meets the condition thresholds to be considered ISCLFW CEEC under the EPBC Act. Additionally, PCT 781 is listed as Freshwater Wetlands on Coastal Floodplains EEC. Vegetation integrity plots within these zones determined that all three TECs have a VI Score of greater than15 and any impacts will require offsetting under the BC Act.

Ecological constraints

Desktop analysis and field survey found that the subject site predominantly consists of land of low ecological value (**Figure 10**). The ecological constrains criteria are summarised in **Table** 4. High constraints comprised vegetation which forms part of an TEC, hollow bearing trees, the Grey-headed Flying-fox camp and Land identified on the BVM. 'Moderate' constraints comprise native vegetation that is not an EEC, areas identified as Terrestrial Biodiversity and Riparian Lands and Watercourses and VRZs that are 3rd order and above. 'Low' constraints comprise 1st and 2nd order VRZs and farm dams. The existing BioBank site is excluded from this constraints assessment as it is to be managed for biodiversity in perpetuity.

Table 4: Ecological constraints within the study area.

Ecological Constraint	Criteria

High	• Areas of native vegetation that are listed as threatened ecological community (TEC) under the BC Act or the EPBC Act. • Hollow bearing trees. • Grey-headed Flying-fox camp. • Land identified on the Biodiversity Values Map.
Moderate	• Areas of native vegetation that are not listed as TEC under the BC Act or EPBC Act. • Areas identified on the 'Terrestrial Biodiversity' map WLEP (2009). • Watercourses identified on the 'Riparian Lands and Watercourses' Map (WLEP 2009). • 3rd order and higher vegetated riparian corridors. • Fig Trees
Low	• 1st and 2nd order vegetated riparian corridors. • Farm dams. • Cleared land / infrastructure. • Plantings. • Weeds and exotics.

Future development options

The BC Act establishes a scientific method for assessing the impacts on biodiversity values of proposed development and land use change. Part 6 of the BC Act established an offsets scheme which aims to ensure there is no net loss of biodiversity values. Entry into the offset is triggered by exceeding the thresholds outlined in part 7 of the *NSW Biodiversity Conservation Regulation 2017* (BC Reg). Specifically, entry into the offset scheme for the site would be triggered by any of the following:

- Clearing of native vegetation across an area of greater than 0.25 ha (based on the minimum lot size or, if there is no minimum lot size, the size of the smallest lot)
- Clearing of native vegetation on land included on the BVM
- Development which will significantly affect threatened species or ecological communities, or their habitats (according to s7.3 of the BC Act)

The proposal will clear native vegetation across an area greater than threshold for clearing. Consequently, clearing of this vegetation will trigger the threshold for entry into the Biodiversity Offset Scheme. A Biodiversity Development Assessment Report (BDAR) will need to be prepared for the proposed development. Where possible, impacts to areas of 'high' conservation value should be avoided or minimised as part of any future developments. Demonstrating avoidance of areas of 'high' ecological values is a requirement and key consideration for Councils during assessment of BDARs.

In order to generate biodiversity credits within the proposed stewardship site. A Biodiversity Stewardship Assessment Report (BSAR) will need to be prepared which accompanies a stewardship application. This report provides an assessment of the total credit generation as the management actions required at the site.

Biodiversity Options

The proposal will impact 124.21 ha of land, of which 22.98 ha comprises native vegetation. Four native vegetation communities with several condition classes will be impacted. An assessment of the overall credit outcome based on the current proposal, proposed stewardship site and the existing BioBank site has been completed. A summary of the credit outcomes for the proposed impact assessment and stewardship site is provided in **Table 5**. Note that no vegetation integrity plots were completed within the cleared land for the proposed stewardship site. To provide an estimate of the credit generation, a vegetation integrity plots completed within the DNG Zone were used. As a result, the final credit generation for the cleared land zone within the Biodiversity Stewardship Site may be slightly lower. Additional plots will need to be undertaken within the areas of cleared land once the stewardship boundary has been finalised.

An estimated credit outcome has been determined. This is based on the difference between the credits generated through the BioBank and Biodiversity Stewardship Site compared to the credits required from the proposed Neighbourhood Plan. Based on the current proposal, PCT 1326 and PCT 1245 will have a net credit surplus of **109** and **43** credits, respectively. There will, however, be **23** PCT 838 and **111** PCT 781 credits required due to the proposal. These credits will have to be secured elsewhere in the market. The price per credit for each PCT based on the Biodiversity Offset Payment Calculator (BOPC) are provided in **Table 6**.

Table 5: Credit outcome of the proposal, Biobank site credits were used to offset development requirements.

Plant community type (PCT)	Condition/Zone	Biobank Site		BSA Site		Development area		Outcome
		Area (ha)	BAM Credits*	Area (ha)	Credits	Area (ha)	Credits required	
Woollybutt - White Stringybark - Forest Red Gum grassy woodland (PCT1326/SR669)	Lantana	31.55	176	11.52	66	6.27	149	109
	Woody Weeds	0.00	0	17.07	46	1.57	0	
	Acacia Regrowth	0.00	0	3.18	15	1.61	19	
	DNG	0.00	0	0.49	2	8.25	75	
	Fingers	0.00	0	0.00	0	1.64	35	
	Cleared land	0.00	0	16.05	82**	0.00	0	
Sydney Blue Gum x Bangalay - Lilly Pilly moist (PCT1245/SR652)	Disturbed	7.78	44	0.00	0	0.10	1	43
Forest Red Gum - Thin-leaved Stringybark grassy woodland (PCT838/SR545)	Disturbed	0.00	0	0.00	0	1.08	23	23
Coastal Freshwater wetland (PCT781/SR536)	Disturbed	0.00	0	0.00	0	3.86	111	111
	Total	**39.33**	**220**	**48.51**	**129**	**24.38**	**413**	**-**

* Based on BBAM to BAM equivalence statement.
** No plots were undertaken in the cleared land. Credit generation is based on DNG plots. Actual credit generation is likely to be slightly lower

Table 6: Price per credit of PCTs found within the study area.

Plant community type (PCT)	BOPC Price per credit (June 2020)
781	$11,018.29
838	$12,965.20
1245	$8,600.85
1326	$26,624.20

Serious and Irreversible Impacts (SAII)

The *Guidance to assist a decision-maker to determine a Significant and Irreversible Impact (SAI)I* (DPIE 2019) and the Threatened Biodiversity Data Collection are used to identify potential SAII entities. PCT 838 and PCT 1326 are listed as ILGW in the Sydney Basin Bioregion, a potential SAII entity. ILGW is currently in a rapid rate of decline and has a very small extent. As such, an assessment in accordance with Section 10.2.2 of the BAM must be conducted and included in a BDAR for any future DA in the study area. Impacts to a potential SAII entity are required to be taken into consideration by the decision maker, and if significant impacts are considered likely, it is the role of the decision maker to refuse to grant development consent. Therefore, it may be necessary for substantial avoidance and minimisation measures to be implemented to reduce impacts to ILGW in the study area. Sufficient avoidance and minimisation measures would reduce the potential for a SAII to occur to ILGW.

Conclusions and recommendations

The proposed Neighbourhood Plan will impact on 124.21 ha of land, of which 22.98 ha comprises native vegetation. An additional 48.51 ha is proposed to be managed under a Biodiversity Stewardship Site. Field survey determined that study area contained four native vegetation communities, three of which are listed as TECs. PCT 1326 and PCT 838 are listed as ILGW, an EEC under the BC Act. Further survey is required to determine if these PCTs also form part of ISCLFW under the EPBC Act. PCT 781 is listed as Freshwater Wetlands on Coastal Floodplains an EEC under the BC Act. A total of seven HBTs were identified within the subject site. The remainder of the study area comprised pasture, woody weeds, farm dams and existing infrastructure.

The ecological constraints of the study area have been assessed. High ecological constraints comprised vegetation which forms part of an EEC, hollow bearing trees, the Grey-headed Flying-fox camp and land identified on the BVM. Where possible, impacts to areas of 'high' conservation value should be avoided or minimised as part of any future developments. Demonstrating avoidance of areas of 'high' ecological values is a requirement and key consideration for Councils during assessment of BDARs. Areas mapped as native vegetation not listed as a TEC, land on the 'Terrestrial Biodiversity'/'Riparian Lands and Watercourses' maps, 3rd order and higher VRZs and fig trees are a considered to be a 'moderate' constraint. All remaining vegetation zones, as well as 1st and 2nd order VRZs are considered to be a 'low' ecological constraint.

No threatened species were recorded during field survey. Forty-two threatened species have previously been recorded within 5 km of the study area. No threatened flora species were recorded during field surveys and due to the degraded nature of the study area, all threatened flora species were assessed as 'low' likelihood of occurrence. Based on the field surveys, 12 threatened fauna species were identified as having 'moderate' or 'high' likelihood of occurrence. Targeted survey in accordance with the BAM will likely be required for threatened fauna species with a 'moderate' or 'high' likelihood of occurrence within the study area.

Several watercourses have been mapped within the study area. Development within 40 m of the top of bank of a watercourse will require a Controlled Activity Approval under the *NSW Water Management Act* 2000.

Given the development will exceed the threshold for the clearance of native vegetation, development of the subject site is likely to trigger the Biodiversity offset Scheme under the BC Act. Consequently, a BDAR will need to be prepared to assess impacts to biodiversity associated with the proposed development and offset requirements through retiring purchased or generated biodiversity credits. The proposed stewardship site will require the preparation of a BSAR to generate additional biodiversity credits within the study area.

Vegetation integrity plots were collected during field survey which enabled an assessment of the credit outcomes. Based on the current proposal, PCT 1326 and PCT 1245 will generate a surplus of credits following development. PCT 838 and PCT 781, however, will require offsetting.

If you would like to discuss any of the above comments and recommendations further, please contact me on the below details.

Yours sincerely

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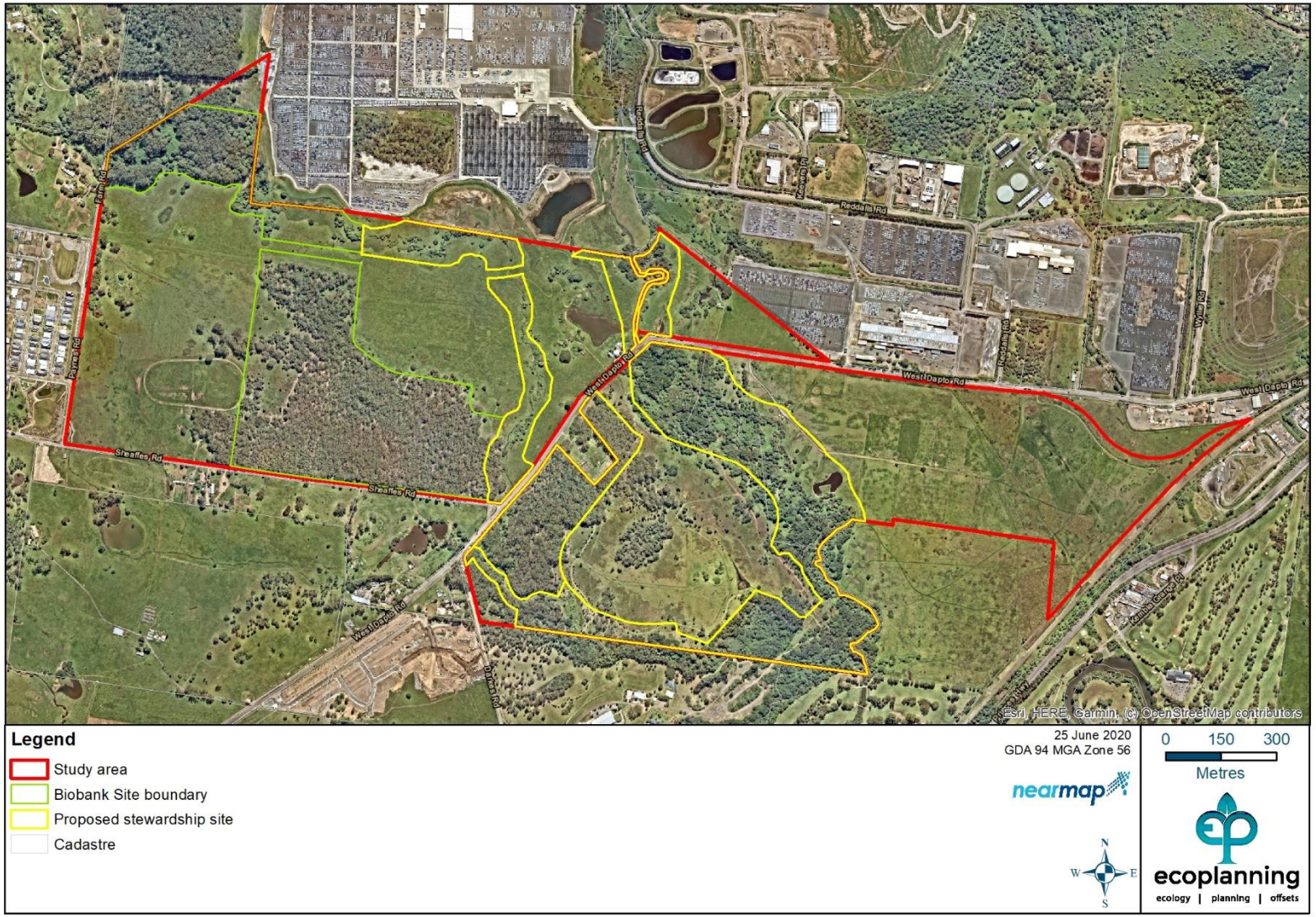

Figure 1: Study area

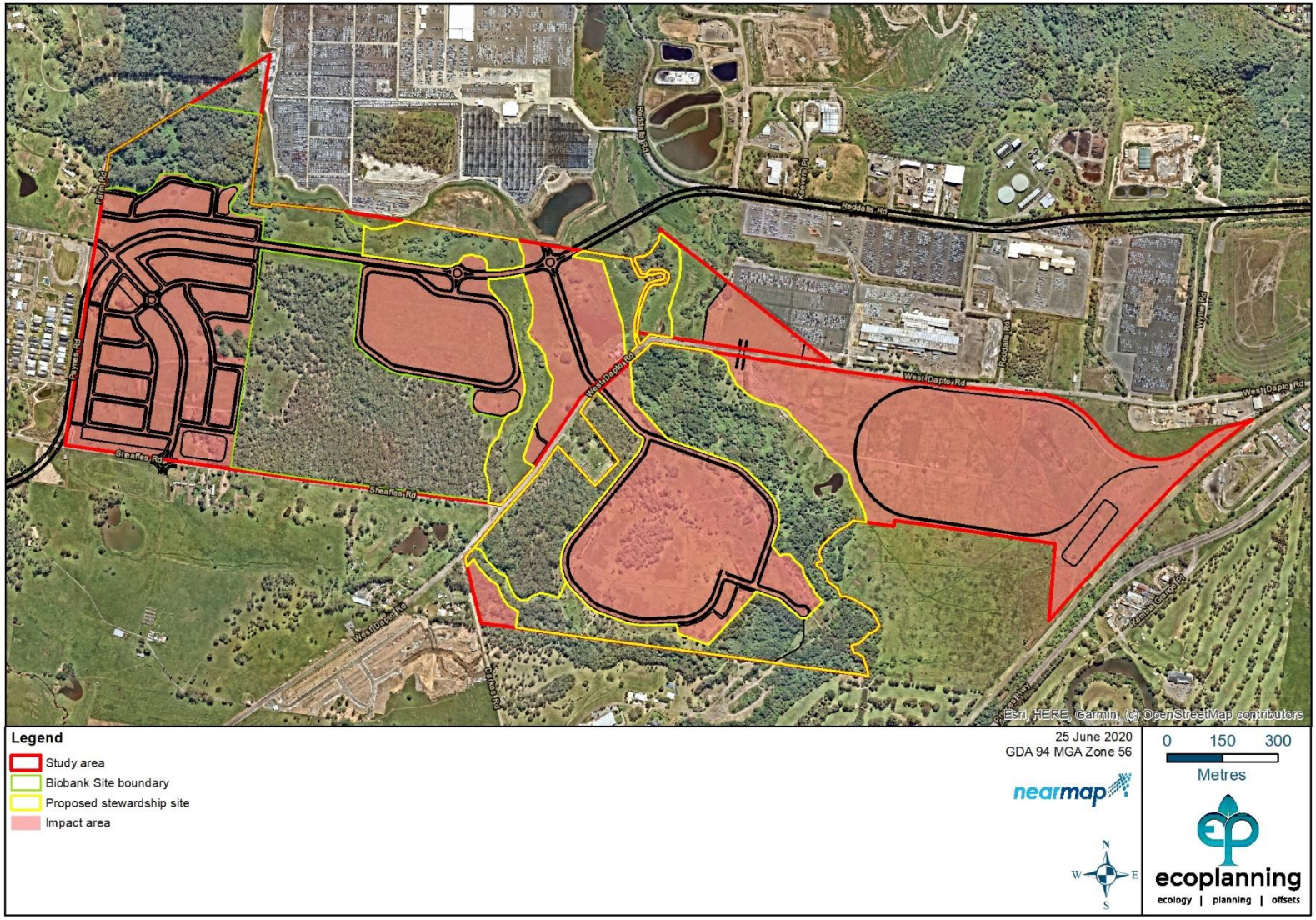

Figure 2: Proposed neighbourhood plan and impact area.

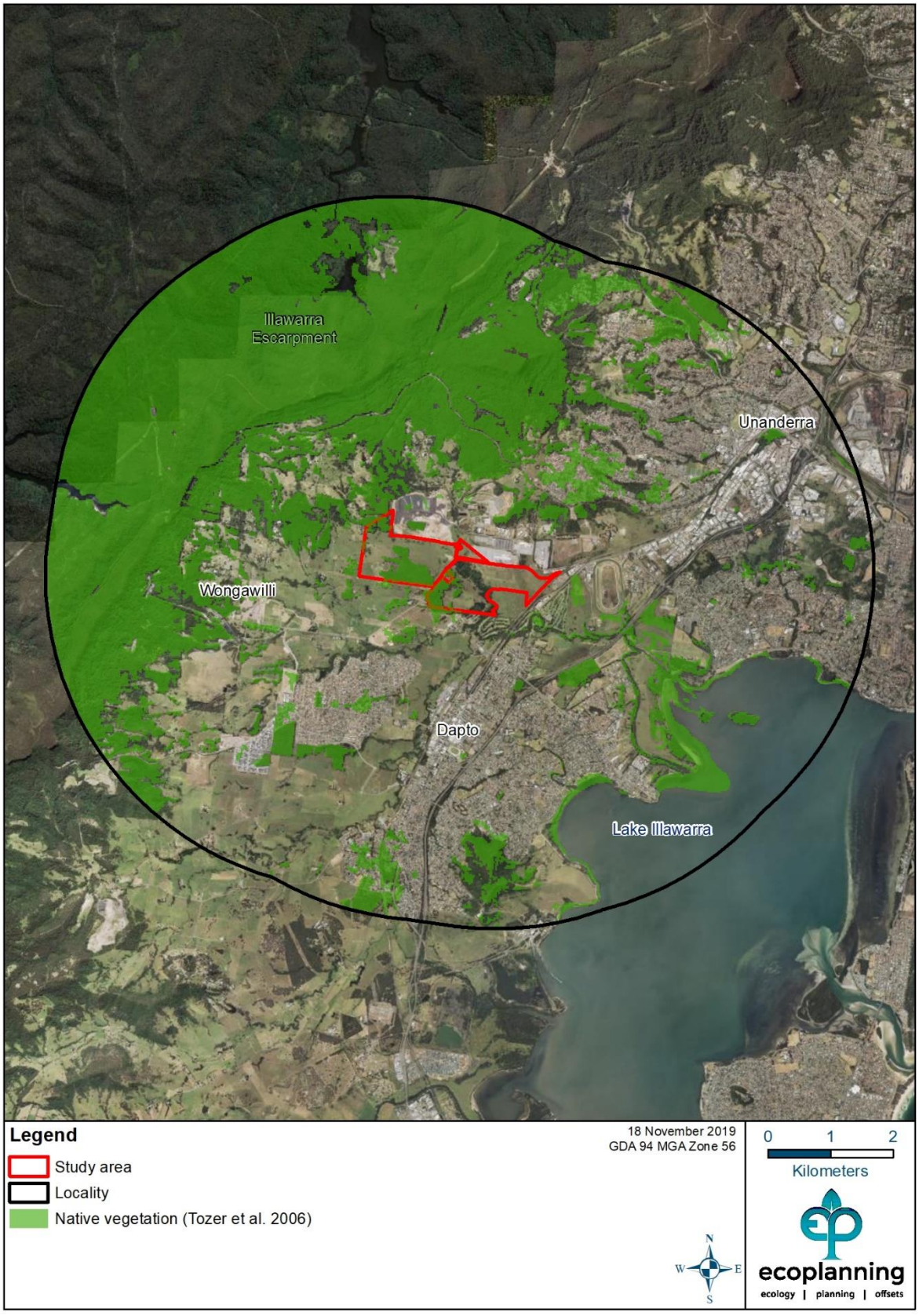

Figure 3: Native vegetation within 5 km of the study area (Tozer et al. 2006).

Figure 4: Riparian lands and watercourses, Terrestrial Biodiversity and Biodiversity Values with the study area.

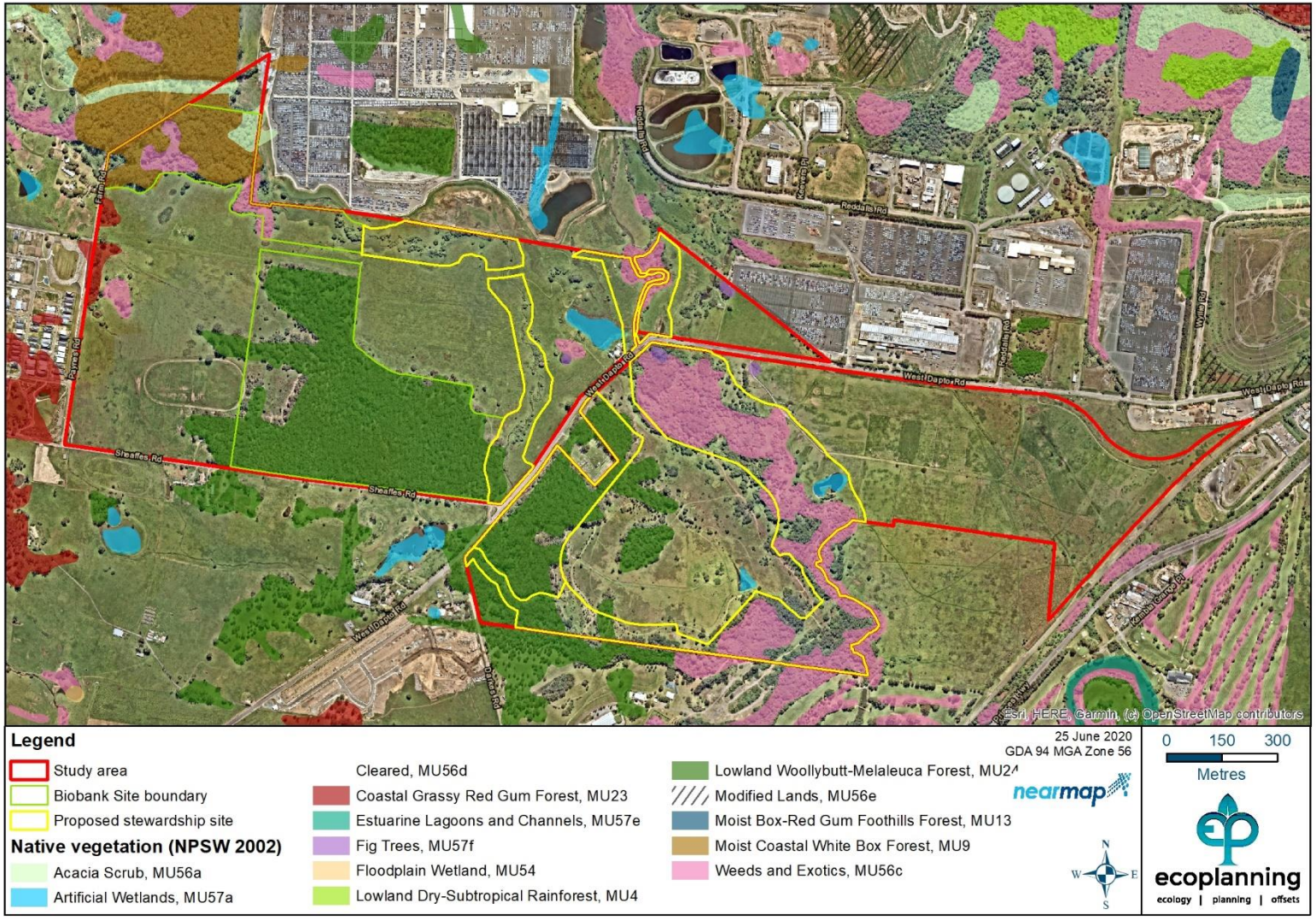

Figure 5: Native vegetation mapping (NPWS 2002).

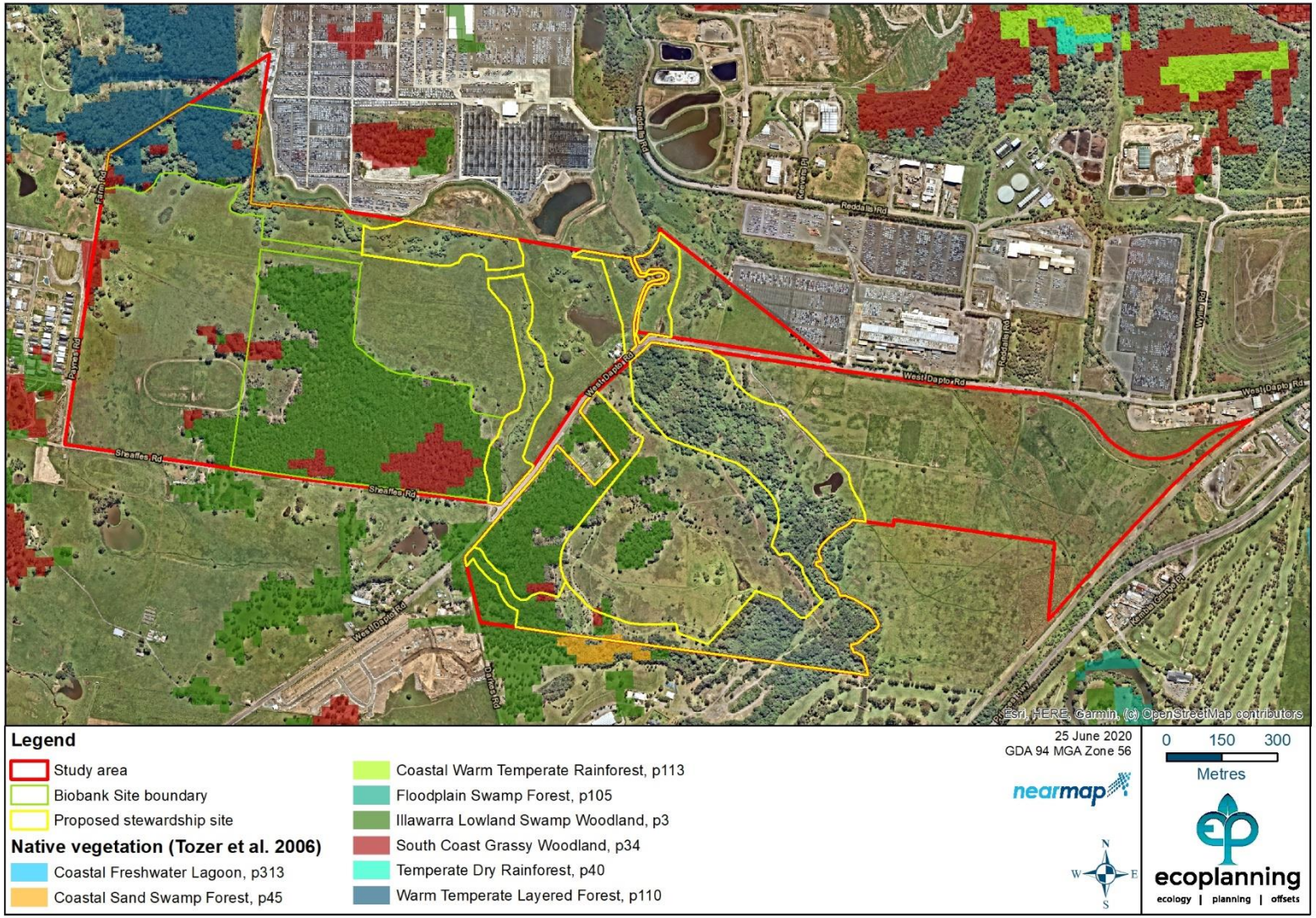

Figure 6: Native vegetation mapping (Tozer et al. 2006).

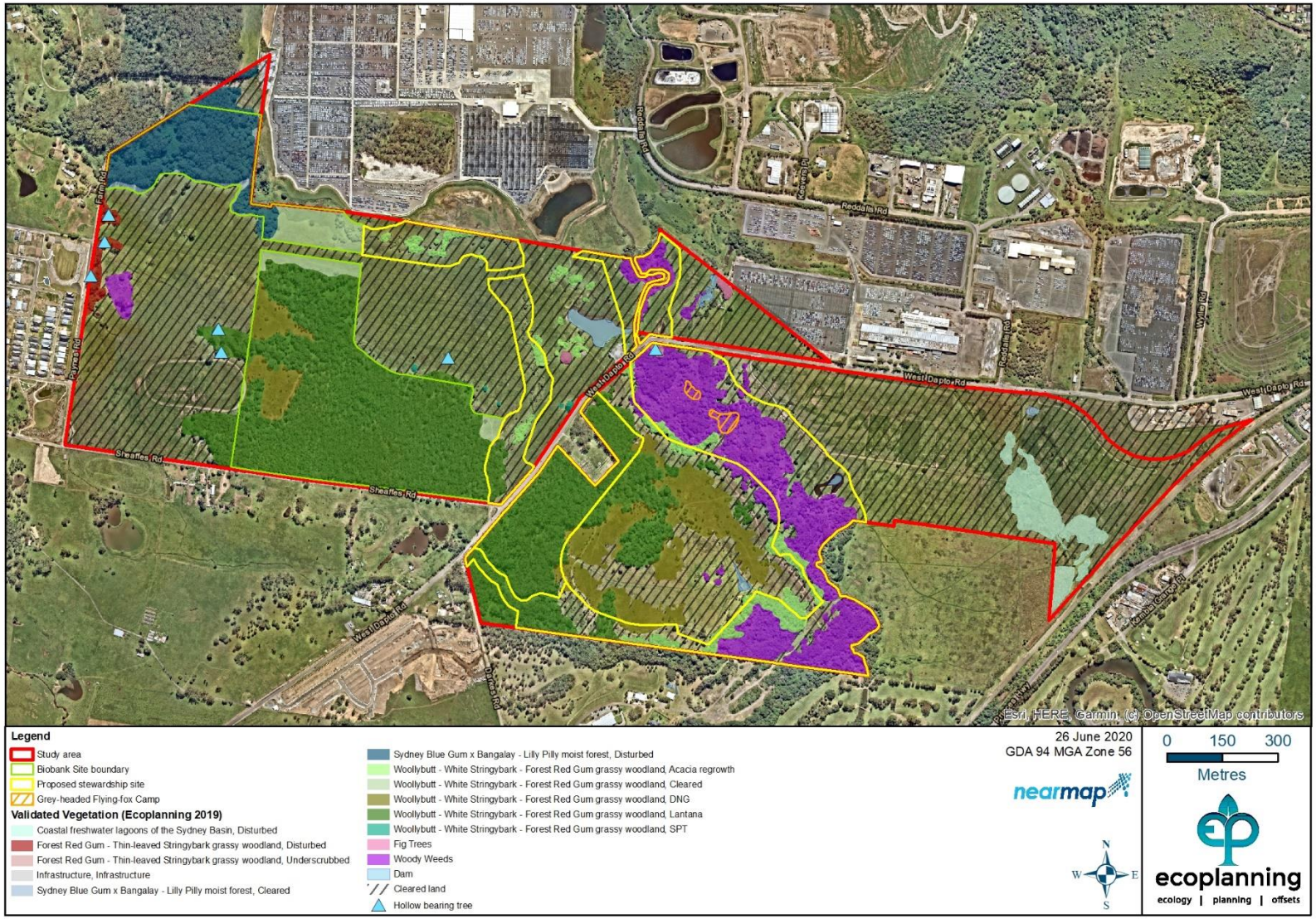

Figure 7: Validated vegetation within the study area.

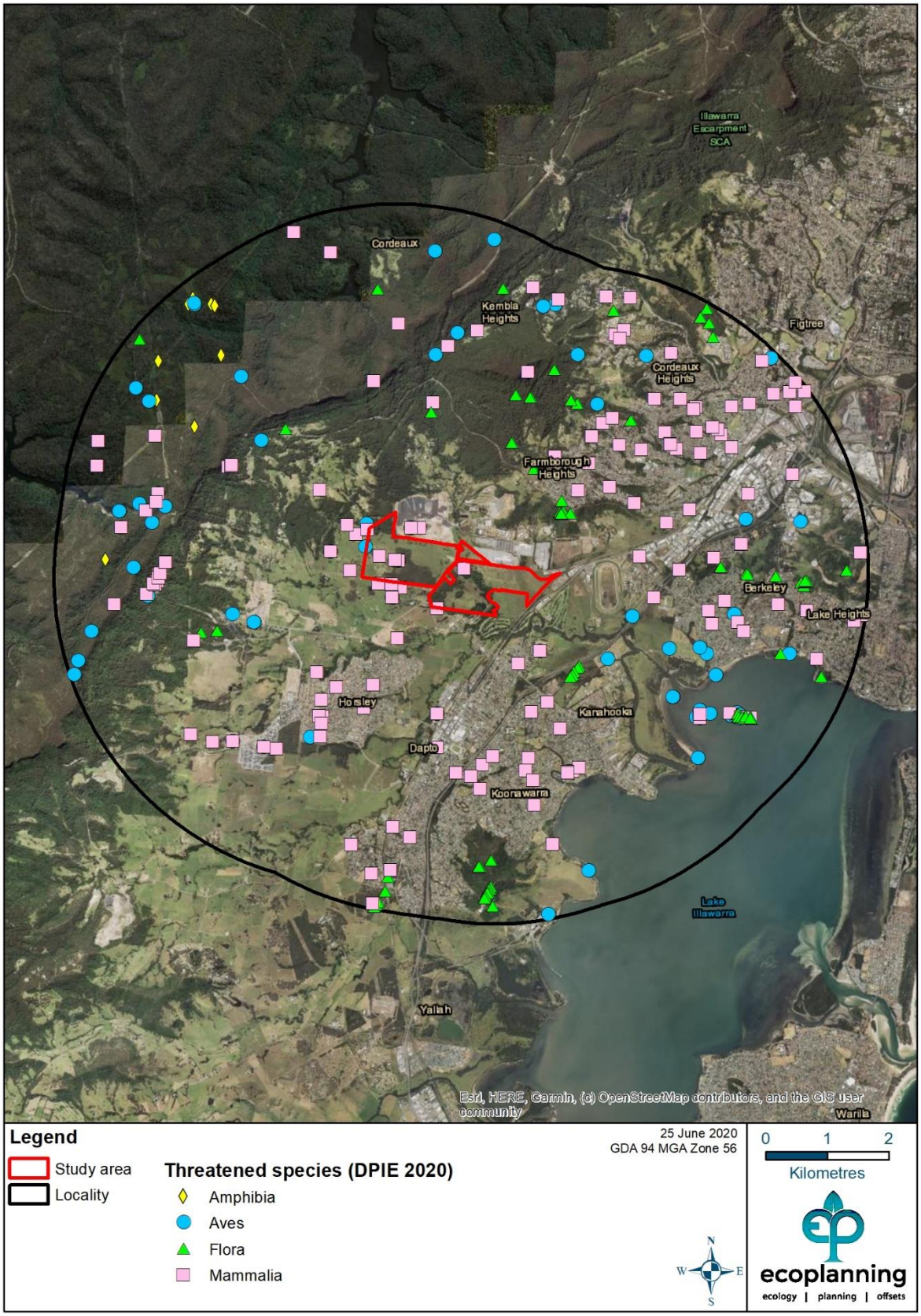

Figure 8: Threatened species within the locality (DPIE 2020).

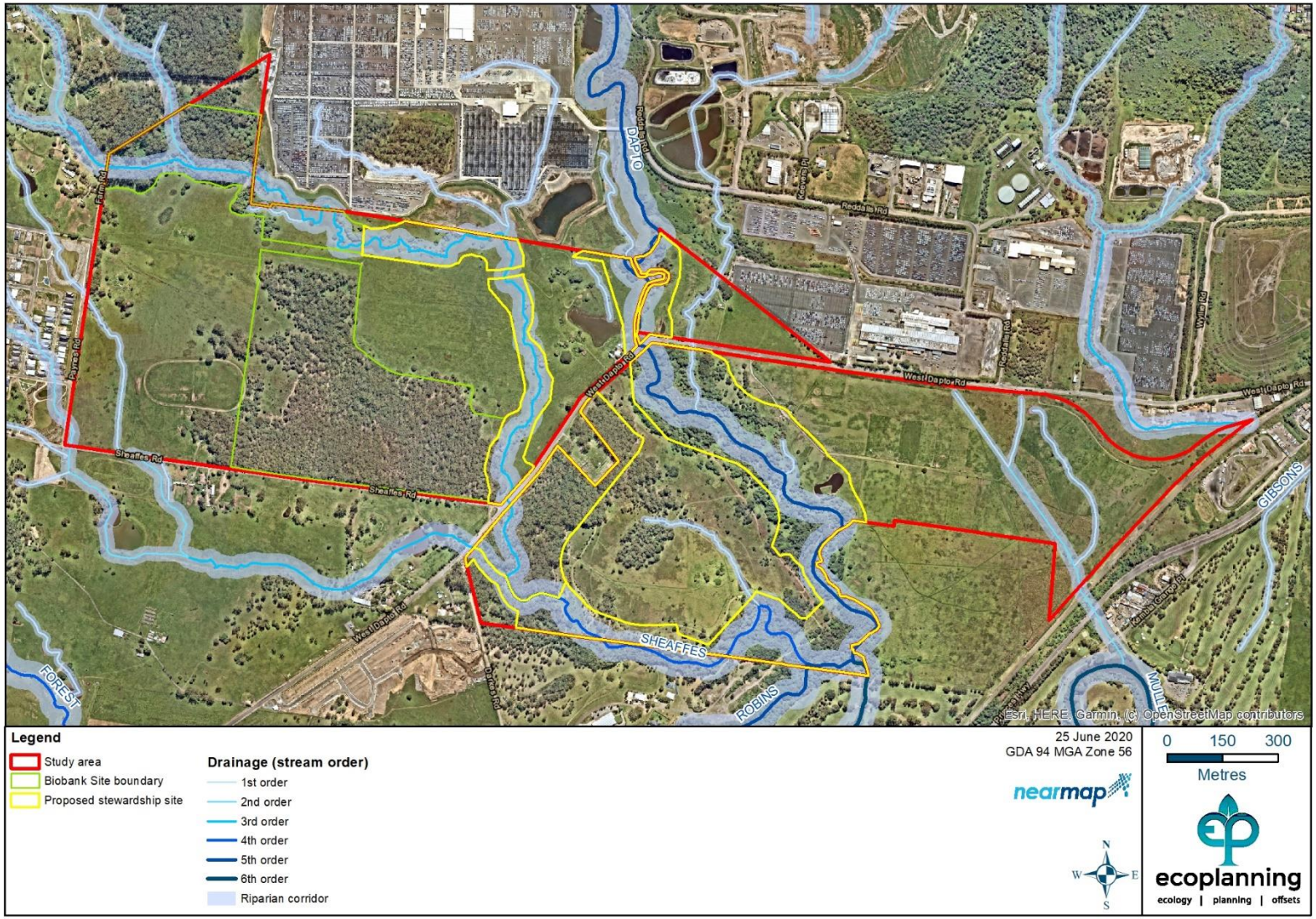

Figure 9: Strahler stream order and riparian corridors within the study area.

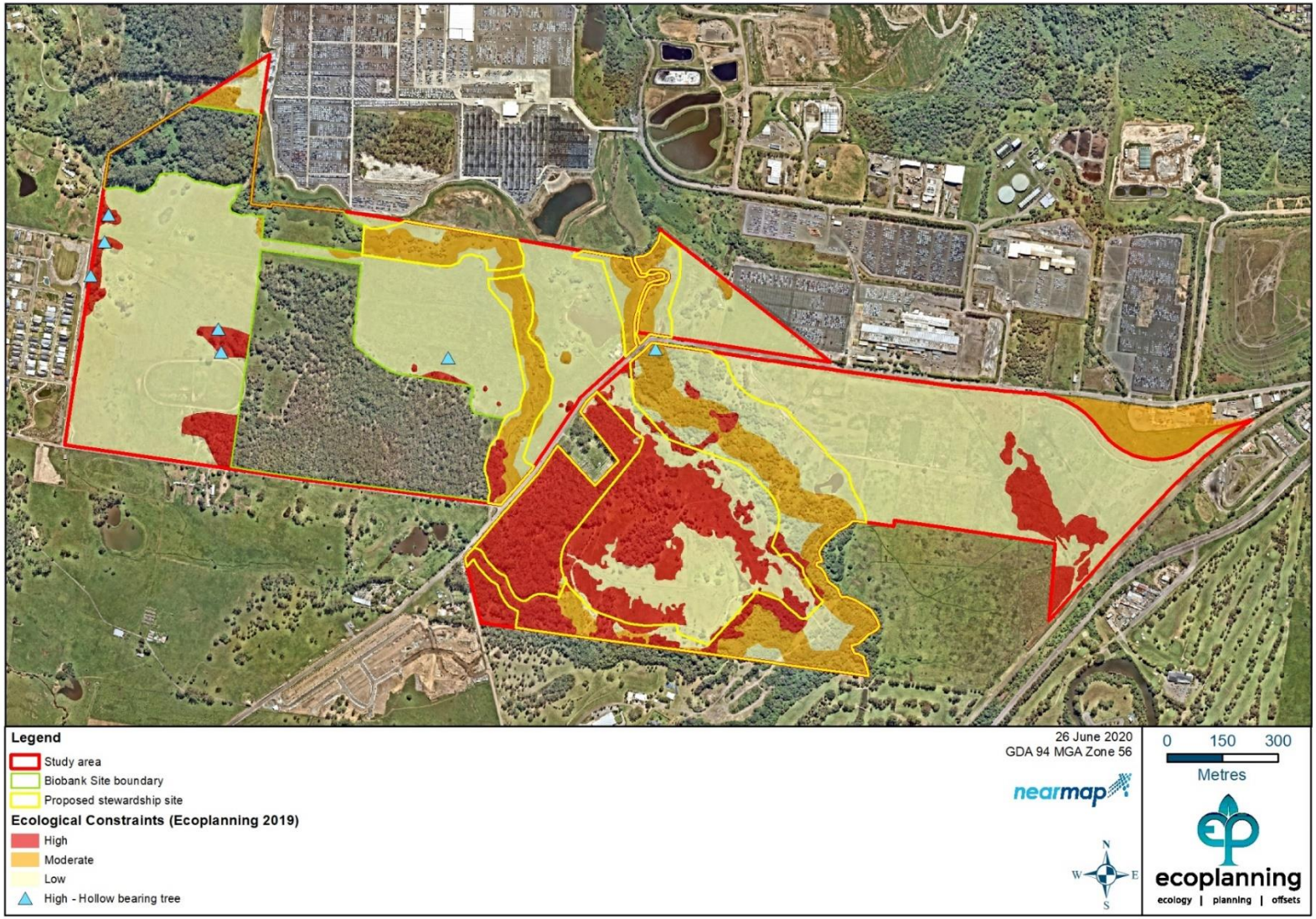

Figure 10: Ecological constraints within the study area.

Appendix A: Flora and fauna species list

Flora

Family	Scientific Name	Common name	Native/Exotic
Apiaceae	*Apium prostratum*	Sea Celery	Native
	Centella asiatica	Indian Pennywort	Native
	Hydrocotyle laxiflora	Stinking Pennywort	Native
Apocynaceae	*Parsonsia straminea*	Common Silkpod	Native
Arecaceae	*Livistona australis*	Cabbage Palm	Native
Asteraceae	*Ageratina adenophora**	Crofton Weed	Exotic
	*Cirsium vulgare**	Spear Thistle	Exotic
	*Hypochaeris radicata**	Catsear	Exotic
	*Senecio madagascariensis**	Fireweed	Exotic
Bignoniaceae	*Pandorea pandorana*	Wonga Vine	Native
Brassicaceae	*Brassicaceae indeterminate**	Mustards	Exotic
Commelinaceae	*Commelina cyanea*	Native Wandering Jew	Native
Convolvulaceae	*Convolvulus erubescens*	Pink Bindweed	Native
	Dichondra repens	Kidney Weed	Native
Cyperaceae	*Carex appressa*	Tall Sedge	Native
	Carex longebrachiata		Native
	Eleocharis spp.	Spike-rush, Spike-sedge	Native
	Lepidosperma laterale	Variable Sword-sedge	Native
Dilleniaceae	*Hibbertia aspera*	Rough Guinea Flower	Native
Ericaceae	*Leucopogon juniperinus*	Prickly Beard-heath	Native
Fabaceae (Faboideae)	*Desmodium varians*	Slender Tick-trefoil	Native
	Glycine clandestina	Twining glycine	Native
	Glycine microphylla	Small-leaf Glycine	Native
	Glycine tabacina	Variable Glycine	Native
	Hardenbergia violacea	False Sarsaparilla	Native
	*Trifolium repens**	White Clover	Exotic
Fabaceae (Mimosoideae)	*Acacia mearnsii*	Black Wattle	Native
	Acacia ulicifolia	Prickly Moses	Native
Gentianaceae	*Centaurium tenuiflorum*	Branched Centaury, Slender centaury	Exotic
Goodeniaceae	*Goodenia hederacea*	Ivy Goodenia	Native
Iridaceae	*Sisyrinchium rosulatum**	Scourweed	Exotic
Juncaceae	*Juncus prismatocarpus*		Native
	Juncus usitatus		Native
Lobeliaceae	*Pratia purpurascens*	Whiteroot	Native
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush	Native
	Lomandra multiflora subsp. *multiflora*	Many-flowered Mat-rush	Native

Family	Scientific Name	Common name	Native/Exotic
Myrtaceae	*Callistemon salignus*	Willow Bottlebrush	Native
	Eucalyptus eugenioides	Thin-leaved Stringybark	Native
	Eucalyptus globoidea	White Stringybark	Native
	Eucalyptus longifolia	Woollybutt	Native
	Eucalyptus pilularis	Blackbutt	Native
	Eucalyptus tereticornis	Forest Red Gum	Native
	Kunzea ambigua	Tick Bush	Native
	Leptospermum polygalifolium	Tantoon	Native
	Melaleuca decora		Native
Oleaceae	*Ligustrum sinense**	Small-leaved Privet	Exotic
	Notelaea venosa	Veined Mock-olive	Native
Onagraceae	*Ludwigia peploides subsp. montevidensis*	Water Primrose	Native
Phyllanthaceae	*Glochidion ferdinandi*	Cheese Tree	Native
Pittosporaceae	*Pittosporum multiflorum*	Orange Thorn	Native
Plantaginaceae	*Plantago lanceolata**	Lamb's Tongues	Exotic
	*Veronica anagallis-aquatica**	Blue Water-speedwell	Exotic
Poaceae	*Andropogon virginicus**	Whisky Grass	Exotic
	*Briza subaristata**		Exotic
	*Cenchrus clandestinus**	Kikuyu Grass	Exotic
	*Cenchrus clandestinus**	Kikuyu Grass	Exotic
	Cymbopogon refractus	Barbed Wire Grass	Native
	Cynodon dactylon	Common Couch	Native
	Entolasia marginata	Bordered Panic	Native
	Eragrostis brownii	Brown's Lovegrass	Native
	*Holcus lanatus**	Yorkshire Fog	Exotic
	Imperata cylindrica	Blady Grass	Native
	Lachnagrostis aemula	Blowngrass	Native
	*Lolium perenne**	Perennial Ryegrass	Exotic
	Microlaena stipoides	Weeping Grass	Native
	Oplismenus aemulus		Native
	*Paspalum dilatatum**	Paspalum	Exotic
	*Phalaris aquatica**	Phalaris	Exotic
Polygonaceae	*Persicaria lapathifolia*	Pale Knotweed	Native
	Rumex spp.	Dock	Native
Primulaceae	*Myrsine variabilis*		Native
Ranunculaceae	*Ranunculus inundatus*	River Buttercup	Native
Rosaceae	*Rubus fruticosus* sp. agg.*	Blackberry complex	Exotic
	Rubus parvifolius	Native Raspberry	Native
Rubiaceae	*Opercularia diphylla*	Stinkweed	Native

Family	Scientific Name	Common name	Native/Exotic
	Opercularia spp.		Native
Rutaceae	*Acronychia oblongifolia*	White Aspen	Native
Verbenaceae	*Lantana camara**	Lantana	Exotic
	Verbena spp.		Native

Fauna

Family	Scientific Name	Common Name	Native/Exotic
Aves			
Acanthizidae	*Acanthiza nana*	Yellow Thornbill	Native
	Acanthiza pusilla	Brown Thornbill	Native
Artamidae	*Cracticus tibicen*	Australian Magpie	Native
	Cracticus torquatus	Grey Butcherbird	Native
Cacatuidae	*Cacatua galerita*	Sulphur-crested Cockatoo	Native
	Cacatua sanguinea	Little Corella	Native
Cuculidae	*Channel-billed Cuckoo*	Scythrops novaehollandiae	Native
Maluridae	*Malurus cyanea*	Superb Fairy-wren	Native
Meliphagidae	*Meliphaga lewinii*	Lewin's Honeyeater	Native
Pardalotidae	*Pardalotus punctatus*	Spotted pardalote	Native
Psittaculidae	*Platycercus elegans*	Crimson rosella	Native
	Trichoglossus haematodus	Rainbow Lorikeet	Native
Rhipiduridae	*Rhipidura albiscapa*	Grey Fantail	Native
Rhipiduridae	*Rhipidura leucophrys*	Willie Wagtail	Native
Amphibia			
Hylidae	*Crinia signifera*	Common Eastern Froglet	Native
	Litoria fallax	Eastern dwarf Tree Frog	Native
	Litoria peronii	Emerald Spotted Tree Frog	Native
Myobatrachidae	*Limnodynastes peronii*	Striped Marsh Frog	Native
Phalangeridae	*Trichosurus vulpecula*	Brush-tailed Possum	Native
Mammalia			
Bovidae	*Bos taurus**	Cow	Exotic
Canidae	*Vulpes vulpes**	Fox	Exotic
Pteropodidae	*Pteropus poliocephalus*	Grey-headed Flying Fox	Native
Leporidae	*Oryctolagus cuniculis**	Rabbit	Exotic
Molossidae	*Micronomus norfolkensis*	Eastcoast Freetail Bat	Native
	Ozimops ridei	Eastern Freetail Bat	Native
Phalangeridae	*Trichosurus vulpecula*	Brush-tailed Possum	Native
Petauridae	*Petaurus breviceps*	Sugar Glider	Native
Vespertilionidae	*Chalinolobus gouldii*	Gould's Wattled Bat	Native
	Chalinolobus morio	Chocolate Wattled Bat	Native
	Falsistrellus tasmaniensis / Scotorepens orion / Scoteanax rueppellii	35 - 38 khz Mixed group	Native
	Scotorepens orion	Eastern broad-nosed Bat	Native

Appendix B: Species likelihood of occurrence

Scientific name (Common name)	Legal Status	No. of records	Closest record (year)	Most recent (distance)	Likelihood of occurrence	
					Pre survey	Post survey
KINGDOM: Animalia; CLASS: Amphibia						
Heleioporus australiacus Giant Burrowing Frog	BC Act: V EPBC Act: V	2	3.28 km (5/11/2001)	25/10/2002 (4.02 km)	Low	Low
Litoria littlejohni Littlejohn's Tree Frog	BC Act: V EPBC Act: V	2	4.17 km (8/07/2013)	19/09/2017 (4.37 km)	Low	Low
Pseudophryne australis Red-crowned Toadlet	BC Act: V	8	3.50 km (17/11/2004)	27/10/2016 (4.63 km)	Low	Low
KINGDOM: Animalia; CLASS: Aves						
Artamus cyanopterus Dusky Woodswallow	BC Act: V	6	0 m (1/12/2016)	10/02/2017 (0.56 km)	Moderate	Moderate
Callocephalon fimbriatum Gang-gang Cockatoo	BC Act: V	7	2.26 km (18/01/2002)	17/11/2004 (3.48 km)	Low	Low
Calyptorhynchus lathami Glossy Black-Cockatoo	BC Act: V	1	3.75 km (17/11/2004)	17/11/2004 (3.75 km)	Low	Low
Daphoenositta chrysoptera Varied Sittella	BC Act: V	1	4.28 km (18/03/2015)	18/03/2015 (4.28 km)	Low	Low
Dasyornis brachypterus Eastern Bristlebird	BC Act: E1 EPBC Act: E	1	3.79 km (8/12/2013)	8/12/2013 (3.79 km)	Low	Low
Glossopsitta pusilla Little Lorikeet	BC Act: V	1	2.91 km (8/10/2014)	8/10/2014 (2.91 km)	Low	Low
Haliaeetus leucogaster White-bellied Sea-Eagle	BC Act: V EPBC Act: C	16	0.17 km (23/01/2014)	5/11/2017 (3.63 km)	Moderate	Moderate
Hieraaetus morphnoides Little Eagle	BC Act: V	3	0 m (19/07/2018)	19/07/2018 (0 m)	High	High

Scientific name (Common name)	Legal Status	No. of records	Closest record (year)	Most recent (distance)	Likelihood of occurrence	
					Pre survey	Post survey
Ixobrychus flavicollis Black Bittern	BC Act: V	5	1.56 km (15/09/2002)	15/02/2017 (2.58 km)	Low	Low
Ninox strenua Powerful Owl	BC Act: V	12	2.60 km (5/12/2001)	1/05/2017 (4.04 km)	Low	Low
Numenius madagascariensis Eastern Curlew	EBPC Act: CE	5	2.72 km (16/02/2017)	10/03/2017 (3.75 km)	Low	Low
Pandion cristatus Eastern Osprey	BC Act: V	3	3.20 km (24/08/2016)	24/08/2016 (3.20 km)	Low	Low
Petroica boodang Scarlet Robin	BC Act: V	3	1.89 km (26/05/2013)	26/05/2013 (1.89 km)	Low	Low
Tyto novaehollandiae Masked Owl	BC Act: V	3	0.17 km (23/01/2014)	27/06/2016 (3.67 km)	Low	Low
Tyto tenebricosa Sooty Owl	BC Act: V	8	3.20 km (27/10/2003)	24/11/2016 (4.04 km)	Low	Low
KINGDOM: Animalia; CLASS: Mammalia						
Cercartetus nanus Eastern Pygmy-possum	BC Act: V	2	1.80 km (31/10/2017)	31/10/2017 (1.80 km)	Low	Low
Chalinolobus dwyeri Large-eared Pied Bat	BC Act: V	3	1.96 km (26/03/2015)	26/03/2015 (1.96 km)	Low	Low
Dasyurus maculatus Spotted-tailed Quoll	BC Act: V EPBC Act: E	1	1.58 km (24/07/2017)	24/07/2017 (1.58 km)	Low	Low
Falsistrellus tasmaniensis Eastern False Pipistrelle	BC Act: V	14	0 m (30/01/2015)	24/01/2019 (1.31 km)	High	High
Micronomus norfolkensis Eastern Coastal Free-tailed Bat	BC Act: V	13	0.19 km (1/09/2015)	9/02/2017 (0.56 km)	High	High

Scientific name (Common name)	Legal Status	No. of records	Closest record (year)	Most recent (distance)	Likelihood of occurrence	
					Pre survey	Post survey
Miniopterus australis Little Bent-winged Bat	BC Act: V	15	0 m (30/01/2015)	27/09/2017 (0 m)	High	High
Miniopterus orianae oceanensis Large Bent-winged Bat	BC Act: V	72	0 m (19/07/2018)	24/01/2019 (1.32km)	High	High
Myotis macropus Southern Myotis	BC Act: V	4	0.20 km (1/12/2016)	24/01/2019 (1.31 km)	Moderate	Moderate
Petauroides volans Greater Glider	EPBC: V	13	0.17 km (23/01/2014)	25/11/2016 (4.53 km)	Moderate	Moderate
Petauroides volans Yellow-bellied Glider	BC Act: V	2	4.84 km (13/01/2017)	13/01/2017 (4.84 km)	Low	Low
Petaurus norfolcensis Squirrel Glider	BC Act: V	1	4.55 km (1/09/2014)	1/09/2014 (4.55 km)	Low	Low
Phascolarctos cinereus *Koala*	BC Act = V EPBC Act = V	2	2.4 km (19/10/2017)	4.00 km (8/11/2017)	Low	Low
Pteropus poliocephalus Grey-headed Flying-fox	BC Act: V EPBC Act: V	165	0 m (27/02/2019)	29/05/2019 (4.00 km)	High	High
Saccolaimus flaviventris Yellow-bellied Sheathtail-bat	BC Act: V	7	0 m (27/09/2017)	27/09/2017 (0.04 km)	High	High
Scoteanax rueppellii Greater Broad-nosed Bat	BC Act: V	18	0 m (26/07/2019)	26/02/2019 (0 m)	High	High
KINGDOM: Plantae						
Cynanchum elegans White-flowered Wax Plant	BC Act: E1 EPBC Act: E	43	0.96 km (22/06/2009)	6/12/2019 (2.60 km)	Low	Low
Gossia acmenoides Gossia acmenoides population in the Sydney Basin Bioregion south of the Georges River	BC Act: E2	2	3.50 km (28/11/2019)	5/02/2020 (4.00 km)	Low	Low
Lespedeza juncea subsp. sericea Lespedeza jencea subsp. sericea in the Wollongong Local Government Area	BC Act: E2	5	4.44 km (4/04/2014)	6/03/2018 (4.87 km)	Low	Low

Scientific name (Common name)	Legal Status	No. of records	Closest record (year)	Most recent (distance)	Likelihood of occurrence	
					Pre survey	Post survey
Pimelea curviflora var. curviflora	BC Act: V EPBC Act: V	1	3.62 km (23/06/2017)	23/06/2017 (3.62 km)	Low	Low
Pultenaea aristata Prickly Bush-pea	BC Act: V EPBC Act: V	1	4.82 km (1/08/2001)	1/08/2001 (4.82 km)	Low	Low
Rhodamnia rubescens Scrub Turpentine	BC Act: E4	13	1.71 km (19/07/2001)	27/09/2016 (4.35 km)	Low	Low
Solanum celatum	BC Act: E1	18	1.80 km (28/09/2016)	19/12/2016 (4.08 km)	Low	Low
Syzygium paniculatum Magenta Lilly Pilly	BC Act: E1 EPBC Act: V	2	1.64 km (13/01/2016)	13/01/2016 (1.64 km)	Low	Low
Zieria granulata Illawarra Zieria	BC Act: E1 EPBC Act: E	6	1.29 km (9/08/2016)	9/08/2016 (1.35 km)	Low	Low