DEPARTMENT OF PLANNING

PROSPECT SOUTH REZONING

BIODIVERSITY CONSTRAINTS ASSESSMENT

FEBRUARY 2018

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Prospect South Rezoning
Biodiversity Constraints Assessment

Department of Planning

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GLOSSARY

*	Denotes exotic species
BAM	Biodiversity Assessment Methodology 2017 that supports the *Biodiversity Conservation Act 2016.*
Biodiversity	The biological diversity of life is commonly regarded as being made up of the following three components: Genetic diversity — the variety of genes (or units of heredity) in any population. Species diversity — the variety of species. Ecosystem diversity — the variety of communities or ecosystems.
Bioregion (region)	A bioregion defined in a national system of bioregionalisation. The site is in the Sydney Basin Bioregion as defined in the Interim Biogeographic Regionalisation for Australia (Thackway and Cresswell, 1995b).
Biometric vegetation type (BVT)	Provides the occurrence of the PCT within a specific catchment management area. A BVT may be assigned catchment specific attributes such as benchmark data, percent cleared in the catchment area value and associations with threatened species, populations and communities. A PCT may be distributed across one or more major catchment areas and is assigned a BVT with each major catchment area occurrence. BVTs are managed in the VIS Classification Database.
Candidate species	Species assessed as having a moderate to high likelihood of occurrence within the subject site.
Critical habitat	The whole or any part or parts of an area or areas of land comprising the habitat of an Endangered species, an Endangered population or an Endangered Ecological Community that is critical to the survival of the species, population or ecological community (Department of Environment and Conservation, 2004). Critical habitat is listed under the EPBC Act with the Secretary (Department of the Environment and Energy) maintaining a register of this habitat. Capitalisation of the term 'Critical Habitat' in this report refers to the habitat listed specifically under Commonwealth legislation.
Cryptic species	An inconspicuous species which can be difficult to identify
Department of the Environment and Energy	The department develops and implements national policy, programs and legislation to protect and conserve Australia's natural environment and cultural heritage and administers the EPBC Act. The Commonwealth Department of Department of the Environment was previously known as: — Department of Sustainability, Environment, Water, Population and Communities (SEWPAC) — Department of the Environment, Water, Heritage and the Arts (DEWHA). — Department of Environment and Heritage (DEH). — Department of the Environment and Water Resources (DEWR).
Ecological community	An assemblage of species occupying a particular area.
Environmental weed	Any plant that is not native to a local area that has invaded native vegetation.

Exotic	Introduced from outside the area (Stralberg et al., 2009). Used in the context of this report to refer to species introduced from overseas.
GPS	Global Positioning System – a navigational tool which uses radio receivers to pick up signals from four or more special satellites to provide precise determination of location.
Habitat	An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic components.
High Threat Weed	Vascular plants not native to Australia that if not controlled will invade and outcompete native species. A list of high threat weeds is available as part of the BAM Calculator (https://www.lmbc.nsw.gov.au/bamcalc)
Indigenous	Native to the area: not introduced (Stralberg et al., 2009).
Introduced	Not native to the area: not indigenous (Stralberg et al., 2009). Refers to both exotic and non-indigenous Australian native species of plants and animals.
Key threatening processes	A process that threatens, or could threaten, the survival, abundance or evolutionary development of native species, populations or ecological communities (Department of Environment and Conservation, 2004). Key threatening processes are listed under the TSC Act, the FM Act and the EPBC Act. Capitalisation of the term 'Key Threatening Processes' in this report refers to those processes listed specifically under the relevant state and Commonwealth legislation.
Likely	Taken to be a real chance or possibility (Department of Environment and Conservation, 2004).
Local population	The population that occurs within the site, unless the existence of contiguous or proximal occupied habitat and the movement of individuals or exchange of genetic material across the boundary can be demonstrated as defined by Department of Environment and Climate Change (2007b).
Locality	The area within a 10 kilometre radius of the project site.
Migratory species	Species listed as Migratory under the EPBC Act relating to international agreements to which Australia is a signatory. These include Japan-Australia Migratory Bird Agreement, China-Australia Migratory Bird Agreement, Republic of Korea-Australia Migratory Bird Agreement and the Bonn Convention on the Conservation of Migratory Species of Wild Animals. Capitalisation of the term 'Migratory' in this report refers to those species listed as Migratory under the EPBC Act.
Noxious weed	An introduced species listed under the *Noxious Weeds Act 1993*. Under the Act, noxious weeds have specific control measures and reporting requirements.
NSW	New South Wales
Plant community type (PCT)	A NSW plant community type identified using the PCT classification system.
Priorities action statements (PAS)	Priorities action statements outline the broad strategies and detailed priority actions to be undertaken in NSW to promote the recovery of Threatened species, population and ecological communities and manage key threatening processes (Department of Environment and Climate Change, 2007a).
Project	The proposed property, described in detail in section 1.

Protected species	Those species defined as protected under the *National Parks and Wildlife Act 1974*. Includes all native animals, as well as all native plants listed on Schedule 13 of the *National Parks and Wildlife Act 1974*.
Recovery plan	A plan prepared under the TSC Act, FM Act or the EPBC Act to assist the recovery of a threatened species, population or ecological community.
Region	A bioregion defined in a national system of bioregionalisation. The project is located within the Sydney Basin Bioregion as defined in the Interim Biogeographic Regionalisation for Australia (IBRA) (Thackway and Cresswell, 1995b).
Rivulet	A small stream of water at the top of a catchment area
Significant	Important, weighty or more than ordinary
Species richness	Species richness is simply the number of species present in a sample, community, or taxonomic group. Species richness is one component of the concept of species diversity, which also incorporates evenness, that is, the relative abundance of species (Matteson and Langellotto, 2010).
Threatened biodiversity	Threatened species, populations or ecological communities as listed under the TSC Act, FM Act or the EPBC Act.
Threatened species, populations and ecological communities	Species, populations and ecological communities listed as Vulnerable, Endangered or Critically Endangered (collectively referred to as threatened) under the TSC Act, FM Act or the EPBC Act. Capitalisation of the terms 'Vulnerable', 'Endangered' or 'Critically Endangered' in this report refers to listing under the relevant state and/or Commonwealth legislation.
Viable local population	A population that has the capacity to live, develop and reproduce under normal conditions, unless the contrary can be conclusively demonstrated through analysis of records and references (Department of Environment and Climate Change, 2007b).
Weed	A plant growing out of place or where it is not wanted: often characterised by high seed production and the ability to colonise disturbed ground quickly (Stralberg et al., 2009). Weeds include both exotic and Australian native species of plant naturalised outside of their natural range.

ABBREVIATIONS

BC Act	*Biodiversity Conservation Act 2016*
BDAR	Biodiversity Development Assessment Report
BAM	Biodiversity Assessment Methodology (2014)
HA	Hectares
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
FM Act	NSW *Fisheries Management Act 1994*
GDEs	Groundwater Dependant Ecosystems
OEH	Office of Environment and Heritage
PCT	Plant Community Type
SAII	Serious and Irreversible Impact
SEARS	Secretary's Environmental Assessment Requirements
TSC Act	NSW *Threatened Species Conservation Act 1995.*

1 PROJECT BACKGROUND

1.1 PROJECT DETAILS

The Office of Strategic Lands (OSL) on behalf of the Minister for Planning is seeking to rezone Prospect South (the study area) to be classified as IN1 General Industrial use to match the adjoining land zone to the south. Currently the zoning for the land is RU4 – Primary Production Small Lots.

The land is located adjoining the M4 Motorway, between the extension of the Prospect Highway to the west and runs along the M4. The land is accessed directly from the Motorway via the Blacktown turn-off, Prospect Highway and Reservoir Road. The southern boundary is defined by the Greystanes Release Area of State Environmental Planning Policy 2009 – Western Sydney Employment Lands. The site comprises approximately 12.2 hectares (plus roads 15.9 hectares) of land which includes:

- Land primarily owned by the Minister for Planning (approx. 11ha)
- 2 private owner blocks
- Local roads owned by Blacktown City Council
- A minor parcel of RMS land that the OSL will rationalise with RMS.

1.2 PURPOSE OF THIS REPORT

The purpose of this Biodiversity Constraints Assessment report is to address biodiversity legislative matters to support a Planning Proposal to rezone land under Part 3 of the *Environmental Planning & Assessment Act 1979*.

1.3 STUDY AREA CONTEXT

The study area occurs predominately in the suburb of Prospect in the Blacktown LGA. The land use within the study area is mainly agricultural use being low intensity grazing. The study area also includes several residential lots along both Reservoir and Thornley Road. Due to historic and ongoing agricultural use, residential dwellings and surrounding industrial use, the biodiversity values of the study area have been heavily impacted and degraded. Majority of remnant native vegetation is in a highly disturbed condition.

An overview of the locality and study area context is provided in Figure 1.1 with the proposed masterplan illustrated in Figure 1.2.

307000 307200 307400 307600 307800 308000

6257500 6257400 6257300 6257200 6257100 6257000 6256900

PROSPECT HIGHWAY

WESTERN MOTORWAY

BLACKTOWN

WESTERN MOTORWAY

PROSPECT

RESERVOIR ROAD

RECONCILIATION ROAD

CUMBERLAND

PEMULWUY

Legend
- Study Area
- LGA Boundary
- Cadastre

Map: PS105757_GIS_S001_A1	Author: David.Naiken		0 30 60 m 1:3,000 Coordinate system: GDA 1994 MGA Zone 56 Scale ratio correct when printed at A3
Date: 10/11/2017	Approved by: Mark Stables		

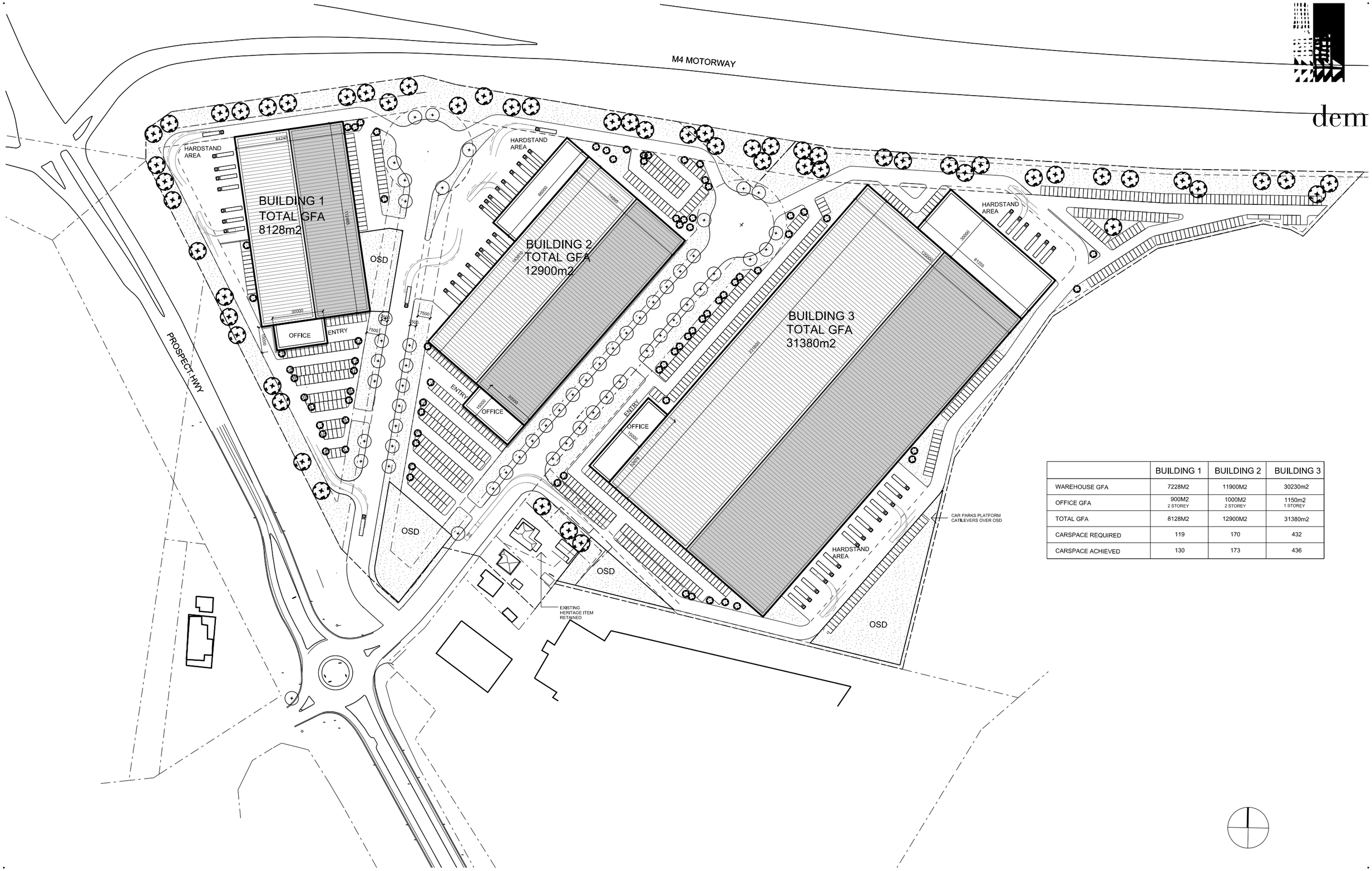
Data source: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Prospect South

Figure 1.1
Locality and Study Area

nominated architects: Rudi Valla BArch (Hons) nsw reg no 6582 Jon Pizey BArch nsw reg no 6567

dem



	BUILDING 1	BUILDING 2	BUILDING 3
WAREHOUSE GFA	7228M2	11900M2	30230m2
OFFICE GFA	900M2 2 STOREY	1000M2 2 STOREY	1150m2 1 STOREY
TOTAL GFA	8128M2	12900M2	31380m2
CARSPACE REQUIRED	119	170	432
CARSPACE ACHIEVED	130	173	436

prospect masterplan

Prospect South Masterplan - Option 1

Figure 1.2
Proposed Masterplan

plotted: 09/02/18 plotted by: VIP

date 09-02-18 scale 1:1000 proj no. 4463-00

drwg no. arsk0101 rev no. -03

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2 LEGISLATIVE CONTEXT

Local Government, State and Commonwealth legislation and planning controls relevant to the protection of biodiversity and this project are outlined briefly in this section. These statutory instruments provide conditions, matters for consideration and requirements to seek authorisation (licenses and approvals) to undertake various actions and activities.

2.1 LOCAL GOVERNMENT PLANNING CONTROLS

The study area is located within the Blacktown Local Government Area and is subject to Blacktown Local Environment Plan 2015 and Blacktown Development Control Plan 2015. Matters relation to biodiversity and the natural environment are outline below.

2.1.1 BLACKTOWN LOCAL ENVIRONMENTAL PLAN 2015

PART 2 - LAND USE

The study area is currently zoned RU4 – Primary Production Small Lots under Blacktown Local Environmental Plan (LEP) 2015. The zoning objectives of RU4 is;

- To enable sustainable primary industry and other compatible land uses.
- To encourage and promote diversity and employment opportunities in relation to primary industry enterprises, particularly those that require smaller lots or that are more intensive in nature.
- To minimise conflict between land uses within this zone and land uses within adjoining zones.
- To ensure that development does not prejudice the orderly and economic development of future urban land.
- To ensure that development is sympathetic to the ecological attributes of the area.

This report has been prepared to support a rezoning of the study area from RU4 to IN1 – General Industrial. The zoning objectives for IN1 under Blacktown LEP 2015 is;

- To provide a wide range of industrial and warehouse land uses.
- To encourage employment opportunities.
- To minimise any adverse effect of industry on other land uses.
- To support and protect industrial land for industrial uses.
- To enable other land uses that provide facilities or services to meet the day to day needs of workers in the area.
- To minimise adverse impacts on the natural environment.

Matters relating to biodiversity and the natural environment are presented within this report.

PART 7 - CLAUSE 7.2 TERRESTRIAL BIODIVERSITY

The objective of this clause is to maintain terrestrial biodiversity by:

- protecting native fauna and flora, and
- protecting the ecological processes necessary for their continued existence, and
- encouraging the conservation and recovery of native fauna and flora and their habitats.

This clause applies to land identified as “Biodiversity” on the Terrestrial Biodiversity Map. Based on a review of Terrestrial Biodiversity Map - Sheet BIO_014, Clause 7.2 does not apply to the land upon which the study area covers (Figure 2.1).

Figure 2.1 Extract of Blacktown LEP 2015 Terrestrial Biodiversity Map - Sheet BIO_014

Source: Blacktown Local Environmental Plan 2015 (https://www.legislation.nsw.gov.au/#/view/EPI/2015/239/maps)
Green: Represents 'Biodiversity' natter

PART 7 - CLAUSE 7.3 RIPARIAN LAND AND WATERCOURSES

The objective of this clause is to protect and maintain the following:

- water quality within watercourses,
- the stability of the bed and banks of watercourses,
- aquatic and riparian habitats,
- ecological processes within watercourses and riparian areas.

The study area has not been identified to contain any watercourse that is identified on a planning or topographical map as a blue line. Overland flow of water through the study area has been subject to historic modifications through the construction of agricultural farm dams, road construction and artificial excavation to facilitate land drainage. Overland flow paths are dominated by exotic high threat weed incursions such as Blackberry, Privet, White Poplar and many annual and perennial exotic grasses and forbs.

2.1.2 BLACKTOWN DEVELOPMENT CONTROL PLAN 2015

Blacktown Development Control Plan 2015 applies to land within the study area This report addresses matters relating to biodiversity and the natural environment.

2.2 STATE LEGISLATION

2.2.1 BIODIVERSITY AND CONSERVATION ACT 2016

The NSW *Biodiversity Conservation Act 2016* (BC Act) came into effect on the 25 August 2017. This Act repealed the *Threatened Species and Conservation Act 1995, Native Vegetation Act 2003* and parts of the *National Parks and Wildlife*

Act 1974. All threatened entities previously listed under the TSC Act have now been listed under the schedules of the BC Act.

The BC Act outlines the framework for addressing impacts on biodiversity from development and clearing. It establishes a framework to avoid, minimise and offset impacts on biodiversity from development through the Biodiversity Offsets Scheme. The Biodiversity Offsets Scheme creates a transparent, consistent and scientifically based approach to biodiversity assessment and offsetting for all types of development that are likely to have a significant impact on biodiversity(Office of Environment and Heritage, 2017a).

Changes under the BC Act now enable land to be subject to biodiversity certification that is a biodiversity assessment process that is particularly suitable to be used where strategic land use planning is proposed or underway (see Part 8 of the BC Act).

Biodiversity certification addresses the potential impacts on biodiversity during the early planning of land use change, it encourages planning authorities and landholders to design their development footprint in a way that avoid and minimise impacts on with biodiversity values and protects those areas.

Biodiversity certification allows for better environmental outcomes compared to site-by-site assessment and provides upfront certainty to developers and the community about the development potential and conservation outcomes for an area.

2.3 COMMONWEALTH LEGISLATION

2.3.1 ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

Under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), any action that has, would have, or is likely to have a significant impact on a Matter of National Environmental Significance (MNES) or on Commonwealth land, triggers the Act and may require assessment and approval from the Commonwealth Minister for the Environment.

The nine matters of national environmental significance protected under the EPBC Act are:

- listed threatened species and ecological communities
- listed migratory species
- wetlands of international importance (listed under the Ramsar Convention)
- Commonwealth marine areas
- world heritage properties
- national heritage places
- The Great Barrier Reef Marine Park
- nuclear actions (including uranium mines)
- a water resource, in relation to coal seam gas development and large coal mining development.

3 METHODOLOGY

3.1 DEFINITIONS

For the purpose of this report the following definitions apply:

- **Study area:** defined as the area in which the project will occur
- **Locality:** is a 10 km radius from the study area.
- **Bioregion:** for this study, the bioregion is the Sydney Basin as defined in the Interim Biogeographic Regionalisation for Australia (Thackway and Cresswell, 1995a).

All other definitions are provided in the Glossary at the start of this document. The project locality and study area are shown in Figure 1.1.

3.2 PERSONNEL

The contributors to the preparation of this report, their qualifications and roles are listed in

Table 3.1 Contributors and their roles

NAME	QUALIFICATION	ROLE
Alex Cockerill	BSc (Hons)	Ecology Executive – technical review
Mark Stables	BSc (Hons)	Principle Ecologist – field survey and reporting
Troy Jennings	BBioCons, MWldMgt, Cert – III ConsMgt	Ecologist – field survey and reporting
Emily Mitchell	BDevSt	GIS consultant – map preparation and data management

All work was carried out under the appropriate licences, including a scientific licence as required under Clause 22 of the National Parks and Wildlife Regulations 2002 and Section 132C of the *National Parks and Wildlife Act 1974*, and an Animal Research Authority issued by the Department of Primary Industries (Agriculture).

3.3 NOMENCLATURE

Names of vegetation communities used in this report are based on the Plant Community Types (PCTs) used in the BioNet Vegetation Classification (Office of Environment & Heritage, 2017a).

These names are cross-referenced with those used for threatened ecological communities listed under the BC Act and/or the EPBC Act. They are also cross-referenced with existing vegetation mapping using dominant species and structure of the communities in:

- Native vegetation of Southeast NSW: A Revised Classification and Map for the Coast and Eastern Tablelands (Tozer et al., 2010).

Names of plants used in this document follow PlantNet Royal Botanic Gardens (Royal Botanic Gardens, 2017) for recent taxonomic changes. Scientific names are used in this report for species of plant. Scientific and common names (where available) are provided in plant lists in appendices. The names of introduced species are denoted with an asterisk (*).

For threatened species of plants, the names used in the OEH Threatened Species Website (Office of Environment and Heritage, 2017d) are also provided in the tabulated data in appendices where these differ from the names used by PlantNet database.

Names of vertebrate fauna follow the Australian Faunal Directory maintained by the Department of the Environment (Department of Environment and Energy, 2017a). Common names are used in the report for species of animal. Scientific names are included in species lists found in appendices.

3.4 DESKTOP ASSESSMENT

A desktop study was conducted to identify:

- The likely distribution of vegetation communities, based on previous mapping and aerial photograph interpretation, for targeted field verification.
- A list of threatened species and populations of plants to consider during vegetation surveys and habitat assessment.
- A list of threatened species and populations of animals and migratory animals to consider during field-based habitat assessment.
- Local landscape-scale features of potential significance to biodiversity; e.g. riparian zones and potential wildlife movement corridors.
- Evaluate baseline information and determine whether additional surveys, mapping and reporting is required to progress to a rezoning application.

The desktop study included analysis of the following information sources:

- Topographic map and aerial photographs.
- Noxious weed declarations online database NSW Department of Trade and Investment (Department of Primary Industries (Agriculture), 2016) for the Blacktown Council Local Control Authority.
- Previous vegetation mapping, ecological studies and other relevant studies of the study area:
  - Prospect/Greystanes Biodiversity Assessment (Parsons Brinckerhoff, 2007)
  - Native vegetation of Southeast NSW: A Revised Classification and Map for the Coast and Eastern Tablelands (Tozer et al., 2010)
  - The Native Vegetation of the Sydney Metropolitan Area (Office of Environment and Heritage, 2016).

In addition to the literature listed above database searches of threatened species, populations and communities were conducted in the locality and are summarised below in Table 3.2.

Table 3.2 Database searches

DATABASE	SEARCH DATE	AREA SEARCHES	REFERENCE
PlantNet Database	25/10/17	10 km radius centred on the study area	(Royal Botanic Gardens, 2017)
OEH BioNet Atlas of NSW Wildlife	25/10/17	10 km x 10 km centred on the study area	(Office of Environment and Heritage, 2017b)
EPBC Protected Matters Search Tool	25/10/17	10 km x 10 km centred on the study area	(Department of Environment, 2017)

NSW Department of Primary Industries (Fishing and Aquaculture) threatened Aquatic Fauna Database	25/10/17	Blacktown LGA	(Department of Primary Industries, 2017b)

3.4.1 DESKTOP ANALYSIS OF VEGETATION

Preliminary mapping of vegetation community boundaries was undertaken through analysis of existing vegetation mapping and aerial photograph interpretation. Analysis of the aerial photographs was used to identify areas of disturbance (e.g. buildings, vehicle tracks, dams and power lines), vegetation structure and likely native versus exotic species composition throughout the study area. This provided an initial definition of vegetation communities into simple structural and disturbance classifications for verification during field surveys.

3.5 FIELD SURVEY

Field surveys were undertaken on the 2 November 2017. This survey sought primarily to assess the extent and condition of vegetation and fauna habitat, especially for threatened species and ecological communities. The vegetation inspection was used to identify variations in vegetation condition that were not apparent in existing vegetation mapping and refine vegetation community boundaries.

The field surveys undertaken are described in sections 3.5.1 to section 3.7.

3.5.1 FLORA SURVEY

The floristic diversity and possible presence of threatened species was assessed using a combination of random meander and plot-based (quadrat) surveys generally in accordance with the NSW *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Working Draft*) (Department of Environment and Conservation, 2004) and Biodiversity Assessment Methodology (BAM) (2014).

3.5.1.1 FIELD VERIFICATION OF EXISTING VEGETATION

Vegetation within the study area and locality has been mapped at the regional scale in '*Native vegetation of the Southeast NSW: Revised Classification and Map for the Coast and Eastern Tablelands'* (Tozer et al., 2010) and previous ecological surveys (Parsons Brinckerhoff, 2007).

Data on geology, dominant canopy species, native diversity, vegetation structure and condition was collected across the study area to validate and refine this existing vegetation classification to determine their associated Plant Community Type (PCT) in accordance with the BioNet Vegetation Classification (Office of Environment & Heritage, 2017c).

3.5.1.2 MAPPING OF VEGETATION ZONES

Field validation (ground-truthing) of the existing vegetation classifications undertaken by regional vegetation mapping and previous ecological surveys of the site was completed to confirm the vegetation structure, dominant canopy species, native diversity, condition and presence of threatened ecological communities. This was based on floristic sampling and vegetation integrity plots as described below.

Vegetation zones and conditions were identified and mapped following the BAM (Office of Environment & Heritage, 2017b). This was based on field verification of the PCT, class and formation as outlined in BioNet Vegetation Classification (Office of Environment & Heritage, 2017c).

3.5.1.3 VEGETATION INTEGRITY SURVEY PLOTS

Three vegetation integrity survey plots (Figure 3.1 and Table 3.3) were completed as outlined in the procedure contained in BAM 2017 (Office of Environment and Heritage, 2014) and as described below.

Prior to establishing plot survey locations, vegetation stratification was undertaken to provide a representative vegetation zone for sampling. Stratification involved marking waypoints and bearings randomly to provide a representative assessment of the vegetation integrity of the vegetation zone in the assessment area and establishing the required number of plots at some of these waypoints.

Table 3.3 Location of BAM plot surveys

PLOT ID	PLANT COMMUNITY TYPE	EASTING	NORTHING	PLOT ORIENTATION
Q1	PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	307362	6257103	5°
Q2	PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	307572	6257297	153°
Q3	PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	307673	6257315	273°

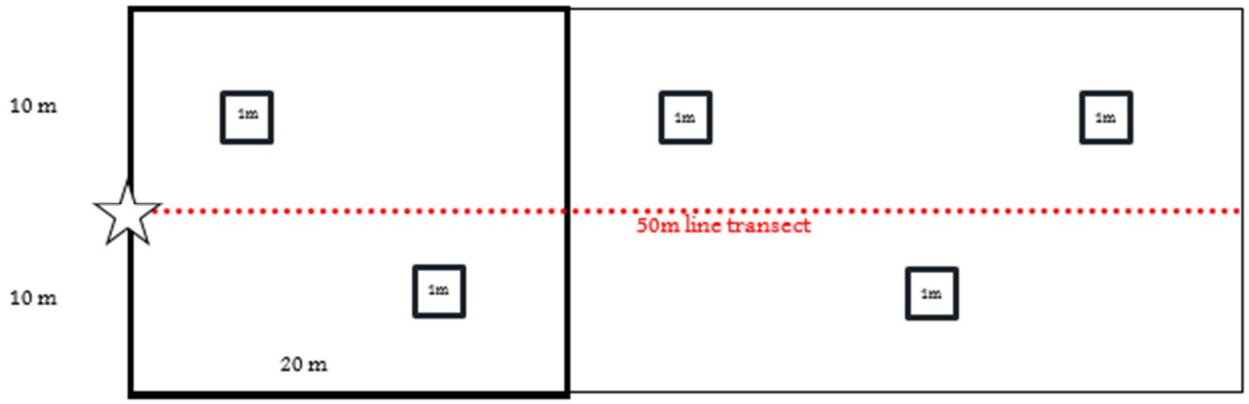

Figure 3.1 Schematic diagram illustrating the layout of the nested 20 m x 20 m and 20 m x 50 m plot used for the assessment of vegetation integrity at each survey site

The following site attributes were recorded at each site:

- **Location** (easting – northing grid type MGA 94, Zone 56).
- **Vegetation structure and dominant species and vegetation condition.** Vegetation structure was recorded through estimates of percentage foliage cover, average height and height range for each vegetation layer.
- **Native and exotic species richness** (within a 400 m^2 quadrat): This consisted of recording all species by systematically walking through each 20 x 20 m quadrat. The cover and abundance (percentage of area of quadrat covered) of each species was estimated. The growth form, stratum/layer and whether each species was native/exotic/high threat weed was also recorded.
- **Number of trees with hollows** (1,000 m^2 quadrat): This was the frequency of hollows within living and dead trees within each 50 x 20 m quadrat. A hollow was only recorded if (a) the entrance could be seen: (b) the estimated entrance width was at least 5 cm across: (c) the hollow appeared to have depth: (d) the hollow was at least 1 m above the ground and the (e) the centre of the tree was located within the sampled quadrat.
- **Number of large trees and stem size diversity** (1,000 m^2 quadrat): tree stem size diversity was calculated by measuring the diameter at breast height (DBH) (i.e.1.3 m from the ground) of all living trees (>5 cm DBH) within

each 50 x 20 m quadrat. For multi-stemmed living trees, only the largest stem was included in the count. Number of large trees was determined by comparing living tree stem DBH against the PCTs benchmarks.

— **Total length of fallen logs** (1,000 m^2 quadrat): This was the cumulative total of logs within each 50 x 20 m quadrat with a diameter of at least 10 cm and a length of at least 0.5 m.

— **Litter cover**: This comprised estimating the average percentage groundcover of litter (i.e. leaves, seeds, twigs, branchlets and branches with a diameter <10 cm which is detached from a living plant) from within five 1 x 1 m sub-plots spaced evenly either side of the 50 m central transect.

— **Evaluation of regeneration**: This was estimated as the presence/absence of overstorey species present at the site that was regenerating (i.e. saplings with a diameter at breast height ≤5 cm).

3.5.1.4 VEGETATION CONDITION CLASS

The vegetation within the study area was firstly assessed to a PCT and then aligned to a vegetation zone which is defined in the BAM as '*an area of native vegetation on the subject land that is the same PCT and has a similar broad condition state'* (Office of Environment & Heritage, 2017b). A broad condition state infers that the vegetation has a similar tree cover, shrub cover, ground cover, weediness or combinations of these attributes which determine vegetation condition.

The vegetation broad condition states which were applied to vegetation within the study area are summarised in Table 3.4. These factors were defined by using factors such as levels of disturbance, weed invasion and resilience.

Table 3.4 Vegetation broad condition states

CONDITION CATEGORY	DESCRIPTION
High	Vegetation still retains the species complement and structural characteristics. The vegetation displays resilience to weed invasion due to intact groundcover, shrub and canopy layers. Native species diversity is relatively high. Weeds may exist in this vegetation type but exhibit <5% foliage cover.
Moderate	Vegetation has retained a native canopy but the understorey and groundcover layers are generally co-dominated by exotic species that exhibit between 5–45% foliage cover. The mid and low stratums may have been structurally modified as a result of previous clearing.
Poor	Vegetation has retained a native canopy or the canopy cover is showing signs of regeneration. The understorey and groundcover layers are generally dominated or co-dominated by exotic species that exhibit between 46–70% foliage cover. Native species diversity is generally relatively low and the mid and low stratums have been structurally modified due to weed incursions or clearing.
Low	Native vegetation generally lacking a native over-storey and where either less than 50% of ground cover vegetation is indigenous species, or greater than 90% of ground cover vegetation is cleared. For native grassland, wetland or herbfield where either less than 50% of ground cover vegetation is indigenous species, or more than 90% of ground cover vegetation is cleared.'

Note: These categories have been used to define vegetation zones in Section 4.

3.5.1.5 RANDOM MEANDER SURVEYS

Random meander surveys are a variation of the transect type survey and were completed in accordance with the technique described by Cropper (1993), whereby the recorder walks in a random meander throughout the study area recording dominant and key plant species (e.g. threatened species, noxious weeds), boundaries between various vegetation communities and condition of vegetation. The time spent in each vegetation community was generally proportional to the size of the community and its species richness.

3.5.2 FAUNA SURVEY

This section outlines the fauna survey effort completed for candidate species which were predicted to have a moderate to high likelihood of occurrence within the study area based on database searches outlined in section 3.4. Threatened fauna surveys completed within the study area were carried out as described below and where applicable, considering the methodology detailed in the NSW Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Working Draft) (Department of Environment and Conservation, 2004), the Survey Guidelines for Australia's Threatened Birds (Department of Environment Water Heritage and the Arts, 2010), the Threatened Species survey and assessment guidelines: field survey and methods for fauna-Amphibians (Department of Environment and Climate Change, 2009) and the Survey guidelines for Australia's threatened frogs (Department of the Environment Water Heritage and the Arts, 2010).

Targeted fauna surveys for threatened species were undertaken during November 2017. Survey methods are described below and survey effort is illustrated in Figure 3.2.

3.5.2.1 FAUNA HABITAT ASSESSMENT

Fauna habitat assessments were undertaken to assess the likelihood of threatened species of animal (those species known or predicted to occur within the locality from the literature and database review) occurring within the study area. Fauna habitat assessments were the primary assessment tool in assessing whether threatened species is likely to occur within the study area. Fauna habitat characteristics assessed included:

- Structure and floristics of the canopy, understorey and ground vegetation, including the presence of flowering and fruiting trees providing potential foraging resources.
- Presence of hollow-bearing trees providing roosting and breeding habitat for arboreal mammals, birds and reptiles.
- Presence of the ground cover vegetation, leaf litter, rock outcrops and fallen timber and potential to provide protection for ground-dwelling mammals, reptiles and amphibians.
- Presence of waterways (ephemeral or permanent) and water bodies.

The following criteria were used to evaluate the condition of habitat values:

- **Good:** A full range of fauna habitat components are usually present (for example, old-growth trees, fallen timber, feeding and roosting resources) and habitat linkages to other remnant ecosystems in the landscape are intact.
- **Moderate:** Some fauna habitat components are missing or greatly reduced (for example, old-growth trees and fallen timber), although linkages with other remnant habitats in the landscape are usually intact, but sometimes degraded.
- **Poor:** Many fauna habitat elements in low quality remnants have been lost, including old growth trees (for example, due to past timber harvesting or land clearing) and fallen timber, and tree canopies are often highly fragmented. Habitat linkages with other remnant ecosystems in the landscape have usually been severely compromised by extensive clearing in the past.

3.5.2.2 OPPORTUNISTIC RECORDING OF FAUNA SPECIES AND EVIDENCE OF FAUNA ACTIVITY

Opportunistic sightings of animals were recorded during field surveys. Evidence of animal activity, such as scats, diggings, scratch marks, nests/dreys, burrows etc., was also noted. This provided indirect information on animal presence and activity.

During these surveys, a hand-held GPS was used to record the locations of:

- Hollow-bearing trees
- Aquatic habitat
- Rock outcrops.

3.5.2.3 DIURNAL BIRD SURVEYS

Formal 20 minute diurnal bird searches were completed within the study area. Bird surveys were completed by actively walking through the study area over a period of 20 minutes. All birds were identified to the species level, either through direct observation or identification of calls. Bird surveys were completed during different times of the day, but generally occurred during morning hours or evening. Birds were also recorded opportunistically during all other surveys.

Where seasonal conditions for some species were not suitable during the timing of onsite investigations, as was the case for endangered blossom nomads such as Swift Parrot, likelihood of occurrence assessments were conducted by the presence/absence of suitable habitat and its condition.

3.5.2.4 ACTIVE INVERTEBRATE SEARCHES

Active invertebrate searches involve diurnal hand searches (i.e. disturbance of habitat) and visual searches targeting specific habitat. In relation to threatened invertebrate species (i.e. Cumberland Plain Land Snail) specific habitat preferences include under logs and other debris, amongst leaf litter and bark accumulations around bases of trees and sometimes in clumps of grass. Invertebrates are also known to shelter under rubbish, disposed building materials and abandoned car parts (National Parks and Wildlife Service, 2000).

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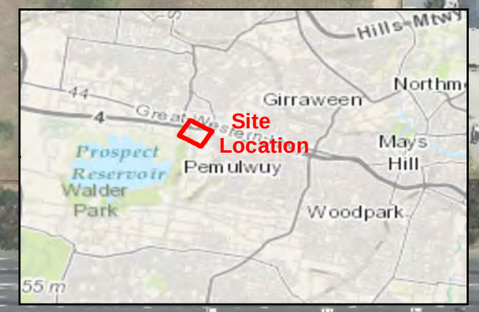
WESTERN MOTORWAY
PROSPECT HIGHWAY
RECONCILIATION ROAD
PROSPECT
PEMULWUY
Q1
Q2
Q3



Legend

Study Area

Cadastre

Flora and Fauna Survey Locations

Cumberland Plain Land Snail - active search area

BAM 2017 Survey Location

Diurnal Bird Survey Location

Map: PS105757_GIS_S005_A1	Author: David.Naiken
Date: 10/11/2017	Approved by: Mark Stables

0 30 60 m

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Coordinate system: GDA 1994 MGA Zone 56
Scale ratio correct when printed at A3

Prospect South

Figure 3.2
Flora and Fauna Survey Locations

3.6 LIKELIHOOD OF OCCURRENCE ASSESSMENT

The likelihood of threatened and migratory and threatened species populations occurring within the study area was assessed against the criteria outlined in Table 3.5.

Species subject to likelihood of occurrence assessments were those identified during the desktop and field-based investigations and any additional species considered having the potential to occur in the professional opinion of contributors to this assessment.

Table 3.5 Likelihood of occurrence assessment

LIKELIHOOD OF OCCURRENCE	CRITERIA
Known	— The species was observed in the study area either during the current survey or during another recent survey.
High	A species has a high likelihood of occurrence if: — the study area contains or forms part of a large area of high quality suitable habitat — important habitat elements (i.e. for breeding or important life cycle periods such as winter foraging periods) are abundant within the study area — the species has been recorded recently in similar habitat in the locality — the study area is likely to support a resident populations or to contain habitat that is visited by the species during regular seasonal movements or migration.
Moderate	A species has a moderate likelihood of occurrence if: — the study area contains or forms part of a small area of high quality suitable habitat — the study area contains or forms part of a large area of marginal habitat — important habitat elements (i.e. for breeding or important life cycle periods such as winter foraging periods) are sparse or absent within the study area — the study area is unlikely to support a resident populations or to contain habitat that is visited by the species during regular seasonal movements or migration but is likely to be used occasionally during seasonal movements and/or dispersal.
Low	A species has a low likelihood of occurrence if: — potentially suitable habitat exists but the species has not been recorded recently (previous 10 years) in the locality despite intensive survey (i.e. the species is considered to be locally extinct) — the species is considered to be a rare vagrant, likely only to visit the study area very rarely; e.g. during juvenile dispersal or exceptional climatic conditions (e.g. extreme drought conditions in typical habitat of inland birds).
None	— Potentially suitable habitat is absent from the study area.

3.7 LIMITATIONS

No sampling technique can eliminate the possibility that a species is present on a site. For example, some species of plant may be present in the soil seed bank and some fauna species use habitats on a sporadic or seasonal basis and may not be present on site during surveys. The conclusions in this report are based upon previous studies, data acquired for the site and the environmental field surveys and are, therefore, merely indicative of the environmental condition of the site at the

time of preparing the report, including the presence or otherwise of species. Also, it should be recognised that site conditions, including the presence of threatened species, can change with time.

Where surveys were conducted outside the optimal time for detecting a species, or field surveys were of limited scope, a precautionary approach was taken and it was assumed that the species was present if suitable habitat was observed.

The data used in the assessment is based on results of the field surveys and are, therefore, merely indicative of the environmental condition of the site at the time of survey, including the presence or otherwise of species. For species where the timing of surveys was not appropriate for detection, a precautionary approach was taken and surveys focussed on detection of areas of potential habitat for these species.

4 EXISTING ENVIRONMENT

4.1 LANDSCAPE CONTEXT

The study area is in the Sydney Basin IBRA bioregion and occurs within the SYB08 Cumberland IBRA subregion (IBRA version 7.0).

Table 4.1 Landscape features and planning information

LANDSCAPE FEATURES AND PLANNING INFORMATION	PROJECT SITE
Local government area (LGA)	Blacktown
Address	Multiple lots: L3 DP1192514; L10 DP448744; L11 DP448744; L12 DP448744; L15 DP448744; L18 DP802753; L24 DP801210; L25 DP801210; L26 DP801210; LA DP374323; LC DP374323; LD DP374324; L10 DP801209; L11 DP801209; L10 DP374325.
Local Land Service (Catchment Management Authority)	Greater Sydney
LEP zoning	RU4 – Primary Production Small Lots
Land use	Residential and Industrial
Mitchell Landscapes	Cumberland Plain
Interim Biogeographic Regionalisation for Australia (IBRA) bioregion, sub-region	Sydney Basin - Cumberland
Botanical sub-region	Central Coast

4.1.1 RIVERS, STREAMS AND ESTUARIES

No rivers, streams or estuaries occur within the study area. However adjacent to the study area Girraween Creek occurs. The study area micro catchment drains into Girraween Creek. The identified waterbody (dam) is ephemeral in nature and would flow into Girraween Creek during wet events.

4.1.2 IMPORTANT AND LOCAL WETLANDS

Based on a review of *A Directory of Important Wetlands in Australia* (Department of Environment and Energy, 2017b) and Sydney Regional Environmental Plan 2005, Sydney Harbour Catchment (Amendment 2016), the study area is not located within or adjacent to a listed important wetland.

4.1.3 CONNECTIVITY OF DIFFERENT AREAS OF HABITAT

Figure 4.2 shows native vegetation within locality of the study area. Native vegetation in the study area is fragmented and disconnected from any large remnant vegetation in the locality. The remnant vegetation patches are fragmented by existing roads and cleared agricultural areas. The study area is adjacent to the riparian area of Girraween Creek, however this creek line is not identified as an important habitat corridor for species in the locality.

4.1.4 AREAS OF GEOLOGICAL SIGNIFICANCE AND SOIL HAZARD FEATURES

The study area does not contain any geologically significant features such as karst, caves, crevices or cliffs.

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ARNDELL PARK
BLACKTOWN
HUNTINGWOOD
SEVEN HILLS
TOONGABBIE
GIRRAWEEN
PENDLE HILL
PROSPECT
PEMULWUY
GREYSTANES

FLUSHCOMBE ROAD
PROSPECT HIGHWAY
CORNELIA ROAD
GREAT WESTERN HIGHWAY
BLACKTOWN ROAD
TOONGABBIE ROAD
GIRRAWEEN ROAD
TARGO ROAD
WESTERN MOTORWAY
RESERVOIR ROAD
RECONCILIATION ROAD
OLD PROSPECT ROAD
GREYSTANES ROAD

CUMBERLAND
IBRA SUBREGION

Legend
- Rivers/Streams
- 1500m Buffer
- Study Area
- Cadastre

Mitchell Landscape
- Cumberland Plain
- Estuary/Water Added
- Sydney Basin Diatremes

Map: PS105757_GIS_S002_A1	Author: David.Naiken
Date: 10/11/2017	Approved by: Mark Stables

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Coordinate system: GDA 1994 MGA Zone 56
Scale ratio correct when printed at A3

Prospect South

Figure 4.1
Landscape Features

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6258200 6257600 6257000 6256400 6255800

ARNDELL PARK
BLACKTOWN
HUNTINGWOOD
SEVEN HILLS
TOONGABBIE
GIRRAWEEN
PROSPECT
PENDLE HILL
PEMULWUY
GREYSTANES

FLUSHCOMBE ROAD
PROSPECT HIGHWAY
CORNELIA ROAD
BLACKTOWN ROAD
TOONGABBIE ROAD
GIRRAWEEN ROAD
TARGO ROAD
GREAT WESTERN HIGHWAY
WESTERN MOTORWAY
RESERVOIR ROAD
RECONCILIATION ROAD
GREYSTANES ROAD
OLD PROSPECT ROAD

Legend

- 1500m Buffer
- Study Area
- Cadastre

Native Vegetation Cover

- Cumberland River Flat Forest - 0.88 Ha
- Cumberland Shale Hills Woodland - 56.07 Ha
- Cumberland Shale Plains Woodland - 22.5 Ha

Map: PS105757_GIS_S004_A1	Author: David.Naiken
Date: 10/11/2017	Approved by: Mark Stables

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Coordinate system: GDA 1994 MGA Zone 56
Scale ratio correct when printed at A3

Data source: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community © Department of Finance, Services & Innovation 2017

Prospect South

Figure 4.2
Assessing Native Vegetation Cover

4.2 NATIVE VEGETATION

4.2.1 VEGETATION PLANT COMMUNITY TYPES (PCTS)

Two PCTs and two non-native miscellaneous ecosystems were recorded within the study area. These PCTs correspond to vegetation types previously identified as occurring within the study area by the broad scale vegetation mapping and previous ecological investigations (Parsons Brinckerhoff, 2007). A summary of the PCTs identified within the study area are outlined below in Table 4.2.

Table 4.2 Vegetation PCTs identified as occurring within the study area

FIELD VERIFIED PCT	BROAD SCALE MAPPING	THREATENED ECOLOGICAL COMMUNITY	VEGETATION FORMATION	VEGETATION CLASS
PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	GW_p29: Shale Plains Woodland (Tozer et al., 2010)	Cumberland Plain Woodland in the Sydney Basin Bioregion - critically endangered ecological community	KF_CH3 Grassy Woodland	Coastal Valley Grassy Woodlands
PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	FoW_p33: Cumberland Alluvial Woodland (Tozer et al., 2010)	River-flat Eucalypt Forest on Coastal Floodplain on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions – endangered ecological community	KF_CH9 Forested Wetlands	Coastal Floodplain Wetlands
Miscellaneous ecosystem - Highly disturbed areas with no or limited native vegetation	N/A	Not listed	N/A	N/A

4.2.2 VEGETATION ZONES

Modification to these two PCTs and one non-native vegetation type due to the following:

- edge effects from adjoining land uses such as residential and agricultural properties
- access tracks within vegetation remnants
- surrounding infrastructure
- historic vegetation clearing and firewood collection
- historic and current agricultural grazing
- rubbish dumping
- invasion by exotic species of plant

These modifications have resulted in differing vegetation conditions within the vegetation types. Based on the vegetation condition categories defined in Table 3.4 there are four vegetation zones which occur in the study area.

A summary of the four vegetation zones is provided in Table 4.3 and described in more detail in Sections 4.2.3 to 4.2.5. The delineation of these vegetation zones is also illustrated in Figure 4.3. Flora survey data collected during the 2017 survey is provided in Appendix B.

Table 4.3 Vegetation zones recorded within the study area

PLANT COMMUNITY TYPE	VEGETATION ZONE	VEGETATION CONDITION	VEGETATION FORMATION	VEGETATION CLASS	IBRA REGION	IBRA SUBREGION	% CLEARED	THREATENED ECOLOGICAL COMMUNITY	PATCH SIZE (HA)
PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	VZ1	Poor	KF_CH3 Grassy Woodland	Coastal Valley Grassy Woodlands	Sydney Basin	SYB08 Cumberland	93	Cumberland Plain Woodland in the Sydney Basin Bioregion - critically endangered ecological community	0.7
PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	VZ2	Poor	KF_CH9 Forested Wetlands	Coastal Floodplain Wetlands	Sydney Basin	SYB08 Cumberland	93	River-flat Eucalypt Forest on Coastal Floodplain on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions – endangered ecological community	1.4
Miscellaneous ecosystem - Highly disturbed areas with no or limited native vegetation	VZ3	N/A	N/A	N/A	N/A	N/A	N/A	Not listed	13.8
Total (incl. roads)									**15.9**

4.2.3 PCT 849 - GREY BOX - FOREST RED GUM GRASSY WOODLAND ON FLATS OF THE CUMBERLAND PLAIN, SYDNEY BASIN BIOREGION

Broad scale vegetation mapping of the study area identified the presence of Shale Plains Woodland occurring as a triangle area of remnant native vegetation in the southern portion of the study area between Thornley Road and Reservoir Road (Tozer et al., 2010), which was confirmed during the site inspection. Shale Plains Woodland is equivalent to PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion.

This plant community type is summarised in Table 4.4 below. Plot data collected during field surveys is compared against community condition benchmarks in Table 4.5 which assisted in the determination of condition classes. The extent of PCT 849 within the study area is shown in Figure 4.3.

Table 4.4 Summary of PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion

PCT 849 - GREY BOX - FOREST RED GUM GRASSY WOODLAND ON FLATS OF THE CUMBERLAND PLAIN, SYDNEY BASIN BIOREGION	
Description	
PCT justification	The canopy stratum is dominated by the two PCT 849 diagnostic species *Eucalyptus tereticornis* (Forest Red Gum) and *Eucalyptus moluccana* (Grey Box). The study area is located on low slopes of the Cumberland Plain. Floristic analysis of positive diagnostics species for PCT 849 reference community (GW_p29, Tozer *et. al*. 2010) identifies that, of the 16-native species recorded from Q1 (excluding *Grevillea robusta* that is not locally recorded in Sydney), the ratio of positive diagnostic species verse total native species is 75%. Other closely related PCTs 850 and 724 recorded ratios of 50% and 65% respectively. Based on floristic, geographic and geological characteristics, this vegetation type is considered consistent with the scientific description and distribution information outlined for PCT 849 within BioNet Vegetation Classification (Office of Environment and Heritage, 2017e).
PCT reference community	GW_p29 Shale Plains Woodland (Tozer et al., 2010)
Conservation status	This vegetation type is commensurate with the threatened ecological community listing under the BC Act for Cumberland Plain Woodland in the Sydney Basin Bioregion. This vegetation type is listed as Critically Endangered under the BC Act and EPBC Act although the vegetation recorded within the study area does not meet condition thresholds under the EPBC Act and as such only meets BC Act listing.
IBRA bioregion % cleared	SYD Sydney Basin – 93%
IBRA subregion	SYB08 Cumberland
Extent	0.7 ha
Vegetation integrity score	43.8

PCT 849 - GREY BOX - FOREST RED GUM GRASSY WOODLAND ON FLATS OF THE CUMBERLAND PLAIN, SYDNEY BASIN BIOREGION			
Condition	**Poor quality:** Ground and mid strata vegetation was heavily disturbed or absent due to clearing or significant weed invasion. Species richness and cover were below condition benchmarks for this community in all attributes Table 4.5. Plot data recorded exotic species richness of 16 with a cover of 70.7 %. Of this 8-exotic species were recorded as high threat level weeds that collectively exhibit a foliage cover of 59% (Appendix B.1).		
Strata	**Height range and average**	**Percentage Foliage Cover range**	**Dominant Species**
Canopy	14 – 18 m (16)	25-35% (30)	*Eucalyptus tereticornis* (Forest Red Gum) and *Eucalyptus moluccana* (Grey Box).
Shrub stratum	0.5-2 m (2)	40-55% (40)	*Bursaria spinosa* subsp. *spinosa* (Native Blackthorn) and *Olea europaea* (African Olive)
Ground layer	0.1-1.2 m (0.5)	60-80%	*Ehrharta erecta** (Panic Veldt Grass), *Microlaena stipoides* var. *stipoides* (Weeping Grass), *Eragrostis curvula** (African Lovegrass), *Sida rhombifolia** (Paddy's Lucerne) and *Brunoniella australis* (Blue Trumpet).

Table 4.5 Comparison of PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion plot data against community condition benchmarks

PLOT	TREE RICHNESS	SHRUB RICHNESS	GRASS RICHNESS	FORB RICHNESS	FERN RICHNESS	OTHER RICHNESS	TREE COVER	SHRUB COVER	GRASS COVER	FORB COVER	FERN COVER	OTHER COVER	FALLEN LOGS	LITTER COVER	LARGE TREES	CONDITION
BM[1]	**5**	**8**	**12**	**15**	**2**	**5**	**52**	**18**	**61**	**10**	**1**	**5**	**40**	**35**	**3/50-79**	**Benchmark**
Q1	3	1	5	5	1	2	30.3	5	8.9	2.9	0.1	0.6	8	48	2/50-79	Poor

1 Benchmark data for equivalent community in Sydney Basin IBRA bioregion (Vegetation Type: PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion quadrat against community condition benchmarks: Keith Formation: KF_CH3 Grassy Woodland: Keith Class: Coastal Valley Grassy Woodlands: source (Office of Environment & Heritage 2017).

Photo 4.1 PCT 849 – Grey Box – Forest Red Gum grassy woodland

Photo 4.2 PCT 849 – Grey Box – Forest Red Gum grassy woodland understorey

4.2.4 PCT 835 - FOREST RED GUM – ROUGH-BARKED APPLE GRASSY WOODLAND ON ALLUVIAL FLATS OF THE CUMBERLAND PLAIN, SYDNEY BASIN BIOREGION

Broad scale vegetation mapping of the study area identified the presence of Cumberland River-flat Forest occurring on alluvial flats in the northern central portion of the study area (Tozer et al., 2010), which was confirmed during the site inspection. Cumberland River-flat Forest is equivalent to 835 - Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion.

This plant community type is summarised in Table 4.6. Plot data collected during field surveys is compared against community condition benchmarks in Table 4.7 which assisted in the determination of condition classes. The extent of PCT 835 within the study area is shown in Figure 4.3 with photographic depictions shown in Photo 4.3 & Photo 4.4.

Table 4.6 Summary of PCT 835 - Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion

PCT 835 - FOREST RED GUM – ROUGH-BARKED APPLE GRASSY WOODLAND ON ALLUVIAL FLATS OF THE CUMBERLAND PLAIN, SYDNEY BASIN BIOREGION	
Description	
PCT justification	The canopy stratum is dominated by the two PCT 835 diagnostic species *Eucalyptus amplifolia* subsp. *amplifolia* (Cabbage Gum) and *Eucalyptus tereticornis* (Forest Red Gum). Parts of the study area where this community occurs is located on alluvial flats of the Cumberland Plain. Floristic analysis of positive diagnostics species for PCT 835 reference community (FoW_p33, Tozer *et. al.* 2010) identifies that, of the 9-native species recorded from Q2, the ratio of positive diagnostic species verse total native species is 78%. For plot Q3, of the 5-native species, the ratio of positive diagnostic species verse total native species is 83%. Based on floristic, geographic and geological characteristics, this vegetation type is considered consistent with the scientific description and distribution information outlined for 835 - Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (Office of Environment and Heritage, 2017e).
Conservation status	This vegetation type is commensurate with River-flat Eucalypt Forest on Coastal Floodplain on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions which is listed as Endangered under the BC Act.
IBRA bioregion % cleared	SYD Sydney Basin – 93%
IBRA subregion	SYB08 Cumberland
Extent	1.35 ha
Vegetation integrity score	30.5
Condition	**Poor quality:** Ground and mid strata vegetation was heavily disturbed or absent due to clearing or significant weed invasion. Species richness and cover were below condition benchmarks for this community in all attributes Table 4.7. Plot data recorded exotic species richness of 19 to 22 with a cover of 68.6 to 70.8 %. Recorded high threat weeds collective exhibit a foliage cover of up to 53% (Appendix B.1).

PCT 835 - FOREST RED GUM – ROUGH-BARKED APPLE GRASSY WOODLAND ON ALLUVIAL FLATS OF THE CUMBERLAND PLAIN, SYDNEY BASIN BIOREGION			
Strata	**Height range and average**	**Percentage Foliage Cover range**	**Dominant Species**
Canopy	16 – 28 m (24)	15-30%	*Eucalyptus amplifolia subsp. amplifolia* (Cabbage Gum) and *Eucalyptus tereticornis* (Forest Red Gum)
Shrub stratum	1.2-2 m (1.2)	<5-20%	*Rubus fruticosus agg.** (Blackberry)
Ground layer	0.1-1.2 m (0.5)	60-80%	*Pennisetum clandestinum** (Kikuyu), *Ehrharta erecta** (Panic Veldt Grass), *Senecio madagascarensis** (Fireweed), *Eragrostis curvula** (African Lovegrass), *Sida rhombifolia** (Paddy's Lucerne), *Lolium perenne** (Rye Grass), *Microlaena stipoides var. stipoides* (Weeping Grass) and *Cynodon dactylon** (Common Couch)

Table 4.7 Comparison of PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion plot data against community condition benchmarks

PLOT	TREE RICHNESS	SHRUB RICHNESS	GRASS RICHNESS	FORB RICHNESS	FERN RICHNESS	OTHER RICHNESS	TREE COVER	SHRUB COVER	GRASS COVER	FORB COVER	FERN COVER	OTHER COVER	FALLEN LOGS	LITTER COVER	LARGE TREES	CONDITION
BM[1]	**4**	**8**	**8**	**7**	**2**	**3**	**21**	**21**	**73**	**3**	**1**	**1**	**12**	**40**	**1/50-79**	**Benchmark**
Q2	2	1	3	3	0	0	30	5	9.2	0.5	0	0	70	12	4/80+	Poor
Q3	1	0	3	1	0	0	15	0	10.1	1	0	0	15	0	2/80+	Poor

1 Benchmark data for equivalent community in Sydney Basin IBRA bioregion (Vegetation Type: PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion quadrat against community condition benchmarks: Keith Formation: KF_CH9 Forested Wetlands: Keith Class: Coastal Floodplain Wetlands: source (Office of Environment & Heritage 2017).

Photo 4.3 PCT 835 – Forest Red Gum – Rough-barked Apple grassy woodland – poor quality

Photo 4.4 PCT 835 – Forest Red Gum – Rough-barked Apple grassy woodland – poor quality

4.2.5 MISCELLANEOUS ECOSYSTEMS

4.2.5.1 HIGHLY DISTURBED AREAS WITH NO OR LIMITED NATIVE VEGETATION

Areas of vegetation unable to be assigned to a recognised NSW PCT due to low native species diversity forms Highly disturbed areas with no or limited native vegetation. Within the study area, these areas included exotic grasslands, exotic weed plumes and planted native vegetation. Most the study area, including roads, building and other artificially constructed entities have been mapped as miscellaneous ecosystem.

This vegetation type exhibited many priority weeds for the Greater Sydney region, Weeds of National Significance (WONS) and high treat weeds listed under BAM 2017 (Table 4.8).

The extent of PCT 835 within the study area is shown in Figure 4.3 with photographic depictions shown in Photo 4.5 & Photo 4.6.

Photo 4.5 Highly disturbed areas with no or limited native vegetation

Photo 4.6 Highly disturbed areas with no or limited native vegetation

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6257500 6257400 6257300 6257200 6257100 6257000 6256900

PROSPECT HIGHWAY

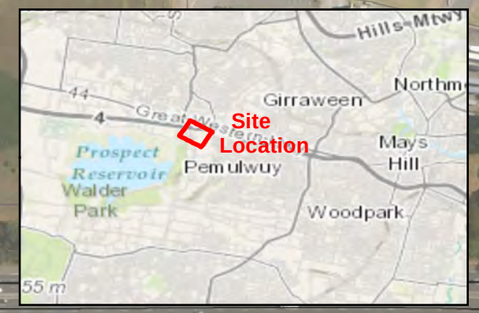
WESTERN MOTORWAY

WESTERN MOTORWAY

RESERVOIR ROAD

PROSPECT

PEMULWUY



Legend

- Study Area
- Cadastre
- Miscellaneous ecosystem - Water bodies (dam)

Plant Community Types

- PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion - 1.35 Ha
- PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain - 0.7 Ha
- Miscellaneous ecosystem - Highly disturbed areas with no or limited native vegetation - 13.7 Ha

Map: PS105757_GIS_S003_A2	Author: David.Naiken
Date: 23/11/2017	Approved by: Mark Stables

0 30 60 m

1:3,000

Coordinate system: GDA 1994 MGA Zone 56
Scale ratio correct when printed at A3

Data source: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community
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Figure 4.3
Plant Community Types

4.3 PRIORITY WEEDS

Of the total weed species recorded within study area, twenty are declared as high threat weeds under BAM 2017. Of these, priority weeds within the Greater Sydney region listed under the *Biosecurity Act 2015*(Department of Primary Industries, 2017a), which encompasses Blacktown City Council, are outlined in Table 4.8. Of these listed weeds, seven are listed as Weeds of National Significance (WoNS) (Australian Weeds Committee, 2017).

Table 4.8 Priority weeds for the Greater Sydney region and Weeds of National Significance (WONS) recorded within the study area

SPECIES	COMMON NAME	WONS	HIGH THREAT	DUTY
Asparagus aethiopicus	Asparagus Fern	**Yes**	HT	Prohibition on dealings: Must not be imported into the State or sold
Asparagus asparagoides	Bridal Creeper	**Yes**	HT	Prohibition on dealings: Must not be imported into the State or sold
Chloris gayana	Rhodes Grass	No	HT	-
Cyperus eragrostis	Umbrella Sedge	No	HT	-
Ehrharta erecta	Panic Veldtgrass	No	HT	-
Eragrostis curvula	African Lovegrass	No	HT	-
Ipomoea indica	Morning Glory	No	HT	-
Juncus acutus	Sharp Rush	No	HT	-
Lantana camara	Lantana	**Yes**	HT	Prohibition on dealings: Must not be imported into the State or sold
Ligustrum lucidum	Large-leaf Privet	No	HT	-
Ligustrum sinense	Small-leaf Privet	No	HT	-
Lycium ferocissimum	African Boxthorn	**Yes**	HT	Prohibition on dealings: Must not be imported into the State or sold
Ochna serrulata	Mickey Mouse Plant	No	HT	-
Olea europaea	African Olive	No	HT	Regional Recommended Measure: An exclusion zone is established for all lands in Blue Mountains City Council and Central Coast local government areas. The remainder of the region is classified as the core infestation area. Whole region: The plant or parts of the plant are not traded, carried, grown or released into the environment. Exclusion zone: The plant is eradicated from the land and the land kept free of the plant. Core infestation area: Land managers prevent spread from their land where feasible.

SPECIES	COMMON NAME	WONS	HIGH THREAT	DUTY
Opuntia monacantha	Prickly Pear	**Yes**	HT	Prohibition on dealings: Must not be imported into the State or sold
Paspalum dilatatum	Paspalum	No	HT	-
Pennisetum clandestinum	Kikuyu Grass	No	HT	-
Populus alba	White Poplar	No	HT	-
Rubus fruticosus agg.	Blackberry	**Yes**	HT	Prohibition on dealings: Must not be imported into the State or sold. All species in the *Rubus fruiticosus* species aggregate have this requirement, except for the varietals Black Satin, Chehalem, Chester Thornless, Dirksen Thornless, Loch Ness, Murrindindi, Silvan, Smooth Stem, and Thornfree.
Senecio madagascarensis	Fireweed	**Yes**	HT	Prohibition on dealings: Must not be imported into the State or sold

4.4 FAUNA HABITATS

Those fauna habitats identified within the study area include sclerophyll open woodland, disturbed land with limited native vegetation and artificial dam. Each fauna habitat is described in detail below and assessed under the criteria described in section 3.5.2.1.

4.4.1 SCLEROPHYLL OPEN WOODLAND

This vegetation associated with this fauna habitat includes:

- PCT 835 – Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain
- PCT 849 – Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain

This vegetation type was heavily disturbed in nature and in a poor - medium condition. Due to current and previous land use agricultural practices (grazing practices) and its location within a largely urbanised landscape, majority of the understorey is heavily disturbed with minimal ground and mid-storey cover present. Disturbance due to rubbish dumping and human activity has resulted in ground structure (i.e. fallen timber, rocks, and small shrubs) to be minimal or non-existence in areas. Despite this in areas where some fallen timber and dumped rubbish/building materials occurred can provide some microhabitat for ground dwelling reptiles, invertebrates and small mammals. However due to the study area's location within a fragmented highly urbanised landscape, species likely to occur are those well adapted to fragmented urban landscapes.

The canopy of this vegetation formed a low to moderate cover of semi-mature to mature trees (mature remnant trees in open grazing paddocks). Canopy species included *Eucalyptus moluccana* (Grey Box) and *Eucalyptus tereticornis* (Forest Red Gum). These canopy species provide suitable foraging habitat for nectar feeding and seed-eating fauna. Remnant Forest Red Gum (*Eucalyptus tereticornis)* within agricultural paddocks also provide some hollows and stags suitable for nesting opportunities for birds, arboreal mammals and roosting for microchiropteran bats. The canopy and

agricultural paddocks also provides foraging opportunities for predatory bird species such as Little Eagle (*Hieraaetus morphnoides*).

Photo 4.7 Remnant open sclerophyll forest

Photo 4.8 Remnant eucalypt trees within agricultural land.

4.4.2 HIGHLY DISTURBED AREAS WITH NO OR LIMITED NATIVE VEGETATION

This habitat type occurred in majority of the study area and corresponds with miscellaneous ecosystem – highly disturbed areas with no or limited native vegetation. This area has been cleared of its original vegetation to be utilised for agricultural activities and occurs as either exotic open grassland or exotic dominated vegetation. The ground cover is dominated with exotic grasses and herbaceous weeds. No fallen timber or rocky habitat was identified in these areas. These areas are likely to provide foraging habitat for common species typical of disturbed environment or parklands (i.e. Australian Magpie, Magpie-lark and Masked Lapwing).

Photo 4.9 Exotic pasturelands with planted native vegetation

Photo 4.10 Highly disturbed vegetation with limited native vegetation

4.4.3 WATERBODIES (DAM)

The waterbodies within the study area were heavily dominated with aquatic vegetation such as Sharp Rush (*Juncus acutus*) and Cumbungi (*Typha* sp.). The area surrounding these waterbodies is dominated by exotic weed species of Blackberry (*Rubus fruticosus agg.*) and Lantana (*Lantana camara*). The waterbody is ephemeral in nature and receives runoff from a culvert from the adjacent western motorway and during wet events flows into Girraween Creek to the east. Due to the waterbody's ephemeral nature; dominance of aquatic vegetation; undefined channels and high nutrient

loads it is likely that aquatic species to utilise these are mainly common species of frogs and invertebrates. The condition of the aquatic habitat is in poor condition and is unlikely to provide habitat for native fish.

Photo 4.11 Heavily disturbed drainage line from artificial dam

Photo 4.12 Artificial dam – heavily surrounded by vegetation and weeds

4.5 FAUNA SPECIES RECORDED

A total of 25 fauna species were recorded during field investigations which included 20 birds, 2 mammals and 3 reptiles (Appendix D). Of the 25 fauna species observed 6 were exotic species. No threatened fauna was recorded during field investigations. Further information on threatened species likely to occur within the study area is discussed in section 5 below.

5 THREATENED BIODIVERSITY

Threatened biodiversity (species, populations and communities) are listed under the NSW *Biodiversity Conservation Act 2016* (BC Act), *Fisheries Management Act 1994* (FM Act) or Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

This section includes an overview of the threatened biodiversity that has been previously recorded, was recorded during field surveys or is to have moderate to high likelihood of occurrence within the study area.

5.1 THREATENED ECOLOGICAL COMMUNITIES

Two threatened ecological communities listed under the BC Act have been recorded to occur within the study area. These communities are:

- Cumberland Plain Woodland in the Sydney Basin Bioregion – Critically Endangered Ecological Community (BC Act)
- River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions – Endangered Ecological Community (BC Act)

No patches of native vegetation recorded within the study area meet condition thresholds for any EPBC Act threatened ecological community listings.

A discussion of BC Act and EPBC Act threatened ecological communities is provided below.

5.1.1 CUMBERLAND PLAIN WOODLAND IN THE SYDNEY BASIN BIOREGION

NSW BC ACT

Cumberland Plain Woodland in the Sydney Basin Bioregion ecological community is listed as Endangered under the Schedule 2, Part 2 of the BC Act.

Correlation of PCT 849 Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion and the NSW Scientific Committee Final Determination (NSW Scientific Committee, 2011a) for this Critically Endangered community is outlined in Table 5.5. Cumberland Plain Woodland has been recorded to cover an extent of 0.7 hectares with in the study area (Figure 5.1).

Poor quality condition class of PCT 849 Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion occurs in a small patch size, is fragmented, isolated and is highly disturbed. Although disturbed, this condition class still contains a partial intact canopy cover, a limited mix of characteristic native species within all stratum and likely to contain a native soil seed bank. This is consistent with the determination which states '*Depending on the disturbance history of a particular site a proportion of the species may be present only in the soil seed bank'*.

Therefore, the entirety of PCT 849 Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion within the study area is consistent with the BC Act listing for Cumberland Plain Woodland.

Cumberland Plain Woodland is listed as a Serious and Irreversible Impact (SAII) entity under Appendix 3 of Guidance to assist a decision-maker to determine a serious and irreversible impact (Office of Environment and Heritage, 2017c).

In determining whether impacts are serious and irreversible the following 5 steps are outlined (Office of Environment and Heritage, 2017c):

- **Step 1**: Identify relevant potential entities

Comment: The SAII entity is Cumberland Plain Woodland

— **Step 2**: Evaluate nature of impact on a potential entity

Comment: Any future Biodiversity Assessment Report for either biodiversity certification or development approval under Part 4 of the EP&A Act will need to set out measures intended to avoid or mitigate any impacts.

— **Step 3**: Determine if the impacts exceed the threshold

Comment: Thresholds and threshold conditions are currently not available in the Threatened Biodiversity Data Collection for Cumberland Plain Woodland (BioNet Ecological Data, accessed 24/11/17).

— **Step 4**: Evaluate a serious and irreversible impact

Comment: Any future Biodiversity Assessment Report for either Biodiversity certification or development approval under Part 4 of the EP&A Act will need to address provisions under Paragraph 10.2.2 of BAM 2017.

— **Step 5**: Decision-making

There are two decision making pathways to address impacts on Cumberland Plain Woodland if the proposal is not likely to have a serious and irreversible impact. These are;

- Application for development consent under Part 4 of the EP&A Act
- Application for biodiversity certification of land under Part 8 of the BC Act

If the further assessment of the proposal under Steps 1-4 above considered it to have a likely serious and irreversible impact on Cumberland Plain Woodland, development consent cannot be granted under Part 4 of the EP&A Act and the decision maker must refuse the application. If the proposal is likely to have a serious and irreversible impact on Cumberland Plain Woodland the decision-making pathways are outlined in Table 5.1.

Table 5.1 Role of the decision maker for different types of development proposals where a serious an irreversible impact is likely

TYPE OF PROPOSAL	ROLE OF THE DECISION MAKER
Application for development consent under Part 4 of the Environmental Planning & Assessment Act 1979 (EP&A Act) (other than an application for state significant development or an application for a complying development certificate) See section 7.16(2) of the BC Act	Required to refuse to grant development consent
Biodiversity certification of land See section 8.8(2) of the BC Act	Required to: — take likely SAII into consideration in determining the application, and — determine if there are any additional and appropriate measures that will minimise the impacts

Given there are currently no threshold or threshold conditions listed for Cumberland Plain Woodland, any impact is considered likely to have a serious and irreversible impact on this entity.

Table 5.2 Correlation of BC Act-listed Cumberland Plain Woodland and associated PCT

THREATENED ECOLOGICAL COMMUNITY (TSC ACT) AND PCT COMPARISON	BIOREGION	LANDFORM AND ALTITUDINAL RANGE	SOIL/GEOLOGY	STRUCTURE	CHARACTERISTIC SPECIES ASSEMBLAGE	CONDITION THRESHOLDS
Cumberland Plain Woodland in the Sydney Basin Bioregion Threatened Ecological Community	Sydney Basin	Typically occurs on flat to undulating or hilly terrain up to about 350 m elevation but may also occur on locally steep sites and at slightly higher elevations.	Clay soils derived from Wianamatta Group geology, or more rarely alluvial substrates	In relatively undisturbed condition, it has an open tree canopy, a near-continuous groundcover dominated by grasses and herbs, sometimes with layers of shrubs and/or small trees. May also occur as regrowth dominated by shrubs and saplings or as derived grassland.	There are 112 characteristic species listed for this community. The total species list of the community is larger with many species present at a small number of sites or in low abundance.	There is no condition threshold described for this community in the determination. Any vegetation in which characteristic native species dominate any structural layer present is considered to constitute the community.
PCT 849: Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Sydney Basin	Occurs on flat to slightly undulating land at 50 m elevation across the site.	Clay soils derived from Wianamatta Group geology	Structure of the community on the site is generally woodland to open forest. The mid stratum is generally absent and dominated by the exotic African Olive. The groundcover is <30% native although no minimum structural condition threshold applies under the BC Act listing for this community.	All plots assigned to the PCT contains *Eucalyptus tereticornis* and *Eucalyptus moluccana* along with some diagnostic understorey species. Total diagnostic species recorded in plot sample: Q1 – 14 spp.	The patch of this community identified has characteristic native species dominant (>50% of cover of layer) for at least one of the structural layer present (canopy).
Conclusion	Meets criterion	Meets criterion	Meets criterion	Meets criterion	Meets criterion	Meets criterion

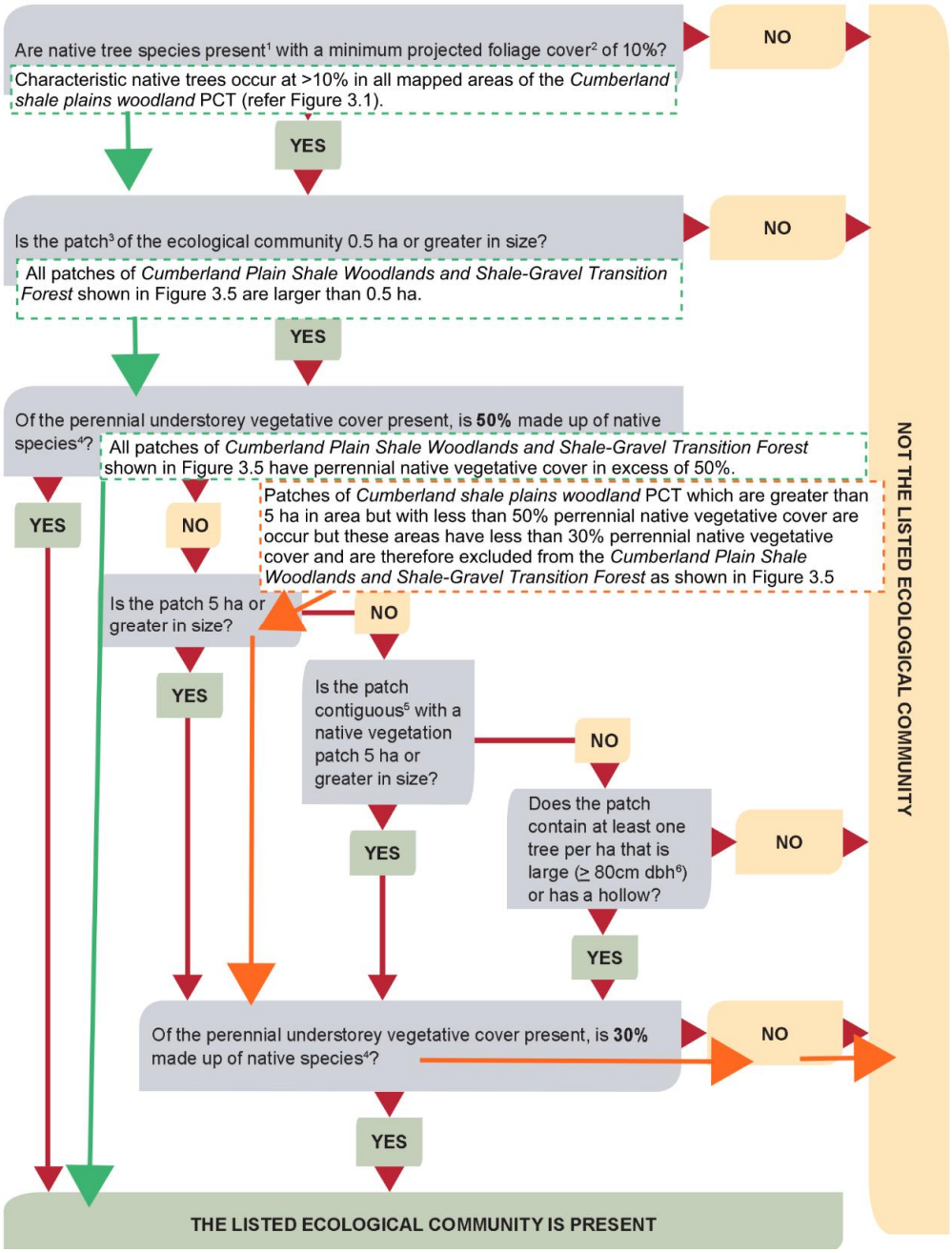
COMMONWEALTH EPBC ACT

The only vegetation type within the study area that potentially aligns with a Commonwealth listed threatened ecological community is PCT 849 Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion. This vegetation type was considered against condition thresholds for the Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest community.

Unlike the equivalent BC Act threatened ecological community listings, the EPBC Act listing is defined by specific patch size and condition thresholds in addition to floristic composition and location characteristics. These condition and patch size thresholds are shown and applied to the project in the flowchart below from Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest: A guide to identifying and protecting the nationally threatened ecological community (Department of the Environment 2010). Assessment of vegetation patches were applied against the EPBC flow chart guidelines (Table 5.3). The assessed vegetation patch was measured against Table 5.4 below.

Based on condition threshold assessment criteria the patch of PCT 849 Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion does not meet the required criteria and as such does not form part of the EPBC Act listing for Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest.

Table 5.3 EPBC flow chart guidelines to determine the presence of the threatened ecological community Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest community



Flowchart for determining presence of EPBC Act listed Cumberland Shale Plains Woodland *and Shale-Gravel Transition Forest* community

Notes for Flowchart: 1. The typical dominant tree species are grey box, forest red gum and red ironbark. Dominant means that one or more of these species comprises 50 per cent or more of the tree cover. Other tree canopy species may occur in association with the typical dominant species and may be locally dominant within the patch at some sites. 2. Projected foliage cover excludes gaps between branches and leaves—for example, the amount of shadow that would be cast on the ground if there were a light source directly overhead. 3. A patch is defined as a discrete and continuous area that comprises the ecological community. It is recognised that patches may occur in a range of sizes and shapes. A patch may include small-scale disturbances, such as tracks or breaks or other small-scale variations in native vegetation that do not significantly alter the overall functionality of the ecological community—for instance, the easy movement of wildlife or dispersal of plant spores and seeds. 4. This determines how much of the understorey is native versus exotic. Perennial understorey vegetation cover includes vascular plant species of the ground and shrub layers with a lifecycle of more than two growing seasons. Measurements of perennial understorey vegetation cover exclude annuals, lichens and mosses, leaf litter or exposed soil. 5. Contiguous means the woodland patch is continuous with, or close to (within 100 m), another patch of vegetation that is dominated by native species in each vegetation layer present. Apart from native vegetation with a tree canopy, adjoining native vegetation may consist of derived grasslands or shrublands. 'Derived' or 'secondary' grasslands or shrublands are sites where the trees have been cleared but the native understorey is retained, giving the appearance of a grassland or shrubland. 6. dbh—diameter at breast height (measured 1.3 m above the base of the tree).

Table 5.4 Assessment of PCT 849 patch against key diagnostic features and condition thresholds for the EPBC Act listed Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community

PATCH	STEPS IN ASSESSMENT PROCESS (BASED ON KEY DIAGNOSTIC FEATURES AND CONDITION THRESHOLDS TO IDENTIFY THE CUMBERLAND PLAIN SHALE WOODLANDS AND SHALE-GRAVEL TRANSITION FOREST ECOLOGICAL COMMUNITY)							RESULT
	1. Are native tree species present[1] with a minimum projected foliage cover[2] of 10%? Yes à 2 No = not the CEEC	2. Is the patch of the ecological community 0.5 ha or greater in size? Yes à 3 No = not the CEEC	3. Of the perennial understorey vegetative cover present, is 50% made up of native species? Yes = the CEEC No à 4	4. Is the patch 5 ha or greater in size? Yes à 7 No à 5	5. Is the patch contiguous with a native vegetation patch 5 ha or greater in size? Yes à 7 No à 6	6. Does the patch contain at least one tree per ha that is large (> 80 cm dbh6) or has a hollow? Yes à 7 No = not the CEEC	7. Of the perennial understorey vegetative cover present, is 30% made up of native species? Yes = the CEEC No = not the CEEC	
1	**Yes**	**Yes**	**No**	**No**	**No**	**No**	**–**	**Not the CEEC**

5.1.2 *RIVER-FLAT EUCALYPT FOREST ON COASTAL FLOODPLAINS OF THE NEW SOUTH WALES NORTH COAST, SYDNEY BASIN AND SOUTH EAST CORNER BIOREGIONS*

NSW BC ACT

River-flat Eucalypt Forest on Coastal Floodplain ecological community is listed as Endangered under the Schedule 2, Part 2 of the BC Act.

Within the study area, native vegetation associated with PCT 835 - Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion was identified to form part of the threatened ecological community listed as River-flat Eucalypt Forest on Coastal Floodplain.

Correlation of PCT 835 and the NSW Scientific Committee Final Determination (NSW Scientific Committee, 2011b) for this Endangered community is outlined in Table 5.5. River-flat Eucalypt Forest on Coastal Floodplain has been recorded to cover an extent of 1.35 hectares with in the study area (Figure 5.1). Within the study area this community generally occurs as canopy remnant only with the shrub and ground layers having been historically cleared and comprise mostly of cosmopolitan native and exotic weed species. The vegetation integrity score for this

River-flat Eucalypt Forest on Coastal Floodplain is not listed as a Serious and Irreversible Impact (SAII) entity under Appendix 3 of Guidance to assist a decision-maker to determine a serious and irreversible impact (Office of Environment and Heritage, 2017c). Given this, provision under Paragraph 10.2.2 of BAM 2017 do not apply to the assessment of development impact on this community.

COMMONWEALTH EPBC ACT

River-flat Eucalypt Forest on Coastal Floodplain is not a listed entity under the EPBC Act.

Table 5.5 Correlation of BC Act-listed River-flat eucalypt forest and associated PCT

THREATENED ECOLOGICAL COMMUNITY AND PCT COMPARISON	BIOREGION	LANDFORM AND ALTITUDINAL RANGE	SOIL/GEOLOGY	STRUCTURE	SPECIES ASSEMBLAGE	CONDITION THRESHOLDS
River-flat eucalypt forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregion Threatened Ecological Community	North Coast, Sydney Basin and South East Corner bioregions	Found on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. Generally occurs below 50 m elevation, but may occur on localised river flats up to 250 m above sea level.	Alluvium; silts, clay-loams and sandy loams	The structure of the community may vary from tall open forests to woodlands, although partial clearing may have reduced the canopy to scattered trees.	There are 88 characteristic species listed for this community. The total species list of the community is larger with many species present at a small number of sites or in low abundance.	There is no condition threshold described for this community in the determination. Any vegetation in which characteristic native species dominate any structural layer present is considered to constitute the community.
Cumberland river-flat forest PCT (PCT 835: Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion)	Sydney Basin	Occurs on alluvial flats below 50 m elevation on the site.	Occurs on clay-loams on the site.	Structure of the community on the site is variable, consisting of partially cleared open forest/woodland with or without a shrub layer.	All plots assigned to the PCT contain *Eucalyptus amplifolia* and some diagnostic understorey species. Total diagnostic species per plot: Q2 – 5 spp. Q3 – 4 spp.	Patches of the community identified have characteristic native species dominant (>50% of cover of layer) for at least one of the structural layers present (canopy).
Comparison	Meets criterion	Meets criterion	Meets criterion	Meets criterion	Meets criterion	Meets criterion

5.2 THREATENED FLORA SPECIES

Background investigations identified one threatened candidate flora species, *Pimelea spicata* was considered to have a moderate likelihood of occurrence to occur within the locality of the study area. Targeted surveys were conducted for this candidate threatened flora species although no individuals were recorded within the study area (Table 5.6). Based on targeted field surveys conducted for this report and pervious ecological site investigations (Ecological Consultants Australia, 2014), no threatened flora species have been considered as affected species due to the action proposed and as such will not be considered further within this report. No specific assessment for any threatened flora species listed under either the BC Act or EPBC Act are considered warranted.

Table 5.6 Threatened flora species with a moderate to high likelihood of occurrence in the study area

SCIENTIFIC NAME	COMMON NAME	BC ACT STATUS[1]	EPBC ACT STATUS[2]	OCCURRENCE WITHIN THE STUDY AREA	AFFECTED SPECIES
Pimelea spicata	Spiked Rice-flower	E	E	**Moderate** – although despite targeted surveys during appropriate flowering period, this species was not recorded in the study area. This finding is consistent with (Parsons Brinckerhoff, 2007).	No

1 BC Act status = (V) Vulnerable, (E1) Endangered species

2 EPBC Act Status = (V) Vulnerable, (E) Endangered

307000 307200 307400 307600 307800 308000

6257500 6257400 6257300 6257200 6257100 6257000 6256900

PROSPECT HIGHWAY

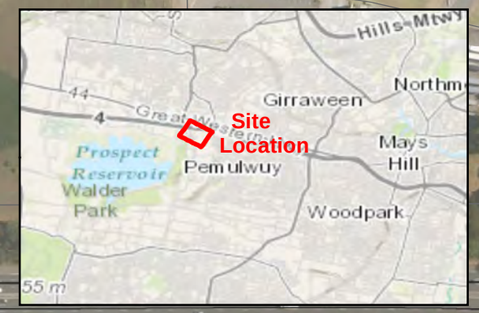
WESTERN MOTORWAY

WESTERN MOTORWAY

PROSPECT

RESERVOIR ROAD

PEMULWUY



Legend

Study Area

Cadastre

Threatened Ecological Communities

River-flat Eucalypt Forest on Coastal Floodplain on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions – Endangered ecological community (BC Act) - 1.35 Ha

Cumberland Plain Woodland in the Sydney Basin Bioregion - Critically endangered ecological community (BC Act) - 0.7 Ha

Map: PS105757_GIS_S006_A1	Author: David.Naiken
Date: 24/11/2017	Approved by: Mark Stables

0 30 60 m

1:3,000

Coordinate system: GDA 1994 MGA Zone 56
Scale ratio correct when printed at A3

Data source: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community
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Figure 5.1
Threatened Ecological Communities

5.3 THREATENED FAUNA SPECIES

Background investigations identified 73 threatened fauna that have been previously recorded or have the potential to occur within the locality (Appendix C). Of the 73 threatened fauna identified, a total of 15 have a moderate to high likelihood to occur within the study area (Table 5.7). The likelihood of these species occurring within the study area was determined based on field investigations and fauna habitat available.

A number of records for Cumberland Plain Land Snail (*Meridolum corneovirens*) have been identified in the locality. However, based on field investigations and active searches no individuals were identified and habitat for this species was considered to be unlikely to support the species in the study area. Due to this, the likelihood for Cumberland Plain Land Snail was considered as a low likelihood of occurrence in the study area.

Table 5.7 Threatened fauna species with a moderate to high likelihood of occurrence in the study area

COMMON NAME	SCIENTIFIC NAME	BC ACT[1]	EPBC ACT[2]	CREDIT TYPE	LIKELIHOOD OF OCCURRENCE
Birds					
Cattle Egret	*Ardea (Bulbulcus) ibis*	-	M	-	Moderate
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	V	-	Ecosystem	Moderate
Varied Sittella	*Daphoenositta chrysoptera*	V	-	Ecosystem	Moderate
Little Lorikeet	*Glossopsitta pusilla*	V	-	Ecosystem	Moderate
Little Eagle	*Hieraaetus morphnoides*	V	-	Ecosystem	Moderate
Swift Parrot	*Lathamus discolor*	E1	CE	Ecosystem	Moderate
Mammals					
Large-eared Pied Bat	*Chalinolobus dwyeri*	V	V	Ecosystem	Moderate
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	V	-	Ecosystem	Moderate
Little Bent-wing Bat	*Miniopterus australis*	V	-	Ecosystem	Moderate
Eastern Bent-wing Bat	*Miniopterus schreibersii oceanensis*	V	-	Ecosystem	Moderate
Eastern Freetail Bat	*Mormopterus (Micronomus) norfolkensis*	V	-	Ecosystem	Moderate
Southern Myotis	*Myotis macropus*	V	-	Species	Moderate
Grey-headed Flying-fox	*Pteropus poliocephalus*	V	V	Ecosystem	Moderate
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	V	-	Ecosystem	Moderate
Greater Broad-nosed Bat	*Scoteanax rueppellii*	V	-	Ecosystem	Moderate

3 V = Vulnerable, E1 = Endangered species, E2 = Endangered population listed under the BC Act

4 V = Vulnerable, E = Endangered, M = Migratory listed under the EPBC Act

5.4 MIGRATORY SPECIES

Migratory species are protected under international agreements to which Australia are a signatory, including Japan-Australia Migratory Bird Agreement (JAMBA), China-Australia Migratory Bird Agreement (CAMBA), Republic of Korea-Australia Migratory Bird Agreement (RoKAMBA) and the Bonn Convention on the Conservation of Migratory Species of Wild Animals. Migratory species are considered Matters of National Environmental Significance and are protected under the EPBC Act.

Based on field investigations, EPBC Protected Matters area search and other desktop database searches, 25 migratory fauna species were identified that could occur within the locality. Based on field investigations and habitat assessments 1 migratory species has a moderate to high likelihood to occur within the study area (Table 5.8).

Table 5.8 Migratory species recorded or have a moderate potential to occur within the study area

COMMON NAME	SCIENTIFIC NAME	EPBC ACT[1]	LIKELIHOOD OF OCCURRENCE
Cattle Egret	*Ardea (Bulbulcus) ibis*	M	Moderate

5 M = Migratory listed under the EPBC Act

This species (Table 5.8) has the potential to utilise a wide variety of habitats, including native vegetation communities found within the study area. The habitats within the study area are unlikely to constitute important habitat for any of the mentioned species (Table 5.8). The habitat present is unlikely to support significant proportions of the population of any migratory species nor are the habitats critical to any life stage of these species. Due to their mobile nature, the mentioned species are likely to utilise higher quality habitat within the greater locality and where more extensive tracts of native vegetation occur. Because of this, the mentioned species are not considered to be significantly impacted by the action proposed and are not considered further in this report.

6 BIODIVERSITY OVERVIEW

6.1 BIODIVERSITY ATTRIBUTES

6.1.1 PATCHES OF THREATENED ECOLOGICAL COMMUNITIES

Threatened ecological communities are distinct assemblages of plants and animals that occur together in a particular area, which are threatened with extinction due to significant reductions in extent, degradation and often very restricted distribution. Conservation of threatened ecological communities is particularly important as it helps to protect threatened species, undiscovered and poorly known taxa (e.g. invertebrates and fungi) and the biological processes critical to maintaining a healthy environment.

The contribution of individual areas of threatened ecological communities to conservation is affected by factors including:

- The diversity and relative abundance of native and exotic species within a patch of the community.
- Patch size and configuration; i.e. larger patches and patches with high area to edge ratio are less prone to disturbance and less likely to lose component species.
- Location with regard to other patches of the same community and patches of other native vegetation communities; areas of a community which are in close proximity to other patches of the same community or other similar communities are more likely to experience positive interactions including seed/spore dispersal, pollen exchange and animal movements.

High value patches of threatened ecological communities are those which:

- Have moderate to high diversity and relative abundance of native plant species and a relatively low diversity and relative abundance of exotic plant species
- Are large and with a high area to edge ratio
- Are moderate in size but located in close proximity to other moderate or large areas of the community and/or other related native vegetation communities.

Within the study area two threatened ecological communities were recorded:

- Cumberland Plain Woodland in the Sydney Basin Bioregion – Critically Endangered Ecological Community (BC Act)
- River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions – Endangered Ecological Community (BC Act)

6.1.1.1 CUMBERLAND PLAIN WOODLAND

The occurrence of this threatened ecological community within the study area is restricted to a single small patch of poor quality PCT 849 Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion. The patch is 0.7 hectares in size and is completely isolated from any adjoin area of native vegetation by Prospect Highway and industrial development to the south, Reservoir Road and Thornley Road to the east and west and the M4 Motorway to the north.

The occurrence of this community within the study area occurs primarily as canopy only, although some limited native shrub and ground stratum species were recorded. Plot data for PCT 849 indicates that the native species richness and cover are below benchmark for all attributes apart from leaf litter cover. The patch also exhibits high weed cover with exotic species richness of 16 and total cover of 70.7 %. Of the 16 weed species recorded, 8 are listed as high threat level weeds that collectively exhibit a foliage cover of 59%.

Given the small patch size, fragmented, isolated and highly disturbed native of this Cumberland Plain Woodland patch, long-term ecological function of this community is considered limited. Given this, the Cumberland Plain Woodland patch recorded within the study area is not considered to meet high value criteria.

Despite the poor quality and low ecological value of this patch, Cumberland Plain Woodland is a SAII listed entity under the BC Act and given thresholds and threshold conditions have not been established any impact on this community would be deemed to likely have a serious and irreversible impact.

APPROVAL OPTIONS FOR CUMBERLAND PLAIN WOODLAND

If avoidance and mitigation options are not considered appropriate due to the low ecological value of this small, isolated and highly disturbed patch, impact assessment would need to be considered at the planning proposal stage through the application for biodiversity certification under Part 8 of the BC Act. Under this scenario, biodiversity offsetting would be required (see Section 6.2) to meet any residual impacts on Cumberland Plain Woodland.

Cumberland Plain Woodland is currently listed as a SAII entity. OEH are yet to publish clearing thresholds to determine if a project will have a SAII. In the absence of a clearing threshold any impact is potentially considered as a SAII and cannot currently be approved under Part 4 of the EP&A Act.

If avoidance and mitigation is adopted and the patch of Cumberland Plain Woodland is retained, future development approval under Part 4 of the EP&A Act would be possible.

Further, it should be noted that when OEH release SAII clearing thresholds the approval of impacts on Cumberland Plain Woodland, including small scale impacts such as Prospect South, will most likely be able to be determined under the Part 4 development application process.

6.1.1.2 RIVER-FLAT EUCALYPT FOREST ON COASTAL FLOODPLAIN

The occurrence of this threatened ecological community within the study area is restricted to a highly disturbed patch of poor quality PCT 835 - Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion. The patch is 1.35 hectares in size and is isolated from any adjoin area of native vegetation by the M4 Motorway to the north and highly disturbed areas with no or limited native vegetation to the east, south and west.

The occurrence of this community within the study area occurs primarily as canopy only, although some limited native shrub and ground stratum species were recorded. Plot data for PCT 835 indicates that the native species richness and cover are below benchmark for all attributes apart from tree cover and fallen logs from plot Q2. The patch also exhibits high weed cover with exotic species richness of 19 to 22 with a cover of 68.6 to 70.8 %. Recorded high threat weeds collective exhibit a foliage cover of up to 53%.

River-flat Eucalypt Forest on Coastal Floodplain is not listed as a Serious and Irreversible Impact (SAII) entity under Appendix 3 of Guidance to assist a decision-maker to determine a serious and irreversible(Office of Environment and Heritage, 2017c). Given this, provision under Paragraph 10.2.2 of BAM 2017 do not apply to the assessment of development impact on this community.

APPROVAL OPTIONS FOR RIVER-FLAT EUCALYPT FOREST

Given this community is not a listed SAII entity, development assessment of any potential impact could be considered and approved under either biodiversity certification (Section 7.16(2) of the BC Act) as part of the planning proposal consideration or deferred assessment of impact under Part 4 of the EP&A Act.

6.1.2 THREATENED SPECIES AND POPULATIONS

No threatened flora or fauna species, listed under either the BC Act or EPBC Act, have been recorded within the study area.

Whilst no threatened flora and fauna species have been recorded within the study area, likelihood of occurrence assessment has considered that there is a moderate or higher likelihood for one threatened flora species and 15 threatened fauna species.

No threatened flora or fauna populations listed under the BC Act have been recorded within the study area.

6.2 BIODIVERSITY OFFSETTING

Under the BC Act, biodiversity offsetting is required for residual impacts on biodiversity matters where the biodiversity offsets scheme threshold applies. The biodiversity offset area clearing threshold applies to all proposed native vegetation clearing under biodiversity certification or Part 4 development approval. An overview of area clearing thresholds are provided in Table 6.1.

Table 6.1 BAM 2017 area clearing threshold

MINIMUM LOT SIZE ASSOCIATED WITH THE PROPERTY	THRESHOLD FOR CLEARING, ABOVE WHICH THE BAM AND OFFSETS SCHEME APPLY
Less than 1 ha	0.25 ha or more
1 ha to less than 40 ha	0.5 ha or more
40 ha to less than 1000 ha	1 ha or more
1000 ha or more	2 ha or more

6.2.1 BIODIVERSITY OFFSET REQUIREMENT

To understanding potential offset requirements for assessment under BAM 2017, the following potential impact on threatened ecological communities and credit offset requirement has been determined (Table 6.1). A draft BAM biodiversity credit report is provided in Appendix E.

Table 6.2 Potential biodiversity impact and credit offset requirement

PLANT COMMUNITY TYPE	VEGETATION INTEGRITY	AREA OF IMPACT	ECOSYSTEM CREDITS
PCT 849 Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	43.8	0.7	19
PCT 835 - Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	30.5	1.4	21
Total ecosystem credits			40

6.2.2 BIODIVERSITY OFFSET COSTS

6.2.2.1 MARKET CREDIT PRICE

Market (baseline) credit prices for PCT 849 Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion has been estimated at $16,857.14 a credit. While PCT 835 - Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion has been estimated to have a baseline credit price of $14,578.55 per credit. This would indicatively set a total estimate offset cost of $631,435.21 to purchase credit requirements from open market if available.

6.2.2.2 PAYMENT INTO BIODIVERSITY CONSERVATION FUND

Under the new *Biodiversity Conservation Act 2016* and associated Biodiversity Offsets Scheme, offset obligations can be met by paying into the Biodiversity Conservation Fund. This is an alternative to retiring credits. By doing this, the responsibility of finding an offset is transferred to the Biodiversity Conservation Trust.

Based on the total credit requirements the current cost for the Biodiversity Conservation Fund for vegetation offsets for the project would be $744,510.59 (incl. GST). The estimated total credit payment is based on calculated offset estimate undertake on 27/11/2017 (BAM calculator Version 1.2.1.00).

7 CONCLUSIONS

This biodiversity constraints assessment comprises the findings of the desktop investigation and field surveys completed to identify the broad scale distribution of biodiversity attributes and their associated values and constraints within the study area.

No threatened flora or fauna species, listed under either the BC Act or EPBC Act, have been recorded within the study area.

Whilst no threatened flora and fauna species have been recorded within the study area, likelihood of occurrence assessment has considered that there is a moderate or higher likelihood for one threatened flora species and 15 threatened fauna species.

No threatened flora or fauna populations listed under the BC Act have been recorded within the study area.

Two threatened ecological communities were recorded within the study area:

- Cumberland Plain Woodland in the Sydney Basin Bioregion – Critically Endangered Ecological Community (BC Act)
- River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions – Endangered Ecological Community (BC Act)

Under the BC Act, Cumberland Plain Woodland has been listed as a SAII entity. This has potential constraints for impact assessment approval as likely impacts to SAII entities cannot be approved under Part 4 of the EP&A Act.

Biodiversity certification under Part 8 of the BC Act may be an option for addressing any impacts on Cumberland Plain Woodland. Any impact assessment under this approval path would need to consider Paragraph 10.2.2 of BAM 2017. Due to the small, isolated and highly disturbed patch, biodiversity certification maybe the appropriate option for this proposal.

Under either the biodiversity certification pathway or Part 4 development approval, biodiversity offsets will be required to compensate for the loss of biodiversity associated with the potential impact associated with the proposal assessment using BAM 2017. Biodiversity offsets have been calculated applying BAM 2017 for the proposal impacts and will require the following ecosystems credits;

- Approximately 19 ecosystem credits for the loss of 0.7 hectares of the PCT 849 Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion
- Approximately 21 ecosystem credits for the loss of 1.4 hectares of the PCT 835 - Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion

Under the new *Biodiversity Conservation Act 2016* and associated Biodiversity Offsets Scheme, offset obligations can be met by paying into the Biodiversity Conservation Fund. This is an alternative to retiring credits. By doing this, the responsibility of finding an offset is transferred to the Biodiversity Conservation Trust.

8 LIMITATIONS

8.1 SCOPE OF SERVICES

This report has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the client and WSP (scope of services). In some circumstances the scope of services may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints.

8.2 RELIANCE ON DATA

In preparing the report, WSP has relied upon data, surveys, analyses, designs, plans and other information provided by the client and other individuals and organisations, most of which are referred to in the report (the data). Except as otherwise stated in the report, WSP has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report (conclusions) are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. WSP will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to WSP.

8.3 ENVIRONMENTAL CONCLUSIONS

In accordance with the scope of services, WSP has relied upon the data provided for the preparation of the report. Within the limitations imposed by the scope of services, the surveys and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. No other warranty, expressed or implied, is made.

8.4 REPORT FOR BENEFIT OF CLIENT

The report has been prepared for the benefit of the client (and no other party). WSP assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of WSP or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Except as provided below parties other than the client should not rely upon the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

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APPENDIX A

THREATENED FLORA LIKELIHOOD

Table 1 Threatened flora likelihood of occurrence

SPECIES NAME	COMMON NAME	EPBC ACT	BC ACT	HABITAT	DATA SOURCE	LIKELIHOOD OF OCCURRENCE
Acacia bynoeana	Bynoes Wattle	V	E1	Occurs south of Dora Creek-Morisset area to Berrima and the Illawarra region and west to the Blue Mountains. It grows mainly in heath and dry sclerophyll forest on sandy soils (Harden, 2002). Seems to prefer open, sometimes disturbed sites such as trail margins and recently burnt areas. Typically occurs in association with *Corymbia gummifera, Eucalyptus haemastoma, E. gummifera, E. parramattensis, E. sclerophylla, Banksia serrata and Angophora bakeri* (NSW National Parks and Wildlife Service, 1999a).	PMST	Low – no suitable habitat occurs within study area
Acacia pubescens	Downy Wattle	V	V	Restricted to the Sydney Region from Bilpin to the Georges River and also at Woodford where it usually grows in open sclerophyll forest and woodland on clay soils. Typically it occurs at the intergrade between shales and sandstones in gravely soils often with ironstones (Harden, 2002, NSW National Parks and Wildlife Service, 2003a).	Bionet, PMST	Low – no suitable habitat occurs within study area
Allocasuarina glareicola		E	E1	Primarily restricted to the Richmond (NW Cumberland Plain) district, but with an outlier population found at Voyager Point, Liverpool (Office of Environment & Heritage, 2016). Grows on lateritic soil in open forest (Harden, 2000).	PMST	Low – no suitable habitat occurs within study area
Asterolasia elegans		E	E1	Known from only seven populations, north of Sydney in the Baulkham Hills, Hawkesbury and Hornsby LGAs; also likely to occur in the western part of Gosford LGA. Occurs on Hawkesbury sandstone in sheltered forests on mid- to lower slopes and valleys, e.g. in or adjacent to gullies which support sheltered forest. The canopy at known sites includes Turpentine (*Syncarpia glomulifera* subsp. *glomulifera*), Smooth-barked Apple (*Angophora costata*), Sydney Peppermint (*Eucalyptus piperita*), Forest Oak (*Allocasuarina torulosa*) and Christmas Bush (*Ceratopetalum gummiferum*)(Office of Environment and Heritage, 2015a).	PMST	Low – no suitable habitat occurs within study area

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SPECIES NAME	COMMON NAME	EPBC ACT	BC ACT	HABITAT	DATA SOURCE	LIKELIHOOD OF OCCURRENCE
Callistemon linearifolius	Netted Bottle Brush		V	Occurs chiefly from Georges to the Hawkesbury River where it grows in dry sclerophyll forest, open forest, scrubland or woodland on sandstone. Found in damp places, usually in gullies (Robinson, 1994, Fairley and Moore, 2002, Harden, 2002). Within the Sydney region, recent records are limited to the Hornsby Plateau area near the Hawkesbury River (NSW Scientific Committee, 1999a).	Bionet	Low – no suitable habitat occurs within study area
Cryptostylis hunteriana	Leafless Tongue Orchid	V	V	Occurs south from the Gibraltar Range, chiefly in coastal districts but also extends on to tablelands. Grows in swamp-heath and drier forest on sandy soils on granite & sandstone. Occurs in small, localised colonies most often on the flat plains close to the coast but also known from some mountainous areas growing in moist depressions and swampy habitats (Harden, 1993, NSW National Parks and Wildlife Service, 1999b).	PMST	Low – no suitable habitat occurs within study area
Cynanchum elegans	White-flowered Wax Plant	E	E1	Occurs from the Gloucester district to the Wollongong area and inland to Mt Dangar where it grows in rainforest gullies, scrub and scree slopes (Harden, 1992). This species typically occurs at the ecotone between dry subtropical forest/woodland communities (NSW National Parks and Wildlife Service, 2002a, James, 1997).	PMST	Low – no suitable habitat occurs within study area
Dillwynia tenuifolia		V	V	Occurs on the Cumberland Plain from the Blue Mountains to Howes Valley area where it grows in dry sclerophyll woodland on sandstone, shale or laterite (Harden, 2002). Specifically, occurs within Castlereagh woodlands, particularly in shale gravel transition forest. Associated species include *Eucalyptus fibrosa, E. sclerophylla, Melaleuca decora, Daviesia ulicifolia, Dillwynia juniperina and Allocasuarina littoralis* (James, 1997).	PlantNET	Low – no suitable habitat occurs within study area
Eucalyptus sp. Cattai			E1	Occurs in the area between Colo Heights and Castle Hill in north-western Sydney, with historical records from central Sydney (Office of Environment and Heritage, 2015b). It grows as an emergent tree in scrub, heath and low woodland on sandy soils, generally on flat ridge tops. It usually occurs as isolated individuals or occasionally in small clustered groups (Harden, 2002). Associated soils are laterised clays overlying sandstone (Office of Environment and Heritage, 2015b).	PlantNET	Low – no suitable habitat occurs within study area

SPECIES NAME	COMMON NAME	EPBC ACT	BC ACT	HABITAT	DATA SOURCE	LIKELIHOOD OF OCCURRENCE
Genoplesium baueri	Bauers Midge Orchid	E	V	Grows in dry sclerophyll forest and moss gardens over sandstone. The species has been recorded from locations between Ulladulla and Port Stephens. About half the records were made before 1960 with most of the older records being from northern Sydney suburbs. The species has been recorded at locations now likely to be within the following conservation reserves: Berowra Valley Regional Park, Royal National Park and Lane Cove National Park. May occur in the Woronora, O'Hares, Metropolitan and Warragamba Catchments (Office of Environment and Heritage, 2014).	PMST	Low – no suitable habitat occurs within study area
Grevillea juniperina subsp. juniperina			V	Restricted to western Cumberland Plain, Marsden Park, Rooty Hill, Riverstone, Plumpton, Castlereagh NR, Blacktown, Penrith and north to Pitt Town, where it grows in open dry sclerophyll (eucalypt-dominated) forest or woodland, at altitudes of less than about 50 m, in sandy to clay-loam soils and red pseudolateritic or sandy gravels (Royal Botanic Gardens, 2005, Fairley, 2004). More specifically it grows in Cumberland Plain Woodland and Castlereagh Woodland, typically in moist sites, often beside creeks on acidic soils and often recorded on road verges. Restricted to red sandy to clay soils (often lateritic) on Wianamatta Shale and Tertiary Alluvium (NSW Scientific Committee, 2000a).	PlantNET	Low – no suitable habitat occurs within study area
Haloragis exalata subsp. exalata		V	V	Found in the south coast, central coast and north west slopes botanical regions where it appears to require protected and shaded damp situations in riparian habitats (Harden, 2002, Department of Environment and Climate Change, 2008).	PMST	Low – no suitable habitat occurs within study area
Marsdenia viridiflora subsp. viridiflora	Native Pear		E2	Occurs in subcoastal and southern Queensland but rarely in NSW with a disjunct occurrence near Sydney. It occurs as scattered plants in remnant woodland and scrub (NSW Scientific Committee, 2000b, Harden, 2002).	Bionet	Low – no suitable habitat occurs within study area
Micromyrtus minutiflora		V	E1	Occurs in the western part of the Cumberland Plain between Richmond and Penrith where it grows on Tertiary sediments in dry sclerophyll forest (NSW Scientific Committee, 2002, Harden, 2002).	PlantNET, PMST	Low – no suitable habitat occurs within study area

SPECIES NAME	COMMON NAME	EPBC ACT	BC ACT	HABITAT	DATA SOURCE	LIKELIHOOD OF OCCURRENCE
Pelargonium sp. Striatellum (G. W. Carr 10345), syn. Pelargonium sp., Pelargonium sp. 1	Omeo Stork's-bill	E	E1	Known from only 4 locations in NSW, with three on lake-beds on the basalt plains of the Monaro and one at Lake Bathurst. The only other known population is at Lake Omeo, Victoria. It occurs at altitudes between 680 to 1030 m. It is known to occur in the local government areas of Goulburn-Mulwaree, Cooma-Monaro, and Snowy River, but may occur in other areas with suitable habitat; these may include Bombala, Eurobodalla, Palerang, Tumbarumba, Tumut, Upper Lachlan, and Yass Valley local government areas. It has a narrow habitat that is usually just above the high-water level of irregularly inundated or ephemeral lakes, in the transition zone between surrounding grasslands or pasture and the wetland or aquatic communities. It occurs with Serrated Tussock (*Nassella trichotoma*) and Curly Sedge (*Carex bichenoviana*), and less commonly with Creeping Hopbush (*Dodonaea procumbens*) and a bog-sedge (*Schoenus nitens*) on sandy soils or gravelly soils or amongst rocks. (Heritage;, 2015)	PMST	Low – no suitable habitat occurs within study area
Persoonia nutans	Nodding Geebung	E	E1	Confined to the Cumberland Plain where it grows in Castlereagh Scribbly Gum Woodlands and Agnes Banks Woodlands (NSW National Parks and Wildlife Service, 2001, Harden, 2002, James, 1997).	Bionet, PlantNET, PMST	Low – no suitable habitat occurs within study area
Pilularia novae-hollandiae	Austral Pillwort		E1	Grows in seasonally dry depressions and margins of marshes and may grow submerged (Harden, 2000). It grows in shallow swamps and waterways, often among grasses and sedges. It is most often recorded in drying mud as this is when it is most conspicuous. Most of the records in the Albury-Urana area were from table drains on the sides of roads. The ACT record was from a subalpine grassy plain. This species is probably ephemeral (especially in the drier parts of its range), appearing when soils are moistened by rain (Department of Environment and Climate Change, 2008).	PlantNET	Low – no suitable habitat occurs within study area
Pimelea curviflora var. curviflora		V	V	Confined to coastal areas around Sydney where it grows on sandstone and laterite soils. It is found between South Maroota, Cowan, Narrabeen, Allambie Heights, Northmead and Kellyville, but its former range extended south to the Parramatta River and Port Jackson region including Five Dock, Bellevue Hill and Manly. Usually occurs in woodland in the transition between shale and sandstone, often on Lucas Heights soil landscape (NSW Scientific Committee, 1998, James, 1997, James et al., 1999, Harden, 2000).	PlantNET, PMST	Low – no suitable habitat occurs within study area

SPECIES NAME	COMMON NAME	EPBC ACT	BC ACT	HABITAT	DATA SOURCE	LIKELIHOOD OF OCCURRENCE
Pimelea spicata	Spiked Rice-flower	E	E1	This species occurs in two disjunct areas: in coastal districts from Lansdowne to Shellharbour, and in Cumberland Plain Woodland inland to Penrith. In western Sydney it grows on Wianamatta Shales in Greybox - Ironbark Woodland with *Bursaria spinosa* and *Themeda australis*. In the Illawarra, it occurs on well structured clay soils in grassland or open woodland (NSW National Parks and Wildlife Service, 2000, Harden, 2000, James, 1997).	Bionet, PlantNET, PMST	**Moderate** – although despite targeted surveys during appropriate flowering period, this species was not recorded in the study area. This finding is consistent with (Parsons Brinckerhoff, 2007).
Pomaderris brunnea		V	V	Confined to the Colo and Upper Nepean Rivers where it grows in open forest (Harden, 2000); in western Sydney (Camden to Picton area) known from sandy alluvium on levee and creek banks (James, 1997).	PMST	Low – no suitable habitat occurs within study area
Pterostylis gibbosa		E	E1	Occurs in the southern part of the Central Coast region with a disjunct population in the Hunter Valley. Grows among grass in sclerophyll forest (Harden, 2002). In the Illawarra it grows in Coastal Grassy Red Gum Forest and in Lowland Woolybutt-Melaleuca forest (NSW National Parks and Wildlife Service, 2003b).	PMST	Low – no suitable habitat occurs within study area
Pterostylis saxicola	Sydney Plains Greenhood	E	E1	Known now only from Freemans Reach to Picton district. Grows in Sydney Sandstone Gully Forest in shallow or skeletal soils over sandstone shelves, often near streams (Harden, 1993, James, 1997, Department of Environment and Climate Change, 2007)	Bionet, PMST	Low – no suitable habitat occurs within study area
Pultenaea parviflora		V	E1	Restricted to the Cumberland Plain where it grows in dry sclerophyll forest on Wianamatta shale, laterite or alluvium (Harden, 2002). Locally abundant within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays. Also occurs in transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland (NSW National Parks and Wildlife Service, 2002b, James, 1997).	Bionet, PlantNET, PMST	Low – no suitable habitat occurs within study area
Pultenaea pedunculata	Matted Bush-pea		E1	Restricted to Wianamatta Shales of the Cumberland Plain from Bankstown to Liverpool and on the South Coast in the Southeast Corner Bioregion at Bournda. If grows on a variety of soils in dry sclerophyll forest and disturbed sites (Harden, 2000, NSW Scientific Committee, 1999b, NSW National Parks and Wildlife Service, 2002c). It is largely confined to loamy soils in dry gullies in populations in the Windellama area (Department of Environment and Climate Change, 2008).	Bionet	Low – no suitable habitat occurs within study area

SPECIES NAME	COMMON NAME	EPBC ACT	BC ACT	HABITAT	DATA SOURCE	LIKELIHOOD OF OCCURRENCE
Syzygium paniculatum	Magenta Lilly Pilly	V	E1	Occurs between Bulahdelah and St Georges Basin where it grows in subtropical and littoral rainforest on sandy soils or stabilized dunes near the sea (Harden, 2002). On the south coast the Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. On the central coast Magenta Lilly Pilly occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities (Department of Environment and Climate Change, 2008).	PMST	Low – no suitable habitat occurs within study area
Thesium australe	Austral Toadflax	V	V	Grows in grassland or woodland often in damp sites. It is a semi-parasitic herb and hosts are likely to be *Themeda australis* and *Poa* spp. (Harden, 1992, Department of Environment and Climate Change, 2008).	PMST	Low – no suitable habitat occurs within study area

1. Listed under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 – CE = Critically Endangered, E = Endangered, V = Vulnerable, M = Migratory.
2. Listed under the NSW Biodiversity Conservation Act 2016 – CE = Critically Endangered, E1 = Endangered Species, E2 = Endangered Population, V = Vulnerable.
3. Bionet = OEH Bionet Atlas of NSW Wildlife, EPBC Protected Matters Search Tool = Department of Environment and Energy's EPBC Protected Matters Search Tool and PlantNet = Royal Botanic Gardens PlantNet Spatial Search.

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APPENDIX B

FLORA PLOT DATA

A.1 FLORA PLOT DATA - BAM 2017

Q1

Prospect South PSQ1			**Covers**	**Native**	Trees	Shrubs	Grass	Forb	Fern	Other	**Exotic**	HighThreat	Easting	Northing
Date: 02/11/2017			**# spp**	**Count**	Count	Count	Count	Count	Count	Count	**Count**	Count	307362	6257103
20x20m plot			**33**	**17**	3	1	5	5	1	2	**16**	8	Orientation	5
Species	**Cover**	**Abundance**	**Sum cover**	**Sum**	Sum	Sum	Sum	Sum	Sum	Sum	**Sum**	Sum	BAM Attributes 20x50m plot	
			118.5	**47.8**	30.3	5	8.9	2.9	0.1	0.6	**70.7**	59	Stem classes	
Eucalyptus tereticornis	15	10	TG		15								80+	0
Eucalyptus moluccana	15	4	TG		15								50-79	2
Olea europaea	35	20	HT									35	30-49	Yes
Bursaria spinosa	5	10	SG			5							20-29	Yes
Bidens pilosa	5	100	EX								5		10-19	Yes
Brunoniella australis	2	50	FG					2					5-9	Yes
Ehrharta erecta	15	500	HT									15	<5	Yes
Microlaena stipoides var. *stipoides*	8	100	GG				8							
Dichondra repens	0.5	50	FG					0.5					Hollows	0
Opuntia monacantha	2	3	HT									2	Lenth of logs	8
Sida rhombifolia	3	100	EX								3			
Glycine clandestina	0.5	50	OG							0.5			BAM Attributes 1x1m plot	
Dianella revoluta	0.2	10	FG					0.2						
Eragrostis curvula	3	50	HT									3	Litter cover	48
Paspalum dilatatum	0.4	10	HT									0.4	Bare ground	12.4
Hardenbergia violacea	0.1	1	OG							0.1			Cryptogam	0.4
Solanum linnaeanum	0.1	1	EX								0.1		Rock	0
Themeda triandra	0.2	3	GG				0.2							
Lantana camara	0.5	1	HT									0.5		
Ipomoea indica	3	10	HT									3		
Avena sativa	1	20	EX								1			
Plantago lanceolata	2	40	EX								2			
Grevillea robusta	0.3	1	TG		0.3									
Cynodon dactylon	0.5	20	GG				0.5							
Cheilanthes sieberi	0.1	2	EG						0.1					
Lomandra filiformis subsp. *filiformis*	0.1	1	GG				0.1							
Bromus catharticus	0.2	15	EX								0.2			
Chloris gayana	0.1	10	HT									0.1		
Echinochloa crus-galli	0.2	15	EX								0.2			
Rytidosperma racemosum	0.1	2	GG				0.1							
Einadia hastata	0.1	1	FG					0.1						
Wahlenbergia gracilis	0.1	2	FG					0.1						
Setaria parviflora	0.2	5	EX								0.2			

Q2

Prospect South PSQ2			**Covers**	**Native**	Trees	Shrubs	Grass	Forb	Fern	Other	**Exotic**	HighThreat	Easting	Northing
Date: 02/11/2017			**# spp**	**Count**	Count	Count	Count	Count	Count	Count	**Count**	Count	307572	6257297
20x20m plot			**30**	**8**	2	1	2	3	0	0	**22**	11	Orientation	153
Species	**Cover**	**Abundance**	**Sum cover**	**Sum**	Sum	Sum	Sum	Sum	Sum	Sum	**Sum**	Sum	BAM Attributes 20x50m plot	
			113.1	**44.5**	30	5	9	0.5	0	0	**68.6**	53.9	Stem classes	
Eucalyptus amplifolia	15	2	TG		15								80+	4
Eucalyptus tereticornis	15	1	TG		15								50-79	0
Olea europaea	10	4	HT									10	30-49	0
Melaleuca styphelioides	5	1	SG			5							20-29	0
Cynodon dactylon	8	100	GG				8						10-19	0
Pennisetum clandestinum	15	200	HT									15	5-9	Yes
Bromus catharticus	5	50	EX								5		<5	0
Cirsium vulgare	2	20	EX								2			
Lycium ferocissimum	1	2	HT									1	Hollows	7
Rubus fruticosus agg.	20	100	HT									20	Lenth of logs	70
Senecio madagascarensis	3	50	HT									3		
Plantago lanceolata	1	30	EX								1		BAM Attributes 1x1m plot	
Juncus usitatus	1	10	GG				1							
Sida rhombifolia	0.3	20	EX								0.3		Litter cover	12.2
Trifolium repens	2	50	EX								2		Bare ground	5.4
Verbena bonariensis	0.1	5	EX								0.1		Cryptogam	0
Conyza sumatrensis	0.5	30	EX								0.5		Rock	0
Rumex brownii	0.2	10	FG					0.2						
Lolium perenne	3	100	EX								3			
Fumaria bastardii	0.1	2	EX								0.1			
Juncus acutus	0.5	1	HT									0.5		
Echinochloa crus-galli	0.5	30	EX								0.5			
Taraxacum officinale	0.2	20	EX								0.2			
Cymbonotus lawsonianus	0.1	2	FG					0.1						
Ochna serrulata	0.1	1	HT									0.1		
Dichondra repens	0.2	30	FG					0.2						
Araujia sericifera	0.1	1	HT									0.1		
Ligustrum sinense	3	10	HT									3		
Cyperus eragrostis	0.2	5	HT									0.2		
Ligustrum lucidum	1	5	HT									1		

Q3

Prospect South PSQ3			**Covers**	**Native**	Trees	Shrubs	Grass	Forb	Fern	Other	**Exotic**	HighThreat	Easting	Northing
Date: 02/11/2017			**# spp**	**Count**	Count	Count	Count	Count	Count	Count	**Count**	Count	307673	6257315
20x20m plot			**24**	**5**	1	0	3	1	0	0	**19**	2	Orientation	273
Species	**Cover**	**Abundance**	**Sum cover**	**Sum**	Sum	Sum	Sum	Sum	Sum	Sum	**Sum**	Sum	BAM Attributes 20x50m plot	
			96.9	**26.1**	15	0	10.1	1	0	0	**70.8**	50	Stem classes	
Eucalyptus tereticornis	15	6	TG		15								80+	2
Anagallis arvensis	0.5	15	EX								0.5		50-79	0
Plantago lanceolata	3	100	EX								3		30-49	0
Lolium perenne	12	200	EX								12		20-29	0
Medicago minima	1	30	EX								1		10-19	0
Cynodon dactylon	8	100	GG				8						5-9	0
Senecio madagascarensis	5	50	HT									5	<5	Yes
Trifolium repens	0.5	15	EX								0.5			
Pennisetum clandestinum	45	500	HT									45	Hollows	2
Vulpia myuros	1	50	EX								1		Lenth of logs	27
Microlaena stipoides var. *stipoides*	2	50	GG				2							
Taraxacum officinale	0.5	20	EX								0.5		BAM Attributes 1x1m plot	
Dichondra repens	1	50	FG					1						
Cirsium vulgare	0.5	20	EX								0.5		Litter cover	13
Sida rhombifolia	0.3	10	EX								0.3		Bare ground	9.4
Gamochaeta calviceps	0.4	15	EX								0.4		Cryptogam	0
Oxalis corniculata	0.1	2	EX								0.1		Rock	0
Vicia sativa	0.1	2	EX								0.1			
Briza minor	0.2	10	EX								0.2			
Echinochloa crus-galli	0.3	15	EX								0.3			
Sporobolus creber	0.1	5	GG				0.1							
Paronychia brasiliana	0.1	5	EX								0.1			
Cyclospermum leptophyllum	0.2	10	EX								0.2			
Bidens pilosa	0.1	5	EX								0.1			

Note:
Floristic plots are 20 x 20 metres nested in a 20 x 50 metre attribute plot in accordance with BAM 2017

Growth form:
TG – Tree
SG – Shrub
GG – Grass and grass like
FG – Forb
EG – Fern
OG – Other
EX – Exotic species
HT – High threat weed

Cover / abundance
Cover: 0.1, 0.2, 0.3, …, 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
Abundance: 1, 2, 3, …, 10, 20, 30, … 100, 200, …, 1000, …

APPENDIX C

THREATENED FAUNA LIKELIHOOD

Table 1 Fauna likelihood of occurrence

SCIENTIFIC NAME	COMMON NAME	EPBC ACT[1]	BC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
AMPHIBIANS						
Heleioporus australiacus	Giant Burrowing Frog	V	V	Exists as two distinct populations: a northern population on the sandstone geology of the Sydney Basin, from Wollemi National Park in the north, south to Jervis Bay; and a southern population in disjunct pockets from about Narooma south into eastern Victoria. In the northern population there is a marked preference for sandstone ridgetop habitat and broader upland valleys where the frog is associated with small headwater and slow flowing to intermittent creeklines. The vegetation is typically woodland, open woodland and heath and may be associated with 'hanging swamp' seepage lines and where small pools form from collected water. Also observed occupying artificial ponded structures such as fire dams, gravel 'borrows', detention basins and box drains that have naturalised and are surrounded by undisturbed habitat. In the southern population, records appear to be associated with Devonian igneous and sedimentary formations and Ordovician metamorphics and are generally from more heavily timbered areas. It is absent from areas that have been cleared for agriculture or for urban development. Breed in summer and autumn in burrows in the banks of small creeks (Cogger, 2000, NSW National Parks and Wildlife Service, 2001).	PMST	Low – no suitable habitat identified within study area
Litoria aurea	Green and Golden Bell Frog	V	E1	This species occurs in fragment patches near coastal locations from Vic to south of the NSW-QLD border. For breeding it utilises a wide range of waterbodies, including both natural and man-made structures, such as marshes, dams and stream sides, and ephemeral wetlands. It is found in small pockets of habitat in otherwise developed areas and can occur in disturbed sites. There is a clear preference for sites with a complexity of vegetation structure and terrestrial habitat attributes which include extensive grassy areas and an abundance of shelter sites such as rocks, logs, tussock forming vegetation and other cover used for foraging and shelter. Over-wintering shelter sites may be adjacent to or some distance away from breeding sites but the full range of possible habitat used is not yet well understood (Department of Environment and Conservation, 2004, Department of Environment and Conservation, 2005).	Bionet, PMST BAM	Low – no suitable habitat identified within study area. Local records >20 years old, likely to be locally extinct.

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SCIENTIFIC NAME	COMMON NAME	EPBC ACT[1]	BC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
Mixophyes balbus	Stuttering Frog	V	E1	Terrestrial species, found in rainforest, Antarctic beech forest or wet sclerophyll forest. The species depends on freshwater streams and riparian vegetation for breeding and habitation. No records are known from riparian habitat that has been disturbed (NSW Scientific Committee, 2003, Cogger, 2000).	PMST	Low – no suitable habitat identified within study area
BIRDS						
Actitis hypoleucos	Common Sandpiper	M		The Common Sandpiper frequents a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity. It is mostly encountered along muddy margins or rocky shores and rarely on mudflats. It has been recorded in estuaries and deltas of streams, banks farther upstream; around lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties. The muddy margins utilised by the species are often narrow, and may be steep. The species is often associated with mangroves, and sometimes found in areas of mud littered with rocks or snags (Geering et al., 2007, Higgins and Davies, 1996). Roost sites are typically on rocks or in roots or branches of vegetation, especially mangroves. The species is known to perch on posts, jetties, moored boats and other artificial structures, and to sometimes rest on mud or 'loaf' on rocks (Higgins and Davies, 1996).	PMST	Low – no suitable habitat identified within study area
Anthochaera phrygia (syn. Xanthomyza phrygia)	Regent Honeyeater	EM	CE	Occurs mostly in box-ironbark forests and woodland and prefers wet, fertile sites such as along creek flats, broad river valleys and foothills. Riparian forests with *Casuarina cunninghamiana* and *Amyema cambagei* are important for feeding and breeding. Spotted Gum and Swamp Mahogany forests are also important feeding areas in coastal areas. Important food trees include *Eucalyptus sideroxylon* (Mugga Ironbark), *E. albens* (White Box), *E. melliodora* (Yellow Box) and *E. leucoxylon* (Yellow Gum) (Garnett and Crowley, 2000).	PMST BAM	Low – marginal foraging habitat for within subject site. Rare occurrences during seasonal movements cannot be discounted.
Apus pacificus	Fork-tailed Swift	M		Breeds in the northern hemisphere, wintering south to Australia. It is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground. It mostly occurs over inland plains but sometimes above foothills or in coastal areas over cliffs, beaches, islands and well out to sea. It also occurs over towns and cities. It mostly occurs over dry and/or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh, grassland, spinifex sandplains, farmland and sand-dunes. It sometimes occurs above forests. It probably roosts aerially, but has occasionally been observed to land (Higgins, 1999).	Bionet, PMST	Low – although species may use aerial spaces above subject site is unlikely to occur within terrestrial vegetation within the subject site.

SCIENTIFIC NAME	COMMON NAME	EPBC ACT[1]	BC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
Ardea (Bulbulcus) ibis	Cattle Egret	M		Widespread and common according to migration movements and breeding localities surveys. Breeds in colonies, either mono-specific or with other Egrets/Herons. In Australia the principal breeding sites are the central east coast from about Newcastle to Bundaberg. It also breeds in major inland wetlands in north NSW (notably the Macquarie Marshes). Occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands. It has occasionally been seen in arid and semi-arid regions however this is extremely rare. High numbers have been observed in moist, low-lying poorly drained pastures with an abundance of high grass; it avoids low grass pastures. It has been recorded on earthen dam walls and ploughed fields. It is commonly associated with the habitats of farm animals, particularly cattle, but also pigs, sheep, horses and deer. The Cattle Egret is known to follow earth-moving machinery and has been located at rubbish tips. It uses predominately shallow, open and fresh wetlands including meadows and swamps with low emergent vegetation and abundant aquatic flora. They have sometimes been observed in swamps with tall emergent vegetation (Department of the Environment, 2016b).	Bionet	**Moderate –** potential foraging habitat in the form of agricultural land during seasonal movements.
Ardea alba (syn. Ardea modesta)	Eastern Great Egret	M		Eastern Great Egrets are widespread in Australia. They occur in all states/territories of mainland Australia and in Tasmania. In Australia, the largest breeding colonies, and greatest concentrations of breeding colonies, are located in near-coastal regions of the Top End of the Northern Territory. The Channel Country of south-western Queensland and north-eastern South Australia have at least 12 breeding colonies, and colonies are also known in the Darling Riverine Plains region of NSW and the Riverina region of NSW and Victoria. Minor breeding sites are widely scattered across the species' distribution and include sites in western Cape York Peninsula, the central coast of Queensland, north and north-eastern NSW, south-eastern South Australia, south-western Western Australia, the Kimberley region of Western Australia and the Barkly Tablelands in the Northern Territory. Non-breeding birds have been recorded across much of Australia, but avoid the driest regions of the western and central deserts. The Eastern Great Egret inhabits a wide range of wetland habitats which include swamps and marshes; margins of rivers and lakes; damp or flooded grasslands, pastures or agricultural lands; reservoirs; sewage treatment ponds; drainage channels; salt pans and salt lakes; salt marshes; estuarine mudflats, tidal streams; mangrove swamps; coastal lagoons; and offshore reefs (Department of the Environment and Energy, 2017b).	PMST	Low –marginal habitat available in study area.

SCIENTIFIC NAME	COMMON NAME	EPBC ACT[1]	BC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
Artamus cyanopterus cyanopterus	Dusky Woodswallow		V	The Dusky Woodswallow is widespread in eastern, southern and southwestern Australia. In New South Wales it is widespread from coast to inland, including the western slopes of the Great Dividing Range and farther west. It is sparsely scattered in, or largely absent from, much of the Upper Western region(Higgins and Peter, 2002). Often reported in woodlands and dry open sclerophyll forests, usually dominated by eucalypts, including mallee associations. It has also been recorded in shrublands and heathlands and various modified habitats, including regenerating forests; very occasionally in moist forests or rainforests(Higgins and Peter, 2002). At sites where Dusky Woodswallows are recorded the understorey is typically open with sparse eucalypt saplings, acacias and other shrubs, including heath(Higgins and Peter, 2002).The ground cover may consist of grasses, sedges or open ground, often with coarse woody debris(Higgins and Peter, 2002). Birds are also often observed in farm land, usually at the edges of forest or woodland or in roadside remnants or wind breaks with dead timber (Higgins and Peter, 2002).In western New South Wales this species is primarily associated with River Red Gum/Black Box/Coolibah open forest/woodland associated with larger river/creek systems and is less common and far more patchily distributed in other communities such as mallee and cypress-pine woodland(Higgins and Peter, 2002).	Bionet BAM	**Moderate** – potential habitat for the species was recorded within the study area.
Botaurus poiciloptilus	Australasian Bittern	E	E1	Occurs in shallow, vegetated freshwater or brackish swamps. Requires permanent wetlands with tall dense vegetation, particularly bulrushes and spikerushes. When breeding, pairs are found in areas with a mixture of tall and short sedges but will also feed in more open territory. (Garnett and Crowley, 2000, NSW National Parks and Wildlife Service, 2002).	PMST BAM	Low – no suitable habitat identified within study area
Burhinus grallarius	Bush Stone-curlew		E1	Found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania. Only in northern Australia is it still common however and in the south-east it is either rare or extinct throughout its former range. Inhabits open forests and woodlands with a sparse grassy ground layer and fallen timber. In coastal areas, structurally similar elements of tidal and estuarine communities (Casuarina woodlands, saltmarsh and mangroves) provide suitable habitat. Nesting sites are frequently located in relatively open areas, where ground cover is extremely low and/or sparse including native vegetation and mown lawns, ploughed paddocks and paddocks cut for hay, dirt and gravel roads, seaweed on sand beach, playing fields, and vacant lots. (Office of Environment & Heritage, 2015a).	BAM	Low – no available habitat in study area.

SCIENTIFIC NAME	COMMON NAME	EPBC ACT[1]	BC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
Calidris acuminata	Sharp-tailed Sandpiper	M		Occurs in a variety of habitats: tidal mudflat, mangrove swamps, saltmarshes, shallow fresh, brackish, salt inland swamps and lakes; flooded and irrigated paddocks, sewage farms and commercial saltfields (Pizzey and Knight, 2007).	PMST	Low – no suitable habitat identified within study area
Calidris ferruginea	Curlew Sandpiper	M	E1	Occurs in inter-tidal mudflats of estuaries, lagoons, mangrove channels and also around lakes, dams, floodwaters and flooded saltbush surrounding inland lakes (Morcombe, 2003).	PMST	Low – no suitable habitat identified within study area
Calidris melanotos	Pectoral Sandpiper	M		In Australasia, the Pectoral Sandpiper prefers shallow fresh to saline wetlands. The species frequents coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. It is usually found in coastal or near coastal habitat but occasionally further inland. It prefers wetlands that have open fringing mudflats and low, emergent or fringing vegetation, such as grass or samphire. It has also been recorded in swamp overgrown with lignum. They forage in shallow water or soft mud at the edge of wetlands (Higgins and Davies, 1996).	PMST	Low – no suitable habitat identified within study area
Callocephalon fimbriatum	Gang-gang Cockatoo		V	Distributed from southern Victoria through south- and central-eastern NSW. 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. It occurs regularly in the ACT. It is rare at the extremities of its range, with isolated records known from as far north as Coffs Harbour and as far west as Mudgee. In spring and summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In autumn and winter, the species often moves to lower altitudes in drier more open eucalypt forests and woodlands, particularly box-gum and box-ironbark assemblages, or in dry forest in coastal areas and often found in urban areas. Favours old growth forest and woodland attributes for nesting and roosting. Nests are in hollows that are 10 cm in diameter or larger and at least 9 m above the ground in eucalypts.	BAM	Low – limited habitat in study area. No records in locality.

SCIENTIFIC NAME	COMMON NAME	EPBC ACT[1]	BC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
Chthonicola sagittata	Speckled Warbler		V	Occurs in a wide range of eucalypt dominated vegetation with a grassy understorey and is often found on rocky ridges or in gullies. It feeds on seeds and insects and builds domed nests on the ground (Garnett and Crowley, 2000). The species has been shown to decrease in abundance as woodland area decreased, and it appears to be extinct in districts where no fragments larger than 100ha remain (Barrett et al., 1994). Isolation of Speckled Warbler populations in small remnants increases their vulnerability to local extinction as a result of stochastic events and decreases their genetic viability in the long term (NSW Scientific Committee, 2001).	BAM	Low – marginal habitat available. No records in locality.
Circus assimilis	Spotted Harrier		V	Occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges, and rarely in Tasmania. Occurs in grassy open woodland including Acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands. Preys on terrestrial mammals (e.g. bandicoots, bettongs, and rodents), birds and reptile, occasionally insects and rarely carrion. (Office of Environment & Heritage, 2012)	BAM	Low – marginal foraging habitat in study area. Irregular occurrences whilst foraging within greater locality.
Climacteris picumnus victoriae	Brown Treecreeper		V	The Brown Treecreeper is endemic to eastern Australia and occurs in eucalypt forests and woodlands of inland plains and slopes of the Great Dividing Range. It is less commonly found on coastal plains and ranges. The western boundary of the range of *Climacteris picumnus victoriae* runs approximately through Corowa, Wagga Wagga, Temora, Forbes, Dubbo and Inverell and along this line the subspecies intergrades with the arid zone subspecies of Brown Treecreeper *Climacteris picumnus picumnus* which then occupies the remaining parts of the state. The eastern subspecies lives in eastern NSW in eucalypt woodlands through central NSW and in coastal areas with drier open woodlands such as the Snowy River Valley, Cumberland Plains, Hunter Valley and parts of the Richmond and Clarence Valleys. Mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and River Red Gum (*Eucalyptus camaldulensis*) Forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses; usually not found in woodlands with a dense shrub layer; fallen timber is an important habitat component for foraging; also recorded, though less commonly, in similar woodland habitats on the coastal ranges and plains. Hollows in standing dead or live trees and tree stumps are essential for nesting(Office of Environment & Heritage, 2014a).	BAM	Low – marginal habitat available in study area.

SCIENTIFIC NAME	COMMON NAME	EPBC ACT[1]	BC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
Cuculus opatus (syn. Cuculus saturatus)	Oriental Cuckoo, Himalayan Cuckoo	M		A non-breeding migrant to Australia, it often inhabits rainforest, vine thickets, wet sclerophyll forest and open woodland and sometimes occurs in mangroves, wooded swamps and as vagrants in gardens (Higgins, 1999). The population trend appears to be stable (BirdLife International, 2009).	PMST	Low – no suitable habitat identified within study area
Daphoenositta chrysoptera	Varied Sittella		V	The Varied Sittella inhabits most of mainland Australia except the treeless deserts and open grasslands. It inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. The Varied Sittella feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees, and from small branches and twigs in the tree canopy. It builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years (Office of Environment & Heritage, 2016e).	Bionet BAM	**Moderate** – potential habitat for the species was recorded within the study area.
Dasyornis brachypterus	Eastern Bristlebird	E	E1	The habitat of the Eastern Bristlebird is characterised by low dense vegetation. Fire is a feature of all areas where known populations occur. Given the poor flight ability of the species it is though that few individuals survive the passage of fire, survival is dependant on the availability of fire refuges and recolonisation may be relatively slow. The bird is cryptic and camouflaged and rarely seen but may be detected by its distinctive, loud calls. Confined to NSW/Queensland border region, Illawarra region and NSW/Victorian border region (NSW National Parks and Wildlife Service, 1997).	PMST	Low – no suitable habitat identified within study area
Falco subniger	Black Falcon		V	Widely, but sparsely, distributed in New South Wales, mostly occurring woodland, shrubland and grassland in the arid and semi-arid zones, especially wooded watercourses and agricultural land with scattered remnant trees. It is usually associated with streams or wetlands, visiting them in search of prey and often using standing dead trees as lookout posts. Habitat selection is generally influenced more by prey densities than by specific aspects of habitat floristics or condition, although in agricultural landscapes it tends to nest in healthy, riparian woodland remnants with a diverse avi-fauna (NSW Scientific Committee, 2013).	Bionet	Low – marginal habitat for the species was recorded within the study area. No recent (<10 years) records in locality.
Gallinago hardwickii	Latham's Snipe	M		Occurs in freshwater or brackish wetlands generally near protective vegetation cover. This species feeds on small invertebrates, seeds and vegetation. It migrates to the northern hemisphere to breed (Garnett and Crowley, 2000).	Bionet, PMST	Low – no suitable habitat identified within study area

SCIENTIFIC NAME	COMMON NAME	EPBC ACT[1]	BC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
Glossopsitta pusilla	Little Lorikeet		V	The Little Lorikeet is a small green lorikeet with black bill and red patch on forehead and throat. The underside is yellow-green. Immatures are duller with less red on face and brown bill. Found in forests, woodland, treed areas along watercourses and roads. Forages mainly on flowers, nectar and fruit. Found along coastal east Australia from Cape York in Queensland down east coast and round to South Australia. Uncommon in southern Victoria (Higgins, 1999).	BAM	**Moderate** – potential foraging habitat (blossoming eucalypts) in study area.
Grantiella picta	Painted Honeyeater	V	V	Lives in dry forests and woodlands. Primary food is the mistletoes in the genus Amyema, though it will take some nectar and insects. Its breeding distribution is dictated by presence of mistletoes which are largely restricted to older trees. Less likely to be found in in strips of remnant box-ironbark woodlands, such as occur along roadsides and in windbreaks, than in wider blocks (Garnett and Crowley, 2000).	PMST BAM	Low – no suitable habitat identified within study area
Haliaeetus leucogaster	White-bellied Sea-Eagle	M	V	Occurs in coastal areas including islands, estuaries, inlets, large rivers, inland lakes and reservoirs. Builds a huge nest of sticks in tall trees near water, on the ground on islands or on remote coastal cliffs (Pizzey and Knight, 2007).	PMST BAM	Low – no suitable habitat identified within study area
Hieraaetus morphnoides	Little Eagle		V	The Little Eagle is distributed throughout the Australian mainland occupying 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, where pairs build a large stick nest in winter and lay in early spring. Prey includes birds, reptiles and mammals, with the occasional large insect and carrion. Preys on birds, reptiles and mammals, occasionally adding large insects and carrion. Most of its former native mammalian prey species in inland NSW are extinct and rabbits now form a major part of the diet (Marchant and Higgins, 1993, Office of Environment & Heritage, 2015d).	Bionet BAM	**Moderate** - potential habitat for the species was recorded within the study area. Previous recorded in the locality

SCIENTIFIC NAME	COMMON NAME	EPBC ACT[1]	BC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
Hirundapus caudacutus	White-throated Needletail	M		Widespread in eastern and south-eastern Australia. In eastern Australia, it is recorded in all coastal regions of Queensland and NSW, extending inland to the western slopes of the Great Divide and occasionally onto the adjacent inland plains. It is almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground. Because they are aerial, it has been stated that conventional habitat descriptions are inapplicable, but there are, nevertheless, certain preferences exhibited by the species. Although they occur over most types of habitat, they are probably recorded most often above wooded areas, including open forest and rainforest, and may also fly between trees or in clearings, below the canopy, but they are less commonly recorded flying above woodland. They also commonly occur over heathland, but less often over treeless areas, such as grassland or swamps. When flying above farmland, they are more often recorded above partly cleared pasture, plantations or remnant vegetation at the edge of paddocks. In coastal areas, they are sometimes seen flying over sandy beaches or mudflats and often around coastal cliffs and other areas with prominent updraughts, such as ridges and sand-dunes (Department of the Environment and Energy, 2017a).	PMST	Low - although species may use aerial spaces above subject site is unlikely to occur within terrestrial vegetation within the study area.
Ixobrychus flavicollis	Black Bittern		V	Usually found in dense vegetation in and fringing streams, swamps, tidal creeks and mudflats, particularly amongst swamp she-oaks and mangroves. Feeds on aquatic fauna along streams, in estuaries and beside billabongs and pools. Breeding occurs in summer in secluded places in densely vegetated wetlands. It nests in trees that overhang the water (NSW National Parks and Wildlife Service, 2002, Garnett and Crowley, 2000).	BAM	Low – no available habitat in study area
Lathamus discolor	Swift Parrot	CE	E1	Breeding occurs in Tasmania, majority migrates to mainland Australia in autumn, over-wintering, particularly in Victoria and central and eastern NSW, but also south-eastern Queensland as far north as Duaringa. Until recently it was believed that in New South Wales, swift parrots forage mostly in the western slopes region along the inland slopes of the Great Dividing Range but are patchily distributed along the north and south coasts including the Sydney region, but new evidence indicates that the forests on the coastal plains from southern to northern NSW are also extremely important. In mainland Australia it is semi-nomadic, foraging in flowering eucalypts in eucalypt associations, particularly box-ironbark forests and woodlands. Preference for sites with highly fertile soils where large trees have high nectar production, including along drainage lines and isolated rural or urban remnants, and for sites with flowering Acacia pycnantha, is indicated. Sites used vary from year to year. (Garnett and Crowley, 2000),(Swift Parrot Recovery Team, 2001).	Bionet, PMST BAM	**Moderate** – potential foraging habitat for the species was recorded within the study area.

SCIENTIFIC NAME	COMMON NAME	EPBC ACT[1]	BC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
Limosa lapponica	Bar-tailed Godwit	M		The Bar-tailed Godwit has been recorded in the coastal areas of all Australian states. It is widespread in the Torres Strait and along the east and south-east coasts of Queensland, NSW and Victoria, including the offshore islands. Found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. It is found often around beds of seagrass and, sometimes, in nearby saltmarsh. It has been sighted in coastal sewage farms and saltworks, saltlakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats. It is rarely found on inland wetlands or in areas of short grass, such as farmland, paddocks and airstrips, although it is commonly recorded in paddocks at some locations overseas (Higgins and Davies, 1996).	PMST	Low – no suitable habitat identified within study area
Limosa lapponica baueri	Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit	VM		The Bar-tailed Godwit (both subspecies combined) has been recorded in the coastal areas of all Australian states. It is widespread in the Torres Strait and along the east and south-east coasts of Queensland, NSW and Victoria. The migratory Bar-tailed Godwit (western Alaskan) does not breed in Australia. Occurs mainly in coastal habitats in coastal habitats which include large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. It also has been recorded in coastal sewage farms and saltworks, saltlakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms and coral reef-flats (Higgins and Davies, 1996).	PMST	Low – no suitable habitat identified within study area
Limosa lapponica menzbieri	Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit	CEM		The Bar-tailed Godwit has been recorded in the coastal areas of all Australian states. It is widespread in the Torres Strait and along the east and south-east coasts of Queensland, NSW and Victoria. The migratory Bar-tailed Godwit (northern Siberian) does not breed in Australia. Occurs mainly in coastal habitats in coastal habitats which include large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. It also has been recorded in coastal sewage farms and saltworks, saltlakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms and coral reef-flats (Higgins and Davies, 1996).	PMST	Low – no suitable habitat identified within study area

SCIENTIFIC NAME	COMMON NAME	EPBC ACT[1]	BC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
Lophoictinia isura	Square-tailed Kite		V	The Square-tailed Kite ranges along coastal and subcoastal areas from south-western to northern Australia, Queensland, NSW and Victoria. In NSW, scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems. It is a summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March. Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses. In arid north-western NSW, has been observed in stony country with a ground cover of chenopods and grasses, open acacia scrub and patches of low open eucalypt woodland. Is a specialist hunter of passerines, especially honeyeaters, and most particularly nestlings, and insects in the tree canopy, picking most prey items from the outer foliage. Breeding is from July to February, with nest sites generally located along or near watercourses, in a fork or on large horizontal limbs.(Garnett and Crowley, 2000, Office of Environment & Heritage, 2014e).	BAM	Low – marginal habitat in study area. Irregular occurrences whilst foraging in greater home range cannot be discounted.
Melanodryas cucullata cucullata	Hooded Robin		V	Found in south-eastern Australia, generally east of the Great Dividing Range. Found in eucalypt woodland and mallee and acacia shrubland. This is one of a suite of species that has declined in woodland areas in south-eastern Australia (Traill and Duncan, 2000, Garnett and Crowley, 2000). The species appears unable to survive in remnants smaller than 100-200ha.	BAM	Low – limited available habitat in study area. No records in locality.
Merops ornatus	Rainbow Bee-eater	M		Usually occur in open or lightly timbered areas, often near water. Breed in open areas with friable, often sandy soil, good visibility, convenient perches and often near wetlands. Nests in embankments including creeks, rivers and sand dunes. Insectivorous, most foraging is aerial, in clearings (Higgins, 1999).	PMST	Low –marginal habitat available in study area.
Monarcha melanopsis	Black-faced Monarch	M		Occurs in rainforests, eucalypt woodlands, coastal scrubs, damp gullies in rainforest, eucalypt forest and in more open woodland when migrating (Pizzey and Knight, 2007).	PMST	Low –marginal habitat available in study area.
Monarcha trivirgatus	Spectacled Monarch	M		Occurs in the understorey of mountain/lowland rainforests, thickly wooded gullies and waterside vegetation. Migrates to NE NSW in summer to breed (Pizzey and Knight, 2007).	PMST	Low –marginal habitat available in study area.

SCIENTIFIC NAME	COMMON NAME	EPBC ACT[1]	BC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
Motacilla flava	Yellow Wagtail	M		This species occurs in a range of habitats including estuarine habitats such as sand dunes, mangrove forests and coastal saltmarshes. This species also occurs in open grassy areas including disturbed sites such as sports grounds and has been recorded on the edges of wetlands, swamps, lakes and farm dams. This species migrates from Asia to Australia in spring-summer. It has been recorded in the estuarine areas of the Hunter River in Newcastle NSW and in QLD and the north of NT and WA (Higgins et al., 2006).	PMST	Low – no suitable habitat identified within study area
Myiagra cyanoleuca	Satin Flycatcher	M		Widespread in eastern Australia. In Queensland, it is widespread but scattered in the east. In NSW, they are widespread on and east of the Great Divide and sparsely scattered on the western slopes, with very occasional records on the western plains. In Victoria, the species is widespread in the south and east, in the area south of a line joining Numurkah, Maldon, the northern Grampians, Balmoral and Nelson. Inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests. Satin Flycatchers mainly inhabit eucalypt forests, often near wetlands or watercourses. They generally occur in moister, taller forests, often occurring in gullies. They also occur in eucalypt woodlands with open understorey and grass ground cover, and are generally absent from rainforest. In south-eastern Australia, they occur at elevations of up to 1400 m above sea level, and in the ACT, they occur mainly between 800 m above sea level and the treeline (Department of the Environment, 2016f, Pizzey and Knight, 2007).	PMST	Low – marginal habitat identified in study area. Rare occurrences during seasonal movements cannot be discounted.
Neophema pulchella	Turquoise Parrot		V	The Turquoise Parrot inhabits eucalypt and cypress-pine open forests and woodlands (commonly box or box-ironbark) with native grasses, sometimes with a low shrubby understorey, often in undulating or rugged country, or on footslopes. It also lives in open woodland or riparian gum woodland, and often near ecotones between woodland and grassland, or coastal forest and heath. The Turquoise Parrot requires live or dead trees, stumps and logs for nesting, trees and shrubs for shelter, and seeding grasses and forbs (often beneath trees) for food. The Turquoise Parrot's nest is a cavity in a live or dead tree, stump or log, or even fence post often within 1-2 m of the ground. Hollows average about 0.5 m deep, with an entrance hole of 10 x 7 cm, and a nest chamber 12 x 9 cm in diameter (Higgins, 1999, Garnett and Crowley, 2000).	BAM	Low – no available habitat in study area. No records in locality.

SCIENTIFIC NAME	COMMON NAME	EPBC ACT[1]	BC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
Ninox connivens	Barking Owl		V	Occurs in dry sclerophyll woodland. In the south west it is often associated with riparian vegetation while in the south east it generally occurs on forest edges. It nests in large hollows in live eucalypts, often near open country. It feeds on insects in the non-breeding season and on birds and mammals in the breeding season (Garnett and Crowley, 2000).	Bionet	Low – marginal foraging habitat in study area. No recent (<10years) records in locality. Irregular occurrences whilst foraging in larger home range cannot be discounted.
Ninox strenua	Powerful Owl		V	A sedentary species with a home range of approximately 1000 hectares it occurs within open eucalypt, Casuarina or Callitris pine forest and woodland. It often roosts in denser vegetation including rainforest of exotic pine plantations. Generally feeds on medium-sized mammals such as possums and gliders but will also eat birds, flying-foxes, rats and insects. Prey are generally hollow dwelling and require a shrub layer and owls are more often found in areas with more old trees and hollows than average stands (Garnett and Crowley, 2000).	BAM	Low – marginal habitat available. Species has large home range (1000ha) and irregular occurrences whilst foraging cannot be discounted. No records in locality.
Numenius madagascariensis	Eastern Curlew	CEM		Inhabits coastal estuaries, mangroves, mud flats and sand pits. It is a migratory shorebird which generally inhabits sea and lake shore mud flats, deltas and similar areas, where it forages for crabs and other crustaceans, clam worms and other annelids, molluscs, insects and other invertebrates. Its migration route ranges from its wintering grounds in Australia to its breeding grounds in northern China, Korea and Russia (Pizzey and Knight, 2007).	PMST	Low – no suitable habitat identified within study area

SCIENTIFIC NAME	COMMON NAME	EPBC ACT[1]	BC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
Pachyptila turtur	Fairy Prion	V		The Fairy Prion is a marine bird which breeds on subantarctic and cool temperate islands within the South Pacific, including the Bass Strait Islands, Tasmania, and Macquarie Island. Fairy Prions are commonly seen offshore from mainland Australia, feeding across the continental shelf and in pelagic waters. The species is particularly common in Tasmania, but does also visit the South east coast of Australia and is often found beach cast. Fairy Prions mostly feed on euphausiids (e.g. krill), and other small crustaceans, with small fish also constituting a smaller portion of their diet. The species is a colonial breeder, which, when breeding, lays a single egg at the end of a burrow. The burrow is usually established in soil, or in crevices and caves in cliffs or rock falls (Merchant and Higgins, 1990).	PMST	Low – no suitable habitat identified within study area
Pandion cristatus (syn. P. haliaetus)	Eastern Osprey	M	V	Generally a coastal species, occurring in estuaries, bays, inlets, islands and surrounding waters, coral atolls, reefs, lagoons, rock cliffs and stacks. Sometimes ascends larger rivers to far inland. Builds nests high in tree, on pylon or on ground on islands. Feeds on fish (Pizzey and Knight, 2007).	PMST BAM	Low – no suitable habitat identified within study area
Petroica boodang	Scarlet Robin		V	In NSW, the Scarlet Robin occupies open forests and woodlands from the coast to the inland slopes. Some dispersing birds may appear in autumn or winter on the eastern fringe of the inland plains. It prefers an open understorey of shrubs and grasses and sometimes in open areas. Abundant logs and coarse woody debris are important structural components of its habitat. In autumn and winter it migrates to more open habitats such as grassy open woodland or paddocks with scattered trees. It forages from low perches, feeding on invertebrates taken from the ground, tree trunks, logs and other coarse woody debris (Higgins and Peter, 2002, Department of Environment Climate Change and Water, 2010). The species has been found to be absent from remnants surrounded by cereal cropping, less common in isolated patches of 30 ha or less (where there was no tree cover within 200 m and less than 20% cover within 1 km), less common in sites surrounded by cattle grazing and more common in sites with native versus exotic grasses if ungrazed for more than 10 years (Barrett et al., 2003).	BAM	Low – marginal habitat in study area. Irregular occurrences during seasonal movements cannot be discounted.

SCIENTIFIC NAME	COMMON NAME	EPBC ACT[1]	BC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
Petroica phoenicea	Flame Robin		V	In NSW the Flame Robin breeds in upland moist eucalypt forests and woodlands, often on ridges and slopes, in areas of open understorey. It migrates in winter to more open lowland habitats. In winter lives in dry forests, open woodlands and in pastures and native grasslands, with or without scattered trees. In winter, occasionally seen in heathland or other shrublands in coastal areas. Occasionally occurs in temperate rainforest, and also in herbfields, heathlands, shrublands and sedgelands at high altitudes. The Flame Robin forages from low perches, feeding on invertebrates taken from the ground, tree trunks, logs and other woody debris. The robin builds an open cup nest of plant fibres and cobweb, which is often near the ground in a sheltered niche, ledge or shallow cavity in a tree, stump or bank (Office of Environment & Heritage, 2015b, Higgins and Peter, 2002).	Bionet BAM	Low - marginal foraging habitat for within study area. Occurrences during seasonal movements cannot be discounted.
Rhipidura rufifrons	Rufous Fantail	M		Occurs in a range of habitats including the undergrowth of rainforests/wetter eucalypt forests/gullies, monsoon forests paperbarks, sub-inland and coastal scrubs, mangroves, watercourses, parks and gardens. When migrating they may also be recorded on farms, streets and buildings. Migrates to SE Australia in October-April to breed, mostly in or on the coastal side of the Great Dividing Range (Pizzey and Knight, 2007).	PMST	Low - marginal foraging habitat for within study area. Rare occurrences during seasonal movements cannot be discounted.
Rostratula australis (syn. R. benghalensis)	Australian Painted Snipe	VM	E1	Inhabits shallow, vegetated, temporary or infrequently filled wetlands, including where there are trees such as Eucalyptus camaldulensis (River Red Gum), E. populnea (Poplar Box) or shrubs such as Muehlenbeckia florulenta (Lignum) or Sarcocornia quinqueflora (Samphire). Feeds at the water's edge and on mudlflats on seeds and invertebrates, including insects, worms, molluscs and crustaceans. Males incubate eggs in a shallow scrape nest (Garnett and Crowley, 2000).	PMST	Low – no suitable habitat identified within study area
Stagonopleura guttata	Diamond Firetail		V	Distributed through central and eastern NSW, extending north into southern and central Queensland and south through Victoria to the Eyre Peninsula, South Australia. In NSW, the species occurs predominantly west of the Great Dividing Range, although populations are known from drier coastal areas (Blakers et al., 1984, Schodde and Mason, 1999). Occurs in a range of eucalypt dominated communities with a grassy understorey including woodland, forest and mallee. Most populations occur on the inland slopes of the dividing range (Garnett and Crowley, 2000). Firetails nest in trees and bushes, and forage on the ground, largely for grass seeds and other plant material, but also for insects (Blakers et al., 1984, Read, 1994).	BAM	Low – no available habitat in study area. No records in locality.

SCIENTIFIC NAME	COMMON NAME	EPBC ACT[1]	BC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
Tringa nebularia	Common Greenshank	M		Occurs in a range of inland and coastal environments. Inland, it occurs in both permanent and temporary wetlands, billabongs, swamps, lakes floodplains, sewage farms, saltworks ponds, flooded irrigated crops. On the coast, it occurs in sheltered estuaries and bays with extensive mudflats, mangrove swamps, muddy shallows of harbours and lagoons, occasionally rocky tidal ledges. It generally prefers wet and flooded mud and clay rather than sand (Morcombe, 2003).	PMST	Low – no suitable habitat identified within study area
Tyto novaehollandiae novaehollandiae	Masked Owl		V	Occurs within a diverse range of wooded habitats including forests, remnants and almost treeless inland plains. This species requires large-hollow bearing trees for roosting and nesting and nearby open areas for foraging. They typically prey on terrestrial mammals including rodents and marsupials but will also take other species opportunistically. Also known to occasionally roost and nest in caves (Garnett and Crowley, 2000).	Bionet BAM	Low – marginal habitat available within study area
FISH						
Macquaria australasica	Macquarie Perch	E		Macquarie Perch are found in the Murray-Darling Basin (particularly upstream reaches) of the Lachlan, Murrumbidgee and Murray rivers, and parts of south-eastern coastal NSW, including the Hawkesbury/Nepean and Shoalhaven catchments. Macquarie Perch are found in both river and lake habitats; especially the upper reaches of rivers and their tributaries. It prefers clear water and deep, rocky holes with lots of cover. As well as aquatic vegetation, additional cover may comprise of large boulders, debris and overhanging banks. Spawning occurs just above riffles (shallow running water). (Department of the Environment, 2016d) (Department of Primary Industries, 2016).	PMST	Low – no suitable habitat identified within study area
Prototroctes maraena	Australian Grayling	V		Occurs in streams and rivers on the eastern and southern flanks of the Great Dividing Range, from Sydney, southwards to the Otway Ranges of Victoria and in Tasmania. The species is found in fresh and brackish waters of coastal lagoons, from Shoalhaven River in NSW to Ewan Ponds in South Australia. The Australian Grayling is diadromous, spending part of its lifecycle in freshwater and at least part of the larval and/or juvenile stages in coastal seas. Adults (including pre spawning and spawning adults) inhabit cool, clear, freshwater streams with gravel substrate and areas alternating between pools and riffle zones such as the Tambo River, which is also known to have granite outcrops. The species has also been associated with clear, gravel-bottomed habitats in the Mitchell and Wonnangatta Rivers (Victoria) and in a muddy-bottomed, heavily silted habitat in the Tarwin River (Victoria). The species has been found over 100 km upstream from the sea (Department of Primary Industries, 2015, Department of the Environment, 2016a).	PMST	Low – no suitable habitat identified within study area

SCIENTIFIC NAME	COMMON NAME	EPBC ACT[1]	BC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
INVERTEBRATES						
Meridolum corneovirens	Cumberland Plain Land Snail		E1	Restricted to the Cumberland Plain and Castlereagh Woodlands of Western Sydney and also along the fringes of River Flat Forest, especially where it meets Cumberland Plain Woodland. It is typically found under logs and other debris, amongst leaf litter and bark around bases of trees. It is also sometimes found under grass clumps and where possible it will burrow into loose soil (NSW National Parks and Wildlife Service, 1999a).	Bionet BAM	Low – heavily disturbed understorey minimal available habitat, despite active searches no individuals found in the study area. There are records in locality.
Pommerhelix duralensis	Dural Land Snail	E	E1	This species prefers the interface of shale-derived and sandstone- derived soils with forested habitats that contain a good native cover and woody debris. It favours shelter under rocks, inside curled-up bark or resting in exposed areas and does not burrow or climb (Office of Environment and Heritage, 2015).	PMST BAM	Low – study area occurs outside species distribution on the northwest fringes of Cumberland Plain and shale-sandstone transitional landscapes. No records in locality.
MAMMALS						

SCIENTIFIC NAME	COMMON NAME	EPBC ACT[1]	BC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
Cercartetus nanus	Eastern Pygmy-possum		V	The Eastern Pygmy-possum is found in south-eastern Australia, from southern Queensland to eastern South Australia and in Tasmania. In NSW it extents from the coast inland as far as the Pilliga, Dubbo, Parkes and Wagga Wagga on the western slopes. Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest. Feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes; an important pollinator of heathland plants such as banksias; soft fruits are eaten when flowers are unavailable. Shelters in tree hollows, rotten stumps, holes in the ground, abandoned bird-nests, Ringtail Possum dreys or thickets of vegetation. (Office of Environment & Heritage, 2014b)	BAM	Low – no suitable habitat within study area. No records in locality.
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Occurs in moderately wooded habitats, mainly in areas with extensive cliffs and caves and roosts in caves, mine tunnels and the abandoned, bottle-shaped mud nests of Fairy Martins (Churchill, 1998, Office of Environment and Heritage, 2011). Breeding habitat (maternity roosts) is located in roof domes in sandstone caves (Office of Environment and Heritage, 2011). Thought to forage below the forest canopy for small flying insects (Churchill, 1998).	PMST BAM	**Moderate** – potential habitat for the species was recorded within the study area.
Dasyurus maculatus maculatus	Spotted-Tailed Quoll	E	V	Occurs from the Bundaberg area in south-east Queensland, south through NSW to western Victoria and Tasmania. In NSW, it occurs on both sides of the Great Dividing Range and north-east NSW represents a national stronghold (NSW National Parks and Wildlife Service, 1999e). Occurs in wide range of forest types, although appears to prefer moist sclerophyll and rainforest forest types, and riparian habitat. Most common in large unfragmented patches of forest. It has also been recorded from dry sclerophyll forest, open woodland and coastal heathland, and despite its occurrence in riparian areas, it also ranges over dry ridges. Nests in rock caves and hollow logs or trees. Feeds on a variety of prey including birds, terrestrial and arboreal mammals, small macropods, reptiles and arthropods (NSW National Parks and Wildlife Service, 1999c, NSW National Parks and Wildlife Service, 1999e).	PMST BAM	Low – no suitable habitat identified within study area. Study highly fragmented and isolated from extensive remnant patches.
Falsistrellus tasmaniensis	Eastern False Pipistrelle		V	Usually roosts in tree hollows in higher rainfall forests. Sometimes found in caves (Jenolan area) and abandoned buildings. Forages within the canopy of dry sclerophyll forest. It prefers wet habitats where trees are more than 20 metres high (Churchill, 2008)	Bionet	**Moderate** – potential habitat for the species was recorded within the study area.

SCIENTIFIC NAME	COMMON NAME	EPBC ACT[1]	BC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
Miniopterus australis	Little Bent-wing Bat		V	Distributed along the east coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW. Found in moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. Roosts in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats(Office of Environment & Heritage, 2014c).	Bionet BAM	**Moderate** – potential habitat for the species was recorded within the study area.
Miniopterus schreibersii oceanensis	Eastern Bent-wing Bat		V	Eastern Bentwing-bats occur along the east and north-west coasts of Australia. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. Hunt in rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, Melaleuca forests and open grasslands(Office of Environment & Heritage, 2016a).	Bionet BAM	**Moderate** – potential habitat for the species was recorded within the study area.
Mormopterus (Micronomus) norfolkensis	Eastern Freetail Bat		V	The Eastern Freetail-bat is found along the east coast from south Queensland to southern NSW. Occur in dry sclerophyll forest and woodland east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures (Churchill, 2008).	Bionet BAM	**Moderate** – potential habitat for the species was recorded within the study area.
Myotis macropus	Southern Myotis, Large-footed Myotis		V	Found in most habitat types in association with streams and permanent waterways usually at low elevations in flat or undulating landscapes from northern areas of Western Australia, and the Northern Territory, down the entire east coast and the southern coast of Australia to just west of the Victoria/South Australia border and inland along the Murray River. Roosts in caves, tree hollows, in clumps of dense vegetation (e.g. Pandanus), mines, tunnels, under bridges, road culverts and stormwater drains often in abandoned, intact Fairy Martin nests. Roost sites are strongly associated with bodies of water where this species commonly feeds on aquatic insects, shrimp and small fish at the water surface, however, aerial foraging for other insects is also known(Churchill, 2008). Breeding habitat likely to coincide with roosting habitat (Office of Environment & Heritage, 2016d).	Bionet	**Moderate** – potential habitat for the species was recorded within the study area.

SCIENTIFIC NAME	COMMON NAME	EPBC ACT[1]	BC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
Petauroides volans	Greater Glider	V		The Greater Glider has a restricted distribution in eastern Australia, from the Windsor Tableland in north Queensland to central Victoria, with an elevated range from sea level to 1200m above sea level. The species is largely restricted to eucalypt forests and woodlands, with a diet comprising of eucalypt leaves and occasional flowers. It is found in abundance in montane eucalypt forest with relatively old trees and an abundance of hollows. It also favours forests with a diversity of eucalypts to cater for seasonal variation in food abundance (Department of the Environment, 2015).	PMST	Low – no suitable habitat identified within study area. No old growth woodland and within highly fragmented landscape.
Petaurus norfolcensis	Squirrel Glider		V	The Squirrel Glider is sparsely distributed along the east coast and immediate inland districts from western Victoria to north Queensland. In NSW it is found in dry sclerophyll forest and woodland but not found in dense coastal ranges, 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. It is associated with mixed tree species stands with a shrub or Acacia midstorey. It requires abundant tree hollows for refuge and nest sites and feeds on gum of acacias, eucalypt sap and invertebrates (NSW National Parks and Wildlife Service, 1999d).	BAM	Low – no suitable habitat within study area. No records in locality.
Petrogale penicillata	Brush-tailed Rock-wallaby	V	E1	Occurs in inland and sub-coastal south eastern Australia where it inhabits rock slopes. It has a preference for rocks which receive sunlight for a considerable part of the day. Windblown caves, rock cracks or tumbled boulders are used for shelter. Occur in small groups or "colonies" each usually separated by hundreds of metres (NSW National Parks and Wildlife Service, 2003a).	PMST	Low – no suitable habitat identified within study area

SCIENTIFIC NAME	COMMON NAME	EPBC ACT[1]	BC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
Phascolarctos cinereus	Koala	V	V	The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. Inhabits eucalypt woodlands and forests. Koalas Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. The preferred tree species vary widely on a regional and local basis. Some preferred species include Forest Red Gum Eucalyptus tereticornis, Grey Gum E. punctata. In coastal areas, Tallowwood E. microcorys and Swamp Mahogany E. robusta are important food species, while in inland areas White Box E. albens, Bimble Box E. populnea and River Red Gum E. camaldulensis are favoured (NSW National Parks and Wildlife Service, 1999b, NSW National Parks and Wildlife Service, 2003b, Office of Environment & Heritage, 2016b). Hawks Nest and Tea Gardens Population and population in the Pittwater LGA listed as Endangered under the NSW TSC Act(Office of Environment & Heritage, 2016c, Office of Environment & Heritage, 2013).	PMST BAM	Low – no suitable habitat identified within study area
Pseudomys novaehollandiae	New Holland Mouse	V		The New Holland Mouse has a fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Known to inhabit open heathlands, woodlands and forests with a heathland understorey and vegetated sand dunes. Due to the largely granivorous diet of the species, sites where the New Holland Mouse is found are often high in floristic diversity, especially leguminous perennials (Department of the Environment, 2016e) (Office of Environment & Heritage, 2014d).	PMST	Low – no suitable habitat identified within study area

SCIENTIFIC NAME	COMMON NAME	EPBC ACT[1]	BC ACT[2]	HABITAT	DATA SOURCE[3]	LIKELIHOOD OF OCCURRENCE
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Occurs in the coastal belt from Rockhampton in central Queensland to Melbourne in Victoria. However, only a small proportion of this range is used at any one time, as the species selectively forages where food is available. As a result, patterns of occurrence and relative abundance within its distribution vary widely between seasons and between years. At a local scale, the species is generally present intermittently and irregularly. At a regional scale, broad trends in the distribution of plants with similar flowering and fruiting times support regular annual cycles of migration. Whilst Brisbane, Newcastle, Sydney and Melbourne are occupied continuously, elsewhere, during spring, Grey-headed Flying-foxes are uncommon south of Nowra and widespread in other areas of their range. The species is widespread throughout their range in summer, whilst in autumn it occupies coastal lowlands and is uncommon inland. In winter, the species congregrates in coastal lowlands north of the Hunter Valley and is occasionally found on the south coast of NSW (associated with flowering Spotted Gum Corymbia maculata) and on the northwest slopes (generally associated with flowering White Box Eucalyptus albens or Mugga Ironbark E. sideroxylon). Occurs 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. Feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines (Office of Environment & Heritage, 2015c) (Department of the Environment, 2016c).	Bionet, PMST BAM	**Moderate** - potential habitat for the species was recorded within the study area. Numerous recent records in locality.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat		V	This species is widespread through tropical Australia and migrates to southern Australia in summer. Occurs in eucalypt forest where it feeds above the canopy and in mallee or open country where it feeds closer to the ground. Generally a solitary species but sometimes found in colonies of up to 10. It roosts and breeds in tree hollows but has also been recorded roosting under exfoliating bark, in burrows of terrestrial mammals, in soil cracks and under slabs of rock and in the nests of bird and sugar gliders (Churchill, 2008, Office of Environment & Heritage, 2014f).	BAM	**Moderate –** potential foraging habitat in study area.
Scoteanax rueppellii	Greater Broad-nosed Bat		V	The preferred hunting areas of this species include tree-lined creeks and the ecotone of woodlands and cleared paddocks but it may also forage in rainforest. Typically it forages at a height of 3-6 metres but may fly as low as one metre above the surface of a creek. It feeds on beetles, other large, slow-flying insects and small vertebrates. It generally roosts in tree hollows but has also been found in the roof spaces of old buildings (Churchill, 2008)	Bionet	**Moderate** – potential habitat for the species was recorded within the study area.

1. Listed under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 – CE = Critically Endangered, E = Endangered, V = Vulnerable, M = Migratory.

2. Listed under the NSW Biodiversity Conservation Act 2016 – CE = Critically Endangered, E1 = Endangered Species, E2 = Endangered Population, V = Vulnerable.
3. **Bionet** = OEH Bionet Atlas of NSW Wildlife, **PMST** = Department of Environment and Energy's EPBC Protected Matters Search Tool and **BAM** = Biodiversity Assessment Methodology Calculator – Version 1.2.0.00

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APPENDIX D

RECORDED FAUNA

SCIENTIFIC NAME	COMMON NAME	NATIVE (N) OR INTRODUCED (I)	BC ACT STATUS[1]	EPBC ACT STATUS[2]
Birds				
Acridotheres tristis	Common Myna	I		
Cacatua tenuirostris	Long-billed Corella	N		
Columba livia	Rock Dove	I		
Corvus coronoides	Australian Raven	N		
Cracticus nigrogularis	Pied Butcherbird	N		
Eolophus roseicapilla	Galah	N		
Gymnorhina tibicen	Australian Magpie	N		
Malurus cyaneus	Superb Fairy-wren	N		
Manorina melanocephala	Noisy Miner	N		
Mesophoyx intermedia	Intermediate Egret	N		
Ocyphaps lophotes	Crested Pigeon	N		
Pardalotus striatus	Striated Pardalote	N		
Platycercus elegans	Crimson Rosella	N		
Pycnonotus jocosus	Red-whiskered Bulbul	I		
Rhipidura leucophrys	Willie Wagtail	N		
Sericornis frontalis	White-browed Scrubwren	N		
Sturnus vulgaris	Common Starling	I		
Threskiornis molucca	Australian White Ibis	N		
Trichoglossus haematodus	Rainbow Lorikeet	N		
Zosterops lateralis	Silvereye	N		
Mammals				
Oryctolagus cuniculus	Rabbit	I		
Bos taurus	Cow	I		
Reptile				
Cryptoblepharus virgatus	Wall Skink	N		
Lampropholis delicata	Grass Skink	N		
Egernia striolata	Tree Skink	N		

1. BC Act status: Biodiversity Conservation Act 2016
2. EPBC Act status: *Environment Protection and Biodiversity Conservation Act 1999*

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APPENDIX E

BIODIVERSITY CREDIT REPORT

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id	Proposal Name	Report Created
00009296/BAAS17020/17/00009297	Prospect South	27/11/2017

Assessor Name	Assessor Number
Alexander Cockerill	0

Proponent Names

Candidate Serious and Irreversible Impacts

No Data

No Data

Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

Predicted Threatened Species Not On Site

Name
Botaurus poiciloptilus / Australasian Bittern
Climacteris picumnus victoriae / Brown Treecreeper (eastern subspecies)
Dasyurus maculatus / Spotted-tailed Quoll
Grantiella picta / Painted Honeyeater
Ixobrychus flavicollis / Black Bittern
Callocephalon fimbriatum / Gang-gang Cockatoo
Petroica phoenicea / Flame Robin
Petroica boodang / Scarlet Robin
Circus assimilis / Spotted Harrier
Haliaeetus leucogaster / White-bellied Sea-Eagle
Lophoictinia isura / Square-tailed Kite
Melanodryas cucullata cucullata / Hooded Robin (south-eastern form)
Neophema pulchella / Turquoise Parrot
Ninox strenua / Powerful Owl
Pandion cristatus / Eastern Osprey
Phascolarctos cinereus / Koala
Chthonicola sagittata / Speckled Warbler
Stagonopleura guttata / Diamond Firetail
Tyto novaehollandiae / Masked Owl

BAM Biodiversity Credit Report (Like for like)

Anthochaera phrygia / Regent Honeyeater

Ecosystem Credit Summary

PCT	TEC	Area	Credits
849-Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Cumberland Plain Woodland in the Sydney Basin Bioregion	0.7	19.00
835-Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	1.4	21.00

Credit classes for 835

Like-for-like options

Any PCT with the below TEC	Containing HBT	In the below IBRA subregions
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (including PCT's 686, 828, 835, 839, 941, 971, 1064, 1108, 1109, 1212, 1228, 1232, 1293, 1318, 1326, 1386, 1522, 1556, 1594, 1618, 1646, 1648, 1720, 1800)	Yes	Cumberland,Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

BAM Biodiversity Credit Report (Like for like)

Credit classes for 849	Like-for-like options		
	Any PCT with the below TEC	Containing HBT	In the below IBRA subregions
	Cumberland Plain Woodland in the Sydney Basin Bioregion (including PCT's 849, 850)	Yes	Cumberland,Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

No Species Credit Data

BAM Credit Summary Report

Assessment Id	Proposal Name	Report Created
00009296/BAAS17020/17/00009297	Prospect South	27/11/2017
Assessor Name	**Assessor Number**	
Alexander Cockerill	0	

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

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Candidate SAII	Ecosystem credits
Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion								
2	835_Poor	30.5	1.4	0.25	High Sensitivity to Potential Gain	2.00	TRUE	21
							Subtotal	**21**
Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion								
1	849_Poor	43.8	0.7	0.25	High Sensitivity to Potential Gain	2.50	TRUE	19
							Subtotal	**19**
							Total	**40**

BAM Credit Summary Report

Species credits for threatened species

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

BAM Vegetation Zones Report

Assessment Id	Assessment name	Report Created
00009296/BAAS17020/17/00009297	Prospect South	27/11/2017

Assessor Name	Assessor Number
Alexander Cockerill	0

Vegetation Zones

Number	Name	PCT	Condition	Area	Minimum no. of plots
1	849_Poor	849-Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Poor	0.7	1
2	835_Poor	835-Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Poor	1.35	1

BAM Predicted Species Report

Assessment Id	Proposal Name	Report Created
00009296/BAAS17020/17/00009297	Prospect South	27/11/2017

Assessor Name	Assessor Number
Alexander Cockerill	0

Threatened species reliably predicted to utilise the site. No surveys are required for these species. Ecosystem credits apply to these species.

Common Name	Scientific Name	Vegetation Types(s)
Australasian Bittern	Botaurus poiciloptilus	835-Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
Black Bittern	Ixobrychus flavicollis	835-Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
Brown Treecreeper (eastern subspecies)	Climacteris picumnus victoriae	849-Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
		835-Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
Diamond Firetail	Stagonopleura guttata	849-Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
		835-Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
Dusky Woodswallow	Artamus cyanopterus cyanopterus	849-Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
		835-Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
Eastern Bentwing-bat	Miniopterus schreibersii oceanensis	849-Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
		835-Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
Eastern Freetail-bat	Mormopterus norfolkensis	849-Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion

Eastern Freetail-bat	Mormopterus norfolkensis	835-Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
Eastern Osprey	Pandion cristatus	835-Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
Flame Robin	Petroica phoenicea	849-Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
		835-Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
Gang-gang Cockatoo	Callocephalon fimbriatum	849-Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
		835-Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
Grey-headed Flying-fox	Pteropus poliocephalus	849-Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
		835-Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
Hooded Robin (south-eastern form)	Melanodryas cucullata cucullata	849-Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
		835-Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
Koala	Phascolarctos cinereus	849-Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
		835-Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
Little Bentwing-bat	Miniopterus australis	849-Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
		835-Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
Little Eagle	Hieraaetus morphnoides	849-Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion

Little Eagle	Hieraaetus morphnoides	835-Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
Little Lorikeet	Glossopsitta pusilla	849-Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
		835-Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
Masked Owl	Tyto novaehollandiae	849-Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
		835-Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
Painted Honeyeater	Grantiella picta	849-Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
		835-Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
Powerful Owl	Ninox strenua	849-Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
		835-Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
Regent Honeyeater	Anthochaera phrygia	849-Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
		835-Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
Scarlet Robin	Petroica boodang	849-Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
		835-Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
Speckled Warbler	Chthonicola sagittata	849-Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
		835-Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
Spotted Harrier	Circus assimilis	849-Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion

Spotted-tailed Quoll	Dasyurus maculatus	849-Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
		835-Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
Square-tailed Kite	Lophoictinia isura	849-Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
		835-Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
Swift Parrot	Lathamus discolor	849-Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
		835-Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
Turquoise Parrot	Neophema pulchella	849-Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
		835-Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
Varied Sittella	Daphoenositta chrysoptera	849-Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
		835-Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
White-bellied Sea-Eagle	Haliaeetus leucogaster	849-Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
		835-Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
Yellow-bellied Sheathtail-bat	Saccolaimus flaviventris	849-Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
		835-Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion

Biodiversity payment summary report

Assessment Id	Payment data version	Revision number	Report created
00009296/BAAS17020/17/00009297	9	0	27/11/2017

PCT list

Include	PCT common name	Credits
Yes	**849 -** Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	19
Yes	**835 -** Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	21

Species list

Include	Species	Credits

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

IBRA sub region	PCT common name	Baseline price	Dynamic coefficient	Market coefficient	Risk premium	Administrative cost	Methodology adjustment factor	Price per credit	No. of ecosystem credits	Final credits price
Cumberland	**849 -** Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion **Note: This PCT has trades recorded**	$ 16,857.14	0.57123400	4.01751300	11.35%	$37.52	1.0000	$ 16,105.33	19	$306,001.18

Cumberland	**835 -** Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion **Note: This PCT has trades recorded**	$ 14,578.55	0.51778360	4.63058100	19.97%	$38.19	1.0000	$ 17,658.41	21	$370,826.63

Subtotal (excl. GST)	**$676,827.81**
GST	**$67,682.78**
Total ecosystem credits (incl. GST)	**$744,510.59**

Species credits for threatened species

Species profile ID	Species	Threat status	Price per credit	Risk premium	Administrative cost	No. of species credits	Final credits price

No species available

Grand total	**$744,510.59**