Biodiversity Assessment Report

Planning Proposal for Rosalind Park

Leda Holdings Pty Ltd

12 September 2022

Final

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Report No. 21170RP1

The preparation of this report has been in accordance with the brief provided by the Client and has relied upon the data and results collected at or under the times and conditions specified in the report. All findings, conclusions or commendations contained within the report are based only on the aforementioned circumstances. The report has been prepared for use by the Client and no responsibility for its use by other parties is accepted by Cumberland Ecology.

Version	Date Issued	Amended by	Details
01	12/09/2022	MP, VO	Version 01

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Position:	Director
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Date:	12 September, 2022

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Glossary

Term/Abbreviation	Definition
BAM	Biodiversity Assessment Method
BAR	Biodiversity Assessment Report
BC Act	NSW *Biodiversity Conservation Act 2016*
BC SEPP	*State Environmental Planning Policy (Biodiversity and Conservation) 2021*
BDAR	Biodiversity Development Assessment Report
BOS	Biodiversity Offsets Scheme
Campbelltown LEP	*Campbelltown Local Environmental Plan 2015*
CEEC	Critically Endangered Ecological Community
Chief Scientist & Engineer Report	*The Advice on the protection of the Campbelltown Koala population: Koala Independent Expert Panel* (Chief Scientist & Engineer 2020)
CKPoM	Campbelltown Comprehensive Koala Plan of Management
client	Leda Holdings Pty Ltd
CPCP	Cumberland Plain Conservation Plan
DA	Development Application
DBH	Diameter at Breast Height
DPE	NSW Department of Planning and the Environment
EEC	Endangered Ecological Community
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
GIS	Geographic Information System
ha	hectare
LGA	Local Government Area
m	metre
MNES	Matters of National Environmental Significance
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
PCT	Plant Community Type
SAII	Serious and Irreversible Impact
subject site	Properties associated with the project listed in ***Section 1.1*** and shown on **Figure 1**
TEC	Threatened Ecological Community

Term/Abbreviation	Definition
The project	A planning proposal to amend the zoning of the subject site as per the Concept Structure Plan
VAR	Vegetation Assessment Report
VI	Vegetation Integrity

1. Introduction

1.1. Purpose

Cumberland Ecology Pty Ltd (Cumberland Ecology) has been commissioned by Leda Holdings Pty Ltd ('the client') to prepare a Biodiversity Assessment Report (BAR) to support a planning proposal (the 'project') to amend the zoning for an area within the following properties:

- Lot 1 DP 589241;
- Lots 1, 2 and 3 DP 622362;
- Lot 35 DP 230946; and
- Lot 58 DP 632328.

The area to be rezoned by the project is hereafter referred to as the subject site and is shown in **Figure 1**. The planning proposal proposes to rezone the subject site from RU2: Rural Landscape under the *Campbelltown Local Environmental Plan 2015* (Campbelltown LEP) to mixed use zoning that will facilitate the redevelopment of the area for urban purposes in a sustainable manner by providing residential allotments of various sizes, commercial land, community and recreation facilities, as well as passive and active open space, primary school, landscaped areas, retained bushland, riparian areas, water quality basins and a koala corridor. The Concept Structure Plan illustrating the proposed rezoning/land usages of the subject site is shown in **Figure 2**.

The purpose of this BAR is to describe the current biodiversity values of the subject site and provide an assessment of the potential impacts of the planning proposal on flora and fauna. Particular attention is focussed on threatened species, populations and communities that are listed under the New South Wales (NSW) *Biodiversity Conservation Act 2016* (BC Act) and/or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). In addition to potential impacts on threatened entities listed under the BC Act and/or EPBC Act, this BAR details how the project interacts with a strategic biodiversity certification plan of the region that currently includes sections of the subject site. The strategic biodiversity certification plan is referred to as the Cumberland Plain Conservation Plan or 'CPCP', which was gazetted in August 2022. Further to the above, this BAR identifies future ecological assessments and associated mitigation measures that may be required for future development within the subject site that would be facilitated by the project (i.e. rezoning of the subject site).

The specific objectives of this report are to:

- Describe the vegetation communities on the subject site;
- Describe fauna habitats and fauna usage of the subject site;
- Identify any threatened species, populations or ecological communities (as listed under the BC Act and/or EPBC Act) existing on the subject site;
- Assess the likelihood of occurrence of threatened species, populations or communities (as listed under the BC Act and/or EPBC Act) within the subject site;

- Describe potential future ecological assessment requirements that may apply at the development application (DA) stage, with consideration of the CPCP;
- Provide a high level assessment of the potential impact of the likely future development on threatened communities, flora and fauna; and
- Where relevant, recommend mitigation measures to reduce the impacts of the planning proposal and subsequent development on biodiversity values.

1.2. Background

1.2.1. Location

The subject site is located at the following residential addresses: 33 Medhurst Road, and 111 and 101 Menangle Road, Menangle Park. The subject site includes a total of six (6) lots that are legally described as Lot 1 DP 589241, Lots 1, 2 and 3 DP 622362, Lot 35 DP 230946 and Lot 58 DP 632328 (**Figure 1**). The subject site is approximately 264 hectares (ha) in size and is located entirely within the Campbelltown Local Government Area (LGA). Several unnamed watercourses are mapped within the subject site, the majority of which drain into Menangle Creek which forms much of the southern and eastern borders of the subject site, and eventually drains into the Nepean River located to the southwest of the subject site. Medhurst Road, a private unnamed road and the Hume Motorway form the western boundary of the subject site, while rural lands with scattered bushland form the northern boundary of the subject site.

Historical imagery of the subject site shows that much of the land was cleared prior to 1947, with treed areas being restricted primarily to areas surrounding watercourses, as well as areas in the northwest. Currently, the southern area of the subject site includes the now disused Menangle Park Quarry and Resource Recovery Facility, and Rosalind Park Gas Plant, while areas in the north contain residential dwellings with landscaped lawns and scattered trees. The remainder of the subject site includes agricultural grasslands as well as woodland areas within riparian areas. A powerline transmission easement and gas easement have been identified that dissect the central-east of the subject site generally in a north-south direction.

The surrounding land uses of the subject site include the Hume Motorway immediately to the west, rural lands containing scattered bushland directly to the north, the Mt Gilead Residential Estate approximately 500 m to the east, and the Menangle Creek riparian corridor and agricultural land to the south.

1.2.2. Landform, Geology and Soils

The topography of the subject site includes steeply undulating terrain that generally includes plateaus above watercourses that grade steeply into the water courses themselves. The southern end of the subject site includes steep escarpments along Menangle Creek, as well as quarry highwalls within the disused quarry. The elevations of the subject site range from ~75 – ~165 m above sea level and the topographical contours of the subject site are shown on **Figure 1**.

The underlying geology of the majority of the subject site is Luddenham which occurs on undulating hills on Wianamatta Group Shales, and is comprised of brown podzolic soils and massive earthy clays over red podzolic soils. The eastern areas of the subject site primarily around Menangle Creek are of Theresa Park geology that

occur on floodplains and terraces of the Nepean River and is comprised of red earths and red podzolic soils. The southeast of the subject site includes areas mapped as Hawkesbury which occurs on rugged, rolling to very steep hills on Hawkesbury Sandstone. It is comprised of Lithosols/Siliceous Sands, Earthy Sands and Yellow Sands. The south west of the subject site includes areas mapped as Disturbed Terrain around the disused quarry as well as areas of Blacktown that occurs in undulating areas along the western boundary of the subject site. Blacktown geology occurs on Wianamatta Group shale and is comprised of red podzolic soils and brown podzolic soils. An additional area of Volcanic geology occurs in the north of the subject site which occurs on volcanic intrusions within the Hawkesbury Sandstone and Wianamatta Group shales. Volcanic geology includes red podzolic soils or yellow podzolic soils.

1.2.3. Vegetation

The subject site has been extensively cleared of vegetation pre-1947 and is currently comprised of agricultural grasslands, wooded/forested riparian corridors, remnant trees occurring over previously cleared areas, planted vegetation as well as regrowth native vegetation occurring along steeper slopes that have been less accessible to livestock for grazing. The majority of the vegetation present generally contains low native species diversity and coverage, with a high coverage of weeds. This is particularly true for riparian areas that have been overrun by weeds such as *Ligustrum sinense* (Small-leaved Privet), *Ligustrum lucidum* (Large-leaved Privet) and *Olea europaea* subsp. *cuspidata* (African Olive). **Photograph 1** below illustrates the weedy condition of an unnamed ephemeral creek in the northeast of the subject site that has been overrun by the exotic species *Ligustrum sinense* (Small-leaved Privet) and *Ligustrum lucidum* (Large-leaved Privet).

Photograph 1 Ephemeral creek in the northeast of the subject site overrun by Small- and Large-leaved Privet

With the exception of the steeper areas in the south of the subject site along Menangle Creek, all vegetation currently present has been highly modified from past land uses and contains little similarity to what was likely present pre-European colonisation.

Broad-scale mapping undertaken as part of the Remnant Vegetation of the Western Cumberland Subregion mapping project (OEH 2016) identifies the following seven native vegetation communities present within the subject site:

- Shale Sandstone Transition Forest (Low Sandstone Influence);
- Shale Sandstone Transition Forest (High Sandstone Influence);
- Shale Plains Woodland;
- Shale Hills Woodland;
- Alluvial Woodland;
- Riparian Forest; and
- Moist Shale Woodland.

1.2.4. Hydrology

The subject site contains several small unnamed ephemeral watercourses that drain to the east and south into Menangle Creek, which ultimately flows into the Nepean River. Additional unnamed ephemeral watercourses are mapped in the north and west of the subject site. Watercourses in the far north flow north into a matrix of agricultural/rural land while the watercourses in the west flow towards the Hume Motorway.

A number of the mapped courses are no longer present as a result of past land practices, including the disused quarry in the south. Following the 'Strahler System', mapped watercourses present in the subject site includes 16 first order streams, four (4) second order streams, two (2) third order streams and one (1) fourth order stream (**Figure 1**).

1.2.5. Project Description

The client proposes to submit a planning proposal to amend the zoning of the subject site in order to redevelop the area for urban purposes in a sustainable manner by providing residential allotments of various sizes, commercial land, community and recreation facilities, as well as passive and active open space, primary school, landscaped areas, retained bushland, riparian areas, water quality basins and a koala corridor. To ensure that environmental outcomes are balanced against developed areas, the planning proposal has identified environmentally sensitive areas across the subject site that will be managed and result in the long-term protection and enhancement of the riparian corridors, fauna linkages (primarily for the koala) and native vegetation that are considered to provide the highest biodiversity value. As a result of the planning proposal, the subject site will become an urban release area that integrates with the existing and proposed urban development within the surrounding urban release areas.

It is understood that this BAR and the planning proposal it supports will be submitted to Campbelltown City Council (Council) and then to the NSW Department of Planning and the Environment (DPE) for Gateway Determination. As part of the planning proposal, the following state planning provisions are required to be addressed/considered either within this BAR itself, or within additional supporting information:

- NSW *Environmental Planning and Assessment Act 1979* (EP&A Act);
- NSW *Biodiversity Conservation Act 2016* (BC Act);
- *State Environmental Planning Policy (Biodiversity and Conservation) 2021* (BC SEPP);
- Campbelltown's approved Comprehensive Koala Plan of Management (the 'CKPoM');
- Campbelltown Local Environmental Plan 2015 (Campbelltown LEP); and
- Campbelltown Development Control Plan 2015.

1.3. Relevant Legislation/Planning Controls

1.3.1. Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

Under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), any action (which includes a development, Project or activity) that is considered likely to have a significant impact on Matters of National Environmental Significance (MNES) (including nationally threatened ecological communities and species and listed migratory species) must be referred to the Commonwealth Minister for the Environment. The purpose of the referral is to allow a decision to be made about whether an action requires approval on a Commonwealth level. If an action is considered likely to have a significant impact on MNES, it is declared a "controlled action" and Commonwealth approval is required.

1.3.2. NSW *Environmental Planning and Assessment Act 1979*

The NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) is the overarching planning legislation in NSW that provides for the creation of planning instruments that guide land use. The EP&A Act also provides for the protection of the environment, including the protection and conservation of native fauna and flora species. This includes threatened species, populations and ecological communities, and their habitats, as listed under the BC Act and NSW *Fisheries Management Act 1994*.

1.3.3. NSW *Biodiversity Conservation Act 2016*

The BC Act is the key piece of legislation in NSW relating to the protection and management of biodiversity and threatened species. The purpose of the BC Act is to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development. The BC Act is supported by regulations, including the *Biodiversity Conservation Regulation 2017*.

1.3.4. *State Environmental Planning Policy (Biodiversity and Conservation) 2021* (BC SEPP)

State Environmental Planning Policy (Biodiversity and Conservation) 2021 (BC SEPP) recently replaced the now repealed *State Environmental Planning Policy (Koala Habitat Protection) 2021*. Chapter 4 'Koala Habitat Protection 2021' of the BC SEPP includes provisions for the assessment of impacts to koalas. Chapter 4 of the BC SEPP applies to the subject site as the LGA is listed in Schedule 2 of the BC SEPP and a Koala Plan of Management (the 'CKPOM') has been approved for the LGA. Under the CKPOM, the subject site includes areas mapped as 'Potential Koala Habitat' as well as 'Strategic Linkage Areas' along Menangle Creek. As such, Council must be satisfied that any Planning Proposal and development application (DA) within the subject site is consistent with the CKPOM. Further to this, the CKPOM requires that any planning proposal submitted within the LGA be supported by a Vegetation Assessment Report (VAR). Cumberland Ecology has been engaged by the client to prepare a VAR required for the project. The VAR will be prepared as a separate document to this BAR and submitted to Council for assessment.

Chapter 13 'Strategic Conservation Planning' of the BC SEPP applies to the subject site as it contains lands included on the 'Land Application Map' (Sheet LAP_006). The aims of Chapter 13 of the BC SEPP as it pertains to the subject site are summarised as follows:

- Ensure development is consistent with the Cumberland Plain Conservation Plan;
- Facilitate appropriate development on biodiversity certified land (i.e. Certified – Urban Capable land);
- Protect areas that contain high biodiversity value, or provide important connectivity, or that are considered to have high ecological restoration value;
- Ensure future development avoids/minimises impacts on areas with high biodiversity value; and
- Support the acquisition of areas with high biodiversity value for in-perpetuity conservation.

The Concept Structure Plan is considered to be consistent with the aims of Chapter 13 of the BC SEPP as it has been developed in an attempt to retain and conserve areas considered to have the following:

- High biodiversity value (e.g. areas containing TECs and associated threatened species habitat);
- Important connectivity to offsite habitat (e.g. areas proposed to become a koala corridor); and
- High restoration value (e.g. weed infested TECs that have potential to be restored with weed management proposed).

Further to the above, any future development with the subject site will be required to demonstrate consistency with the relevant development controls identified in Chapter 13 of the BC SEPP.

1.3.5. Cumberland Plain Conservation Plan (CPCP)

A strategic biodiversity certification plan referred to as the Cumberland Plain Conservation Plan or 'CPCP' applies to a significant portion of the subject site. The CPCP was gazetted in August 2022 and includes the following land categories within the subject site:

- Certified – Urban Capable;
- Excluded;
- Non-certified;
- Strategic Conservation Area; and
- Important Koala Habitat.

Figure 3 illustrates all land within the subject site that is 'Certified – Urban Capable' under the CPCP. As illustrated in **Figure 3**, a significant portion of the subject site is 'Certified – Urban Capable' land under the CPCP. Areas identified as 'Certified – Urban Capable' land under the CPCP are areas that are certified under the BC Act as having the biodiversity approvals to progress development. Such areas will not require further site-specific biodiversity assessments as these areas have been strategically chosen to avoid and minimise impacts on biodiversity values. Any areas of the subject site not mapped as 'Certified – Urban Capable' that will be zoned for development by the project will require site-specific biodiversity assessments at the DA stage in accordance with the BAM.

The CPCP includes a mechanism where landholders can submit a modification application to DPE to modify the extent of 'Certified – Urban Capable' land; however, the application must demonstrate that the proposed modification is consistent with the CPCP's avoidance criteria, that all options to avoid impacts have been considered and that the proposal has no or minimal biodiversity impact. Any changes to the CPCP will be made within 12 months of the CPCP being implemented and will be included in a single update to the CPCP (DPE 2022).

The client is currently holding ongoing discussions with DPE regarding modifying the extent of 'Certified – Urban Capable' land under the CPCP. As a result of these discussions, the client intends to lodge an application with DPE to modify the current extent of 'Certified – Urban Capable' land mapped under the CPCP to match the extents of the land uses proposed under the Concept Structure Plan.

The extent of 'Certified – Urban Capable' land to be proposed under the modification application is shown in **Figure 4**. A comparison of **Figures 3** and **4** identify that the proposed changes would result in areas of 'Certified – Urban Capable' land being shifted away from the proposed koala corridor to better match the proposed land uses of the subject site. The proposed modification will ensure that areas of the koala corridor will not be developed in the future, whereas under the CPCP, areas of the proposed koala corridor would become 'Certified – Urban Capable' land and be susceptible to future development.

1.3.6. Campbelltown Local Environmental Plan 2015 (Campbelltown LEP)

The Campbelltown LEP aims to make local environmental planning provision for land within the Campbelltown LGA. The Planning Proposal is subject to the Campbelltown LEP as the subject site is located entirely within the LGA. The subject site also includes areas mapped as 'Biodiversity – significant vegetation' in the Campbelltown LEP 2015 map (BIO_003).

The main objectives are to:

- Protect and conserve the LGA's biodiversity through the retention of native vegetation;
- Maintain, enhance and/or establish corridors, which enable existing plant and animal communities to survive and range in their natural habitat;
- Protect habitat resources including hollow-bearing trees and hollow logs within Campbelltown LGA; and
- Provide appropriate measures to compensate for the loss of hollow-bearing trees within the LGA.

Although the Planning Proposal will facilitate the removal of vegetation that is mapped as 'Biodiversity – significant vegetation', a significant portion of this vegetation will also be retained by the Planning Proposal. It is further noted that all areas mapped as 'Biodiversity – significant vegetation' are superseded by the CPCP.

1.3.7. Campbelltown (Sustainable City) Development Control Plan 2015

The Campbelltown Development Control Plan 2015 Volume 1 Section 11 (Vegetation and Wildlife Management) and Volume 2 Part 8 Section 1.11 (Environmental Management) apply to the subject site as it is located entirely within Campbelltown LGA.

2. Methodology

2.1. Desktop Assessment

Mapping layers from The Native Vegetation of the Sydney Metropolitan Area (OEH 2016) and the Map of Threatened Ecological Communities in Greater Sydney (DPIE 2021) were reviewed to determine the potential vegetation communities present, including those that align to Threatened Ecological Communities (TECs) listed under the BC Act and/or EPBC Act.

Database analysis was conducted for the locality (10 km radius of the subject site) on 6 June 2022 using the NSW BioNet Atlas (EHG 2022) and the Commonwealth EPBC Act Protected Matters Search Tool (DAWE 2022). The NSW BioNet Atlas and the Commonwealth Protected Matters Search Tool were examined for records of any threatened flora and fauna species listed under the BC Act and/or EPBC Act within the locality.

2.2. Field Surveys

2.2.1. Flora Survey

A flora survey was conducted on 24, 25 and 27 January, and 11 April 2022 by a botanist and an ecologist from Cumberland Ecology. The flora survey consisted of the following:

- A random meander survey across the subject site to compile a species list and to map vegetation communities;
- A plot-based vegetation integrity assessment performed in accordance with the Biodiversity Assessment Method (BAM);
- Targeted searches for threatened flora species identified as being present within the locality and having the potential to be present by way of random meander;
- Rapid assessment surveys where the dominant species and associated cover were recorded at various locations; and
- Taking photographs of vegetation to provide a visual documentation of Plant Community Types (PCTs) present and their condition.

Identification of the PCTs occurring within the subject site was guided by the findings of the floristic survey. The data collected during surveys of the subject site was analysed in conjunction with a review of the PCTs held within the VIS Classification Database. Consideration was given to the occurrence within the Sydney Basin Interim Biogeographic Regionalisation for Australia (IBRA) Bioregion and Cumberland IBRA Sub-regions. The locations of flora surveys within the subject site are shown in **Figure 5**.

2.2.1.1. Vegetation Mapping

Previous vegetation mapping of the subject site prepared by the former Office of Environment and Heritage (OEH) and the former Department of Planning, Industry and Environment were reviewed prior to the survey in order to determine vegetation communities that could occur within the subject site (OEH 2016, DPIE 2021). The vegetation within the subject site was ground-truthed by Cumberland Ecology. Vegetation community boundaries were made using a hand-held Global Positioning System and mark-up of aerial photographs. The

data collected was analysed and the resultant information was synthesised using a Geographic Information System (GIS) to produce a vegetation map of the subject site.

2.2.1.2. Rapid Assessment

To supplement the vegetation mapping of the subject site, rapid assessments were undertaken at various locations within the subject site to document the species composition and condition of vegetation present. At each rapid assessment point the dominant species and associated cover were recorded, and photographs taken.

2.2.1.3. Random Meander

A flora survey was undertaken within the subject site via random meander. Flora species encountered during the random meander were noted to compile a species list for the subject site. The random meander also targeted threatened flora species known from the locality.

2.2.1.4. Vegetation Integrity Assessment

A vegetation integrity assessment (BAM plots) was undertaken in the subject site in accordance with the BAM. The data collected from the BAM plots is used to determine the vegetation integrity (VI) score of the vegetation which is a quantitative measure of vegetation condition (i.e. the higher the VI score, the better condition the vegetation is in). Surveys included establishment of a single 20 m x 50 m plot within which the following data was collected:

- Composition for each growth form group by counting the number of native plant species recorded for each growth form group within a 20 m x 20 m floristic plot;
- Structure of each growth form group as the sum of all the individual projected foliage cover estimates of all native plant species recorded within each growth form group within a 20 m x 20 m floristic plot;
- Cover of 'High Threat Exotic' weed species within a 20 m x 20 m floristic plot;
    - Assessment of function attributes within a 20 m x 50 m plot, including:
    - Count of number of large trees;
    - Tree stem size classes, measured as 'diameter at breast height over bark' (DBH);
    - Regeneration based on the presence of living trees with stems <5 cm DBH;
    - The total length in metres of fallen logs over 10 cm in diameter;
- Assessment of litter cover within five 1 m x 1 m plots evenly spread within the 20 m x 50 m plot; and
- Number of trees with hollows that are visible from the ground within the 20 m x 50 m plot.

A total of 14 BAM plots were undertaken within the subject site, and the locations are shown in **Figure 5**.

2.2.2. Fauna Survey

2.2.2.1. Habitat Assessment

A fauna habitat assessment was conducted by an ecologist on 24, 25 and 27 January, and 11 April 2022. The subject site was assessed for groundcover, shrub/understory cover, canopy cover, tree hollows as well as other habitat features such as bush rock, cliffs, fallen trees and signs of fauna use such as scats, scratches and scrapings.

The nature and extent of fauna habitats in the subject site were assessed and areas where fauna species could reside or forage were identified. This included consideration of important indicators of habitat condition and complexity including the occurrence of microhabitats such as tree hollows, cliffs, fallen logs, bush rock and wetland areas such as creeks and soaks.

An assessment of the structural complexity of vegetation, the age structure of the vegetation and the nature and extent of human disturbance throughout the subject site was also undertaken and considered. Tree hollows were used as a general indication of habitat quality for arboreal fauna and hollow-dwelling birds and bats. Any hollows observed during surveys were recorded and the general vegetation condition and tree maturity was used to predict whether trees on site were likely to contain hollows.

During the habitat assessment, any fauna species seen or heard calling were recorded.

2.2.3. Riparian Assessment

Due to the high number of mapped watercourses within the subject site, a riparian assessment was undertaken to confirm the presence and extent of mapped watercourses. The number, type and extent of watercourse present were initially determined via desktop assessment. Field surveys undertaken on 24, 25 and 27 January, and 11 April 2022 sought to verify the number, condition and extent of the following types of watercourses:

- Rivers and streams; and
- Dams.

The riparian assessment also included consideration of stream condition and complexity of the mapped watercourses, including:

- The presence of a defined bed and bank;
- Evidence of flow and geomorphic features (whether water is present or not); and
- The presence of aquatic/riparian vegetation (particularly those containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.).

2.3. Limitations

The weather conditions at the time of the flora surveys were generally favourable for plant growth and production of features required for identification of most species. Shrubs, grasses, herbs and creepers were readily identifiable in most instances. It is expected that not all flora species present would have been recorded

during surveys. Despite this, it is considered that sufficient information has been collected to assess issues including conservation significance of the flora, condition and viability of vegetation and likely impact on native vegetation. An assessment of potential habitat for threatened flora species listed for the locality in the database searches was undertaken to supplement the flora surveys. The combination of these techniques is considered appropriate for assessing the habitat values for threatened flora within the subject site.

Opportunistic observations of fauna provide a "snapshot" of some of the fauna present on a site that were active during the time of the survey. The data produced by the survey is intended to be indicative of the types of species that could occur and not an absolute census of all vertebrate fauna species occurring within the subject site. Therefore not all fauna utilising the subject site are likely to have been recorded during surveys. An assessment of potential habitat for threatened and migratory fauna species listed for the locality in the database searches was undertaken to supplement the fauna surveys. The combination of these techniques is considered appropriate for assessing the habitat values for threatened fauna within the subject site.

3. Results

The following sections present the results of the surveys and desktop assessment undertaken for the subject site.

3.1. Vegetation Communities

Previous broad-scale mapping conducted by OEH indicates that Shale Plains Woodland, Shale Hills Woodland, Alluvial Woodland, Riparian Forest, Moist Shale Woodland and Shale Sandstone Transition Forest are present within the subject site. A number of these communities are described as conforming to various TECs listed under the BC Act and/or EPBC Act. Surveys by Cumberland Ecology for this BAR refined the existing vegetation mapping which is presented in **Figure 6**. **Table 1** identifies all mapped vegetation communities as well as their best-fit PCT, their listing status under the BC Act and/or EPBC Act, and their areas of extent within the subject site. Descriptions of each of the vegetation communities are provided below.

Table 1 Vegetation communities within the subject site

Vegetation Community	PCT	Subject Site Area (ha)	BC Act Status	EPBC Act Status
Cumberland Shale Plains Woodland	849	3.7	CEEC	CEEC
Cumberland Shale Hills Woodland	850	42.0	CEEC	CEEC
Cumberland Shale Hills Woodland - derived native grassland	850	3.3	CEEC	-
Cumberland Shale - Sandstone Ironbark Forest	1395	12.2	CEEC	CEEC
Cumberland Moist Shale Woodland	830	1.2	EEC	CEEC
Cumberland River-flat Forest	835	18.7	EEC	CEEC
Hinterland Dry Rainforest	877	2.3	EEC	CEEC
River Oak Open Forest of Major Streams	1105	1.8	-	-
Phragmites australis and Typha orientalis coastal freshwater wetlands	1071	0.4	EEC	-
Planted Native Vegetation	-*	4.5	-	-
Exotic Dominated Vegetation	-	147.7	-	-
Dams	-	5.8	-	-
Cleared Land	-	20.8	-	-
Total		**264.3**		

**Planted native vegetation occurs throughout the subject site and each area would need to be assigned to a 'best-fit' PCT for future DAs based on location, topography, soils and species composition of the specific patch being assessed. In most cases the planted native vegetation would be assigned to the same PCT as the nearest naturally occurring PCT.*

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

3.1.1. PCT 849 - Cumberland Shale Plains Woodland

BC Act Status: CEEC

EPBC Act Status: CEEC

Vegetation Formation: Grassy Woodlands

Vegetation Class: Coastal Valley Grassy Woodlands

This community occurs generally within two areas of the subject site that are in lower-lying and flat areas in the northeast and southeast of the subject site (see **Figure 6**). The dominant canopy species are *Eucalyptus tereticornis* (Forest Red Gum) and *Eucalyptus moluccana* (Grey Box). A scattered native shrub layer is present with *Calotis dentex* (Burr-daisy) and *Bursaria spinosa* (Native Blackthorne) being the most prevalent native shrubs present. A native groundlayer is present that includes the native grasses *Microlaena stipoides* var. *stipoides* (Weeping Grass), *Themeda triandra* (Kangaroo Grass), *Eragrostis brownii* (Brown's Lovegrass), *Cymbopogon refractus* (Barbed Wire Grass), *Chloris ventricosa* (Tall Chloris) and *Echinopogon caespitosus* (Bushy Hedgehog-grass). Native herbs present in the groundlayer include *Plectranthus parviflorus* (Cockspur Flower), *Brunonia australis* (Blue Pincushion), *Oxalis perennans*, *Dichondra repens* (Kidney Weed) and *Solanum prinophyllum* (Forest Nightshade). Climbers found within this community include *Glycine tabacina* (Variable Glycine) and G*lycine microphylla* (Small-leaf Glycine). A high number of weeds occur within this community at high coverages, ranging from ~16-37% cover, and includes *Olea europaea* subsp. *cuspidata* (African Olive), *Lycium ferocissimum* (African Boxthorn), *Lantana camara* (Lantana), *Cirsium vulgare* (Spear Thistle), *Plantago lanceolata* (Lamb's Tongues), *Senecio madagascariensis* (Fireweed), *Setaria parviflora* and *Sida rhombifolia* (Paddy's Lucerne).

With the exception of one small, isolated tree located in the south-central portion of the subject site, all areas of this community present within the subject site conform to the BC Act listed CEEC Cumberland Plain Woodland in the Sydney Basin Bioregion following a comparison to the community's final determination (NSW Scientific Committee 2009).

The two largest patches of this community within the subject site, located in the northeast and southeast (see **Figure 6**) conform to the EPBC Act listed CEEC Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest following a comparison to the community's Approved Listing Advice (Threatened Species Scientific Committee 2009). These two areas are contiguous with patches of native vegetation greater than 5 ha in area and have a perennial native understorey cover of greater than 30% (refer to floristic plots 2 and 4 in **Appendix A**). All other areas of the community comprise small, scattered patches that are not afforded protection under the EPBC Act as they are not contiguous with other areas of native vegetation, lack hollows and do not contain large trees.

This community occurs within 'Certified - Urban Capable' land and 'Avoided Land' under the CPCP. The extend of this community within the subject site as well as its listing status under the BC Act and EPBC Act are identified in **Figure 6**. An example of this community within the subject site is shown in **Photograph 2**.

Photograph 2 PCT 849 – Shale Plains Woodland in the south of the subject site

3.1.2. PCT 850 - Cumberland Shale Hills Woodland

BC Act Status: CEEC

EPBC Act Status: CEEC

Vegetation Formation: Grassy Woodlands

Vegetation Class: Coastal Valley Grassy Woodlands

This community occurs generally within the upper slopes of the subject site (**Figure 6**). The dominant canopy species are *Eucalyptus tereticornis* (Forest Red Gum) and *Eucalyptus moluccana* (Grey Box). The community lacks a native shrub layer with the exception of some regrowth canopy species in areas. A native groundlayer is present that includes the native grasses *Microlaena stipoides* var. *stipoides* (Weeping Grass), *Carex inversa* (Knob Sedge), *Cyperus gracilis* (Slender Flat-sedge), *Eriochloa pseudoacrotricha* (Early Spring Grass). Native herbs present in the groundlayer include *Brunonia australis* (Blue Pincushion), *Oxalis perennans*, *Dichondra repens* (Kidney Weed), *Euchiton sphaericus* (Star Cudweed) and *Einadia trigonos* (Fishweed). Climbers found within this community include *Glycine tabacina* (Variable Glycine), *Convolvulus erubescens* (Pink Bindweed) and *Desmodium varians* (Slender Tick-trefoil). A high number of weeds occur within this community at high coverages, ranging from ~24-97% cover, and includes *Olea europaea* subsp. *cuspidata* (African Olive), *Lycium ferocissimum* (African Boxthorn), *Lantana camara* (Lantana), *Cirsium vulgare* (Spear Thistle), *Plantago lanceolata* (Lamb's Tongues), *Senecio madagascariensis* (Fireweed) and *Bidens pilosa* (Cobbler's Pegs).

All areas of this community present within the subject site conform to the BC Act listed CEEC Cumberland Plain Woodland in the Sydney Basin Bioregion following a comparison to the community's final determination (NSW Scientific Committee 2009).

Areas of this community in the north of the subject site conform to the EPBC Act listed CEEC Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest (**Figure 6**) following a comparison to the community's Approved Listing Advice (Threatened Species Scientific Committee 2009) as these areas are contiguous with patches of native vegetation greater than 5 ha in area, and have a perennial native understorey cover of greater than 30% (refer to floristic plots 1, 11 and 14 in **Appendix A**). All areas of the community to the south of the EPBC Act listed community are not afforded protection under the EPBC Act as they do not have a perennial native understorey cover greater than 30%.

Within the northwest corner of the subject site an existing fence separates areas of this vegetation community that are afforded protection under the EPBC Act and not afforded protection under the EPBC Act (see **Figure 6**). The land uses between areas to the north and south of the fence have resulted in significant condition differences that are evidenced by areas to the north having an estimated native groundcover of 100% (refer to floristic plot 14 in **Appendix A**), while areas to the south within maintained areas have an estimated native groundcover of only 4% (refer to floristic plot 11 in **Appendix A**). So although the two areas of vegetation is contiguous (i.e. overlapping canopy separated by fence), areas in the north are considered to meet the EPBC Act listing requirements, while areas to the south, are not.

This community occurs within 'Certified - Urban Capable' land and 'Avoided Land' under the CPCP. The extent of this community within the subject site as well as its listing status under the BC Act and EPBC Act are identified

in **Figure 6**. An example of the EPBC Act listed community is provided in **Photograph 3**, while an example of the non-EPBC Act listed community is provided in **Photograph 4**

Photograph 3 PCT 850: Shale Hills Woodland within the north of the subject site (EPBC Act listed)

Photograph 4 PCT 850: Shale Hills Woodland within the subject site (not EPBC Act listed)

3.1.3. PCT 850 - Cumberland Shale Hills Woodland – derived native grassland

BC Act Status: CEEC

EPBC Act Status: not listed

Vegetation Formation: Grassy Woodlands

Vegetation Class: Coastal Valley Grassy Woodlands

This community occurs generally within the upper slopes in centre and north of the subject site around the edges of woodland forms of the community (see **Figure 6**). This community lacks a canopy and has a sparse shrub layer in areas that includes the native *Bursaria spinosa* (Native Blackthorn). While a canopy and shrub layer are generally absent, the groundlayer has a high coverage of native grasses estimated to be 49% (refer to floristic plot 13 in **Appendix A**). Native grasses present include *Themeda triandra* (Kangaroo Grass), *Panicum effusum* (Hairy Panic), *Microlaena stipoides* var. *stipoides* (Weeping Grass), *Bothriochloa decipiens* var. *decipiens* (Pitted Bluegrass) and *Sporobolus creber* (Slender Rat's Tail Grass). Native herbs present include *Geranium solanderi* var. *solanderi* and *Rumex brownii* (Swamp Dock), as well as the native climber *Glycine tabacina* (Variable Glycine). Exotic species present include *Nassella neesiana* (Chilean Needle Grass), *Setaria parviflora*, *Paspalum dilatatum* (Paspalum), *Gomphocarpus fruticosus* (Narrow-leaved Cotton Bush) and *Verbena bonariensis* (Purpletop).

All areas of this community present within the subject site conform to the BC Act listed CEEC Cumberland Plain Woodland in the Sydney Basin Bioregion following a comparison to the community's final determination (NSW Scientific Committee 2009).

Although occurrences of derived native grassland alone are not afforded protection under the EPBC Act, areas of the community in the north of the subject site are considered to conform to the EPBC Act listed CEEC Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest following a comparison to the community's Approved Listing Advice (Threatened Species Scientific Committee 2009) as these areas are contiguous with patches of woodland that are listed under the EPBC Act.

The lone area of this community located in the centre of the subject site does not conform to the EPBC Act listed CEEC Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest following a comparison to the community's Approved Listing Advice (Threatened Species Scientific Committee 2009) as this area is not contiguous with patches of woodland that are listed under the EPBC Act.

This community occurs within 'Certified - Urban Capable' land and 'Avoided Land' under the CPCP. The extend of this community within the subject site as well as its listing status under the BC Act are identified in **Figure 6**. An example of the community is provided in **Photograph 5**.

Photograph 5 PCT 850: Shale Hills Woodland – derived native grassland within the north of the subject site

3.1.4. PCT 1395 - Cumberland Shale – Sandstone Ironbark Forest

BC Act Status: CEEC

EPBC Act Status: CEEC

Vegetation Formation: Grassy Woodlands

Vegetation Class: Coastal Valley Grassy Woodlands

This community occurs in areas upslope of riparian areas and forms a transitional areas between the generally more elevated Cumberland Shale Hills Woodland and lower altitude communities such as Cumberland Shale Plains Woodland and Cumberland Riverflat Forest (see **Figure 6**). The dominant canopy species are *Eucalyptus crebra* (Narrow-leaved Ironbark), *Eucalyptus tereticornis* (Forest Red Gum) and *Eucalyptus punctata* (Grey Gum). The community lacks a substantive shrub layer, but does include scattered occurrences of *Melaleuca styphelioides* (Prickly-leaved Tea Tree), *Ozothamnus diosmifolius* (White Dogwood) and *Bursaria spinosa* (Native Blackthorn), as well as regenerating canopy species. A native groundlayer is present that includes the native grasses *Microlaena stipoides* var. *stipoides* (Weeping Grass), *Themeda triandra*, *Cymbopogon refractus* (Barbed Wire Grass), *Oplismenus aemulus* and *Echinopogon caespitosus* (Bushy Hedgehog-grass). Native herbs present include *Plectranthus parviflorus*, *Commelina cyanea* (Native Wandering Jew), *Dichondra repens* (Kidney Weed) and *Cynoglossum australe*. Climbers recorded within this community include *Pandorea pandorana* (Wonga Vine), *Clematis aristata* (Headache Vine), *Glycine tabacina* (Variable Glycine) and G*lycine clandestina* (Twining Glycine). A number of weeds occur within this community and include *Ligustrum lucidum* (Large-leaved Privet), *Ligustrum sinense* (Small-leaved Privet), *Olea europaea* subsp. *cuspidata* (African Olive), *Bidens subalternans* (Greater Beggar's Ticks), *Lantana camara* (Lantana), *Plantago lanceolata* (Lamb's Tongues), *Senecio madagascariensis* (Fireweed), *Setaria parviflora*, *Chloris gayana* (Rhode's Grass) and *Sida rhombifolia* (Paddy's Lucerne).

All areas of this community present within the subject site conform to the BC Act listed CEEC Shale/Sandstone Transition Forest following a comparison to the community's final determination (NSW Scientific Committee 2014).

Areas of the community located along Menangle Creek in the south of the subject site conform to the EPBC Act listed CEEC Shale Sandstone Transition Forest of the Sydney Basin Bioregion following a comparison to the community's Approved Listing Advice (TSSC 2014). All other areas of the community in the central and north-eastern areas of the subject site are not considered be listed under the EPBC Act as these areas are dominated by exotic species and have a perennial native understorey cover of less than 30% (refer to floristic plots 3 and 9 in **Appendix A**).

This community occurs within 'Certified - Urban Capable' land and 'Avoided Land' under the CPCP. The extend of this community within the subject site as well as its listing status under the BC Act are identified in **Figure 6**. An example of this community within the subject site is shown in **Photograph 6**.

Photograph 6 PCT 1395: Cumberland Shale – Sandstone Ironbark Forest within the subject site

3.1.5. PCT 830 – Cumberland Moist Shale Woodland

BC Act Status: EEC

EPBC Act Status: CEEC

Vegetation Formation: Grassy Woodlands

Vegetation Class: Coastal Valley Grassy Woodlands

This community occurs in one riparian area with a sheltered aspect (i.e. on slopes facing south) in the northeast of the subject site (see **Figure 6**). The dominant canopy species are *Acacia implexa* (Hickory Wattle) and *Acacia parramattensis* (Parramatta Wattle) that occur over a native shrub layer of *Bursaria spinosa* (Native Blackthorn) and *Trema tomentosa* var. *aspera* (Native Peach). A native groundlayer is present that includes the native grasses *Microlaena stipoides* var. *stipoides* (Weeping Grass), *Oplismenus aemulus* and *Oplismenus imbecillis*, as well as the native herbs *Einadia hastata* (Berry Saltbush), *Plectranthus parviflorus* and *Solanum prinophyllum* (Forest Nightshade). Climbers recorded within this community include *Pandorea pandorana* (Wonga Vine). A number of weeds occur within this community with *Ligustrum sinense* (Small-leaved Privet), *Ligustrum lucidum* (Large-leaved Privet) and *Olea europaea* subsp. *cuspidata* (African Olive) being the most prevalent with a projected foliage cover of 85%, combined. Additional weeds species recorded include *Rubus fruticosus* (Blackberry Complex), *Ehrharta erecta* (Panic Veldtgrass), *Cirsium vulgare* (Spear Thistle) and *Lantana camara* (Lantana).

All areas of this community present within the subject site conform to the BC Act listed EEC Moist Shale Woodland in the Sydney Basin Bioregion following a comparison to the community's final determination (NSW Scientific Committee 2011b).

No areas of the community within the subject site conform to the EPBC Act listed CEEC Western Sydney Dry Rainforest and Moist Woodland on Shale following a comparison to the community's condition thresholds (DOE 2015) as the community is dominated by exotic species and less than 20 native species are present in a 0.04 ha sample plot (refer to floristic plot 6 in **Appendix A**).

This community occurs within 'Certified - Urban Capable' land and 'Avoided Land' under the CPCP. . The extend of this community within the subject site as well as its listing status under the BC Act are identified in **Figure 6**. An example of this community within the subject site is shown in **Photograph 7**.

Photograph 7 PCT 830: Cumberland Moist Shale Woodland within the subject site

3.1.6. PCT 835 - Cumberland Riverflat Forest

BC Act Status: EEC

EPBC Act Status: CEEC

Vegetation Formation: Forested Wetlands

Vegetation Class: Coastal Floodplain Wetlands

This community occurs in riparian areas on alluvial soils of the subject site (see **Figure 6**). The dominant canopy species is *Eucalyptus moluccana* (Grey Box) as well as scattered occurrences of *Acacia decurrens* (Black Wattle) that occur over a native shrub layer of *Bursaria spinosa* (Native Blackthorn). A native groundlayer is present that includes the native grasses *Microlaena stipoides* var. *stipoides* (Weeping Grass), *Oplismenus aemulus* and *Aristida ramosa* (Purple Wiregrass). Native herbs present include *Plectranthus parviflorus, Brunonia australis* (Blue Pincushion), *Dichondra repens* (Kidney Weed) and *Solanum prinophyllum* (Forest Nightshade). Climbers recorded within this community include *Pandorea pandorana* (Wonga Vine), *Glycine tabacina* (Variable Glycine), *Clematis glycinoides* (Headache Vine) and *Cayratia clematidea* (Native Grape). A number of weeds occur within this community with *Ligustrum sinense* (Small-leaved Privet), *Ligustrum lucidum* (Large-leaved Privet) and *Olea europaea* subsp. *Cuspidata* (African Olive) being the most prevalent with a projected foliage cover of 70%, combined. Additional weeds species recorded include *Lycium ferocissimum* (African Boxthorn), *Opuntia stricta* (Common Prickly Pear), *Conyza sumatrensis* (Tall Fleabane) and *Plantago lanceolata* (Lamb's Tongues).

All areas of this community present within the subject site conform to the BC Act listed EEC River-flat eucalypt forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions following a comparison to the community's final determination (NSW Scientific Committee 2019).

No areas of the community within the subject site conform to the EPBC Act listed River-flat Eucalypt Forest on coastal floodplains of southern New South Wales and eastern Victoria following a comparison to the community's Approved Listing Advice (DAWE 2020) as the community is dominated by exotic species and its total native perennial understorey vegetation cover is less than 30% (refer to floristic plot 7 in **Appendix A**) .

This community occurs within 'Certified - Urban Capable' land and 'Avoided Land' under the CPCP. The extend of this community within the subject site as well as its listing status under the BC Act are identified in **Figure 6**. An example of this community within the subject site is shown in **Photograph 8**.

Photograph 8 PCT 835: Cumberland Riverflat Forest within the subject site

3.1.7. PCT 877 – Hinterland Dry Rainforest

BC Act Status: EEC

EPBC Act Status: CEEC

Vegetation Formation: Rainforests

Vegetation Class: Dry Rainforests

This community occurs in steep, sheltered areas along Menangle Creek in the south of the subject site (see **Figure 6**). The canopy of this community is comprised of *Backhousia myrtifolia* (Grey Myrtle) as well as scattered occurrences of *Clerodendrum tomentosum* (Hairy Clerodendrum). The shrub layer includes *Pittosporum undulatum* (Native Daphne) over a native groundlayer that includes *Adiantum aethiopicum* (Common Maidenhair), *Pellaea falcata* (Necklace Fern) and *Pyrrosia rupestris* (Rock Felt Fern). This community has a relatively low number of weeds when compared to adjacent communities but areas of *Lantana camara* (Lantana) are present in areas that transition into PCT 1395 - Cumberland Shale – Sandstone Ironbark Forest.

All areas of this community present within the subject site conform to the BC Act listed EEC Western Sydney dry rainforest in the Sydney Basin Bioregion following a comparison to the community's final determination (NSW Scientific Committee 2004).

No detailed floristic plots were undertaken within this community within the subject site as it is outside of areas that may be impacted by the proposed rezoning and therefore it cannot be confirmed whether or not this community's occurrence within the subject site conforms to the EPBC Act listed CEEC Western Sydney Dry Rainforest and Moist Woodland on Shale. However, as a precaution, it has been assumed that this community contains more than 20 native species in a 0.04 ha sample plot and has a perennial weed cover of less than 50%, and therefore is likely to be afforded protection under the EPBC Act following a comparison to the community's Approved Listing Advice (DOE 2015).

This community occurs entirely within 'Avoided Land' under the CPCP. The extend of this community within the subject site as well as its listing status under the BC Act are identified in **Figure 6**. An example of this community within the subject site is shown in **Photograph 9**.

Photograph 9 PCT 877: Hinterland Dry Rainforest within the subject site

3.1.8. PCT 1105 – River Oak open forest of major streams, Sydney Basin Bioregions and South East Corner Bioregion

BC Act Status: not listed

EPBC Act Status: not listed

Vegetation Formation: Forested Wetlands

Vegetation Class: Eastern Riverine Forests

This community occurs along the southern boundary of the subject site along Menangle Creek (see **Figure 6**). The canopy of this community is comprised of *Casuarina cunninghamiana* (River Oak), *Clerodendrum tomentosum* (Hairy Clerodendrum) and *Melaleuca decora*. Native shrubs present include *Melichrus urceolatus* (Urn-heath) and *Melaleuca styphelioides* (Prickly-leaved Tea Tree). Native groundcovers include the fern *Pellaea falcata* (Sickle Fern) and grasses *Oplismenus imbecillis* and *Oplismenus aemulus*.

This community occurs entirely within 'Avoided Land' under the CPCP. This community is not listed under the BC Act or EPBC Act. The extent of this community within the subject site is shown in **Figure 6**. An example of this community within the subject site is shown in **Photograph 10**.

Photograph 10 PCT 1105: River Oak open forest within the subject site

3.1.9. PCT 1071 – Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion

BC Act Status: EEC

EPBC Act Status: not listed

Vegetation Formation: Freshwater Wetlands

Vegetation Class: Coastal Freshwater Lagoons

This community occurs along the south-eastern boundary of the subject site along Menangle Creek (see **Figure 6**). The community lacks a canopy and is comprised of aquatic and semi-aquatic species include *Typha orientalis* (Broad-leaved Cumbungi) and *Phragmites australis* (Common Reed). The community conforms to the BC Act listed TEC Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions following a comparison to the community's final determination (NSW Scientific Committee 2011a). This community does not conform to a TEC listed under the EPBC Act.

This community occurs entirely within 'Avoided Land' under the CPCP. The location and extent of the community within the subject site are shown in **Figure 6** and an example of the community is shown in **Photograph 11.**

Photograph 11 PCT 1071: Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion within the subject site

3.1.10. Planted Native Vegetation

BC Act Status: not listed

EPBC Act Status: not listed

This community occurs primarily around existing residential dwellings, along riparian areas and existing roads, as well as in areas adjacent to the disuses quarry in and Rosalind Park Gas Plant in the south of the subject site (see **Figure 6**). Streetside native plantings in straight rows include a range of species including *Eucalyptus crebra* (Narrow-leaved Ironbark), *Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus moluccana* (Grey Box) and *Melaleuca styphelioides* (Prickly-leaved Tea Tree). Native plantings around existing residential dwellings includes *Ficus rubiginosa* (Port Jackson Fig) individuals. Native plantings around the Rosalind Park Gas Plant and disused quarry include planted stands of *Casuarina glauca* (She Oak) in rows. Native plantings along riparian areas include *Eucalyptus moluccana* (Grey Box), *Eucalyptus crebra* (Narrow-leaved Ironbark), *Corymbia maculata* (Spotted Gum) and *Corymbia citriodora* (Lemon-scented Gum).

The planted native vegetation within the subject site does not conform to a naturally occurring PCT as the stands have been clearly planted. Therefore, areas of this community are not considered to be listed under the BC Act or EPBC Act. This community occurs within areas of 'Certified - Urban Capable' land and 'Avoided Land' under the CPCP. The extent of this community within the subject site is shown in **Figure 6**. Examples of this community within the subject site are shown in **Photographs 12** and **13.**

Photograph 12 Planted Native Vegetation along riparian areas

Photograph 13 Planted Native Vegetation along existing roads

3.1.11. Exotic Dominated Vegetation

BC Act Status: not listed

EPBC Act Status: not listed

This community occurs comprises open grassland areas that are dominated by exotic groundcovers. This community also includes exotic trees and shrubs that have been planted around existing residential dwellings. Exotic trees present within this community include *Erythrina* x *sykesii* (Coral Tree), *Phoenix canariensis* (Canary Island Date Palm) and *Araucaria bidwillii* (Buna Pine), which is not endemic to NSW.

Exotic dominated vegetation within open grassland areas are dominated by exotic grasses including *Setaria parviflora*, *Paspalidium dilatatum* (Paspalum), *Eragrostis curvula* (African Lovegrass) and *Bromus catharticus* (Praire Grass). Other common exotic non-grass species present include *Verbena bonariensis* (Purpletop), *Sida rhombifolia* (Paddy's Lucerne), *Senecio madagascariensis* (Fireweed), *Plantago lanceolata* (Lamb's Tongues), *Medicago polymorpha* (Burr Medic), *Hypericum perforatum* (St. John's Wort) and *Conyza sumatrensis* (Tall Fleabane).

Native groundcover are present within this community, but are generally low in numbers and total coverage. Native groundcovers present include *Microlaena stipoides* var. *stipoides* (Weeping Grass), *Sporobolus creber* (Slender Rat's Tail Grass), *Oxalis perennans* and *Geranium solanderi* var. *solanderi*.

This community occurs within 'Certified - Urban Capable' land and 'Avoided Land' under the CPCP. The extend of this community within the subject site is shown on **Figure 6** and examples of this community within the subject site are shown in **Photographs 14** and **15**.

Photograph 14 Exotic Dominated Vegetation within the subject site

Photograph 15 Exotic Dominated Vegetation within the subject site

3.1.12. Dams

BC Act Status: not listed

EPBC Act Status: not listed

Over 20 dams are present within the subject site that range in size from small to relatively large (see **Figure 6**). The types of dams present vary from agricultural dams used for watering livestock and depressions within the disused quarry that all have little to no native fringing vegetation and are surrounded by exotic grasses and shrubs such as *Eragrostis curvula* (African Lovegrass) and *Olea europaea* subsp. *Cuspidata* (African Olive). These dams are not listed under the BC Act or EPBC Act as they are all artificial and lack native vegetation.

Dams occur within and outside of 'Certified - Urban Capable' land under the CPCP. The location and extent of the dams present within the subject site are shown in **Figure 6**, and examples of the dams present are shown in **Photographs 16** and **17.**

Photograph 16 Dam within disused quarry in the south of the subject site

Photograph 17 Agricultural dam in the north of the subject site

3.2. Flora

3.2.1. General Species

A total of 185 flora species were recorded within the subject site during field surveys, including 112 native species (61%) and 73 exotic species (39%). Of the 73 exotic species recorded, a total of 20 are listed as high threat weeds under the BAM. The BAM identifies high threat weeds as plants that if left uncontrolled will invade and outcompete native plant species. In addition to the 20 high threat weeds, a total of 17 species are listed under the Greater Sydney Regional Strategic Weed Management Plan 2017 – 2022 (LLS: Greater Sydney 2021) under the NSW *Biosecurity Act 2015*. This includes seven (7) State Priority Weeds and ten (10) Other Weeds of Regional Concern. The high threat weeds and weeds listed under the *Biosecurity Act 2015* are provided in **Table 2**. A total species list for the subject site is provided in **Appendix A**.

Table 2 High threat weeds and weeds listed under the NSW *Biosecurity Act 2015* recorded within the subject site

Scientific Name	Common Name	High Threat Weed	*Biosecurity Act 2015* Status
Anthoxanthum odoratum	Sweet vernal-grass	No	OWRC
Asparagus asparagoides	Bridal Creeper	YES	SP
Bidens pilosa	Cobbler's Pegs	YES	-
Bidens subalternans	Greater Beggar's Ticks	YES	-
Briza subaristata		YES	-
Carthamus lanatus	Saffron Thistle	YES	-
Cenchrus clandestinus	Kikuyu Grass	YES	OWRC
Chloris gayana	Rhodes Grass	YES	OWRC
Ehrharta erecta	Panic Veldtgrass	YES	-
Eragrostis curvula	African Lovegrass	YES	OWRC
Erythrina x sykesii	Coral Tree	No	OWRC
Hypericum perforatum	St. John's Wort	YES	OWRC
Lantana camara	Lantana	YES	SP
Ligustrum lucidum	Large-leaved Privet	YES	OWRC
Ligustrum sinense	Small-leaved Privet	YES	OWRC
Lycium ferocissimum	African Boxthorn	YES	SP
Nassella neesiana	Chilean Needle Grass	YES	SP
Opuntia stricta	Common Prickly Pear	YES	SP
Paspalum dilatatum	Paspalum	YES	-
Phoenix canariensis	Canary Island Date Palm	YES	OWRC
Polygala virgata		YES	-
Rubus fruticosus	Blackberry complex	No	SP

Scientific Name	Common Name	High Threat Weed	*Biosecurity Act 2015* Status
Salpichroa origanifolia	Pampas lily of the valley	No	OWRC
Senecio madagascariensis	Fireweed	YES	SP

SP=State Priority Weed, OWRC=Other Weed of Regional Concern

3.2.2. Threatened Flora Species

No threatened flora species were recorded within the subject site during surveys.

Although no threatened individuals were recorded during surveys, a BioNet Atlas of Australia (EHG 2022) search and Protected Matters Search Tool (DAWE 2022) search of the locality identifies 35 threatened flora species that have either been previously recorded in the locality since 1980, or are considered to have the potential to occur in the locality based on the habitat types present as predicted by the Protected Matters Search Tool (DAWE 2022). **Appendix B** lists the threatened flora species identified in the aforementioned database searches of the locality, as well as their likelihood of occurrence within the subject site. As identified in **Appendix B**, a total of 13 threatened species are considered to have the potential to occur within the subject site. These are detailed in **Table 3** below.

Table 3 Threatened flora species considered to have the potential to occur within the subject site

Scientific Name	Common Name	BC Act Status	EPBC Act Status
Pterostylis saxicola	Sydney Plains Greenhood	E	E
Acacia pubescens	Downy Wattle	V	V
Caladenia tessellata	Thick-lipped Spider-orchid	E	V
Cynanchum elegans	White-flowered Wax Plant	E	E
Eucalyptus benthamii	Camden White Gum	V	V
Grevillea parviflora subsp. *Parviflora*	Small-flower Grevillea	V	V
Haloragis exalata subsp. Exalata	Wingless Raspwort	V	V
Persicaria elatior	Knotweed	V	V
Persoonia hirsuta	Hairy Geebung	E	E
Pimelea spicata	Spiked Rice-flower	E	E
Pomaderris brunnea	Brown Pomaderris	E	V
Pultenaea pedunculata	Matted Bush-pea	E	-
Thesium australe	Austral Toadflax	V	V

V=Vulnerable, E=Endangered

3.3. Fauna

3.3.1. Fauna Habitat

The fauna habitats within the subject site predominantly occur within the woodland and forest vegetation and to a lesser extent within previously cleared areas comprised of exotic vegetation. Woodland and forest vegetation within the study area generally occurs as narrow linear patches surrounded by exotic grassland, or as linear patches adjacent to riparian corridors. To a large degree, the majority of the habitat within the subject site has been highly modified as a result of previous clearing and agricultural land uses.

Despite the modified nature and extent of the remaining habitat present, the subject site provides habitat features that provide foraging, shelter and breeding opportunities for native fauna, including threatened species. Key habitat features recorded within the subject site include:

- Riparian environments and farm dams – suitable for fauna species dependent on these habitats such as wetland birds, amphibians and reptiles;
- Fallen logs, debris and leaf litter – shelter habitat for amphibians, reptiles and terrestrial mammals;
- Hollow-bearing trees and stags – providing shelter and breeding habitat for a range of reptiles, birds, arboreal mammals and microchiropteran bats (microbats);
- Rocky outcrops along Menangle Creek in the south of the subject site – suitable for fauna species dependent on these habitats such as reptiles and potentially cave-dwelling microbats; and
- Nectar-producing trees and shrubs – foraging habitat for insects, blossom-dependant birds, arboreal mammals and megachiropteran bats (Flying-foxes).

3.3.2. General Species

No targeted fauna surveys were undertaken to support this BAR; however, a number of species were recorded incidentally during surveys. Fauna species recorded within the subject site are identified in **Table 4**.

Table 4 Fauna species recorded within the subject site

Scientific Name	Common Name	Exotic (*)	EPBC Act Status	BC Act Status
Egretta novaehollandiae	White-faced heron		-	-
Acanthiza nana	Yellow Thornbill		-	-
Alisterus scapularis	Australian King-Parrot		-	-
Anthus novaeseelandiae	Australasian Pipit		-	-
Aquila audax	Wedge-tailed eagle		-	-
Coracina novaehollandiae	Black-faced Cuckoo-shrike		-	-
Cormobates leucophaea	White-throated Treecreeper		-	-
Dacelo novaeguineae	Laughing Kookaburra		-	-

Scientific Name	Common Name	Exotic (*)	EPBC Act Status	BC Act Status
Eurystomus orientalis	Dollarbird		-	-
Gambusia holbrooki	Mosquito Fish			
Geopelia humeralis	Bar-shouldered Dove		-	-
Cracticus tibicen	Australian Magpie		-	-
Helix aspera	Garden Snail	*	-	-
Litoria fallax	Eastern Dwarf Tree Frog		-	-
Malurus cyaneus	Superb Fairy-wren		-	-
Manorina melanocephala	Noisy Miner		-	-
Manorina melanophrys	Bell Miner		-	-
Meliphaga lewinii	Lewin's Honeyeater		-	-
Neochmia temporalis	Red-browed Finch		-	-
Ocyphaps lophotes	Crested Pigeon		-	-
Pardalotus punctatus	Spotted Pardalote		-	-
Platycercus eximius	Eastern rosella		-	-
Psephotus haematonotus	Red-rumped Parrot		-	-
Psophodes olivaceus	Eastern Whipbird		-	-
Ptilonorhynchus violaceus	Satin Bowerbird		-	-
Rhipidura albiscapa	Grey Fantail		-	-
Rhipidura leucophrys	Willie Wagtail		-	-
Turdus merula	Common Blackbird	*	-	-
Zosterops lateralis	Silvereye		-	-

3.3.3. Threatened Fauna Species

No threatened fauna species were recorded within the subject site during surveys.

Although no threatened fauna were recorded during surveys, a BioNet Atlas of Australia (EHG 2022) search and Protected Matters Search Tool (DAWE 2022) search of the locality identifies 75 threatened fauna species that have either been previously recorded in the locality since 1980, or are considered to have the potential to occur in the locality based on the habitat types present as predicted by the Protected Matters Search Tool (DAWE 2022). **Appendix B** lists the threatened fauna species identified in the aforementioned database searches of the locality, as well as their likelihood of occurrence within the subject site. As identified in **Appendix B**, a total of 32 threatened fauna species are considered to have the potential to occur within the subject site. These are detailed in **Table 5** below.

Table 5 Threatened fauna species considered to have the potential to occur within the subject site

Class	Scientific Name	Common Name	BC Act Status	EPBC Act Status
Amphibian	*Heleioporus australiacus*	Giant Burrowing Frog	V	V
Amphibian	*Litoria aurea*	Green and Golden Bell Frog	E	V
Amphibian	*Litoria littlejohni*	Littlejohn's Tree Frog	V	E
Amphibian	*Litoria watsoni*	Watson's Tree Frog	-	E
Aves	*Artamus cyanopterus*	Dusky Woodswallow	V	
Aves	*Callocephalon fimbriatum*	Gang-gang Cockatoo	V	E
Aves	*Circus assimilis*	Spotted Harrier	V	
Aves	*Climacteris picumnus victoriae*	Brown Treecreeper (eastern subspecies)	V	-
Aves	*Daphoenositta chrysoptera*	Varied Sittella	V	-
Aves	*Ephippiorhynchus asiaticus*	Black-necked Stork	E	-
Aves	*Glossopsitta pusilla*	Little Lorikeet	V	-
Aves	*Hieraaetus morphnoides*	Little Eagle	V	
Aves	*Hirundapus caudacutus*	White-throated Needletail	-	MIG
Aves	*Lathamus discolor*	Swift Parrot	E	CE
Aves	*Lophoictinia isura*	Square-tailed Kite	V	-
Aves	*Ninox strenua*	Powerful Owl	V	-
Aves	*Petroica boodang*	Scarlet Robin	V	-
Aves	*Stagonopleura guttata*	Diamond Firetail	V	-
Fish	*Macquaria australasica*	Macquarie Perch	-	E
Gastropoda	*Meridolum corneovirens*	Cumberland Plain Land Snail	E	-
Insect	*Austrocordulia leonardi*	Sydney Hawk Dragonfly	-	E
Mammalia	*Chalinolobus dwyeri*	Large-eared Pied Bat	V	V
Mammalia	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle	V	-
Mammalia	*Micronomus norfolkensis*	Eastern Coastal Free-tailed Bat	V	-
Mammalia	*Miniopterus australis*	Little Bent-winged Bat	V	-
Mammalia	*Miniopterus orianae oceanensis*	Large Bent-winged Bat	V	-
Mammalia	*Myotis macropus*	Southern Myotis	V	-

Class	Scientific Name	Common Name	BC Act Status	EPBC Act Status
Mammalia	*Phascolarctos cinereus*	Koala	E	E
Mammalia	*Phoniscus papuensis*	Golden-tipped Bat	V	-
Mammalia	*Pteropus poliocephalus*	Grey-headed Flying-fox	V	V
Mammalia	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat	V	-
Mammalia	*Scoteanax rueppellii*	Greater Broad-nosed Bat	V	-

V=Vulnerable, E=Endangered, CE=Critically Endangered, Mig.=Migratory

3.4. Watercourses

The riparian assessment of the subject site identified that several mapped watercourses are no longer present as a result of past land practices, including the disused quarry in the south. Further to this, the riparian assessment identified that the extent of some mapped watercourses are less than what is mapped. Reductions in the extent of watercourses or the entire removal of watercourses were a result of the watercourse not meeting the definition of a watercourse as defined by NRAR's 'Waterfront Land Tool' (2020). To be considered a watercourse, one of the following three key factors must be present:

- The presence of a defined bed and bank;
- Evidence of flow and geomorphic features (whether water is present or not); and
- The presence of aquatic/riparian vegetation.

Based on the results of the riparian assessment, the subject site is considered to have nine (9) first order streams, four (4) second order streams, two (2) third order streams and one (1) fourth order stream. The location and extent of watercourses confirmed to be present are presented in **Figure 6**.

4. Discussion

4.1. Potential Ecological Impacts

This chapter considers the potential ecological impacts of future development on the biodiversity values within the subject site that may be facilitated by the project. Any future development of the subject site as a result of the project will require some land clearance that has the potential to directly and indirectly impact biodiversity values within the subject site and surrounds. It is noted that the majority of the subject site that may be impacted by future development has been 'Certified – Urban Capable' land under the CPCP. This means that the majority of the vegetation and associated habitat cleared in the future that is facilitated by the project has already been accounted for on a strategic level (i.e. DPE has assessed these areas as having reduced biodiversity value and assumed their removal to facilitate the development needs of the region).

As previously discussed in ***Section 1.3.5***, discussions between DPE and the client have taken place for the proposed modification of the extent of 'Certified – Urban Capable' land under the CPCP. Discussions have focused on reducing the amount of native vegetation cleared and improving future development outcomes, while maintaining the recommended koala corridor minimum width dimensions as detailed in the CKPOM and the *Advice on the protection of the Campbelltown Koala population: Koala Independent Expert Panel* (Chief Scientist & Engineer 2020) (the 'Chief Scientist & Engineer Report').

Nevertheless, potential impacts of development associated with the project include:

- Removal of native vegetation;
- Removal of fauna habitat features such as hollow-bearing trees, coarse woody debris, blossom-producing trees and shrubs, and dams/waterbodies;
- Removal of potential habitat (both terrestrial and aquatic) for threatened flora and fauna species;
- Modification of microhabitats through edge effects;
- Modification of habitat connectivity;
- Runoff, sedimentation and erosion;
- Weed invasion; and
- Injury or mortality to fauna species.

Table 6 and **Figure 7** identify the area of each vegetation community and associated habitat that may be directly impacted by future development facilitated by the project. **Table 6** and **Figure 7** also identify the total area of each vegetation community to be retained, as well as the total percentage of each vegetation community to be retained within the subject site.

Table 6 Future impacts associated with the project

Vegetation Community	PCT	Subject Site (ha)	Total Retained (ha)	Total Impact (ha)	% Retained
Cumberland Shale Plains Woodland	849	3.7	3.0	0.7	81%
Cumberland Shale Hills Woodland	850	42.0	24.8	17.2	59%
Cumberland Shale Hills Woodland - derived native grassland	850	3.3	0.7	2.5	22%
Cumberland Shale - Sandstone Ironbark Forest	1395	12.2	4.3	7.9	35%
Cumberland Moist Shale Woodland	830	1.2	<0.001	1.2	1%
Cumberland River-flat Forest	835	18.7	15.5	3.2	83%
Hinterland Dry Rainforest	877	2.3	2.3	0.0	100%
River Oak Open Forest of Major Streams	1105	1.8	1.8	0.0	100%
Phragmites australis and Typha orientalis coastal freshwater wetlands	1071	0.4	0.4	0.0	100%
Planted Native Vegetation	-	4.5	0.8	3.7	18%
Exotic Dominated Vegetation	-	147.7	23.7	124.0	16%
Dams	-	5.8	0.8	5.0	14%
Cleared Land	-	20.8	1.6	19.2	8%
Total		**264.3**	**79.7**	**184.6**	**30%**

4.1.1. Direct Impacts

4.1.1.1. Vegetation Removal

For the purposes of this BAR it has been assumed that any areas proposed to become 'Riparian', 'Koala Corridor' or 'Environmental Conservation' under the Concept Structure Plan (**Figure 2**) will be entirely avoided and managed in the long-term, while all other areas may be entirely cleared by future development. It has also been assumed that the easements identified in the Concept Structure Plan will also not require future clearing further to what is currently required by the relevant management authority for ongoing maintenance.

It is anticipated that the extent of impacts on vegetation communities and habitat facilitated by the project will not extend beyond the areas to be rezoned for development (e.g. zoned for residential, open space, infrastructure, mixed use and environmental conservation). These impacts are proposed to be ameliorated through the retention of some of the largest patches of native vegetation with connectivity to offsite habitat within areas to be become 'Riparian', 'Koala Corridor' or 'Environmental Conservation' under the Concept Structure Plan. All areas to be retained under the Concept Structure Plan will be enhanced and managed under an appropriate management plan. It is also noted that future development will be staged over time to enable vegetation enhancement works within retained areas to commence, which will provide additional/enhanced habitat for any displaced fauna species to be relocated to during clearing works.

It is important to note that additional vegetation is likely to be retained within areas proposed to be zoned for developed, in particular areas proposed to become 'Open Space' under the Concept Structure Plan, as it is anticipated that some 'Open Space' areas can be designed to retain native vegetation. Further to the likely retention of vegetation within 'Open Space', any future DAs lodged within areas that are not 'Certified – Urban Capable' land under the CPCP will have to demonstrate the avoid, minimise, offset hierarchy of the BAM, likely resulting in the further retention of vegetation within areas zoned for development that are not 'Certified – Urban Capable' land under the CPCP. Therefore, the potential impacts on vegetation presented in **Table 6** and shown on **Figure 7** are a 'worst-case' scenario of what impacts could be facilitated by the project.

As identified in **Table 6**, the majority of the vegetation susceptible to clearing by future DAs as a result of the project is comprised of Exotic Dominated Vegetation that holds limited biodiversity value. Further to this, all areas of PCTs 877, 1105 and 1071 will be entirely avoided by future development, while greater than 50% of the PCTs 849, 850 and 835, and ~35% of PCT 1395 will be avoided by future development. Although the majority of PCT 1395 may be removed by future development, impacts are limited to the most degraded areas of the community in the centre and north of the subject site that are dominated by exotic species. All areas of PCT 1395 in the best condition, located in the south of the subject site, will be retained. The retention of large areas of the aforementioned PCTs (all of which except for PCT 1105 conform to a TEC) significantly increases the long-term viability of the community's local occurrence and reduces the likelihood that future DAs will have a significant impact on the communities.

While it is acknowledged that nearly all areas of PCT 830 may be impacted by future DAs, this community is restricted to a small isolated linear patch within the subject site that is currently in poor condition (VI Score = 21.4) and infested with high threat exotic weeds (estimated cover of >50%). Without active management to this community, its long-term survival within the subject site is questionable. It is further noted that this community is not listed as a Serious and Irreversible Impact (SAII) candidate entity. SAII entities are threatened ecological communities and species considered to be at most risk of extinction as a result of development activities. Under Part 4 (local development) of the EP&A Act, Council is required to refuse any DA that is considered to result in a SAII. As the community is not an SAII, the entire removal of the community within the subject site under a future DA assessed under Part 4 (local development) of the EP&A Act, may be approved by Council.

4.1.1.2. Threatened species habitat removal

Future development within the subject site will result in the removal of potential habitat for 13 threatened flora species and 32 threatened fauna species considered to have the potential to occur within the subject site (refer to **Tables 3** and **5**). Potential habitat for threatened species will be removed; however, no threatened species have been recorded within the subject site during surveys. Although no targeted threatened species surveys have been carried out within the subject site to date, such surveys will be required for each future DA as required by the BAM. Therefore, it is considered unlikely that future development within the subject site will result in a significant impact on any threatened species, due to the amount of suitable threatened species habitat being retained (~80 ha) as well as the generally degraded condition of the habitat to be removed. Further to this, each future DA on lands that are not 'Certified – Urban Capable' will need to demonstrate the avoid, minimise, offset hierarchy of the BAM for any threatened flora species detected, assumed present, or confirmed through an expert report. It is further noted that in addition to the retention of large areas of

potential habitat for threatened species within the subject site, a number of mitigation measures will be implemented across the subject site to ameliorate any indirect impacts on retained vegetation as a result of future DAs. These mitigation measures are summarised in ***Section 4.2***.

4.1.1.3. General Fauna Habitat Feature Removal

Future development that the project will facilitate, will require the removal of the following habitat features that provide suitable habitat for threatened insects, blossom-dependant birds, hollow-dependent birds, arboreal mammals, megachiropteran bats (flying-foxes), microchiropteran bats (micro-bats), reptiles and amphibians:

- Riparian environments and farm dams – suitable for fauna species dependent on these habitats such as wetland birds, amphibians and reptiles;
- Fallen logs, debris and leaf litter – shelter habitat for amphibians, reptiles and terrestrial mammals;
- Hollow-bearing trees and stags – providing shelter and breeding habitat for a range of reptiles, birds, arboreal mammals and microbats; and
- Nectar-producing trees and shrubs – foraging habitat for insects, blossom-dependant birds, arboreal mammals and megachiropteran bats (Flying-foxes).

Although the project will facilitate the removal of the aforementioned fauna habitat features, it will also ensure the retention of habitat features within areas proposed to be retained which will ensure that suitable habitat for native species that has connectivity to offsite habitat remains in the subject site. With consideration of the impacts and avoidance proposed, it is considered that any impacts on fauna habitat will be appropriately ameliorated through the retention of habitat as well as the implementation of the mitigation measures described in ***Section 4.2*** that are anticipated to be incorporated into an approved DAs conditions of consent.

4.1.1.4. Koala Habitat Removal

As mentioned previously, Chapter 4 of the BC SEPP applies to the subject site and an approved Koala Plan of Management (the 'CKPOM') has been approved for the LGA. Under the CKPOM, the subject site includes areas mapped as 'Potential Koala Habitat', as well as 'Strategic Linkage Areas' along Menangle Creek.

The project's Concept Structure Plan has been developed in consultation with DPE and will result in a 40 ha koala corridor that has a minimum overall width of 402 m in accordance with the recommendations of the CKPOM and the Chief Scientist & Engineer Report. The project will result in the retention of all 'Strategic Linkage Areas' mapped under the CKPOM; however, 'Potential Koala Habitat' mapped by the CKPOM will be removed by future development facilitated by the project. The extent of koala habitat (as defined by the CKPOM) to be rezoned for development and subsequently removed by future DAs is yet to be determined; however, this will be detailed in a separate VAR to be prepared to support the project.

In addition to the production of a VAR to document the extent of koala habitat that may be removed by future DAs, all future DAs will need to demonstrate consistency with the CKPOM or a separate 'site-specific' koala plan of management to the satisfaction of Council. Due to the retention of lands as a 'Koala Corridor' within the subject site, it is anticipated that any future DAs can show consistency with the CKPOM as substantial

amounts of habitat for the species will be retained and managed in the long-term. It is further noted that exclusion fencing will be installed as part of a koala corridor, likely restricting any koala usage of areas outside the corridor currently mapped as 'Potential Koala Habitat' under the CKPOM (i.e. currently mapped 'Potential Koala Habitat' will no longer be potential habitat as access to the areas will be restricted). It is further noted that any 'Certified – Urban Capable' land under the CPCP will not need to demonstrate consistency with the CKPOM as detailed in Chapter 4 of the BC SEPP.

4.1.2. Indirect Impacts

The indirect impacts of future development are anticipated to occur in areas throughout the subject site and surrounding area situated directly adjacent to areas proposed to be rezoned for development. Indirect impacts are discussed in the subsections below.

4.1.2.1. Edge Effects

Edge effects are impacts that occur at the interface between natural habitats, especially forests and disturbed or developed land (Yahner 1988). When an edge is created between woodland and a cleared area, changes to ecological processes within the vegetation can extend between 10 m and 100 m from the edge (Yahner 1988). These include microclimatic changes in light, temperature, humidity and wind, which can favour a suite of different species and therefore cause significant changes to the ecology of the patch (Lindenmayer and Fischer 2006). Edge effects can also result from the increase in noise and artificial light from a project.

Future development practises are not considered likely to result in significant edge effects to vegetation due to the currently modified and edge effected condition of the available habitat within and surrounding the subject site.

4.1.2.2. Construction Impacts

A number of indirect impacts relevant to the construction phase of future development have the potential to impact the remaining ecological values of the subject site, such as those relating to dust, noise, light and erosion.

4.1.2.3. Noise

Noise can affect animal physiology and behaviour, and if it becomes an ongoing stress, it can be injurious to an animal's energy budget, reproductive success and long-term survival. There are other potential impacts that include habitat loss through avoidance, reduced reproductive success and a retreat away from favourable habitats (AMEC 2005).

It is likely that most animal species will habituate to the periodic noise disturbance (AMEC 2005), and the construction phases of future development are likely to cause only temporary disturbance only to occurring fauna. It is unlikely that noise levels will have a significant, long-term, impact on any wildlife populations.

4.1.2.4. Light

Future development has the potential to increase the level of artificial light in the natural environment. Increased light levels may adversely impact wildlife by direct glare, chronic or periodic increased illumination and temporary unexpected fluctuations in light levels (Saleh 2007, Longcore and Rich 2010).

While future development practises will have some effect on the surrounding environment, the impacts from light pollution are likely to be minimal to moderate. Any increase in light levels is expected to be localised to the future development area and immediate surrounds. Light pollution from the future development is unlikely to have a significant or long-term impact on any fauna species, considering the extensive amount of vegetation being retained. Nevertheless, it is recommended that future lighting associated with development utilise lighting that reduces light spill into retained habitat. With the implementation of appropriate lighting controls, the risk of light pollution is considered to be minor and manageable.

4.1.2.5. Sedimentation and Erosion

During the construction phase of future development, the retained vegetation can be impacted by sedimentation and erosion. Cut and fill bulk earthworks within the subject site is likely to increase potential erosion. Eroded sediment can smother retained vegetation if appropriate control measures are not implemented. Smothering can reduce regeneration of groundcover species and enter drainage lines. Sediment and eroded material can also contain weed matter and nutrients, and movement of this material into the retained vegetation can facilitate the spread of weeds. Increased weed invasion can result in changes to community composition. With the implementation of appropriate sediment control methods that are checked and rectified on a regular basis, the risk of sedimentation is considered to be minor and manageable. It is anticipated that a detailed sediment and erosion control plan will be required for each future DA that will form part of the approved DAs Construction Environment Management Plan.

4.2. Avoidance and Mitigation Measures

The purpose of this section is to outline a suite of indicative avoidance and mitigation measures that are proposed to minimise the impacts of future development practises upon the biodiversity values of the subject site. Any required mitigation measures will be described in further detail within the relevant biodiversity assessment at each DA stage and included in the DAs conditions of consent, if approved.

4.2.1. Vegetation Retention

The Concept Structure Plan has been developed in consultation with DPE in relation to the CPCP, as well as Cumberland Ecology, in order to zone areas for future development that hold reduced conservation value, while zoning other areas for retention that hold high conservation value. This is evidenced by the Concept Structure Plan proposing to retain the majority of 'Strategic Conservation Area' land under the CPCP. This includes the creation of a koala corridor that will include the retention of land identified in the CPCP as 'Important Koala Habitat', land identified in the CKPOM as 'Strategic Koala Linkage' and land identified as a 'Secondary Corridor' (Corridor A) for koalas identified in the 'Chief Scientist & Engineer Report' that all link to Mt Gilead to the east and the Nepean River to the southwest. Further to the retention/creation of a koala corridor, the project proposes to retain and manage additional areas of TEC vegetation that are 'Certified – Urban Capable' land under the CPCP, which could be otherwise cleared.

Currently, the entire subject site is zoned as RU2 Rural Landscape which as currently zoned is susceptible to further land clearing. The project will result in approximately 80 ha of land that will be rezoned for environmental conservation/retention as part of a 'Koala Corridor', 'Riparian' or 'Environmental Conservation' (refer to **Figure 2**) which would otherwise be susceptible to future clearing if the project is not approved. Of

the 80 ha of land proposed to be retained by the project, ~51 ha conforms to a TEC listed under the BC Act, ensuring that the majority of the land to be retained holds high conservation value that will provide suitable habitat in the long-term for any threatened species considered to have the potential to occur within the subject site.

It is further noted that all areas of vegetation proposed to be retained are anticipated to be further enhanced in the future through the implementation of management plans for areas to be zoned as 'Koala Corridor', 'Riparian' and 'Environmental Conservation'. Further details on the management plans anticipated to be implemented are provided in the sections below.

4.2.2. Koala Corridor and Koala Management Plan

The project will result in approximately 41 ha of land that will become a koala corridor under the Concept Structure Plan. The location of the proposed koala corridor includes areas identified as 'Important Koala Habitat' in the CPCP, the 'Secondary Corridor' (Corridor A) identified in the Chief Scientist & Engineer Report, all areas identified as 'Strategic Linkage Areas' in the CKPOM, and adjoins the adjacent koala corridor detailed in the Council endorsed Gilead Koala Conservation Plan (M. Anderson and T. Paynter 2020). The koala corridor will ensure that movement corridors for the species will be maintained in the region and allow the species to travel across the landscape. It is anticipated that a site-specific koala management plan will be prepared in the future to guide the long-term management of the koala corridor within the subject site that will be consistent with the Council endorsed Gilead Koala Conservation Plan (M. Anderson and T. Paynter 2020) prepared for the Mt Gilead lands located directly to the east and south of the subject site.

As part of the management plan for the subject site, the koala corridor will require koala exclusion fencing along the entire perimeter of the corridor, that in conjunction with the koala corridor identified in the 'Gilead Koala Conservation Plan', will allow for an average corridor width of >402m, consistent with the recommended koala corridor width identified in the CKPOM and the Chief Scientist & Engineer Report (2020). **Figure 8** shows the transect widths of the proposed koala corridor within the subject site and adjoining lands that are included in the 'Gilead Koala Conservation Plan'. Example cross sections of how the koala corridor will interface with developable areas are provided in **Appendix C**, which have been taken directly from the approved Gilead Koala Conservation Plan (M. Anderson and T. Paynter 2020). In addition to exclusion fencing, the management plan to be prepared will include ongoing vegetation management works to supplement (i.e. plantings) existing koala habitat present and manage weed infestations to improve the overall biodiversity value of the corridor itself. The management plan to be prepared will be consistent with the Council endorsed Gilead Koala Conservation Plan, as well as the CKPOM and the findings of the Chief Scientist & Engineer Report (2020).

4.2.3. Vegetation Management Plan(s)

In addition to the management plan to be developed for the koala corridor in the subject site, it is anticipated that further vegetation management plans will be required and prepared for areas to be zoned as 'Riparian' and 'Environmental Conservation' by the Concept Structure Plan and the CPCP.

For areas zoned as 'Riparian' vegetation management plans will be required to offset any impacts on riparian corridors elsewhere within the subject site. Such plans are typically required post DA approval as a condition of consent and will need to be approved by both Council and NRAR under the *Water Management Act 2000*.

The aims of the vegetation management plans prepared for 'Riparian' areas will be to replant and manage retained vegetation within riparian corridors with native vegetation characteristic of the riparian communities currently on-site (being namely the TEC River-flat Eucalypt Forest).

For areas zoned as 'Environmental Conservation' vegetation management plans will be required to ensure that indirect impacts of the project are ameliorated appropriately (i.e. no reduction in vegetation integrity for retained vegetation). The associated vegetation management plans would include a weed management plan to facilitate the natural regeneration of native species present, as well as supplemental plantings, as required.

4.2.4. Fauna Management Plans

For any approved DAs that impact on native vegetation or fauna habitat, a fauna management plan will be prepared in order to minimise impacts on the biodiversity values of the subject site and surrounds. The fauna management plan will form part of the Construction Environment Management Plan prepared for the DA. The fauna management plan will include the following mitigation measures (where relevant) to be implemented for each DA:

- Environmental inductions for all site workers;
- Delineation of clearing limits to protect retained vegetation (i.e. fencing plan);
- Sediment/erosion controls;
- Weed management protocols including the provision of washdown areas;
- Pre-clearance surveys to identify habitat features requiring a two-stage clearing process;
- Two-stage clearing process for the removal of habitat features identified in the pre-clearance surveys;
- Relocation of native fauna into retained habitat during clearing activities;
- Dam dewatering protocols (where relevant); and
- Nest box installation (where relevant).

4.3. Future Assessment Requirements

4.3.1. EPBC Act Requirements

Threatened species, populations and communities listed under the EPBC Act that are considered to be directly or indirectly impacted by a future DA will be assessed in accordance with the *Matters of National Environmental Significance Significant Impact Guidelines 1.1* (DOE 2013). If a development is considered to significantly impact any MNES, then a referral to the Commonwealth will be required.

Based on the known ecological values of the subject site, there are areas of native vegetation that are considered to be MNES based on the surveys undertaken to date (refer to 'CEEC EPBC' in **Figure 6**). Although the majority of MNES are within areas proposed to be rezoned and retained, or are within 'Certified – Urban Capable' land under the CPCP, the CPCP has not been approved by the Commonwealth. This means that any

impacts on MNES (irrespective of whether or not the MNES is within 'Certified – Urban Capable' land) would currently require a referral to the Commonwealth. DPE is currently seeking Commonwealth approval for the CPCP, and if approved, then any future DAs that impact on MNES that are within 'Certified – Urban Capable' land would not require a referral to the Commonwealth, while any impacts on MNES outside of 'Certified – Urban Capable' land would require a referral to the Commonwealth.

Any future DA within the subject site will be required to assess whether or not the DA will have a significant impact to MNES and if a referral is warranted.

4.3.2. BC Act Requirements

As identified previously, the majority of the subject site proposed to be re-zoned for development is 'Certified – Urban Capable' land under the CPCP (**Figure 3**). Any 'Certified – Urban Capable' land will not require additional assessment under the BC Act as all biodiversity matters will have been addressed on a strategic level; however, any future DA within 'Certified – Urban Capable' land will need to demonstrate consistency with the planning control 'Cumberland Plain Conservation Plan Mitigation Measures Guidelines'.

The subsections below apply only to future DAs that include lands that are not 'Certified – Urban Capable' under the CPCP.

4.3.2.1. Biodiversity Offsets Scheme Entry Thresholds

To determine the type of assessment required for a future DA under Part 4 (Local Development) of the EP&A Act, it is necessary to determine whether the proposed development triggers the BOS. For the proposed development to trigger the BOS, it would need to be considered as likely to significantly affect threatened species, which could occur as follows:

- It is likely to significantly affect threatened species or ecological communities, or their habitats, according to the test of significance in Section 7.3 of the BC Act;
- It exceeds the biodiversity offsets scheme threshold according to Clause 7.1 of the *Biodiversity Conservation Regulation 2017*, with the thresholds being:
    - The clearing of native vegetation of an area above a prescribed threshold based on the minimum lot size; or
    - The clearing of native vegetation, or other prescribed action, on land included on the Biodiversity Values Map.
- It is carried out in a declared area of outstanding biodiversity value (AOBV).

As no DAs are proposed at this stage of the project, no tests of significance for threatened entities in accordance with Section 7.3 of the BC Act have been undertaken for this assessment. As such, any future DA lodged that proposes impacts on land that is **not** 'Certified – Urban Capable' under the CPCP would need to prepare a test of significance in accordance with Section 7.3 of the BC Act in the event that the BOS was not triggered by another mechanism.

Areas of the subject site proposed to be rezoned for development include areas mapped on the Biodiversity Values Map as of 8 June 2022. Therefore, any future DA that proposes impacts on land that is mapped on the Biodiversity Values Map that is **not** 'Certified – Urban Capable' land under the CPCP would trigger entry into the BOS and require the preparation of a BDAR by this mechanism. The BDAR would only be required to assess the proposed impacts on land that is not 'Certified – Urban Capable' under the CPCP and would not require assessment of the 'Certified – Urban Capable' land.

The subject site is not currently mapped as an AOBV. Therefore, the BOS would not currently be triggered by this mechanism by a future DA within areas that are not 'Certified – Urban Capable'.

4.3.3. Water Management Act 2000 Requirements

Under the *Water Management Act 2000*, any future DA that impacts on waterfront land will require controlled activity approval from NRAR. The Concept Structure Plan assumes impacts on waterfront land, including the complete removal of mapped watercourses as well as impacting on the associated recommended riparian buffer zone of mapped watercourses as detailed in the 'Guidelines for controlled activities on waterfront land' (NRAR 2018).

As detailed in ***Section 3.4***, several of the mapped watercourses are no longer present or have a reduced extent to what is currently mapped. The removal of a watercourse or reduction of mapped watercourse's extent is permitted by NRAR on a case by case basis if sufficient information is provided to support the removal/reduction. Such discussions are typically undertaken post DA approval in order to gain NRAR approval as part of a condition of consent. It is anticipated that discussions with NRAR will be held early on in the assessment of the project in order to get initial feedback from NRAR on the potential impacts on waterfront land currently proposed by the project.

Although some impacts on waterfront land will be facilitated by the project, the project has sought to retain the largest watercourses within the subject site that are anticipated to be managed in the long-term under an associated management plan. As such, it is anticipated that any future DAs that impact on waterfront land can gain NRAR approval under the *Water Management Act 2000* as substantial areas will become 'Riparian' under project that can serve as offsets for future impacts on recommended riparian zones as per the 'Guidelines for controlled activities on waterfront land' (NRAR 2018). In the event that a controlled activity approval is not granted by NRAR for a future DA, then this will result in the additional retention of riparian areas and associated vegetation to what is currently proposed under the Concept Structure Plan.

5. Conclusion

This BAR supports a planning proposal seeking to amend the Campbelltown LEP to change the zoning of the subject site from RU2 Rural Landscape to mixed use zoning that will facilitate the redevelopment of the area for urban purposes in a sustainable manner. This will occur by providing residential allotments of various sizes, commercial land, community and recreation facilities, as well as passive and active open space, primary school, landscaped areas, retained bushland, riparian areas, water quality basins and implementation of a koala corridor. The location of the koala corridor has been situated to align with the CPCP, the Council endorsed Gilead Koala Conservation Plan, as well as the CKPOM and the findings of the Chief Scientist & Engineer Report (2020).

The layout of the Concept Structure Plan has sought to retain vegetation and habitat of the subject site considered to have the highest biodiversity value with consideration of the following: listing status under the BC Act and EPBC Act, connectivity to offsite habitat, consistency with the CPCP, CKPOM, Chief Scientist & Engineer Report, Gilead Koala Conservation Plan and riparian areas. Although the planning proposal seeks some variations to the extent of 'Certified – Urban Capable' land under the CPCP (most notably two 'fingers' of TEC vegetation in the northeast corner of the subject site – refer to **Figures 2** and **3**), these areas of 'Avoided Land' under the CPCP proposed to be developed by the Concept Structure Plan have diminished ecological value due to being dominated by exotic species. The removal these two 'fingers' will be offset by the retention and conservation of 'Certified – Urban Capable' land in the centre of the subject site that also contains TECs, which could otherwise be developed.

As a result, the project will retain a minimum of ~80 ha of land of the 264 ha present within the subject site (i.e. retention of 30% of all land available), noting that ~168 ha of the subject site is currently comprised of already cleared land and Exotic Dominated Vegetation. Of the land to be retained, ~51 ha conforms to a BC Act listed TEC, which equates to the retention of ~61% of all TECs present (total of ~84 ha) within the subject site. The TECs to be retained are also considered to provide the most suitable habitat for threatened species, meaning that ~61% of the most suitable threatened species habitat (flora and fauna) will also be retained.

Although an estimated 39% of the TECs (and associated threatened species habitat) present within the subject site may be removed by future development, the majority of this is considered to have reduced conservation value due to high weed infestations, low native species diversity and limited connectivity to offsite habitat. Further to this, significant portions of the TECs that may be removed are 'Certified – Urban Capable' land under the CPCP. This means that the removal of much of the TECs proposed to be removed by the project has already been accounted for on a strategic level (i.e. DPE has assessed these areas as having reduced conservation value and assumed these areas will be removed to facilitate the development needs of the region).

In addition to retaining the majority of the TEC extent present within the subject site, the project currently proposes a Concept Structure Plan that is considered to be consistent with the objectives of the Council endorsed Gilead Koala Conservation Plan, Chief Scientist & Engineer Report, as well as the CKPOM. The inclusion of a koala corridor with a minimum overall width of >395 m in alignment with the CPCP, the Gilead Koala Conservation Plan, Chief Scientist & Engineer Report and CKPOM will ensure suitable habitat for the species that has connectivity to adjoining areas will be retained and managed in the long-term, increasing the species long-term viability in the region.

Any future DAs the project facilitates will need to be assessed independently to determine the type of assessments that are required. This includes (but is not limited to) consideration of controlled activity approvals under the *Water Management Act 2000*, entry into the BOS under the BC Act, and Commonwealth approval under the EPBC Act. Further to this, any future DAs that propose impacts on land that is not 'Certified – Urban Capable' under the CPCP will need to demonstrate the avoid, minimise, offset hierarchy of the BAM, likely resulting in the further retention of vegetation and associated threatened species habitat within areas to be zoned for development.

The biodiversity values of the subject site and potential ecological impacts of future development the project may facilitate, have been appropriately assessed to allow decision makers to appropriately assess the project. With consideration of the substantial areas of habitat to be retained by the project as well as large areas of the subject site mapped as 'Certified – Urban Capable' land under the CPCP, it is considered that the future development the Concept Structure Plan will facilitate is achievable under the biodiversity legislation and planning controls relevant to the project.

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APPENDIX A :
Flora Species List

Table 7 Flora Species List

Family	Scientific Name	Common Name	Exotic	Plot #	1		2		3		4		5		6		7		8		9		10		11		12		13		14		Random Meander
				PCT	PCT 850		PCT 849		PCT 1395		PCT 849		PCT 1395		PCT 830		PCT 835		Exotic Grassland		PCT 1395		Exotic Grassland		PCT 850		Exotic Grassland		PCT850-DNG		PCT850		
				High Threat Weed	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	Presence (X)
Amaranthaceae	Alternanthera denticulata	Lesser Joyweed							0.1	5	0.1	5					0.1	5															
Anacardiaceae	Schinus molle	Pepper Tree	*																						1	1							
Anthericaceae	Tricoryne elatior	Yellow Autumn-lily					0.2	20																			0.1	10					
Apiaceae	Cyclospermum leptophyllum	Slender Celery	*																								0.2	20					
Apocynaceae	Araujia sericiflora	Moth Vine	*						0.1	5	0.1	5			0.4	20					0.2	10											
Apocynaceae	Gomphocarpus fruticosus	Narrow-leaved Cotton Bush	*				0.1	10																	0.1	2			0.5	20	0.5	20	
Araucariaceae	Araucaria bidwillii	Bunya Pine	*																														X
Arecaceae	Phoenix canariensis	Canary Island Date Palm	*	Yes																													X
Asparagaceae	Asparagus asparagoides	Bridal Creeper	*	Yes																	0.1	5											
Asteraceae	Bidens pilosa	Cobbler's Pegs	*	Yes	0.1	5	0.1	10					0.2	20			0.1	10							0.2	20			0.5	35	0.1	20	
Asteraceae	Bidens subalternans	Greater Beggar's Ticks	*	Yes					0.1	10	0.1	10	0.1	10			0.1	5			0.2	10			1	80					0.1	2	
Asteraceae	Calotis dentex	Burr-daisy					5	40																									
Asteraceae	Carthamus lanatus	Saffron Thistle	*	Yes																							0.1	10					
Asteraceae	Cirsium vulgare	Spear Thistle	*		0.3	15	0.1	10			2	15	0.1	2	0.2	10					2	60	0.2	20	0.2	10	0.2	20	0.1	2	0.2	5	
Asteraceae	Conyza bonariensis	Flaxleaf Fleabane	*		0.1	10													0.1	10							0.1	5	0.1	3			
Asteraceae	Conyza sumatrensis	Tall fleabane	*				0.1	10					0.2	20			0.1	2	0.2	20	0.2	10	0.2	20			0.2	20	1	50	0.2	20	
Asteraceae	Euchiton sphaericus	Star Cudweed																									0.4	40					
Asteraceae	Hypochaeris albiflora	White Flatweed	*																												0.1	5	
Asteraceae	Hypochoeris radicata	Catsear	*		0.1	10	0.2	20					0.1	10																			
Asteraceae	Lactuca serriola	Prickly Lettuce	*								0.1	2																					
Asteraceae	Olearia viscosa						0.2	2																									
Asteraceae	Ozothamnus diosmifolius	White Dogwood																			0.2	2											
Asteraceae	Senecio hispidulus	Hill Fireweed															0.1	2			0.2	20											
Asteraceae	Senecio madagascariensis	Fireweed	*	Yes	0.2	20	0.2	20			0.2	20	0.2	20					0.2	20	0.2	20	0.2	20	0.2	20	0.2	20	0.5	100	0.5	100	
Asteraceae	Sigesbeckia orientalis	Indian Weed					0.2	20					1	80																			
Asteraceae	Solenogyne bellioides	Solengyne															0.1	5															
Asteraceae	Sonchus asper	Prickly Sowthistle	*				0.1	5													0.2	10											
Asteraceae	Sonchus oleraceus	Common Sowthistle	*		0.1	2																									0.1	5	
Asteraceae	Tagetes minuta	Stinking Roger	*										0.2	20																			
Asteraceae	Taraxacum officinale	Dandelion	*								0.2	20	0.1	5							0.2	40											
Asteraceae	Vittadinia cuneata var. cuneata f. minor						0.1	2									0.1	5															
Bignoniaceae	Pandorea pandorana	Wonga Wonga Vine							0.1	2			0.3	30	0.4	40	0.4	40															
Boraginaceae	Cynoglossum australe												0.2	10																			
Brassicaceae	Lepidium africanum	Common Peppercress	*																0.1	10									0.1	10			
Cactaceae	Opuntia stricta	Common Prickly Pear	*	Yes													0.1	5															
Campanulaceae	Lobelia purpurascens	whiteroot					0.2	20																									
Campanulaceae	Wahlenbergia gracilis	Sprawling Bluebell					0.1	10																			0.1	10			0.1	3	
Campanulaceae	Wahlenbergia stricta	Tall Bluebell			0.1	5																											
Caryophyllaceae	Petrorhagia dubia		*																										0.1	5			
Casuarinaceae	Casuarina cunninghamiana	River Oak																															X
Casuarinaceae	Casuarina glauca	Swamp Oak																															X
Chenopodiaceae	Einadia hastata	Berry Saltbush													0.2	10					0.2	10											
Chenopodiaceae	Einadia nutans subsp. nutans	Climbing Saltbush			0.1	10	0.1	10					0.1	10																			
Chenopodiaceae	Einadia trigonos	Fishweed			0.2	20																											
Clusiaceae	Hypericum perforatum	St. Johns Wort	*	Yes	0.2	40															0.1	10	0.2	10			0.1	10					
Commelinaceae	Commelina cyanea	Native Wandering Jew									0.2	20	0.4	40																			
Convolvulaceae	Convolvulus erubescens	Pink Bindweed			0.1	5															0.1	10											
Convolvulaceae	Dichondra repens	Kidney Weed					1	200	0.1	10	0.4	180	0.3	30			0.2	20							0.4	120							
Cyperaceae	Carex inversa	Knob Sedge			0.1	5					0.1	10													0.1	5					0.2	200	
Cyperaceae	Cyperus compressus		*										0.1	10																			
Cyperaceae	Cyperus gracilis	Slender Flat-sedge			0.2	40																			0.1	5					0.1	100	
Cyperaceae	Fimbristylis dichotoma	Common Fringe-sedge																													0.1	20	
Cyperaceae	Gahnia aspera	Rough Saw-sedge					0.2	1					0.4	3																			
Dilleniaceae	Hibbertia diffusa	Wedge Guinea Flower					0.2	5																									
Ericaceae	Melichrus urceolatus	Urn Heath																															X
Euphorbiaceae	Euphorbia peplus	Petty Spurge	*								0.2	20																					
Fabaceae (Faboideae)	Desmodium varians	Slender Tick-trefoil			0.1	2											0.1	2													0.1	10	
Fabaceae (Faboideae)	Erythrina x sykesii	Coral tree	*																														X
Fabaceae (Faboideae)	Glycine clandestina	Twining glycine											0.1	5																			
Fabaceae (Faboideae)	Glycine microphylla	Small-leaf Glycine					0.1	10			0.1	10																			0.1	40	
Fabaceae (Faboideae)	Glycine tabacina	Variable Glycine			0.1	10	0.8	200			1	200	0.2	20			0.2	10									0.4	40	0.1	10	0.1	20	
Fabaceae (Faboideae)	Hardenbergia violacea	False Sarsaparilla															0.1	5															
Fabaceae (Faboideae)	Medicago arabica	Spotted Burr Medic	*								0.1	10																					
Fabaceae (Faboideae)	Medicago polymorpha	Burr Medic	*																0.1	10			0.4	40			0.2	20	0.1	10			
Fabaceae (Faboideae)	Oxytes brachypoda	Large Tick-trefoil																			0.2	5							0.1	3			
Fabaceae (Faboideae)	Trifolium repens	White Clover	*																								1	100					
Fabaceae (Mimosoideae)	Acacia decurrens	Black Wattle															3	20			0.2	1											
Fabaceae (Mimosoideae)	Acacia implexa	Hickory Wattle													10	10																	
Fabaceae (Mimosoideae)	Acacia parramattensis	Parramatta Wattle													5	3					3	2											
Gentianaceae	Centaurium tenuiflorum	Branched Centaury	*		0.2	20															0.1	10	0.1	10			0.2	20					
Geraniaceae	Geranium solanderi var. solanderi				0.2	20					1	100	0.2	20					0.1	10	0.2	20					0.2	20	0.1	10			
Goodeniaceae	Brunonia australis	Blue Pincushion					0.4	60			0.2	20					0.2	20							0.1	10					0.1	50	
Goodeniaceae	Goodenia hederacea subsp. hederacea						0.1	5																									
Lamiaceae	Ajuga australis	Austral Bugle					0.4	40																									
Lamiaceae	Clerodendrum tomentosum	Hairy Clerodendrum											0.4	2																			
Lamiaceae	Marrubium vulgare	White Horehound	*								0.4	5																					
Lamiaceae	Plectranthus parviflorus						5	200					5	200	0.4	20	1	50															
Lamiaceae	Stachys arvensis	Stagger Weed	*																														X
Linaceae	Linum marginale	Native Flax					0.1	10					0.1	20																			
Linaceae	Linum trigynum	French Flax	*		0.4	80							0.1	10													0.1	5	0.1	5			
Lomandraceae	Lomandra filiformis subsp. filiformis						0.1	5	0.2	2																					0.1	20	

Family	Scientific Name	Common Name	Exotic	Plot #	1		2		3		4		5		6		7		8		9		10		11		12		13		14		Random Meander
				PCT	PCT 850		PCT 849		PCT 1395		PCT 849		PCT 1395		PCT 830		PCT 835		Exotic Grassland		PCT 1395		Exotic Grassland		PCT 850		Exotic Grassland		PCT850-DNG		PCT850		
Malvaceae	Malva parviflora	Small-flowered Mallow	*																		0.1	5			0.1	2							
Malvaceae	Modiola caroliniana	Red-flowered Mallow	*																0.1	10											0.1	1	
Malvaceae	Sida corrugata	Corrugated Sida			0.1	16																											
Malvaceae	Sida rhombifolia	Paddy's Lucerne	*		0.2	20	5	300			15	800	30	1000					0.4	40	15	500	5	80			2	100	0.25	20	5	400	
Meliaceae	Melia azedarach	White Cedar					0.3	1																							0.1	2	
Moraceae	Ficus rubiginosa	Port Jackson Fig																															X
Myrtaceae	Angophora floribunda	Rough-barked Apple																															X
Myrtaceae	Backhousia myrtifolia	Grey Myrtle																															X
Myrtaceae	Corymbia citriodora	Lemon-scented Gum	*																														X
Myrtaceae	Corymbia maculata	Spotted Gum																															X
Myrtaceae	Eucalyptus amplifolia subsp. amplifolia																																X
Myrtaceae	Eucalyptus botryoides	Bangalay																															X
Myrtaceae	Eucalyptus crebra	Narrow-leaved Ironbark							30	1											20	5									25	9	
Myrtaceae	Eucalyptus fibrosa	Red Ironbark																															X
Myrtaceae	Eucalyptus globoidea	White Stringybark																															X
Myrtaceae	Eucalyptus moluccana	Grey Box			12	58	15	12									35	11							40	12							
Myrtaceae	Eucalyptus punctata	Grey Gum							10	2			12	6							20	4											
Myrtaceae	Eucalyptus tereticornis	Forest Red Gum			25	9	30	7			40	1	25	10																			
Myrtaceae	Kunzea ambigua	Tick Bush																															X
Myrtaceae	Melaleuca decora																																X
Myrtaceae	Melaleuca styphelioides	Prickly-leaved Tea Tree																			2	1											
Oleaceae	Ligustrum lucidum	Large-leaved Privet	*	Yes					40	200			1	10	5	50	20	100															
Oleaceae	Ligustrum sinense	Small-leaved Privet	*	Yes					5	20					40	500	10	50															
Oleaceae	Olea europaea subsp. cuspidata	African Olive	*		30	40	0.1	10	30	100	0.2	5	0.2	5	40	400	40	200			5	20			90	450					15	100	
Oxalidaceae	Oxalis corniculata	Creeping Oxalis	*																										0.1	30	0.1	10	
Oxalidaceae	Oxalis perennans				0.1	10	0.2	40			0.1	10					0.1	5	0.1	10	0.1	20					0.1	10			0.1	2	
Passifloraceae	Passiflora subpeltata	White Passionflower	*										0.1	2							0.1	10											
Phyllanthaceae	Poranthera microphylla	Small Poranthera					0.2	60																									
Phytolaccaceae	Phytolacca octandra	Inkweed	*																		1	30											
Pittosporaceae	Bursaria spinosa	Native Blackthorn					0.4	5			3	3			5	20	1	20															
Pittosporaceae	Pittosporum undulatum	Sweet Pittosporum																															X
Plantaginaceae	Plantago debilis	Shade Plantain					0.1	5																									
Plantaginaceae	Plantago lanceolata	Lamb's Tongues	*				0.1	5			0.4	60	0.2	20			0.1	10	0.4	40	0.2	20	1	180	0.2	20			0.1	30	0.1	20	
Plantaginaceae	Veronica plebeia	Trailing Speedwell					0.2	10																	0.1	5							
Poaceae	Anthoxanthum odoratum	Sweet Vernal Grass	*								0.4	40									1	100											
Poaceae	Aristida ramosa	Purple Wiregrass															0.2	20											1	100	20	2000	
Poaceae	Austrostipa verticillata	Slender Bamboo Grass											0.2	10																			
Poaceae	Bothriochloa decipiens var. decipiens	Pitted Bluegrass																											5	500	5	500	
Poaceae	Bothriochloa macra	Red Grass																					1	50			1	100					
Poaceae	Briza subaristata		*	Yes																			0.2	20									
Poaceae	Bromus catharticus	Praire Grass	*																15	1500	0.2	20			2	200							
Poaceae	Bromus molliformis	Soft Brome	*																5	500							1	100					
Poaceae	Cenchrus clandestinus	Kikuyu Grass	*	Yes															5	500													
Poaceae	Chloris gayana	Rhodes Grass	*	Yes									1	50					0.2	20			2	200									
Poaceae	Chloris ventricosa	Tall Chloris					1	30			1	100					0.1	10					0.4	40	0.2	20					10	1000	
Poaceae	Cymbopogon refractus	Barbed Wire Grass					5	250					1	100																			
Poaceae	Cynodon dactylon	Common Couch			0.4	40													3	300									5	400	3	300	
Poaceae	Dichanthium sericeum subsp. sericeum	Queensland Bluegrass																	0.2	20									1	100			
Poaceae	Dichelachne micrantha	Shorthair Plumegrass											0.4	40							0.4	40									0.1	1	
Poaceae	Digitaria parviflora	Small-flowered Finger Grass					1	50																									
Poaceae	Echinochloa crus-galli	Barnyard Grass	*																														X
Poaceae	Echinopogon caespitosus	Bushy Hedgehog-grass									5	250	0.4	40																			
Poaceae	Ehrharta erecta	Panic Veldtgrass	*	Yes	0.1	10			1	100	2	200			5	500																	
Poaceae	Eleusine tristachya	Goose Grass	*																1	100													
Poaceae	Entolasia marginata	Bordered Panic					0.2	20					0.4	40			0.1	10															
Poaceae	Eragrostis brownii	Brown's Lovegrass					5	500																									
Poaceae	Eragrostis curvula	African Lovegrass	*	Yes																			20	1000									
Poaceae	Eragrostis leptostachya	Paddock Lovegrass			0.8	80	3	300					0.4	40					0.2	20	2	200	0.2	20					1	100			
Poaceae	Eriochloa pseudoacrotricha	Early Spring Grass			0.2	20																			1	100	2	200					
Poaceae	Lachnagrostis filiformis				0.2	20																											
Poaceae	Melinus repens	Red Natal Grass	*																										0.1	10			
Poaceae	Microlaena stipoides var. stipoides	Weeping Grass			2	200	10	1000			30	3000	20	2000	2	200	2	200	1	100	40	4000	10	1000	2	200	2	200	5	500	60	6000	
Poaceae	Nassella neesiana	Chilean Needle Grass	*	Yes																									20	1000			
Poaceae	Oplismenus aemulus								1	100					2	200	2	200															
Poaceae	Oplismenus imbecillis								0.1	10					5	500					5	500											
Poaceae	Panicum effusum	Hairy Panic			1	100																	0.2	20					15	1500			
Poaceae	Paspalidium criniforme										1	100							1	100	0.4	40					1	100					
Poaceae	Paspalidium distans																														1	100	
Poaceae	Paspalum dilatatum	Paspalum	*	Yes	2	100					10	500							60	3000							15	750	20	2000	1	100	
Poaceae	Phalaris aquatica	Phalaris	*								2	100							0.6	60	0.2	10					1	50					
Poaceae	Phragmites australis	Common Reed																															X
Poaceae	Poa sieberiana var. sieberiana	Snowgrass																					0.1	1									
Poaceae	Rytidosperma caespitosum	Ringed Wallaby Grass															0.2	20			0.4	40											
Poaceae	Rytidosperma fulvum	Wallaby Grass			4	400											0.1	10					1	100									
Poaceae	Setaria parviflora		*				10	500			3	300	1	100					5	500	10	500	40	2000			60	3000	10	1000			
Poaceae	Sporobolus creber	Slender Rat's Tail Grass			0.4	20	5	250					0.2	20					1	100			1	50			4	200	1	100	1	100	
Poaceae	Themeda triandra				1	50	10	500					2	150															15	1000	1	100	
Polygalaceae	Polygala virgata		*	Yes																											0.2	10	
Polygonaceae	Rumex brownii	Swamp Dock																											0.1	2			
Polypodiaceae	Pyrrosia rupestris	Rock Felt Fern																															X
Portulacaceae	Portulaca oleracea	Pigweed			0.1	5																											
Primulaceae	Lysimachia arvensis	Scarlet Pimpernel	*		0.1	10					0.1	10									0.2	25											
Primulaceae	Myrsine variabilis																																X
Proteaceae	Persoonia linearis	Narrow-leaved Geebung					0.1	5																									

Family	Scientific Name	Common Name	Exotic	Plot #	1		2		3		4		5		6		7		8		9		10		11		12		13		14		Random Meander
				PCT	PCT 850		PCT 849		PCT 1395		PCT 849		PCT 1395		PCT 830		PCT 835		Exotic Grassland		PCT 1395		Exotic Grassland		PCT 850		Exotic Grassland		PCT850-DNG		PCT850		
Pteridaceae	Adiantum aethiopicum	Common Maidenhair							0.1	2																					
Pteridaceae	Cheilanthes sieberi subsp. sieberi	Rock Fern					0.2	30									0.1	10											0.1	5	
Pteridaceae	Pellaea falcata	Sickle Fern							0.1	5			0.1	10	0.2	20															
Ranunculaceae	Clematis aristata	Old Man's Beard											0.1	5																	
Ranunculaceae	Clematis glycinoides	Headache Vine															0.1	5			0.1	5									
Rosaceae	Rubus fruticosus	Blackberry complex	*												2	10					10	100									
Rubiaceae	Asperula conferta	Common Woodruff																											0.1	5	
Solanaceae	Lycium ferocissimum	African Boxthorn	*	Yes	0.4	5	0.2	2			0.4	2					0.4	20							2	10					
Solanaceae	Salpichroa origanifolia	Pampas Lily-of-the-valley	*																0.2	20	0.1	2									
Solanaceae	Solanum nigrum	Black-berry Nightshade	*		0.1	1															0.8	40							0.2	3	
Solanaceae	Solanum prinophyllum	Forest Nightshade					0.2	10			0.1	2			0.2	20	0.2	10											0.2	3	
Solanaceae	Solanum pseudocapsicum	Madeira Winter Cherry	*				0.2	2																							
Typhaceae	Typha orientalis	Broad-leaved Cumbungi																													X
Ulmaceae	Trema tomentosa var. aspera	Native Peach													0.2	5															
Verbenaceae	Lantana camara	Lantana	*	Yes	0.4	5	0.2	2					2	18	0.2	20									0.1	10					
Verbenaceae	Verbena bonariensis	Purpletop	*		0.2	20													0.2	20	0.1	10	5	180			3	100	5	200	0.2	10
Verbenaceae	Verbena officinalis	Common Verbena	*																1	100							0.2	20				
Verbenaceae	Verbena quadrangularis		*																										0.2	30		
Verbenaceae	Verbena rigida	Veined Verbena	*																				1	60								
Vitaceae	Cayratia clematidea	Native Grape															0.1	5														

APPENDIX B :

Threatened Species Likelihood of Occurrence

Table 8 Threatened species likelihood of occurrence

Class	Scientific Name	Common Name	BC Act Status	EPBC Act Status	Records	Habitat Requirements	Likelihood of Occurrence
Flora	*Pterostylis saxicola*	Sydney Plains Greenhood	E	E	34	The species occurs in small pockets of shallow soil in flat areas on top of sandstone rock shelves above cliff lines, or on mossy rocks in gullies. Sclerophyll forest/woodland often occurs growing above where the species occurs, on shale or shale/sandstone transition soils. Flowering time is from October to December. It is currently only known to occur at five locations within western Sydney: Georges River National Park, close to Yeramba Lagoon, Peter Meadows Creek, and St Marys Towers.	Potential. Moderate number of records from the locality and suitable habitat is present.
Flora	*Acacia bynoeana*	Bynoe's Wattle	E	V	Species or species habitat likely to occur within area	Found in heath and woodland on sandy soils. Prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches. Associated overstorey species include *Corymbia maculata* (Red Bloodwood), *Eucalyptus haemastoma* (Scribbly Gum), *Eucalyptus parramattensis* (Parramatta Red Gum), *Banksia serrata* (Saw Banksia) and *Angophora bakeri* (Narrow-leaved Apple).	Unlikely. No records from the locality and no suitable habitat is present.

Class	Scientific Name	Common Name	BC Act Status	EPBC Act Status	Records	Habitat Requirements	Likelihood of Occurrence
Flora	*Acacia pubescens*	Downy Wattle	V	V	Species or species habitat likely to occur within area	Occurs on alluviums, shales and at the intergrade between shales and sandstones. Occur in open woodland and forest, including Cooks River/Castlereagh Ironbark Forest, Shale/Gravel Transition Forest and Cumberland Plain Woodland.	Potential. Although no records from the locality, suitable habitat is present.
Flora	*Allocasuarina glareicola*		E	E	Species or species habitat likely to occur within area	Grows in Castlereagh woodland on lateritic soil with Eucalyptus parramattensis, Eucalyptus fibrosa, Angophora bakeri, Eucalyptus sclerophylla and Melaleuca decora. Primarily restricted to the Richmond (NW Cumberland Plain) district, but with an outlier population found at Voyager Point, Liverpool.	Unlikely. No records from the locality and minimal suitable habitat is present.
Flora	*Astrotricha crassifolia*	Thick-leaf Star-hair	V	V	Species or species habitat likely to occur within area	Occurs near Patonga (Gosford LGA), and in Royal NP and on the Woronora Plateau (Sutherland and Campbelltown LGAs). Occurs in dry sclerophyll woodland on sandstone.	Unlikely. No records from the locality and no suitable habitat present.
Flora	*Caladenia tessellata*	Thick-lipped Spider-orchid	E	V	Species or species habitat likely to occur within area	Generally found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil.	Potential. Although no records from the locality, suitable habitat is present.

Class	Scientific Name	Common Name	BC Act Status	EPBC Act Status	Records	Habitat Requirements	Likelihood of Occurrence
Flora	*Commersonia prostrata*	Dwarf Kerrawang	E	E	Species or species habitat likely to occur within area	Species occurs primarily on the southern Highlands and Southern Tablelands. Grows on sandy and sometimes peaty soils. Often associated with *Imperata cylindrica, Empodisma minus* and *Leptospermum continentale*.	Unlikely. No records from the locality and no suitable habitat present.
Flora	*Cryptostylis hunteriana*	Leafless Tongue-orchid	V	V	Species or species habitat likely to occur within area	Occur in a wide variety of habitats including heathlands, heathy woodlands, sedgelands, Xanthorrhoea spp. plains, dry sclerophyll forests (shrub/grass sub-formation and shrubby sub-formation), forested wetlands, freshwater wetlands, grasslands, grassy woodlands, rainforests and wet sclerophyll forests. Soils are generally considered to be moist and sandy, however, this species is also known to grow in dry or peaty soils. Is associated with the community Bloodwood / Scribbly Gum / Silver-top Ash Forest on the South Coast. Species is known to have occurrence associated with other Cryptostylis species. Flowering occurs generally from November to February.	Unlikely. No records from the locality and no associated communities present.

Class	Scientific Name	Common Name	BC Act Status	EPBC Act Status	Records	Habitat Requirements	Likelihood of Occurrence
Flora	*Cynanchum elegans*	White-flowered Wax Plant	E	E	Species or species habitat likely to occur within area	Usually associated with dry rainforest vegetation and in coastal communities. Can occur in clay influenced woodland associated with *Eucalyptus tereticornis* and *Corymbia maculata*.	Potential. Although no records from the locality, suitable habitat is present.
Flora	*Eucalyptus benthamii*	Camden White Gum	V	V	1	Occurs on the alluvial flats of the Nepean River and its tributaries. There are two major subpopulations: in the Kedumba Valley of the Blue Mountains National Park and at Bents Basin State Recreation Area. This species requires a combination of deep alluvial sands and a flooding regime that permits seedling establishment.	Potential. Although only one record from the locality, suitable habitat is present.
Flora	*Eucalyptus camfieldii*	Camfield's Stringybark	V	V	Species or species habitat likely to occur within area	Found in exposed areas on sandstone ridges, slopes and plateaus near tall coastal heath or low open woodland.	Unlikely. No records from the locality and minimal suitable habitat present.
Flora	*Genoplesium baueri*	Yellow Gnat-orchid	E	E	Species or species habitat likely to occur within area	Grows in dry sclerophyll forest and moss gardens over sandstone.	Unlikely. No records from the locality and minimal suitable habitat present.

Class	Scientific Name	Common Name	BC Act Status	EPBC Act Status	Records	Habitat Requirements	Likelihood of Occurrence
Flora	*Grevillea parviflora* subsp. *parviflora*	Small-flower Grevillea	V	V	12	Grows in sandy or light clay soils usually over thin shales, often with lateritic ironstone gravels and nodules. Sydney region occurrences are usually on Tertiary sands and alluvium, and soils derived from the Mittagong Formation. Occurs in a range of vegetation types from heath and shrubby woodland to open forest.	Potential. Moderate number of records from the locality and suitable habitat is present.
Flora	*Haloragis exalata* subsp. *exalata*	Wingless Raspwort	V	V	Species or species habitat likely to occur within area	Species requires protected and shaded damp situations in riparian habitats.	Potential. Although no records from the locality, suitable habitat is present.
Flora	*Isotoma fluviatilis* subsp. *fluviatilis*			X	1	Currently known from only two adjacent sites on a single private property at Erskine Park in the Penrith LGA. Previous sightings are all from western Sydney, at Homebush and at Agnes Banks. Known to grow in damp places, on the Cumberland Plain, including freshwater wetland, grassland/alluvial woodland and an alluvial woodland/shale plains woodland (Cumberland Plain Woodland) ecotone.	Unlikely. Species is classified as extinct.

Class	Scientific Name	Common Name	BC Act Status	EPBC Act Status	Records	Habitat Requirements	Likelihood of Occurrence
Flora	*Leucopogon exolasius*	Woronora Beard-heath	V	V	Species or species habitat likely to occur within area	Found along the upper Georges River area and in Heathcote National Park. Occurs in woodland on sandstone.	Unlikely. No records from the locality and subject site is outside known locations.
Flora	*Melaleuca deanei*	Deane's Melaleuca	V	V	Species or species habitat likely to occur within area	Found in marshy heath on coastal sandstone plateaus. Restricted to sandstones of Sydney and south coast.	Unlikely. No records from the locality and no suitable habitat present.
Flora	*Persicaria elatior*	Knotweed	V	V	Species or species habitat likely to occur within area	Species in known to occur in Raymond Terrace and Grafton areas. Grows in damp places, preferring areas near streams and lakes and occasionally found in swamp forest.	Potential. Although no records from the locality, suitable habitat is present.
Flora	*Persoonia bargoensis*	Bargo Geebung	E	V	Species or species habitat likely to occur within area	Species is restricted to the western edge of the Woronora Plateau and the northern edge of the Southern Highlands. Occurs in woodland or dry sclerophyll forest on sandstone and on heavy, well drained, loamy, gravelly soils of the Wianamatta Shale and Hawkesbury Sandstone.	Unlikely. No records from the locality and subject site is outside known locations.

Class	Scientific Name	Common Name	BC Act Status	EPBC Act Status	Records	Habitat Requirements	Likelihood of Occurrence
Flora	*Persoonia hirsuta*	Hairy Geebung	E	E	1	Occurs in dry sclerophyll forest and woodland with a shrubby understorey.	Potential. Although only one record from the locality, suitable habitat is present.
Flora	*Persoonia nutans*	Nodding Geebung	E	E	Species or species habitat likely to occur within area	Northern populations are confined to aeolian and alluvial sediments and occur in a range of sclerophyll forest and woodland vegetation communities, with the majority of individuals occurring within Agnes Banks Woodland or Castlereagh Scribbly Gum Woodland and some in Cooks River / Castlereagh Ironbark Forests. Southern populations also occupy tertiary alluvium, but extend onto shale sandstone transition communities and into Cooks River / Castlereagh Ironbark Forest.	Unlikely. No records from the locality and associated communities absent.
Flora	*Pimelea curviflora* var. *curviflora*	null	V	V	Species or species habitat likely to occur within area	Confined to the coastal area of Sydney between northern Sydney in the south and Maroota in the north-west. Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands.	Unlikely. No records from the locality and minimal suitable habitat present.

Class	Scientific Name	Common Name	BC Act Status	EPBC Act Status	Records	Habitat Requirements	Likelihood of Occurrence
Flora	*Pimelea spicata*	Spiked Rice-flower	E	E	21	On the Cumberland Plain sites it is associated with Grey Box communities (particularly Cumberland Plain Woodland variants and Moist Shale Woodland) and in areas of ironbark. 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.	Potential. Moderate number of records from the locality and suitable habitat is present.
Flora	*Pomaderris brunnea*	Brown Pomaderris	E	V	44	In the region, the species is only found in a very limited area around the Colo, Nepean and Hawkesbury Rivers, including the Bargo area and near Camden. It grows in moist woodland or forest on clay and alluvial soils of flood plains and creek lines.	Potential. Moderate number of records from the locality and suitable habitat is present.

Class	Scientific Name	Common Name	BC Act Status	EPBC Act Status	Records	Habitat Requirements	Likelihood of Occurrence
Flora	*Pomaderris cotoneaster*	Cotoneaster Pomaderris	E	E	Species or species habitat likely to occur within area	Cotoneaster Pomaderris has a very disjunct distribution, being known from the Nungatta area, northern Kosciuszko National Park (near Tumut), the Tantawangalo area in South-East Forests National Park and adjoining freehold land, Badgery's Lookout near Tallong, Bungonia State Conservation Area, the Yerranderie area, Kanangra-Boyd National Park, the Canyonleigh area and Ettrema Gorge in Morton National Park. Habitats that the species is found within include forest with deep, friable soil, amongst rock beside a creek, on rocky forested slopes and in steep gullies between sandstone cliffs.	Unlikely. No records from the locality and minimal suitable habitat is present.
Flora	*Pomaderris sericea*	Bent Pomaderris	E	V	Species or species habitat likely to occur within area	In New South Wales, the Silky Pomaderris is known from two localities, Morton National Park near Bundanoon and from Wollemi National Park. Both these records are from open forest on sandstone habitats.	Unlikely. No records from the locality and subject site is outside known locations.
Flora	*Prasophyllum affine*	Jervis Bay Leek Orchid	E	E	Species or species habitat likely to occur within area	Grows on poorly drained grey clay soils that support low heathland and sedgeland communities.	Unlikely. No records from the locality and subject site lacks associated communities.

Class	Scientific Name	Common Name	BC Act Status	EPBC Act Status	Records	Habitat Requirements	Likelihood of Occurrence
Flora	*Pultenaea aristata*		V	V	Species or species habitat likely to occur within area	The underground dormant tubers commence shooting in mid-winter and leaves are known to have emerged above ground by June.	Unlikely. No records from the locality and minimal habitat present.
Flora	*Pultenaea pedunculata*	Matted Bush-pea	E		9	Within the Cumberland Plain, the species favours clay or sandy-clay soils on Wianamatta Shale-derived soils, usually close to Tertiary alluvium or Shale-Sandstone interface. All sites have a lateritic influence with ironstone gravel present. Associated tree species include: Eucalyptus moluccana, E. fibrosa, E. crebra, E. longifolia and Melaleuca decora.	Potential. Low number of records from the locality, but suitable habitat is present.
Flora	*Rhizanthella slateri*	Eastern Underground Orchid	V	E	Species or species habitat likely to occur within area	Habitat requirements are poorly understood and no particular vegetation type has been associated with the species, although it is known to occur in sclerophyll forest. The species is highly cryptic given that it grows almost completely below the soil surface, with flowers being the only part of the plant that can occur above ground. Flowers September to November.	Unlikely. No records from the locality and only small area of suitable habitat present.

Class	Scientific Name	Common Name	BC Act Status	EPBC Act Status	Records	Habitat Requirements	Likelihood of Occurrence
Flora	*Rhodamnia rubescens*	Scrub Turpentine	CE	CE	Species or species habitat likely to occur within area	Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils. The species is distributed in coastal districts north from Batemans Bay in New South Wales to areas inland of Bundaberg in Queensland. Populations of R. rubescens typically occur in coastal regions and occasionally extend inland onto escarpments up to 600 m a.s.l. in areas with rainfall of 1,000-1,600 mm.	Unlikely. No records from the locality and no suitable habitat present.
Flora	*Syzygium paniculatum*	Magenta Lilly Pilly	E	V	Species or species habitat likely to occur within area	On south coast of NSW occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. On the central coast occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities.	Unlikely. No records from the locality and no suitable habitat present.
Flora	*Thelymitra kangaloonica*	Kangaloon Sun Orchid	CE	CE	Species or species habitat likely to occur within area	Species is only known to occur on the southern tablelands of NSW in the Moss Vale / Kangaloon / Fitzroy Falls area at 550-700 m above sea level. It is found in swamps and in sedgelands over grey silty grey loam soils. It is thought to be a short-lived perennial, flowering in late October and early November.	Unlikely. No records from the locality and subject site is outside known locations.

Class	Scientific Name	Common Name	BC Act Status	EPBC Act Status	Records	Habitat Requirements	Likelihood of Occurrence
Flora	*Thesium australe*	Austral Toadflax	V	V	Species or species habitat likely to occur within area	Found in very small populations scattered across eastern NSW. Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Often found in association with Kangaroo Grass (Themeda australis).	Potential. Although no records from the locality, suitable habitat is present.
Flora	*Xerochrysum palustre*	Swamp Everlasting, Swamp Paper Daisy		V	Species or species habitat likely to occur within area	Grows in swamps and bogs which are often dominated by heaths. Also grows at the edges of bog margins on peaty soils with a cover of shrubs or grasses. Re-sprouts after fires. Sometimes grows in bogs with Sphagnum.	Unlikely. Only small areas of potential habitat present that lack preferred cover characteristics.
Amphibian	*Heleioporus australiacus*	Giant Burrowing Frog	V	V	Species or species habitat likely to occur within area	Occurs in heath, woodland and open dry sclerophyll forest on a variety of soil types. Breeding habitat for this species usually contains soaks or pools within first of second order streams.	Potential. Although no records from the locality, suitable habitat is present.

Class	Scientific Name	Common Name	BC Act Status	EPBC Act Status	Records	Habitat Requirements	Likelihood of Occurrence
Amphibian	*Litoria aurea*	Green and Golden Bell Frog	E	V	Species or species habitat likely to occur within area	The species is found in a wide range of water bodies except fast moving streams. It commonly inhabits disturbed sites such abandoned quarries and mines, though generally breeds in habitats that include still, shallow, unpolluted water bodies, that are unshaded, contain aquatic plants are free of Mosquito fish and other predators, with a range of diurnal shelter sites (emergent aquatic vegetation).	Potential. Although no records from the locality, suitable habitat is present.
Amphibian	*Litoria littlejohni*	Littlejohn's Tree Frog	V	E	Species or species habitat likely to occur within area	Inhabits forest, coastal woodland and heath, from 100 to 950 m above sea level. It breed in rocky streams, still water in dams, ditches, isolated pools, and temporary pools where sufficient run-off water is available.	Potential. Although no records from the locality, suitable habitat is present.

Class	Scientific Name	Common Name	BC Act Status	EPBC Act Status	Records	Habitat Requirements	Likelihood of Occurrence
Amphibian	*Litoria watsoni*	Watson's Tree Frog		E	Species or species habitat likely to occur within area	***Litoria littlejohni, endemic to south-eastern Australia has been split into 2 species, now Litoria littlejohni and newly named Litoria watsoni.*** This species breeds in the upper reaches of permanent streams and in perched swamps. Non-breeding habitat is heath based forests and woodlands where it shelters under leaf litter and low vegetation, and hunts for invertebrate prey either in shrubs or on the ground. Breeding is triggered by heavy rain and can potentially occur all year, but is usually from late summer to early spring when conditions are favourable.	Potential. Although no records from the locality, suitable habitat is present.
Amphibian	*Mixophyes balbus*	Stuttering Frog	E	V	Species or species habitat likely to occur within area	Typically found in association with permanent streams through temperate and sub-tropical rainforest, and wet sclerophyll forest. It is rarely found in dry, open, tableland, riparian vegetation, and moist gullies in dry forest.	Unlikely. No records from the locality and preferred habitat is absent.
Aves	*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V		5	Inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1000 m in which stands of She-Oak species, particularly Black She-oak (Allocasuarina littoralis), Forest She-oak (A. torulosa) or Drooping She-oak (A. verticillata) occur.	Unlikely. Low number of records from the locality and no preferred feed trees are present.

Class	Scientific Name	Common Name	BC Act Status	EPBC Act Status	Records	Habitat Requirements	Likelihood of Occurrence
Aves	*Anthochaera phrygia*	Regent Honeyeater	E	CE	3	Inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. The Regent Honeyeater is a generalist forager, which mainly feeds on the nectar from a wide range of eucalypts and mistletoes.	Unlikely. Low number of records from the locality and no mapped important habitat present.
Aves	*Artamus cyanopterus cyanopterus*	Dusky Woodswallow	V		90	In New South Wales the species is widespread from coast to inland, including the western slopes of the Great Dividing Range and farther west. The Dusky Woodswallow is found in woodlands and dry open sclerophyll forests, usually dominated by eucalypts, including mallee associations. The species primarily eats invertebrates, mainly insects, which are captured whilst hovering and sallying above the canopy or over water.	Potential. High number of records from the locality and suitable habitat is present.
Aves	*Botaurus poiciloptilus*	Australasian Bittern	E	E	Species or species habitat likely to occur within area	Occurs in freshwater wetlands, and more rarely, estuarine wetlands. It favours wetlands with tall, dense vegetation, and forages in shallow water up to a depth of 0.3m. It nests in deep vegetative cover over shallow pools.	Unlikely. Low number of records from the locality and minimal suitable habitat present.

Class	Scientific Name	Common Name	BC Act Status	EPBC Act Status	Records	Habitat Requirements	Likelihood of Occurrence
Aves	*Calidris canutus*	Red Knot		E	8	Found on the coast in sandy estuaries with tidal mudflats.	Unlikely. Although a low number of records from the locality, no suitable habitat is present.
Aves	*Calidris ferruginea*	Curlew Sandpiper	E	CE	Species or species habitat likely to occur within area	The Curlew Sandpiper is found in coastal areas with intertidal mudflats, including estuaries, inlets and lagoons, and ponds in saltworks. The species have also occasionally been recorded inland around lakes , dams and waterholes with mud or sand present. Main requirements for feeding habitats are the presence of mudflats or shallow water up to 60mm. The Curlew Sandpiper may also forage in saltmarsh environments and flooded paddocks.	Unlikely. No records from the locality and minimal suitable habitat present.
Aves	*Callocephalon fimbriatum*	Gang-gang Cockatoo	V	E	15	In summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, may occur at lower altitudes in drier more open eucalypt forests and woodlands, and often found in urban areas. In NSW, the Gang-gang Cockatoo is distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes.	Potential. Low number of records from the locality, but suitable habitat is present.

Class	Scientific Name	Common Name	BC Act Status	EPBC Act Status	Records	Habitat Requirements	Likelihood of Occurrence
Aves	*Circus assimilis*	Spotted Harrier	V		1	Occurs throughout mainland Australia except in densely forested or wooded habitats of the coast, escarpment, and ranges. It inhabits open grassy woodland, shrubland, and grassland. It nests in trees and preys on terrestrial mammals, birds, and reptiles, and will occasionally consume carrion.	Potential. Although only one record from the locality, suitable habitat is present.
Aves	*Climacteris picumnus victoriae*	Brown Treecreeper (eastern subspecies)	V		4	Found in eucalypt woodlands and dry open forest of the inland slopes and plains inland of the Great Dividing Range. The species favours woodlands dominated by stringybarks or other Rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species. Fallen timber is an important habitat component for foraging.	Potential. Low number of records from the locality, but suitable habitat is present.
Aves	*Daphoenositta chrysoptera*	Varied Sittella	V		52	Inhabits eucalypt forests and woodlands, especially those containing Rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Inhabits most of mainland Australia except the treeless deserts and open grasslands.	Potential. High number of records from the locality and suitable habitat is present.

Class	Scientific Name	Common Name	BC Act Status	EPBC Act Status	Records	Habitat Requirements	Likelihood of Occurrence
Aves	*Dasyornis brachypterus*	Eastern Bristlebird	E	E	Species or species habitat likely to occur within area	Habitat for central and southern populations is characterised by dense, low vegetation including heath and open woodland with a heathy understorey. In northern NSW the habitat occurs in open forest with dense tussocky grass understorey and sparse mid-storey near rainforest ecotone; all of these vegetation types are fire prone.	Unlikely. No records from the locality and minimal suitable habitat is present.
Aves	*Ephippiorhynchus asiaticus*	Black-necked Stork	E		1	Occurs in floodplain wetlands of major coastal rivers along with minor floodplains, coastal sandplain wetlands and estuaries. Species builds nest in high in trees close to water.	Potential. Low number of records from the locality, but suitable habitat is present.
Aves	*Falco hypoleucos*	Grey Falcon	E	V	Species or species habitat likely to occur within area	The Grey Falcon is sparsely distributed in NSW, chiefly throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing Range. The breeding range has contracted since the 1950s with most breeding now confined to arid parts of the range. There are possibly less than 5000 individuals left. Population trends are unclear, though it is believed to be extinct in areas with more than 500mm rainfall in NSW.	Unlikely. No records from the locality and although suitable habitat is present, species is rare east of the Great Dividing Range.

Class	Scientific Name	Common Name	BC Act Status	EPBC Act Status	Records	Habitat Requirements	Likelihood of Occurrence
Aves	*Glossopsitta pusilla*	Little Lorikeet	V		25	Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophoras, Melaleucas and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Also utilises isolated flowering trees in open country, e.g. paddocks, roadside remnants and urban trees. Roosts in treetops, often distant from feeding areas. Nests in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of smooth-barked Eucalypts.	Potential. Moderate number of records from the locality and suitable habitat is present.
Aves	*Grantiella picta*	Painted Honeyeater	V	V	Species or species habitat likely to occur within area	Occurs in Boree, Brigalow and Box-Gum Woodlands and Box-Ironbarks. Feeds primarily on mistletoe fruit and insects.	Unlikely. No records from the locality and no suitable habitat present.
Aves	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	V		12	The White-bellied Sea-Eagle is found in coastal habitats (especially those close to the sea-shore) and around terrestrial wetlands in tropical and temperate regions of mainland Australia and its offshore islands. The habitats occupied by the sea-eagle are characterised by the presence of large areas of open water.	Unlikely. No large stick nests recorded and habitat present is marginal considering larger areas of suitable habitat are

Class	Scientific Name	Common Name	BC Act Status	EPBC Act Status	Records	Habitat Requirements	Likelihood of Occurrence
							nearby (e.g. Nepean River).
Aves	*Hieraaetus morphnoides*	Little Eagle	V		14	The Little Eagle occupies habitats rich in prey within open eucalypt forest, woodland, or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used. For nest sites it requires a tall living tree within a remnant patch.	Potential. Moderate number of records from the locality and suitable habitat is present.
Aves	*Hirundapus caudacutus*	White-throated Needletail		MIG	1	Almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground. Occur over most types of habitat, particularly above wooded areas including open forest and rainforest, between trees or in clearings and below the canopy.	Potential. Although only one record from the locality, suitable habitat is present.
Aves	*Lathamus discolor*	Swift Parrot	E	CE	114	In NSW mostly occurs on the coast and south west slopes. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Eucalyptus robusta, Corymbia maculata, C. gummifera, E. sideroxylon, and E. albens. Breeds in Tasmania in spring and summer.	Potential. High number of records from the locality and suitable habitat is present.

Class	Scientific Name	Common Name	BC Act Status	EPBC Act Status	Records	Habitat Requirements	Likelihood of Occurrence
Aves	*Lophoictinia isura*	Square-tailed Kite	V		5	Found in a variety of timbered habitats including dry woodlands and open forests. It is a specialist hunter preying on passerine birds, especially honeyeaters and targets predominately nestlings and insects occurring in the tree canopy. It nests in tree forks or on large horizontal tree limbs located mostly along or near watercourses.	Potential. Low number of records from the locality, but suitable habitat is present.
Aves	*Ninox strenua*	Powerful Owl	V		13	In NSW the Powerful Owl lives in forests and woodlands occurring in the coastal, escarpment, tablelands and western slopes environments. Specific habitat requirements include eucalypt forests and woodlands on productive sites on gentle terrain; a mosaic of moist and dry types, with mesic gullies and permanent streams; presence of leafy sub canopy trees or tall shrubs for roosting; presence of large old trees to provide nest hollows. Optimal habitat includes a tall shrub layer and abundant hollows supporting high densities of arboreal marsupials.	Potential. Moderate number of records from the locality and suitable habitat is present.

Class	Scientific Name	Common Name	BC Act Status	EPBC Act Status	Records	Habitat Requirements	Likelihood of Occurrence
Aves	*Numenius madagascariensis*	Eastern Curlew		CE	Species or species habitat likely to occur within area	Prefers sheltered coasts, especially estuaries, bays, harbours, inlets and lagoons. Also known to occur in sewage farms, wetlands and mangroves. Species roosts on sandy spits and in low Saltmarsh or mangroves.	Unlikely. No records from the locality and no suitable habitat present.
Aves	*Petroica boodang*	Scarlet Robin	V		10	Occurs in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and regrowth vegetation. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps. Habitat usually contains abundant logs and fallen timber: these are important components of its habitat. Nests are often found in a dead branch in a live tree, or in a dead tree or shrub.	Potential. Moderate number of records from the locality and suitable habitat is present.
Aves	*Pycnoptilus floccosus*	Pilotbird		V	Species or species habitat likely to occur within area	Pilotbirds usually inhabit the ground layer of wet sclerophyll forests in temperate zones in moist gullies. They can also be found in dry sclerophyll forests and woodlands occupying dry slopes and ridges with dense undergrowth.	Unlikely. No records from the locality and minimal suitable habitat is present.
Aves	*Rostratula australis*	Australian Painted Snipe	E	E	Species or species habitat likely to occur within area	Inhabits fringes of shallow inland wetlands, swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	Unlikely. No records from the locality and waterbodies present lack

Class	Scientific Name	Common Name	BC Act Status	EPBC Act Status	Records	Habitat Requirements	Likelihood of Occurrence
							preferred cover characteristics.
Aves	*Stagonopleura guttata*	Diamond Firetail	V		2	Occurs in grassy eucalypt woodland, open forest and riparian areas.	Potential. Although only two records from the locality, suitable habitat is present.

Class	Scientific Name	Common Name	BC Act Status	EPBC Act Status	Records	Habitat Requirements	Likelihood of Occurrence
Aves	*Stictonetta naevosa*	Freckled Duck	V		1	This species occurs primarily in south-eastern and south-western Australia and occurs as a vagrant elsewhere. It breeds in large, temporary swamps created during flood events in the Bulloo and Lake Eyres basins and along the Murray-Darling river system. During inland droughts the species disperses to wetlands in the Murray River basin, and occasionally to coastal areas. The species prefers permanent freshwater swamps and creeks heavy with shrub, sedge, and rush growth. It rests in dense cover during the day, usually in deep water and feeds at dusk and sawn on algae, seeds, and vegetative parts of aquatic sedges and grasses. It nests generally during October to December in dense vegetation near to the water level.	Unlikely. Only one record from the locality and waterbodies present lack preferred cover characteristics.

Class	Scientific Name	Common Name	BC Act Status	EPBC Act Status	Records	Habitat Requirements	Likelihood of Occurrence
Aves	*Tyto novaehollandiae*	Masked Owl	V		2	Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting. Lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides. The typical diet consists of tree-dwelling and ground mammals, especially rats.	Unlikely. Only two records from the locality and subject site lacks large enough patches of woodland/forest required for the species.
Fish	*Macquaria australasica*	Macquarie Perch		E	Species or species habitat likely to occur within area	The species is a riverine, schooling species that prefers clear water, and deep rocky holes with lots of cover. It naturally occurs in the Murray-darling basin and associated water courses, Shoalhaven River, and the Hawkesbury Nepean System.	Potential. Suitable habitat present within the lower reaches of Menangle Creek in the southwest of the subject site.
Fish	*Prototroctes maraena*	Australian Grayling		V	Species or species habitat likely to occur within area	Species spends part of its lifecycle in freshwater and part of the larval and/or juvenile stages in coastal seas. Adults inhabit cool, clear, freshwater streams with gravel substrate and areas alternating between pools and riffle zones.	Unlikely. No suitable habitat present for adults.

Class	Scientific Name	Common Name	BC Act Status	EPBC Act Status	Records	Habitat Requirements	Likelihood of Occurrence
Gastropoda	*Meridolum corneovirens*	Cumberland Plain Land Snail	E		106	Primarily inhabits Cumberland Plain Woodland. Lives under litter of bark, leaves and logs, or shelters in loose soil around grass clumps. Lives in a very small area on the Cumberland Plain west of Sydney, from Richmond and Windsor south to Picton and from Liverpool west to the Hawkesbury and Nepean Rivers at the base of the Blue Mountains.	Potential. High number of records from the locality and suitable habitat is present.
Gastropoda	*Pommerhelix duralensis*	Dural Land Snail	E	E	1	Species occurs under rocks or inside curled-up bark within communities in the interface region between sandstone-derived and shale-derived soils.	Unlikely. Although one record from the locality the subject site is outside its known distribution.

Class	Scientific Name	Common Name	BC Act Status	EPBC Act Status	Records	Habitat Requirements	Likelihood of Occurrence
Insect	*Austrocordulia leonardi*	Sydney Hawk Dragonfly		E	Species or species habitat likely to occur within area	The known distribution of Austrocordulia leonardi is extremely limited, being found in only three locations in a small area south of Sydney, from Audley to Picton. This species is known from the following drainages: Hawkesbury-Nepean, Georges River, Port Hacking, and possibly Karuah. This species appears to have specific habitat requirements, including slow-flowing water in rocky rivers with steep sides that provide shady resting areas. Natural deep pools, which this species favours as a primary habitat.	Potential. Little is known about this species and southern reaches of Menangle Creek contain identified habitat characteristics.
Mammalia	*Cercartetus nanus*	Eastern Pygmy-possum	V		5	Species is found in a broad range of habitats from rainforest to wet and dry sclerophyll forests through to woodland and heath. Woodland and heath habitats are preferred. The species feeds on pollen and nectar from banksias, eucalypts, and bottlebrushes, though will eat soft fruits when flowers are unavailable, and will also eat insects throughout the year. They shelter in tree hollows, rotten stumps, holes in the ground, abandoned birds' nests and Ringtail Possum dreys, and thickets of vegetation. Tree hollows are preferred for nesting but the species will also nest under tree bark and shredded bark in tree forks.	Unlikely. Low number of records from the locality and vegetation lacks bottlebrushes and banksia preferred by the species.

Class	Scientific Name	Common Name	BC Act Status	EPBC Act Status	Records	Habitat Requirements	Likelihood of Occurrence
Mammalia	*Chalinolobus dwyeri*	Large-eared Pied Bat	V	V	8	The species is associated with areas dominated by sandstone escarpments; sandstone cliffs and fertile woodland valley habitat occurring in close proximity to each other is important for the species. It roosts in cliff/escarpment areas and forages in fertile forest. Roosting is predominately in arch caves with dome roofs, but has been observed in disused mines shafts, overhangs, and disused Fairy Martin nests.	Potential. Low number of records from the locality, but suitable habitat is present.
Mammalia	*Dasyurus maculatus*	Spot-tailed Quoll	v	E	Species or species habitat likely to occur within area	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.	Unlikely. No records from the locality and only a small area of potential habitat present.
Mammalia	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle	V		11	Favours hollow trunks of Eucalypt trees over 20m high in wet sclerophyll forest and coastal mallee. Occasionally found in old wooden buildings.	Potential. Low number of records from the locality, but suitable habitat is present.

Class	Scientific Name	Common Name	BC Act Status	EPBC Act Status	Records	Habitat Requirements	Likelihood of Occurrence
Mammalia	*Isoodon obesulus obesulus*	Southern Brown Bandicoot	E	E	Species or species habitat likely to occur within area	Within NSW, the species is rare and almost exclusively restricted to the coastal fringe of the state, from the southern side of the Hawkesbury River in the north to the Victorian border in the south. More specifically, the subspecies is considered to occur primarily in two areas: Ku-ring-gai Chase and Garigal National Parks; and in the far south-east corner of the state. Occurs within their distribution in a variety of habitats including heathland, shrubland, sedgeland, heathy open forest and woodland.	Unlikely. No records from the locality and only a small area of potential habitat present.
Mammalia	*Micronomus norfolkensis*	Eastern Coastal Free-tailed Bat	V		25	Occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures.	Potential. Moderate number of records from the locality and suitable habitat is present.
Mammalia	*Miniopterus australis*	Little Bent-winged Bat	V		11	Moist eucalypt forest, rainforest or dense coastal banksia scrub. Little Bentwing-bats roost in caves, tunnels and sometimes tree hollows during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.	Potential. Low number of records from the locality, but suitable habitat is present.

Class	Scientific Name	Common Name	BC Act Status	EPBC Act Status	Records	Habitat Requirements	Likelihood of Occurrence
Mammalia	*Miniopterus orianae oceanensis*	Large Bent-winged Bat	V		16	Forages above the canopy and eats mostly moths. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures.	Potential. Moderate number of records from the locality and suitable habitat is present.
Mammalia	*Myotis macropus*	Southern Myotis	V		161	Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, 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.	Potential. High number of records from the locality and suitable habitat is present.
Mammalia	*Petauroides volans*	Greater Glider		V	1	Occurs in eucalypt forests and woodlands from north-eastern Queensland to the Central Highlands of Victoria. The species has a relatively small home range which consists of numerous tree hollows.	Unlikely. Only one record from the locality and no areas within the subject site contain 'numerous hollows'.

Class	Scientific Name	Common Name	BC Act Status	EPBC Act Status	Records	Habitat Requirements	Likelihood of Occurrence
Mammalia	*Petaurus australis australis*	Yellow-bellied Glider (south-eastern)	V	V	Species or species habitat likely to occur within area	Occurs in tall, mature, eucalypt forest generally in areas with high rainfall and nutrient rich soils. It feeds primarily on plant and insect exudate, with insects providing protein. It extracts sap from trees by biting into the trunk and branches leaving distinctive 'V' shaped scars. It dens in large hollows within trees, in groups of two to six individuals.	Unlikely. No records from the locality and subject site lacks substantial 'mature eucalypt forest'.
Mammalia	*Petaurus norfolcensis*	Squirrel Glider	V		2	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. Widely, though sparsely, distributed in eastern Australia, from northern Queensland to western Victoria.	Unlikely. Low number of records from the locality and minimal suitable habitat present.
Mammalia	*Petrogale penicillata*	Brush-tailed Rock-wallaby	E	V	Species or species habitat likely to occur within area	Prefers rocky habitats, including loose boulder-piles, rocky outcrops, steep rocky slopes, cliffs, gorges, and isolated rock stacks. Vegetation types associated with the species include dense forest, wet sclerophyll forest, vine thicket, dry sclerophyll forest, and open forest.	Unlikely. No records from the locality and minimal suitable habitat is present.

Class	Scientific Name	Common Name	BC Act Status	EPBC Act Status	Records	Habitat Requirements	Likelihood of Occurrence
Mammalia	*Phascolarctos cinereus*	Koala	E	E	430	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 feed species. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size.	Potential. High number of records from the locality and suitable habitat is present.
Mammalia	*Phoniscus papuensis*	Golden-tipped Bat	V		2	Theis species is found along the east coast of Australia in scattered locations from Cape York Peninsula in Queensland to south of Eden in southern NSW. It prefers rainforest and adjacent wet and dry sclerophyll forest up to 1000m, and has also been recorded in tall open forest, Casuarina-dominated riparian forest and coastal Melaleuca forests. Bats will fly up to two kilometres from roosts to forage in rainforest and sclerophyll forest on mid and upper-slopes. Roost mainly in rainforest gullies on small first- and second-order streams	Potential. Only two records from the locality, but suitable habitat present along Menangle Creek.
Mammalia	*Potorous tridactylus*	Long-nosed Potoroo	V	V	Species or species habitat likely to occur within area	Occurs in coastal heaths and dry and wet sclerophyll forests. Species prefers areas with a dense understorey with occasional open areas.	Unlikely. No records from the locality and minimal suitable habitat present.

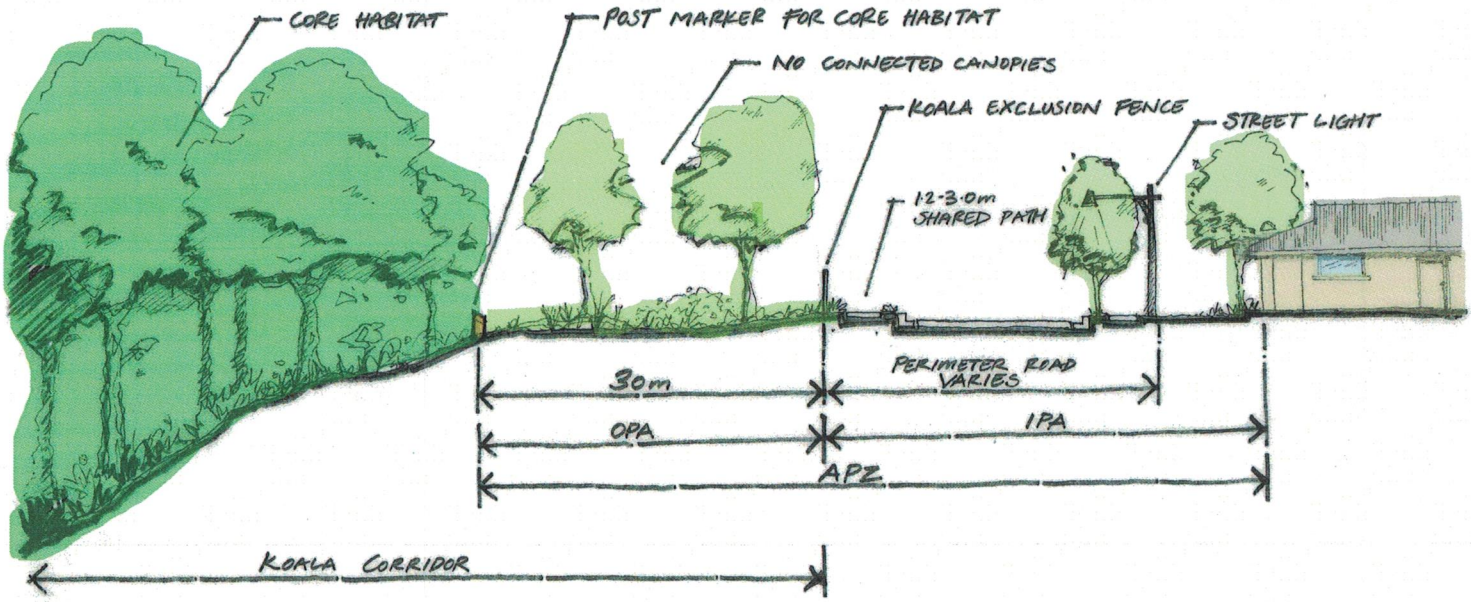
Class	Scientific Name	Common Name	BC Act Status	EPBC Act Status	Records	Habitat Requirements	Likelihood of Occurrence
Mammalia	*Pseudomys novaehollandiae*	New Holland Mouse		V	Species or species habitat likely to occur within area	Occurs in open habitats (heathland, woodland and forest) with a heath understorey and vegetated sand dunes. The species prefers deep soft top soils in order to burrow.	Unlikely. No suitable habitat is present.
Mammalia	*Pteropus poliocephalus*	Grey-headed Flying-fox	V	V	95	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.	Likely. Species likely utilised the subject site for foraging. No camps are present.
Mammalia	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat	V		3	Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.	Potential. Low number of records from the locality, but suitable habitat is present.

Class	Scientific Name	Common Name	BC Act Status	EPBC Act Status	Records	Habitat Requirements	Likelihood of Occurrence
Mammalia	*Scoteanax rueppellii*	Greater Broad-nosed Bat	V		10	Found mainly in the gullies and river systems that drain the Great Dividing Range. Usually roosts in tree hollows and buildings. Forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3 - 6 m. Open woodland habitat and dry open forest suits the direct flight of this species as it searches for beetles and other large, slow-flying insects.	Potential. Low number of records from the locality, but suitable habitat is present.
Reptilia	*Delma impar*	Striped Legless Lizard, Striped Snake-lizard	V	V	Species or species habitat likely to occur within area	Found mainly in Natural Temperate Grassland but has also been captured in grasslands that have a high exotic component. Also found in secondary grassland near Natural Temperate Grassland and occasionally in open Box-Gum Woodland. Habitat is where grassland is dominated by perennial, tussock-forming grasses such as Kangaroo Grass Themeda australis, spear-grasses Austrostipa spp. and Poa tussocks Poa spp., and occasionally wallaby grasses Austrodanthonia spp. Sometimes present in modified grasslands with a significant content of exotic grasses. Sometimes found in grasslands with significant amounts of surface rocks, which are used for shelter. Sometimes utilises dried cowpats for shelter. Goes below ground or under rocks or logs over winter.	Unlikely. No records from the locality and no suitable habitat present.

Class	Scientific Name	Common Name	BC Act Status	EPBC Act Status	Records	Habitat Requirements	Likelihood of Occurrence
Reptilia	*Hoplocephalus bungaroides*	Broad-headed Snake	E	V	Species or species habitat likely to occur within area	Shelters in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter and spring. Moves from the sandstone rocks to shelters in crevices or hollows in large trees within 500m of escarpments in summer.	Unlikely. No records from the locality and minimal habitat present.

APPENDIX C :

Koala Fencing Cross Sections



SECTION 1A: PERIMETER LOCAL STREET TO KOALA CORRIDOR

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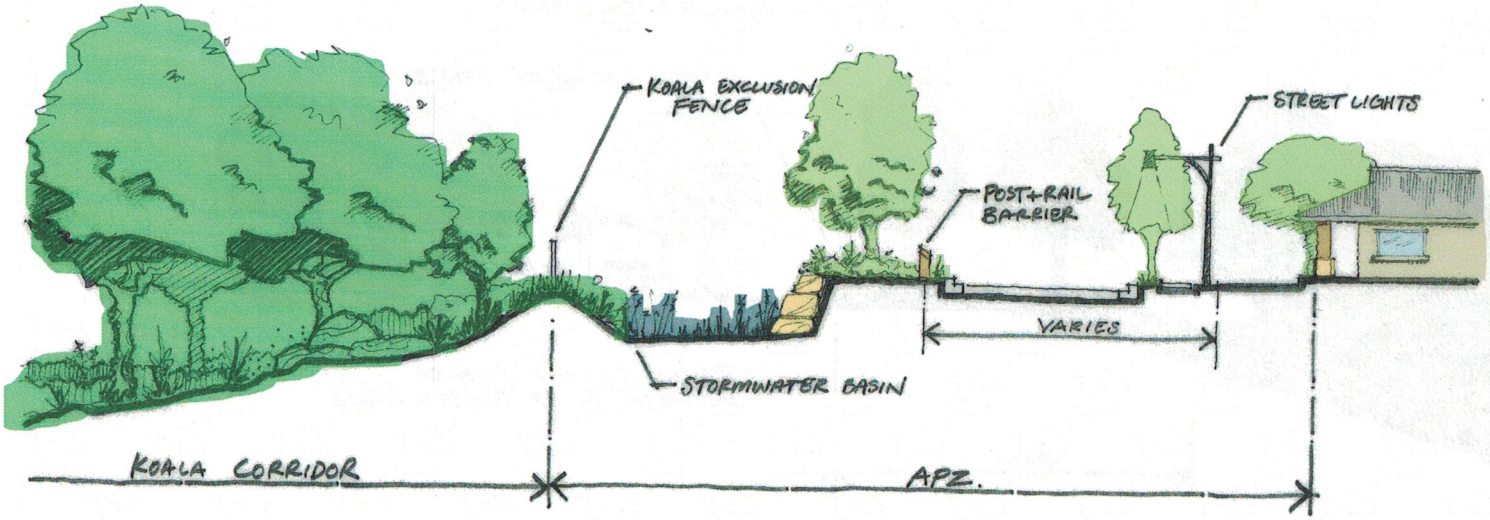
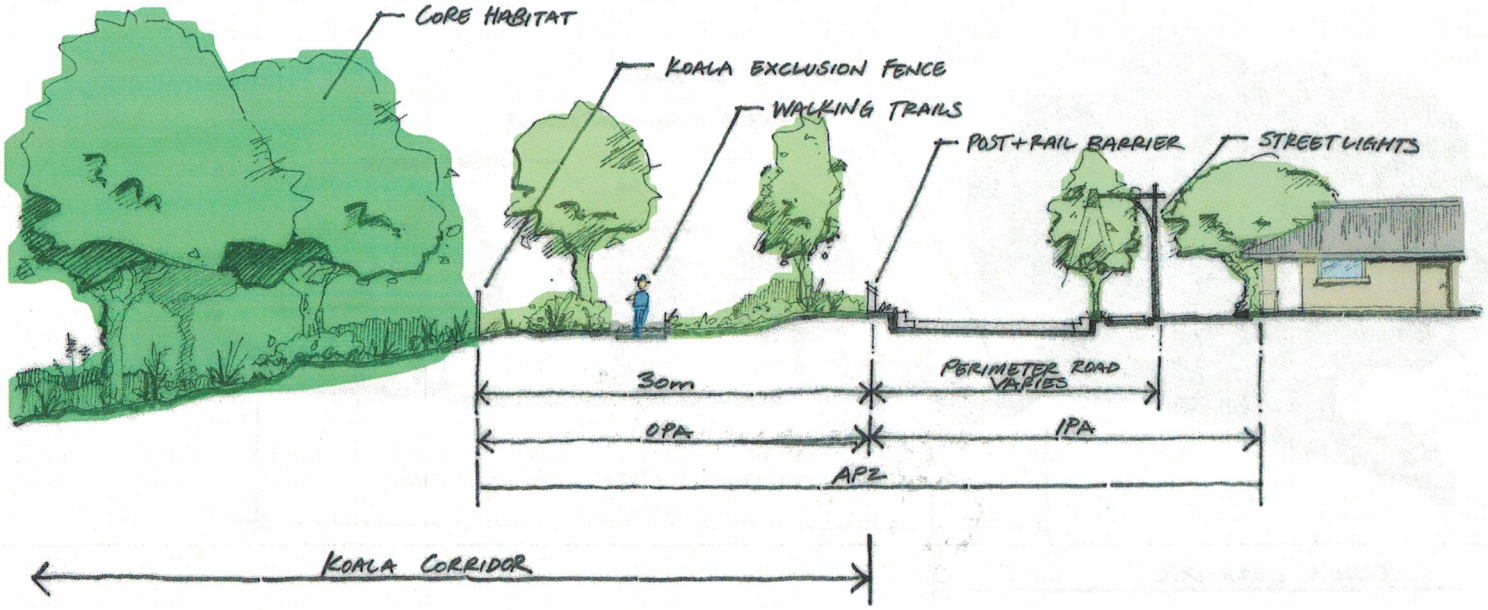


SECTION 5A: PERIMETER LOCAL STREET TO W.S.U.D. + KOALA CORRIDOR

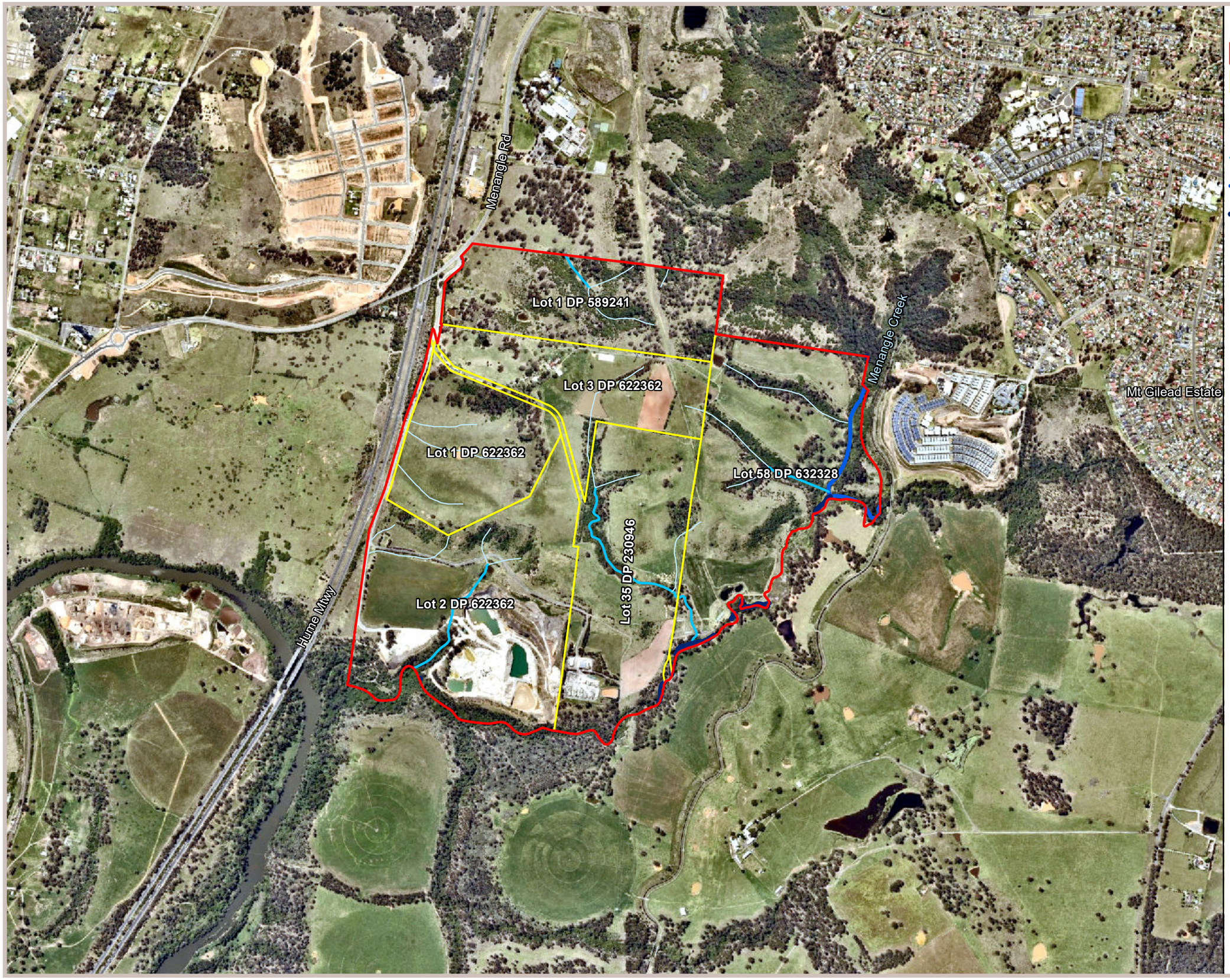
1:200 @ A3.



SECTION 1B: PERIMETER LOCAL STREET TO KOALA CORRIDOR

1:200 @ A3

FIGURES



Legend

- Subject Site
- Lot Boundary

Mapped Watercourse

- 1st Order
- 2nd Order
- 3rd Order
- 4th Order

Image Source:
Nearmap © Image (2022)
Dated: 07/10/2021

Data Source:
Sixmaps Clip & Ship
Spatial Services
NSW Department of
Finance and Services

Coordinate System: MGA Zone 56 (GDA 94)

cumberland ecology

0 100 200 300 400 m

I:\...\21170\Figures\RP1\20220609\Figure 1. Location of the subject site

Figure 1. Location of the subject site

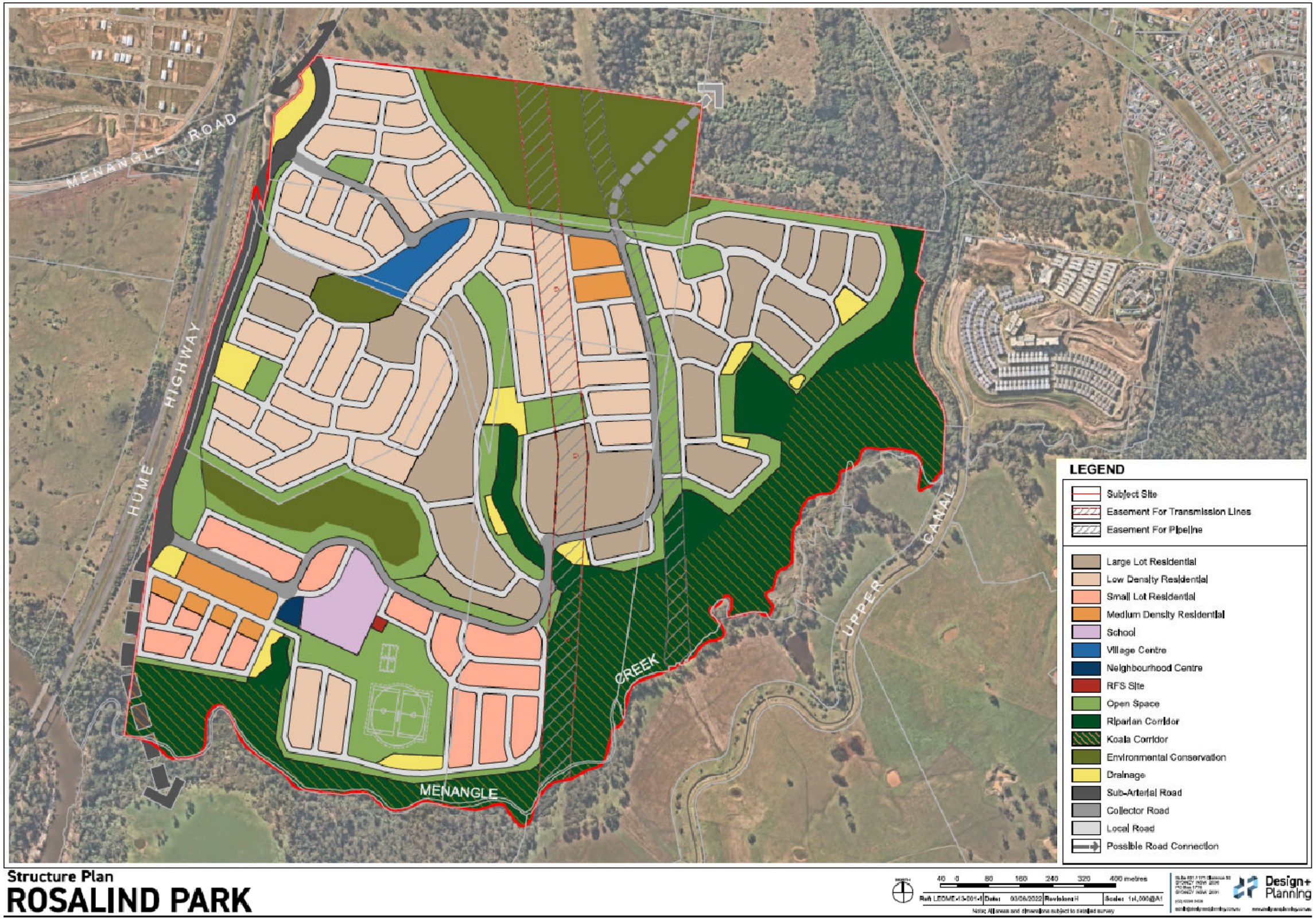
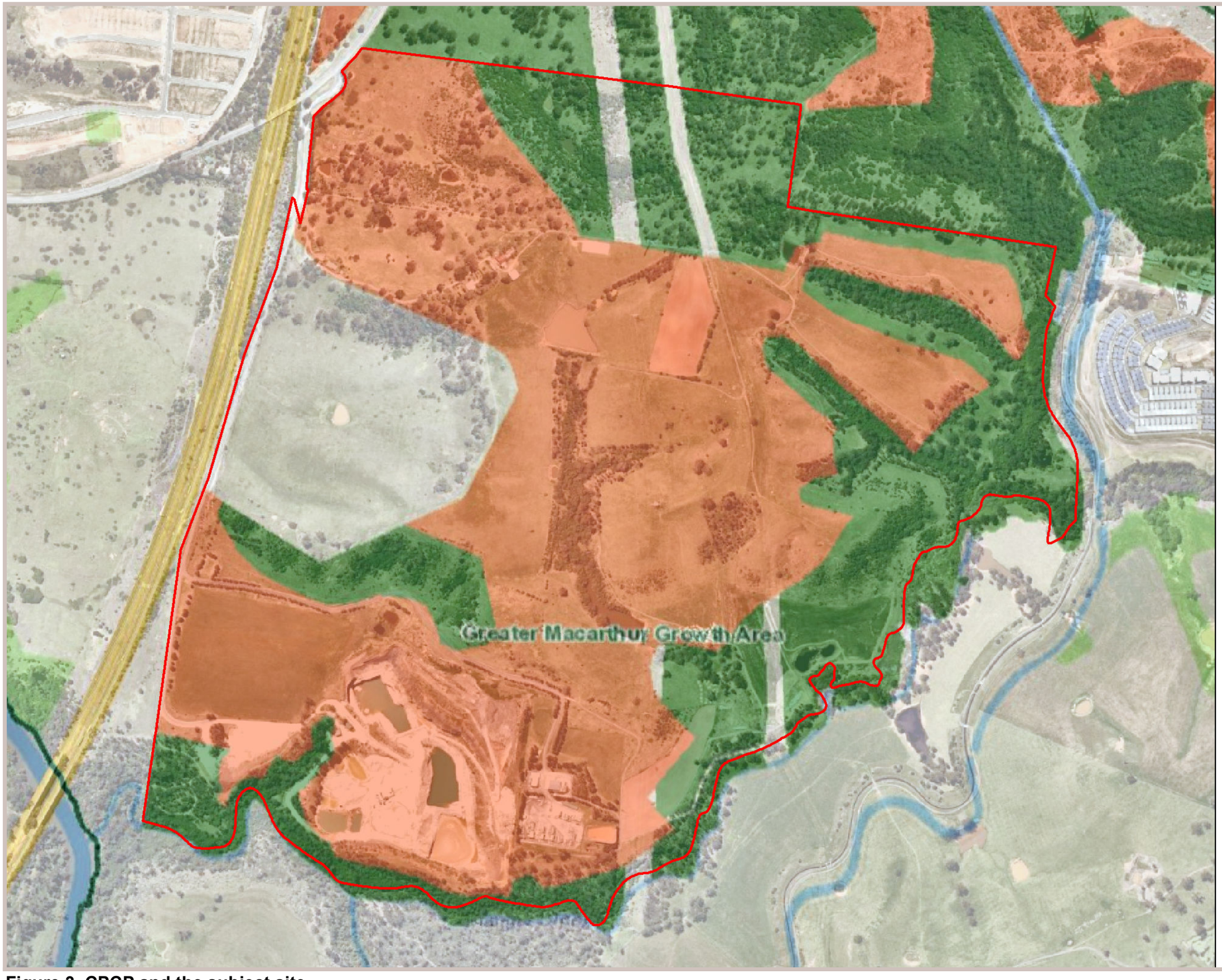


Figure 2. Concept Structure Plan

Image Source: Design + Planning (2022)

I:\...\21170\Figures\RP1\20220805\Figure 2. Concept Master Plan



Legend

- Subject Site
- Certified - Urban Capable Land
- Avoided Land

Image Source:
Nearmap © Image (2022)
Dated: 07/10/2021

Data Source:
Sixmaps Clip & Ship
Spatial Services
NSW Department of
Finance and Services
Cumberland Plain
Conservation Plan - Exhibition
NSW Department of Planning,
Industry and Environment

Coordinate System: MGA Zone 56 (GDA 94)

cumberland ecology

0 50 100 150 200 m

I:\...\21170\Figures\RP1\20220822\Figure 3. CPCP and the subject site

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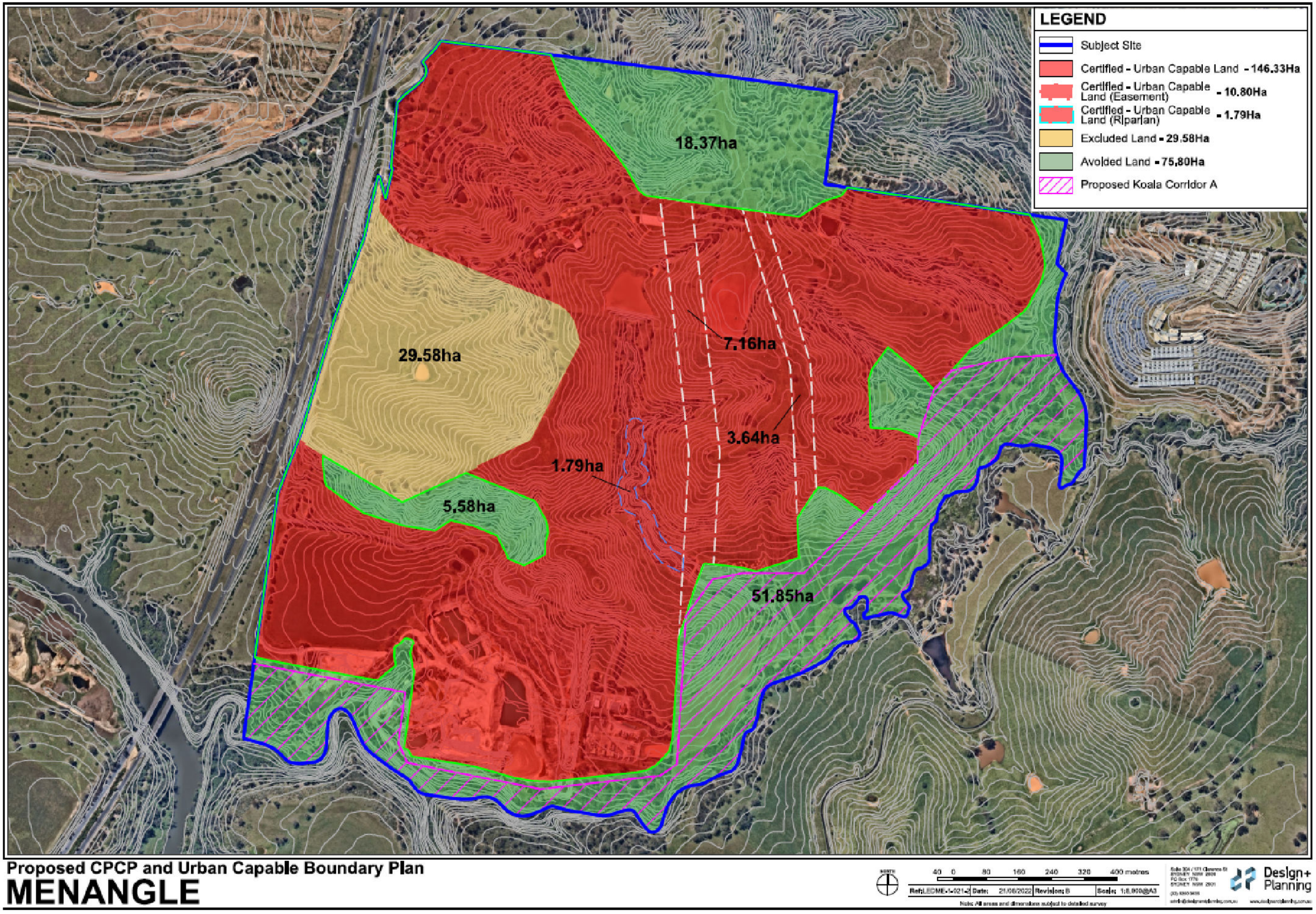

Figure 4. Proposed amendments to CPCP

Image Source: Design + Planning (2022)

I:\...\21170\Figures\RP1\20220822\Figure 4. Proposed amendments to CPCP

Legend

- Subject Site
- BAM Plot
- Survey Tracks
- Rapid Assessment

Image Source:
Nearmap © Image (2022)
Dated: 07/10/2021

Data Source:
Sixmaps Clip & Ship
Spatial Services
NSW Department of
Finance and Services

Coordinate System: MGA Zone 56 (GDA 94)

cumberland ecology

0 50 100 150 200 m

I:\...\21170\Figures\RP1\20220623\Figure 5. Survey locations

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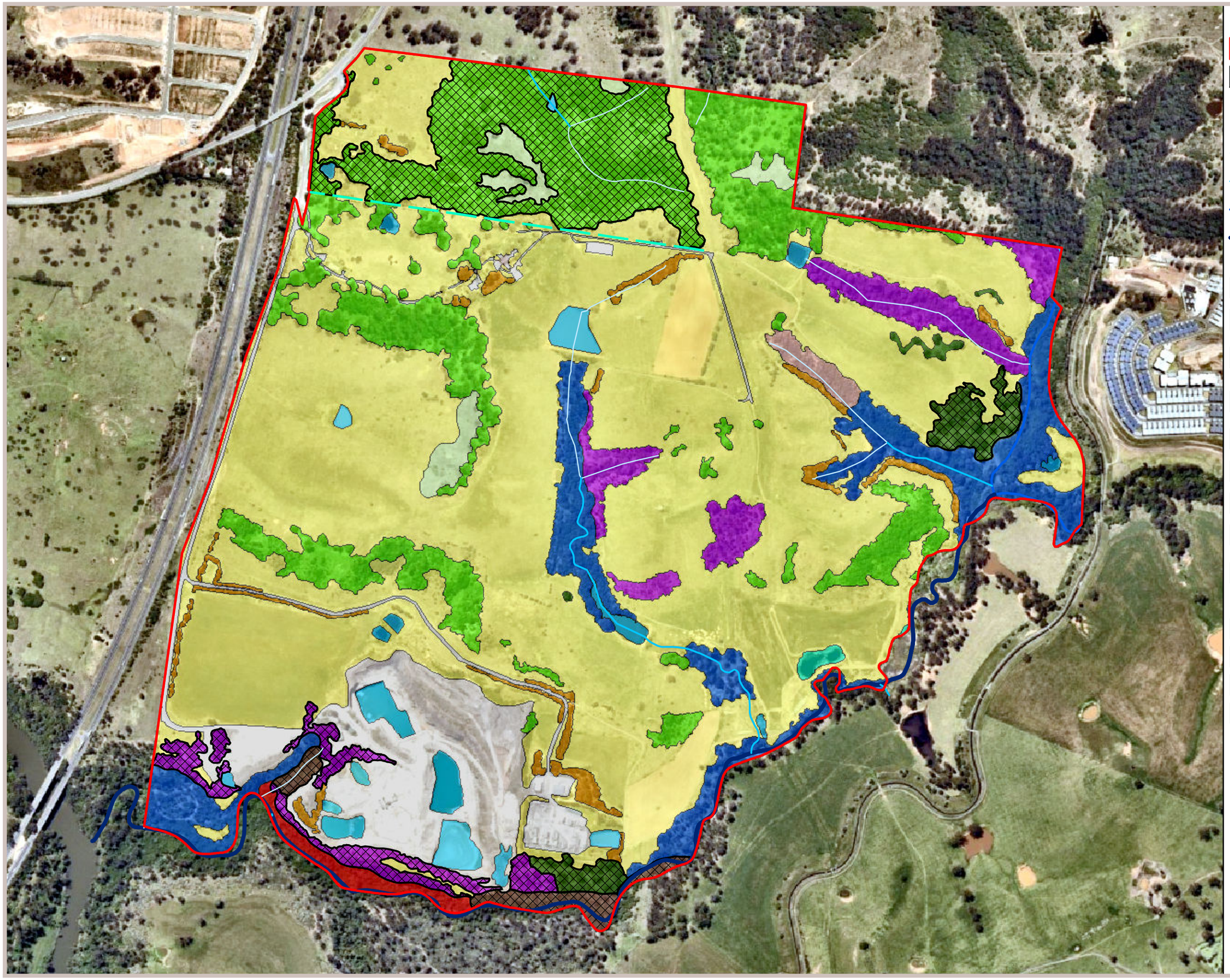


Figure 6. Vegetation communities within the subject site

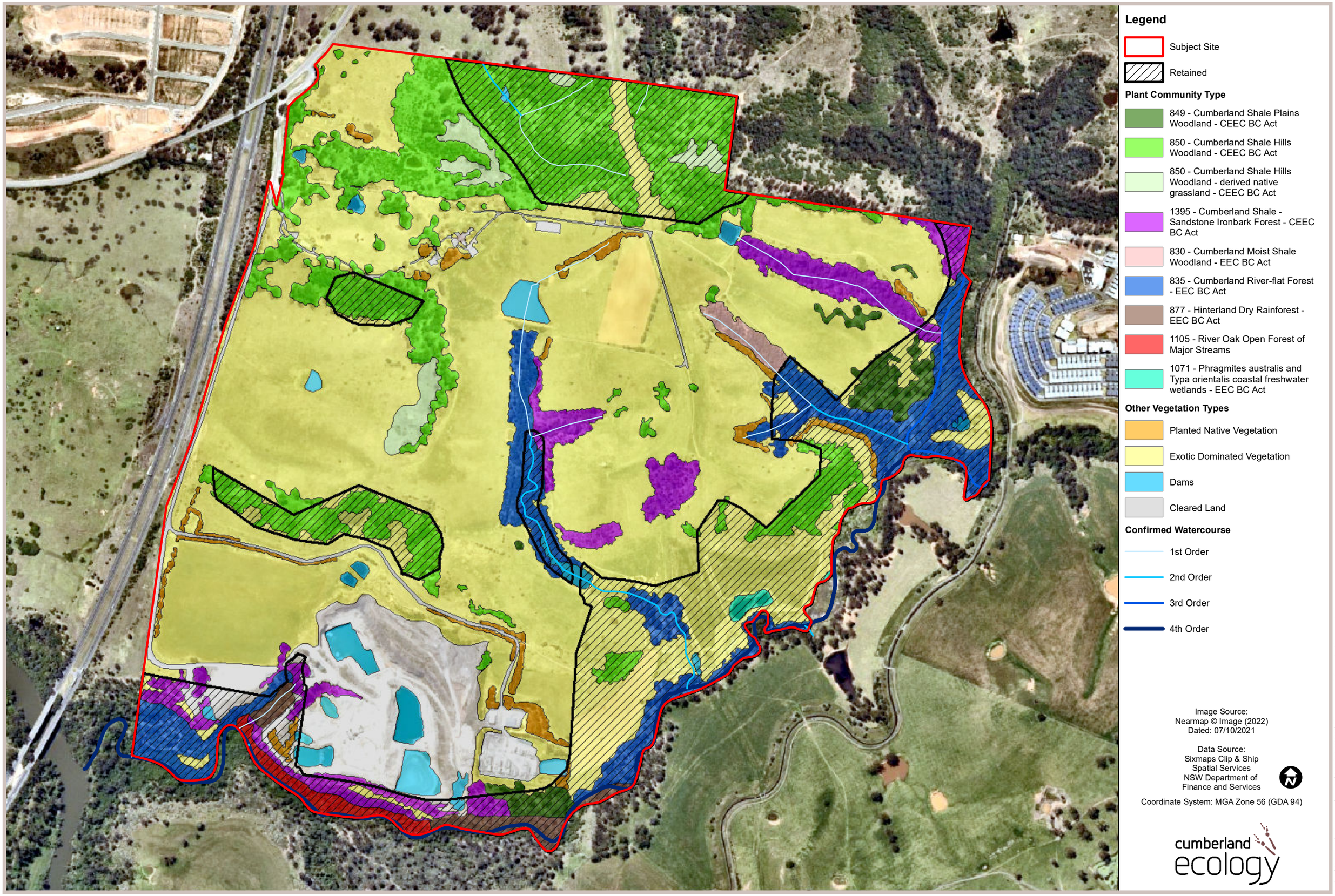
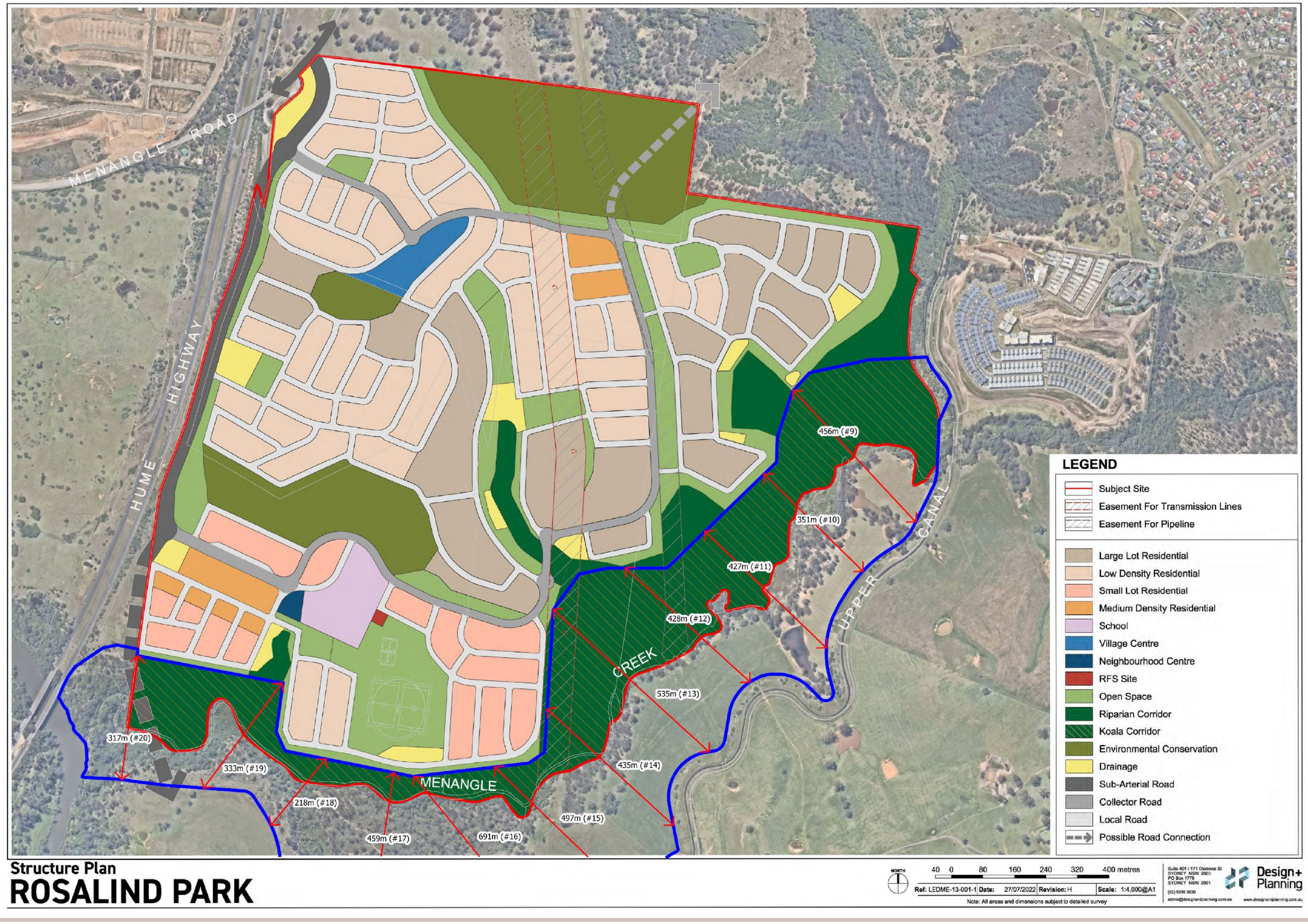


Figure 7. Vegetation retained vs impacted



I:\...\21170\Figures\RP1\20220822\Figure 8. Koala corridor transect widths

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Image Source: Design + Planning (2022)