Berkeley Life City

Biodiversity Development Assessment Report

FINAL REPORT

Prepared for TCG Planning

21 February 2020

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- NSW Environment, Energy and Science Group for access to the BioNet Atlas of NSW Wildlife.
- BirdLife Australia for access to the New Atlas of Australian Birds 1998-2013.

Biosis staff involved in this project were:

- Byron Dale, Rebecca Dwyer and Paul Price (assistance in the field)
- Anne Murray (mapping)

Contents

Tables

Figures

Glossary

BAM	NSW Biodiversity Assessment Method
BC Act	NSW *Biodiversity Conservation Act 2016*
BDAR	Biodiversity Development Assessment Report
Biosecurity Act	NSW *Biosecurity Act 2015*
BOS	Biodiversity Offsets Scheme
CEMP	Construction Environmental Management Plan
DA	Development Application
DBH	Diameter at Breast Height
DEE	Commonwealth Department of the Environment and Energy
DoIW	Directory of Important Wetlands
DPIE	NSW Planning Industry and Environment
DPI	NSW Department of Primary Industries
Ecosystem credit species	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.
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
GDE	Groundwater Dependent Ecosystem
GIS	Geographic Information System
IBRA	Interim Biogeographic Regionalisation of Australia
LEP	Local Environmental Plan
LGA	Local Government Area
Locality	Area located within 5 kilometres radius from the study area
LPI	NSW Land and Property Information
Matters of NES	Matters of National Environmental Significance protected by a provision of Part 3 of the EPBC Act
EES	NSW Environment, Energy and Science Group
PCT	Plant Community Type
SALIS	NSW Soil and Land Information System
SEPP 44	NSW State Environmental Planning Policy No. 44 – Koala Habitat Protection

SSD	State Significant Development
study area	The broader area in which the subject site is located, including all direct and indirect impacts
subject site	The area of direct impact for the proposed development
TEC	Threatened Ecological Community
WM Act	NSW *Water Management Act 2000*

Summary

Delbest proposes to develop land at Warwick, Nottingham and York Street Berkeley (hereafter referred to as the study area). The study area encompasses the subject land and includes areas outside of the subject land that could be indirectly impacted by the proposal including adjacent areas downslope where there may be minor changes to hydrology through alteration to overland flow patterns.

The development will involve the construction of a high-tech holistic cancer and medical hospital facility, 'Life City', to be constructed over six stages within the subject land. Life City will comprise a medical centre, day surgery, child-care centre, respite centre, medi-hostel and medi-serviced apartments, high-tech holistic cancer and medical hospital, self-care seniors housing, residential care facility and hostel, holistic health care course, internal roads, access from Nolan Street and landscape works to include native regeneration. Concept plan approval (MP10_0147) has been granted in accordance with section 750 of the *Environmental Planning and Assessment Act, 1979* (EP&A Act). The concept plan is considered State Significant Development (SSD).

The project is proposed to be undertaken in six stages. Stage 1 of the project will be assessed through the local government authority (LGA), Wollongong City Council, while stages 2-6 will be assessed at a future date. The overall project's status as a SSD, triggers the Biodiversity Offsets Scheme (BOS), and an assessment is required in accordance with the NSW Biodiversity Assessment Method (BAM) (OEH 2017a) and the *Biodiversity Conservation Act 2016* (BC Act).This BDAR has been prepared to support a Development Application (DA) for Stage 1 only. However, impacts to biodiversity have been assessed for Stages 1-6 in this report to ensure a comprehensive assessment has been provided to Council for the Stage 1 DA.

Field investigation, undertaken in accordance with the BAM, recorded 15.1 hectares of native vegetation within the study area, representing two threatened ecological communities (TECs).

Avoidance of native vegetation, TECs and threatened species habitat have been undertaken to restrict impacts. Stage 1 impacts results in 0.48 hectares of native vegetation clearing and 0.3 hectares to be managed as an Asset Protection Zone (APZ) of which 0.01 is TEC, while stages 2-6 involve clearing of 5.35 hectares of native vegetation of which 1.65 hectares is TEC. The entire project will therefore remove 5.82 hectares of native vegetation. TEC Illawarra Subtropical Rainforest in the Sydney Basin Bioregion (Endangered) and Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion (Endangered) do not meet the condition threshold for listing of the CEEC under the Commonwealth EPBC Act, as detailed in Table 2 and 3. Figure 6 shows the TECs recorded within the study area.

Plot data were entered into the BAM calculator to determine vegetation integrity score, and are presented in Appendix 3. Vegetation integrity loss for VZ1 and VZ4 were assessed as partial clearing, where the tree and groundcovers were considered to remain in its current condition, due to the APZ requiring removal of shrubs and selective tree thinning only. The vegetation integrity scores for vegetation surveyed in Stage 1are such that eight ecosystem credits, as offsets are required for all vegetation zones, as PCT 1300 and PCT 838 are both representative of an endangered ecological community, and the vegetation integrity scores are greater than 15 (Table 13).

One threatened flora species, White-flowered Wax Plant *Cynanchum elegans*, was recorded within the study area. No impacts are proposed to White-flowered Wax Plant as part of Stage 1. However Stages 2-6 are expected to impact approximately 19 individuals over an area of 0.44 hectares. Further targeted surveys and redesign of the access road have been recommended prior to any future approval submissions to the Department of Planning, Infrastructure and Environment (DPIE) for Stages 2-6 of this project.

In accordance with Section 10.3 of the BAM, offsets are required to be secured for the proposed development for ecosystem and species credits.

The project is not considered likely to result in a significant impact to species or communities listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and as such a referral to the Minister of the Environment and Energy is not required.

Stage 1 – Biodiversity assessment

1 Introduction

Biosis Pty Ltd was commissioned by TCG Planning to undertake a biodiversity assessment of the proposed Life City holistic care facility at Berkeley, NSW.

The purpose of this assessment was to apply the NSW BAM (OEH 2017a) to the proposed development, and provide TCG Planning with a Biodiversity Development Assessment Report (BDAR). The BDAR is to be submitted to Wollongong City Council to support the DA for Stage 1only, and to the Department of Planning, Infrastructure and Environment (DPIE) as part of a SSD application for the proposed future development of Stages 2-6.

1.1 Project background

Delbest proposes to develop a hi-tech holistic cancer and medical hospital facility at Warwick, Nottingham and York Street Berkeley (the study area) (Figure 1). The concept plan has been determined as a SSD and is therefore required to be entered into the BOS.

The BC Act requires that the BAM be applied to all proposals that trigger the BOS, and that a BDAR is required to be submitted to the approval authority.

The project is proposed to be undertaken in six stages. This BDAR has been prepared to support a DA to Wollongong City Council for Stage 1 only, and a future SSD application to DPIE for Stages 2-6.

1.2 Purpose of this assessment

This BDAR will:

- Address the BAM and the BOS.
- Identify how the proponent proposes to avoid and minimise impacts to biodiversity.
- Identify any potential impact that could be characterised as serious and irreversible.
- Describe the offset obligations required to compensate for any unavoidable biodiversity impacts resulting from the proposed development.
- Consider and assess the proposal in accordance with other relevant legislation such as the Commonwealth EPBC Act.

All biodiversity assessments have been undertaken in accordance with the BAM, and this BDAR has been prepared by Accredited Assessor Mark Feeney (BAAS18067), and reviewed by Accredited Assessor Callan Wharfe (BAAS18138).

1.3 The subject land

The subject land is defined as the total area of proposed disturbance, encompassing the proposed development footprint and all areas that could be disturbed during construction (e.g. plant laydown, road batters, Asset Protection Zone [APZ] management, and access tracks). Figure 1 shows the entire disturbance footprint for all stages. Note only the APZ for Stage 1 has been identified as distinct from the overall footprint as this report supports the DA for Stage 1 only. The APZ for stages 2-6 has been incorporated in the overall disturbance footprint to provide context for the future stages of the development..

The subject land, includes entire development, which consists of Stages 1-6, and is approximately 9.19 hectares in area. The site comprises Lot 4 DP258635 of Warwick Street, Lot 2 DP 534116 of Nottingham Street and Lot 2 DP249814 of York Street, Berkeley. The north-west boundary of the subject land is adjacent to the Princess Motorway and Northcliffe Drive is located 300 metres to the south-west. Unanderra is the neighbouring suburb to the north and Kembla Grange to the West, with the Wollongong CBD is approximately 7 kilometres to the north-east.

The subject land is located in the Wollongong City Council Local Government Area (LGA) and the South East Local Land Services (LLS) Region. The land is zoned as R2 Low Density Residential in the north and south while the centre of the site is zoned E3 Environmental, managed under the *Wollongong Local Environmental Plan 2009* (LEP). The subject land is currently vacant and infrastructure is limited to dirt tracks and overhead power lines.

The terrain is undulating and the highest point is 74 metres above sea level. A ridge runs roughly north-east to south-west, with steeper slopes on the southern aspects. There are no watercourses within the subject land, however, a small dam is situated at a lower area close to the Princess Motorway. Vegetation on the site is dominated by Black Wattle *Acacia mearnsii* and exotic species, interspersed with regenerating Illawarra Subtropical Rainforest species and Illawarra Lowlands Grassy Woodlands species. The geology of the area between the escarpment and the coast is formed on Permian sandstone and shale with patches of basalt (Mitchell 2002).

1.4 The study area

The study area encompasses the subject land and includes areas outside of the subject land that could be indirectly impacted by the proposal including adjacent areas downslope where there may be minor changes to hydrology through alteration to overland flow patterns.

Legend

- Study area

Subject land

- Stage 1
- Stages 2-6
- IBRA Sub-region
- Proposed development
- Asset protection zone (APZ)

Figure 1 Site map

0 50 100 150

Metres
Scale: 1:3,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55

N

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Matter: 30681
Date: 13 December 2019,
Checked by: MFF, Drawn by: AEDM, Last edited by: amurray
Location:P:\30600s\30681\Mapping
30681_BDAR_F1_SiteMap

Acknowledgements: Basemap © Land and Property Information 2016, Imagery © NearMap

1.5 Sources of information

Sources of information used in the assessment included relevant databases, spatial data, literature and previous site reports.

In order to provide a context for the study area, records of flora and fauna from within 5 kilometres (the locality) were collated from the following databases and were reviewed:

- Commonwealth Department of the Environment and Energy (DEE) Protected Matters Search Tool for matters protected by the EPBC Act.
- BioNet Atlas of NSW Wildlife, for species, populations and ecological communities listed under the BC Act.
- PlantNET (The Royal Botanic Gardens and Domain Trust).
- BirdLife Australia, the New Atlas of Australian Birds 1998-2015.

Other sources of biodiversity information relevant to the study area were sourced from:

- The NSW Plant Community Types (PCTs), as held within the BioNet Vegetation Classification database (EES 2019b).
- Relevant vegetation mapping, such as *South East Local Land Services Biometric Vegetation Map, 2014. VIS_ID 4211* (OEH 2014).

The following reports were also reviewed and relied on to provide additional information:

- Kevin Mills & Associates, 2012. Flora and Fauna Assessment.
- Ecological 2019. Bushfire Protection Assessment: Stage 1 Life City Berkeley.
- Boss Design PTY LTD 2019. Stage 1 Life City Wollongong Architectural Drawings.

Basemap data was obtained from NSW Land and property information (LPI) 1:25,000 digital topographic databases, with cadastral data obtained from LPI digital cadastral database.

The following spatial datasets were utilised during the development of this report:

- Catchment Boundaries of New South Wales dataset.
- Mitchell Landscapes Version 3.0.
- Interim Biogeographic Regionalisation of Australia (IBRA) Version 7.
- Directory of Important Wetlands (DoIW).
- State Environmental Planning Policy (SEPP) Coastal Management 2018.
- Spatial data associated with *South East Local Land Services Biometric Vegetation Map, 2014. VIS_ID 4211* (OEH 2014).
- NSW Soil and Land Information System (SALIS).

Mapping has been produced using a Geographic Information System (GIS). The following maps and data have been provided:

- Digital mapping with aerial photography showing 1:1000 or finer.
- Site map as described in subsection 4.2.1.1 of the BAM.

- Location Map as described in subsection 4.2.1.2 of the BAM.
- Landscape map with features including 1500 metre buffer, as described in section 4.2.1.3 of the BAM.

Mapping was conducted using hand-held (uncorrected) GPS units (GDA94), mobile tablet computers running Collector for ArcGIS and aerial photo interpretation. The accuracy of this mapping is therefore subject to the accuracy of the GPS units (generally ± 5 metres) and dependent on the limitations of aerial photo rectification and registration.

1.6 Legislative requirements

The project has been assessed against relevant biodiversity legislation and government policy, including:

- *Environment Protection and Biodiversity Conservation Act 1999*
- *Environmental Planning and Assessment Act 1979*
- *Biodiversity Conservation Act 2016*
- *Biosecurity Act 2015*
- State Environmental Planning Policy 44 Koala Habitat Protection
- *Wollongong City Council LEP 2009*

2 Landscape context

This chapter describes the landscape and site context of the subject land, describing the landscape features present within the subject land and within a 1500 metre buffer, as required by the BAM (OEH 2017a). Figure 2 shows the location of the subject land and landscape features within the 1500 metre buffer.

2.1 Landscape features

2.1.1 Bioregions

The study area occurs within the Sydney Basin IBRA bioregion and the Illawarra IBRA subregion. The Sydney Basin Bioregion lies on the central east coast of NSW and covers an area of approximately 3,624,008 hectares. It occupies about 4.53% of NSW and is one of two bioregions contained wholly within the state. The bioregion extends from just north of Batemans Bay to Nelson Bay on the central coast, and almost as far west as Mudgee. The bioregion is bordered to the north by the Brigalow Belt South and North Coast bioregions, to the south by the South East Corner Bioregion and to the west by the South Eastern Highlands and South Western Slopes bioregions. The Sydney Basin Bioregion is one of the most species diverse in Australia. This is a result of the variety of rock types, topography and climates in the bioregion (OEH 2016a).

2.1.2 NSW (Mitchell) Landscape

The study area occurs within the Kiama Coastal Slopes Mitchell Landscape. Comparable to the Dapto-Wollongong slopes but with higher relief, steep slopes and higher rainfall. Maximum elevation 250m, relief 160m. Well-structured red-brown loam with gradational profiles is widespread on the Gerringong volcanics of trachyte, latite and tuff. Sandstone is less common but tends to form steep slopes with texture-contrast soils marginal to the adjacent escarpment. Extensively cleared but originally had a wide distribution of rainforest elements; Cabbage Palm *Livistona australis*, Scentless Rosewood *Synoum glandulosum*, Brush Cherry *Syzygium australe*, Black Apple *Planchonella australis*, Plum Pine *Podocarpus elatus* amongst Turpentine *Syncarpia glomulifera* and Grey Ironbark *Eucalyptus paniculata* and River Oak *Casuarina cunninghamiana* along the streams (Mitchell 2002).

2.1.3 Soil

The subject land falls predominantly within the Gwynneville soil landscape (Residual – Regw) of the Wollongong/Port Hacking 1:100,000 soil landscape map (Hazelton and Tille 1990) with a small area of Berkeley soil landscape in the south eastern corner of the site.

The Gwynneville soil landscape is characterised as footslopes of the Illawarra Escarpment and isolated rises of the Wollongong Plain. Local relief 10 metre to 70 metre, slopes 3 to 25%. Broad to moderately (250 metres to 850 metres) rounded ridges and gently to steeply inclined slopes. Structural benches and occasional rock outcrop. Soils within this landscape consist of shallow brown podzolic soils and xanthozems on upper slopes, lithosols on simple slopes and shallow brown earths on midslopes and lower slopes. Limitations include extreme erosion hazard, steep slopes, mass movement hazard, local flooding. Reactive subsoils and impermeable, low wet bearing strength clay subsoils.

The Berkeley soil landscape is characterised by rolling to steep low hills and foot-slopes and gently undulating valley floors on volcanic sediments. Up to 20% of crests and upper slopes are covered by minor rock outcrops occurring as small knobs and caps. Local relief is usually 50-100 metres and slope gradients 10-15%. Soils are shallow (<50 centimetres) stony Chocolate Soils/Prairie Soils on crest and upper slopes. Deep (up to two metres) red Krasnozems and brown Krasnozems, Red Podzolic Soils and localised Prairie Soil on mid to lower slopes

grading into Yellow Podsolic Soil in areas of poor drainage. Limitations include mass movement hazard, extreme erosion hazard, reactive subsiols and locally impeded drainage (Hazelton and Tille 1990).

2.1.4 Native vegetation extent

Vegetation within the study area and within the 1500 metre buffer area was assessed using aerial photographic interpretation, field survey results and existing vegetation mapping. Table 1 provides the list of PCTs identified from existing vegetation mapping, and the current assessment, as occurring within the study area and within the 1500 metre buffer. Conservation status of the communities is also provided.

Table 1 PCTs Identified within the Study Area and 1500m Buffer

PCT – mapped OEH 2014 and Biosis 2019	Conservation Status	Subject land	Study area	1500 m buffer
1300 Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion	Endangered BC Act Critically Endangered EPBC Act	1.55	10.29	12.48
838 Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	Endangered BC Act Critically Endangered EPBC Act	4.27	4.85	11.29
906 Lilly Pilly - Sassafras - Stinging Tree subtropical/warm temperate rainforest on moist fertile lowlands, southern Sydney Basin Bioregion	Endangered BC Act Critically Endangered EPBC Act	0	0	0.06
1078 Prickly Tea-tree - sedge wet heath on sandstone plateaux, central and southern Sydney Basin Bioregion	Endangered BC Act Endangered EPBC Act	0	0	12.16
1326 Woollybutt - White Stringybark - Forest Red Gum grassy woodland on coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion	Endangered BC Act Critically Endangered EPBC Act	0	0	2.31
1126 Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	Endangered BC Act Vulnerable EPBC Act	0	0	3.78
781 Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion	Endangered BC Act	0	0	16.67
1245 Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion	N/A	0	0	2.99
1913 Seagrass meadows of the estuaries and lagoons of the New South Wales coast	Endangered EPBC Act	0	0	0.58

2.1.5 Cleared areas

Parts of the study area mapped as planted natives and exotic grasses with no native over storey or mid storey cover and less than 50% cover of native groundcover have been defined as cleared land. Similarly areas within the 1500 metre buffer that showed no mid-storey or canopy cover on aerial imagery were not considered as native vegetation due to the urban context of the surrounding area. Roads, buildings and other infrastructure were also considered as cleared lands. A total of 814.08 hectares of cleared land occurs within the study area and 1500 metre buffer.

2.1.6 Differences between mapped vegetation extent and aerial imagery

Within the 1500 metre buffer there was a significant difference between mapped vegetation extent and vegetation visible on aerial imagery. Patches of vegetation shown on the aerial imagery that were not mapped were assumed to be native and amounted to 106.95 hectares. The mapped vegetation extent totalled 62.33 hectares, therefore a combined total of 169.28 hectares of native vegetation is shown in Figure 3.

An area of 0.63 hectares of TEC *Illawarra Subtropical Rainforest in the Sydney Basin Bioregion* is mapped within the study area, however aerial imagery showed this to be a part of a larger patch of native vegetation. Field surveys confirmed that the extent of this patch was 15.1 hectares, and further, 4.48 hectares, was identified as Illawarra Subtropical Rainforest as compared to the mapped 0.63 hectares. Additionally, 0.60 hectares of TEC Illawarra Lowlands Grassy Woodlands in the Sydney Basin Bioregion was identified in the study area, which was not shown on mapping records (Figure 4).

A small area of vegetation between the study area and mapped vegetation to the south east of the study area is visible on aerial imagery. This vegetation was investigated in the field due to its potential impact on patch sizes in the study area. The vegetation was found not to be intact due to a lack of native species in all structural layers and therefore does not contribute to the a broader patch.

2.1.7 Rivers, streams and wetlands

The study area is located within the South East LLS Region and the Lake Illawarra catchment. The closest river-mouth is the Lake Illawarra entrance located approximately 8.5 kilometres to the south-east of the study area. The closest major waterbody is Lake Illawarra, located approximately 1.5 kilometres to the south-east of the site.

There are no streams in the study area and no tributaries originating from the site. Hooka Creek and Mullet Creek are the closest down-gradient streams.

There are no Key Fish Habitats as mapped by the NSW Department of Primary Industries (DPI) within the study area (DPI 2013).

There are no important wetlands in the study area as listed in the DoIW.

2.1.8 Connectivity features

Surrounding vegetation occurs as small patches within a matrix of residential development. A major highway bounds the western edge of the study area, previously cleared walking tracks and small vehicle tracks provide another level of disturbance. High abundance of weeds disrupts the native vegetation (refer to Section 3). A single dam on the western edge could provide foraging habitat for some migratory bird species. However, as the only fringing vegetation is comprised of groundcover dominated by exotics, there are no hollow-bearing trees in the study area, the absence of water during dry periods, and the small size of the dam, it is considered poor foraging habitat. Recovering rainforest species and Acacia spp. would serve as refuge for migratory birds and birds moving between habitat areas. The closest watercourse, Hooka Creek, is located 1 kilometre south of the study area and Lake Illawarra lies 1.5 kilometres to the south. There is no intact vegetation within 100 metres of the study area to provide a larger vegetation patch for connectivity. The high level of disturbance throughout the site and its surrounds provides poor connectivity.

2.1.9 Areas of geological significance

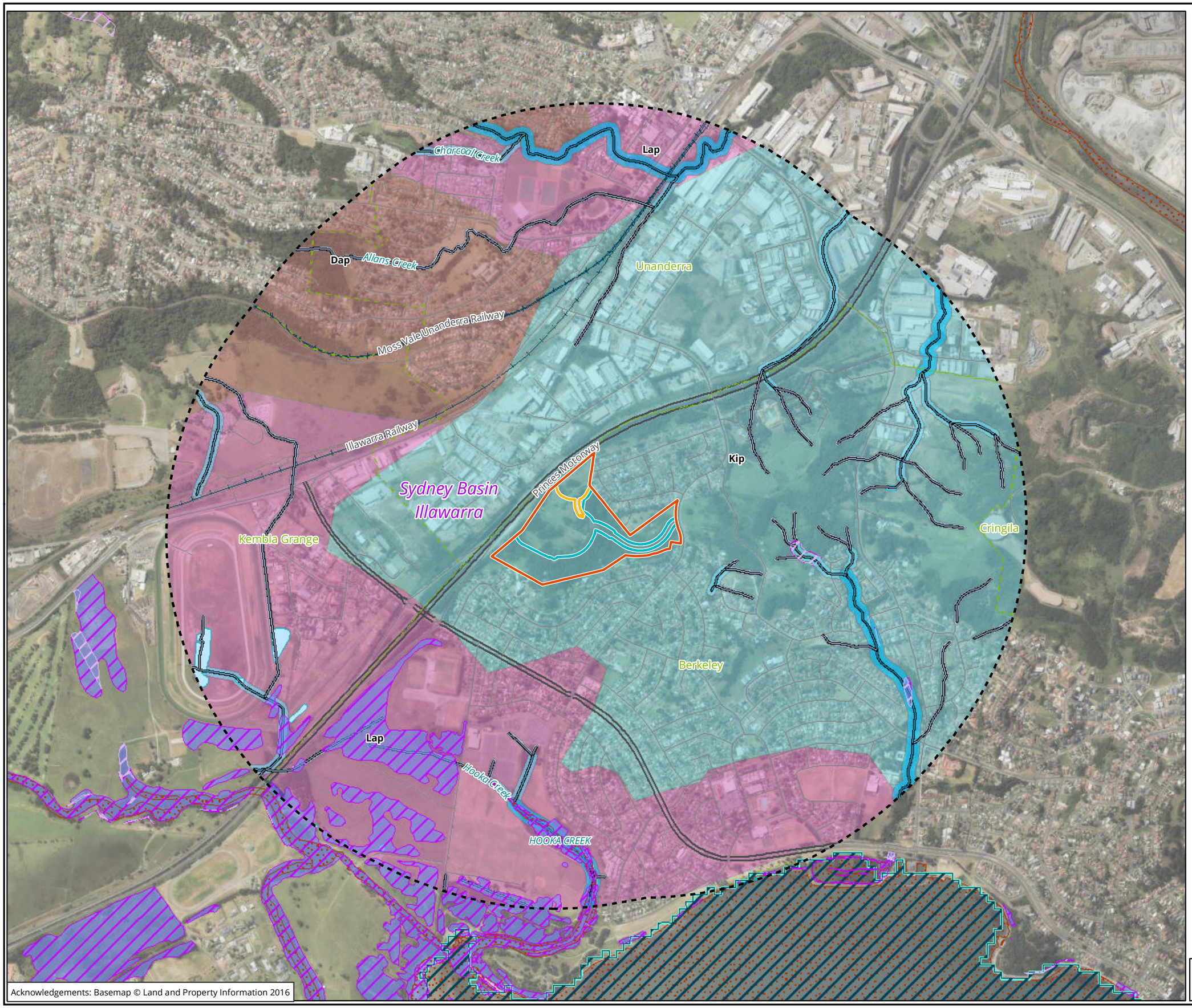
There were no recorded karst, caves, crevices, cliffs or other areas of geological significance within the study area or within the 1500 metre buffer area surrounding the study area.

2.1.10 Biodiversity Values Map

The biodiversity values mapping showed no areas of outstanding biodiversity or Biodiversity Values within the study area (OEH 2019a). Although the South East Local Land Services Biometric Map showed 0.63 hectares of Illawarra Subtropical Rainforest. Surveys within the study area identified a larger extent of 4.48 hectares of Illawarra Subtropical Rainforest and 0.60 hectares of Illawarra Lowlands Grassy Woodlands.

2.1.11 Soil hazard features

The south-west edge of the study area is mapped as class five acid sulfate soils. Acid sulfate soils are not typically found in class 5 areas but are located within 500 metres of a higher class acid sulfate area (Stone et al. 1998). As the class 5 area is not within the subject land and is unlikely to contain acid sulfate soils, no further assessment was considered necessary.



Legend

- Study area
- Stage 1
- Stages 2-6
- Study area 1500m buffer
- IBRA Sub-region

Biodiversity Values

- Biodiversity Values older than 90 days
- Biodiversity Values added in the last 90 days

HydroLine stream order

- 1
- 2
- 3
- Directory of Important Wetlands of Australia (DIWA)
- Local wetlands
- Estuaries
- Coastal Wetlands

Mitchell landscape V3

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

Figure 2.1 Location Map

0 200 400 600 800

Metres
Scale: 1:15,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

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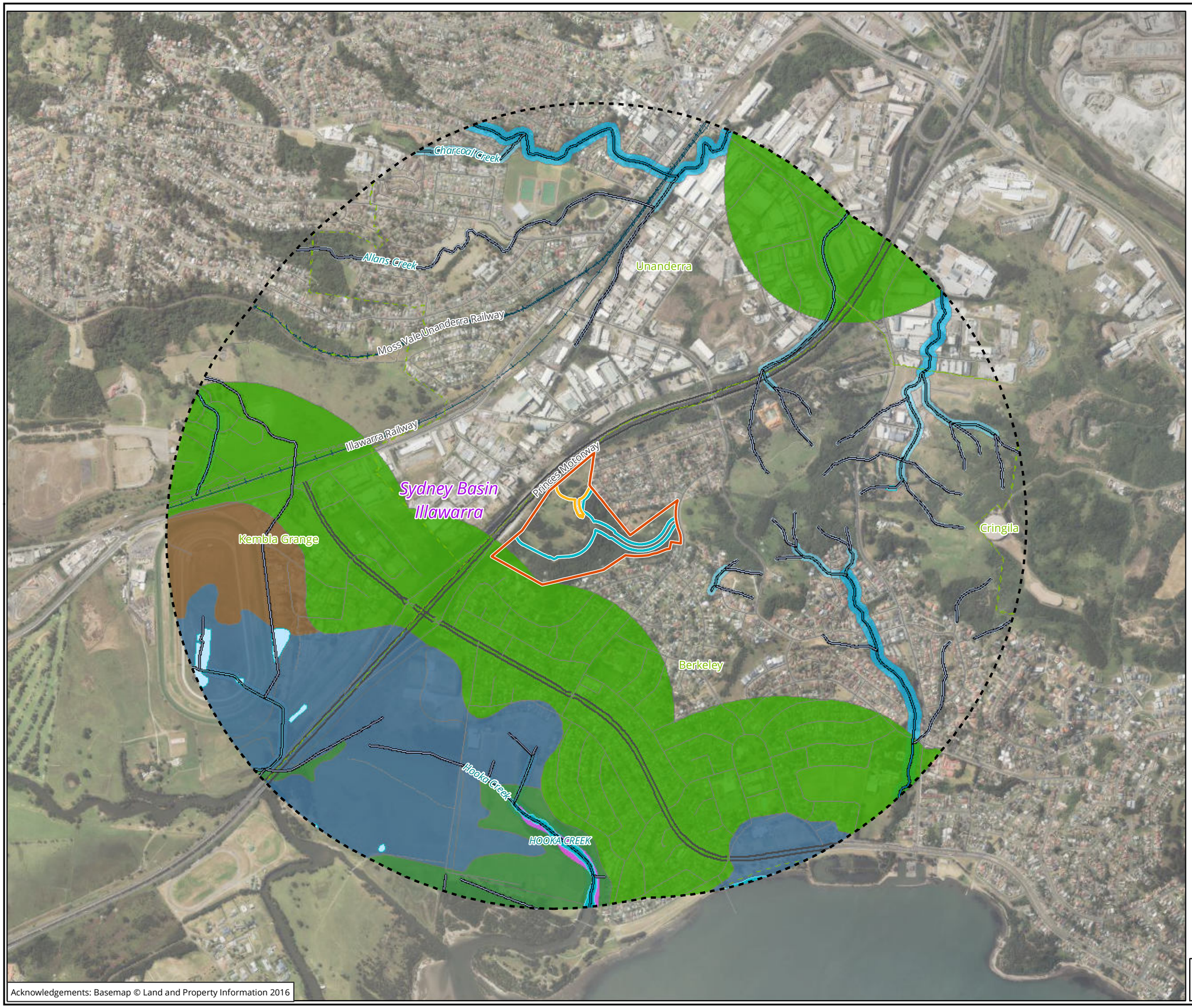

Legend

- Study area
- Stage 1
- Stages 2-6
- Study area 1500m buffer
- IBRA Sub-region

EPI - Acid Sulfate Soils

- Class 1
- Class 2
- Class 3
- Class 4
- Class 5

HydroLine stream order

- 1
- 2
- 3

HydroLine stream order buffers

- 1
- 2
- 3
- 6

Figure 2.2 Location Map

0 200 400 600 800

Metres
Scale: 1:15,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

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2.2 Site context

The site context was assessed using a site-based method undertaken 9 and 16 October and 6 December 2019. The habitats and vegetation within the study area are a small subset of those in the wider landscape.

2.2.1 Native vegetation cover

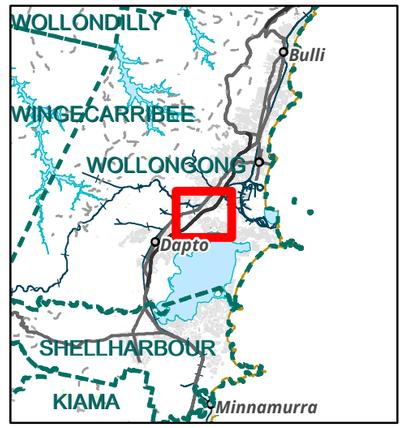
Native vegetation cover was assessed using GIS based on the most suitable vegetation mapping, in this case the *South East Local Land Services Biometric Vegetation Map, 2014. VIS_ID 4211* (OEH 2014).

Native vegetation cover within the 1500 metre buffer was found to be 17.21% (169.28 hectares).

2.2.2 Patch size

Patch size was assessed as per the BAM (OEH 2017a) using a select process in ArcGIS. All intact vegetation that has a gap of less than or equal to 100 metres for woody vegetation and less than or equal to 30 metres for non-woody vegetation from the next area of native vegetation is considered to be of the same patch.

Vegetation within the study area meeting this criteria was mapped as one large patch and it was found to be isolated from surrounding patches. Roadside vegetation was not included in the patch size due to the lack of native vegetation in all structural layers. The patch size was found to be 15.1 hectares and contained within the study area.



Legend

- Study area

Subject land

- Stage 1
- Stages 2-6
- Study area 1500m buffer
- Native vegetation
- Habitat connectivity

Figure 3 Native vegetation and connectivity

0 200 400 600 800

Metres
Scale: 1:15,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55

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30681_BDAR_F3_NativeVeg

Acknowledgements: Basemap © Land and Property Information 2016

3 Native vegetation

The extent of native vegetation and TECs and the vegetation integrity within the study area was determined using the results of site investigations and Chapter 5 and Appendix 6 of the BAM (OEH 2017a).

3.1 Methods

3.1.1 Background review

Regional vegetation mapping OEH (OEH 2014) and database searches (See Section 1.4) were reviewed to inform the site investigations. Based on the results of the background review and the requirements of the BAM with respect to this BDAR, appropriate surveys were designed for the study area and impact area.

3.1.2 Field investigation

The biodiversity assessment was conducted on 9 and 16 October and 6 December 2019 under the terms of Biosis' Scientific Licence issued by the EES under the *National Parks and Wildlife Act 1974* (SL100758, expiry date 31 March 2020). Fauna survey was conducted under approval 11/355 from the NSW Animal Care and Ethics Committee (expiry date 31 January 2020). The BAM Assessment was carried out by Mark Feeney (BAAS18067).

The study area was surveyed in accordance with the BAM (OEH 2017a), which involved:

- The identification and mapping of PCTs according to the structural definitions of South East Land Services Biometric Vegetation map (OEH 2014).
- The identification of native and exotic plant species, according to the Flora of NSW (Harden 1992, 1993, 2000, 2002) with reference to recent taxonomic changes.
- Undertaking floristic plots within each vegetation zone in accordance with Section 5 of the BAM (OEH 2017a).
- Targeted searches for plant species of conservation significance according to the *NSW Guide to surveying Threatened Plants* (OEH 2016b).
- Incidental observations using the "random meander" method (Cropper 1993).
- Identifying fauna habitats, assessing their condition and assessing their value to threatened fauna species.
- Observations of animal activity and searches for indirect evidence of fauna (such as scats, nests, burrows, hollows, tracks, scratches and diggings).
- An assessment of the natural resilience of the vegetation of the site.
- Identification of previous and current factors threatening the ecological function and survival of native vegetation within and adjacent to the study area.

The conservation significance of plant species and plant communities was determined according to:

- BC Act for significance within NSW.
- EPBC Act for significance within Australia.

Detailed mapping of PCTs was conducted using hand-held (uncorrected) tablet units (Samsung Galaxy Tab 3) using the ArcGIS Collector application and aerial photo interpretation. Areas of native vegetation for which a PCT

could validly be assigned were identified and delineated in the field, and their condition determined. Identification of PCTs within the study area was confirmed with reference to the community profile descriptors (and diagnostic species tests) held within the (2016a) mapping project and NSW BioNet Vegetation Classification database (OEH 2019b). Locations of floristic plots surveyed are shown on Figure 4.

3.2 Results

3.2.1 Vegetation description

The study area supports 15.1 hectares of native vegetation with varying levels of disturbance. Black Wattle was dominant in all native vegetation and all vegetation zones had high abundance of exotic species, in particular Lantana. Subtropical rainforest species were identified over an area of 4.48 hectares, although there was low abundance of mature trees and canopy cover was patchy. Forest Red Gums *Eucalyptus tereticornis* were identified in two locations, however there was a large amount of weeds in the mid-storey and groundcover in these areas. Patches of native grassland totalled 0.23 hectares and cleared land dominated by exotic grasses was measured at 4 hectares.

Parts of the study area mapped as planted natives and exotic grasses (Figure 4) with no native over storey or mid storey cover, and less than 50% cover of native groundcover met the definition of cleared land and were not mapped as native vegetation.

3.2.2 Native vegetation extent

Figure 4 provides a map of the native vegetation extent recorded within the study area and subject land, as assessed during field investigations undertaken in October 2019. The figure includes all areas of native vegetation (native ground cover and areas with canopy). Areas not shown as native vegetation cover within Figure 4, and which do not provide habitat for threatened species, are not included for further assessment in accordance with Section 5.1.1.5 of the BAM (OEH 2017a).

3.2.3 Plant community types

The following PCTs were assessed as present within the within the study area:

- PCT 1300 *Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion* (Table 2).
- PCT 838 *Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion* (Table 3).

Table 2 and 3 provide detailed descriptions of the PCTs recorded within the study area. PCTs recorded within the study area are shown on Figure 4.

Table 2 Vegetation description – PCT 1300

PCT 1300: Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion	
Vegetation formation	Rainforests
Vegetation class	Subtropical rainforests
Extent within study area	10.29 ha
Extent within subject land	1.55 ha
Condition	This community within the subject land was recorded in a moderate condition state (1.3 ha), and low condition state (0.35 ha).

PCT 1300: Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion	
	A description of each condition is provided below.
Description: **VZ 1 PCT 1300 Whalebone Tree Weedy**	Occurs mainly on dry slopes on fertile soils below about 300 m in the Illawarra-Kiama and Milton areas. Low closed forest with prominent shrub stratum and sparse groundcover. (OEH 2017b). Within the study area this community existed on darker volcanic soils mid-slope, with native species present in all strata. Brush Kurrajong *Commersonia fraseri* was the most abundant rainforest native species in the mid-storey, although equivalent cover was provided by Black Wattle. Whalebone tree *Streblus brunonianus,* a key indicator species for the PCT was also present. The mid-storey is however, dominated by Lantana *Lantana camara*, with native grasses and forbs dominating the ground cover.
Description: **VZ5 PCT 1300 Low**	VZ5 consisted of an absent canopy. A mid storey dominated by Black Wattle *Acacia mearnsii,* and Maiden's Wattle *Acacia maidenii,* with scattered occurrences of Coffee Bush *Breynia oblongifolia*, and native groundcover of Kidney Weed *Dichondra repens*, Weeping Grass *Microlaena stipoides* and *Carex longebrachiata.* Exotic species present included the priority weeds Crofton Weed *Argentina adenophora,* Moth Vine *Araujia sericifera*, Cobbler's Pegs *Bidens pilosa,* Lantana and Narrow Leafed Privet *Ligustrum sinense.*
Survey effort	One BAM plots and targeted flora surveys within VZ1 and one BAM plot within VZ5.
Justification of PCT	• The study area is within the Sydney Basin IBRA bioregion and the Illawarra (SYB12) sub-region. • Occurs at the study area at approximately 70 m above sea level on a sloping gradient, consistent with diagnostics for the PCT. • VZ1: Whalebone tree, Cockspur Thorn *Maclura cochinchinensis,* Whalebone Tree, Brush Kurrajong and other species associated with the PCT were identified. The BioNet PCT Identification tool identified PCT 1300 from the species recorded at the subject land. • VZ 5: Given there is no PCT specific to 'Acacia Scrub' in BioNet. PCT 1300, was assigned to this vegetation zone, in accordance with Section 5.2 of the BAM, based on the IBRA sub-region and location of the vegetation within the landscape.
TEC Status	**NSW BC Act:** Illawarra Subtropical Rainforest in the Sydney Basin Bioregion (Endangered). **Commonwealth EPBC Act:** The PCT within the study area does not meet the condition threshold under the Commonwealth EPBC Act listing for Illawarra-Shoalhaven Subtropical Rainforest of the Sydney Basin Bioregion Critically Endangered Ecological Community (CEEC), due to the native canopy cover occurring as less than 30%.
Estimate of percent cleared value of PCT	90%

PCT 1300: Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion	
Image: **VZ1 PCT 1300 Whalebone Tree Weedy**	
Image: **VZ5 PCT 1300 Low**	

Table 3 Vegetation description – PCT 838

PCT 838: Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	
Vegetation formation	Grassy woodlands
Vegetation class	Coastal valley grassy woodlands
Extent in study area	4.85 ha
Extent within subject land	4.27 ha
Condition	This community within the subject land was recorded in a moderate condition state (0.36 ha), and low condition state (3.68 ha) and occurs as a derived native grassland (DNG) (0.23 ha). A description of each condition is provided below.
Description: VZ4 PCT 838 Forest Red Gum Moderate	Occurs as an open grassy woodland which occurs on lower slopes in coastal rain-shadow valleys, below 350m ASL, from Wollongong to Milton and west to Yalwal (OEH 2017b). The canopy consists of Forest Red Gum, with an open shrub layer of Black Wattle, Coffee Bush, Wombat Berry *Eustrephus latifolius* and *Myrsine variabilis.* Lantana was dominant in scattered occurrence throughout the mid-storey. The ground cover was dominated by, Weeping Grass, Common Couch *Cynodon dactylon,* Kangaroo Grass *Themeda triandra*, *Carex longebrachiata,* Kidney Weed and Blue Flax-lily *Dianella caerulea.* Dominant exotic species present were Lantana, Kikuyu Grass *Cenchrus clandestinus,* Narrow Leaved Cotton Bush *Gomphocarpus fruticosus*, Shivery Grass *Briza minor.*
Description: VZ2 PCT 838 Low	VZ2 consisted of an absent canopy, mid storey dominated by Black Wattle, with scattered occurrences of Coffee Bush. A scattered native groundcover of Kidney Weed, *Carex inversa* and Blueberry Lily *Dianella longifolia.* Exotic species included the priority weeds Crofton Weed *Argentina adenophora,* Moth Vine, Cobbler's Pegs, Lantana, Large Leafed Privet *Ligustrum lucidum* and Blackberry *Rubus fruticosus.* The ground cover was dominated by the exotic grasses Rhodes Grass *Chloris gayana,* Panic Veldgrass *Ehrharta erecta,* Paspalum *Paspalum dilatatum*.
Description: VZ3 PCT 838 DNG	The DNG consisted of no canopy or mid-storey. The ground cover was dominated by >50% native species including Blady Grass *Imperata cylindrical,* Browns Lovegrass *Eragrostis brownii* and Kidney Weed. Dominant exotic species included Crofton Weed, Cobbler's Pegs, Lantana and Fireweed *Senecio madagascariensis.*
Survey effort	Four BAM plots and targeted surveys within VZ4 PCT 838 Forest Red Gum.
Justification of PCT	• The study area is within the Sydney Basin IBRA bioregion and the Illawarra (SYB12) sub-bioregion. • The community occurs at the study area lower than 350 m above sea level on a sloping gradient. • VZ4 and VZ3: The BioNet PCT Identification tool identified PCT 838 from the species recorded at the subject land. • VZ2: Given there is no PCT specific to 'Acacia Scrub' in BioNet. PCT 838, was assigned to this vegetation zone, in accordance with Section 5.2 of the BAM, based on the IBRA sub-region and location of the vegetation within the landscape.
TEC Status	**NSW BC Act:** Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion (Endangered).

PCT 838: Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	
	VZ4: PCT 838 Moderate is considered a TEC due to the presence of mature Forest Red Gum and associated characteristic species in the midstorey and groundcover. VZ2: PCT 838 Low is also considered the TEC, as the NSW Scientific Committee – final determination states that some remnants consist of regrowth after clearing or other disturbances, and 10 from the list of 72 species provided in the Scientific Determination occur within the patch. VZ3: PCT 838 DNG is not considered the TEC, as the TEC does not occur in a DNG state as describe in the Scientific Determination. In addition, no characteristic tree or shrub species are present and only four of the listed 72 characteristic species were present. **Commonwealth EPBC Act:** The PCT within the study area does not meet the condition threshold under the Commonwealth EPBC Act listing for Illawarra and South Coast Lowland Forest and Woodland CEEC. VZ4, PCT 838 Moderate: 0.36 ha occurs in the subject land and is proposed for removal. Although this vegetation zone contained mature Forest Red Gums (including a tree > 50cm DBH) the patch size is below the area threshold of 0.5 ha, as defined in the Conservation Advice (DEE, 2016). VZ2 and VZ3 do no contribute to the overall patch size of VZ4 as they are not considered Illawarra and South Coast Lowland Forest and Woodland CEEC, in accordance with the Conservation Advice (DEE, 2016). VZ2, PCT 838 Low and VZ3 PCT 838 DNG: Do not meet the key diagnostics species, and are not characterised by the plant species provided in Appendix A of the Conservation Advice (DEE, 2016), as a greater diversity, abundance and cover of exotic species occurs, as compared to native species. VZ2 and VZ3 are also not defined as 'forests' or 'woodlands', as they are absent of upper stratums and characteristic tree species. VZ3 contained only five of the listed characteristic species and was dominated by Blady Grass which had 90% cover in the plot. VZ2 did not meet the condition thresholds for perennial understorey cover (30%) and lacked any large trees of DBH >50 cm or containing hollows. VZ3 also did not contain any large trees or any key characteristic tree species. *Therefore, VZ2 and VZ3 do not contribute to the overall patch size of VZ4, and are not considered the CEEC listed under the EPBC Act.*
Estimate of percent cleared value of PCT	85%

PCT 838: Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	
Image: **VZ4 PCT 838 Forest Red Gum Moderate**	
Image: **VZ2 PCT 838 Low**	

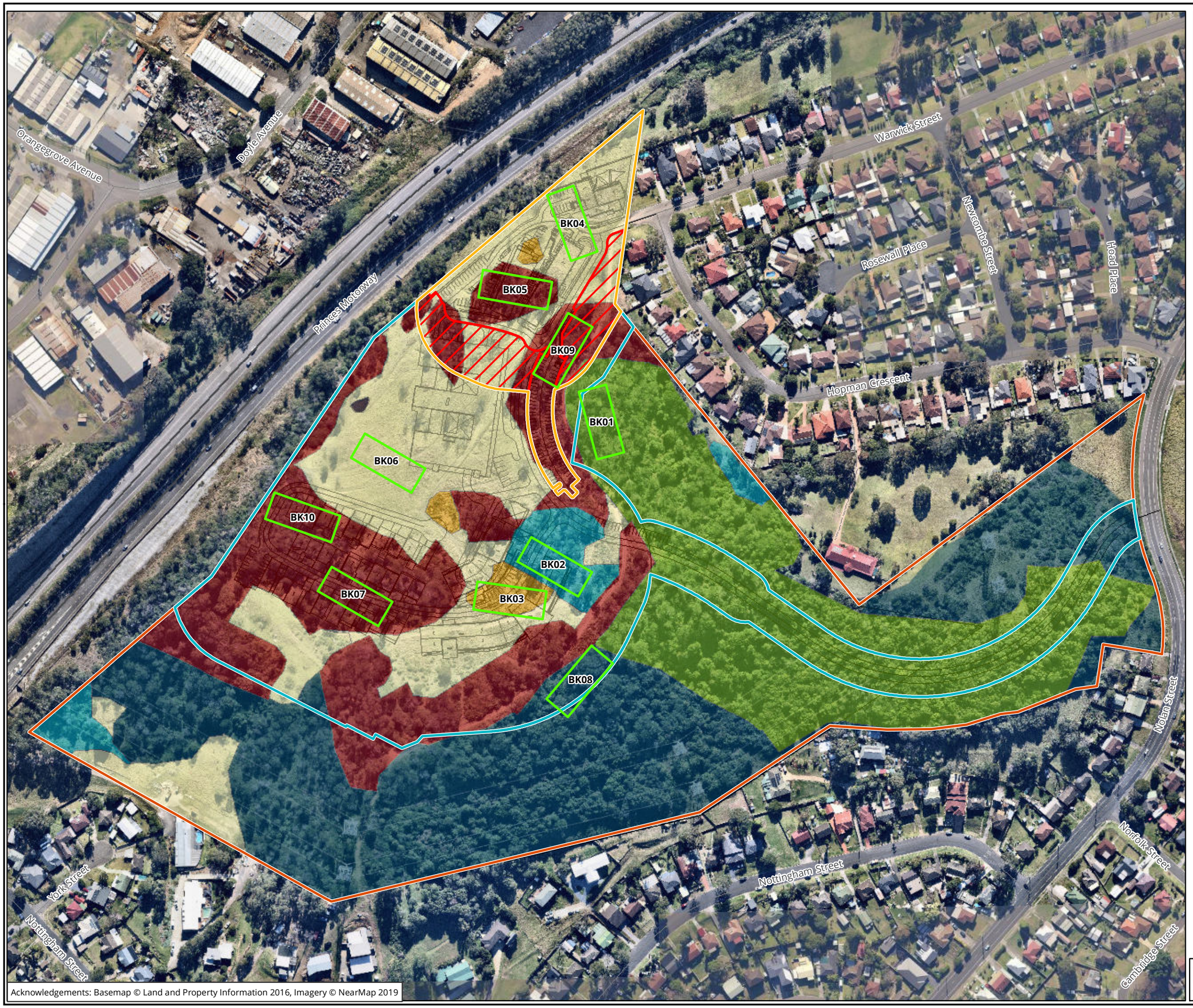
PCT 838: Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	
Image: **VZ3 PCT 838 Native Grassland**	

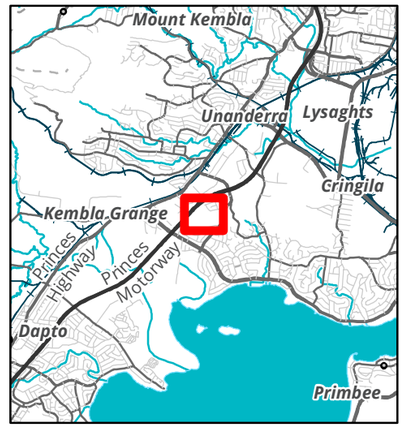
3.2.4 Threatened ecological communities

Two vegetation zones, VZ1 1300 Whalebone Tree and VZ2 and VZ4 838 Forest Red Gum, recorded within the study area were found to represent a TEC listed under the NSW BC Act:

- *Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion.*
- *Illawarra Subtropical Rainforest in the Sydney Basin Bioregion*.

Both vegetation zones do not meet the condition threshold for listing of the CEEC under the Commonwealth EPBC Act, as detailed in Table 2 and 3 above. Figure 6 shows the TECs recorded within the study area.





Legend

- Study area

Subject land

- Stage 1
- Stages 2-6
- Proposed development
- Asset protection zone (APZ)
- BAM plot

Plant community type

- PCT 1300 Acacia scrub
- PCT 1300 Whalebone tree
- PCT 838 Acacia scrub
- PCT 838 DNG
- PCT 838 Forest red gum
- Exotic grassland

Figure 4 Vegetation of the study area

0 25 50 75 100

Metres

Scale: 1:2,500 @ A3

Coordinate System: GDA 1994 MGA Zone 56

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Date: 13 December 2019,
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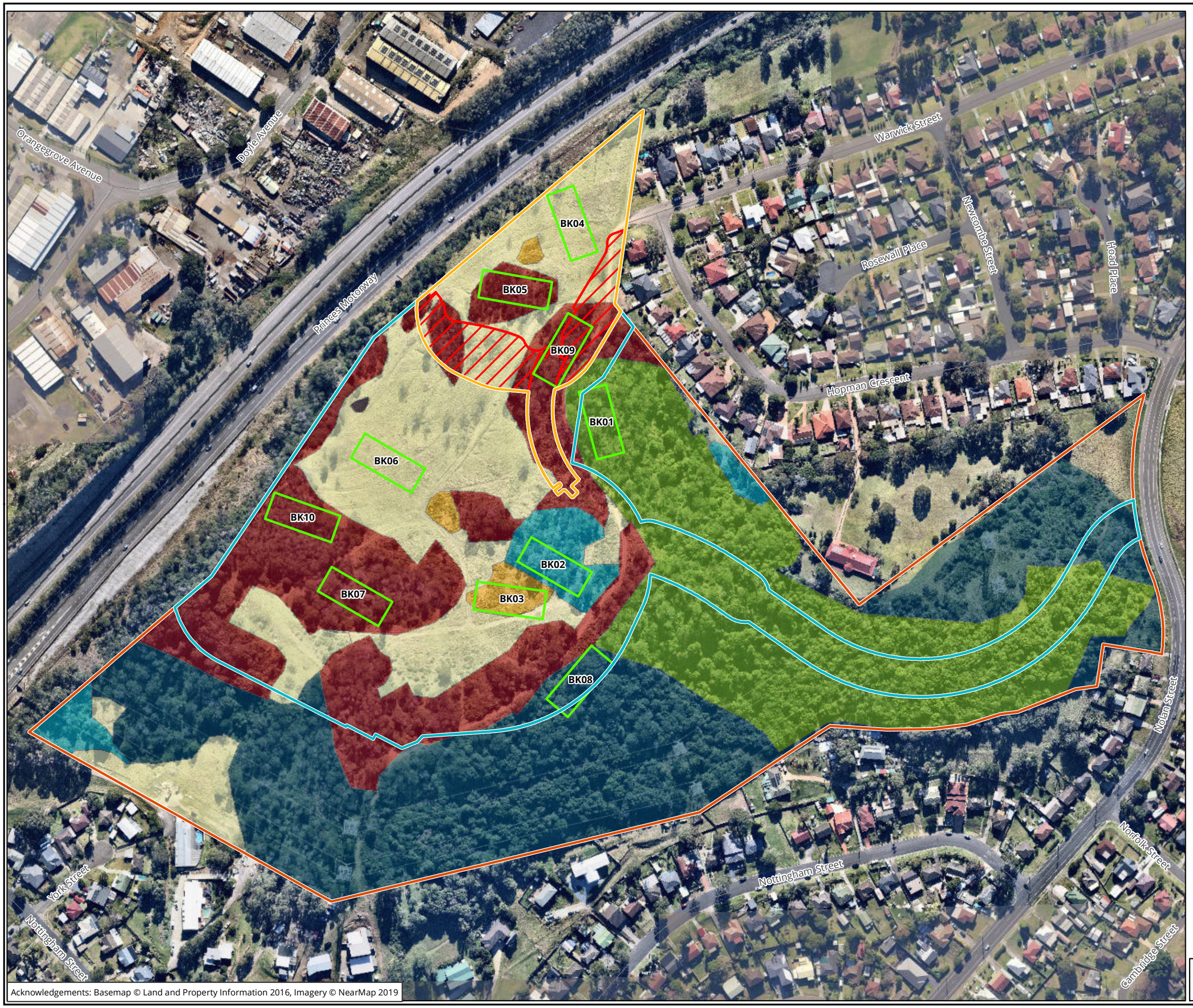

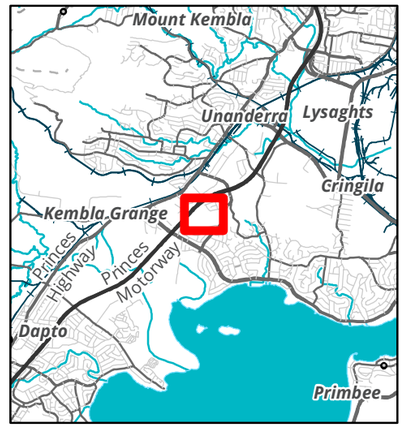

Legend

Study area

Subject land

Stage 1

Stages 2-6

Asset protection zone (APZ)

BAM plot

Vegetation zones

VZ1 - Exotic grassland

VZ2 - PCT 1300 Whalebone tree

VZ3 - PCT 838 Acacia scrub

VZ4 - PCT 838 DNG

VZ5 - PCT 838 Forest red gum

VZ6 - PCT 1300 Acacia scrub

Figure 5 Vegetation zones

0 25 50 75 100

Metres

Scale: 1:2,500 @ A3

Coordinate System: GDA 1994 MGA Zone 56

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3.3 Vegetation integrity assessment

3.3.1 Vegetation zones

PCTs within the impact area were assessed and stratified, based on broad condition state, into vegetation zones. This resulted in six vegetation zones identified within the impact area. Table 4 describes each of the zones.

Table 4 Vegetation zones mapped within the impact area

Vegetation zone	PCT	Condition	Area (ha)	Plots surveyed
VZ1	1300 Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion	Weedy	1.3	1
VZ2	838 Low	Low	3.68	4
VZ3	838 DNG	Low	0.23	1
VZ4	838 Forest Red Gum Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion	Moderate	0.36	1
VZ5	1300 Low	Low	0.27	1

3.3.2 Vegetation integrity

Vegetation integrity was assessed using data obtained from undertaking BAM plots, as per the methodology outlined in Section 5.3.4 of the BAM (OEH 2017a). Plot data was collected via:

- A 20 metre x 50 metre quadrat and 50 metre transect for assessment of site attributes and function.
- A 20 metre x 20 metre quadrat, nested within the larger quadrat for full floristic survey to determine composition and structure of the PCT.

The minimum number of BAM plots per vegetation zone was determined using Table 6 of the BAM (OEH 2017a). A total of 10 BAM plots were completed within the impact area (two within the Exotic Grassland vegetation to determine the percentage native cover and abundance only). An assessment of vegetation integrity was undertaken using benchmark data collected as outlined in Subsection 5.3.3 of the BAM. No additional local data was used for this assessment.

A list of flora species was compiled, and records of all flora species will be submitted to EES for incorporation into the Atlas of NSW Wildlife, and is included in Appendix 3.

3.3.3 Vegetation integrity score

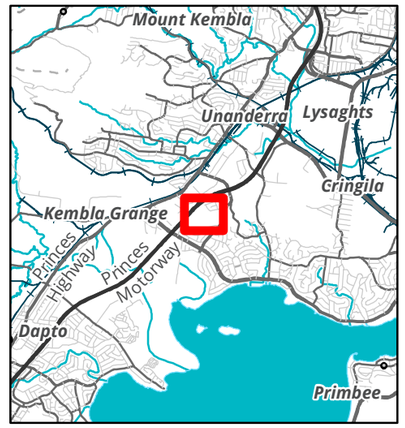
Plot data were entered into the BAM calculator to determine vegetation integrity score, and are presented in Appendix 3. Vegetation integrity loss for VZ1 and VZ4 were assessed as partial clearing, where the tree and groundcovers were considered to remain in its current condition, due to the APZ requiring removal of shrubs and selective tree thinning only. Vegetation integrity scores for the vegetation zones are provided in Table 5.

Table 5 Vegetation zone integrity scores

PCT (No)	Vegetation zone	Composition condition score	Structure condition score	Function condition score	Vegetation integrity score
1300	VZ1	47.7	20	46.5	35.4
838	VZ2	19.2	12.3	19.6	16.8
838	VZ3	15.2	43	15	21.4
838	VZ4	42.5	62	77.5	58.9
1300	VZ5	16.1	1.2	45	9.5

As outlined in Section 10.3.1 of the BAM, an offset is required for impacts on native vegetation where the vegetation integrity score is:

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



Legend

- Study area

Subject land

- Stage 1
- Stages 2-6
- Asset protection zone (APZ)

Threatened ecological communities

- PCT 1300 Whalebone tree
- PCT 838 Forest red gum
- Cynanchum elegans patch

Figure 6 Threatened flora and ecological communities

0 25 50 75 100

Metres

Scale: 1:2,500 @ A3

Coordinate System: GDA 1994 MGA Zone 56

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30681_BDAR_F6_TECs

4 Threatened species

4.1 Predicted species

A list of predicted species (ecosystem credit species) expected to occur within the subject land was refined as per Section 6 of the BAM. Impacts to these species require assessment, however targeted survey is not required as these species are assumed to occur, based on the occurrence of the PCTs and patch sizes. All predicted ecosystem credit species were assumed to occur within the study area. Table 6 lists the ecosystem credit species predicted to occur in the study area.

The potential for a species to occur within the subject land was assessed in accordance with Sections 6.3 and 6.4 of the BAM and species with geographical or habitat restrictions not matching that within the subject land were not required to be surveyed. Targeted searches were undertaken for remaining species.

In addition to these species, species previously recorded within a 5 kilometre radius of the study area were also reviewed and all species were considered with respect to their habitat requirements and potential to be impacted by the proposal. These assessments are included Appendix 2.

Table 6 Threatened ecosystem credit species (predicted species) with potential to occur

Species name	Common name
***Anthochaera phrygia* (Foraging)**	Regent Honeyeater
Artamus cyanopterus cyanopterus	Dusky Woodswallow
***Calyptorhynchus lathami* (Foraging)**	Glossy Black-Cockatoo
Dasyurus maculatus	Spotted-tailed Quoll
Glossopsitta pusilla	Little Lorikeet
Haliaeetus leucogaster	White-bellied Sea-Eagle
Lathamus discolor	Swift Parrot
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat
***Miniopterus australis* (Foraging)**	Little Bent-winged Bat
Miniopterus orianae oceanensis	Large Bent-winged Bat
Petroica boodang	Scarlet Robin
Petroica phoenicea	Flame Robin
***Phascolarctos cinereus* (Foraging)**	Koala
***Pteropus poliocephalus* (Foraging)**	Grey-headed Flying-fox
Ptilinopus superbus	Superb Fruit-Dove

4.2 Species credit species

The species listed in Table 7 were targeted in surveys, and have been considered in the impact management and mitigation measures recommended for this proposal. Habitat for these species was considered to be potentially present within the subject land and as such targeted survey was required to discount presence.

Table 7 Threatened species credit species (candidate species) targeted in surveys

Species name	Common name
Flora	
Chorizema parviflorum	Eastern Flame Pea
Cynanchum elegans	White-flowered Wax Plant
Daphnandra johnsonii	Illawarra Socketwood
Gossia acmenoides	Scrub Ironwood
Pimelea curviflora* var. *curviflora	
Rhodamnia rubescens	Scrub Turpentine
Senna acclinis	Rainforest Cassia
Solanum celatum	
Zieria granulata	Illawarra Zieria

No targeted survey for fauna species listed as Species Credit Species was undertaken due to the nature of the habitats present within the subject land and study area more broadly.

Further information on the presence and condition of habitats for Species Credit Species within the subject land and study area, and the requirement for targeted survey is included in Appendix 2.

4.3 Threatened species surveys

Targeted flora survey and fauna habitat assessments at the subject land were undertaken on 9 October 2019 by botanist Rebecca Dwyer and Zoologist Byron Dale. Targeted flora survey of the study area was undertaken on 16 October and 6 December by Restoration Ecologists Paul Price and Mark Feeney. Weather observations for each survey date are shown in Table 9.

Table 8 Weather observations during flora and fauna surveys (Albion Park, NSW)

Survey undertaken	Survey date	Temperature (°C)		Rain (mm)
		Min.	Max.	
Habitat assessment and targeted flora	09/10/2019	10.8	19.1	8.6
Targeted flora surveys	16/10/2019	12.6	25.5	0
Targeted flora surveys	6/12/2019	11.7	29.7	0

Information from the Australian Government Bureau of Meteorology website.

4.3.1 Threatened flora habitat and survey

The habitats for threatened flora species at the subject land and within the study area have been degraded through clearing, and past and ongoing feral deer grazing. The habitats consist of poor condition partially cleared woodland, and derived wet forests and shrublands dominated by pioneer species, such as wattles. Weeds such as Lantana also occur in dense thickets.

Table 7 lists the threatened flora species targeted in surveys at the subject land. Surveys were undertaken over two days, in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016). Threatened flora species were considered with respect to their habitat requirements and potential to be impacted by the proposal. These assessments are included in Appendix 2.

One threatened flora species, White-flowered Wax Plant was recorded during the field survey. White-flowered Wax Plant is listed as Endangered under the BC Act and EPBC Act. A patch of approximately 440 square metres containing 19 individuals was recorded within the proposed road corridor during targeted surveys. It is recommended that further targeted surveys are undertaken at the assessment Stage associated with the access road in order to refine the road corridor and minimise impacts to White-flowered Wax Plant.

This population will not be impacted by Stage 1 of the project, for which the current DA approval is being sought.

4.3.2 Fauna habitat assessment and field investigation

Fauna habitat assessment was undertaken to determine whether the vegetation to be impacted by the proposed development contained microhabitats suitable to support the threatened fauna species listed in Table 6. The habitat assessments focussed on the presence of the following features within the study area:

- Hollow-bearing trees
- Large rock outcrops
- Buildings, culverts or infrastructure for microbat roosting
- Availability of flowering shrubs and feed tree species
- Condition of native vegetation and the presence of exotic species
- Condition of pools and waterways
- Quantity and type of ground litter and logs
- Searches for indirect evidence of fauna
- Evidence of previous and ongoing disturbance

Following habitat assessments, no species credit species were considered to have the potential to occur within the subject land due to the absence or degraded nature of suitable habitat. Further information is provided in Appendix 2.

4.4 Biodiversity risk weighting

Table 1 outlines the Biodiversity Risk Weighting for threatened species potentially impacted by the proposed development.

Table 9 Threatened species Biodiversity Risk Weighting

Scientific name	Common name	Biodiversity Risk	Biodiversity Risk Weighting
Flora			
Cynanchum elegans	White-flowered Wax Plant	High	2

Stage 2 – Impact assessment (biodiversity values)

5 Avoid and minimise impacts

This section identifies the potential impacts of the proposal on the biodiversity values of the study area and subject land, and includes measures taken to date and additional recommendations to assist the final design of the development to further avoid and minimise impacts on biodiversity within and surrounding the subject land and study area.

5.1 Actions to avoid/minimise project impacts

The principal means to reduce impacts on biodiversity values within the study area is to avoid and/or minimise the removal of native vegetation and fauna habitat. Additional recommendations include measures to mitigate residual impacts after all measures to avoid and minimise impacts have been considered.

Steps undertaken to avoid and minimise impacts to biodiversity are broken down into site selection and planning, construction and operation.

5.1.1 Site selection and planning

The original design for the proposed development included two additional stages of works and a much larger footprint. A concept plan is included in Appendix 6, prepared by Boss Design (November 2012), which identifies the full extent of the original design. The project has since been downsized and the location of structures has been altered which has led to a significant decrease in the total disturbance footprint.

The proposed development footprint has been selected, in part, to minimise impacts to the native vegetation and flora and fauna habitats present within the broader study area.

Due to the scale of the project, complete avoidance of impacts to threatened species and TECs was not possible. The project will likely impact on:

- *Illawarra Subtropical Rainforest in the Sydney Basin Bioregion* (Endangered, BC Act).
- *Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion* (Endangered, BC Act).
- White-flowered Wax Plant (Endangered, EPBC Act and BC Act).

An area of 1.29 hectares of weedy condition PCT 1300 Illawarra Subtropical Rainforest TEC will be removed during Stages 2-6 of the project, due to the construction of an access road from Nolan Street in the south east. Concept approval was granted by the Planning Commission of New South Wales for the project concept with an included term of approval that access would be provided from Nolan Street. As the access road is a requirement of the SSD, impacts will need to be minimised by re-aligning the road to have the least impact possible. Re-alignment of the road cannot be undertaken at this time as the current accompanying DA applies only to Stage 1. As such the impacts of the access road will be reassessed at a later stage, as part of the SSD application to DPIE for Stages 2-6.

The disturbance footprint of the project occurs predominantly on exotic grasslands at the site in order to minimise impacts to native vegetation. An area of 0.36 hectares of moderate condition PCT 838 Illawarra Lowlands Grassy Woodland was unable to be avoided and will be removed during Stages 2-6 of the development. The patch within the study area does not meet the condition threshold under the Commonwealth EPBC Act listing for *Illawarra and South Coast Lowland Forest and Woodland* CEEC, due to the area threshold of 0.5 hectares. A total of 0.24 hectares of this vegetation will be retained within the study area.

A patch of White-flowered Wax plant approximately 440 square metres occurs within the proposed road alignment. As the current DA pertains only to Stage 1 of the development, impacts to White-flowered Wax Plant should be further considered during future DAs for Stages 2-6 of this project. It is recommended that the road be re-aligned further south to minimise impacts to the White-flowered Wax Plant.

5.1.2 Construction

Mitigation measures recommended to avoid and minimise further indirect impacts to vegetation and habitats during the construction phase of the proposed development include:

- Installation of appropriate exclusion fencing around trees and vegetation to be retained in the study area.
- This would include appropriate signage such as 'No Go Zone' or 'Environmental Protection Area'.
- Identify the location of any 'No Go Zones' in site inductions and a Construction Environmental Management Plan (CEMP).
- All material stockpiles, vehicle parking and machinery storage will be located within cleared areas proposed for clearing, and not in areas of native vegetation that are to be retained.
- Where appropriate native vegetation cleared from the study area should be mulched for re-use on the site, to stabilise bare ground.
- Wet down areas to reduce dust generation during construction.
- Implementation of temporary stormwater controls during construction and to ensure that discharges to the drainage channels are consistent with existing conditions.
- Sediment and erosion control measures should be implemented prior to construction works commencing (e.g. silt fences, sediment traps), to prevent soil loss and sedimentation of local drainage. Sediment and erosion control should conform to Managing Urban Stormwater: Soils and construction – volume 1 (the 'Blue Book') and should be maintained throughout the construction period and removed following the completion of works.
- Develop a Construction Environmental Management Plan (CEMP). Prescriptions for mitigation of potential impacts of construction activities on retained native vegetation and habitat should be addressed in a site-specific CEMP. The CEMP should include all measures outlined above.

5.1.3 Operation

The following recommendations are made to avoid impacts resulting from 'operation' of the proposed development:

- Any lighting required around the facility should point towards the development and not into surrounding vegetated areas. This can be addressed by providing a lighting plan at the construction certificate phase for each stage of the development.
- Any consent issued should be conditioned to require the incorporation of adequate stormwater control measures to direct water flowing from the roads and infrastructure and to ensure that all stormwater control measures shall adhere to Australian Standards (AS/NZS 3500.3.2002).
- On-going treatment of exotic species from within retained vegetation in accordance with an approved Vegetation Management Plan should be undertaken to assist resilience and vegetation quality. This vegetation management plan shall incorporate the development application for stage 2 and later stages of the project in accordance with the requirements of Condition 5 of Concept Approval MP 10_0147.

6 Assessment of unavoidable impacts

Assessment of direct and indirect impacts unable to be avoided has been undertaken in accordance with the BAM (OEH 2017a). The following direct and indirect impacts are unable to be avoided in progressing the proposed development.

6.1 Direct impacts

Direct impacts arising from the project include:

Stage 1

- Removal of 0.45 hectares of PCT 838 Low.
- Partial removal of 0.28 hectares of PCT 838 Low (midstory only) to meet APZ standards
- Removal of 0.03 hectares of PCT 838 DNG.
- Removal of 0.80 hectares of urban native/exotic grassland.
- Partial removal of 0.01 hectares (mid-storey only) of PCT 1300 Weedy to meet APZ standards

Stages 2-6

- Removal of 0.35 hectares of PCT 1300 Low.
- Removal of 1.29 hectares of PCT 1300 Whalebone Tree (TEC).
- Removal of 3.23 hectares of PCT 838 Low.
- Removal of 0.20 hectares of PCT 838 DNG.
- Removal of 0.36 hectares of PCT 838 Forest Red Gum (TEC).
- Removal of 2.75 hectares of urban native/exotic grassland.
- Removal of 15 stems and four seedlings over an area of 0.44 hectares of threatened species White-flowered Wax Plant.

These impacts will be permanent and will occur from the outset of the development as per the relevant development stage. Mitigation measures outlined in Section 5 above will help to minimise the potential impacts to biodiversity values that remain present within the study area.

6.2 Indirect impacts

Potential indirect impacts arising from the project are outlined and addressed in Table 10 below.

Table 10 Assessment of indirect impacts

Indirect impact	Assessment / likelihood of occurrence
Stage 1	
Inadvertent impacts on adjacent habitat or vegetation.	All contractors will be inducted and notified about the sensitivity of the adjacent vegetation (see Section 5.1 above). No-Go Zones will be

Indirect impact	Assessment / likelihood of occurrence
	established to prevent impacts to adjacent retained vegetation.
Reduced viability of adjacent habitat due to edge effects.	An existing access road has already established edge effects to the vegetation on the south east of Stage 1. These impacts are not expected to vary due to development of Stage 1
Reduced viability of adjacent habitat due to noise, dust or light spill.	Increase in dust is expected during construction but not during operation. Light spill shall be minimal as the operation of Stage 1 development will be during normal business hours. Impacts from the use of outdoor lighting shall be minimised by pointing lights towards buildings rather than emanating from the buildings themselves. Noise impacts from increased traffic shall be minimised through the use of low speed limits and speed bumps.
Stages 2-6	
Inadvertent impacts on adjacent habitat or vegetation.	All contractors will be inducted and notified about the sensitivity of the adjacent vegetation (see Section 5.1 above). No-Go Zones will be established to prevent impacts to adjacent retained vegetation.
Reduced viability of adjacent habitat due to edge effects.	The access road at Nolan St will bisect vegetation in the south east of the study area. This will create a new edge through the vegetation patch, and increase the edge to area ratio of the retained vegetation. Implementation of the recommended Vegetation Management Plan will mitigate the effect of this indirect impact through the ongoing treatment of exotic species in the area.
Transport of weeds and pathogens from the site to adjacent vegetation.	Vehicle movement along the access road at Nolan St will provide a vector for weeds and may lead to the introduction of new weed species to the site and increase the abundance of existing weed species. Implementation of the recommended Vegetation Management Plan will mitigate the effect of this indirect impact through the ongoing treatment of exotic species in the area.
Reduced viability of adjacent habitat due to noise, dust or light spill.	Increased noise and dust will occur during construction works. These impacts will be managed through a Construction Environment Management Plan. Impacts from the use of outdoor lighting shall be minimised by pointing lights towards buildings rather than emanating from the buildings themselves. Noise impacts from increased traffic shall be minimised through the use of low speed limits and speed bumps.
Fragmentation of movement corridors.	No movement corridors will be impacted, however the access road from Nolan Street will fragment native vegetation in the south east.

6.3 Prescribed impacts

Assessment of prescribed biodiversity impacts are outlined and addressed in Table 11 below.

Table 11 Assessment of prescribed impacts

Prescribed impact	Assessment / likelihood of occurrence
Impacts of development on the habitat of threatened species or ecological communities associated with non-native vegetation.	A total of 3.55 ha of urban native/exotic grassland will be removed, however, there were no threatened species recorded on the subject land that rely on this habitat.
Impacts of development on the habitat of threatened species or ecological communities associated with rocks.	There were no threatened species or ecological communities recorded within the subject land that are associate with rock.
Impacts of development on the habitat of threatened species or ecological communities associated with human made structures.	The proposal will not result in this impact. There are no human made structures within the subject land or adjacent to the subject land that could be affected by the proposal.
Impacts of development on the habitat of threatened species or ecological communities associated with non-native vegetation.	No threatened species or ecological community habitat was associated with non-native vegetation.
Impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range.	The proposal will not result in this impact. There are no habitats that facilitate movement of a species across its range within the subject land.
Impacts of the development on movement of threatened species that maintains their life cycle.	The proposal will not result in this impact. The subject land does not represent an area that would interrupt movement of species.
Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities (including subsidence or upsidence resulting from underground mining or other development)	A small dam (55 m^2) will be removed from the subject land. No threatened species or ecological communities were recorded in association with the dam and due to the small size of the dam no impacts to hydrological processes are expected. Although Southern Myotis *Myotis macropus* are known to forage over dams, the dam on the subject land is not considered suitable for foraging. The dam is not considered suitable foraging habitat as it lacks fringing vegetation, there are no hollow-bearing trees or suitable habitat in the study area and the small size (50 m^2) of the dam.
Impacts of wind turbine strikes on protected animals.	The proposal will not result in this impact.
Impacts of vehicle strikes on threatened species of animals or on animals that are part of a TEC	Construction of the access road at Nolan St and access and parking from Warwick St will introduce vehicle movement at the site and increase the potential for vehicle strikes. As the vehicle speeds on these roads will be low and in the context of surrounding roads, the impacts are expected to be minimal. Furthermore, the only recorded threatened fauna species was Grey-headed Flying Fox which is unlikely to be at a greater risk for vehicle strikes due to its movements comprising flying at night.

6.4 Impacts to groundwater dependent ecosystems

The subject land is located on hilly terrain and is unlikely to contain any groundwater dependent ecosystems (GDEs). Measures to reduce any potential indirect impacts to the mapped watercourses adjacent to the study area include stormwater and runoff controls during construction and operation of the development (see Section 5.1).

6.5 Adaptive management strategy

The proposed development will not result in impacts relating to karst, caves, crevices, cliffs and other geological features of significance, subsidence and upsidence, wind turbine strikes or vehicle strikes and as such as an Adaptive Management Strategy is not considered necessary.

7 Impact summary

7.1 Thresholds for assessment and offsetting

This section outlines the thresholds for assessment and offsetting in accordance with Section 10 of the BAM. Section 10.2 of the BAM requires the BDAR to assess whether the proposed development will result in serious and irreversible impacts (SAII) to any candidate listed TEC or species.

7.1.1 Serious and irreversible impacts

The Illawarra Subtropical Rainforest TEC (PCT 1300 Whalebone Tree) is listed under NSW legislation as Endangered and is newly listed (as of 5 September 2019) as Critically Endangered under Commonwealth legislation. The TEC is listed in the BioNet Threatened Biodiversity Data Collection as a SAII in NSW as it aligns with the EPBC Act Critically Endangered *Illawarra-Shoalhaven Subtropical Rainforest of the Sydney Basin Bioregion* TEC. Given the absence of definitive impact thresholds stated for the community, the potential for serious and irreversible impact will be determined by the consent authority, guided by the additional assessment regarding this EEC in Table 12.

Table 12 Assessment of SAII for Illawarra Subtropical Rainforest EEC

Information required (BAM Section 10.2.2)	Response
a. the action and measures taken to avoid the direct and indirect impact on the potential entity for a SAII	Measures undertaken by the proponent to avoid and minimise impact to the EEC (PCT 1334) are provided in Section 5.1 above. The development design has been sited to avoid 70% of the mapped vegetation within the study area. Unavoidable impacts following all measures to avoid and minimise impacts will result in the removal of 0.01 ha for Stage 1 and 1.29 ha for Stages 2-6.
b. the area (ha) and condition of the threatened ecological community (TEC) to be impacted directly and indirectly by the proposed development. The condition of the TEC is to be represented by the vegetation integrity score for each vegetation zone	Direct removal of 0.01 ha (0.04%) for Stage 1 and 1.3 ha (30%) for Stages 2-6 of poor condition PCT 1300 (VI score of 35.4). The 1.3 ha of the EEC that will be impacted exists in low condition, with high levels of weed cover and diversity. The TEC occurs only in VZ1.
c. a description of the extent to which the impact exceeds the threshold for the potential entity that is specified in the Guideline for determining an SAII	No threshold for impacts to Illawarra Subtropical Rainforest EEC have been published to date.
d. the extent and overall condition of the potential TEC within an area of 1000ha, and then 10,000ha, surrounding the proposed development footprint	According to *South East Biometric Vegetation* (OEH 2014), there is 17.1 ha within the 1000 ha area surrounding the study area. Within a 10,000 hectare area, the community comprises approximately 108 ha. The overall condition across all areas is expected to be varied due to the majority (93%) occurring on privately owned land (OEH 2014).
e. an estimate of the extant area and overall condition of the potential TEC remaining in the IBRA subregion before	The study area occurs in the Illawarra IBRA subregion. An estimate of the area extant in the subregion is 4,313.4 ha (OEH 2014). The proposed development will result in the removal of 1.3 ha, equating to 0.03% of the

Information required (BAM Section 10.2.2)	Response
and after the impact of the proposed development has been taken into consideration	EEC in the subregion.
f. an estimate of the area of the candidate TEC that is in the reserve system within the IBRA region and the IBRA subregion	Mapped areas of the TEC within reserve systems amount to 301.3 ha (OEH 2014) which represents 7% of the EEC within the subregion. • NSW reserves: 301.3 ha • IBRA region: 4317.9ha • IBRA subregion: 4317.9 ha
g. the development, clearing or biodiversity certification proposal's impact on: • abiotic factors critical to the long-term survival of the potential TEC; for example, how much the impact will lead to a reduction of groundwater levels or the substantial alteration of surface water patterns. • characteristic and functionally important species through impacts such as, but not limited to, inappropriate fire/flooding regimes, removal of understorey species or harvesting of plants, • the quality and integrity of an occurrence of the potential 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 potential TEC.	• The proposal will not affect abiotic factors critical to the long term survival of the EEC (see Section 5.1). Flow patterns of water into surrounding habitats will be maintained and any runoff from the proposed development will be managed appropriately and detailed in the site management plans. • An area of 0.01 ha of EEC is proposed to be cleared for management as an APZ as part of Stage 1. Groundcover species shall not be impacted and trees shall remain, however midstorey shrubs will be removed. • An area 1.3 ha of EEC is proposed to be cleared for the development of an access road as part of Stages 2-6. This will result in the removal of all characteristic species which occur within the disturbance footprint (see Appendix 3). Under the current alignment the threatened species White-flowered Wax Plant will also be impacted, however it is proposed that at the appropriate development stage the road should be re-aligned to minimise these impacts. Removal of canopy species such as Guioa *Guioa semiglauca* will create edge impacts on the vegetation adjacent to the road and will likely alter the composition of species due to changes in light availability. • Implementation of the recommended Vegetation Management Plan will prevent the establishment of exotic weeds within the retained EEC vegetation. Best practice bush regeneration measures will be employed which will minimise the likelihood of indirect impacts associated with herbicides and fertilisers. The project is not considered likely to result in the establishment or proliferation of fauna pests within the retained EEC vegetation.
h. direct or indirect fragmentation and isolation of an important area of the potential TEC	Construction of the proposed road will fragment the Illawarra Subtropical Rainforest which occurs on the site.
i. the measures proposed to contribute to the recovery of the potential TEC in the IBRA subregion	In addition to the required credit offset, the proponent will contribute to the improvement of condition of the EEC to be retained within the study area, through assisted rehabilitation by a qualified bush regeneration contractor. The Vegetation Management Plan will specify measures to be implemented.

7.2 Impacts requiring offsets

7.2.1 Impacts to native vegetation (ecosystem credits)

As outlined in Section 10.3.1 of the BAM, the accredited assessor is required to determine an offset for all impacts of the proposed development on PCTs that are associated with:

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

On this basis, offsets are required for all vegetation zones. The offset requirement for the proposal was calculated using the BAM Calculator. Table 13 provide a summary of the ecosystem credit offsets required for impacts from proposed development at the subject land.

Table 13 Offsets required for the proposed development (ecosystem credits)

Vegetation zone	Area (ha)	Impact	Vegetation integrity score	Future Vegetation integrity score	Offset required?	Credit requirement
	Stage 1					
VZ1 PCT 1300 Whalebone Tree Weedy	0.01	APZ management	35.4	5.6	Yes	1
VZ2 PCT 838 Low	0.45	Clearance	17.7	0	Yes	4
VZ2 PCT 838 Low	0.29	APZ management	15.6	0.8	Yes	2
VZ3 PCT 838 DNG	0.03	Clearance	21.4	0	Yes	1
	Stages 2-6					
VZ4 PCT 838 Forest Red Gum Moderate	0.36	Clearance	58.9	0	Yes	11
VZ3 PCT 838 DNG	0.20	Clearance	21.4	0	Yes	2
VZ2 PCT 838 Low	3.23	Clearance	16.8	0	Yes	0
VZ1 PCT 1300 Whalebone Tree Weedy	1.29	Clearance	35.4	0	Yes	23
VZ5 PCT 1300 Low	0.27	Clearance	9.5	0	No	0

The BAM calculator does not allow for distinctions between vegetation zones associated and not associated with a TEC for the same PCT. Thus for Stage 1, VZ2 was entered as not associated with a TEC and no credits were calculated as required. For Stages 2-6, VZ4 is associated with a TEC and so the BAM Calculator assumes VZ2 is also associated with a TEC as they are associated with the same PCT. Thus, the BAM Calculator indicates credit offset requirements for VZ2 for stages 2-6. However, since VZ2 has a vegetation integrity score < 17 (16.8) and is not associated with a TEC these offsets are not applicable, and will be reassessed as part of the SSD application for Stages 2-6 to DPIE in the future.

7.2.2 Impacts to threatened species (species credits)

As outlined in Section 10.3.2 of the BAM an offset is also required for the potential threatened species impacted by the development that require species credits, White-flowered Wax Plant is the only species credit identified in this assessment. Impacts to White-flowered Wax Plant are proposed to occur during Stages 2-6, although it is recommended that a re-design is undertaken to minimise the impacts.

The offset requirement for the proposal was calculated using the BAM Calculator. Table 14 shows the species credit offsets required for impacts from proposed development at the subject land.

Table 14 Offsets required for the proposed development (species credits)

Species	Habitat condition (vegetation integrity score) loss	Area (ha)	Biodiversity risk weighting	Credit requirement
White-flowered Wax Plant	35.7	0.44	2	8

Figure 6 shows the location of the White-flowered Wax Plant, including a 30 metre buffer, to be impacted by the project under the current road alignment.

8 Biodiversity credits

Offsetting through the transfer and retirement of biodiversity credits, or paying into the BCT Offset Fund, is required for the current assessment, Stage 1, for impacts to three vegetation zones within the subject land. A biodiversity credit report is provided below for Stage 1. A credit payment report is not presented in this report, due to unavailability of the Biodiversity Offset Payment (BOP) Calculator. Offsetting will also be required for the later development Stages 2-6 of this project.

BAM Credit Summary Report

Proposal Details

Assessment Id
00017828/BAAS18067/20/00018109

Proposal Name
Berkeley Life City Stage 1

BAM data last updated *
26/11/2019

Assessor Name
Rebecca Dwyer

Report Created
06/02/2020

BAM Data version *
22

Assessor Number
BAAS17067

BAM Case Status
Finalised

Date Finalised
06/02/2020

Assessment Revision
0

Assessment Type
Major Projects

* 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.

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	Potential SAII	Ecosystem credits
Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion								
1	838_DNG	21.4	0.0	0.25	High Sensitivity to Potential Gain	2.00		1
3	838_APZ_Low	14.8	0.3	0.25	High Sensitivity to Potential Gain	2.00		2
4	838_Low	17.7	0.5	0.25	High Sensitivity to Potential Gain	2.00		4

							Subtotal	**7**
Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion								
2	1300_Weedy_APZ	29.8	0.0	0.25	High Sensitivity to Potential Gain	2.00		1
							Subtotal	**1**
							Total	**8**

Species credits for threatened species

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

9 Assessment against biodiversity legislation

9.1 Environment Protection and Biodiversity Conservation Act 1999

An assessment of the impacts of the proposed development on Matters of National Environmental Significance (MNES), against heads of consideration outlined in Commonwealth of Australia (2013) was prepared to determine whether referral of the proposed development to the Commonwealth Minister for the Environment is required. Matters of NES relevant to the proposed development are summarised in Table 15.

Table 15 Assessment of the proposed development against the EPBC Act

Matter of NES	Project specifics	Potential for significant impact
Threatened species	EPBC listed threatened species previously recorded within the locality include 2 flora species and 5 fauna species. One threatened flora species, White-flowered Wax Plant (Endangered EPBC Act) was recorded within the subject land. A SIC assessment is provided in Appendix 5. Additional threatened species listed under the EPBC Act were considered to have a low likelihood of occurrence and were not detected during targeted survey. Occurrence of threatened fauna is considered to be on a transient basis only and no significant or restricting habitat was identified within the subject land for these species.	The project will not result in a significant impact to any MNES.
Threatened ecological communities	There are no EPBC Act listed TECs within the subject land or study area.	No potential for impact.
Migratory species	Migratory species are considered to have the potential to occur within the subject land on a transient basis. Vegetation outside the study area provides higher quality foraging and breeding habitat for these species.	No direct impact is expected to any Migratory listed species. Mitigation measures will prevent indirect impacts from occurring during construction and during operation of the new facility.
Wetlands of international importance (Ramsar sites)	There are no wetlands of international importance within proximity to the subject land.	No potential for significant impact.

On this basis, the EPBC Act is unlikely to be triggered and referral of the proposed development to the Australian Government Minister for the Environment will not be required.

9.2 Wollongong City Council Local Environmental Plan (2009)

The subject land is zoned R2 Low Density Residential in the north west of the subject land and E3 – Environmental in the remainder.

The objectives of management for R2 zoned land under the LEP are:

- To provide for the housing needs of the community within a low density residential environment.
- To enable other land uses that provide facilities or services to meet the day to day needs of residents.

The land zoning does not specify objectives specific to biodiversity. The proposed development is not contrary to the objectives of the zone.

The objectives of management for E3 zoned land under the LEP zone are:

- To protect, manage and restore areas with special ecological, scientific, cultural or aesthetic values.
- To provide for a limited range of development that does not have an adverse effect on those values.

The proposed development is regarded as a Community Facility and is therefore permitted with consent.

9.3 Wollongong Development Control Plan (2009)

Council's mapping indicates a there are no watercourses in the subject land *Wollongong Development Control Plan 2009* (DCP).

Development works are not proposed within 50 metres of the top of the bank along any watercourse adjacent to the subject land. The development is considered consistent with objectives of the DCP.

9.4 Biosecurity Act 2015

The Biosecurity Act provides for the identification, classification and control of priority weeds with the purpose of determining if a biosecurity risk is likely to occur. A biosecurity risk is defined as the risk of a biosecurity impact occurring, which for weeds includes the introduction, presence, spread or increase of a pest into or within the State or any part of the State. A pest plant has the potential to; harm or reduce biodiversity or out-compete other organisms for resources, including food, water, nutrients, habitat and sunlight.

A total of 20 Priority Weeds for the South East Local Land Services Region were recorded in the subject land and are listed in Table 16 along with their associated Duty.

Table 16 Priority weeds recorded at the subject land

Scientific name	Common name	General biosecurity duty
Asparagus asparagoides	Bridal Creeper	General biosecurity duty Prohibition on dealings
Asparagus aethiopicus	Ground Asparagus	Prohibition on dealings
Chrysanthemoides monilifera* subsp. *rotundata	Bitou Bush	General biosecurity duty Prohibition on dealings Biosecurity zone
Delairea odorata	Cape Ivy	General biosecurity duty

Scientific name	Common name	General biosecurity duty
Lantana camara	Lantana	General biosecurity duty Regional Recommended Measure: Land managers should mitigate the risk of new weeds establishing
Olea europaea	African Olive	General biosecurity duty Regional recommended measure: The plant or parts of the plant are not traded, carried, grown or released into the environment. Exclusion zone
***Rubus fruticosus* agg. species**	Blackberry	Prohibition on dealings Must not be imported into the State or sold.
Senecio madagascariensis	Fireweed	Prohibition on dealings Must not be imported into the State or sold

9.5 Water Management Act 2000

A controlled activity approval under the WM Act is required for the following types of activities undertaken on waterfront land:

- The erection of a building or the carrying out of a work (within the meaning of the EP&A Act), or
- The removal of material (whether or not extractive material) or vegetation from land, whether by way of excavation or otherwise, or
- The deposition of material (whether or not extractive material) on land, whether by way of landfill operations or otherwise, or
- The carrying out of any other activity that affects the quantity or flow of water in a water source.

Waterfront land means the bed of any river, lake or estuary, and the land within 40 metres of the river banks, lake shore or estuary mean high water mark.

Development works are not proposed within 40 metres of the top of the bank along any watercourse adjacent to the subject land. Therefore a controlled activity permit from the DPI is not required for the proposal.

9.6 SEPP No 44 – Koala Habitat Protection

The subject land is located within the Wollongong City Council LGA. Wollongong LGA is listed under Schedule 1 of SEPP 44 and is therefore subject to the requirements laid out by the policy. Specifically this means before a consent authority may grant consent to a DA, it must satisfy itself whether or not the land is a potential koala habitat. Clause 4 of the policy defines potential Koala habitat as areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component.

One feed tree species, Forest Red Gum, listed within Schedule 2 of the policy is present within the study area. These constitute less than 15% of the total number of trees in the upper or lower strata of the tree component. Therefore the area is not considered potential koala habitat and no further action under the policy is required.

10 Conclusion

Avoidance of impacts to native vegetation, TECs and fauna habitat have been has been undertaken and resulted in a total reduced clearing of native vegetation to 0.48 hectares for Stage 1 and 0.3 hectares of APZ managed land and 4.62 hectares of clearing of native vegetation for Stages 2-6 (APZ and road batters are included in this total). Cleared/exotic vegetation removal for Stage 1 is 0.80 hectares and 2.75 hectares for Stages 2-6.

Plot data were entered into the BAM calculator to determine vegetation integrity score, and are presented in Appendix 3. Vegetation integrity loss for VZ1 and VZ4 were assessed as partial clearing, where the tree and groundcovers were considered to remain in its current condition, due to the APZ requiring removal of shrubs and selective tree thinning only. The vegetation integrity scores for vegetation surveyed in Stage 1are such that eight ecosystem credits, as offsets are required for all vegetation zones, as PCT 1300 and PCT 838 are both representative of an endangered ecological community, and the vegetation integrity scores are greater than 15 (Table 13).

The vegetation integrity scores for vegetation surveyed in Stages 2-6 are such that a total of 36 ecosystem credits and eight species credits are required as offsets for impacts to four vegetation zones and one threatened species (Table 13 and Table 14).

One threatened fauna species, Grey Headed Flying Fox, was recorded at the subject land. This species is an ecosystem species and a species credit species when present as a breeding camp. As no breeding camps were identified on the site, no additional offsets are required for impacts to the habitat of this species. Mitigation measures to avoid impacts to native fauna are provided in Section 5.1 of this report. A full list of predicted species credit species was compiled based on the presence of PCT 1300 and 838 and a vegetation patch of 15 hectares, with an assessment of impacts provided in Appendix 2.

The potential for a species to occur within the subject land was assessed in accordance with Sections 6.3 and 6.4 of the BAM and species with geographical or habitat restrictions not matching that within the subject land were not required to be surveyed. An assessment of the habitats present within the subject land and study area, and the potential occurrence, and potential for impact, for all species credit species is provided in Appendix 2. No fauna species credits are required for offsetting

All flora species credit species listed with a moderate likelihood of occurrence or higher were surveyed for in accordance with the *NSW Guide to surveying Threatened Plants* (OEH 2016b). One threatened flora species, White-flowered Wax Plant, was recorded (Figure 6) in association with Stages 2-6 of the project. A total of 8 species credits are required as offsets for impacts to this species. As these impacts are not associated with the current DA, it is recommended that during the DA phase of Stages 2-6 the alignment of the road alignment should be reconsidered to minimise the impact to this species.

Matters of NES are not likely to be significantly impacted by the proposed development and as such, a referral of the project to the Commonwealth is not required.

The project should proceed as planned whilst implementing the recommended mitigation measures listed herein.

References

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Appendices

Appendix 1 Survey methods

Appendix 1.1 Nomenclature

The flora taxonomy (classification) used in this report follows the most recent Flora of NSW (Harden 1992, Harden 1993, Harden 2002). All doubtful species names were verified with the on-line Australian Plant Name Index (Australian National Botanic Gardens 2007). Flora species, including threatened species and exotic flora species, are referred to by both their common and then scientific names when first mentioned. Subsequent references to flora species cite the common names only, unless there is no common name, for which scientific name will be used. Common names, where available, have been included in threatened species tables and the complete flora list in Appendix 2.

Names of vertebrates follow the Census of Australian Vertebrates (CAVs) maintained by the DEE (Commonwealth of Australia 2009). In the body of this report vertebrates are referred to by both their common and scientific names when first mentioned. Subsequent references to these species cite the common name only.

Appendix 1.2 Permits and licences

The flora and fauna assessment was conducted under the terms of Biosis' Scientific Licence issued by EES (SL100758, expiry date 31 March 2020). The BAM Assessment and quality review of the BDAR was carried out by Accredited Assessor/s Mark Feeney (BAAS18067) and Callan Wharfe (BAAS18138).

Appendix 1.3 Limitations

Field surveys were undertaken in accordance with the BAM. Ecological surveys provide a sampling of flora and fauna at a given time and season. Factors influencing detectability of species during survey include species dormancy, seasonal conditions, ephemeral status of waterbodies, and migration and breeding behaviours of some fauna. In many cases, these factors do not present a significant limitation to assessing the overall biodiversity values of a site.

The field survey was conducted in spring during fine weather, which is a suitable time to determine the presence of the relevant threatened species.

Surveys undertaken, combined with habitat assessments and desktop analysis are considered sufficient to reach the conclusions herein in regards to this and all other species' likelihood of occurrence within the study area.

Database searches, and associated conclusions on the likelihood of species to occur within the study area, are reliant upon external data sources and information managed by third parties.

Appendix 2 BAM Ecosystem credit species and candidate species assessment

Table A. 1 Threatened flora candidate species assessment

Species	Conservation status		Potential occurrence in subject land	Survey required/ undertaken	Potential for impact	BAM Candidate species	Candidate species rationale	Habitat description
	EPBC	BC						
***Chorizema parviflorum* - endangered population**	N/A	EP	Low	Undertaken	Low	No	Targeted surveys undertaken within the subject area associated with Forest Red Gum in accordance with approved survey timetable for the species (August to January). The survey was completed in accordance with the BAM (OEH 2017b), *NSW Guide to Surveying Threatened Plants* (OEH 2016a).	All known sites (excluding the site at Austinmer) occupy woodland or forest dominated by Forest Red Gum and/or Woollybutt *Eucalyptus longifolia*. At Austinmer, the species is recorded from a coastal headland. Flowering period is August to January, with seeds maturing from November.
***Cynanchum elegans* White-flowered Wax Plant**	E	E	High	Undertaken	High	Yes	Targeted surveys identified the species in the subject area associated with associated with PCT 1300 Whalebone Tree. The survey was completed in accordance with the BAM (OEH 2017b), *NSW Guide to Surveying Threatened Plants* (OEH 2016a).	The White-flowered Wax Plant usually occurs on the edge of dry rainforest vegetation. Flowering occurs between August and May, with a peak in November. Flower abundance on individual plants varies from sparse to prolific
***Daphnandra johnsonii* Illawarra Socketwood**	E	E	Moderate	Undertaken	Low	No	Targeted surveys undertaken within the subject area associated with PCT 1300 Whalebone Tree. The survey was completed in accordance with	Occupies the rocky hillsides and gullies of the Illawarra lowlands, occasionally extending onto the upper escarpment slopes. Associated vegetation includes rainforest and moist eucalypt forest.

Species	Conservation status		Potential occurrence in subject land	Survey required/ undertaken	Potential for impact	BAM Candidate species	Candidate species rationale	Habitat description
	EPBC	BC						
							the BAM (OEH 2017b), *NSW Guide to Surveying Threatened Plants* (OEH 2016a).	Associated soils are loams and clay loams derived from volcanic and fertile sedimentary rocks. Flowers briefly in September and early October with fruits taking 10 to 12 months to mature.
***Gossia acmenoides* - endangered population**	N/A	E	Moderate	Undertaken	Low	No	Targeted surveys undertaken within the subject area associated with PCT 1300 Whalebone Tree. The survey was completed in accordance with the BAM (OEH 2017b), *NSW Guide to Surveying Threatened Plants* (OEH 2016a).	Found in subtropical and dry rainforest on the ranges and coastal plain of eastern Australia Estimated less than 100 mature plants, through approximately 30 sites. Occurring often as a single individual or small group. Flowers late spring to early autumn
***Irenepharsus trypherus* Illawarra Irene**	E	E	Low	No	Low	No	Habitat constraint: Site is east of the Princess Highway. Site is absent of steep rocky slopes near cliff lines and ridge tops. Habitat on site is considered unsuitable.	Typically inhabits steep rocky slopes near cliff lines and ridge tops. The species is less typically found growing out of rock crevices or on narrow benches along cliff lines. The vast majority of sites are recorded from the upper slopes of the ridge systems that extend south and east of the Illawarra escarpment, although the species has also been recorded from the deep sandstone gorges of the Shoalhaven River. Associated vegetation includes moist sclerophyll forest, Ironwood *Backhousia myrtifolia* thicket, and rainforest.
Lespedeza juncea	N/A	EP	Low	No	Low	No	Only one known population,	Known from just one roadside population of

Species	Conservation status		Potential occurrence in subject land	Survey required/ undertaken	Potential for impact	BAM Candidate species	Candidate species rationale	Habitat description
	EPBC	BC						
subsp. *sericea* - endangered population							recorded outside of the local vicinity of the project	approximately 200 plants. Located in a small strip of open forest dominated by Forest Red Gum, Woollybutt, and White Feather Honeymyrtle *Melaleuca decora*, on Budgong Sandstone.
Pimelea curviflora* var. *curviflora	V	V	Moderate	Undertaken	Low	No	PCT 838 Forest Red Gum provides potential habitat, although site is degraded Targeted surveys were undertaken on the subject land, species was not detected.	Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands. Also recorded in Illawarra Lowalnd Grassy Woodland habitat at Albion Park on the Illawarra coastal plain. Flowers October to May.
***Pimelea spicata* Spiked Rice-flower**	V	V	Low	No	Low	No	Woodland habitat is degraded. Weed species are dominant in the groundcover and the mid storey. Black Wattle creates a lower canopy and only two mature Forest Red Gum are present.	In both the Cumberland Plain and Illawarra environments this species is found on well-structured clay soils. In the coastal Illawarra it occurs commonly in Coast Banksia open woodland with a better developed shrub and grass understorey. Coastal headlands and hilltops are the favoured sites. The IIIlawarra populations usually occur in one of two communities - a woodland or a coastal grassland. Woodland sites are dominated by Forest Red Gum and Stringybark, with a groundcover dominated by Kangaroo Grass and Matrush. The grassland sites are dominated by Kangaroo Grass and Matrush, with Blady Grass.
Pterostylis gibbosa	E	E	Low	No	Low	No	Habitat is degraded.	All known populations grow in open forest or

Species	Conservation status		Potential occurrence in subject land	Survey required/ undertaken	Potential for impact	BAM Candidate species	Candidate species rationale	Habitat description
	EPBC	BC						
Illawarra Greenhood								woodland, on flat or gently sloping land with poor drainage. In the Illawarra region, the species grows in woodland dominated by Forest Red Gum, Woollybutt and White Feather Honey-myrtle. The Illawarra Greenhood is a deciduous orchid that is only visible above the ground between late summer and spring, and only when soil moisture levels can sustain its growth. The leaf rosette grows from an underground tuber in late summer, followed by the flower stem in winter. After a spring flowering, the plant begins to die back and seed capsules form
Rhodamnia rubescens **Scrub Turpentine**	N/A	CE	Moderate	Undertaken	Low	No	PCT 1300 Whalebone Tree provides potential habitat. Targeted surveys were undertaken on the subject land, species was not detected.	Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils
Senna acclinis **Rainforest Cassia**	N/A	E	Moderate	Undertaken	Low	No	PCT 1300 Whalebone Tree provides potential habitat. Targeted surveys were undertaken on the subject land, species was not detected.	Grows on the margins of subtropical, littoral and dry rainforests. Often found as a gap phase shrub. Flowering occurs in spring and summer and the fruit is ripe in summer and autumn.
Solanum celatum	N/A	E	Low	Undertaken	Low	No	PCT 1300 Whalebone Tree and margins provides potential habitat. Targeted surveys were undertaken on the subject land,	Majority of records are prior to 1960 and the majority of populations are likely to have been lost to clearing. Grows in rainforest clearings, or in wet

Species	Conservation status		Potential occurrence in subject land	Survey required/ undertaken	Potential for impact	BAM Candidate species	Candidate species rationale	Habitat description
	EPBC	BC						
							species was not detected.	sclerophyll forests. Flowers August to October and produces fruit December to January. Fire sensitive obligate seeder, with adults plants killed by fire and recruitment occurring from a soil stored seed bank. Normally recorded in disturbed margins and clearings
Zieria granulata **Illawarra Zieria**	E	E	Low	undertaken	Low	No	PCT 1300 Whalebone Tree and margins provides potential habitat. Species is also associated with Forest Red Gum woodland. Targeted surveys were undertaken on the subject land, species was not detected.	The typical habitat is dry ridge tops and rocky outcrops on shallow volcanic soils, usually on Bumbo Latite. Less frequently found on the moist slopes of the Illawarra escarpment and in low-lying areas on Quaternary sediments. Associated vegetation includes Bracelet Honey-myrtle scrub, Forest Red Gum woodland and rainforest margins, although the species has been recorded from a number of other vegetation types. Most vegetation types are also listed as Endangered Ecological Communities.

Table A. 2 Threatened fauna species assessment

Species	Conservation status		Potential occurrence in subject land	Survey required/ undertaken	Potential for impact	BAM Candidate species	BAM Ecosystem Credit Species	Species rationale	Habitat description
	EPBC	BC							
Anthochaera phrygia **Regent Honeyeater**	CE	CE	Low	No	Low	No	No	Woodland habitat at the site is in poor condition and is dominated by Black Wattle. The primary feed trees documented are not present on site. The site does not occur in an identified breeding zone for the species	The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. The Regent Honeyeater is a generalist forager, although it feeds mainly on the nectar from a relatively small number of eucalypts that produce high volumes of nectar. Nectar and fruit from the mistletoes *Amyema miquelii*, *A. pendula* and *A. cambagei* are also utilised. When nectar is scarce lerp and honeydew can comprise a large proportion of the diet. There are three known key breeding areas, two of them in NSW - Capertee Valley and Bundarra-Barraba regions.
Calyptorhynchus lathami **Glossy Black-Cockatoo**	N/A	V	Low	No	Low	No	Presence assumed	No hollow bearing trees or dead trees with hollows greater than 15cm and above 5m are present.	Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of Sheoak occur. Black Sheoak and Forest Sheoak are important foods. Inland populations feed on a wide range of Sheoaks, including Drooping Sheoak, *Allocasuarina diminuta* and *A. gymnanthera*. Feeds almost exclusively on the seeds of several species of Sheoak (Casuarina and Allocasuarina species), shredding the cones with the massive bill. Dependent on large hollow-bearing eucalypts for nest sites. A single egg is laid between March and May.

Species	Conservation status		Potential occurrence in subject land	Survey required/ undertaken	Potential for impact	BAM Candidate species	BAM Ecosystem Credit Species	Species rationale	Habitat description
	EPBC	BC							
Dasyurus maculatus **Spotted-tailed Quoll**	E	V	Low	Habitat survey only	Low	No	No	Unsuitable habitat due to absence of rocky outcrops, hollow-bearing trees and minimal fallen logs. Dominant fallen logs associated with Acacia spp.. Connectivity also limited due the prevalence of surrounding roads and suburbia.	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock outcrops and rocky-cliff faces as den sites. Use communal 'latrine sites', often on flat rocks among boulder fields, rocky cliff-faces or along rocky stream beds or banks. Such sites may be visited by multiple individuals and can be recognised by the accumulation of the sometimes characteristic 'twisty-shaped' faeces deposited by animals. Are known to traverse their home ranges along densely vegetated creek lines.
Haliaeetus leucogaster **White-bellied Sea-Eagle**	N/A	V	Low	No	Low	No	Presence assumed	Few suitably sized trees on site. None of which contained nests.	Habitats are characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea. Occurs at sites near the sea or sea-shore, such as around bays and inlets, beaches, reefs, lagoons, estuaries and mangroves; and at, or in the vicinity of freshwater swamps, lakes, reservoirs, billabongs and saltmarsh. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, and forest (including rainforest). Breeding habitat consists of mature tall open forest, open forest, tall woodland, and swamp sclerophyll forest close to foraging habitat. Nest trees are typically large emergent eucalypts and often have emergent dead branches or large dead trees nearby which are used as 'guard roosts'. Nests

Species	Conservation status		Potential occurrence in subject land	Survey required/ undertaken	Potential for impact	BAM Candidate species	BAM Eco-system Credit Species	Species rationale	Habitat description
	EPBC	BC							
									are large structures built from sticks and lined with leaves or grass
Lathamus discolor **Swift Parrot**	CE	E	Low	No	Low	No	Presence assumed	Low abundance of feed trees, only two mature Forest Red Gum within the study area. No lerp infestation in the study area.	Migrates to the Australian south-east mainland between February and October. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany Eucalyptus robusta, Spotted Gum Corymbia maculata, Red Bloodwood C. gummifera, Forest Red Gum E. tereticornis, Mugga Ironbark E. sideroxylon, and White Box E. albens. Commonly used lerp infested trees include Inland Grey Box E. microcarpa, Grey Box E. moluccana, Blackbutt E. pilularis, and Yellow Box E. melliodora
Litoria aurea **Green and Golden Bell Frog**	V	E	Low	No	Low	No	N/A	One small dam is present on site, however, there is no fringing vegetation to support the species. Connectivity to the site is low with the closest waterway 1.2km (Hooka Ck). The closest recorded sighting (Bionet) is at Port Kembla over 4kms away and separated by Industrial and suburban areas.	Inhabits marshes, dams and stream-sides, particularly those containing bullrushes or spikerushes .Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow *Gambusia holbrooki*, have a grassy area nearby and diurnal sheltering sites available. Some sites, particularly in the Greater Sydney region occur in highly disturbed areas.
Miniopterus	N/A	V	Low	No	Low	No	Presence	Habitat is degraded, dominant	Moist eucalypt forest, rainforest, vine thicket, wet and dry

Species	Conservation status		Potential occurrence in subject land	Survey required/ undertaken	Potential for impact	BAM Candidate species	BAM Ecosystem Credit Species	Species rationale	Habitat description
	EPBC	BC							
***australis* Little Bent-winged Bat**							assumed	canopy species consist of Black Wattle. No adequate roosting sites.	sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats. Only five nursery sites /maternity colonies are known in Australia.
Miniopterus orianae oceanensis Large Bent-winged Bat	N/A	V	Low	No	Low	No	Presence assumed	No suitable roosting habitat on site.	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. Maternity caves have very specific temperature and humidity regimes. At other times of the year, populations disperse within about 300 km range of maternity caves.
***Myotis macropus* Southern Myotis**	N/A	V	Low	No	Low	No	N/A	No suitable roosting habitat on site. Not within 200m of a riparian zone. A dam within the subject land was not considered suitable habitat as there is no fringing vegetation, no HBT in the study area and the small	Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, and storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface. In NSW females have one young each year usually in November or December.

Species	Conservation status		Potential occurrence in subject land	Survey required/ undertaken	Potential for impact	BAM Candidate species	BAM Ecosystem Credit Species	Species rationale	Habitat description
	EPBC	BC							
								size of the dam (50m^2).	
***Petaurus norfolcensis* Squirrel Glider**	N/A	V	Low	No	Low	No	N/A	Habitat is unsuitable and degraded. No Blackbutt-Bloodwood forest present. No tree hollows	Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia midstorey. Require abundant tree hollows for refuge and nest sites
***Phascolarctos cinereus* Koala (Breeding)**	V	V	Low	No	Low	No	N/A (Presence assumed for foraging)	Low abundance of feed trees in the subject area (two mature Forest Red Gum) and poor connectivity to surrounding habitat.	Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species.
***Pteropus poliocephalus* Grey-headed Flying-fox (Breeding)**	V	V	Low	Survey for camps undertaken	Low	No	N/A (Presence assumed for foraging)	No camps were located on the site. A known camp is located 5km away	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. 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.

Appendix 3 Flora

Appendix 2.1 BAM plot field data

Table A. 3 Flora species recorded in the study area from BAM plots

Plot ID	Growth form (native only)	Species	N/E/HTE	Cover	Abundance
BK06_Urban native/exotic_02		*Ageratina adenophora*	HTE	0.1	1
BK06_Urban native/exotic_02		*Bidens pilosa*	HTE	0.1	10
BK06_Urban native/exotic_02		*Cenchrus clandestinus*	E	100	5000
BK06_Urban native/exotic_02		*Cerastium glomeratum*	E	0.1	100
BK06_Urban native/exotic_02		*Chloris gayana*	HTE	0.1	10
BK06_Urban native/exotic_02		*Conyza bonariensis*	E	0.1	100
BK06_Urban native/exotic_02		*Daucus carota*	E	0.1	50
BK06_Urban native/exotic_02		*Gomphocarpus fruticosus*	E	0.1	10
BK06_Urban native/exotic_02		*Hypochaeris radicata*	E	0.1	1
BK06_Urban native/exotic_02		*Modiola caroliniana*	E	0.1	50
BK06_Urban native/exotic_02		*Paspalum dilatatum*	HTE	0.1	50
BK06_Urban native/exotic_02		*Plantago lanceolata*	E	0.1	100
BK06_Urban native/exotic_02		*Senecio madagascariensis*	E	0.2	100
BK06_Urban native/exotic_02		*Sporobolus africanus*	E	0.1	50
BK06_Urban native/exotic_02		*Trifolium subterraneum*	E	0.2	500
BK06_Urban native/exotic_02		*Verbena bonariensis*	E	0.1	50

Plot ID	Growth form (native only)	Species	N/E/HTE	Cover	Abundance
BK06_Urban native/exotic_02		*Verbena rigida*	E	0.1	50
BK06_Urban native/exotic_02		*Vicia tetrasperma*	E	0.1	10
BK06_Urban native/exotic_02	Forb (FG)	*Centella asiatica*	N	0.2	500
BK06_Urban native/exotic_02	Forb (FG)	*Dichondra repens*	N	0.1	500
BK06_Urban native/exotic_02	Grass & grasslike (GG)	*Cynodon dactylon*	N	0.1	10
BK06_Urban native/exotic_02	Grass & grasslike (GG)	*Imperata cylindrica*	N	0.1	1
BK06_Urban native/exotic_02	Grass & grasslike (GG)	*Juncus usitatus*	N	0.1	10
BK01_VZ1 PCT 1300 Whalebone tree weedy	Other (OG)	*Amyema congener*	N	0.5	2
BK01_VZ1 PCT 1300 Whalebone tree weedy		*Asparagus aethiopicus*	HTE	20	2
BK01_VZ1 PCT 1300 Whalebone tree weedy		*Asparagus asparagoides*	HTE	20	2
BK01_VZ1 PCT 1300 Whalebone tree weedy		*Delairea odorata*	HTE	20	2
BK01_VZ1 PCT 1300 Whalebone tree weedy		*Lantana camara*	HTE	20	2
BK01_VZ1 PCT 1300 Whalebone tree weedy		*Senecio madagascariensis*	E	20	2
BK01_VZ1 PCT 1300 Whalebone tree weedy		*Sida rhombifolia*	E	20	2
BK01_VZ1 PCT 1300 Whalebone tree weedy	Forb (FG)	*Commelina cyanea*	N	1	2
BK01_VZ1 PCT 1300 Whalebone tree weedy	Forb (FG)	*Dianella caerulea*	N	1	2
BK01_VZ1 PCT 1300 Whalebone tree weedy	Forb (FG)	*Dichondra repens*	N	5	10
BK01_VZ1 PCT 1300 Whalebone tree weedy	Forb (FG)	*Einadia hastata*	N	1	2
BK01_VZ1 PCT 1300 Whalebone tree weedy	Grass & grasslike (GG)	*Carex longebrachiata*	N	1	2
BK01_VZ1 PCT 1300 Whalebone tree weedy	Grass & grasslike (GG)	*Lomandra longifolia*	N	1	2
BK01_VZ1 PCT 1300 Whalebone tree weedy	Grass & grasslike (GG)	*Microlaena stipoides*	N	1	2

Plot ID	Growth form (native only)	Species	N/E/HTE	Cover	Abundance
BK01_VZ1 PCT 1300 Whalebone tree weedy	Other (OG)	*Eustrephus latifolius*	N	1	2
BK01_VZ1 PCT 1300 Whalebone tree weedy	Other (OG)	*Glycine clandestina*	N	1	2
BK01_VZ1 PCT 1300 Whalebone tree weedy	Other (OG)	*Maclura cochinchinensis*	N	1	2
BK01_VZ1 PCT 1300 Whalebone tree weedy	Other (OG)	*Pandorea pandorana*	N	5	10
BK01_VZ1 PCT 1300 Whalebone tree weedy	Other (OG)	*Trophis scandens*	N	1	2
BK01_VZ1 PCT 1300 Whalebone tree weedy	Shrub (SG)	*Acacia mearnsii*	N	10	5
BK01_VZ1 PCT 1300 Whalebone tree weedy	Shrub (SG)	*Breynia oblongifolia*	N	1	2
BK01_VZ1 PCT 1300 Whalebone tree weedy	Shrub (SG)	*Commersonia fraseri*	N	5	10
BK01_VZ1 PCT 1300 Whalebone tree weedy	Shrub (SG)	*Exocarpos cupressiformis*	N	1	2
BK01_VZ1 PCT 1300 Whalebone tree weedy	Shrub (SG)	*Melaleuca styphelioides*	N	5	10
BK01_VZ1 PCT 1300 Whalebone tree weedy	Shrub (SG)	*Myrsine variabilis*	N	1	2
BK01_VZ1 PCT 1300 Whalebone tree weedy	Shrub (SG)	*Rubus parvifolius*	N	1	2
BK01_VZ1 PCT 1300 Whalebone tree weedy	Tree (TG)	*Guioa semiglauca*	N	1	2
BK01_VZ1 PCT 1300 Whalebone tree weedy	Tree (TG)	*Streblus brunonianus*	N	5	10
BK02_VZ4 PCT 838 Forest Red Gum	Forb (FG)	*Oxalis perennans*	N	1	20
BK02_VZ4 PCT 838 Forest Red Gum	Other (OG)	*Amyema congener*	N	0.5	1
BK02_VZ4 PCT 838 Forest Red Gum		*Bidens pilosa*	HTE	0.1	5
BK02_VZ4 PCT 838 Forest Red Gum		*Briza minor*	E	1	1
BK02_VZ4 PCT 838 Forest Red Gum		*Chloris gayana*	HTE	1	1
BK02_VZ4 PCT 838 Forest Red Gum	Other (OG)	*Glycine tabacina complex*	N	0.1	10
BK02_VZ4 PCT 838 Forest Red Gum		*Gomphocarpus fruticosus*	E	2	1

Plot ID	Growth form (native only)	Species	N/E/HTE	Cover	Abundance
BK02_VZ4 PCT 838 Forest Red Gum		*Lantana camara*	HTE	50	5
BK02_VZ4 PCT 838 Forest Red Gum		*Olea europaea*	HTE	1	2
BK02_VZ4 PCT 838 Forest Red Gum		*Pennisetum clandestinum*	E	0.1	5
BK02_VZ4 PCT 838 Forest Red Gum		*Plantago lanceolata*	E	0.1	2
BK02_VZ4 PCT 838 Forest Red Gum		*Senecio madagascariensis*	E	0.2	1
BK02_VZ4 PCT 838 Forest Red Gum		*Sida rhombifolia*	E	0.1	5
BK02_VZ4 PCT 838 Forest Red Gum		*Solanum mauritianum*	E	0.1	1
BK02_VZ4 PCT 838 Forest Red Gum		*Tephrosia glomeruliflora*	E	0.1	1
BK02_VZ4 PCT 838 Forest Red Gum		*Verbena bonariensis*	E	0.1	5
BK02_VZ4 PCT 838 Forest Red Gum	Forb (FG)	*Centella spp.*	N	0.1	2
BK02_VZ4 PCT 838 Forest Red Gum	Forb (FG)	*Dianella caerulea*	N	3	10
BK02_VZ4 PCT 838 Forest Red Gum	Forb (FG)	*Dichondra repens*	N	2	100
BK02_VZ4 PCT 838 Forest Red Gum	Forb (FG)	*Wahlenbergia planiflora*	N	0.1	1
BK02_VZ4 PCT 838 Forest Red Gum	Grass & grasslike (GG)	*Bothriochloa spp.*	N	0.1	1
BK02_VZ4 PCT 838 Forest Red Gum	Grass & grasslike (GG)	*Carex longebrachiata*	N	5	50
BK02_VZ4 PCT 838 Forest Red Gum	Grass & grasslike (GG)	*Cynodon dactylon*	N	20	100
BK02_VZ4 PCT 838 Forest Red Gum	Grass & grasslike (GG)	*Eragrostis brownii*	N	0.1	1
BK02_VZ4 PCT 838 Forest Red Gum	Grass & grasslike (GG)	*Microlaena stipoides*	N	30	200
BK02_VZ4 PCT 838 Forest Red Gum	Grass & grasslike (GG)	*Sporobolus creber*	N	0.1	1
BK02_VZ4 PCT 838 Forest Red Gum	Grass & grasslike (GG)	*Themeda australis*	N	20	100
BK02_VZ4 PCT 838 Forest Red Gum	Other (OG)	*Desmodium spp.*	N	0.1	2

Plot ID	Growth form (native only)	Species	N/E/HTE	Cover	Abundance
BK02_VZ4 PCT 838 Forest Red Gum	Other (OG)	*Glycine clandestina*	N	0.1	2
BK02_VZ4 PCT 838 Forest Red Gum	Shrub (SG)	*Acacia mearnsii*	N	30	7
BK02_VZ4 PCT 838 Forest Red Gum	Shrub (SG)	*Breynia oblongifolia*	N	0.1	1
BK02_VZ4 PCT 838 Forest Red Gum	Shrub (SG)	*Myrsine variabilis*	N	0.1	1
BK02_VZ4 PCT 838 Forest Red Gum	Tree (TG)	*Eucalyptus tereticornis*	N	10	3
BK02_VZ4 PCT 838 Forest Red Gum	Tree (TG)	*Grevillea robusta*	N	0.5	1
BK03_VZ3 PCT 838 DNG		*Ageratina adenophora*	HTE	0.1	20
BK03_VZ3 PCT 838 DNG		*Bidens pilosa*	HTE	1	10
BK03_VZ3 PCT 838 DNG		*Briza maxima*	E	0.1	10
BK03_VZ3 PCT 838 DNG		*Daucus carota*	E	0.1	10
BK03_VZ3 PCT 838 DNG		*Gomphocarpus fruticosus*	E	0.1	10
BK03_VZ3 PCT 838 DNG		*Hypochaeris radicata*	E	0.1	10
BK03_VZ3 PCT 838 DNG		*Lantana camara*	HTE	0.1	2
BK03_VZ3 PCT 838 DNG		*Pennisetum clandestinum*	E	2	10
BK03_VZ3 PCT 838 DNG		*Senecio madagascariensis*	E	0.1	2
BK03_VZ3 PCT 838 DNG		*Sida rhombifolia*	E	1	10
BK03_VZ3 PCT 838 DNG		*Stellaria media*	E	0.1	10
BK03_VZ3 PCT 838 DNG		*Tephrosia glomeruliflora*	E	0.1	10
BK03_VZ3 PCT 838 DNG		*Verbena bonariensis*	E	0.1	2
BK03_VZ3 PCT 838 DNG	Forb (FG)	*Centella spp.*	N	1	10
BK03_VZ3 PCT 838 DNG	Forb (FG)	*Dichondra repens*	N	1	10

Plot ID	Growth form (native only)	Species	N/E/HTE	Cover	Abundance
BK03_VZ3 PCT 838 DNG	Forb (FG)	*Oxalis perennans*	N	1	10
BK03_VZ3 PCT 838 DNG	Grass & grasslike (GG)	*Chloris truncata*	N	0.1	20
BK03_VZ3 PCT 838 DNG	Grass & grasslike (GG)	*Cynodon dactylon*	N	1	10
BK03_VZ3 PCT 838 DNG	Grass & grasslike (GG)	*Eragrostis brownii*	N	0.5	10
BK03_VZ3 PCT 838 DNG	Grass & grasslike (GG)	*Imperata cylindrica*	N	90	1000
BK03_VZ3 PCT 838 DNG	Grass & grasslike (GG)	*Setaria spp.*	E	0.1	10
BK03_VZ3 PCT 838 DNG	Grass & grasslike (GG)	*Themeda australis*	N	1	10
BK03_VZ3 PCT 838 DNG	Other (OG)	*Glycine tabacina*	N	0.1	10
BK03_VZ3 PCT 838 DNG	Shrub (SG)	*Acacia longifolia*	N	1	10
BK04_Urban native/exotic_01		*Araujia sericifera*	HTE	0.1	1
BK04_Urban native/exotic_01		*Bidens pilosa*	HTE	0.1	10
BK04_Urban native/exotic_01		*Briza minor*	E	0.5	1000
BK04_Urban native/exotic_01		*Cenchrus clandestinus*	E	95	5000
BK04_Urban native/exotic_01		*Cerastium glomeratum*	E	0.1	10
BK04_Urban native/exotic_01		*Chloris gayana*	HTE	0.2	10
BK04_Urban native/exotic_01		*Conyza bonariensis*	E	0.1	10
BK04_Urban native/exotic_01		*Ehrharta erecta*	HTE	0.1	100
BK04_Urban native/exotic_01		*Foeniculum vulgare*	E	0.1	20
BK04_Urban native/exotic_01		*Gomphocarpus fruticosus*	E	0.1	100
BK04_Urban native/exotic_01		*Lantana camara*	HTE	0.1	1
BK04_Urban native/exotic_01		*Lilium formosanum*	E	0.1	20

Plot ID	Growth form (native only)	Species	N/E/HTE	Cover	Abundance
BK04_Urban native/exotic_01		*Oxalis corniculata*	E	0.1	20
BK04_Urban native/exotic_01		*Oxalis debilis*	E	0.1	20
BK04_Urban native/exotic_01		*Paspalum dilatatum*	HTE	0.1	20
BK04_Urban native/exotic_01		*Plantago lanceolata*	E	0.1	100
BK04_Urban native/exotic_01		*Senecio madagascariensis*	E	0.1	1000
BK04_Urban native/exotic_01		*Sida rhombifolia*	E	0.1	10
BK04_Urban native/exotic_01		*Verbena rigida*	E	0.1	20
BK04_Urban native/exotic_01		*Vicia tetrasperma*	E	0.1	1000
BK04_Urban native/exotic_01	Forb (FG)	*Centella asiatica*	N	95	1000
BK04_Urban native/exotic_01	Forb (FG)	*Dichondra repens*	N	0.1	20
BK04_Urban native/exotic_01	Grass & grasslike (GG)	*Carex longebrachiata*	N	0.1	10
BK04_Urban native/exotic_01	Grass & grasslike (GG)	*Cynodon dactylon*	N	5	1000
BK04_Urban native/exotic_01	Grass & grasslike (GG)	*Juncus usitatus*	N	0.1	10
BK04_Urban native/exotic_01	Other (OG)	*Glycine tabacina*	N	0.1	20
BK04_Urban native/exotic_01	Other (OG)	*Hardenbergia violacea*	N	0.1	10
BK04_Urban native/exotic_01	Tree (TG)	*Grevillea robusta*	N	0.1	10
BK05_VZ2 PCT 838 Low_01		*Ageratina adenophora*	HTE	0.1	5
BK05_VZ2 PCT 838 Low_01		*Araujia sericifera*	HTE	0.1	500
BK05_VZ2 PCT 838 Low_01		*Bidens pilosa*	HTE	0.1	500
BK05_VZ2 PCT 838 Low_01		*Briza minor*	E	40	1000
BK05_VZ2 PCT 838 Low_01		*Cenchrus clandestinus*	E	30	2000

Plot ID	Growth form (native only)	Species	N/E/HTE	Cover	Abundance
BK05_VZ2 PCT 838 Low_01		*Cirsium vulgare*	E	0.1	10
BK05_VZ2 PCT 838 Low_01		*Conyza bonariensis*	E	0.1	500
BK05_VZ2 PCT 838 Low_01		*Cyclospermum leptophyllum*	E	0.1	10
BK05_VZ2 PCT 838 Low_01		*Ehrharta erecta*	HTE	0.1	1000
BK05_VZ2 PCT 838 Low_01		*Gomphocarpus fruticosus*	E	0.1	2000
BK05_VZ2 PCT 838 Low_01		*Lantana camara*	HTE	40	30
BK05_VZ2 PCT 838 Low_01		*Oxalis corniculata*	E	0.1	10
BK05_VZ2 PCT 838 Low_01		*Paspalum dilatatum*	HTE	0.1	50
BK05_VZ2 PCT 838 Low_01		*Phytolacca octandra*	E	0.1	100
BK05_VZ2 PCT 838 Low_01		*Plantago lanceolata*	E	0.1	50
BK05_VZ2 PCT 838 Low_01		*Poa annua*	E	0.1	10
BK05_VZ2 PCT 838 Low_01		*Senecio madagascariensis*	E	0.1	30
BK05_VZ2 PCT 838 Low_01		*Sida rhombifolia*	E	0.1	100
BK05_VZ2 PCT 838 Low_01		*Solanum mauritianum*	E	0.1	100
BK05_VZ2 PCT 838 Low_01		*Sonchus oleraceus*	E	0.1	1
BK05_VZ2 PCT 838 Low_01		*Sporobolus africanus*	E	0.1	100
BK05_VZ2 PCT 838 Low_01		*Trifolium subterraneum*	E	0.1	10
BK05_VZ2 PCT 838 Low_01		*Verbena bonariensis*	E	0.1	100
BK05_VZ2 PCT 838 Low_01		*Verbena rigida*	E	0.1	10
BK05_VZ2 PCT 838 Low_01	Forb (FG)	*Centella asiatica*	N	0.1	100
BK05_VZ2 PCT 838 Low_01	Forb (FG)	*Desmodium gunnii*	N	0.1	1

Plot ID	Growth form (native only)	Species	N/E/HTE	Cover	Abundance
BK05_VZ2 PCT 838 Low_01	Forb (FG)	*Dianella longifolia*	N	0.1	100
BK05_VZ2 PCT 838 Low_01	Forb (FG)	*Dichondra repens*	N	1	5000
BK05_VZ2 PCT 838 Low_01	Forb (FG)	*Rumex brownii*	N	0.1	1
BK05_VZ2 PCT 838 Low_01	Grass & grasslike (GG)	*Carex inversa*	N	0.3	500
BK05_VZ2 PCT 838 Low_01	Grass & grasslike (GG)	*Carex longebrachiata*	N	0.1	100
BK05_VZ2 PCT 838 Low_01	Grass & grasslike (GG)	*Cynodon dactylon*	N	0.1	2000
BK05_VZ2 PCT 838 Low_01	Grass & grasslike (GG)	*Microlaena stipoides*	N	0.1	2000
BK05_VZ2 PCT 838 Low_01	Other (OG)	*Glycine clandestina*	N	0.1	50
BK05_VZ2 PCT 838 Low_01	Other (OG)	*Glycine tabacina*	N	0.1	50
BK05_VZ2 PCT 838 Low_01	Shrub (SG)	*Acacia mearnsii*	N	40	30
BK05_VZ2 PCT 838 Low_01	Tree (TG)	*Grevillea robusta*	N	0.1	10
BK07_VZ2 PCT 838 Low_02	Shrub (SG)	*Acacia longifolia var. sophorae*	N	0.1	1
BK07_VZ2 PCT 838 Low_02		*Ageratina adenophora*	HTE	0.1	1
BK07_VZ2 PCT 838 Low_02		*Bidens pilosa*	HTE	0.1	1
BK07_VZ2 PCT 838 Low_02		*Briza minor*	E	0.1	10
BK07_VZ2 PCT 838 Low_02		*Celtis australis*	E	0.1	1
BK07_VZ2 PCT 838 Low_02		*Cerastium glomeratum*	E	0.1	1
BK07_VZ2 PCT 838 Low_02		*Chloris gayana*	HTE	0.5	100
BK07_VZ2 PCT 838 Low_02		*Conyza bonariensis*	E	0.1	10
BK07_VZ2 PCT 838 Low_02	Other (OG)	*Desmodium varians var. gunnii*	N	0.1	1
BK07_VZ2 PCT 838 Low_02		*Ehrharta erecta*	HTE	0.1	10

Plot ID	Growth form (native only)	Species	N/E/HTE	Cover	Abundance
BK07_VZ2 PCT 838 Low_02		*Gomphocarpus fruticosus*	E	0.1	10
BK07_VZ2 PCT 838 Low_02		*Lantana camara*	HTE	90	200
BK07_VZ2 PCT 838 Low_02		*Ligustrum lucidum*	HTE	0.1	1
BK07_VZ2 PCT 838 Low_02		*Ligustrum sinense*	HTE	0.1	1
BK07_VZ2 PCT 838 Low_02		*Olea europaea subsp. europaea*	E	0.1	1
BK07_VZ2 PCT 838 Low_02		*Passiflora suberosa*	E	0.1	2
BK07_VZ2 PCT 838 Low_02		*Plantago lanceolata*	E	0.1	10
BK07_VZ2 PCT 838 Low_02		*Polygala myrtifolia*	HTE	0.1	10
BK07_VZ2 PCT 838 Low_02	Shrub (SG)	*Myrsine variabilis*	N	0.1	1
BK07_VZ2 PCT 838 Low_02		*Rubus fruticosus*	HTE	0.1	10
BK07_VZ2 PCT 838 Low_02		*Senecio madagascariensis*	E	0.1	2
BK07_VZ2 PCT 838 Low_02		*Sida rhombifolia*	E	0.1	10
BK07_VZ2 PCT 838 Low_02		*Sonchus oleraceus*	E	0.1	1
BK07_VZ2 PCT 838 Low_02	Forb (FG)	*Dianella longifolia*	N	0.1	1
BK07_VZ2 PCT 838 Low_02	Forb (FG)	*Dichondra repens*	N	0.1	100
BK07_VZ2 PCT 838 Low_02	Tree (TG)	*Guioa semiglauca*	N	0.1	5
BK07_VZ2 PCT 838 Low_02	Grass & grasslike (GG)	*Microlaena stipoides*	N	0.1	10
BK07_VZ2 PCT 838 Low_02	Grass & grasslike (GG)	*Oplismenus aemulus*	N	0.1	10
BK07_VZ2 PCT 838 Low_02	Other (OG)	*Amylotheca spp.*	N	0.1	1
BK07_VZ2 PCT 838 Low_02	Other (OG)	*Geitonoplesium cymosum*	N	0.1	1
BK07_VZ2 PCT 838 Low_02	Other (OG)	*Glycine clandestina*	N	0.1	10

Plot ID	Growth form (native only)	Species	N/E/HTE	Cover	Abundance
BK07_VZ2 PCT 838 Low_02	Other (OG)	*Pandorea pandorana*	N	0.1	1
BK07_VZ2 PCT 838 Low_02	Shrub (SG)	*Acacia mearnsii*	N	5	10
BK07_VZ2 PCT 838 Low_02	Shrub (SG)	*Breynia oblongifolia*	N	0.1	1
BK08_VZ5 PCT 1300 Low		*Araujia sericifera*	HTE	0.1	10
BK08_VZ5 PCT 1300 Low		*Asparagus aethiopicus*	HTE	0.1	10
BK08_VZ5 PCT 1300 Low		*Bidens pilosa*	HTE	0.1	5
BK08_VZ5 PCT 1300 Low		*Briza minor*	E	0.1	10
BK08_VZ5 PCT 1300 Low		*Cenchrus clandestinus*	E	10	10
BK08_VZ5 PCT 1300 Low		*Chloris gayana*	HTE	0.2	1
BK08_VZ5 PCT 1300 Low		*Chrysanthemoides monilifera subsp. rotundata*	HTE	0.1	5
BK08_VZ5 PCT 1300 Low		*Conyza bonariensis*	E	0.1	10
BK08_VZ5 PCT 1300 Low		*Lantana camara*	HTE	85	500
BK08_VZ5 PCT 1300 Low		*Ligustrum sinense*	HTE	0.1	10
BK08_VZ5 PCT 1300 Low	Shrub (SG)	*Myrsine variabilis*	N	0.1	1
BK08_VZ5 PCT 1300 Low	Grass and grasslike (GG)	*Poa labillardierei*	N	0.1	1
BK08_VZ5 PCT 1300 Low		*Polygala myrtifolia*	HTE	0.1	5
BK08_VZ5 PCT 1300 Low		*Senecio madagascariensis*	E	0.1	100
BK08_VZ5 PCT 1300 Low		*Senna pendula var. glabrata*	E	0.2	10
BK08_VZ5 PCT 1300 Low		*Solanum nigrum*	E	0.1	1
BK08_VZ5 PCT 1300 Low		*Tephrosia glomeruliflora*	E	0.1	10
BK08_VZ5 PCT 1300 Low	Forb (FG)	*Dichondra repens*	N	0.1	100

Plot ID	Growth form (native only)	Species	N/E/HTE	Cover	Abundance
BK08_VZ5 PCT 1300 Low	Grass & grasslike (GG)	*Carex longebrachiata*	N	0.2	100
BK08_VZ5 PCT 1300 Low	Grass & grasslike (GG)	*Microlaena stipoides*	N	0.1	10
BK08_VZ5 PCT 1300 Low	Grass & grasslike (GG)	*Oplismenus aemulus*	N	0.1	20
BK08_VZ5 PCT 1300 Low	Other (OG)	*Marsdenia rostrata*	N	0.1	20
BK08_VZ5 PCT 1300 Low	Shrub (SG)	*Acacia mearnsii*	N	10	10
BK08_VZ5 PCT 1300 Low	Shrub (SG)	*Breynia oblongifolia*	N	0.1	10
BK08_VZ5 PCT 1300 Low	Tree (TG)	*Acacia maidenii*	N	0.1	10
BK08_VZ5 PCT 1300 Low	Tree (TG)	*Guioa semiglauca*	N	0.1	10
BK08_VZ5 PCT 1300 Low		*Ageratina adenophora*	HTE	5	100
BK09_VZ2 PCT 838 Low_03	Shrub (SG)	*Acacia mearnsii*	N	15	70
BK09_VZ2 PCT 838 Low_03	Other (OG)	*Amyema congener*	N	0.1	5
BK09_VZ2 PCT 838 Low_03		*Araujia sericifera*	HTE	0.1	200
BK09_VZ2 PCT 838 Low_03		*Bidens pilosa*	E	0.1	2
BK09_VZ2 PCT 838 Low_03	Shrub (SG)	*Breynia oblongifolia*	N	0.1	1
BK09_VZ2 PCT 838 Low_03		*Briza subaristata*	HTE	0.1	1
BK09_VZ2 PCT 838 Low_03		*Cenchrus clandestinus*	HTE	0.1	50
BK09_VZ2 PCT 838 Low_03		*Cirsium vulgare*	E	0.1	1
BK09_VZ2 PCT 838 Low_03	Shrub (SG)	*Commersonia fraseri*	N	0.1	2
BK09_VZ2 PCT 838 Low_03	Grass & grasslike (GG)	*Cynodon dactylon*	N	0.1	50
BK09_VZ2 PCT 838 Low_03	Forb (FG)	*Dichondra repens*	N	0.5	50
BK09_VZ2 PCT 838 Low_03		*Ehrharta erecta*	HTE	0.1	500

Plot ID	Growth form (native only)	Species	N/E/HTE	Cover	Abundance
BK09_VZ2 PCT 838 Low_03	Other (OG)	*Glycine microphylla*	N	0.1	1
BK09_VZ2 PCT 838 Low_03		*Gomphocarpus fruticosus*	E	0.1	1000
BK09_VZ2 PCT 838 Low_03	Tree (TG)	*Grevillea robusta*	N	0.1	10
BK09_VZ2 PCT 838 Low_03	Grass & grasslike (GG)	*Imperata cylindrica*	N	0.2	100
BK09_VZ2 PCT 838 Low_03		*Lantana camara*	HTE	60	1000
BK09_VZ2 PCT 838 Low_03	Grass & grasslike (GG)	Microlaena stipoides	N	0.1	10
BK09_VZ2 PCT 838 Low_03		*Ochna serrulata*	HTE	0.1	2
BK09_VZ2 PCT 838 Low_03		*Passiflora subpeltata*	E	0.1	5
BK09_VZ2 PCT 838 Low_03	Forb (FG)	*Pseuderanthemum variabile*	N	0.1	1
BK09_VZ2 PCT 838 Low_03		*Senecio madagascariensis*	E	0.1	10
BK09_VZ2 PCT 838 Low_03		*Sida rhombifolia*		0.1	50
BK10_VZ2 PCT 838 Low 04	Shrub (SG)	Acacia mearnsii - Black Wattle	N	10	50
BK10_VZ2 PCT 838 Low 04	Other (OG)	*Amyema congener*	N	0.1	1
BK10_VZ2 PCT 838 Low 04		Asparagus aethiopicus	HTE	0.1	1
BK10_VZ2 PCT 838 Low 04		Asparagus asparagoides	HTE	0.1	1
BK10_VZ2 PCT 838 Low 04		Briza subaristata	HTE	0.1	1
BK10_VZ2 PCT 838 Low 04		Chloris gayana	HTE	0.5	100
BK10_VZ2 PCT 838 Low 04	Grass & grasslike (GG)	Cymbopogon refractus	N	0.1	1000
BK10_VZ2 PCT 838 Low 04	Grass & grasslike (GG)	Cynodon dactylon	N	0.1	100
BK10_VZ2 PCT 838 Low 04	Forb (FG)	Dichondra repens	N	0.1	100
BK10_VZ2 PCT 838 Low 04		Ehrharta erecta	HTE	0.2	100

Plot ID	Growth form (native only)	Species	N/E/HTE	Cover	Abundance
BK10_VZ2 PCT 838 Low 04	Other (OG)	Geitonoplesium cymosum	N	0.1	10
BK10_VZ2 PCT 838 Low 04	Other (OG)	Glycine microphylla	N	0.1	1
BK10_VZ2 PCT 838 Low 04	Other (OG)	Glycine tabacina complex	N	0.1	1
BK10_VZ2 PCT 838 Low 04		Lantana camara	HTE	0.5	1000
BK10_VZ2 PCT 838 Low 04		Ligustrum sinense	HTE	0.1	100
BK10_VZ2 PCT 838 Low 04	Grass & grasslike (GG)	Microlaena stipoides	N	0.1	10
BK10_VZ2 PCT 838 Low 04		Murraya paniculata	E	0.1	1
BK10_VZ2 PCT 838 Low 04	Shrub (SG)	Myrsine variabilis	N	0.1	1
BK10_VZ2 PCT 838 Low 04		Ochna serrulata	HTE	0.1	100
BK10_VZ2 PCT 838 Low 04	Grass & grasslike (GG)	Oplismenus aemulus	N	0.1	10
BK10_VZ2 PCT 838 Low 04		*Passiflora subpeltata*	E	0.1	1
BK10_VZ2 PCT 838 Low 04		Senecio madagascariensis	E	0.1	100
BK10_VZ2 PCT 838 Low 04		Sida rhombifolia	E	0.1	1
BK10_VZ2 PCT 838 Low 04		Solanum pseudocapsicum	E	0.1	5

Appendix 4 Fauna

Table A. 4 Fauna species recorded at the subject land

Scientific Name	Common Name
Mammals	
Pteropus poliocephalus	Grey-headed Flying Fox
Cervus timorensis	Rusa Deer
Birds	
Calyptorhynchus funereus	Yellow Tailed Black Cockatoo
Acridotheres tristis	Indian Mynah
Sericornis magnirostra	Large-billed scrubwren
Trichoglossus haematodus	Rainbow Lorikeet
Grallina cyanoleuca	Magpie-lark
Manorina melancocephala	Noisy Miner
Pardalotus punctatus	Spotted Pardalote
Malarus cyaneus	Superb Fairy-wren
Corvus coronoides	Australian Raven
Cacatua galerita	Sulphur-crested Cockatoo

Appendix 5 SIC Assessment

Threatened flora: White-flowered Wax-plant

The White-flowered Wax Plant is a climber or twiner with a highly variable form. Mature stems have a fissured corky bark and can grow to 10 m long and 3.5 cm thick (Harden & Williams, 1992). This species can be mistaken for the common exotic climber Araujia sericifera (Moth Plant) (NPWS, 2002). The White-flowered Wax Plant occurs within the Hawkesbury–Nepean, Hunter–Central Rivers, Northern Rivers, Southern Rivers and Sydney Metro (NSW) Natural Resource Management Regions. Within these regions, it has been recorded from the Gloucester district to the Wollongong area and inland to Mt Dangar (Harden & Williams, 1992)

The White-flowered Wax Plant is considered to be primarily clonal and is usually found as a ground of stems over a small area (NSW SC 2009). NSW SC (2009) indicates a high degree of uncertainty regarding accurate estimates of population mixing or genetic isolation of these groups due to lack of genetic data. Therefore the White-flowered Wax-plant within the subject site has been assessed as being a local population.

Concept approval has been granted under the EP&A Act for a multi-staged development of a holistic health care facility at Berkeley. This BDAR has been written with respect to all six stages of the proposal, it should however be noted that the proponent is currently only seeking development consent for Stage 1. There are no impacts to White-flowered Wax Plant as a result of Stage 1. Stages 2-6 involve the potential removal of 15 stems and four seedlings of White-flowered Wax Plant as a result of the proposed access road from Nolan Street. It is recommended that further surveys are undertaken to better document the extent of the local population and that the proposed access road is re-designed in order to avoid impacts to the White-flowered Wax Plant for Stages 2-6.

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility it will:

Lead to a long-term decrease in the size of a population

Stage 1 of the project will not result in any decrease in the population of the White-flowered Wax Plant. Stages 2-6 involve the potential removal of 15 White-flowered Wax Plant stems and four seedlings, over an approximate area of 0.44 hectares, as a result of the proposed access road. It is recommended that the access road be re-designed to avoid direct impacts to the White-flowered Wax Plant at the appropriate development stage.

Reduce the area of occupancy of the species

There is 4.48 hectares of suitable habitat in the study area, and 1.29 hectares proposed for removal during Stages 2-6, of which 0.44 hectares contains known records of the White-flowered Wax Plant. No impacts on White-flowered Wax Plant are proposed during Stage 1. It is recommended that further surveys and re-design of the road during Stages 2-6 are undertaken to minimise direct impacts to White-flowered Wax Plant.

Fragment an existing population into two or more populations

The subject land in the context of the locality represents an already highly fragmented landscape. There is more cleared land, buildings, roads and infrastructure (814.08 hectares) than there is native vegetation (169.28 hectares). The vegetation on the site has been highly modified and disturbed in the past and is a recovering patch.

Stage 1 of the project will not result in direct impacts to White-flowered Wax Plant. Stages 2-6 of the project involve the construction of a proposed access road from Nolan Street to the subject land, which will fragment

the suitable habitat.. It is recommended that the proposed access road is redesigned to minimise direct impacts to White-flowered Wax Plant, and prevent fragmentation of the local population.

Adversely affect habitat critical to the survival of a species

To date no habitat critical for the survival of White-flowered Wax Plant species has been listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act.

Disrupt the breeding cycle of a population

White-flowered Wax Plant is primarily clonal in nature (NSW SC 2009) and therefore is not wholly reliant on a pollinator to maintain small discrete populations. As seedlings of White-flowered Wax-plant were recorded, this has been conservatively assumed for this population.

Stage 1 of the project will have no impact on the breeding cycle of the population. It is recommended that the proposed access road during Stages 2-6 is re-designed in order to avoid direct impacts to the White-flowered Wax Plant and in particular the establishment of further clonal seedlings.

Modify, destroy, remove, isolate or decrease the availability or quality of habit to the extent that the species is likely to decline

Stage 1 of the project will have no direct impacts to the availability or quality of habitat of the White-flowered Wax Plant. Stages 2-6 involve the removal of 1.29 hectares of suitable habitat, however in the context of the study area, 3.18 hectares of suitable habitat will remain in-situ. Therefore, the proposed removal of 1.29 hectares is not considered to decrease the habitat to an extent that the species is likely to decline as a result.

Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered species habitat

Stage 1 of the project is unlikely to result in the introduction of invasive species in the endangered species habitat, as there is no habitat within Stage 1 and an effective construction environmental management plan (CEMP) has been recommended to prevent introduction of weeds during the construction phase.

Stages 2-6 will include the proposed construction of an access road which will provide a vector for weed introduction. However, due to the number of roads surrounding the site already and the current abundance of weeds the extent of this impact is considered minor.

Introduce disease that may cause the species to decline

Introduction of plant pathogens and pests to suitable habitat may occur during Stages 2-6 as a result of vehicle and machinery movement. To reduce the risk of plant pathogen and pest introduction, clean down procedures to remove soil and vegetative biomass from vehicles and machinery entering the subject site will be incorporated into the CEMP.

Interfere with a recovery of the species

To date no recovery plans have been prepared for White-flowered Wax-plant.

Conclusion

Based on the assessment above, Stage 1 of the project is unlikely to have a significant impact on White-flowered Wax-plant. Furthermore, re-design of the access road during Stages 2-6 is will ensure that a significant impact on the White-flowered Wax Plant is unlikely.

Appendix 6 Original development area

Appendix 6: Proposed development area with vegetation types and slope classification

Appendix 7 Photo Plates

Plate 1 Plot 1 VZ1 PCT 1300 Whalebone Tree weedy start

Plate 2 Plot 1 VZ1 PCT 1300 Whalebone Tree weedy end

Plate 3 Plot 2 VZ4 PCT 838 Forest Red Gum moderate start

Plate 4 Plot 2 VZ4 PCT 838 Forest Red Gum moderate end

Plate 5 Plot 3 VZ3 PCT 838 DNG start

Plate 6 Plot 3 VZ3 PCT 838 DNG end

Plate 7 Plot 4 Urban/exotic grassland start

Plate 8 Plot 4 Urban/exotic grassland end

Plate 9 Plot 5 VZ2 PCT 838 Low start

Plate 10 Plot 5 VZ2 PCT 838 Low end

Plate 11 Plot 6 Urban/exotic grassland start

Plate 12 Plot 6 Urban/exotic grassland end

Plate 13 Plot 7 VZ2 PCT 838 Low start

Plate 14 Plot 7 VZ2 PCT 838 Low end

Plate 15 Plot 8 VZ5 PCT 1300 Low start

Plate 16 Plot 8 VZ5 PCT 1300 Low end

Plate 17 Plot 9 VZ2 838 Low start

Plate 18 Plot 9 VZ2 PCT 838 Low end

Plate 19 Plot 10 VZ2 PCT 838 Low start

Plate 20 Plot 10 VZ2 PCT 838 Low end

Plate 21 White-flowered Wax Plant leaf

Plate 22 White-flowered Wax Plant stem

Plate 23 Small dam