Campbelltown Hospital Stage 2 Redevelopment Biodiversity Development Assessment Report

Health Infrastructure c/o Root Partnerships

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Executive Summary

Eco Logical Australia Pty Ltd (ELA) was engaged by Root Partnerships to prepare a Biodiversity Development Assessment Report (BDAR) for a proposed redevelopment within Lot 6 DP1058047 located at Therry Road, Campbelltown (the Development Site) in the Campbelltown City Council Local Government Area (LGA).

The State Significant Development Application (SSD 9241) involves impacts on two Threatened Ecological Communities (TEC) listed under the NSW *Biodiversity Conservation Act 2016* (BC Act) including one Critically Endangered Ecological Community (CEEC) Cumberland Plain Woodland (CPW), and one Endangered Ecological Community (EEC), River-flat Eucalypt Forest. A BDAR was requested to be completed through the Secretary's Environmental Assessment Requirements (SEARs). Proposed impacts to threatened species must be assessed under the new NSW BC Act enacted on the 25 August 2017. This report has been prepared to meet the requirements of the Biodiversity Assessment Method 2016 (BAM) established under Section 6.7 of the NSW BC Act 2016.

The Development Site is an area of 4.90 ha bounded by Prospect Highway to the east, native and exotic vegetation to the south and west, and industrial development to the north. The Development Site was subject to vegetation disturbance as a result of past clearing, mainly for on grade carparks and is degraded by weed infestation.

Two Plant Community Types (PCTs) occurring in varying condition are present within the Development Site. The PCTs have been mapped as PCT *850 - Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion* and PCT 835 - *Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion*

PCT 850 conforms to the CEEC 'Cumberland Plain Woodland in the Sydney Basin Bioregion' listed under the NSW BC Act. While PCT 850 also conforms to 'Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest' listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), the condition of this PCT did not meet the minimum condition thresholds under the EPBC Act. PCT 835 conforms to the EEC 'River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South-East Corner Bioregions' which is listed under the NSW BC Act. No threatened flora or fauna were recorded on the development site.

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

A small amount of vegetation within the Development Site will be removed, resulting in the clearing of 0.33 ha of CPW. The BAMC calculated that a total of 6 ecosystem credits are required to offset the unavoidable impacts on the Development Site. Because no habitat for candidate species credit species was recorded in the study area, no species credits are required to offset the development.

Serious and Irreversible Impacts (SAII) values have been considered in this assessment. CPW is a listed SAII. The SAII threshold for CPW is yet to be published by OEH. Given the small area (0.33 ha) and poor condition of CPW to be impacted, it is considered unlikely that the development would result in an SAII.

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Abbreviations

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

1. Stage 1: Biodiversity assessment

1.1 Introduction

This Biodiversity Development Assessment Report (BDAR) has been prepared by Mike Lawrie, Stacey Wilson and Matthew Dowle who is an Accredited Person under the NSW Biodiversity Conservation Act 2016 (BC Act). The contents of this BDAR complies with the minimum requirements outlined in Table 25 of the Biodiversity Assessment Methodology (BAM: OEH, 2017).

1.1.1 General description of the Development Site

The Development Site is located within Lot 6 DP1058047 in the Campbelltown LGA. This report includes two base maps, the Site Map (Figure 1) and the Location Map (Figure 2).

The Development Site comprises an area of 4.90 ha which occurs entirely within the grounds of Campbelltown Hospital. The Hospital is bounded by Campbelltown Private Hospital and IRT Macarthur Lifestyle Community (a seniors living development) to the north, Parkside Crescent and Marsden Park to the west, and arterial roads Appin Road and Therry Road to the east and south, respectively. The development site currently consists of existing car parks, remnant trees and buildings and other infrastructure associated with Campbelltown Hospital. The Development Site has been subject to native vegetation disturbance as a result of past clearing and is degraded by severe weed infestation. The majority of the development site comprises exotic vegetation.

Two Plant Community Types (PCTs) are present within the Development Site. The PCTs have been mapped as PCT *850 - Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion* and PCT 835 - *Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion*.

PCT 850 conforms to the Critically Endangered Ecological Community (CEEC) 'Cumberland Plain Woodland in the Sydney Basin Bioregion' which is listed under the NSW BC Act. While PCT 850 also conforms to 'Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest' listed under the Commonwealth EPBC Act, the condition of this PCT in the Development Site did not meet the minimum condition thresholds under the EPBC Act. PCT 835 conforms to the Endangered Ecological Community (EEC) 'River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South-East Corner Bioregions' which is listed under the NSW BC Act.

1.1.2 Development Site footprint

The Development Site proposed footprint comprises of one main buildings, internal roads and parking spaces. The Development Site boundary (Figure 1) includes both the operational and construction footprint associated with all temporary construction facilities and infrastructure.

1.1.3 Sources of information used

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

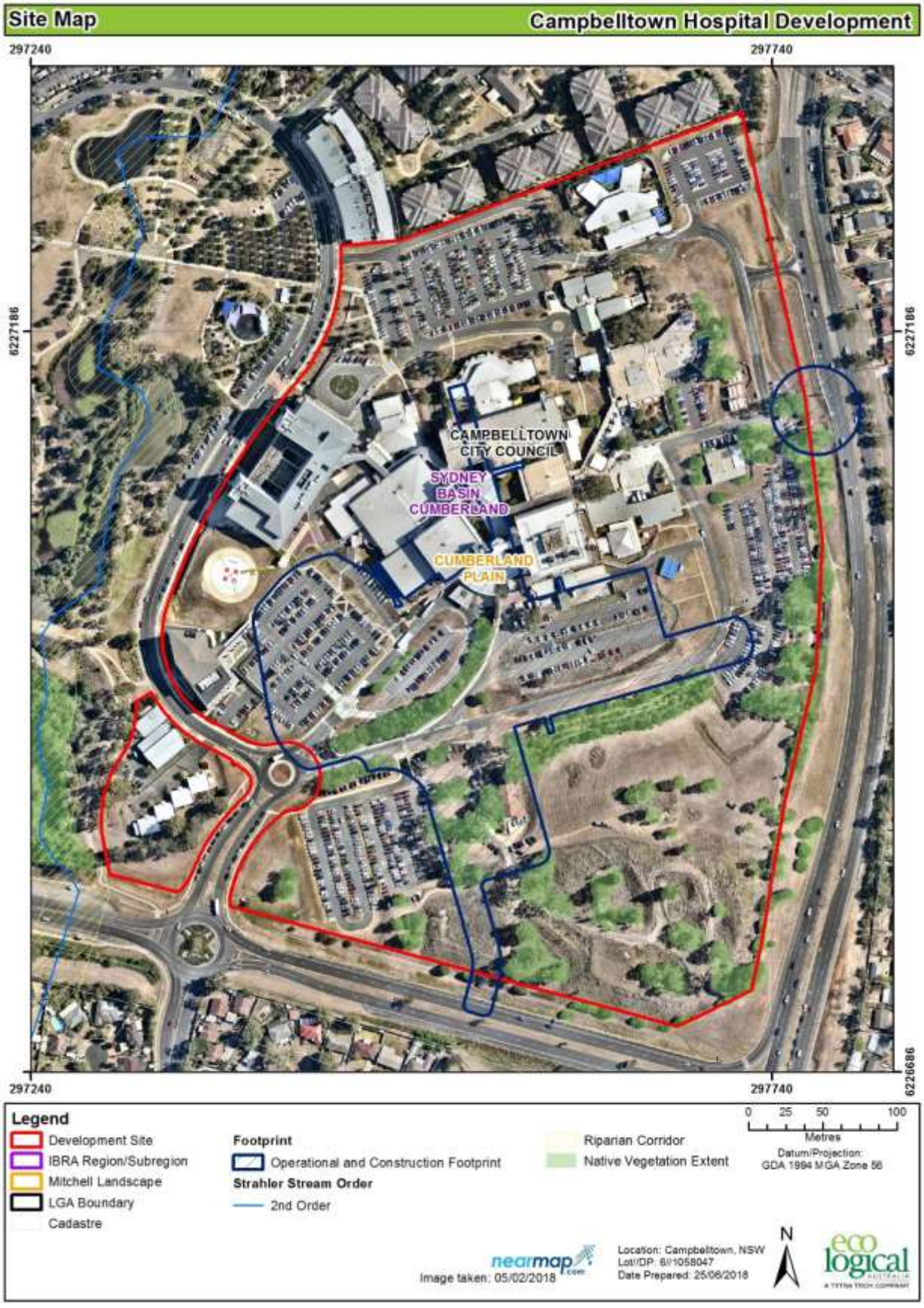

Figure 1: Site Map

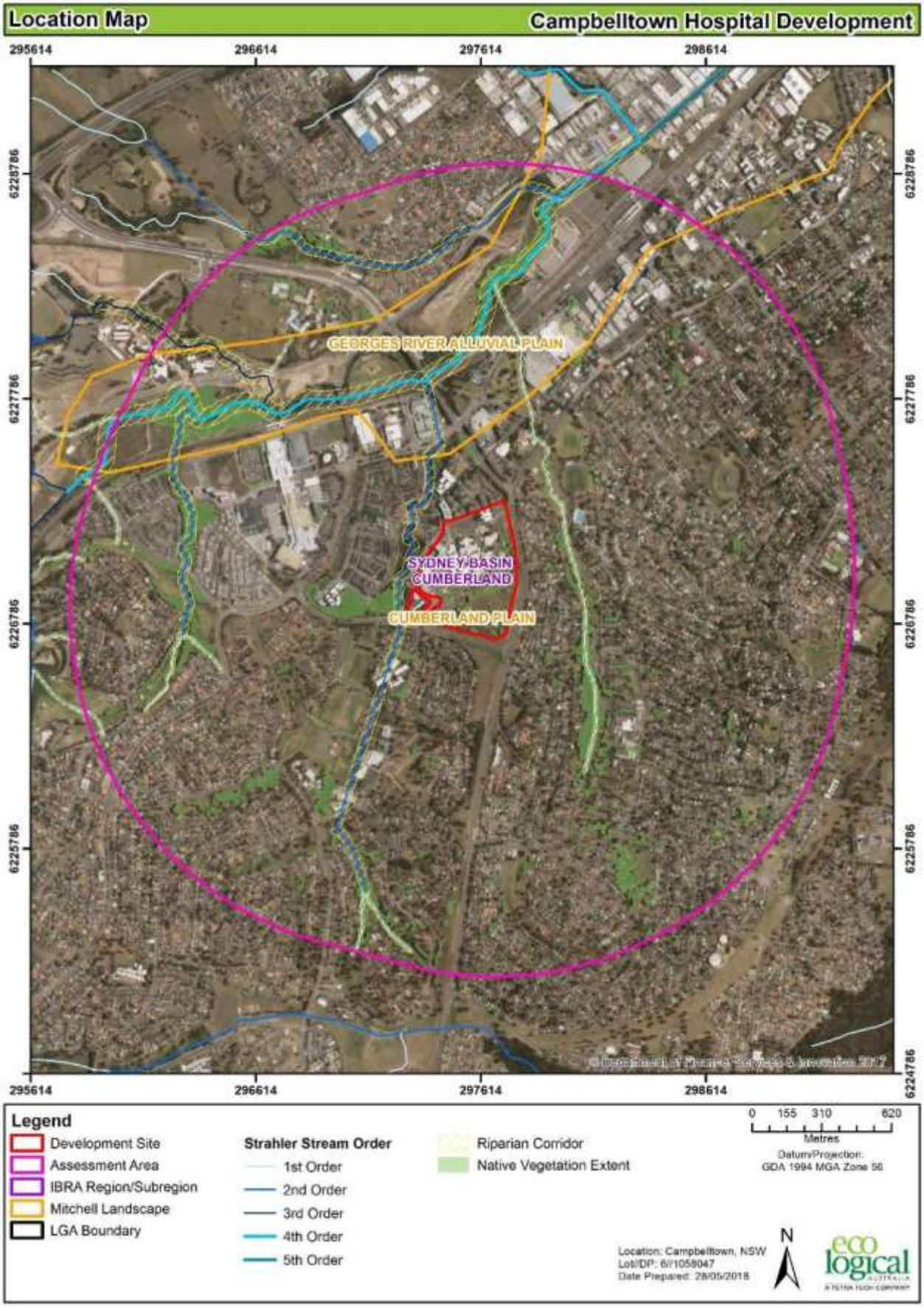

Figure 2: Location Map

1.2 Legislative context

Table 1: Legislative context

Name	Relevance to the project
Commonwealth	
Environmental Protection and Biodiversity Conservation Act 1999	Matters of national Environmental Significance have not been identified on the Development Site. This report does not further assess impacts to MNES.
NSW	
Biodiversity Conservation Act 2016	The proposed development requires submission of a Biodiversity Development Assessment Report (i.e. this report).
Environmental Planning and Assessment Act 1979	The proposed development requires consent under the EP&A Act.
Fisheries Management Act 1994	The development does not involve impacts to Key Fish Habitat, does not involve harm to marine vegetation, dredging, reclamation or obstruction of fish passage. A permit or consultation under the FM Act is not required.
Local land Services Amendment Act 2016	The LLS Act does not apply to this development.
Water Management Act 2000	The project does not involve works on waterfront land. A Controlled Activity Approval under s91 of the WM Act is not required.
Planning Instruments	
SEPP Coastal Management 2018	This SEPP does not apply to the Development Site
SEPP 44 – Koala Habitat Protection	SEPP 44 - Koala Habitat applies to the Campbelltown LGA. However, SEPP 44 does not apply to this site as the area of native vegetation on site does not meet the criteria for *potential koala habitat*.
Campbelltown City Council Local Environment Plan 2015	The subject site is zoned SP2 - Infrastructure: Health Services Facilities under the Campbelltown City Council LEP.
Campbelltown City Council Development Control Plan (DCP)	The Campbelltown DCP has been reviewed for additional provisions that may relate to the Development Site. No additional provisions are required.

1.3 Landscape features

1.3.1 IBRA regions and subregions

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

1.3.2 Mitchell Landscapes

The Development Site falls within one Mitchell Landscapes as outlined in Table 2.

Table 2: Mitchell Landscapes

Mitchell landscape	Description
Cumberland Plain	Low rolling hills and valleys in a rain shadow area between the Blue Mountains and the coast on horizontal Triassic shales and lithic sandstones forming a down-warped block on the coastal side of the Lapstone monocline. Intruded by a small number of volcanic vents and partly covered by Tertiary river gravels and sands (Hawkesbury-Nepean Terrace Gravels ecosystem). Quaternary alluvium along the mains streams. General elevation 30 to 120m, local relief 50m. and sometimes affected by salt in tributary valley floors. Pedal uniform red to brown clays on volcanic hills. Red and brown texture-contrast soils on crests grading to yellow harsh texture-contrast soils in valleys Woodlands and open forest of grey box, forest red gum, narrow-leaved ironbark, thin-leaved stringybark, cabbage gum and broad-leaved apple. Grassy to shrubby understorey often dominated by blackthorn, poorly drained valley floors, often salt affected with swamp oak and paperbark.

1.3.3 Rivers and streams

The Development Site does not contain any rivers or streams.

1.3.4 Wetlands

The Development Site does not contain any wetlands.

1.3.5 Connectivity features

The Development Site is highly fragmented and connectivity of vegetation is disrupted by major roads, residential dwellings and industrial areas. The vegetation within the Development Site is of low value on a local scale.

1.3.6 Areas of geological significance and soil hazard features

The Development Site contains the areas of geological significance and soil hazard features as outlined in Table 3. The Development Site falls under the Blacktown residual soil landscape (9029bt). This landscape is characterised by gently undulating rises on Wianamatta Group shales and Hawkesbury shale for this site it intrudes into Wianamatta Shale. This soil group has moderate erosion hazard, highly plastic subsoil, have low soil fertility and poor soil drainage (Murphy et al., 1993).

Table 3: Areas of geological significance and soil hazard features

Area of geological significance or soil hazard feature	Feature type
Erosion Hazard	Soil erosion hazard for concentrated flows is moderate to high.
Surface Movement Potential	The deep clay soils are moderately reactive. These are generally found on sideslopes and footslopes. Shallower soils on crests are slightly reactive.

1.3.7 Site context

1.3.7.1 Method applied

The site based method has been applied to this development.

1.3.7.2 Percent native vegetation cover in the landscape

The current percent native vegetation cover in the landscape was assessed in a Geographic Information System (GIS) using aerial imagery sourced from SIX Maps (LPI 2015). The percent native vegetation cover within the 1,500 m buffer area is 58.4 ha and 5.86% (997.05 ha).

1.3.7.3 Patch size

Patch size was calculated using mapping specifically developed for this project that enabled vegetation to be mapped for all patches of intact native vegetation on and adjoining the Development Site. There are three patches on the Development Site which fall within the class of <5ha.

1.4 Native vegetation

Vegetation survey was undertaken within the development site on 28 May 2018 by Stacey Wilson and Mike Lawrie.

Three floristic vegetation plots were undertaken to identify PCTs on the Development Site in accordance with the BAM (Table 4). Two PCTs were mapped across three vegetation zones.

Table 4: Full-floristic and vegetation integrity plots

Veg Zone	PCT ID	PCT Name	Condition	Ancillary Code	Area within Development Site (ha)	Plots required	Plots surveyed
1	850	*Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion*	Low	Native understorey	0.73	1	1
2	850	*Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion*	Low	Exotic understorey	1.14	1	1
3	835	*Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion*	Low	Native understorey	0.05	1	1
				Total	**1.92**	**3**	**3**

1.4.1 Plant Community Types present

Two PCTs were identified on the Development Site (Table 5,

Table 6). Justification for the selection of PCT occurring on the Development Site was based on qualitative and quantitative analysis of full-floristic plot data, surrounding vegetation and landscape features, and is provided in

Table 6 and Section 1.4.1.1.

Due to the degraded nature of native vegetation and limited number of native species present, a quantitative analysis tool was generally considered impractical to define the PCT. Hence additional information including soil type, geographic location, surrounding vegetation and landscape position were also utilised. One of the two PCTs within the Development Site varied in its condition and was delineated into a two vegetation zones. The other PCT present on site was in one condition class and was delineated into a single vegetation zone (Figure 4).

Table 5: Plant Community Types

PCT ID	PCT Name	Vegetation Class	Vegetation Formation	Area within Development Site (ha)	Percent cleared
850	*Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion*	Coastal Valley Grassy Woodlands	Grassy Woodlands	1.87	88%
835	*Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion*	Coastal Floodplain Wetlands	Forested Wetlands	0.05	93%

Table 6: PCT selection justification

PCT ID	PCT Name	Selection criteria	Species relied upon for identification of vegetation type and relative abundance
850	*Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion*	IBRA region, landform, soils vegetation formation and vegetation class	*Eucalyptus moluccana*, *Eucalyptus tereticornis, Eucalyptus crebra* and *Corymbia maculata* present within canopy. No mid-storey was present. Groundcover species *Einadia* spp., *Dichondra repens* and *Aristida ramosa*. Exotic groundcovers within the area of this CPW patch were *Eragrostis curvula*, *Sida rhombifolia*, *Plantago lanceolata*, *Cynodon dactylon* and *Chloris gayana*
835	*Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion*	IBRA region, landform, soils vegetation formation and vegetation class	*Casuarina glauca* present within canopy. No midstorey was present. Groundcover species included *Einadia* spp. and *Aristida ramosa*, *Microlaena stipoides*, *Cyperus gracilis* and *Dichondra repens*.

1.4.1.1 PCT selection justification

In determining the PCT for the Development Site, various attributes were considered in combination to assign vegetation to the best fit PCT. Attributes included dominant species in each stratum, community composition, soils and landscape position. Reference was made to the PCT descriptions in the BioNet Vegetation Classification, the final scientific determination and other published documents describing the vegetation community.

ELA considered all the native vegetation within the Development Site comprised of two native vegetation communities *PCT 850 - Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion.*

PCT 850 within the Development Site was highly disturbed, with a native midstorey lacking and ground-layer species and diverging considerably from species originally present in this PCT, due to past land clearing and the high degree of weed incursion. However, several species typical of PCT 850 were present within Plot 1. The canopy was composed of *Eucalyptus moluccana*, (Grey Box), *Allocasuarina littoralis* (Black She-oak), *Eucalyptus crebra* (Narrow-leaved Ironbark) and *Corymbia maculata* (Spotted Gum). It is evident that the vegetation on site is managed (mown) regularly due to the close proximity to adjacent buildings and car parks and therefore a native midstorey was lacking within the patch. The groundcover was highly disturbed and composed predominantly of exotic species such as *Chloris gayana* (Rhodes Grass*), Sida rhombifolia* (Paddy's Lucerne) and *Eragrostis curvula* (African Love Grass).

However, in some areas a native soil seedbank is evident, with several native species present in the groundcover. However, they had low cover and abundance. The native groundcover species present included *Einadia* spp., *Plantago ovata*, *Dichondra repens* (Kidney Weed), *Cyperus gracilis* (Slender Flat-sedge), *Themeda triandra* (Kangaroo Grass) and *Aristida ramosa* (Purple Wiregrass)

The IBRA region location of the Development Site and vegetation formation and class of the vegetation on site conforms to PCT 850. While these are fairly broad criteria and there are several PCTs that have the same criteria, they are still useful determining factors to assist with PCT selection.

Justification of PCT 835 within the Development Site comprising River-flat Eucalypt Forest is based on the composition of species in the canopy and understory. The canopy species in this vegetation zone contained mature *Casuarina glauca* (Swamp She-oak) and a native understorey of grasses and forbs including *Microlaena stipoides* (Weeping Grass), *Cyperus gracilis*, *Aristida ramosa* (Purple Wiregrass), *Dichondra repens* (Kidney Weed), *Plantago hispida* and *Einadia* spp. This PCT was most consistent with RFEF and lacked Eucalypt species which were present in the adjacent CPW.

The justification was also based on the topography of the vegetation zone. This zone was flat and grassy, and is within 170 m to a 2nd order stream (Birunji Creek). The area resembled an alluvial plain, being relatively flat and gently sloping towards Biruni Creek. The remnant RFEF may have once reached this extent during major flooding events and is adjacent to RFEF which is present along the riparian corridor of Birunji Creek.

1.4.1.2 Threatened Ecological Communities Justification

BioNet lists PCT 850 as comprising the CEEC, 'Cumberland Plain Woodland in the Sydney Basin Bioregion' listed under the NSW BC Act.

Justification of PCT 850 within the Development Site comprising Cumberland Plain Woodland is based on the presence of diagnostic species in the upper and lower stratum, vegetation structure and characteristic soil of Cumberland Plain Woodland.

While the community was degraded and the under-storey vegetation dominated by exotic species, several characteristic CPW species were present including *Eucalyptus crebra* (Narrow-leaved Ironbark), *Eucalyptus* moluccana (Grey Box) and *Corymbia maculata* (Spotted Gum) in the canopy, and in the ground layer including *Einadia* spp. and *Aristida racemosa* sp.

While the vegetation is degraded by weeds and past clearing, it retains an open grassy woodland structure typical of CPW. CPW is associated with soils derived from Wianamatta Shale. The Development Site is located on Blacktown soil landscape which is overlain on Wianamatta Group Shales.

BioNet lists PCT 835 as comprising the EEC, 'River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South-East Corner Bioregions' listed under the NSW BC Act.

The canopy species in this vegetation zone contained mature *Casuarina glauca* (Swamp She-oak) and a native understorey of grasses and forbs including *Microlaena stipoides* (Weeping Grass), *Cyperus gracilis*, *Aristida ramosa* (Purple Wiregrass), *Dichondra repens* (Kidney Weed), *Plantago hispida* and *Einadia* spp. This PCT was most consistent with RFEF and lacked Eucalypt species which were present in the adjacent CPW.

This zone was flat and grassy, and is within 170 m to a 2nd order stream (Birunji Creek). The area resembled an alluvial plain, being relatively flat and gently sloping towards Biruni Creek. The remnant

RFEF may have once reached this extent during major flooding events and is adjacent to RFEF which is present along the riparian corridor of Birunji Creek.

1.4.2 Vegetation integrity assessment

A vegetation integrity assessment using the Credit Calculator (BAMC) was undertaken and the results are outlined in Table 7. Approximately 4.90 ha will be cleared for the building footprint and roads impacting 0.33 ha of native vegetation.

Table 7: Vegetation integrity

Veg Zone	PCT ID	Condition	Ancillary Code	Impact Area (ha)	Composition Condition Score	Structure Condition Score	Function Condition Score	Current vegetation integrity score
1	850	Degraded	Native understorey	0.05	18.5	38.2	45.9	31.9
2	850	Degraded	Exotic understorey	0.28	23.9	20.9	53.8	30
3	835	Degraded	Native understorey	0	31.6	60.8	8.9	25.8

1.4.3 Use of local data

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

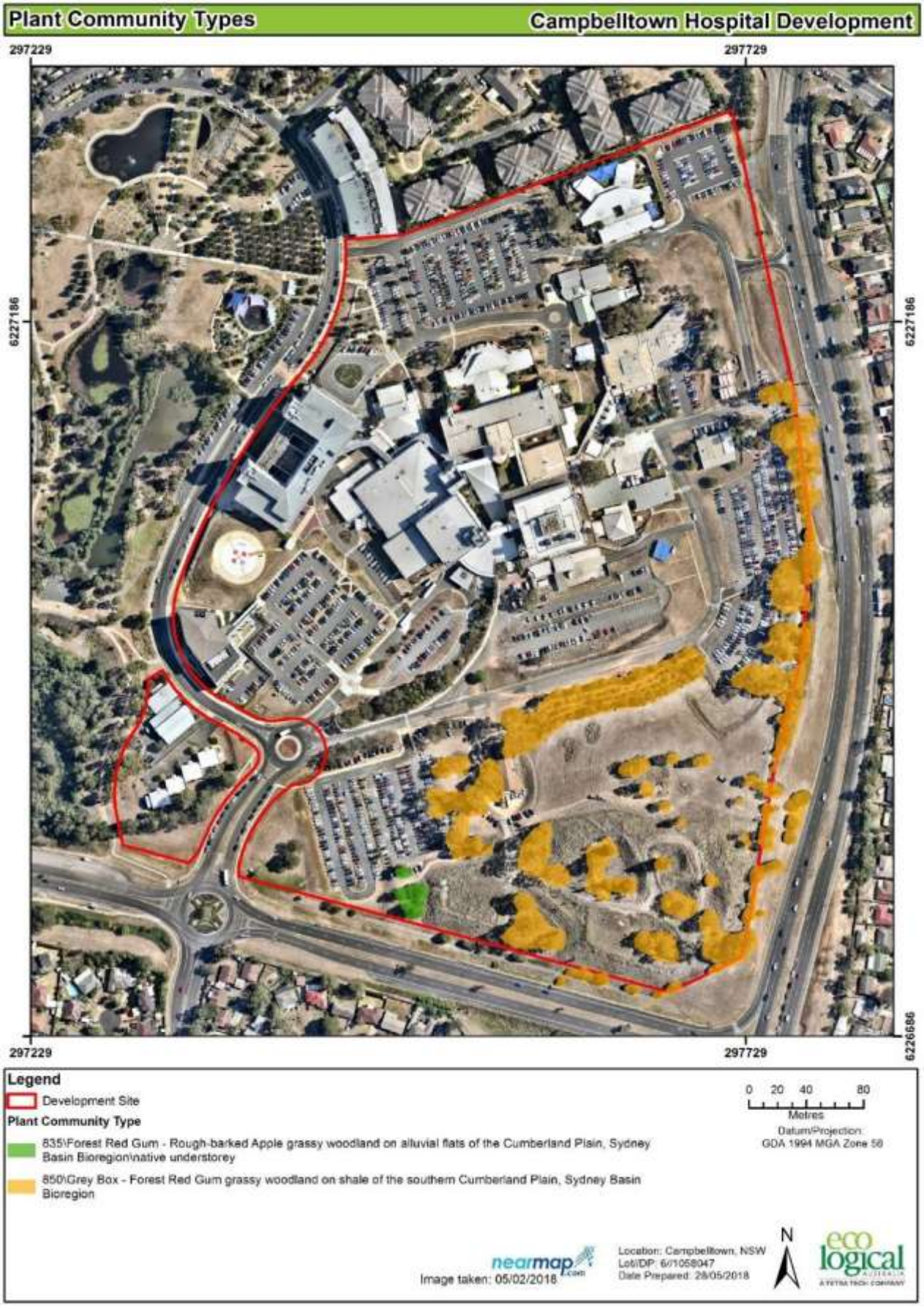

Figure 3: Plant Community Type and other vegetation

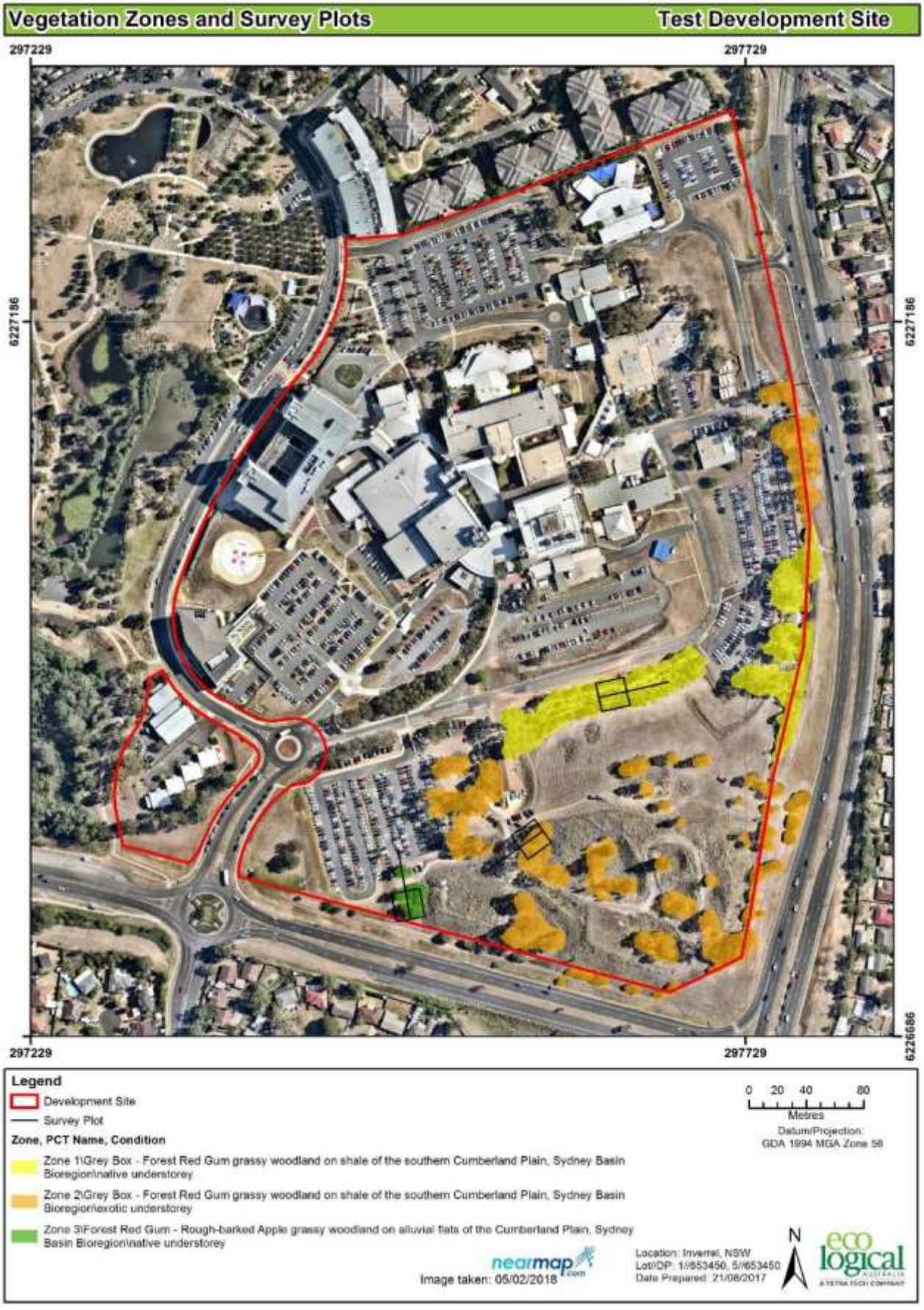

Figure 4: Vegetation Zone and Survey Plot

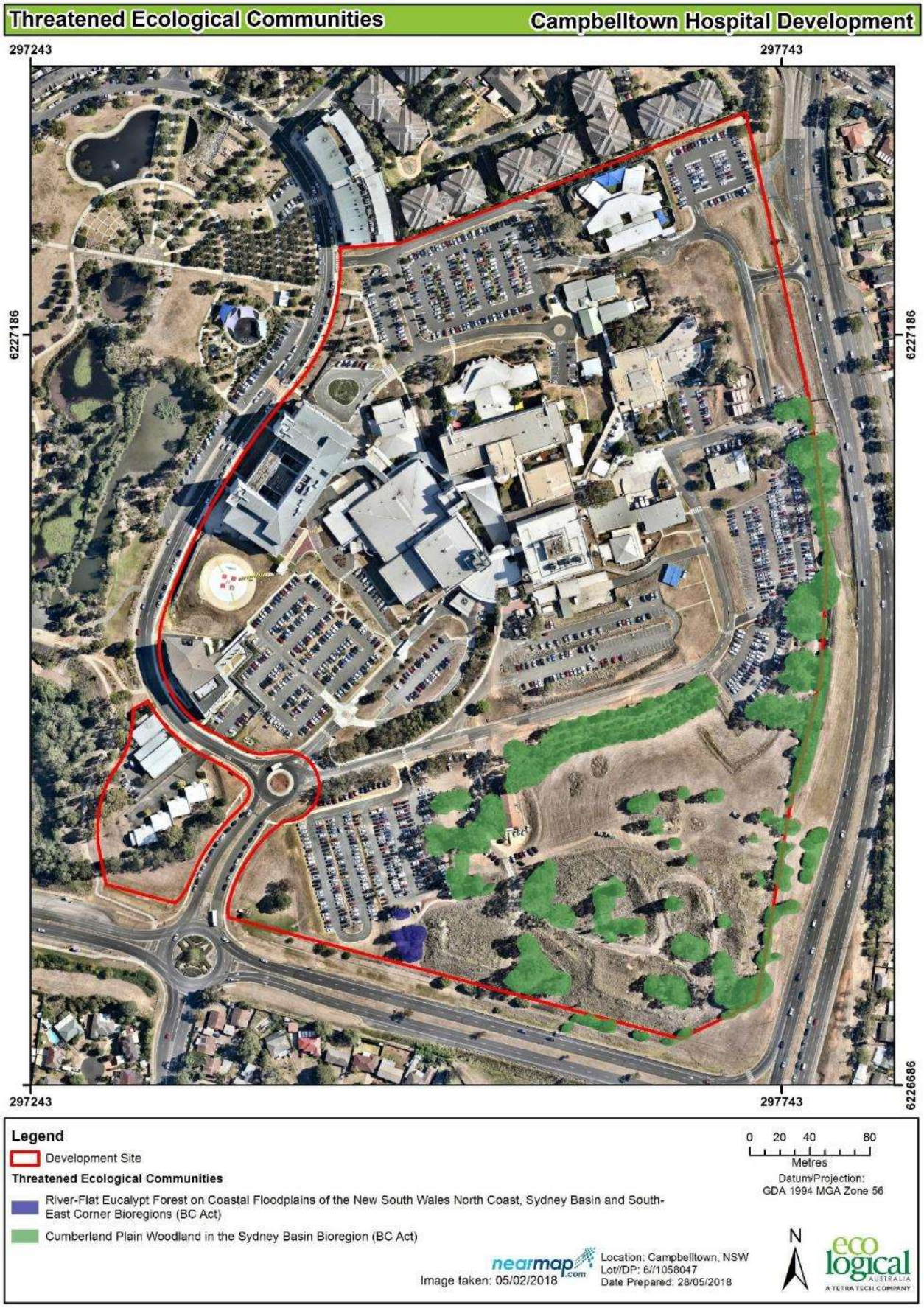

Figure 5: Threatened Ecological Communities

1.5 Threatened species

1.5.1 Ecosystem credit species

Ecosystem credit species predicted to occur at the Development Site, their associated habitat constraints, geographic limitations and sensitivity to gain class is included in Table 8.

Table 8: predicted ecosystem credit species

Species	Common Name	Sensitivity to gain class	BC Act	EPBC Act
Anthochaera phrygia	Regent Honeyeater	High Sensitivity to Potential Gain	Critically Endangered	Critically Endangered
Artamus cyanopterus cyanopterus	Dusky Woodswallow	Moderate Sensitivity to Potential Gain	Vulnerable	N/A
Botaurus poiciloptilus	Australasian Bittern	Moderate Sensitivity to Potential Gain	Endangered	Endangered
Chthonicola sagittata	Speckled Warbler	High Sensitivity to Potential Gain	Vulnerable	N/A
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	High Sensitivity to Potential Gain	Vulnerable	N/A
Dasyurus maculatus	Spotted-tailed Quoll	High Sensitivity to Potential Gain	Vulnerable	Endangered
Glossopsitta pusilla	Little Lorikeet	High Sensitivity to Potential Gain	Vulnerable	N/A
Haliaeetus leucogaster	White-bellied Sea-Eagle	High Sensitivity to Potential Gain	Vulnerable	N/A
Lathamus discolor	Swift Parrot	Moderate Sensitivity to Potential Gain	Vulnerable	N/A
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	Moderate Sensitivity to Potential Gain	Endangered	Critically Endangered
Miniopterus australis	Little Bentwing-bat	High Sensitivity to Potential Gain	Vulnerable	N/A
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	High Sensitivity to Potential Gain	Vulnerable	N/A
Mormopterus norfolkensis	Eastern Freetail-bat	High Sensitivity to Potential Gain	Vulnerable	N/A
Pandion cristatus	Eastern Osprey	Moderate Sensitivity to Potential Gain	Vulnerable	N/A
Petroica boodang	Scarlet Robin	Moderate Sensitivity to Potential Gain	Vulnerable	N/A
Petroica phoenicea	Flame Robin	Moderate Sensitivity to Potential Gain	Vulnerable	N/A
Phascolarctos cinereus	Koala	High Sensitivity to Potential Gain	Vulnerable	Vulnerable
Pteropus poliocephalus	Grey-headed Flying-fox	High Sensitivity to Potential Gain	Vulnerable	Vulnerable
Stagonopleura guttata	Diamond Firetail	Moderate Sensitivity to Potential Gain	Vulnerable	N/A

1.6 Species credit species

1.6.1 Candidate Species credit species

Species credit species predicted to occur at the Development Site (i.e. candidate species), their associated habitat constraints, geographic limitations and sensitivity to gain class are shown in Table 9.

Table 9: Candidate Species Credit Species

Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	BC Act	EPBC Act
Acacia pubescens	Downy Wattle			High	Vulnerable	Vulnerable
Anthochaera phrygia	Regent Honeyeater			High	Critically Endangered	Critically Endangered
Caladenia tessellata	White-flowered Wax Plant			Moderate	Endangered	Vulnerable
Cynanchum elegans	Cynanchum elegans			High	Endangered	Endangered
Eucalyptus benthamii	Camden White Gum			High	Vulnerable	Vulnerable
Grevillea juniperina* subsp. *juniperina	Small-flower Grevillea			High	Vulnerable	Vulnerable
Haliaeetus leucogaster	White-bellied Sea-Eagle			High	Vulnerable	Vulnerable
Hibbertia* sp. *Bankstown	Hibbertia sp. Bankstown			N/A	Critically Endangered	Critically Endangered
Lathamus discolor	Swift Parrot			Moderate	Endangered	Endangered
Litoria aurea	Green and Golden Bell Frog	Semi-permanent/ephemeral wet areas, within 1km of wet areas/swamps, within 1 km of waterbody,		High	Endangered	Endangered
Marsdenia viridiflora* subsp. *viridiflora **- endangered population**	Marsdenia viridiflora R. Br. subsp. viridiflora population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas		Those LGAs named in the population's listing	High	Endangered Population	Not Listed
Meridolum corneovirens	Cumberland Plain Land Snail			High	Endangered	Not Listed

Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	BC Act	EPBC Act
Miniopterus australis	Little Bentwing Bat (Breeding)			Very High	Vulnerable	Not Listed
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat (Breeding)			Very High	Vulnerable	Not Listed
Myotis macropus	Southern Myotis	Hollow bearing trees Within 200 m of riparian zone| Other Bridges, caves or artificial structures within 200 m of riparian zone		High	Vulnerable	Not Listed
Persicaria elatior	Tall Knotweed			Moderate	Vulnerable	Vulnerable
Persoonia hirsuta	Hairy Geebung			High	Endangered	Endangered
Petaurus norfolcensis	Squirrel Glider			High	Vulnerable	Not Listed
Phascolarctos cinereus	Koala (Breeding)			High	Vulnerable	Vulnerable
Pilularia novae-hollandiae	Austral Pillwort	Semi-permanent/ephemeral wet areas Periodically waterlogged sites (including table drains and farm dams))		High	Endangered	N/A
Pimelea spicata	Spiked Rice-flower			High	Endangered	Endangered
Pomaderris brunnea	Brown Pomaderris			High	Endangered	Vulnerable
Pommerhelix duralensis	Dural Woodland Snail	Leaf litter and shed bark or within 50m of litter of bark, Rocks or within 50m of rocks, Fallen/standing dead timber including logs, Including logs and bark or within 50m of logs or bark, Other		High	Endangered	Endangered
Pteropus poliocephalus	Grey-headed Flying-fox			High	Vulnerable	Vulnerable
Pultenaea pedunculata	Matted Bush-pea			N/A	Endangered	Not Listed

Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	BC Act	EPBC Act
Thesium australe	Austral Toadflax			Moderate	Vulnerable	Vulnerable
Wahlenbergia multicaulis **- endangered population**	Tadgell's Bluebell in the local government areas of Auburn, Bankstown, Baulkham Hills, Canterbury, Hornsby, Parramatta and Strathfield	Land situated in damp, disturbed sites		High	Endangered population	N/A

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

Table 10: Justification for exclusion of candidate species credit species

Species	Common Name	NSW listing status	EPBC Listing status	Justification for exclusion of species
Acacia pubescens	Downy Wattle	Vulnerable	Vulnerable	The species was not identified, and it was determined that the habitat is substantially degraded such that this species is unlikely to utilise the subject land.
Anthochaera phrygia	Regent Honeyeater	Critically Endangered	Critically Endangered	Species habitat is substantially degraded such that this species is unlikely to utilise the subject land.
Caladenia tessellata	Thick Lip Spider Orchid	Endangered	Vulnerable	Habitat is substantially degraded such that this species is unlikely to utilise the subject land.
Cynanchum elegans	Cynanchum elegans	Endangered	Endangered	Habitat is substantially degraded such that this species is unlikely to utilise the subject land.
Eucalyptus benthamii	Camden White Gum	Vulnerable	Vulnerable	The species was not identified, and it was determined that the habitat is substantially degraded such that this species is unlikely to utilise the subject land.
Grevillea juniperina **subsp.** ***juniperina***	Small-flower Grevillea	Vulnerable	Vulnerable	The species was not identified, and it was determined that the habitat is substantially degraded such that this species is unlikely to utilise the subject land.
Haliaeetus leucogaster	White-bellied Sea-Eagle	Vulnerable	Vulnerable	Habitat is substantially degraded such that this species is unlikely to utilise the subject land.
Hibbertia **sp.** ***Bankstown***	Hibbertia sp. Bankstown	Critically Endangered	Critically Endangered	Habitat is substantially degraded such that this species is unlikely to utilise the subject land.
Lathamus discolor	Swift Parrot	Endangered	Endangered	Habitat is substantially degraded such that this species is unlikely to utilise the subject land.
Litoria aurea	Green and Golden Bell Frog	Endangered	Endangered	Habitat is substantially degraded such that this species is unlikely to utilise the subject land.
Marsdenia viridiflora **subsp.** ***viridiflora*** **-**	Marsdenia viridiflora R. Br. subsp.	Endangered Population	Not Listed	Habitat is substantially degraded such that this species is unlikely to utilise the subject land.

Species	Common Name	NSW listing status	EPBC Listing status	Justification for exclusion of species
endangered population	viridiflora population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas			
Meridolum corneovirens	Cumberland Plain Land Snail	Endangered	Not Listed	Habitat is substantially degraded such that this species is unlikely to utilise the subject land.
Miniopterus australis	Little Bentwing Bat (Breeding)	Vulnerable	Not Listed	This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. No cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding cliffs are present in the Development Site.
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat (Breeding)	Vulnerable	Not Listed	This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. No cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding cliffs are present in the Development Site.
Myotis macropus	Southern Myotis	Vulnerable	Not Listed	This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. No hollow-bearing trees, bridges, caves or artificial structures within 200 m of riparian zone are present in the Development Site.
Persicaria elatior	Tall Knotweed	Vulnerable	Vulnerable	Habitat is substantially degraded such that this species is unlikely to utilise the subject land.
Persoonia hirsuta	Hairy Geebung	Endangered	Endangered	The species was not identified, and it was determined that the habitat is substantially degraded such that this species is unlikely to utilise the subject land.
Petaurus norfolcensis	Squirrel Glider	Vulnerable	Vulnerable	Habitat is substantially degraded such that this species is unlikely to utilise the subject land. No hollow-bearing trees were recorded.
Phascolarctos cinereus	Koala (Breeding)	Endangered	Not Listed	Habitat is substantially degraded such that this species is unlikely to utilise the subject land. Habitat present does not represent Koala breeding habitat.
Pilularia novae-hollandiae	Austral Pillwort	Vulnerable	Vulnerable	Habitat is substantially degraded such that this species is unlikely to utilise the subject land.
Pimelea spicata	Spiked Rice-flower	Endangered population	N/A	Habitat is substantially degraded such that this species is unlikely to utilise the subject land.
Pomaderris brunnea	Brown Pomaderris	Vulnerable	Vulnerable	The species was not identified, and it was determined that the habitat is substantially degraded such that this species is unlikely to utilise the subject land.

Species	Common Name	NSW listing status	EPBC Listing status	Justification for exclusion of species
Pommerhelix duralensis	Dural Woodland Snail	Critically Endangered	Critically Endangered	Although the site is located within the eastern extent of the species range the habitat is substantially degraded such that this species is unlikely to utilise the subject land.
Pteropus poliocephalus	Grey-headed Flying-fox	Endangered	Vulnerable	This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. Suitable breeding habitat (camps) was not available within the Development Site.
Pultenaea pedunculata	Matted Bush-pea	Endangered	Endangered	Habitat is substantially degraded such that this species is unlikely to utilise the subject land.
Thesium australe	Austral Toadflax	Vulnerable	Vulnerable	Habitat is substantially degraded such that this species is unlikely to utilise the subject land.
Wahlenbergia multicaulis **- endangered population**	Tadgell's Bluebell in the local government areas of Auburn, Bankstown, Baulkham Hills, Canterbury, Hornsby, Parramatta and Strathfield	Vulnerable	Vulnerable	Habitat is substantially degraded such that this species is unlikely to utilise the subject land.

1.6.1.1 Targeted surveys

Although the above species credit species were not included in the assessment, due to lack of potential habitat, surveys throughout the Development Site were conducted as a conservative measure for species that were conspicuous, and/or met the survey timing requirements under the BAM (Table 11). Surveys for threatened flora involved a meander of PCTs and did not identify these species credit species. Targeted survey for invertebrates involved searching under leaf litter and at the bases of eucalypts within PCT 850.

Table 11: Targeted surveys

Date	Surveyors	Target species
28/05/2018	Stacey Wilson and Mike Lawrie	*Acacia pubescens*, *Eucalyptus benthamii*, *Grevillea juniperina* subsp. *juniperina*, *Marsdenia viridiflora* subsp. *viridiflora*, *Meridolum corneovirens*, *Persoonia hirsuta*, *Pilularia novae-hollandiae*, *Pimelea spicata*, *Pomaderris brunnea*, *Pommerhelix duralensis*,

Weather conditions during the targeted survey are outlined in Table 12.

Table 12: Weather conditions

Date	Rainfall (mm)	Minimum temperature 0C	Maximum temperature 0C
28/05/2018	0	6.0	21.0

Survey effort undertaken at the Development Site is outlined in Table 13.

Table 13: Survey effort

Method	Habitat (ha)	Total effort	Target species
Area search	0.51	60 minutes search	*Acacia pubescens*, *Eucalyptus benthamii*, *Grevillea juniperina* subsp. *juniperina*, *Marsdenia viridiflora* subsp. *viridiflora*, *Meridolum corneovirens*, *Persoonia hirsuta*, *Pilularia novae-hollandiae*, *Pimelea spicata*, *Pomaderris brunnea*, *Pommerhelix duralensis*,

1.6.1.2 Targeted Survey results

No threatened flora or fauna species were recorded during targeted surveys within the Development Site.

However, one threated flora species *Eucalyptus scoparia* (Wallangarra white gum) listed as an Endangered species under the NSW BC Act and as Vulnerable under the EPBC Act was found in two locations in close proximity to the Development Site. This species (*Eucalyptus scoparia*) occurs naturally in northern NSW and is not indigenous to Sydney. Two individuals were identified are likely to have been cultivated and planted with other landscaped plantings around the edges of the car parks.

1.6.2 Use of local data

The use of local data is not proposed.

1.6.3 Expert reports

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

2. Stage 2: Impact Assessment

2.1 Avoiding impacts

The Development Site is small and contains small and fragmented patches of degraded vegetation. The development has been located in a way which avoids and minimises impacts as outlined in Table 14 and Table 15.

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

Table 14: Locating a project to avoid and minimise impacts on vegetation and habitat

Approach	How addressed	Justification
locating the project in areas where there are no biodiversity values	Areas of cleared land or exotic vegetation containing no biodiversity values have been utilised. The development site has been relocated to avoid impacts to RFEF. An area of CPW (0.33 ha) will be impacted, which has been reduced from an initial impact area of 0.48 ha.	The Development Site is predominantly located in areas containing no biodiversity values. RFEF will not be impacted. The area of CPW to be impacted is in a degraded condition.
locating the project in areas where the native vegetation or threatened species habitat is in the poorest condition	All native vegetation on site is in poor condition.	Native vegetation within the study area is in poor condition with a vegetation integrity score between 30 and 31.9 for CPW vegetation zones. Adjacent areas of native vegetation outside of the Development Site to the south and west appeared to be in better condition and will not be impacted by the proposal.
locating the project in areas that avoid habitat for species and vegetation in high threat categories (e.g. an EEC or CEEC), indicated by the biodiversity risk weighting for a species	The Development Site has been located to avoid impacting on areas of RFEF. The development cannot avoid impacts to all areas of CPW, however these impacts have been minimised. A total area of 0.33 ha of CPW will be impacted	The Development Site is predominantly located in areas containing no biodiversity values. The area of CPW to be impacted is in a degraded condition
locating the project such that connectivity enabling movement of species and genetic material between areas of adjacent or nearby habitat is maintained	The Development Site footprint does not impact on connectivity values surrounding the Development Site.	The Development Site is located within a fragmented landscape. Land directly to the north, east and south has been highly developed. Small pockets of habitat exist along Fishers Ghost Creek to the south east and Birunji creek to the west. However, these pockets of habitat are highly fragmented by roads and residential areas. Therefore, there is limited habitat connectivity. Given the proposed development will utilise an area of already highly developed land and fragmented native vegetation, the movement of species and genetic material between areas of adjacent or nearby habitat will be maintained.

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

Table 15: Designing a project to avoid and minimise impacts on vegetation and habitat

Approach	How addressed	Justification
reducing the clearing footprint of the project	The clearing footprint has primarily utilised areas of already developed land and areas of disturbed or planted vegetation. The impact area has been redesigned to reduce impacts on CPW from 0.48 ha to 0.33 ha and completely avoid impacts on RFEF.	The Development Site is primarily located within existing infrastructure, road corridors. A small area of disturbed native vegetation will be impacted including a small area that is not consistent with a PCT.
locating ancillary facilities in areas where there are no biodiversity values	Ancillary features are located in areas where there are minimal biodiversity values.	The Development site utilises areas containing predominantly exotic vegetation and no biodiversity values (0.25 ha). There will be a small impact (0.33 ha) to areas containing low biodiversity value, however, this has been minimised.
locating ancillary facilities in areas where the native vegetation or threatened species habitat is in the poorest condition (i.e. areas that have a lower vegetation integrity score)	All vegetation on the site has a relatively low vegetation integrity score.	Ancillary features are located in areas where native vegetation has a low to moderate vegetation integrity score (30-31.9 for CPW), and in areas containing predominantly exotic vegetation.
locating ancillary facilities in areas that avoid habitat for species and vegetation in high threat status categories (e.g. an EEC or CEEC)	Ancillary features are not located in areas containing habitat for species in high threat status categories but will impact a CEEC and EEC in poor condition	Ancillary features will be located in areas that impact vegetation with high threat status (i.e., CEEC), however the condition of this vegetation community is poor, and following avoidance where practical, only a small amount will be impacted (0.33 ha).
providing structures to enable species and genetic material to move across barriers or hostile gaps	Not deemed necessary as connectivity is limited to within the Development site and only applies to those highly mobile avian species or GHFF.	The the local occurrence of CPW is confined to the hospital grounds. There is no habitat connectivity values within the Development Site to large areas of habitat, except for highly mobile species.
making provision for the demarcation, ecological restoration, rehabilitation and/or ongoing maintenance of retained native vegetation habitat on the Development Site.	Proponent to protect all remaining vegetation outside of the Development Site footprint.	The proponent will demarcate all areas outside the Development Site boundary to be retained as no go areas to avoid impacts occurring to intact good quality native vegetation within the northern portion of the Lot.

2.1.3 Prescribed biodiversity impacts

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

- Occurrences of karst, caves, crevices and cliffs - none occur within the Development Site
- Occurrences of rock - no rock outcrops or scattered rocks occur within the Development Site
- Occurrences of human made structures and non-native vegetation - as the Development Site is located in a heavily urbanised area almost the entire study area contains human made

structures. Consideration was given during literature review to buildings or structures that could potentially be utilised as a roosting resource by microchiropteran bats (microbats). Non-native vegetation was identified and assessed for the potential to provide habitat for threatened flora and fauna species

- Hydrological processes that sustain and interact with the rivers, streams and wetlands - none occur within the Development Site.
- Proposed development for a wind farm and use by species as a flyway or migration route - the project does not involve any wind farm development.

The Development Site has the prescribed biodiversity impacts outlined in Table 16.

Table 16: Prescribed biodiversity impacts

Prescribed biodiversity impact	Description in relation to the Development Site	Threatened species or ecological communities affected.
Impacts of development on the habitat of threatened species or ecological communities associated with non-native vegetation	The potential removal of planted native and non-native vegetation may be required within the Development Site.	*Pteropus poliocephalus* (Grey-headed Flying Fox)

2.1.3.1 Locating a project to avoid and minimise prescribed biodiversity impacts

The development has been located in a way which avoids and minimises prescribed biodiversity impacts as outlined in Table 17.

Table 17: Locating a project to avoid and minimise prescribed biodiversity impacts

Approach	How addressed	Justification
Locating the envelope of surface works to avoid direct impacts on the habitat features	Surface works are to occur primarily within existing infrastructure and road corridors.	Areas of non-native vegetation with no biodiversity values will be removed, and PCTs with low integrity will be avoided where possible.

2.1.3.2 Designing a project to avoid and minimise prescribed biodiversity impacts

The development has been designed in a way which avoids and minimises prescribed biodiversity impacts as outlined in Table 18.

Table 18: Designing a project to avoid and minimise prescribed biodiversity impacts

Approach	How addressed	Justification
Design of the project to maintain environmental processes critical to the formation and persistence of habitat features not associated with native vegetation	The Development Site is designed to avoid trees where possible to maintain habitat features	The Development Site has utilised areas not associated with native vegetation where possible.

2.2 Assessment of impacts

2.2.1 Direct impacts

The direct impacts on native vegetation and threatened ecological communities are outlined in Table 19 and

Table 20.

Table 19: Direct impacts to native vegetation

PCT ID	PCT Name	Vegetation Class	Vegetation Formation	Direct impact
850	*Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion*	Coastal Valley Grassy Woodlands	Grassy Woodlands	0.33 ha

Table 20: Direct impacts on threatened ecological communities

PCT ID	BC Act				EPBC Act		
	Listing status	Name		Direct impact (ha)	Listing status	Name	Direct impact (ha)
850	CEEC	Cumberland Woodland	Plain	0.33	N/A	N/A	N/A

2.2.2 Change in vegetation integrity

The change in vegetation integrity as a result of the development is outlined in Table 21. The future vegetation integrity score of 0 for the 0.33 ha portion of the Development Site reflects the clearing of all native vegetation within the Development Site.

Table 21: Change in vegetation integrity

Veg Zone	PCT ID	Condition	Area (ha)	Current vegetation integrity score	Future vegetation integrity score	Change in vegetation integrity
1	850	Degraded	0.05	31.9	0	-31.9
2	850	Degraded	0.28	30	0	-30

2.2.3 Indirect impacts

The indirect impacts of the development are outlined in Table 22.

Table 22: Indirect impacts

Indirect impact	Project phase	Nature	Extent	Frequency	Duration	Timing
sedimentation and contaminated and/or nutrient rich run-off	Construction	Runoff during construction works	Downhill (west) from Development Site.	During heavy rainfall or storm events	During rainfall events	Short-term impacts
inadvertent impacts on adjacent habitat or vegetation	Construction	Damage to adjacent habitat or vegetation	Approximately 5-10m from Development Site boundary	Daily, during construction works	Throughout construction period	Short-term impacts
transport of weeds and pathogens from the site to adjacent vegetation	Construction	Spread of weed seed or pathogens	Potential for spread into adjacent habitat	Daily, during construction works	Sporadic throughout construction period	Short-term impacts
trampling of threatened flora species	Construction / operation	No threatened flora present	N/A	N/A	N/A	N/A
bush rock removal and disturbance	Construction / operation	No bush rock present	N/A	N/A	N/A	N/A
increase in predatory species populations	Construction / operation	Negligible likelihood of impact occurring because only a small degraded are of native vegetation will be removed	N/A	N/A	N/A	N/A
increase in pest animal populations	Construction / operation	Negligible likelihood of impact occurring because only a small degraded are of native vegetation will be removed	N/A	N/A	N/A	N/A

2.2.4 Prescribed biodiversity impacts

The development does not have any prescribed biodiversity impacts.

2.2.5 Mitigating and managing impacts

Measures proposed to minimise impacts at the Development Site before, during and after construction are outlined in Table 23.

Table 23: Measures proposed to minimise impacts

Measure	Risk before mitigation	Risk after mitigation	Action	Outcome	Timing	Responsibility
Displacement of resident fauna	Minor	Negligible	No trees within the Development site contained hollows. As such, trees should be removed in accordance with best practise methods. In the event that fauna are injured during tree removal works a qualified ecologist/licensed wildlife handler should be contacted.	Relocation of fauna in a sensitive manner	Prior to and during clearing works	Project Manager
instigating clearing protocols including pre-clearing surveys, daily surveys and staged clearing, the presence of a trained ecological or licensed wildlife handler during clearing events	Minor	Minor	All trees identified for retention should be clearly flagged with surveyors flagging tape / paint	Any fauna utilising habitat within the Development Site will be identified and managed to ensure clearing works minimise the likelihood of injuring resident fauna	Prior to and during clearing works	Project Manager
installing artificial habitats for fauna in adjacent retained vegetation and habitat or human made structures to replace the habitat resources lost and encourage animals to move from the impacted site, e.g. nest boxes	Negligible	Negligible	If no hollows/hollow trunks/fissures are present in the Development Site replacement is not required.	Replacement of habitat features not required	N/A	N/A
clearing protocols that identify vegetation to be retained, prevent inadvertent damage and reduce soil disturbance	Moderate	Minor	Install No Go fencing prior to construction works around entire development site to prevent impacts to adjacent vegetation. Fencing and signage will be placed around those areas of vegetation to be maintained to prevent any accidental construction damage and provide a permanent barrier between the Development Site and retained areas	Vegetation to be retained outside of the Development Site boundary (northern portion of Lot) and retained vegetation within the Development Site will not be disturbed/impacted	Fencing to be set up prior to any works occurring on site and to remain throughout duration of construction works	Project Manager

Measure	Risk before mitigation	Risk after mitigation	Action	Outcome	Timing	Responsibility
			The type of fencing during construction may be of a temporary nature and scale that is robust enough to withstand damage during this phase of work			
sediment barriers or sedimentation ponds to control the quality of water released from the site into the receiving environment	Minor	Negligible	Appropriate controls will be utilised to manage exposed soil surfaces and stockpiles to prevent sediment discharge into waterways Ensure all works within proximity to the drainage lines have adequate sediment and erosion controls	Erosion and sedimentation will be controlled	For the duration of construction works	Project Manager
noise barriers or daily/seasonal timing of construction and operational activities to reduce impacts of noise	Minor	Negligible	Timing of construction works should be planned to occur outside of the winter/spring breeding season for both Squirrel glider and nesting birds. Daily timing of construction activities is recommended in accordance with Table 1 of Interim Noise Guidelines (2009) Monday to Friday 7.00am to 6.00pm Saturday 8.00am to 1.00pm No work on Sunday or public holidays	Noise impacts associated with the development will be managed in accordance with guidelines	For the duration of construction works	Project Manager
adaptive dust monitoring programs to control air quality	Minor	Negligible	Dust suppression measures will be implemented during construction works to limit dust on site Commence revegetation as soon as practicable to minimise areas likely to create dust	Mitigate dust created during construction activities	For the duration of construction works	Project Manager
hygiene protocols to prevent the spread of weeds or pathogens between infected areas and uninfected areas	Moderate	Minor	Weeds present within the Development Site listed under the NSW *Biosecurity Act 2015* and Greater Sydney Regional Strategic Weed Management Plan should be managed. Weeds present include 1. *Olea europaea* subsp. *cuspidata* (African Olive) 2. *Rubus fruticosus* species *aggregate* (Blackberry) 3. *Asparagus asparagoides* (Bridal Creeper) 4. *Eragrostis curvula* (African Love Grass)	Prevent spread of weeds or pathogens	For the duration of construction works	Project Manager

Measure	Risk before mitigation	Risk after mitigation	Action	Outcome	Timing	Responsibility
			5. *Pennisetum clandestinum* (Kikuyu) 6. *Chloris gayana* (Rhodes Grass) 7. *Araujia sericifera* (Moth Vine) All weeds are to be managed/removed by a qualified Bush Regenerator			
staff training and site briefing to communicate environmental features to be protected and measures to be implemented	Minor	Negligible	All staff working on the development will undertake an environmental induction as part of their site familiarisation. This induction will include items such as: 1. Importance of No Go zones 2. Site environmental procedures (vegetation management, sediment and erosion control, exclusion fencing and noxious weeds) 3. What to do in case of environmental emergency (chemical spills, fire, injured fauna) 4. Key contacts in case of environmental emergency	All staff entering the Development Site are fully aware of the presence of native vegetation adjacent to the site what to do in case of any environmental emergencies	To occur for all staff entering/working at the Development Site. Site briefings should be updated based on phase of the work and when environmental issues become apparent.	Project Manager
development control measures to regulate activity in vegetation and habitat adjacent to residential development including controls on pet ownership, rubbish disposal, wood collection, fire management and disturbance to nests and other niche habitats	Minor	Negligible	Temporary fencing to be placed around the perimeter of the Development Site to prevent impacts to adjacent vegetation.	Protect vegetation and habitat adjacent to Development Site.	During operational phase	Client
making provision for the ecological restoration, rehabilitation and/or ongoing maintenance of retained native vegetation habitat on or adjacent to the Development Site	Minor	Negligible	Landscaping in the Development Site is to use locality derived native species and those found within the PCTs present Retained area in the south-west portion of the Lot is to be left untouched.	Areas within the Development Site will be landscaped using appropriate species	Throughout construction and following completion of construction activities	Project Manager

2.2.6 Serious and Irreversible Impacts (SAII)

The Development Site contains one Serious and Irreversible Impact (SAII) candidate entity identified in Table 24. Detailed consideration of whether impacts on candidate TECs are serious and irreversible is included in Table 25.

Table 24: Candidate Serious and Irreversible Impacts

Species / Community	Common Name	Principle	Direct impact individuals / area (ha)	Threshold
Cumberland Plain Woodland in the Sydney Basin Bioregion	Cumberland Plain Woodland in the Sydney Basin Bioregion	Principle 1 and Principle 2	Removal 0.33 ha	Not yet published

Table 25: Evaluation of an impact on a TEC

Impact Assessment Provisions	Assessment
1. the area and condition of the TEC to be impacted directly and indirectly by the proposed development	The development will remove 0.33 ha of CPW in a degraded condition with an integrity score of approximately 30 in the BAMC.
2. the extent and overall condition of the TEC within an area of 1500 metres, and then 5000 metres, surrounding the proposed development footprint. In the case of strategic biodiversity certification projects, the extent and overall condition of the TEC may be assessed across the IBRA sub region	Within 1500 metres of the development site there is an estimated 20.3 ha of CPW (SMCMA, 2016). Within 5,000 metres of the development site there is an estimated 413.3 ha (SMCMA, 2016; OEH 2013);
3. an estimate of the extant area and overall condition of the TEC remaining before and after the impact of the proposed development has been taken into consideration	The proposal will reduce the extant area of CPW by 0.33 ha. Considering the very small area and poor quality of the vegetation to be removed, it is considered that the development will have a negligible impact on the extant area and overall condition of the TEC on a broad scale with a loss of 1.6% of CPW within 1,500 m of the development site and 0.01% within 5,000 m of the development site.
4. the development proposal's impact on:	
a. abiotic factors critical to the long-term survival of the TEC; for example, will the impact lead to a reduction of groundwater levels or substantial alteration of surface water patterns; will it alter natural disturbance regimes that the TEC depends upon, e.g. fire, flooding etc.?	The development will not impact abiotic factors critical to the long-term survival of the TECs.
b. characteristic and functionally important species through impacts such as, but not limited to, inappropriate fire/flooding regimes, removal of under-storey species or harvesting of plants	The development will not impact characteristic and functionally important species outside of the proposed impact area.
c. the quality and integrity of an occurrence of the TEC through threats and indirect impacts including, but not limited to, assisting invasive flora and fauna species to become established or causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants which may harm or inhibit growth of species in the TEC	The development has the potential to assist the spread of invasive flora in CPW adjacent to the study area. This potential impact will be controlled during the construction phase. The development will not have additional impacts to the quality and integrity of the occurrence of CPW outside of the proposed impact area.
5. direct or indirect fragmentation and isolation of an area of the TEC	The development will not cause direct or indirect fragmentation or isolation of any area of CPW.
6. the measures proposed to contribute to the recovery of the TEC in the IBRA subregion.	In its current form, the proposed development does not contribute to the recovery of the TEC in the IBRA subregion

2.3 Risk Assessment

A risk assessment has been undertaken for any residual impacts likely to remain after the mitigation measures (Section 2.2.5, Table 23) have been applied. Likelihood criteria, consequence criteria and the risk matrix are provided in Table 26,

Table 27 and

Table 28 respectively and the risk assessment outcome is presented in Table 29.

Table 26: Likelihood criteria

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

Table 27: Consequence criteria

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

Table 28: Risk matrix

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

Table 29: Risk assessment

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

2.4 Adaptive management strategy

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

2.5 Impact Summary

2.5.1 Serious and Irreversible Impacts (SAII)

As discussed in Section 2.2.6, because the thresholds for a SAII on CPW or have not yet been published by the OEH, it cannot be determined with certainty if the proposed development will have SAII. Considering the degraded nature of CPW in the development site and small area to be removed (0.33 ha), it is unlikely that the development would result in a SAII.

2.5.2 Impacts requiring offsets

The impacts of the development requiring offset for native vegetation are outlined in Table 30 and shown on Figure 6.

Table 30: Impacts to native vegetation that require offset.

PCT ID	PCT Name	Vegetation Class	Vegetation formation	Direct impact (ha)
850	*Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion*	Coastal Valley Grassy Woodlands	Grassy Woodlands	0.33

2.5.3 Impacts not requiring offset

The development will not result in impacts on native vegetation or threatened species that do not require offset (i.e. impacts on native vegetation less than the threshold required for offsetting as outlined in Section 3.1.1.3 of the BAM).

2.5.4 Areas not requiring assessment

The Development Site contains areas not requiring assessment (Figure 7), which included the cleared/exotic vegetation, the built environment and planted vegetation that did not form a part of any native PCT (Plate 1).

2.5.4.1 Planted vegetation

Surrounding the car parks and hospital buildings were landscaped plantings (0.28 ha), which included native juvenile Eucalyptus sp., *Corymbia filifolia* (Summer Red), *Jacaranda mimosifolia* (Jacaranda), *Melaleuca styphelioides* (Prickly-leaved Paperbark), *Lomandra longifolia* (Spiny-head Mat-rush) and Dianella caerulea (Blue Flax-lily). Exotic species included *Tradescantia fluminensis* (Wandering Jew), *Vicia sativa* (Common Vetch), *Pennisetum setaceum* (Foxtail Grass), *Senna pendula* var. *glabrata* (Senna) and *Asphodelus fistulosus* (Onion Weed). This vegetation also included a stand of planted *Corymbia citriodora* with no midstorey and the understorey covered in mulch. This vegetation is not consistent with any listed native Plant Community Type (PCT) and is predominantly exotic.

2.5.4.2 Exotics/Cleared/Built environment

The majority of the Development Site was composed of exotic or cleared vegetation or was part of the build environment (4.9 ha). Dominant groundcovers present were *Eragrostis curvula* (African Love Grass), *Chloris gayana* (Rhodes Grass), *Pennisetum clandestinum* (Kikuyu), *Cynodon dactylon* (Couch), *Sida rhombifolia* (Paddy's Lucerne) and *Olea europaea* subsp. *cuspidata* (African Olive) and *Asparagus asparagoides* (Bridal Creeper). This vegetation is exotic and does not consistent with any listed native Plant Community Type (PCT).

Plate 1: Planted native and exotic vegetation within the Development Site.

2.5.5 Credit summary

A summary of the credit report generated by the BAMC is outlined in Table 31. No candidate species credit species or likely habitat was recorded within the Development Site; hence no species credits are required to offset the development. A full biodiversity credit report is included in Appendix D.

Table 31: Ecosystem credits required

PCT ID	PCT Name	Vegetation Formation	Direct impact (ha)	Credits required
850	*Grey Box - Forest Red Gum grassy woodland on shale of the Cumberland Plain, Sydney Basin Bioregion*	Coastal Valley Grassy Woodlands	0.33	6

2.6 Offset options

There are a number of options that can be utilised to offset these biodiversity and species credits. These include retiring biodiversity credits either through establishing a Biodiversity Stewardship (offset) site, or through purchasing credits on the open market, making a payment to the Biodiversity Conservation Trust or funding biodiversity actions for individual species or communities. However, this last option has some limitations. Due to the small scale of the project, and lack of suitable offset land owned by the proponent, it is likely that making a payment to the Biodiversity Conservation Trust will be the most appropriate option to retire credits for this redevelopment.

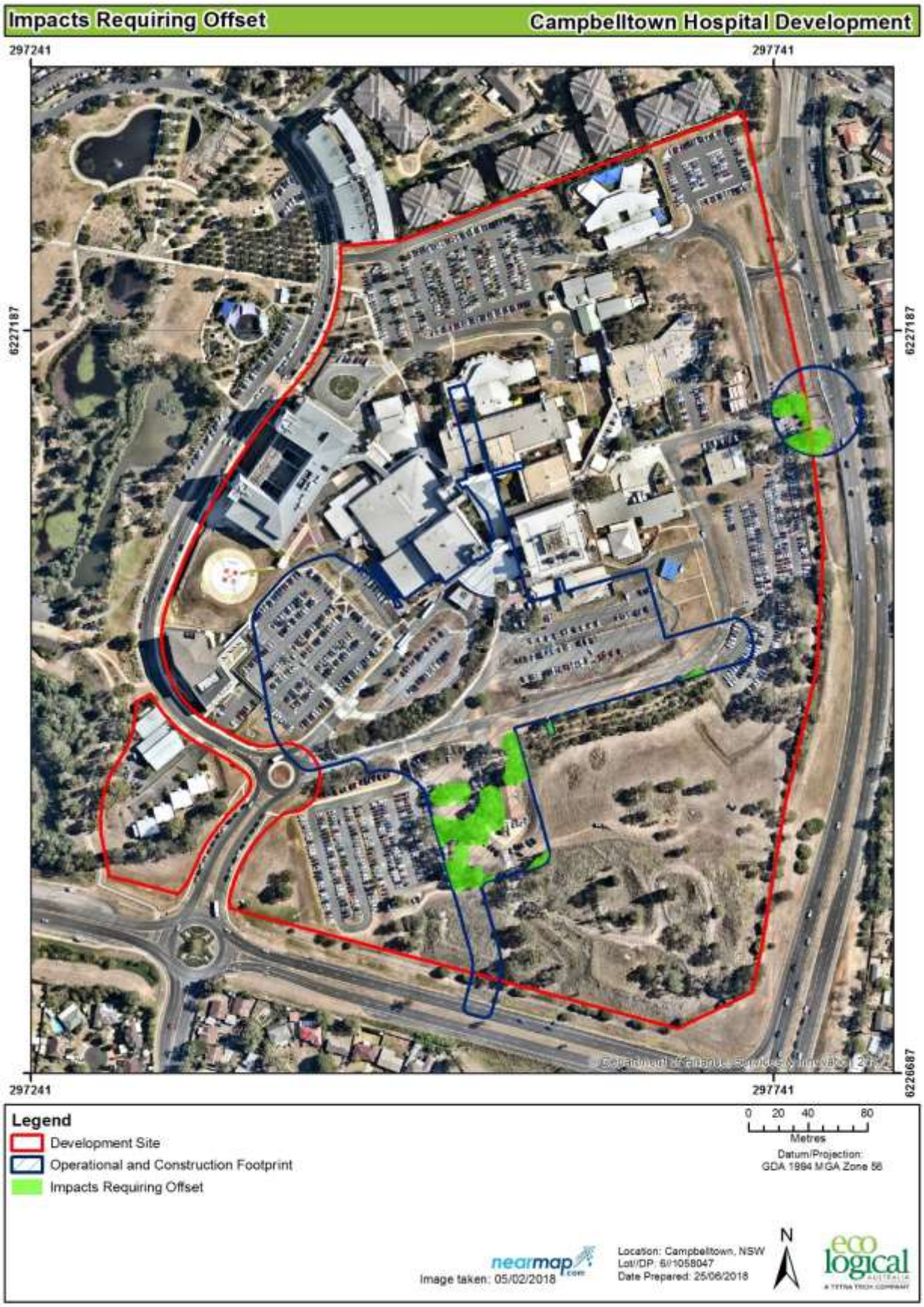

Figure 6: Impacts requiring offset

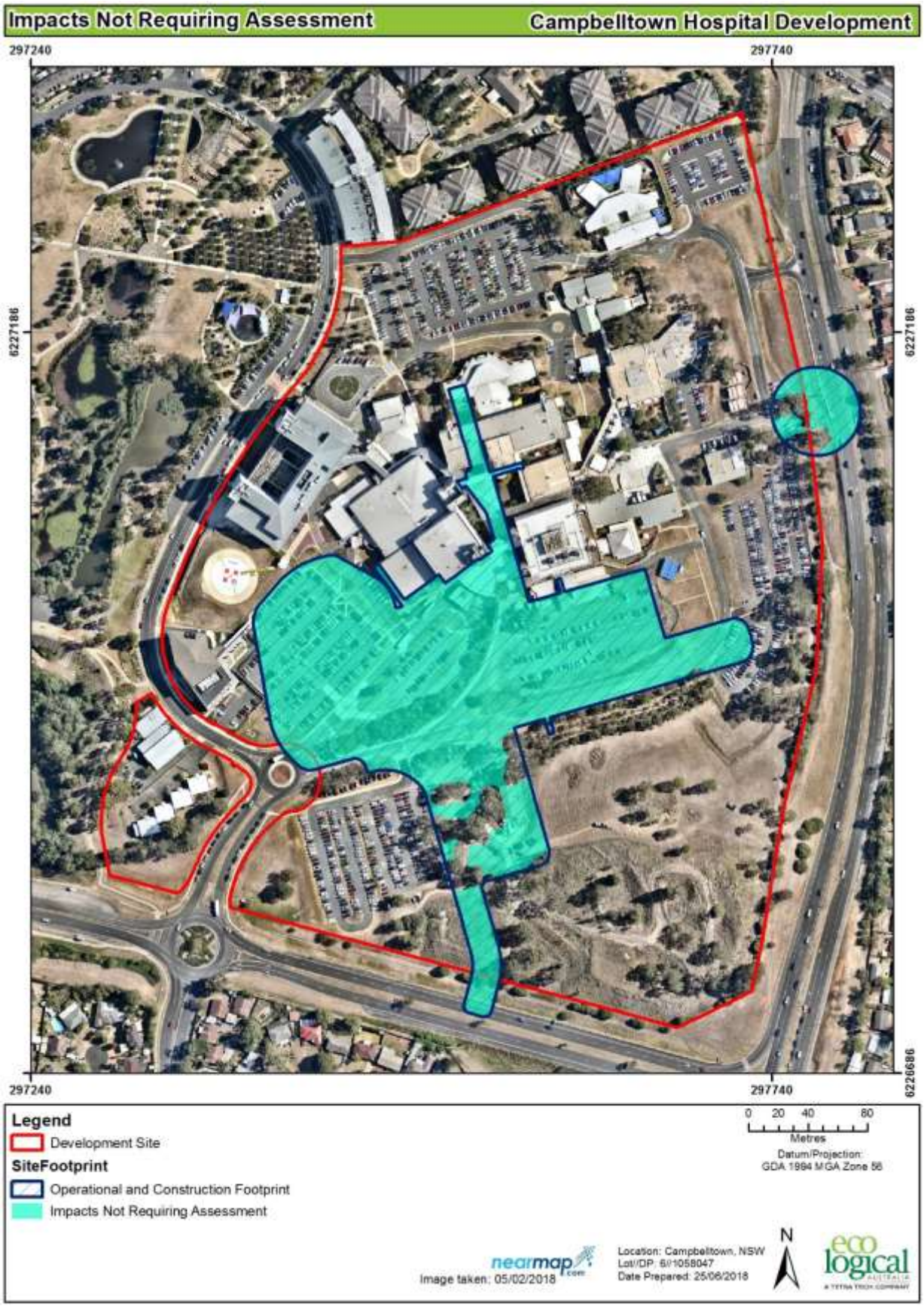

Figure 7: Areas not requiring assessment

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Appendix A: Definitions

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

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

Appendix B: Vegetation plot data

Table 32: Species matrix (species recorded by plot)

Stratum	Form	*Species name*	Common name	Exotic	High Threat Weed	Plot 1		Plot2		Plot 3	
						Cover (%)	Abundance	Cover (%)	Abundance	Cover (%)	Abundance
Upper	TG	*Acacia parramattensis*						0.2	1		
Mid	TG	*Allocasuarina littoralis*				2	5				
Ground		*Araujia sericifera*		Y	Y					0.1	2
Ground	GG	*Aristida ramosa*				20	500	2	100	1	100
Ground		*Asparagus spp.*		Y						0.1	5
Ground		*Bidens pilosa*		Y	Y					0.2	2
Ground		*Brassica spp.*		Y				0.1	2		
Ground		*Briza subaristata*		Y	Y	1	10	1	50	0.1	5
Mid	TG	*Casuarina glauca*								20	6
Ground		*Chloris gayana*		Y	Y	10	30	40	100	2	10
Ground		*Cirsium vulgare*		Y						0.1	2
Ground		*Conyza bonariensis*		Y				0.1	4	0.1	1
Upper	TG	*Corymbia maculata*				5	10	20	9		
Ground		*Cynodon dactylon*								15	200
Ground	FG	*Cyperus aggregatus*		Y				0.1	1		
Ground	GG	*Cyperus gracilis*				15	500	1	50	0.3	50
Ground	FG	*Dianella caerulea*						0.1	1		
Ground	FG	*Dichondra repens*				0.1	5	0.1	20	0.1	10
Ground		*Ehrharta erecta*		Y	Y					0.5	20
Ground	FG	*Einadia hastata*						1	30		

Stratum	Form	*Species name*	Common name	Exotic	High Threat Weed	Plot 1		Plot2		Plot 3	
Ground	FG	*Einadia polygonoides*				0.1	1	0.2	10	0.2	5
Ground		*Eragrostis curvula*		Y	Y			20	100		
Upper	TG	*Eucalyptus crebra*				2	3				
Upper	TG	*Eucalyptus spp.*				1	1				
Upper	TG	*Eucalyptus moluccana*				4	5				
Upper	TG	*Eucalyptus punctata*						5	2		
Upper	TG	*Eucalyptus tereticornis*				2	1				
Ground	OG	*Glycine tabacina*				0.1	2				
Ground		*Lepidium africanum*		Y				0.1	1		
Mid	SG	*Melaleuca linariifolia*				1	5				
Ground	GG	*Microlaena stipoides*				0.1	10	0.1	10	25	500
Ground		*Modiola caroliniana*		Y				0.1	2	0.1	5
Ground		*Olea europaea subsp. cuspidata*		Y		1	15	1	5	5	3
Ground		*Paspalum dilatatum*		Y	Y					1	10
Ground		*Pennisetum clandestinum*		Y	Y			2	50	0.5	20
Ground	FG	*Plantago hispida*				0.5	10	1	100	0.5	20
Ground		*Plantago lanceolata*		Y						0.1	2
Mid		*Ligustrum sinense*		Y	Y					2	1
Ground		*Setaria spp.*		Y				0.1	1		
Ground		*Sida rhombifolia*		Y		0.1	20	0.2	5	0.1	5
Ground	GG	*Themeda triandra*								0.1	1

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

Table 33: Vegetation integrity data (Composition, Structure and function)

Plot location data					
Plot no.	PCT	Condition	Eastings	Northings	Bearing
1	850	Degraded	297630	6226923	63° NE
2	850	Degraded	297584	6226833	205° SW
3	835	Degraded	297494	6226768	335° NW

Composition (number of species)						
Plot no.	Tree	Shrub	Grass	Forb	Fern	Other
1	6	1	3	3	0	1
2	3	0	4	5	0	0
3	1	0	5	3	0	0

Structure (Total cover)						
Plot no.	Tree	Shrub	Grass	Forb	Fern	Other
1	16	1	35	1	0	0
2	25	0	3	2	0	0
3	20	0	41	1	0	0

Function											
Plot no.	Large Trees	Hollow trees	Litter Cover	Length Fallen Logs	Tree Stem 5-9	Tree Stem 10-1 9	Tree Stem 20-2 9	Tree Stem 30-49	Tree Stem 50-79	Tree Regen	High Threat Weed Cover
1	0	0	72	6	1	1	1	1	0	1	11
2	1		55	4	1	0	1	1	1	1	63
3	0	0	17	0	0	0	0	1	0	0	6

Appendix C: Plot photos

Plate 2: Plot 1 transect start

Plate 3: Plot 1 transect end

Plate 4: Plot 2 transect start

Plate 5: Plot 2 transect end

Plate 6: Plot 3 transect start

Appendix D: Biodiversity credit report

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BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00010969/BAAS17043/18/00010971	10333 Campbelltown Hospital	24/02/2018
Assessor Name	Report Created	BAM Data version *
Matthew Dowle	26/06/2018	3
Assessor Number	* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.	
BAAS17043		

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

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Candidate SAII	Ecosystem credits
Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion								
1	850_Low	31.9	0.1	0.25	High Sensitivity to Potential Gain	2.50	TRUE	1
2	850_Degraded	30.0	0.3	0.25	High Sensitivity to Potential Gain	2.50	TRUE	5
							Subtotal	**6**
							Total	**6**

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BAM Credit Summary Report

Species credits for threatened species

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

Appendix E: Proposed Scope Plan

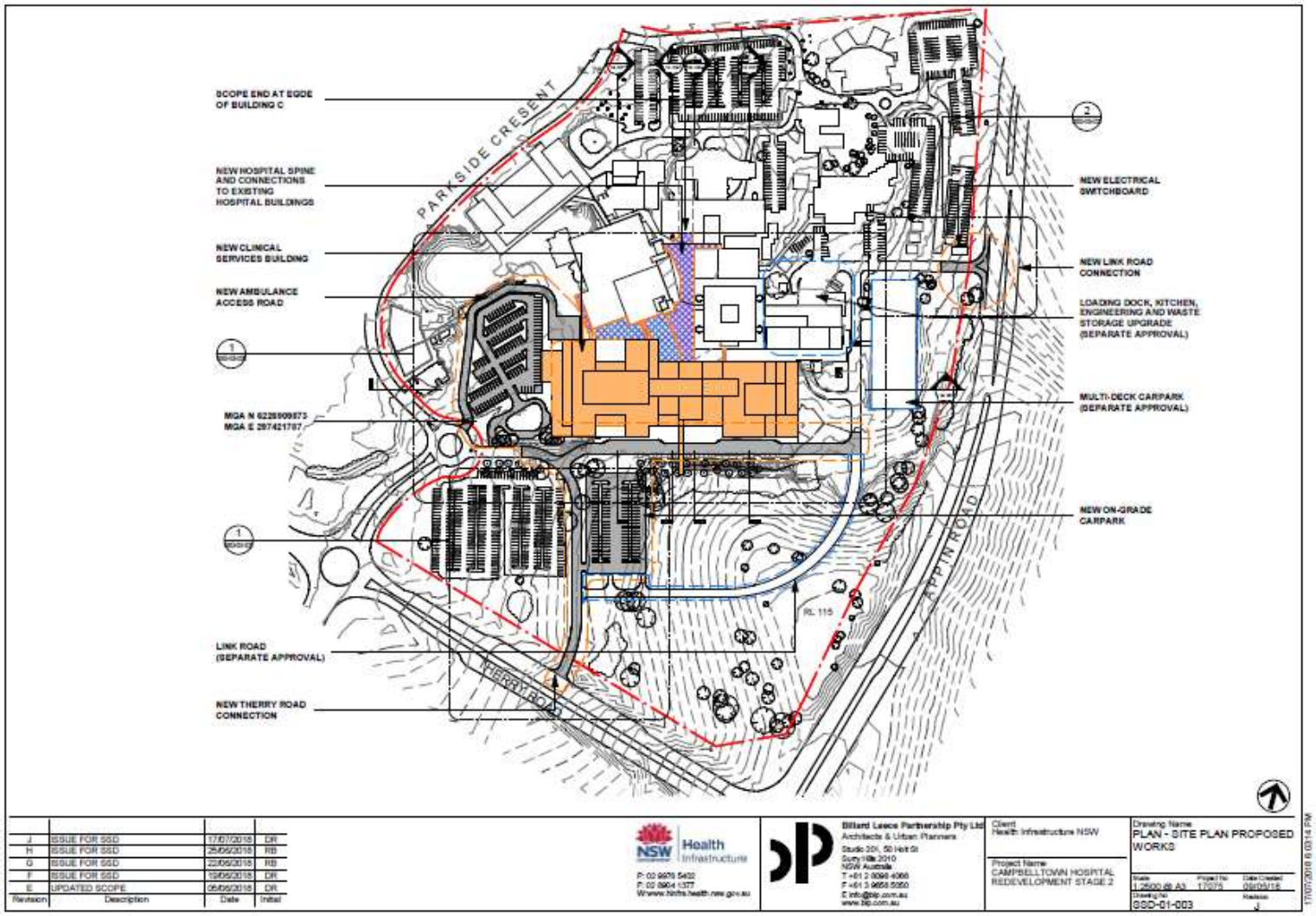

Figure 8: Proposed Scope Plan

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