



**BIODIVERSITY DEVELOPMENT
ASSESSMENT REPORT (BDAR)**

**LEVEE WALL NEAR
BUILDING 29
PREPARED FOR
UNIVERSITY OF WOLLONGONG**



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Prepared by:

Jack Talbert
Environmental Planner and Ecologist
Accredited Biodiversity Assessor BAAS18140

Elira Reynolds
Ecologist

Lodge Environmental
 ABN 85 631 988 148
 Scientific License SL102041
 Animal Research Authority – Flora and Fauna Survey
 Mobile: 0423 296 045
 Email: info@lodgeenviro.com.au

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1.0 EXECUTIVE SUMMARY

The University of Wollongong proposes to construct a retaining wall and gabian wall (levee wall) on the western side of the new Building 29. The project spans approximately 45 m and will require removal of landscaped, roadside vegetation.

Impact to native vegetation will total a maximum of 0.045 ha. The proposal will impact planted and naturally regenerating native plants which are consistent with Plant Community Type (PCT) 1245: Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes. This vegetation is not associated with a Threatened Ecological Community (TEC).

The impacts include removal of a maximum of 17 trees for the proposed wall alignment, as well as areas of disturbance to the ground directly adjacent. Once the wall has been constructed, the disturbed area directly adjacent to the wall will be replanted using species similar to those which currently occur within the wider patch of vegetation. Impacts to native vegetation will be avoided as much as possible, however, a conservative approach has allowed for an impact assessment on a total removal of 17 trees.

One Biodiversity Assessment Method (BAM) plot was completed to assess the vegetation and habitat values affected by the proposal. The data gathered was input into the BAM Credit Calculator by an accredited assessor. The credit required for this proposal is 1 Ecosystem Credit for PCT 1245: Sydney Blue Gum x Bangalay – Lilly Pilly moist forest. This is calculated at a cost of \$5,108.16 if purchased from the Biodiversity Conservation Trust Fund, noting prices are subject to change.

Candidate species credit species were considered. Due to the fragmented occurrence of the regrowth vegetation, within a heavily disturbed landscape, and lacking habitat complexity such as tree hollows, no candidate species were considered as potentially occurring within the Subject Land. Consequently, the BAM Credit Calculator did not generate a requirement for any Species Credit offsets.

Additional avoidance and mitigation measures will be undertaken at the time of the wall construction, with an ecologist to be present during clearance to catch and relocate any native fauna encountered, ensure the impact does not go beyond the 17 trees considered within this report, and to advise on additional tree retention. The University landscape manager will replace all trees with similar natives at completion of the works.

2.0 INTRODUCTION

Lodge Environmental were commissioned by the University of Wollongong (UOW) to prepare this Biodiversity Development Assessment Report (BDAR) to assess the impact of minor vegetation removal associated with the construction of a flood training levee wall near Building 29 at the UOW Wollongong main campus – Lot 119A DP15266.

This BDAR has been prepared by Accredited Assessor Jack Talbert (BAAS18140) in accordance with the Biodiversity Conservation Regulation 2017 (BC Reg) and through application of the *Biodiversity Assessment Methodology* (BAM) – case 00018261/BAAS18140/19/00018262.

This BDAR will accompany an Environmental Impact Statement (EIS) in support of the State Significant Development Application (SSD-8596-Mod-2) for the Western Building modification under the *Environmental Planning and Assessment Act 1979* (EP&A Act). Specifically, the Department of Planning, Industry and Environment (DPIE) has requested detail of the biodiversity impacts related to clearing for the purposes of constructing the flood training wall in accordance with the BAM and documented in a BDAR.

This report documents the results of the biodiversity assessment of the Subject Land, defined as the area to be impacted by the development, and how the proponent proposes to avoid, minimise and offset impacts from the proposed development upon native vegetation or biodiversity listed under the State *Biodiversity Conservation Act 2016* (BC Act) (s6.12 and 7.14(1)) and the *Biodiversity Conservation Regulation 2017* (s6.8). This report is based on information obtained through data searches and field survey. The legislative context, methods used, and recommendations are included within this report.

2.1 SITE DESCRIPTION

The Subject Land is located at the western end of the UOW campus within the Wollongong City Council (WCC) Local Government Area (LGA). The land is located less than 3 km northwest of Wollongong CBD. The Subject Land is zoned SP2 – Infrastructure under the Wollongong LEP 2009. The Subject Land is bounded by UOW roads and carparks to the north, east and south, and by O' Leary Road to the west.

The Subject Land is entirely vegetated and currently acts as a screen between O' Leary Road and the UOW Western Carpark. The vegetation was planted by the UOW approximately 40 years ago with the aim of establishing vegetation within a road verge garden that would have likely existed prior to the historic agrarian clearance (circa 1950).

2.2 PROJECT DESCRIPTION

This proposed development is a flood mitigation wall required to achieve flood mitigation requirements as part of the Building 29 approval. A levee needs to be constructed in the Subject Land to assist in diverting water into the riparian corridor to the south during intense rain events. The levee will involve a retaining wall for the majority of the length, and a gabion wall for a minor section at the southern end (**Figure 2** and **Figure 3**).



Figure 1: Site Map

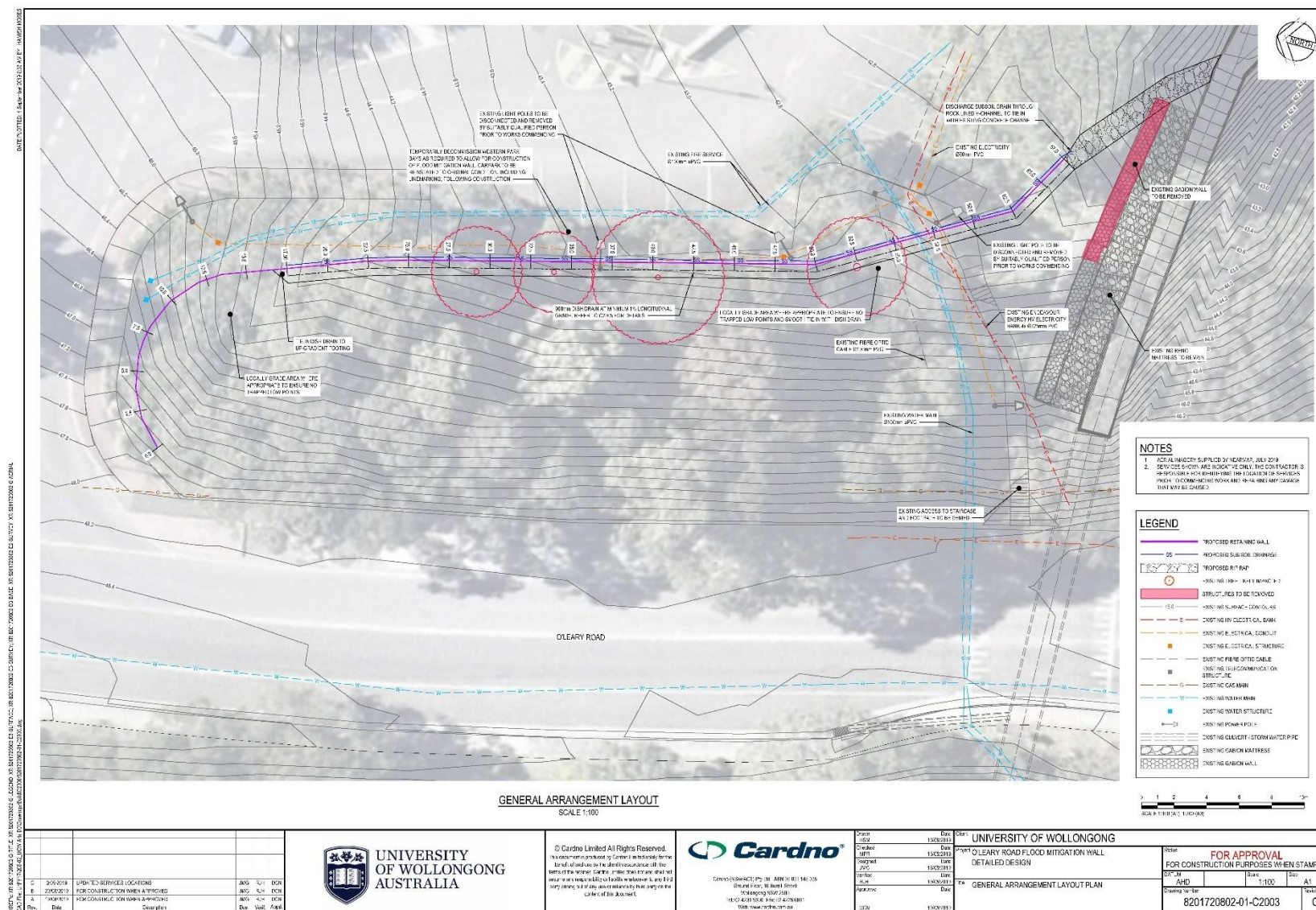


Figure 2: Detailed project design – note, 17 trees along the alignment to be removed.

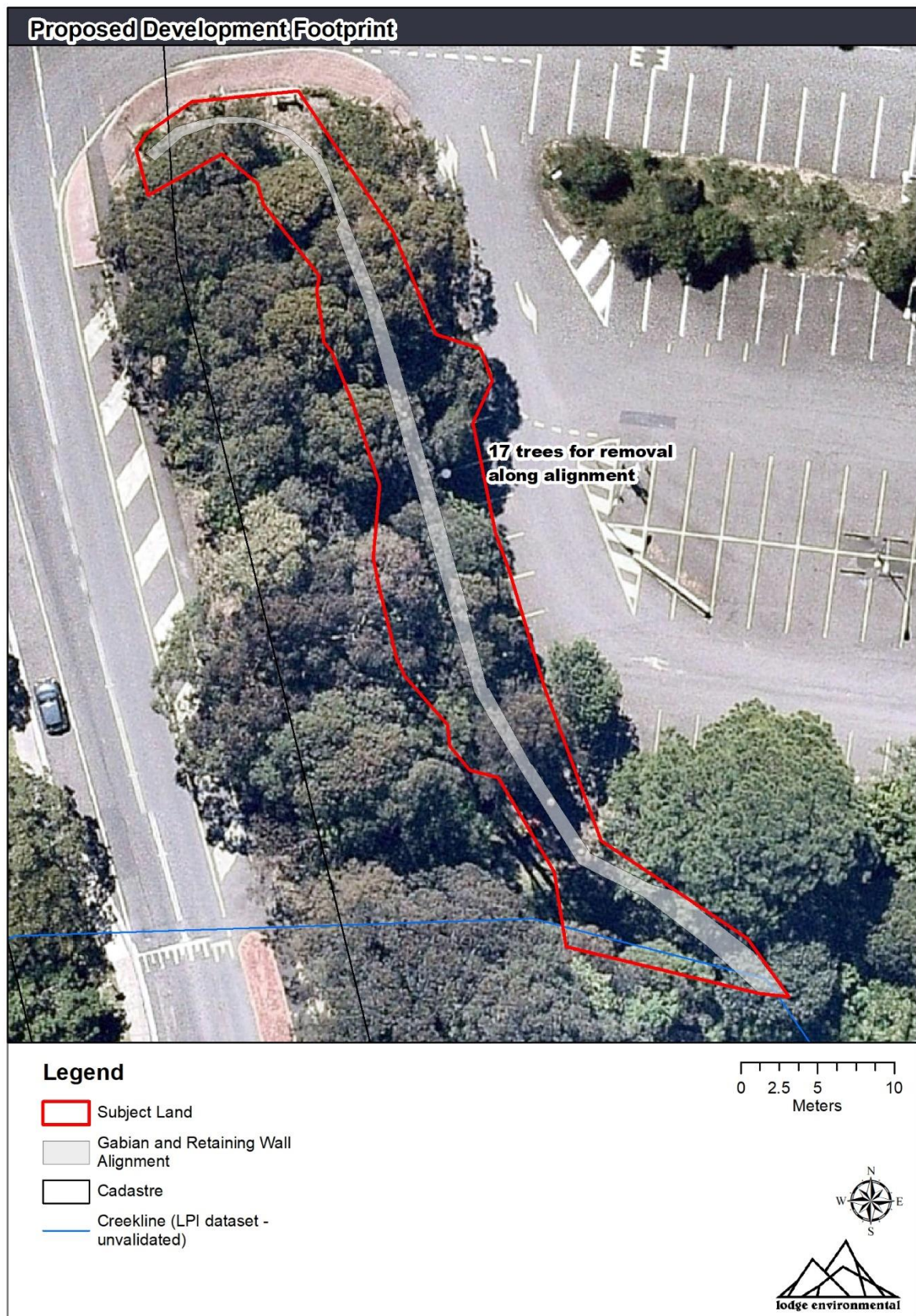


Figure 3: Proposal Layout

2.3 PERSONNEL AND QUALIFICATIONS

This BDAR has been prepared through the compilation of field data, desktop analysis and reporting by the following technical professionals:

- Jack Talbert – Environmental Planner and Ecologist
BEnvSci (Honours), Accredited BAM Assessor (No: BAAS 18140)
Jack was the project manager for this assessment and completed or closely supervised all surveys, data entry, GIS mapping, review, BAM credit calculations and report preparation
- Elira Reynolds – Ecologist
BSc (ConsBio)(Honours) / BCom
Elira assisted in the vegetation community mapping and completion of the vegetation plots

All surveys were undertaken in accordance with the following:

- Animal Research Authority (ARA) granted under the NSW Animal Research Act 1985 by the NSW Department of Primary Industries Secretary's Animal Care and Ethics Committee
- NSW Scientific License issued by the NSW Department of Planning, Industry and Environment under s132C of the NSW National Parks and Wildlife Act 1974 (SL102041)

3.0 LANDSCAPE CONTEXT

3.1 LANDSCAPE FEATURES

In accordance with Chapter 4 of the BAM, a range of landscape features must be identified where they occur on the Subject Land. These features may contain biodiversity values that are important for the site context of the Subject Land, or for informing the likely habitat suitability of the Subject Land. The below subsections and **Figure 4** detail these features, including Interim Biogeographic Regionalisation Australia (IBRA) regions, landscape regions (Mitchell Landscapes) and other features such as rivers, streams, wetlands, habitat connectivity, karst topography and areas of outstanding biodiversity value that have been identified under the BC Act.

3.1.1 IBRA BIOREGIONS AND IBRA SUBREGIONS

IBRA regions is a nationally endorsed classification system for mapping large, geographically distinct bioregions based on the following aspects; climate, geology, landform, native vegetation and species information. The Subject Land occurs entirely within the Illawarra IBRA subregion (version 7) and within the NSW Sydney Basin IBRA region (version 7) (**Figure 4**). The Sydney Basin region is characterised by mesozoic sandstones and shales; dissected plateaus; forests, woodlands and heaths; skeletal soils, sands and podzolics.

3.1.2 MITCHELL LANDSCAPES

Mitchell Landscapes are areas of land with relatively homogenous geomorphology, soils and broad vegetation. The Subject Land occurs on the 'Dapto – Wollongong Coastal Slopes' landscape (Mitchell Landscapes version 3.1). The Dapto – Wollongong Coastal Slopes Landscape was input into the BAM calculator.

3.1.3 OTHER FEATURES AND BIODIVERSITY VALUES MAP

Review of the NSW Biodiversity Values Map shows that the Subject Land does not contain any mapped land (**Figure 5**).

The Subject Land does not contain any karst topography, caves, crevices, cliffs or other areas/features of geological significance.

Under the Wollongong Local Environment Plan 2009 (LEP), a mapped watercourse occurs immediately to the south of the Subject Land. The drainage line is a 2nd order waterway (Strahler System) and the buffer for this drainage line intersected the Subject Land.

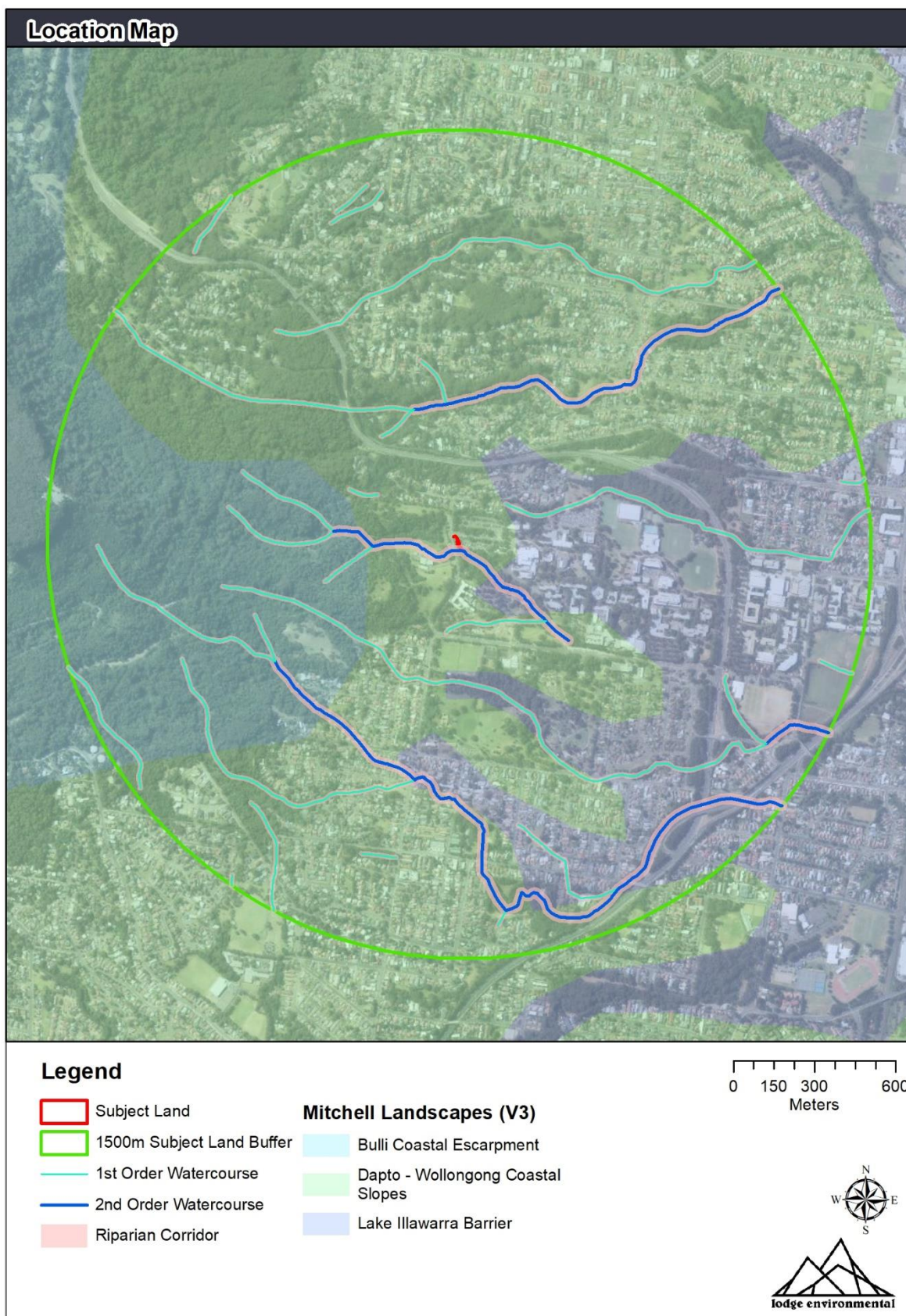


Figure 4: Location Map

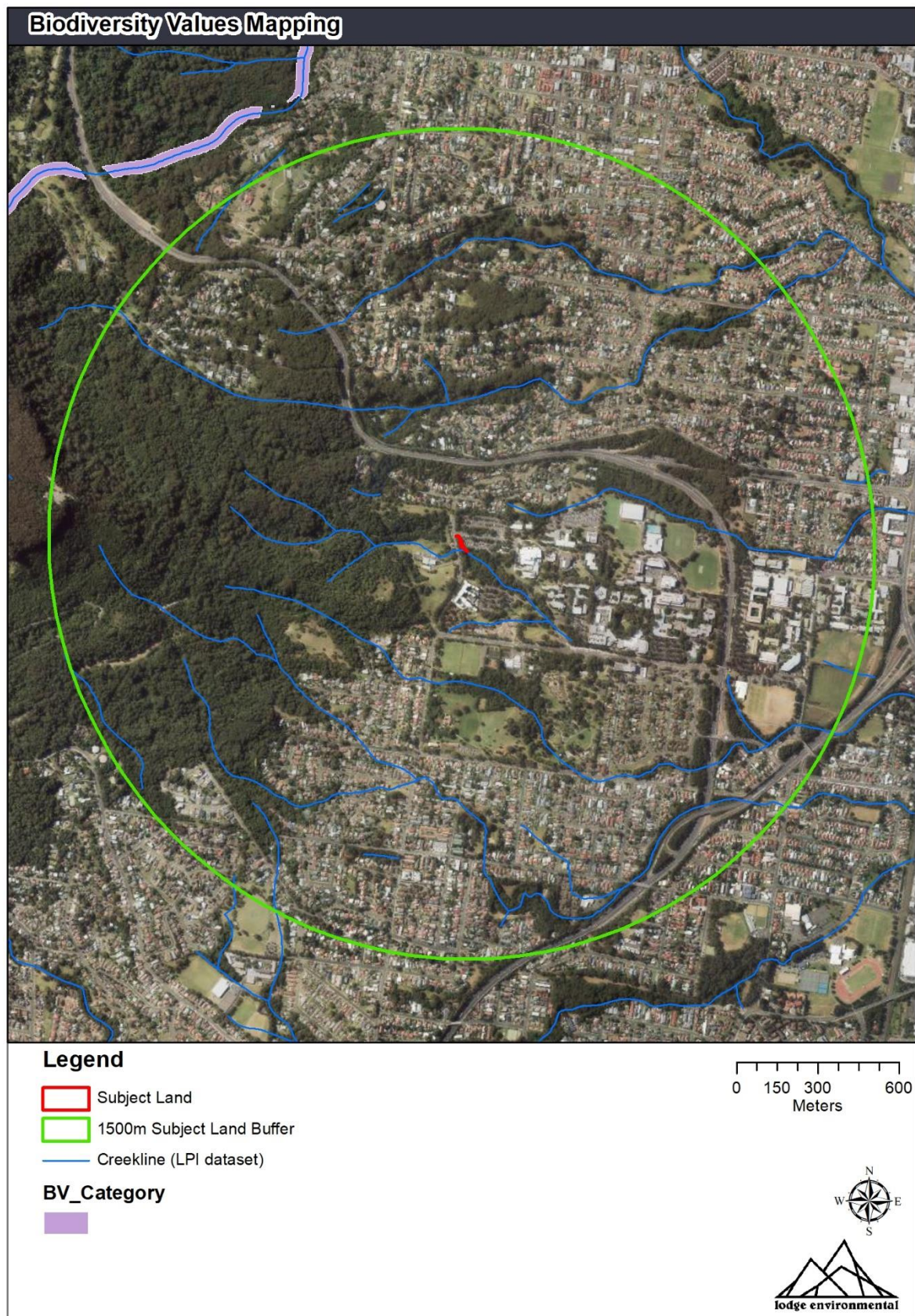


Figure 5: Biodiversity Values mapping

3.2 SITE CONTEXT

3.2.1 Native Vegetation Cover

To determine the site context of the Subject Land the Department of Planning, Industry and Environment (DPIE) (2016) Biometric Vegetation Mapping was used within a 1,500 m radius (**Figure 6**). Edits were made where necessary based on current aerial imagery to reflect any relevant changes in vegetation extent. Areas of Weeds and Exotics were not included within the total area count. The presence of remnant canopy trees, understanding of regional garden landscaping and agricultural patterns and differentiation between groundcover colour were taken into account during the aerial image interpretation.

Table 1 displays the relevant site context values. The native vegetation cover class used in the BAM calculator is **42%**.

Table 1: Native Vegetation Cover

1,500 m buffer area	Native Vegetation Cover	Percent Vegetation Cover
304 ha	728 ha	42%

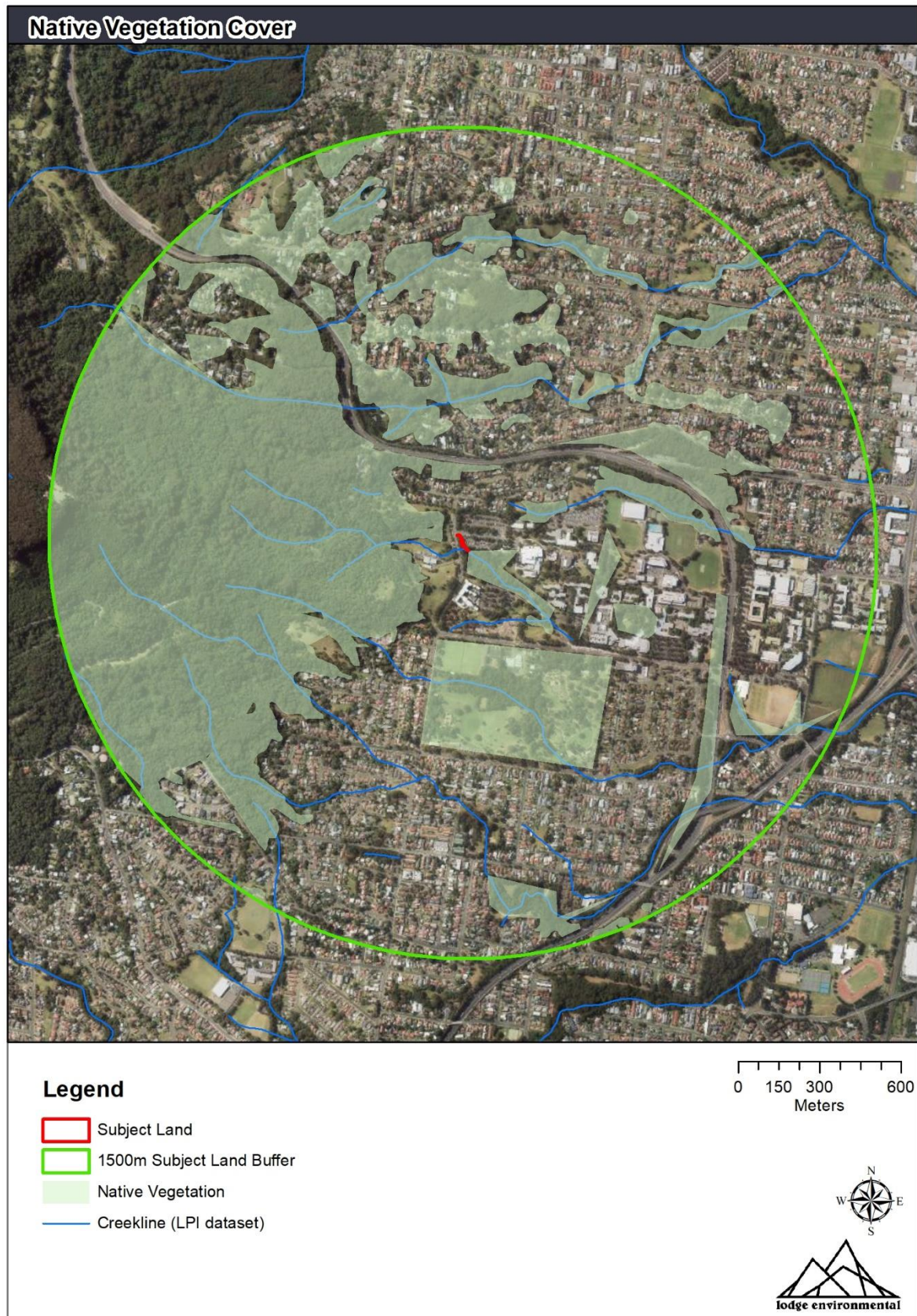


Figure 6: Native vegetation cover within 1,500m of the Subject Land

3.2.2 Patch Size

Patch size for each vegetation zone within the Subject Land was calculated and assigned to a vegetation class, being either <5ha, 5-24 ha, 25-100 ha or ≥ 100 ha.

Patch size is defined within the BAM as an area of intact vegetation that:

- a) occurs on the development site or biodiversity stewardship site, and
- b) includes native vegetation that has a gap of less than 100 m from the next area of moderate to good condition native vegetation (or ≤ 30 m from non-woody ecosystems).

Intact vegetation is defined as “vegetation where all tree, shrub, grass and/or forb structural growth form groups expected for a plant community type are present” .

Patch size may extend onto adjoining land that is not part of the development site or biodiversity stewardship site. The patch size class is used to assess the habitat suitability of the Subject Land for threatened species.

A single patch of native vegetation was identified within the Subject Land. The patch size class used to assess the habitat suitability for all native vegetation patches within the Subject Land is **5 ha** as it has connectivity through riparian vegetation and native landscaping with UOW campus.

4.0 NATIVE VEGETATION

4.1 VEGETATION FIELD ASSESSMENT

The native vegetation within the Subject Land includes all areas of native vegetation including native ground cover and the canopy area of trees. The native vegetation was mapped, in accordance with the BAM, into Plant Community Types (PCT) within the Subject Land, using the following methods:

- review of previous vegetation mapping – Biometric Vegetation Types (DPIE 2016)
- review of Protected Matters Search Tool (Commonwealth of Australia 2019)
- review of NSW Bionet Atlas of NSW Wildlife (2019)
- site assessment by ecologists Jack Talbert and Elira Reynolds on 13 November 2019. The Subject Land was traversed to identify plant species present as well as dominance of species per native vegetation patch. Initial survey focussed on traversing the entirety of the Subject Land to confirm the sites stratification into vegetation zones reflecting the broad condition state of vegetation.
- Plot based vegetation survey was then undertaken in accordance with the BAM – i.e. a 20 m x 20 m plot. Table 4 of the BAM was reviewed and used to inform the required number of plots. The 20 m x 20 m plot included the vegetation integrity plots. Each plot was randomly located within each vegetation zone while also avoiding ecotones, vehicle tracks and their edges, or other disturbed areas that were readily distinguishable from the broad condition state of the vegetation zone.
- a review of the BioNet Vegetation Classification database (<https://www.environment.nsw.gov.au/research/Vegetationinformationsystem.html>) was utilised to determine the most suitable PCT for the vegetation communities within the Subject Land. This is in accordance with the NSW PCT classification (BioNet Vegetation Classification (DPIE 2019)).
- Consideration was given to the geographic distribution (based upon IBRA subregions), vegetation formation and floristics of vegetation within the Subject Land. The data for each potential PCT including vegetation stratum floristics and formation, descriptive attributes and distribution information were then reviewed and compared to the observations made during field survey. A final determination was then made to determine the most suitable PCT.

4.2 PLANT COMMUNITY TYPE MAPPING

A review of vegetation mapping that covers the Subject Land (DPIE 2016) identified a single vegetation type which did not constitute a Plant Community Type (PCT), being:

- Weeds and Exotics – no PCT

On-site vegetation community assessment was based on analysis of site location, aspect, condition and validated against DPIE Bionet Vegetation Classification (<https://www.environment.nsw.gov.au/NSWVCA20PRapp/search/pctsearch.aspx>).

One homogenous vegetation community (comprising one PCT) was observed within the Subject Land on the 13 November 2019 over four-person-hours.

The PCT was then broken down into distinct 'vegetation zones' for the purposes of input into the BAM calculator. This stratification was based on observed condition, floristic composition and structure. A vegetation zone is henceforth an area of native vegetation on the Subject Land that has the same PCT and a similar broad condition state.

The vegetation communities confirmed within the Subject Land were:

- PCT 1245: Sydney Blue Gum x Bangalay – Lilly Pilly moist open forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion (Planted/regrowth – poor condition).

It is noted that the UOW grounds in their entirety have been subject to substantial historic clearance, however a strict landscape management regime has resulted in planted vegetation patches that are representative of PCTs which would have occurred prior to clearance. Throughout the University, vegetation is comprised of mature, planted landscaping trees, comprising both locally indigenous species and ornamental exotic species. A broad range of native and exotic species have been planted throughout the University and the Subject Land itself.



Figure 7: Plant Community Type mapping (DPIE 2016)

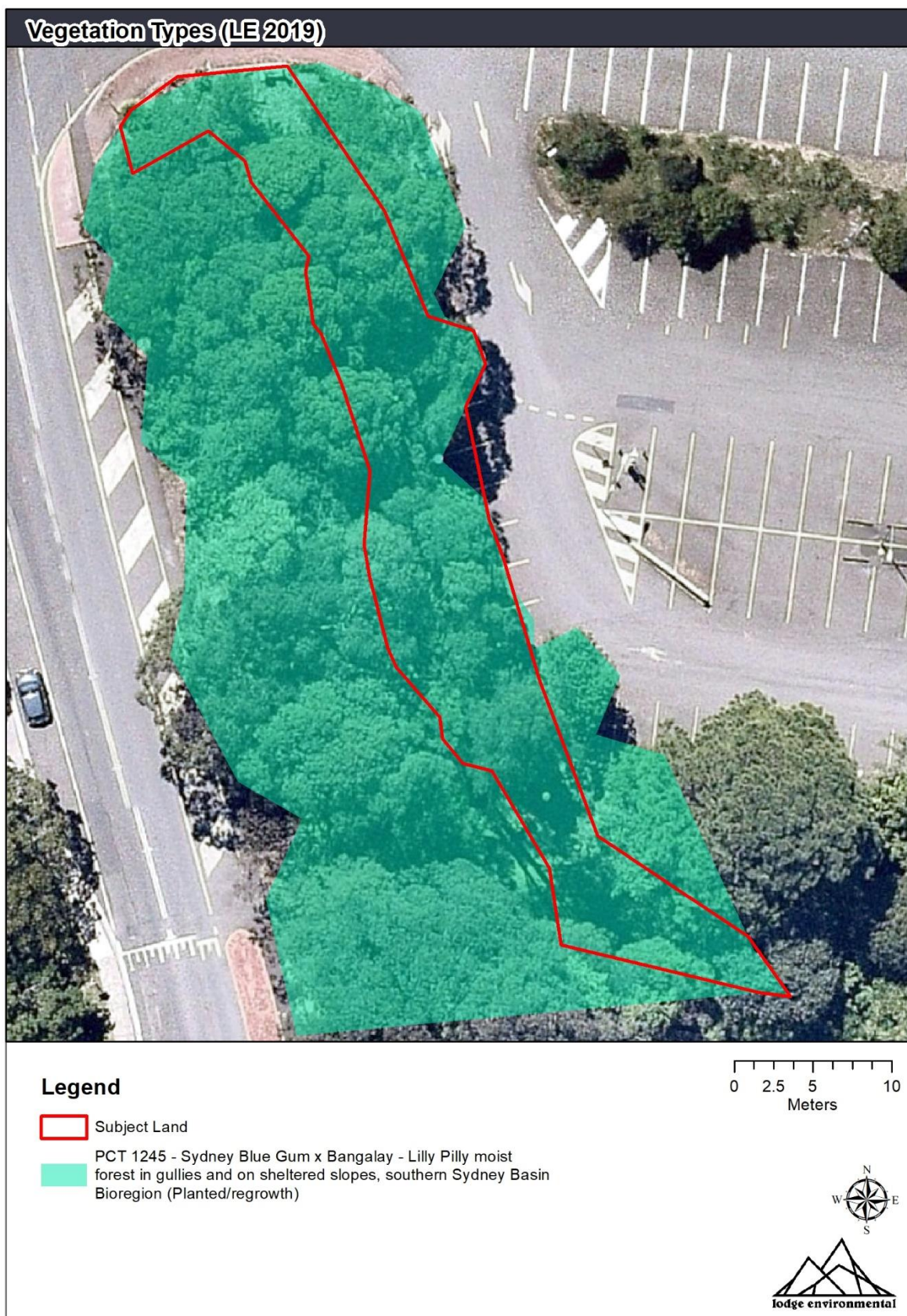


Figure 8: Validated Plant Community Types (LE 2019)

The following table provides a detailed description of the PCT recorded within the Subject Land.

Table 2: PCT 1245 – Sydney Blue Gum x Bangalay – Lilly Pilly moist forest

PCT 1245 – Sydney Blue Gum x Bangalay – Lilly Pilly moist forest in gullies and sheltered slopes			
PCT ID	1245		
Vegetation formation	Wet Sclerophyll Forest (Shrubby)		
Vegetation class	North Coast Wet Sclerophyll Forests		
Condition	Planted / regrowth – poor condition		
Extent within Subject Land	Approximately 0.045 ha of PCT 1245 in a poor condition was recorded within the Subject Land.		
Description	The general community was represented primarily by codominance of Grey Ironbark <i>Eucalyptus paniculata</i> and Sydney Blue Gum <i>Eucalyptus saligna</i> x <i>botrioides</i>. Other common canopy species included Turpentine <i>Syncarpia glomulifera</i> and Tallowwood <i>Eucalyptus microcorys</i> supported by occasional representations of Blackbutt <i>Eucalyptus pilularis</i>. All vegetation is a result of tailored landscaping by the University aimed at re-establishing a native dominant patch of roadside vegetation. The shrub layer consisted of Prickly-leaved Tea-tree <i>Melaleuca stypheloides</i>, Illawarra Flame Tree <i>Brachychiton populneus</i>, various Acacia species including; Two-veined Hickory <i>Acacia binervata</i>, Hickory Wattle <i>Acacia implexa</i> and Stiff-leaf Wattle <i>Acacia obtusifolia</i>, as well as Willow Bottlebrush <i>Callistemon salignus</i>, regrowth Swamp Oak <i>Casuarina glauca</i> and Turpentines <i>Syncarpia glomulifera</i>. The ground layer was sparse, but included the climbing Native Grape <i>Cayratia clematidea</i>, Rock Fern <i>Cheilanthes sieberi</i>, Blue Flax Lilly <i>Dianella caerulea</i> and Many-flowered Mat-rush <i>Lomandra multiflora</i>. The area is experiencing edge effects from the adjacent disturbances evidenced by the presence of characteristic disturbance margin weeds including; Madeira Vine <i>Anredera cordifolia</i>, Asparagus Weed <i>Asparagus aethiopicus</i>, Lantana <i>Lantana camara</i>, Fennel <i>Foeniculum vulgare</i>, Senna <i>Senna pendula</i>, Fireweed <i>Senecio madagascariensis</i>, Flatweed <i>Hyperchaeris radicata</i> and <i>Trifolium glomeratum</i> Clusted Clover.		
Survey effort	One VI plot was established this zone. Plot 1.		
PCT Justification: Expected Species by Stratum (Bold denotes species relied upon for identification of vegetation type)	<u>Upper Stratum:</u> <i>Acmena smithii</i> ; <i>Livistona australis</i> ; <i>Synoum glandulosum</i> ; <i>Pittosporum undulatum</i> ; <i>Cryptocarya glaucescens</i> ; <i>Eucalyptus saligna</i> ; <i>Eucalyptus quadrangulata</i> ; <i>Eucalyptus pilularis</i> ; <i>Syncarpia glomulifera</i> ;	<u>Mid Stratum:</u> <i>Notelaea venosa</i> ; <i>Clerodendrum tomentosum</i> ; <i>Eupomatia laurina</i> ;	<u>Ground Stratum:</u> <i>Doodia aspera</i> ; <i>Pseuderanthemum variabile</i> ; <i>Oplismenus imbecillis</i> ; <i>Gymnostachys anceps</i> ; <i>Blechnum cartilagineum</i> ; <i>Adiantum formosum</i> ; <i>Calochlaena dubia</i> ;
TEC Status	There are currently no TECs associated with this PCT.		
Estimate of percent cleared value of PCT in the major catchment area	43%		

Image of PCT 1245



4.3 VEGETATION INTEGRITY ASSESSMENT (SITE CONDITION)

Vegetation Integrity (VI) plots were undertaken in accordance with the BAM. The number of plots were informed by Table 4 within the BAM. A total of 1 plot was completed during field work (**Appendix B**) as shown in **Figure 9**. **Table 3** below details the area of each native vegetation zone, associated impacts and number of plots undertaken.

Table 3: PCTs, associated impacts and plots undertaken per BAM Table 4 requirement

PCT	Condition class	Impact (ha)	VI plots undertaken per required
PCT 1245: Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes	Planted/ Regrowth – poor	0.045 (rounded to 0.05 ha in BAM calculator)	1/1

The VI plots allowed for calculation of vegetation integrity scores for each vegetation zone at the current condition as well as following the proposal impacts.

The future vegetation integrity scores for the vegetation to be impacted is calculated to be 0. This is because a conservative approach has been taken in defining the impact and a total 0.045 ha of native vegetation is herein assessed to be impacted in its entirety to make way for a retaining wall and gabien wall in accordance with the General Arrangement Layout Plan (8201720802-01-C2003) (**Figure 2**). **Table 4** outlines the VI scores calculated/input into the BAM calculator. However, during construction it is likely that the final impact will not remove all vegetation within the Subject Land.

Table 4: Vegetation Integrity Scoring

PCT and condition class	Impact (ha)	Current VI score	VI score after development
PCT 1245: Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes	0.05 ha	45.6	0

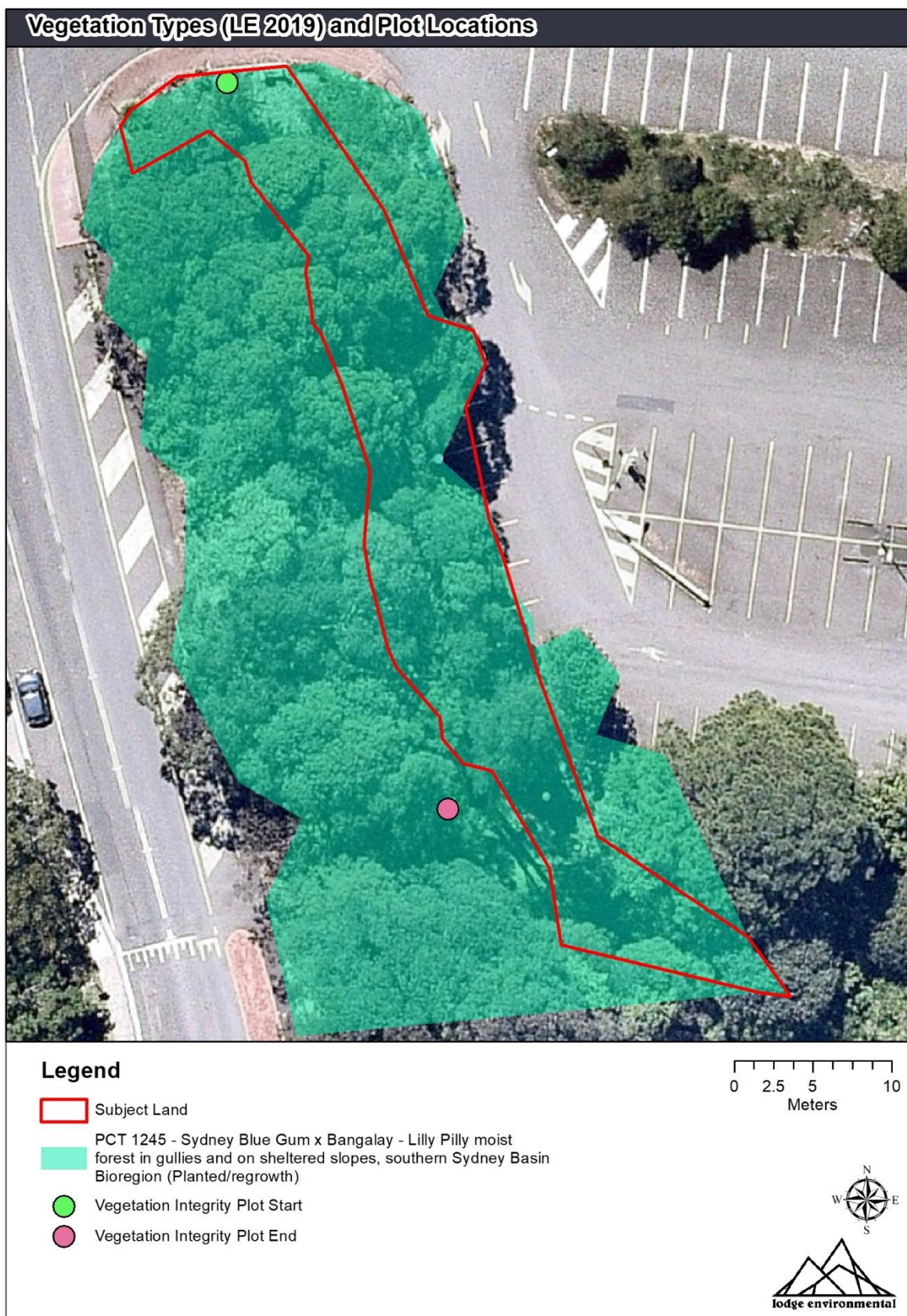


Figure 9: Vegetation Integrity Plots and Vegetation Zones

5.0 THREATENED SPECIES

5.1 IDENTIFY THREATENED SPECIES FOR ASSESSMENT

5.1.1 ECOSYSTEM CREDIT SPECIES

The ecosystem credit species predicted on site are provided in **Table 5**. All ecosystem credit species were maintained in the assessment with the exception of Spotted-tailed Quoll, Broad-headed Snake, Koala and Long-nosed Potoroo, as justified in **Table 5**.

Table 5: Ecosystem credit species output from BAM calculator

Species	BC Act Listing	EPBC Act Listing
<i>Anthochaera phrygia</i> Regent Honeyeater (Foraging)	Critically Endangered	Critically Endangered
<i>Artamus cyanopterus cyanopterus</i> Dusky Woodswallow	Vulnerable	-
<i>Callocephalon fimbriatum</i> Gang-gang Cockatoo (Foraging)	Vulnerable	-
<i>Calyptorhynchus lathami</i> Glossy Black-Cockatoo (Foraging)	Vulnerable	-
<i>Daphoenositta chrysoptera</i> Varied Sittella	Vulnerable	-
<i>Dasyurus maculatus</i> Spotted-tailed Quoll REMOVED. Not likely to occur within university grounds due to severe disturbance on all sides of Subject Land. No records within 5km.	Vulnerable	Endangered
<i>Falsistrellus tasmaniensis</i> Eastern False Pipistrelle	Vulnerable	-
<i>Glossopsitta pusilla</i> Little Lorikeet	Vulnerable	-
<i>Hieraaetus morphnoides</i> Little Eagle (Foraging)	Vulnerable	-
<i>Hoplocephalus bungaroides</i> Broad-headed Snake		

Species	BC Act Listing	EPBC Act Listing
(Foraging) REMOVED. Not likely to occur within university grounds due to severe disturbance on all sides of Subject Land. No records within 5 km.		
<i>Lathamus discolor</i> Swift Parrot (Foraging)	Endangered	Critically Endangered
<i>Lophoictinia isura</i> Square-tailed Kite (Foraging)	Vulnerable	-
<i>Miniopterus orianae oceanensis</i> Large Bent-winged Bat (Foraging)	Vulnerable	-
<i>Miniopterus australis</i> Little Bent-winged Bat (Foraging)	Vulnerable	-
<i>Mormopterus norfolkensis</i> Eastern Coastal Freetail-bat	Vulnerable	-
<i>Ninox connivens</i> Barking Owl (Foraging)	Vulnerable	-
<i>Phascolarctos cinereus</i> Koala (Foraging) REMOVED. Not likely to occur within university grounds due to severe disturbance on all sides of Subject Land. No records within 5km below escarpment.	Vulnerable	Vulnerable
<i>Phoniscus papuensis</i> Golden-tipped Bat	Vulnerable	-
<i>Potorous tridactylus</i> Long-nosed Potoroo REMOVED. Not likely to occur within university grounds due to severe disturbance on all sides of Subject Land. No records within 5km.	Vulnerable	Vulnerable
<i>Pteropus poliocephalus</i> Grey-headed Flying-fox (Foraging)	Vulnerable	Vulnerable

Species	BC Act Listing	EPBC Act Listing
<i>Ptilinopus regina</i> Rose-crowned Fruit-Dove	Vulnerable	-
<i>Ptilinopus superbus</i> Superb Fruit-Dove	Vulnerable	-
<i>Saccolaimus flaviventris</i> Yellow-bellied Sheath-tail-bat	Vulnerable	-
<i>Scoteanax rueppellii</i> Greater Broad-nosed Bat	Vulnerable	-
<i>Tyto novaehollandiae</i> Masked Owl (Foraging)	Vulnerable	-

5.1.2 SPECIES CREDIT SPECIES

Species credit species are predicted within the BAM calculator based on an assessment of the Subject Lands habitat attributes and geography. Some of the species predicted within the BAM calculator may be incorrectly predicted and require further review prior confirming the final candidate species list.

A predicted candidate species may be considered unlikely to utilise the Subject Land if the habitat is considerably degraded to a degree that the species is not expected to utilise the area, or otherwise an expert report has provided an assessment that identified the species is not likely to be present. A predicted candidate species that does not have suitable habitat within the Subject Land is then excluded from further assessment.

The Subject Land exists as a replanted area of roadside, native vegetation. The species have been chosen by the landscapers at the University and aim to represent the vegetation which would have occurred prior to the historic clearance associated with the land (circa 1950s) for farming. The vegetation patch is no greater than 20m in width and bound by roads and concrete surfaces on three sides. The trees within the Subject Land are not of an age cohort suitable to have developed tree hollows, and therefore the Subject Land lacks significant habitat complexity. The gardening regime within the vegetation also acts to keep the vegetation relatively thinned, free of garbage, and native dominant. The Subject Land is thus considered highly modified.

This understanding of the Subject Land habitat condition was then combined with a review of threatened species, populations and migratory species within a 10 km radius of the Subject Land using BioNet Atlas of NSW Wildlife Search (DPIE 2019). A final assessment of the likelihood of occurrence was then made based on; habitat condition, years since sighting of any nearby records, number and proximity of nearby records, review of species habitat requirements, and experience. Any species determined as not suitable for inclusion as candidate species, in accordance with section 6.4 of the BAM, were then removed from any further consideration and targeted survey. However, informal survey occurred irrelevant of likelihood whilst inspecting the Subject Land broadly.

The Subject Land is not considered to have any suitable habitat for several candidate species. This is due to the degraded nature of the Subject Land, notably the proximity to significant disturbance, no hollow bearing trees, and a history of clearing, under scrubbing, and long term management. **Table 6** provides a justification of the candidate species removed from further assessment in accordance with section 6.4.1.17 of the BAM.

Table 6: Assessment of the habitat and geographic constraints on the Subject Land

Species	Constraints	BAM question input	Final candidate species determination	Justification
<i>Anthochaera phrygia</i> Regent Honeyeater (Breeding)	-	-	No	There are three known key breeding areas, two of them in NSW - Capertee Valley and Bundarra-Barraba regions. The species breeds between July and January in Box-Ironbark and other temperate woodlands and riparian gallery forest dominated by River Sheoak. This is not present the Subject Land. Additionally, Noisy Miners and other aggressive birds are present within the Subject Land that would prevent nesting by the Regent Honeyeater. The Subject Land does not have any breeding habitat.
<i>Callocephalon fimbriatum</i> Gang-gang Cockatoo (Breeding)	Hollow Bearing Trees	No	No	Favours old growth forest and woodland attributes for nesting and roosting. Nests are located in hollows that are 10 cm in diameter or larger and at least 9 m above the ground in eucalypts. The Subject Land does not have any breeding habitat.
<i>Calyptorhynchus lathami</i> Glossy Black-Cockatoo (Breeding)	Hollow Bearing Trees	No	No	Dependent on large hollow-bearing eucalypts for nest sites. No hollow bearing trees were present within the Subject Land. The Subject Land does not have any breeding habitat.
<i>Cercartetus nanus</i> Eastern Pygmy-possum	-	-	No	In accordance with section 6.4.1.17, after carrying out field assessment of the habitats and microhabitats, the habitat is considered substantially degraded such that the species is unlikely to utilise the Subject Land. The Subject Land was absent of any preferential feed trees, notably banksia, nor were there any suitable hollow bearing trees.
<i>Chalinolobus dwyeri</i> Large-eared Pied Bat	1. Cliffs 2. Within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or	Yes	No	The Subject Land does not have cliffs. The Subject Land is however within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, crevices of old mines or tunnels, nevertheless, the habitat is considered substantially degraded such that the species is unlikely to utilise the Subject Land. No nearby records (within 5km).

Species	Constraints	BAM question input	Final candidate species determination	Justification
	crevices, or within two kilometres of old mines or tunnels			
<i>Daphnandra johnsonii</i> Illawarra Socketwood	-	-	No	Not recorded during site inspection. No nearby records (within 5km).
<i>Heleioporus australiacus</i> Giant Burrowing Frog	-			The Subject Site does not contain suitable habitat due to a general absence of dense understorey vegetation, or pooled water.
<i>Hieraaetus morphnoides</i> Little Eagle (Breeding)	Nest trees	No	No	Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter. No nests were recorded during site inspection.
<i>Hoplocephalus bungaroides</i> Broad-headed Snake (Breeding)	Rocky areas including escarpments, outcrops and pogodas with the Sydney Sandstone geologies	No	No	The species requires rock crevices/cliffs and large hollow bearing trees for breeding habitat. None of which occur within the Subject Land.
<i>Irenepharsus trypherus</i> Illawarra Irene	-	No	No	Not recorded during site inspection. No nearby records (within 5km).
<i>Lathamus discolor</i> Swift Parrot (Breeding)	-	-	No	Breeds in Tasmania during spring and summer. Has never been recorded as nesting in NSW. The Subject Land does not have any breeding habitat.
<i>Litoria aurea</i> Green and Golden Bell Frog	1. Semi-permanent/ephemeral wet areas 2. Within 1km of wet areas 3 Swamps within 1km of swamp	Yes – within 1 km of wet area.	No	Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (<i>Typha spp.</i>) or spikerushes (<i>Eleocharis spp.</i>). The Subject Land did not contain any wet areas or suitable groundcover for shelter or movement of the species. Only known at Port Kembla and Puckeys Reserve with 5km.

Species	Constraints	BAM question input	Final candidate species determination	Justification
	4. Waterbodies within 1km of waterbody			
<i>Lophoictinia isura</i> Square-tailed Kite (Breeding)	-	-	No	Nest sites generally located along or near watercourses. No nests were recorded during site survey. The Subject Land does not have any breeding habitat.
<i>Miniopterus australis</i> Little Bent-winged Bat (Breeding)	Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding	No	No	roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings, none of which occur within the Subject Land. Only five nursery sites/maternity colonies are known within Australia.
<i>Miniopterus orianae oceanensis</i> Large Bent-winged Bat (Breeding)	Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding	No	No	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. The Subject Land does not have any breeding habitat.
<i>Mixophyes balbus</i> Stuttering Frog				This species is found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range. Adults require deep leaf litter and this understorey vegetation. The Subject Land does not contain suitable habitat. No nearby records (within 5km).
<i>Myotis macropus</i> Southern Myotis	1. Hollow bearing trees 2. Within 200 m of riparian zone 3. Bridges, caves or artificial structures within 200 m of riparian zone	No	No	The Subject Land does not contain any hollow bearing trees, is more than 200 m from a riparian zone with standing water, and does not contain bridges, caves or artificial structures. The Subject Land does not contain suitable habitat. No nearby records (within 5km).
<i>Ninox connivens</i> Barking Owl (Breeding)	Hollow bearing trees, hollow great than 20cm in diameter		No	This species roosts in shaded portions of tree canopies, including tall midstorey trees with dense foliage such as Acacia and Casuarina species. During nesting season, the male perches in a nearby tree overlooking the hollow entrance.

Species	Constraints	BAM question input	Final candidate species determination	Justification
				The Subject Land does not have any breeding habitat.
<i>Petrogale penicillata</i> Brush-tailed Rock-wallaby	Land within 1 km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or clifflines	Yes	No	The species occupies rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north, none of which exist within the Subject Land. No nearby records (within 5km).
<i>Petroica rodinogaster</i> Pink Robin	-	-	No	No suitable densely vegetated, shrubby habitat. Dominance of aggressive Noisy Miners that make the habitat unsuitable. No nearby records (within 5km).
<i>Phascolarctos cinereus</i> Koala (Breeding)	Areas identified via survey as important	No	No	Koalas are not known to occur on the coastal plain of the Illawarra.
<i>Pseudophryne australis</i> Red-crowned Toadlet	-	-	No	The Subject Land does not contain suitable habitat. The species requires rocks and masses of dense vegetation of thick piles of leaf litter. No nearby records on the coastal plain or escarpment foothills and within 5km.
<i>Pteropus poliocephalus</i> Grey-headed Flying-fox (Breeding)	Breeding camps	No	No	Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. There is no breeding habitat within the Subject Land. The nearest camp is 4 km to the south along the Princes Motorway near Figtree with reference to the National Flying-fox monitoring viewer (DotEE 2019).
<i>Rhodamnia rubescens</i> Scrub Turpentine	-	-	No	Not recorded within Subject Land during site survey. No nearby records (within 5km).
<i>Solanum celatum</i> Solanum celatum	-	-	No	Not recorded during site survey. No nearby records (within 5km).
<i>Syzygium paniculatum</i> Magenta Lilly Pilly	Within ten km of coast	Yes	No	Not recorded during site inspection.

Species	Constraints	BAM question input	Final candidate species determination	Justification
<i>Tyto novaehollandiae</i> Masked Owl (Breeding)	Hollow bearing trees, hollow greater than 20cm in diameter	-	No	Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting. The Subject Land does not have any breeding habitat.
<i>Zieria granulata</i> <i>Illawarra Zieria</i>	-	-	No	Not recorded during site survey. No nearby records (within 5km).

*species habitat associations informed by DPIE (2019) species profiles and species records assessed via Bionet (2019)

5.2 DETERMINE PRESENCE OR ABSENCE OF A CANDIDATE SPECIES CREDIT SPECIES

5.2.1 TARGETED FIELD SURVEYS – FLORA

The following survey methods were undertaken on the 13th November 2019 by ecologists Jack Talbert and Elira Reynolds:

- identification of plant species and vegetation communities present within the site with comparison made to the DPIE (2016) Biometric Vegetation Type mapping
- search for signs of threatened species, observe and record significant flora, threatened species and other incidental observations
- observe and record current disturbance and threats (e.g. weeds, grazing, trampling, litter)
- identifying potential habitat for threatened species (e.g. creeks, geology etc)
- recording presence of environmental weeds
- taking reference photographs of the entire site.

Following vegetation and habitat assessment undertaken on 13 November, the Subject Land was considered too degraded to retain any habitat for candidate flora species in accordance with Section 6.4.1.17. A species survey was conducted during the time period specified in the Threatened Biodiversity Data Collection (s6.5.1.2 of the BAM) regardless.

Due to the small size of the Subject Land, thorough searches were taken throughout the entire Subject Land. No candidate threatened flora species were recorded on the Subject Land. A species list is included in **Appendix B**.

5.2.2 FIELD SURVEYS – FAUNA

The following survey methods were undertaken on the 13 November 2019 by ecologists Jack Talbert and Elira Reynolds:

- search for signs of threatened species, observe and record significant fauna, threatened and migratory species and other incidental observations
- identifying potential habitat for threatened species (e.g. hollow bearing trees, exfoliating bark, boulders creeks, geology etc)
- taking reference photographs of the entire site.

The Subject Land was considered too degraded to retain any habitat for all candidate fauna species in accordance with Section 6.4.1.17. Due to the small size of the Subject Land, searches were still taken throughout the entire area. Opportunistic observations of fauna were recorded during the survey, along with any sightings of scat, markings, signs of site usage, hair, feathers, etc.

The Subject Land is homogenous in poor habitat condition with no hollow bearing trees, no trees greater than 40 years, no mid stratum, wet areas, or rocky outcrops. The Subject Land exists as a

planted roadside of native vegetation. The Subject Land is considered to provide the following limited fauna habitat only:

- intact canopy suitable for foraging by common arboreal mammals and birds.

A total of 6 fauna species were identified within the Subject Land. A species list is included in **Appendix C**.

No candidate threatened fauna species were recorded on the Subject Land.

5.2.3 SURVEY WEATHER

The weather during the field survey on 13 November 2019 is summarised below.

- Temperature on the day: 17.8 – 21.9°C
- Dominant NE wind of 56 km/hr
- 0mm rainfall
- 64% humidity
- Low cloud cover

Observations were drawn from Bellambi AWS {station 068228}.

5.2.4 SURVEY LIMITATIONS

Habitat assessments were conducted to predict the likelihood of species occurrence at the site. A conservative approach was applied in the assumption of the presence of species that could potentially occur within the Subject Land. In this regard, the survey is considered adequate for the purposes of this report. The aim of the survey was to record as many species as possible within the timing and budgetary constraints of the project. A definitive list is not considered possible (i.e. multiple seasons over longer periods) however the survey carried out is suitable to accurately define the vegetation communities, condition and threatened flora and fauna presence or likelihood.

5.3 DETERMINE THE AREA OR COUNT, AND LOCATION OF SUITABLE HABITAT FOR A SPECIES CREDIT SPECIES

The Subject Land did not contain any confirmed candidate species. Targeted surveys for species credit species were not required to be undertaken in accordance with Section 6.5 of the BAM.

6.0 AVOIDING AND MINIMISING IMPACTS ON BIODIVERSITY VALUES

Inadequate consideration of avoiding and/or minimising biodiversity impacts can compromise the approval of a development application. Consideration at an early stage in project planning was therefore undertaken to allow for the greatest opportunities to reduce impacts on biodiversity. The key consideration was the alignment of the retaining wall. The UOW landscape manager was consulted to advise on the best location of the retaining wall to ensure minimal impact on existing native vegetation, and where impacts were unavoidable, they were designed to occur to trees of lesser value (i.e. younger age, lower health (SULE rating) and not a unique species within the surrounding area).

6.1 NATIVE VEGETATION AND HABITAT DURING PROJECT PLANNING

Entirely avoiding native vegetation was not possible, however, the extent of the impact has been micro-sited through consultation with the university landscapers and minimised to the fullest extent possible. All plants will be replaced by the university landscapers to ensure there will be no net loss on the number of plants within the area. The patch of vegetation of which the Subject Land is sited in will not lose any species that are unique to the patch and will retain the existing condition and function.

Underscrubbing and vegetation management is currently occurring at the Subject Land to maintain the area as a landscaped road verge. Management includes thinning of the ground cover and midstorey, control of weeds, and control of rubbish. As a result, the vegetation exists in a poor and modified state compared to that which would be expected for a remnant patch of similar vegetation. The number and diversity of birds on the property, particularly passerines, was also notably lower than it should have been, due largely to the lack of a shrub layer.

A genuine effort has been made to avoid and minimise the impacts of clearing of native vegetation and habitat. The impacts associated with the proposal have been sited within a specific area of the of the roadside vegetation, in a position that allows for the construction of the flood mitigation works, but also avoids fragmenting the patch of vegetation. The impact is to occur to trees on the eastern boundary only, directly adjacent to a car park, and running through a corridor predominantly void of shrubs and ground covers.

Prescribed impacts have also been avoided or kept to a minimum. **Table 8** details the prescribed impacts relevant to the proposal and the planning that has been part of the proposal to minimise these impacts.

In total, 0.045 ha of native vegetation communities is considered to be cleared by the proposed development. The areas of vegetation to be cleared is included in the below table.

Table 7: Areas of vegetation communities to be impacted

PCT	Condition class	Total impact (ha)
PCT 1245: Sydney Blue Gum x Bangalay – Lilly Pilly moist forest	Planted/regrowth – poor condition	0.045

6.1.1 PRESCRIBED BIODIVERSITY IMPACTS

Table 8 below outlines the prescribed biodiversity impacts listed in clause 6.1 of the Biodiversity Regulation 2017 that are of relevance to the proposal.

Table 8: Prescribed biodiversity impacts

Prescribed Impact	Assessment of impact	Measures taken to avoid and minimise the impacts
Connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range	The proposal is sited along the eastern boundary of the patch of vegetation and will not fragment the small patch of vegetation such that it no longer provides a movement habitat for mobile fauna species. The remainder of the vegetation to be retained and continue as fauna habitat.	The proposal has been sited on an outer fringe of habitat so to not dissect any movement corridors. The trees that are to be removed will be replaced by the UOW landscapers.
Movement of threatened species that maintains their lifecycle	There will be no increase in restriction of fauna movement. The proposal is for a retaining wall to be located on the edge of the vegetation adjacent to the car-park which is an existing fauna barrier.	Existing informal boundaries (i.e. car park and roads) have been considered in the proposal layout as to not require further movement restriction within the retained native habitat.
Vehicle strikes on threatened species of animals or on animals that are part of a threatened ecological community	The proposed retaining wall is not considered to dissect a movement corridor for any threatened species due to the retention of habitat trees surrounding the proposal. Car speed is already restricted adjacent to the proposal location within the car park.	The retaining wall will not introduce any new risks to fauna associated with vehicle strikes.

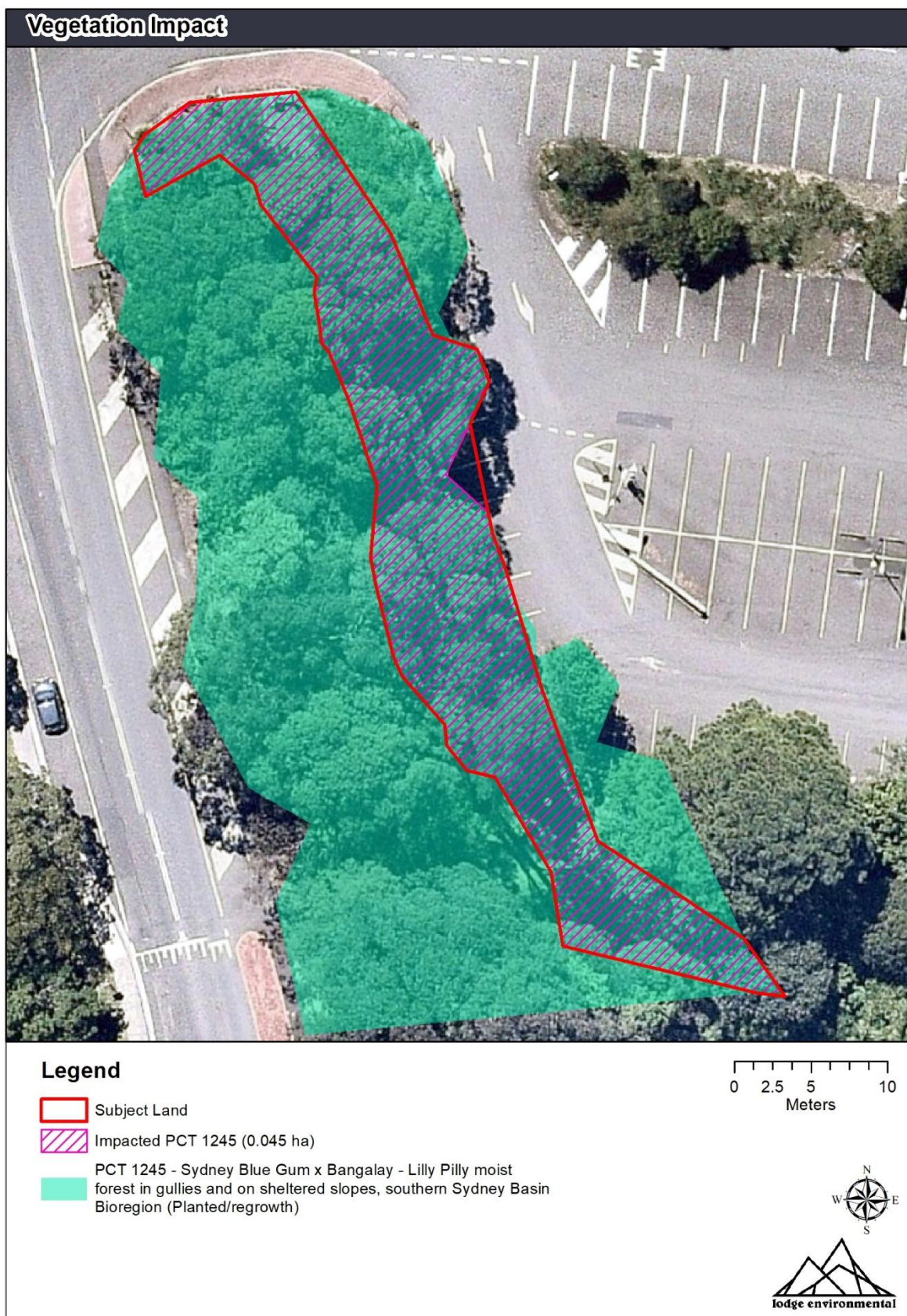


Figure 10: Areas of impacted land assessed within this BDAR. Circular areas represent tree for removal (4 in total)

6.1.2 KOALA SEPP 44

SEPP 44 aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for *Phascolarctos cinereus* (Koala) to ensure a permanent free-living population over their present range and reverse the current trend of Koala population decline.

The site is not considered core, or potential, koala habitat as defined under SEPP 44 for the below reasons:

- the Subject Land does not contain an area of land with a resident population of koalas or recent sightings and historical records of a population
- the native vegetation within the Subject Land does not contain at least 15% of trees listed in Schedule 2 of the SEPP.

7.0 IMPACT SUMMARY AND OFFSET ASSESSMENT

7.1 DIRECT IMPACT

The direct impact imposed by the proposal is due to the construction of a flood mitigation wall, which will include a retaining wall, gabion wall, and the removal of 17 trees. The total impact on vegetation is 0.045 ha and has been assessed within the report. This will occur to PCT 1245 in a poor condition, and not associated with a Threatened Ecological Community.

The total clearance of 0.045 ha of native vegetation has been considered within this report.

Within the native vegetation proposed to be impacted, the shrub layer is nearly entirely absent, with the retaining wall being strategically located to avoid the more dense adjacent areas. The trees which require removal are estimated at less than 40 years old and did not have any habitat features such as hollows or fissures.

7.2 INDIRECT IMPACTS

Indirect impacts occur when project-related activities affect species or ecological communities in a manner other than direct loss within the Subject Land. Indirect impacts may sterilise or reduce the habitability of adjacent or connected habitats.

The proposal is not considered to impact any fauna through indirect impacts such as starvation, exposure, predation by domestic and/or feral animals, loss of breeding opportunities, loss of shade/shelter, reduction in viability of adjacent habitat due to edge effects, deleterious hydrological changes, increased soil salinity, erosion, inhibition of nitrogen fixation, weed invasion, noise, light spill, fertiliser drift, or increased human activity within or directly adjacent to sensitive habitat areas. Considerable disturbance exists surrounding the proposed retaining wall area and therefore the addition of the wall will not introduce any new disturbances to those surrounding. Additionally, the wall has been sited to ensure no fragmentation to any biodiversity linkages.

7.3 MITIGATION MEASURES

As discussed earlier, the proposal has been sited to minimise impacts as much as possible. The UOW landscape manager was engaged to inform the retaining wall alignment such that a minimum number of trees are removed, and the ones selected are of a lesser value or poorer health/SULE rating. It was not possible to avoid all native trees, and therefore the below mitigation measures will be implemented to reduce the residual impact of the proposal.

Tree and habitat replacement

The proposal has been sited to minimise impacts to native vegetation. UOW has full time landscapers who will replace the trees for removal with similar species as soon as construction is

complete. The trees removed shall be replaced using plantings sourced from a local provenance nursery such as the Wollongong Botanic Gardens Nursery. The trees shall be representative of the indigenous vegetation communities.

Where possible, logs and felled timber will be retained within the adjacent vegetation to act as habitat for fauna.

Weed removal will be undertaken using mechanical and manual means, with any use of herbicides to be given careful consideration to impacts on aquatic habitat.

Construction and Environmental Management Plan

A Construction and Environmental Management Plan (CEMP) will be prepared that will outline appropriate erosion, sediment and control protocols for implementation during construction. This will ensure there are no impacts from erosion associated with the construction. Drainage will be controlled in line with the *Protection of the Environment Operations Act 1997* to avoid impacts downstream. The sediment and erosion measures are to be in accordance with best practice guidelines (Landcom 2004).

Equipment, heavy machinery and materials will be situated in designated lay-down areas in the adjacent car park where they are least likely to cause erosion, or damage to vegetation.

Tree removal measures will also be included within the CEMP. These will state that:

- Prior to the removal of any tree, each tree will be inspected by a qualified ecologist. The ecologist will remain on site for the duration of the tree removal to ensure any fauna encountered is relocated. The ecologist will be commissioned at least 5 days prior to the removal of any trees.
- if felled vegetation cannot be retained as ground habitat, it must be mulched and stockpiled on site. The mulch and stockpiling must be appropriately controlled with sediment fencing. The mulch will be reused on site.
- Councils tree preservation orders are to be observed at all times. All trees not specified for removal are to be maintained during the works.
- All tree protection fencing is to be installed prior to any works being carried out and maintained for the duration of the civil works.

7.4 ZONING

The Subject Land is zoned SP2 – Special Infrastructure: Education Establishment. The objectives of this zoning are to:

- provide for infrastructure and related uses
- to prevent development that is not compatible with or that may detract from the provision of infrastructure
- to provide for key transport corridors.

The proposal is not in contradiction to these objectives.

7.5 WATER MANAGEMENT ACT 2000

The Subject Land is within a riparian corridor, classified as 3rd order (Strahler Stream Order). It is understood UOW has a landscape management plan for the riparian corridor which will allow for the permanent protection and management of the riparian corridor. In accordance with the Water Management Act, stormwater outlet structures and essential services are permissible, as listed within the Riparian Corridor Matrix.

7.6 LOCAL PROVISIONS

The Subject Land is covered by Clause 7.4 'Riparian Lands' of the Wollongong Local Environmental Plan 2009 (WLEP). The development therefore must not adversely impact upon riparian lands. The above-mentioned mitigation measures will ensure that there is no adverse impact upon the riparian lands. The purpose of the proposal is to mitigate detrimental high volume and high velocity flows and therefore improve the function of the riparian environment.

Specifically, a 'Category 2' watercourse is located within the southern extent of the Subject Land. In accordance Chapter E23: Riparian Land Management of the Wollongong Development Control Plan (WDCP) 2009, a Category 2 watercourse comprises a 30m extent 'measured from the top of a watercourse bank away from the watercourse centreline', encompassing a 20m Core Riparian Zone and a further 10m Vegetated Buffer'.

The development will abide by the 'Riparian Corridor Objectives' of a Category 2 watercourse, which are to:

- Maintain/restore the natural functions of watercourses;
- Maintain the viability of native riparian vegetation;
- Minimise 'edge effects' at the riparian corridor / urban interface by the provision of a suitable riparian corridor width;
- Maintain adequate riparian corridor width, based on geomorphological and environmental
- considerations and to maintain or improve bank stability;
- Protect water quality of the watercourse through an adequate riparian corridor width;
- Restore the vegetation, geomorphic structure, hydrology and water quality of the riparian
- corridor to its original (pre-European) state, where practicable;
- Minimise the number of road crossings and such crossings are designed to maintain riparian connectivity;
- Restrict the encroachment of flood compatible development (e.g. playing fields) to the edge of the riparian corridor rather than within the core riparian zone;
- Locate infrastructure or utility services (i.e. electricity, water, sewerage etc) outside the riparian corridor, wherever practicable; and
- Treat stormwater run-off outside the riparian corridor before discharge into the watercourse.

The Subject Land is also required to adhere to the Wollongong Development Control Plan 2009 (WDCP) objectives of Ecologically Sustainable Development and WLEP Preservation and Management of Trees and Vegetation. The proposal will not contradict these clauses, primarily due to the 1:1 replacement of onsite trees to those removed with endemic species, as well as application of the BOS and offsetting under the BAM.

7.7 ADAPTIVE MANAGEMENT FOR UNCERTAIN IMPACTS

No adaptive management measures are proposed additional to those listed above.

7.8 THRESHOLDS FOR THE ASSESSMENT AND OFFSETTING OF IMPACTS OF DEVELOPMENT

7.8.1 SERIOUS AND IRRVERSIBLE IMPACTS

There are no potential Serious and Irreversible Impact (SAII) entities to be impacted by the proposal.

7.8.2 IMPACTS REQUIRING OFFSETTING

All impacts on native vegetation from the proposal require offsetting as they are associated with either:

- a vegetation zone that has a vegetation integrity score ≥ 15 where the PCT is representative of an endangered or critically endangered ecological community, or
- a vegetation zone that has a vegetation integrity score of ≥ 17 where the PCT is associated with threatened species habitat (as represented by ecosystem credits) or is a vulnerable ecological community, or
- a vegetation zone that has a vegetation integrity score ≥ 20 where the PCT is not representative of a TEC or associated with threatened species habitat.

The impacts assessed within this report that require offsetting are detailed in **Table 9**.

Table 9: Areas of vegetation requiring offsets

PCT	Condition class	Total impact (ha)
PCT 1245: Sydney Blue Gum x Bangalay – Lilly Pilly moist forest	Planted/regrowth – poor condition	0.045

7.8.3 IMPACTS THAT DO NOT REQUIRE FURTHER ASSESSMENT

Not applicable.

8.0 FINAL CREDIT CALCULATIONS

8.1.1 ECOSYSTEM CREDITS

The ecosystem credits calculated as a requirement for the proposal impact are outlined in **Table 10**. In total, 1 ecosystem credit is required.

Table 10: Ecosystem credit requirement

PCT	Condition class	Total impact (ha)	Ecosystem Credit Requirement
PCT 1245: Sydney Blue Gum x Bangalay – Lilly Pilly moist forest	Planted/regrowth – poor condition	0.045	1

8.1.2 SPECIES CREDITS

No species credits are required for the impacts associated with the proposal.

8.2 CREDIT COSTS

In order to offset the impacts from the proposal the proponent has the option to make a payment to the Biodiversity Conservation Trust (BCT). The payment calculated using the Biodiversity Offset Payment Calculator (BOPC), as of 9 December 2019, is **\$5,108.16** (excluding GST). The costs are summarised in **Table 11**.

Note: Prices of credits in the BOPC are subject to change. The amount payable to discharge an offset obligation will be determined at the time of payment.

Table 11: Offset liability and cost

PCT	Charge per credit	Ecosystem Credit Requirement	Final Credit Price (excluding GST)
PCT 1245: Sydney Blue Gum x Bangalay – Lilly Pilly moist forest	\$5,108.16	1	\$5,108.16
Total			\$5,108.16

Alternatively, the proponent may source the credits on the market. The following offset rules must be followed if this option is pursued:

Credit classes for PCT 1245, like for like options:

- Any PCT in the classes of North Coast Wet Sclerophyll Forests (including PCT's 487, 613, 661, 684, 686, 692, 693, 694, 695, 699, 747, 748, 752, 812, 1073, 1208, 1217, 1222, 1237, 1244, 1245, 1257, 1259, 1260, 1261, 1265, 1266, 1282, 1284, 1285, 1504, 1561, 1562, 1563, 1566, 1567, 1568, 1569, 1572, 1573, 1575, 1579, 1841, 1843, 1915)
- North Coast Wet Sclerophyll Forests - < 50% cleared group (including Tier 7 or higher)

- Not containing HBTs
- In the IBRA subregions Illawarra , Ettrema, Jervis, Moss Vale, Sydney Cataract and Northern Basalts or any IBRA subregion that is within 100 kilometres of the outer edge of the impacted site.

9.0 CONCLUSION

This BDAR has been prepared by Accredited Assessor Jack Talbert (BAAS18140) in accordance with the Biodiversity Conservation Regulation 2017 (BC Reg) and through application of the *Biodiversity Assessment Methodology* (BAM) – case 00018261/BAAS18140/19/00018262.

After all avoidance and mitigation measures, the proposal will result in the maximum removal of 0.045 ha of native vegetation associated with poor, planted/regrowth PCT 1245: Sydney Blue Gum x Bangalay – Lilly Pilly moist forest.

Application of the BAM requires that 1 Ecosystem Credit for PCT 1245: Sydney Blue Gum x Bangalay – Lilly Pilly moist forest is retired by the proponent. This is calculated at a cost of \$5,108.16 if purchased from the Biodiversity Conservation Trust Fund, noting prices are subject to change. The BAM Credit Calculator did not generate a requirement for any Species Credit offsets.

10.0 REFERENCES

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11.0 LIMITATIONS

This report and the associated services performed by Lodge Environmental are in accordance with the scope of services set out in the contract between Lodge Environmental and the Client. The scope of services was defined by the requests of the Client, by the time and budgetary constraints imposed by the Client, and by the availability of access to Site.

Lodge Environmental derived the data in this report primarily from visual inspections, and, limited survey and analysis made on the dates indicated. In preparing this report, Lodge Environmental has relied upon, and presumed accurate, certain information provided by government authorities, the Client and others identified herein. The report has been prepared on the basis that while Lodge Environmental believes all the information in it is deemed reliable and accurate at the time of preparing the report, it does not warrant its accuracy or completeness and to the full extent allowed by law excludes liability in contract, tort or otherwise, for any loss or damage sustained by the Client arising from or in connection with the supply or use of the whole or any part of the information in the report through any cause whatsoever.

The data, findings, observations, conclusions and recommendations in the report are based solely upon the state of the Site at the time of the investigation. The passage of time, manifestation of latent conditions or impacts of future events (e.g. changes in legislation, scientific knowledge, land uses, etc) may render the report inaccurate. In those circumstances, Lodge Environmental shall not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance on, the contents of the report.

This report has been prepared on behalf of and for the exclusive use of the Client, and is subject to and issued in connection with the provisions of the agreement between Lodge Environmental and the Client. Lodge Environmental accepts no liability or responsibility whatsoever and expressly disclaims any responsibility for or in respect of any use of or reliance upon this report by any third party or parties.

It is the responsibility of the Client to accept if the Client so chooses any recommendations contained within and implement them in an appropriate, suitable and timely manner.

Appendices

Appendix A: Vegetation Plot Data

Plot ID	Composition						Structure						Function										
	Tree	Shrub	Grass	Forb	Fern	Other	Tree	Shrub	Grass	Forb	Fern	Other	Large trees >80 cm	Hollow trees	Litter cover	CWD	Tree stem 5-9	Tree stem 10-19	Tree stem 20-29	Tree stem 30-49	Tree stem 50-79	Tree regen	High threat exotic
Plot 1	13	6	2	1	1	3	93.1	9.1	2.5	0.1	0.1	2.1	0	0	77.6	3.5	26	32	23	4	5	Yes	3.3

Appendix B: Flora Species List

Scientific name	Common name	Native	Exotic
<i>Acacia binervata</i>	Two-veined Hickory	Yes	
<i>Acacia implexa</i>	Hickory Wattle	Yes	
<i>Acacia mearnsii</i>	Black Wattle	Yes	
<i>Acacia obtusifolia</i>	Blunt-leaf Wattle, Stiff-leaf Wattle	Yes	
<i>Anredera cordifolia</i>	Madeira Vine, Lamb's Tail, Jalap, Potato Vine		Yes
<i>Asparagus aethiopicus</i>	Asparagus weed		Yes
<i>Brachychiton populneus</i>	Kurrajong	Yes	
<i>Callistemon salignus</i>	Willow Bottlebrush	Yes	
<i>Casuarina glauca</i>	Swamp Oak	Yes	
<i>Cayratia clematidea</i>	Native Grape	Yes	
<i>Cheilanthes sieberi</i>	Rock Fern	Yes	
<i>Corymbia gummifera</i>	Red Bloodwood	Yes	
<i>Corymbia maculata</i>	Spotted Gum	Yes	
<i>Cynodon dactylon</i>	Couch, Bermudagrass	Yes	
<i>Dianella caerulea</i>	Blue Flax Lily	Yes	
<i>Ehrharta erecta</i>	Panic Veldtgrass		Yes
<i>Eucalyptus botryoides</i>	Bangalay	Yes	
<i>Eucalyptus longifolia</i>	Woollybutt	Yes	
<i>Eucalyptus microcorya</i>	Tallowwood	Yes	
<i>Eucalyptus paniculata</i>	Grey Ironbark	Yes	
<i>Eucalyptus pilularis</i>	Blackbutt	Yes	
<i>Eucalyptus salignus</i>	Sydney Blue Gum	Yes	
<i>Eucalyptus saligna</i> x <i>botryoides</i>	Sydney Blue Gum	Yes	
<i>Eucalyptus tereticornis</i>	Red Gum	Yes	
<i>Euphorbia peplus</i>	Petty Spurge, Radium Plant		Yes
<i>Foeniculum vulgare</i>	Fennel		Yes
<i>Gamochaeta coarctata</i>			Yes
<i>Glycine clandestina</i>	Twining Glycine	Yes	
<i>Grevillea robusta</i>	Silky Oak	Yes	
<i>Hypochaeris radicata</i>	Flatweed, Catsear		Yes
<i>Lantana camara</i>	Lantana		Yes
<i>Lomandra multiflora</i>	Many-flowered Mat-rush	Yes	
<i>Lophostemon confertus</i>	Queensland Box	Yes	
<i>Melaleuca styphelioides</i>	Prickly-leaved Tea Tree	Yes	
<i>Parsonsia straminea</i>	Common Silkpod, Monkey Rope	Yes	



<i>Pittosporum undulatum</i>	Native Daphne, Sweet Pittosporum	Yes	
<i>Pseuderanthemum variable</i>	Pastel Flower	Yes	
<i>Senecio madagascariensis</i>	Fireweed		Yes
<i>Senna pendula</i>	Senna		Yes
<i>Syncarpia glomulifera</i>	Turpentine	Yes	
<i>Solanum stelligerum</i>	-	Yes	
<i>Syzygium australe</i>	Brush Cherry	Yes	
<i>Trifolium glomeratum</i>	Clustered Clover		Yes
<i>Yucca aloifolia</i>	Yucca		Yes

*denotes threatened species

Appendix C: Fauna Species List

Class Name	Scientific Name	Common Name
Bird	<i>Anthochaera carunculata</i>	Red Wattlebird
	<i>Eopsaltria australis</i>	Eastern Yellow Robin
	<i>Grallina cyanoleuca</i>	Australian Magpie-lark
	<i>Gymnorhina tibicen</i>	Australian Magpie
	<i>Manorina melanocephala</i>	Noisy Myna
	<i>Acridotheres tristis</i>	Common Myna

Appendix D: Biodiversity Offset Payment Calculator (BOPC) Report

IBRA sub region	PCT common name	Threaten status	Offset trading group	Risk premium	Administrative cost	Methodology adjustment factor	Charge per credit	No. of ecosystem credits	Final credits charge
Illawarra	1245 - Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion	No	North Coast Wet Sclerophyll Forests;. <50%	19.72%	\$165.15	1.6690	\$5,108.13	1	\$5,108.13
							Subtotal (excl. GST)		\$5,108.13
								GST	\$510.81
							Total ecosystem credits (incl. GST)		\$5,618.94
Calculated as on: 26/11/2019 14:51:07							Grand total		\$5,618.94