Transport
for NSW

Biodiversity assessment report

Henry Lawson Drive Upgrade Stage 1B

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Introduction

Transport for NSW (Transport) proposes to upgrade Henry Lawson Drive along a 1.8-kilometre section between Auld Avenue, Milperra and the M5 Motorway, Milperra (the proposal). The proposal is known as the 'Henry Lawson Drive Upgrade, Stage 1B', and will include the widening of Henry Lawson Drive from two to four lanes; constructing a new local link road between Auld Avenue and Keys Parade; extending Raleigh Road; and modifying the Bullecourt Avenue / Ashford Avenue intersection. This Biodiversity Assessment Report (BAR) assesses the likely biodiversity impacts of this proposal.

Native Vegetation

Vegetation survey and assessment was completed in accordance with Chapter 4 of the Biodiversity Assessment Method (DPIE 2020a). The assessment has identified, described and mapped five vegetation zones encompassing five plant community types (PCTs) within the study area. In addition, two vegetation zones were assigned within the study area that did not conform to a locally occurring PCT: 'Planted native vegetation' and 'Exotic vegetation'. Seven vegetation integrity plots were subsequently completed within mapped PCTs as part of the assessment.

The assessment determined that the following four threatened ecological communities (TECs) listed under the *Biodiversity Conservation Act 2016* (BC Act) occur within the study area:

- Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion (Endangered Ecological Community; EEC) (PCT 725)
- River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (EEC) (PCT 835)
- Castlereagh Swamp Woodland Community (EEC) (PCT 1067)
- Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (EEC) (PCT 1800)

No vegetation zones within the study area conform to any *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listings.

Threatened Species

A habitat assessment was undertaken to assess the likelihood of threatened and/or migratory species to occur in the study area. The habitat assessment formed the basis for determining whether targeted surveys were required. The need for targeted surveys has considered all threatened species-credit species associated with the PCTs in the study area.

Targeted surveys for five species credit flora species and one species credit fauna species with a moderate to high likelihood of occurrence (as per Appendix B) were undertaken in accordance with Section 5.3 of the BAM and the relevant threatened species survey guidelines (DPIE 2020c). None of the targeted flora or fauna species were found to occur within the study area.

Targeted surveys were not conducted for two species credit fauna species: Cumberland Plain Land Snail and Southern Myotis. Based on the Transport guidelines, where a species credit species with a moderate to high likelihood of occurrence has not been adequately surveyed, then the species may be assumed present. As such, species polygons have been prepared for each of these species (Section 3.5.3). A Test of Significance for each species in accordance with Section 7.3 of the BC Act was undertaken (Appendix D). It was determined that Stage 1B is unlikely to have a significant impact on these species.

Following habitat suitability assessment and targeted surveys for threatened fauna, fourteen BAM ecosystem credit species were deemed as having a moderate to high likelihood of occurrence within the subject land. These species are highly mobile and may intermittently use the subject land for foraging and/or breeding. A Test of Significance in accordance with Section 7.3 of the BC Act was undertaken for each species (Appendix D), and where relevant, Assessments of Significance in accordance with EPBC Act Significant Impact Guidelines 1.1 (DotE 2013; Appendix E) were undertaken. It was determined that Stage 1B is unlikely to have a significant impact on these species.

Impact assessment

A summary of the direct impacts of Stage 1B on native vegetation is outlined below:

- 0.14 ha of PCT 725 - Broad-leaved Ironbark - Melaleuca decora shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion (conforms to BC Act listed EEC Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion).
- 0.08 ha of PCT 781 - Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion
- 2.16 ha of PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (conforms to BC Act listed EEC River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions).
- 0.68 ha of PCT 1800 - Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley (conforms to BC Act listed EEC Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions).
- 2.62 ha of Planted Native Vegetation.

Threatened ecological communities present within the subject land were assessed in accordance with the Threatened Species Test of Significance Guidelines (OEH 2018c). It was determined that Stage 1B is unlikely to have a significant impact on these ecological communities.

In addition, Stage 1B will impact habitat of sixteen threatened fauna species deemed to have a moderate to high likelihood of occurring within the subject land. This includes fourteen BAM ecosystem credit species and two BAM species credit species. In addition, one hollow-bearing tree will be removed that forms potential roosting/breeding habitat for hollow-dependent microbats. No threatened flora species were deemed to have a moderate or high likelihood of occurring within the subject land.

Impact avoidance and minimisation

Transport address impacts to biodiversity through applications of the 'avoid, minimise, mitigate and offset' hierarchy. Measures have been implemented to avoid and minimise impacts to biodiversity within the study area. The majority of the vegetation within the study area is Planted Native Vegetation, which is located in avenues along Henry Lawson Drive. There are small areas of TECs within the subject land that will be affected. Most of these TECs are in a degraded state, consisting of mature canopy with a mown or exotic dominated groundcover and no shrub layer.

Note that while the final design is still in preparation, the subject land (impact area) is significantly larger than the existing design impact. This has been utilised to provide flexibility with the final design and ensure all ecological constraints are considered during this design phase. As such, the impact discussed in Section 5 of this BAR are likely to be overstated, with the final construction footprint seeking to retain as many areas of native vegetation and fauna habitat as possible. Minimising clearing within TECs, retaining hollow-bearing trees and limiting impacts to riparian vegetation and watercourse would avoid and minimise impacts.

Furthermore, as impacts to biodiversity cannot be completely avoided by Stage 1B, several mitigation measures are outlined in this BAR to assist with ensuring that direct and indirect impacts are mitigated to the highest extent possible.

Offsetting

The Transport No Net Loss Guidelines (Transport 2022a) were consulted to determine the offset thresholds for vegetation and threatened species within the study area. As biodiversity offsetting thresholds have been reached under the No Net Loss Guideline, a Biodiversity Offset Strategy should be prepared as an environmental safeguard.

The following species credits have been generated by the BAM-C, as the offset threshold has been exceeded:

- 18 species credits for *Meridolum corneovirens* (Cumberland Plain Land Snail).
- 32 species credits for *Myotis macropus* (Southern Myotis).

The 5.68 ha of vegetation that that does not require offsets in accordance with the No Net Loss Guideline were subsequently assessed against the requirements of the Tree and Hollow Replacement Guideline. All remaining vegetation zones will require tree and hollow replacement. A Tree and Hollow Replacement Plan is to be prepared as an environmental safeguard.

1. Introduction

1.1 Proposal background

Transport for NSW (Transport) is proposing to upgrade Henry Lawson Drive between the Hume Highway and the M5 Motorway. Henry Lawson Drive is mostly a single lane carriageway and is a key connection for traffic moving between the M5 Motorway, Milperra Road and the Hume Highway. Henry Lawson Drive also provides a vital transport link from Bankstown Airport to the M5 Motorway and is designated as a B-Double access route. The upgrade is proposed to alleviate traffic congestion and delays currently experienced along single lane sections of the road, provide road safety improvements and implement pedestrian safety and accessibility improvements across the site.

The proposed upgrade of Henry Lawson Drive is divided into four different stages: Stage 1A, Stage 1B, Stage 2 and Stage 3. A Biodiversity Assessment Report (BAR) was previously completed for the strategic phase of the entire Henry Lawson Drive Upgrade Program, including Stage 1B (WSP 2019) (the Strategic BAR). The biodiversity impacts of the Stage 1A project has been assessed by WSP (2021) and WSP (2022).

This Biodiversity Assessment Report (BAR) assesses the likely biodiversity impacts of Stage 1B, which includes a 1.8-kilometre section of Henry Lawson Drive, Milperra between Auld Avenue, Milperra and the approach to the M5 Motorway, Milperra (Figure 1-1), referred to as the 'Henry Lawson Drive Upgrade: Stage 1B'. Key features of the proposal are outlined in Section 1.2.

1.2 The proposal

Transport for NSW (Transport) proposes to upgrade a 1.8-kilometre section of Henry Lawson Drive between Auld Avenue, Milperra and the approach to the M5 Motorway (known as the Henry Lawson Drive Upgrade Stage 1B) (the proposal). This include road widening to increase traffic capacity and improve travel time as well as upgrades of key intersections to enhance capability and driver safety. Key features of the proposal would include:

- widening Henry Lawson Drive from two to four lanes between Auld Avenue, Milperra and the M5 Motorway, Milperra with a raised central median
- upgrading the Henry Lawson Drive / Bullecourt Avenue signalised intersection, including:
  - an additional right-turn lane from Henry Lawson Drive (northbound) to Bullecourt Avenue (two right-turn lanes total)
  - an additional right-turn lane from Bullecourt Avenue to Henry Lawson Drive (northbound) (two right-turn lanes total)
  - converting the existing dedicated left-turn lane from Bullecourt Avenue to Henry Lawson Drive (southbound) into a dedicated left-turn slip lane
  - maintaining the dedicated left-turn lane from Henry Lawson Drive (southbound) to Bullecourt Avenue
- upgrading the Henry Lawson Drive / Pozieres Avenue signalised intersection, including:
  - a new dedicated right-turn lane from Henry Lawson Drive (southbound) to Pozieres Avenue
  - a new dedicated left-turn lane from Henry Lawson Drive (northbound) to Pozieres Avenue and relocation of the existing bus stop north of the intersection
- providing a new two-lane local link road between Auld Avenue and Keys Parade (about 160 metres), crossing over Milperra Drain, providing access to / from southbound lanes of Henry Lawson Drive and Auld Avenue, and removing up to eight parking spaces on Auld Avenue to accommodate the link road
- extending Raleigh Road about 120 metres to connect with Keys Parade at a roundabout, and removing the direct connection between Raleigh Road and Henry Lawson Drive
- converting the Henry Lawson Drive intersections to be left-in left-out only, at:
  - Ruthven Avenue
  - Whittle Avenue

  - Amiens Avenue
  - Ganmain Crescent
  - Fromelles Avenue
  - Hermies Avenue
- modifying the Bullecourt Avenue / Ashford Avenue intersection to better accommodate heavy vehicle movements
- constructing a three-metre-wide shared path:
  - on the western side of Henry Lawson Drive between Pozieres Avenue and Keys Parade
  - along Keys Parade, the new Auld Avenue local link road and the extended section of Raleigh Road
- reconstruction of some existing shared paths within the proposal area
- constructing a new footpath within the proposal area:
  - on the eastern side of Henry Lawson Drive between the Flower Power and Ingram Avenue
  - along the northern side of Ingram Avenue
  - along the eastern side of Fromelles Avenue
- installing new drainage infrastructure and water quality controls within the proposal area, including:
  - an upgraded longitudinal and transverse drainage pits and pipes network along Henry Lawson Drive
  - a bioretention basin between Henry Lawson Drive, Bullecourt Avenue and Fleurbaix Avenue and maintenance access to this basin
  - swales along Henry Lawson Drive and Keys Parade and installation of Gross Pollutant Traps
- construction activities and ancillary work, including:
  - relocation of utilities (including electrical, gas, water and telecommunications)
  - civil earthworks, drainage work, water quality controls and tie-in work to adjoining sections of Henry Lawson Drive and local roads
  - final roadworks including pavement, kerb and gutters, signs, road furniture, landscaping, lighting and line marking
  - new traffic signals and intelligent transport systems including, but not limited to, closed-circuit television
  - establishment of temporary ancillary facilities to support construction, including compound sites, site offices, stockpile and laydown locations, temporary access tracks and water quality devices.

Proposal options were explored within the strategic design BAR (WSP 2019) including a 4 lane and 6 lane option. The four-lane option has been adopted. Construction works are expected to commence in 2024 and would take two years to complete.

The concept design would be further refined during detailed design to minimise environmental and social impacts and to consider community feedback to the exhibition of the REF.

1.2.1 Assessment areas

The key assessment areas and proposal boundaries used within this BAR are defined in the following section and shown in Figure 1-1 and Figure 1-2:

- The proposal: Henry Lawson Drive Upgrade, Stage 1B as described above in Section 1.2.
- Study area: incorporates all elements of the strategic design and construction footprint plus an additional area to allow for the consideration of indirect impacts and to provide flexibility for design development. This includes either a minimum of five metres from the edge of the design or areas encompassing road reserve to private property boundaries. The study area also includes two areas with approved DAs that may be utilised for construction and/or stockpiling for

Stage 1B: Keys Parade roadway (approved DA-108/2020) and 27 Bullecourt Avenue Seniors Housing Development (approved DA-1213/2017).

- Subject land: the area to be directly impacted by construction and operation, including any additional clearing associated with temporary/ancillary construction facilities and infrastructure. Includes additional areas other than existing design to allow for flexibility with location of final design. Does not include areas approved under existing DAs (Figure 1-2).
- Bioregion: Cumberland Interim Biogeographically Regionalisation of Australia (IBRA) sub-region (Sydney Basin IBRA bioregion).
- Locality: land within a 10-kilometre radius of the subject land.

For the purposes of this BAR the impact of the proposal (the subject land) has been overstated to provide flexibility with the final design. As such, the biodiversity impacts would be a 'worse-case' scenario, with the final design and construction likely to be a reduced impact to what is assessed in this BAR.

Stage 1B is situated within the suburb of Milperra in the south-western Sydney Local Government Area (LGA) of Canterbury-Bankstown. The surrounding area comprises a mixture of low-density residential and industrial zones, as well as public recreation areas including parks and bushland (Figure 1-1). The study area occurs within the Sydney Basin Bioregion and the Cumberland IBRA subregion. The northern section of Stage 1B occurs within the Georges River Alluvial Plain Mitchell Landscape and the southern section occurs with Ashfield Plain Mitchell Landscape. The Georges River occurs to the west and north of the study area and flows in a southerly direction, eventually entering Botany Bay around 24 kilometres downstream. Coastal wetlands occur to the east of Henry Lawson Drive and parts of the study area occur within the Proximity Area for Coastal Wetlands. Milperra Drain flows from these wetlands west underneath Henry Lawson Drive and through Vale of Ah Reserve where it enters the Georges River (Figure 1-1).

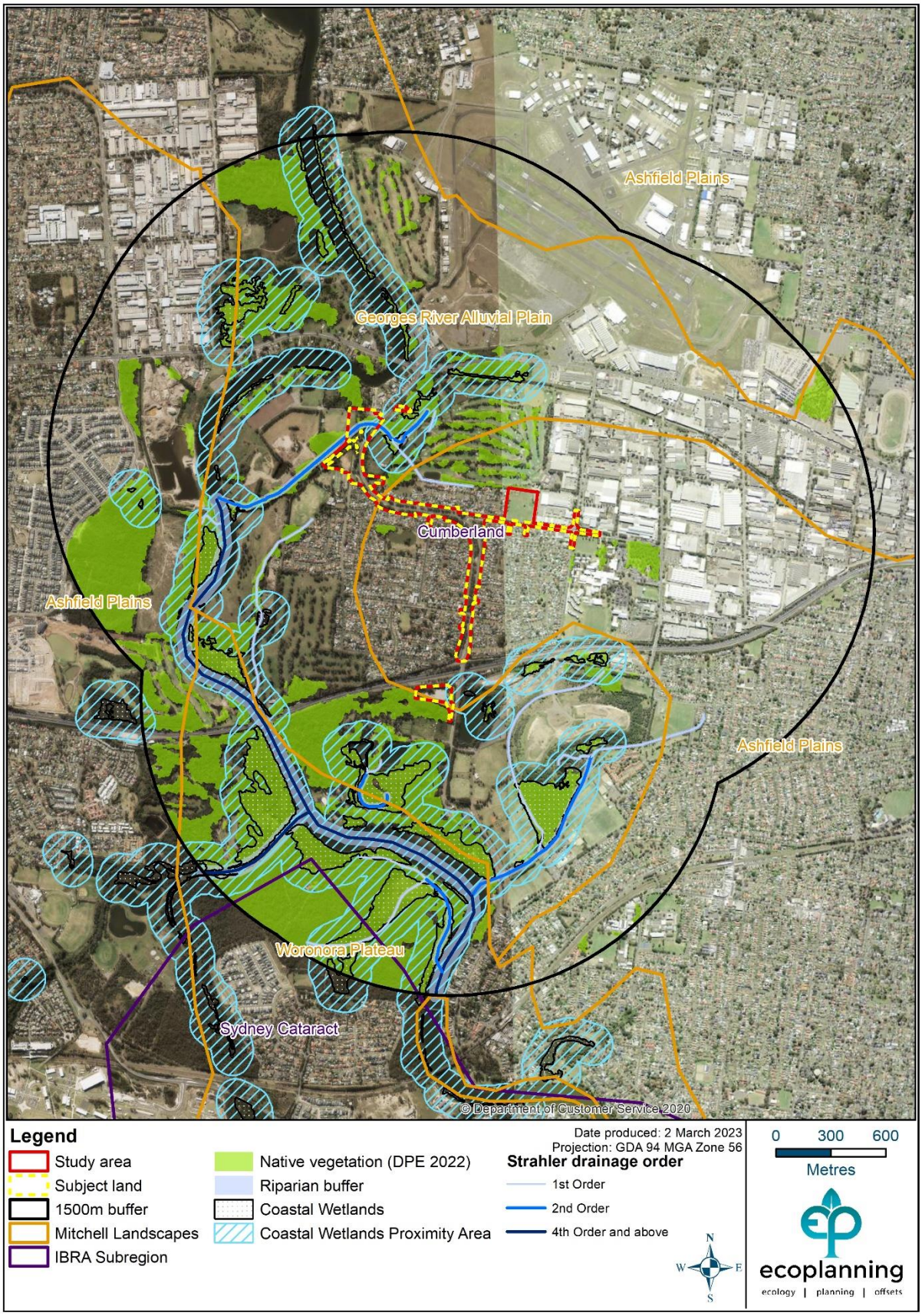

Figure 1-1: Proposal context.

Figure 1-2: The proposal (Stage 1B).

1.3 Legislative context

1.3.1 Environmental Planning and Assessment Act 1979

A Review of Environmental Factors (REF) has been prepared to satisfy Transport responsibilities under s.5.5 of the EP&A Act to "examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity" and s.5.5 in making decisions on the likely significance of any environmental impacts. This biodiversity impact assessment forms part of the REF being prepared for Stage 1B of the Henry Lawson Drive upgrade and assesses the biodiversity impacts of the proposal to meet the requirements of the EP&A Act.

1.3.2 Biodiversity Conservation Act 2016

Part 7 of the BC Act requires that the significance of the impact on threatened species, populations and threatened ecological communities is assessed using a five-part test listed in Section 7.3 of the BC Act. Where a significant impact is likely to occur, a species impact statement (SIS) must be prepared in accordance with the Environment Agency Head's requirements, or a Biodiversity Development Assessment Report (BDAR) must be prepared by an accredited assessor in accordance with the Biodiversity Assessment Method (BAM) (DPIE 2020a).

1.3.3 Fisheries Management Act 1994

The objects of the FM Act are to conserve, develop and share the fishery resources of the State for the benefit of present and future generations. If a planned development or activity is likely to have any impact on a threatened species listed under the Fisheries Management Act 1994 (FM Act), a preliminary assessment of the potential impacts must be made (the 'Assessment of Significance' or '7 part test'). Division 12, Part 7A of the FM Act sets out the factors which must be considered when assessing potential impacts on threatened species, populations or ecological communities listed under the FM Act.

1.3.4 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places, defined in the EPBC Act as matters of national environmental significance. The nine matters of national environmental significance to which the EPBC Act applies are:

- World heritage properties.
- National heritage places.
- Wetlands of international importance (often called 'Ramsar' wetlands after the international treaty under which such wetlands are listed).
- Nationally threatened species and ecological communities.
- Migratory species.
- Commonwealth marine areas.
- The Great Barrier Reef Marine Park.
- Nuclear actions (including uranium mining).
- A water resource, in relation to coal seam gas development and large coal mining development.

In September 2015, a "strategic assessment" approval was granted by the Federal Minister in accordance with the EPBC Act. The approval applies to Transport road activities being assessed under Division 5.1 (formerly Part 5) of the EP&A Act with respect to potential impacts on nationally listed threatened species, ecological communities and migratory species.

As a result, Transport road proposals assessed via an REF:

- Must address and consider potential impacts on EPBC Act listed threatened species, populations, ecological communities and migratory species, including application of the "avoid, minimise, mitigate and offset" hierarchy
- Do not require referral to the Department of Agriculture, Water and the Environment (DAWE) for these matters, even if the activity is likely to have a significant impact

- Must use the Biodiversity Assessment Method (BAM) to calculate credits that would offset significant impacts on EPBC Act listed threatened species, populations, ecological communities, and migratory species.

To assist with this, significant impact criteria assessments are required for all relevant biodiversity values in accordance with the Matters of National Environmental Significance: Significant impact guidelines 1.1. Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth of Australia 2013).

2. Methods

2.1 Personnel

The personnel involved in the assessment and an overview of their qualifications and experience is outlined in Table 2-1.

Table 2-1: Personnel

Name	Role	Qualifications
Ed Cooper	Senior Ecologist – Project director and technical review	BSc Hons (Environmental Biology), Accredited BAM Assessor (BAAS18047)
Karen Spicer	Senior Ecologist – Project manager, field survey and report preparation	B Env Sc (Hons 1), Accredited BAM Assessor (BAAS18141)
Sarah Cardenzana	Consultant Ecologist – Field survey and report preparation	B Env Sc (Conservation and Management), Accredited BAM Assessor (BAAS 21007)
Declan Moylan	Field Ecologist – Field survey	B Cons Bio (Hons) (Dean's Schol)

2.2 Survey effort and weather conditions

Field survey was undertaken on 10 May, 26 May, and 20 July 2022. Figure 2-3 shows the areas traversed during the vegetation assessment and targeted surveys. A total of 34.5 person hours were spent conducting vegetation mapping, plots, targeted flora and fauna survey and habitat assessment. The weather conditions during the survey period are listed below in Table 2-2.

Table 2-2: Weather conditions during the survey period

Date	Temp. min	Temp. max	Rain (mm)
10 May 2022	13	21	5
26 May 2022	12	22	0
20 July 2022	9	13	6.8

2.3 Background research

Background research has been conducted to collect and review information on the presence or likelihood of occurrence of:

- Threatened terrestrial and aquatic species and their habitat
- Threatened ecological communities
- Important habitat for migratory species
- Areas of outstanding biodiversity value.

A site-specific literature and database review was undertaken for the study area prior to undertaking the field survey and the preparation of this report. A minimum search area of 10 kilometres around the study area has been undertaken, which included the following sources:

- BioNet - the website for the Atlas of NSW Wildlife and Threatened Biodiversity Data Collection (TBDC) (DPE 2022a) (accessed throughout May to December 2022 as required); a 10km radius was used for database searches.
- BioNet Vegetation Classification Database (DPE 2022b) (accessed throughout May to December 2022 as required)

- Commonwealth Bureau of Meteorology's Atlas of Groundwater Dependent Ecosystems (GDE) (Commonwealth of Australia 2022) (accessed November 2022)
- eSPADE (DPE 2022c) (accessed May and June 2022)
- National Flying-fox monitoring viewer (DCCEEW 2022b) (accessed November 2022)
- NSW DPI Fisheries Spatial Data Portal (DPI 2022) (accessed November 2022)
- NSW ePlanning Viewer (DPE 2022d) (accessed throughout May to December 2022 as required)
- NSW State Vegetation Type Map (DPE 2022g)
- Protected Matters Search Tool (DCCEEW 2022) (accessed 25 October 2022); a 10km radius was used for database searches.
- SIX maps (LPI 2022) (accessed throughout May to December 2022 as required)
- The Native Vegetation of the Sydney Metropolitan Area - Version 3.1 (OEH, 2016) (accessed May 2022)

The following policies and guidelines were considered in the preparation of this report:

- 'Species credit' threatened bats and their habitats (OEH 2018b)
- Biodiversity Assessment Method (BAM) (DPIE 2020a)
- Biodiversity Assessment Method 2022 Operation Manual – Stage 1 (DPE 2022e)
- Biodiversity Assessment Method Operation Manual – Stage 2 (DPIE 2019)
- Biodiversity Assessment Method Operational Manual – Stage 1 (OEH 2018a)
- EPBC Act Matters of National Environmental Significance: Significant Impact Guidelines (DotE 2013)
- Guidelines for controlled activities on waterfront land - Riparian corridors (DPI 2018)
- Interim Biogeographic Regionalisation for Australia, Version 7 (DoEE 2012)
- Koala (Phascolarctos cinereus) Biodiversity Assessment Method Survey Guide (DPE 2022f)
- NSW Mitchell Landscapes – version 3.1 (DECC 2016)
- NSW Survey Guide for Threatened Frogs (DPIE 2020b)
- State Environmental Planning Policy (Biodiversity and Conservation) (2021)
- State Environmental Planning Policy (Resilience and Hazards) 2021
- Surveying threatened plants and their habitats (DPIE 2020c)
- Transport Biodiversity assessment guidelines (Transport 2022c)
- Transport Editorial Style Guide (Transport 2019)
- Transport No Net Loss Guidelines (Transport 2022a)
- Transport Tree and Hollow Replacement Guidelines (Transport 2022b)
- Threatened Species Test of Significance Guidelines (OEH 2018c).

Previous ecological studies, vegetation mapping and fieldwork undertaken in the same location as Stage 1B for corridor or route selection studies has been reviewed, including:

- Henry Lawson Drive Upgrade (Stage 1A), between Keys Parade and Tower Road Biodiversity Assessment Report (WSP 2021)
- Henry Lawson Drive Upgrade (M5 to Hume Highway) Biodiversity Assessment Report for Strategic Design (WSP 2019).

The review of these documents identified the following constraints within the Stage 1B study area (Figure 2-1 and Figure 2-2):

- Plant Community Type (PCT) 781: Coastal Freshwater Lagoons of the Sydney Basin and South East Corner. However, this community is not equivalent to the Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin

and South East Corner bioregions endangered ecological community (EEC) under the NSW Biodiversity Conservation Act 2016 (BC Act), given it is a constructed stormwater drain.

- PCT 835: Forest Red Gum - Rough-barked Apple Grassy Woodland on Alluvial Flats of the Cumberland Plain, Sydney Basin. This community is equivalent to River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions EEC under the NSW BC Act.
- PCT 1800: Swamp Oak Open Forest on Riverflats of the Cumberland Plain and Hunter valley. This community is equivalent to Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions EEC under the BC Act and potentially equivalent to Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community EEC under the EPBC Act.

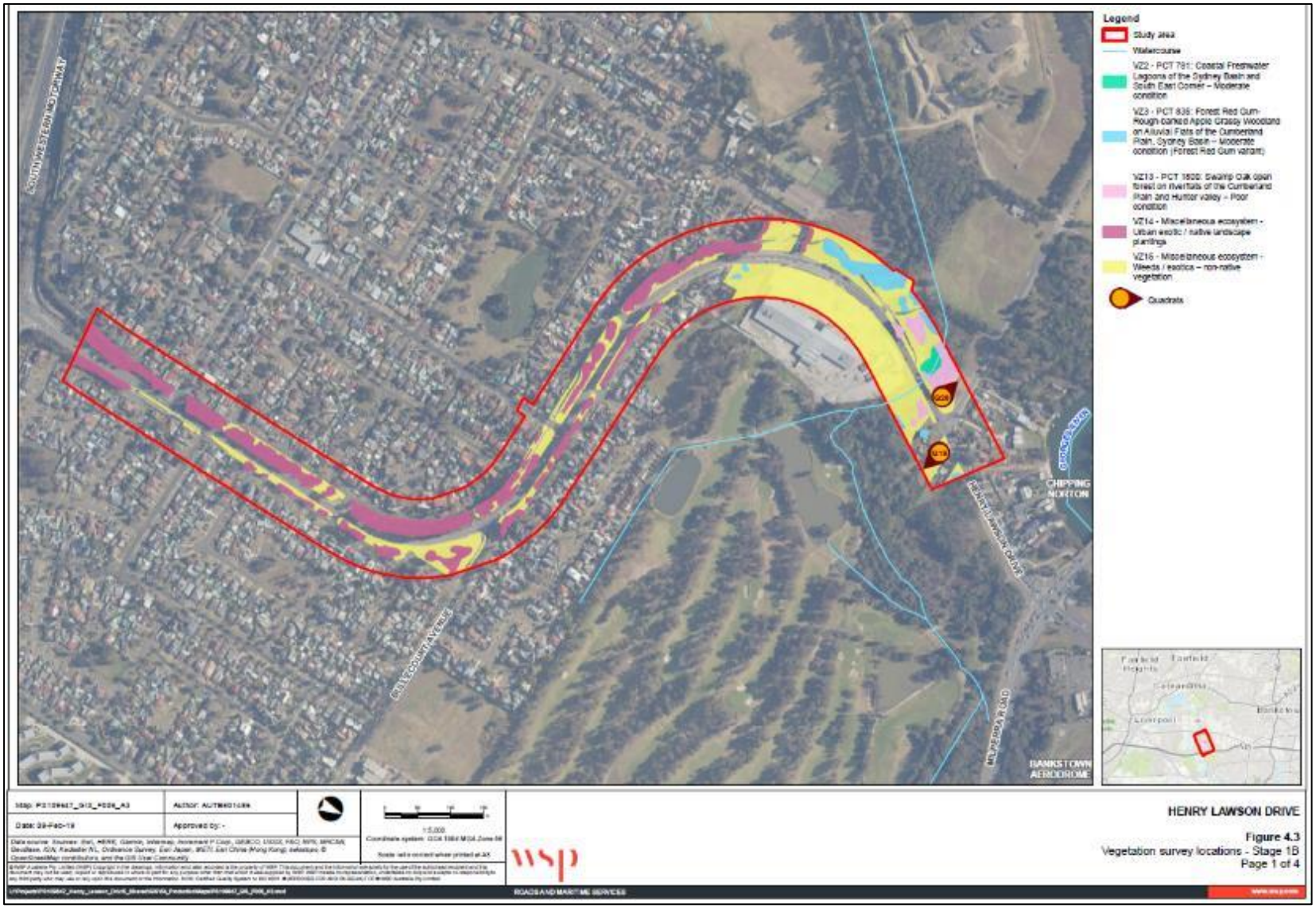

Figure 2-1. Vegetation communities identified in the Strategic BAR (WSP 2019) relevant to Stage 1B.

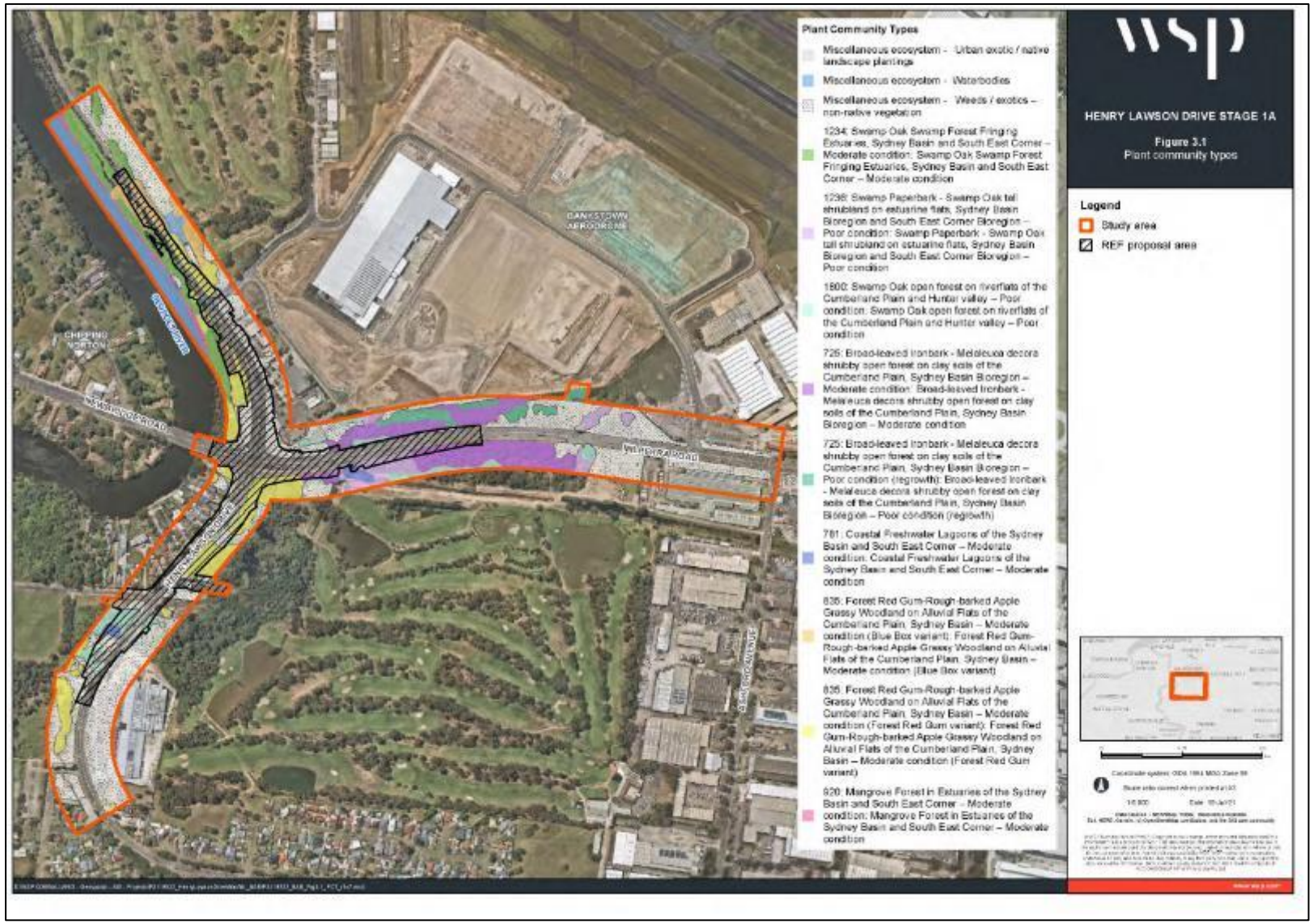

Figure 2-2. Vegetation communities identified in the Stage 1A BAR (WSP 2021) relevant to Stage 1B.

2.4 Vegetation assessment

2.4.1 Vegetation survey and classification

Vegetation survey and assessment has been completed in accordance with Chapter 4 of the Biodiversity Assessment Method (DPIE 2020a). Prior to undertaking field survey, vegetation mapping undertaken by OEH (2016) and the recently released NSW State Vegetation Type mapping (DPE 2022g) were reviewed. Field survey was undertaken on 10 May, 26 May, and 20 July 2022. Figure 2-3 shows the areas traversed during the vegetation assessment. A total of 34.5 person hours were spent conducting vegetation mapping, plots, targeted flora and fauna survey and habitat assessment.

During the vegetation survey, the dominant species within each structural layer was recorded. The field surveys were conducted to identify the extent of native vegetation, validate PCT boundaries and map the condition of vegetation zones (variation in the broad condition state of vegetation polygons) in accordance with Chapter 4 of the BAM (DPIE 2020a).

In determining the PCT for the study area, various attributes were considered in combination to assign vegetation to the best fit PCT. Attributes included (but not limited to) consideration of dominant species in each stratum and relative abundance, community composition, previous vegetation mapping, soil landscape and landscape position. Reference was made to the PCT descriptions in the NSW Vegetation Information Sydney (VIS) Classification Database (DPE 2022b) and the final determinations for assignment of TECs.

The categorisation of areas of planted native vegetation were determined using the Decision-making key (D.1) in Appendix D of the BAM. The decision-making key provides a framework for the assessment of planted native vegetation using the BAM. Justification for the assignment of planted native vegetation has been provided in Section 3.2.7. As per Appendix D of the BAM, planted native vegetation was assessed for threatened species habitat (eg. presence of stick nests and tree hollows).

All remaining areas of vegetation within the study area that do not contain native vegetation have been mapped as 'Exotic'. Justification as to why these areas do not support any native vegetation has been provided in Section 3.2.8.

Vegetation zones

PCTs have been delineated into vegetation zones based on broad condition states. Disturbance to growth form groups for tree, shrub and ground cover or extent of exotics (or combinations of these) have been used to identify areas of similar condition. Vegetation zones have been broadly assessed in accordance with the definitions outlined in Table 2-3.

Table 2-3: Vegetation condition classes and definitions.

Condition Class	Definition
Good	Vegetation still retains full 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 generally exhibit <10% foliage cover.
Moderate	Vegetation has retained some native canopy and shows signs of significant regeneration. The understorey and groundcover layers are generally co-dominated by exotic species that generally exhibit between 10–49% foliage cover. The mid and low stratums may have been structurally modified as a result of previous clearing.
Low	Vegetation has limited retained native canopy and the canopy cover is showing occasional signs of regeneration. The understorey and groundcover layers of this condition are absent and/or the understorey is generally dominated or co-dominated by exotic species (i.e. foliage cover >50%). Native species diversity is generally relatively low and the mid and low stratums have been structurally modified.
Exotic	Vegetation displays no native canopy and is not showing signs of regeneration. The understorey and groundcover layers of this condition are dominated by exotic species (i.e. foliage cover >80%). Native species diversity in all stratums is low or absent because of high disturbance.

Following the collection of data from vegetation integrity plots, these condition classes were revised to be consistent with the BAM (Section 9.2.1) and Transport guidelines, where vegetation zones were assigned a 'Low' condition if the vegetation integrity score (VI score) was:

- VI <15, where the PCT is representative of an endangered ecological community (EEC) or a critically endangered ecological community (CEEC).
- VI <17, where the PCT is associated with threatened species habitat (as represented by ecosystem credits) or represents a vulnerable ecological community (VEC).
- VI <20, where the PCT does not represent a TEC and is not associated with threatened species habitat.

'Moderate to good' condition was assigned to vegetation zones with VI scores above these thresholds. These revised condition classes were adopted to assist with determining offsets as per the Transport guidelines and thresholds (Section 7.1). See Section 3.2 for further discussion of these results.

Plot-based vegetation survey

A plot-based full floristic survey has been completed in accordance with subsection 4.3.4 of the BAM. Table 2-4 lists the minimum number of plots required per hectare for each vegetation zone. Due to the degraded and linear nature of the survey area, and the small size of each vegetation zone, it was not always possible to establish plots beyond 50m of ecotones, vehicle tracks and their edges, or other disturbed areas that are easily distinguishable from the broad condition state of the vegetation zone. In some cases, it was not possible to fit a standard plot within a vegetation zone and where this has occurred, the plot dimensions have been altered to ensure the plot was situated to capture a 400 m^2 floristic plot and a 1000 m^2 function plot. Plots were located to ensure they captured all attributes relevant to that vegetation zone. Note only a floristic plot is required for PCT 781.

Each plot was established around a central 50 metres (or 100 metres) midline as follows (Table 2-5):

- One 400 m^2 plot (standard 20m × 20m), to assess all the composition and structure attributes.
- One 1000 m^2 (standard 20m × 50m) plot, to assess the function attributes (number of large trees, stem size classes, tree regeneration and length of logs).
- Five 1m^2 subplots, to assess average litter cover (and other optional ground cover components) for the plot.

Where a 100 metre midline was used, the plot size was adjusted to equal the same area (i.e. a 10m x 40m floristic plot and a 10m x 100m function plot). A summary of the number of plots required for each vegetation zone is outlined in Table 2-6.

Chapter 4 of the BAM (Full floristic surveys) is not required for areas not identified as native vegetation (exotic vegetation and planted native vegetation). As such, no plots were established within these zones.

Table 2-4: Minimum number of plots required per zone area

Vegetation zone area (ha)	Minimum number of plots/midlines
<2	1 plot/midlines
>2-5	2 plots/midlines
>5-20	3 plots/midlines
>20-50	4 plots/midlines
> 50–100	5 plots/midlines
> 100–250	6 plots/midlines
> 250–1000	7 plots/midlines; more plots may be needed if the condition of the vegetation is variable across the zone.
> 1000	8 plots/midlines; more plots may be needed if the condition of the vegetation is variable across the zone.

Table 2-5: Growth form groups and condition attributes used to assess the composition, structure and function components of vegetation integrity (copied from Table 2 of the BAM).

Condition attributes used assess composition		
Tree richness	Tree cover	Number of large trees
Shrub richness	Shrub cover	Tree regeneration
Grass and grass-like richness	Grass and grass-like cover	Tree stem size classes
Forb richness	Forb cover	Total length of fallen logs
Fern richness	Fern cover	Litter cover
Other richness	Other cover	High threat weed cover

Table 2-6: Minimum number of plots required and completed per vegetation zone

Veg zone	PCT (entered into BAM C)	Condition	Area (ha) within study area	No. plots required	No. plots completed (plot IDs)
1	PCT 725 - Broad-leaved Ironbark - Melaleuca decora shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion	Low	0.14	1	1 – Plot 6
2	PCT 781 - Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion	Good	0.08	1	1 – Plot 5 (50m x 8m due to limited extent of vegetation zone; floristics only - function data not required for this PCT)
3	PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Moderate	2.20	1	3 – Plot 2, 4 and 7. Plot 7 had dimensions of 10m x 100m due to shape of roadside planting
4	PCT 1067 - Parramatta Red Gum woodland on moist alluvium of the Cumberland Plain, Sydney Basin Bioregion	Moderate	0.13	1	1 - Plot 1
5	PCT 1800 - Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley	Moderate	0.99	1	1 - Plot 3

2.4.2 Patch size

As per Section 4.3.2 of the BAM, patch size for each vegetation zone was calculated by including native vegetation less than 100m from a mapped polygon of a vegetation zone to generate a 'patch size'. Patch size for each vegetation zone was assigned to one of the following classes: <5 ha, 5-25 ha, 25-<100 ha, and >100 ha. Based on GIS assessment of patch sizes, each vegetation zone was assigned a patch size of >100ha and was entered into the BAMC.

2.4.3 Native vegetation cover

In accordance with Section 3.2 of the BAM, native vegetation cover must be assessed for a 1,500 m assessment buffer around the subject land to assess the habitat suitability for threatened species. The extent of native vegetation on the subject land and immediate surrounds was mapped using DPE (2022g).

The total area of the 1,500 m buffer around the subject land is 1,558 ha, with the area of native vegetation mapped within the buffer being 312 ha. This equates to a native vegetation cover of 20 % (>10-30 % class as defined in the BAM) and this value was entered into the BAM calculator (Table 2-7).

Table 2-7: Native vegetation cover in the assessment area

Assessment area (ha)	1,558 ha
Total area of native vegetation cover (ha)	312 ha
Percentage of native vegetation cover (%)	20 %
Class (0-10, >10-30, >30-70 or >70%)	>10-30

2.5 Threatened species assessment

2.5.1 Habitat suitability assessment

A habitat assessment was undertaken to assess the likelihood of each threatened and/or migratory species to occur in the study area. The assessment was based on the results of database searches within a 10 kilometre radius of the study area from both BioNet and the Protected Matters Search Tool (PMST), as well as a review of Schedule 4, 4A and 5 of the FM Act. The likelihood of occurrence of threatened species was based on the presence, condition, and type of habitat, as well as previous records.

Information in the threatened biodiversity data collection (TBDC; DPE 2022a) was considered during habitat assessment for each threatened species potentially occurring, including geographic limitations and habitat constraints (e.g. mapped important areas) where applicable. The likelihood of a species occurring is to be assessed using the criteria detailed in Appendix B. A species may be considered likely to occur where:

- The geographic distribution of the species is known or predicted to include the IBRA subregion in which the proposal site is located.
- The study area contains habitat constraints associated with the species e.g. hollow-bearing trees, stick nests etc. The presence of these habitat constraints was surveyed and mapped during the field survey period.
- Past surveys undertaken at the proposal site indicate that the species is present.

The habitat assessment has formed the basis for determining whether targeted surveys are required. The need for targeted surveys has considered all threatened species-credit species associated with the PCTs in the study area. These species-credit species were identified by the BAM-C based on plot data and landscape information collected in the field and from GIS.

2.5.2 Targeted surveys

Targeted surveys for species credit species (or dual credit species where breeding habitat is identified) with a moderate to high likelihood of occurrence (as per Appendix B) have been undertaken in accordance with Section 5.3 of the BAM and the relevant threatened species survey guidelines (DPIE 2020c). The survey effort, timing and locations for species credit flora and fauna species are outlined in the following sections. In accordance with the BAM, targeted survey is not required for ecosystem-credit species.

Species not identified as candidate species for further assessment do not require targeted threatened species survey. This includes species that have a low or unlikely possibility of occurring within the study area, and/or species that are not classified as species credit species (or dual credit species) (see Appendix B for further details on classification and likelihood of occurrence).

Several dual credit species were considered to have a moderate likelihood of occurring within the study area. However, specific habitat constraints that provide essential breeding habitat were not present within the study area. As such, targeted survey for these species was not required and these species are considered to be ecosystem credit species. These species and their breeding habitat constraints include:

- *Haliaeetus leucogaster* (White-bellied Sea Eagle) – no living or dead mature trees containing a large stick nest within the canopy were recorded. This survey was conducted in July, consistent with the recommended survey timing.
- *Minopterus australis* (Little Bent-winged Bat) and *Miniopterus orianae oceanensis* (Large Bent-winged Bat) – no breeding habitat present within the study area (caves, tunnels, mines, culverts).
- *Ninox strenua* (Powerful Owl) – no living or dead trees with a hollow greater than 20 centimetres diameter were recorded.
- *Pandion cristatus* (Eastern Osprey) – no stick nests in living and dead trees of greater than 15 metres or artificial structures within 100 m of a floodplain were recorded. This survey was conducted in May and July, consistent with the recommended survey timing.
- *Pteropus poliocephalus* (Grey-headed Flying-Fox) – no breeding camps are present within the study area.

Targeted flora surveys

Targeted surveys were undertaken for five species credit flora species considered to have a moderate likelihood of occurrence prior to undertaking the field survey:

- *Acacia pubescens* (Downy Wattle): detected during assessment of the Stage 1A and Strategic BARs. BioNet records from 2009 occur within the study area.
- *Callistemon linearifolius* (Nettled Bottle Brush): detected during assessment of the Stage 1A and Strategic BARs.
- *Dillwynia tenuifolia*: not detected in previous Stage 1A or Strategic BAR surveys but has potential habitat within the study area.
- *Grevillea juniperina* subsp. *juniperina* (Juniper-leaved Grevillea): not detected in previous Stage 1A or Strategic BAR surveys but has potential habitat within the study area.
- *Haloragis exalata* subsp. *exalata* (Square Raspwort): not detected in previous Stage 1A or Strategic BAR surveys but has potential habitat within the study area.

Targeted surveys for species credit flora species were undertaken on the 3rd and 24th May 2022 and 20 July 2022 in accordance with 'Surveying threatened plants and their habitats: NSW survey guide for the Biodiversity Assessment Method' (DPIE 2020c). Details of targeted surveys are outlined in Table 2-8. Survey tracks are shown in Figure 2-3.

Table 2-8: Targeted threatened flora survey details

Species name	Common name	Required survey period	Associated PCTs in the study area	Minimum survey requirements[1]	Survey completed
Acacia pubescens	Downy Wattle	Year round	PCT 725	Targeted parallel traverses 10m wide in dense vegetation and 20m wide in open vegetation	Yes – survey completed within both PCTs and along disturbed roadsides.
Callistemon linearifolius	Netted Bottle Brush	October to January (when flowering)	PCT 725 PCT 835	Targeted parallel traverses 10m wide in dense vegetation and 20m wide in open vegetation	Yes – survey completed within both PCTs (conducted outside flowering period, however plant still visible whilst not flowering).
Dillwynia tenuifolia	-	August to October (when flowering)	PCT 725 PCT 1067	Targeted parallel traverses 10m wide in dense vegetation and 20m wide in open vegetation	Yes – survey completed within relevant PCTs (conducted outside flowering period, however plant still visible whilst not flowering).
Grevillea juniperina subsp. *juniperina*	Juniper-leaved Grevillea	Year round	PCT 725	Targeted parallel traverses 10m wide in dense vegetation and 20m wide in open vegetation	Yes – survey completed within potential habitat in both PCTs.
Haloragis exalata subsp. *exalata*	Square Raspwort	Year round	PCT 781	Targeted parallel traverses 5m wide in dense vegetation and 10m wide in open vegetation	Yes – survey completed within potential habitat in relevant PCT.

Note: 1. Based on BAM survey guidelines (DPIE 2020c).

Targeted fauna surveys

Targeted fauna surveys were undertaken for one species credit fauna species considered to have a moderate likelihood of occurrence within the study area:

- *Litoria aurea* (Green and Golden Bell Frog): species credit species. Potential habitat within Milperra Drain as it contains emergent aquatic vegetation.

Targeted surveys for Green and Golden Bell Frog were conducted by WSP in 2018 as part of the Stage 1A assessment. Although targeted surveys by WSP only focused on the northern portion of the Stage 1B study area (near Milperra Drain), this is the only area of suitable habitat for Green and Golden Bell Frog within the study area. As such, this survey has also been utilised for the Stage 1B proposal. Details of targeted surveys are outlined in Table 2-9. Survey details are shown in Figure 2-4.

Due to project timing not aligning with the optimal timing or conditions to detect some species, targeted surveys have not been conducted for the following species credit species with a moderate likelihood of occurrence within the study area:

- *Meridolum corneovirens* (Cumberland Plain Land Snail): potential habitat within unmown areas of PCT 835, including leaf litter and logs. All other associated PCTs did not have suitable habitat for this species, as they are predominately mown and/or lacked a good cover of leaf litter and logs. Numerous records of this species within the locality.
- *Myotis macropus* (Southern Myotis): suitable foraging and breeding habitat (tree hollows) within the study area. Several records of this species within the locality. Detected roosting in a culvert under Henry Lawson Drive near Tower Road as part of the Stage 1A assessment (WSP 2021).

Based on the Transport guidelines, where a species credit species with a moderate to high likelihood of occurrence has not been adequately surveyed, then the species may be assumed present. There is also potential for these species to be surveyed prior to project commencement. See Section 3.5 for further details.

Table 2-9: Targeted threatened fauna survey details

Species name	Common name	Required survey period	Associated PCTs in the subject land	Minimum survey requirements[1]	Survey completed
Litoria aurea	Green and Golden Bell Frog	November – March	PCT 725 PCT 781 PCT 835 PCT 1067 Note: suitable habitat only present in Milperra Drain.	Nocturnal call playback (One playback on each of two separate nights) Systematic day habitat search (One hour per stratification unit) Night habitat search of damp and watery sites (30 minutes on two separate nights) Night watercourse search (Two hours per 200m of water body edge) Minimum of one site per defined water body (retaining potential habitat) in the early evening and completed on each of four separate nights.	Surveys undertaken by WSP (2021) on 4–5 December & 12–13 December 2018 after a significant rainfall event of >50 mm: • Call playback (4 nights after heavy rainfall event (>50mm). Multiple sites including Milperra Drain. • Spotlighting and active searches – 26 person hours • 4 days of opportunistic sightings

Note: 1. Based on BAM survey guidelines (DPIE 2020c).

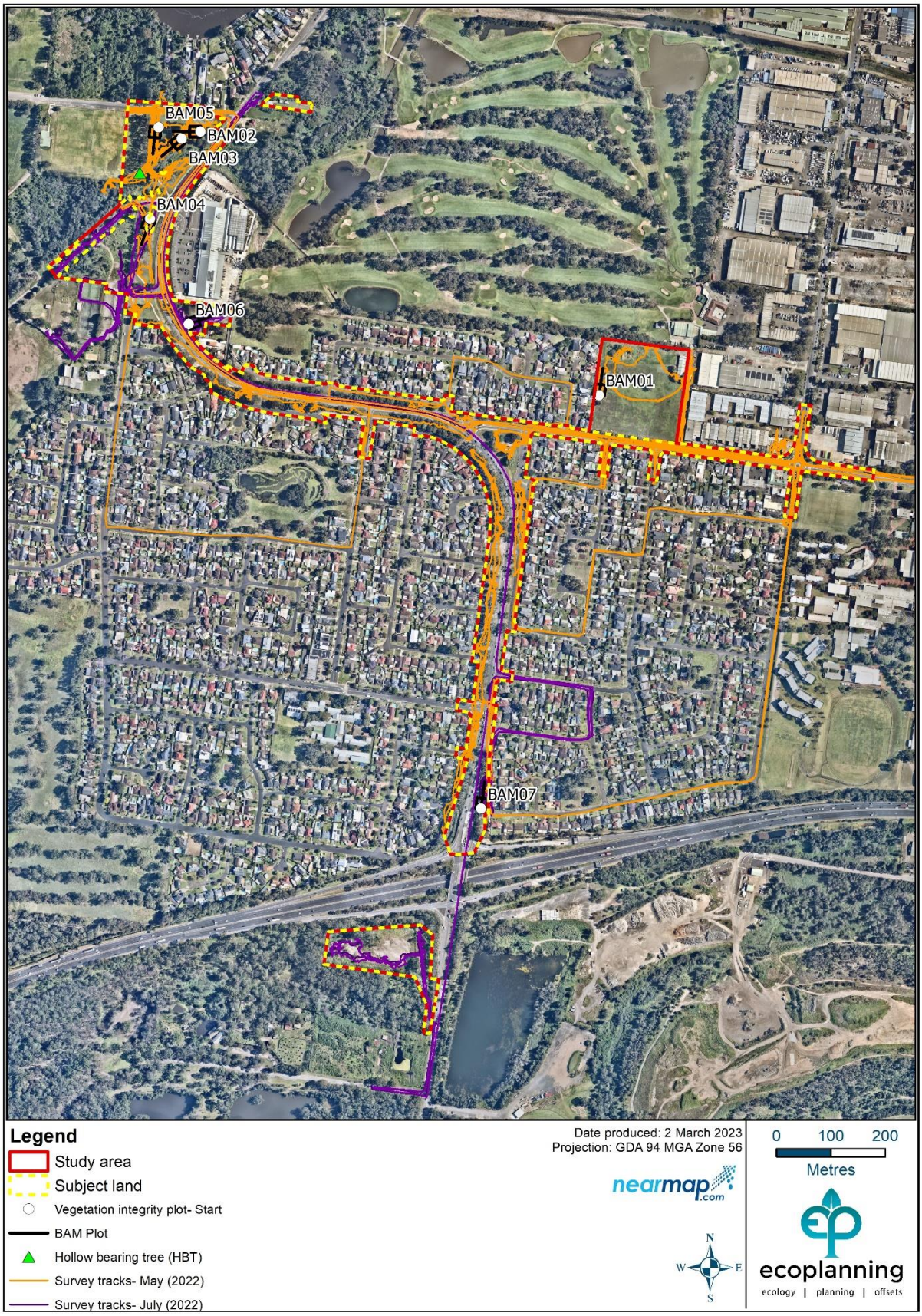

Figure 2-3: Threatened species habitat assessment and targeted survey tracks.

Figure 2-4: Location of Green and Golden Bell Frog surveys undertaken for the Stage 1A project (WSP 2021).

2.6 Aquatic surveys

A habitat assessment was conducted for threatened species, populations and ecological communities listed under the FM Act. The habitat value of each waterway (i.e. habitat sensitivity and classification of waterways for fish passage) has been characterised in accordance with NSW DPI (Fisheries) document *Policy and Guidelines for fish habitat conservation and management (2013 update)*. Locations of aquatic habitat assessment are shown in (Figure 2-5).

The waterway habitat assessment included:

- The ecosystem type (eg wetlands, floodplains, streams, estuaries, lakes)
- Dimensions of waterway and depth of water
- Flow characteristics and hydrological features of aquatic habitat, including changes to drainage and filtration and flow regime
- Bed substrate (eg rocks, coral, gravel, sand, mud)
- Habitat features (eg pools, riffles, billabongs, reefs)
- Existing infrastructure and barriers to fish movement (natural or artificial)
- Width and species composition of riparian vegetation including the type of vegetation present (eg macrophytes, snags, seaweeds, seagrasses, mangroves, saltmarsh) and condition
- Water quality (based on visual observations)

In addition, aquatic habitat assessment was undertaken by WSP (2021) as part of the assessment for Stage 1A. Two of these habitat assessment sites were located within the 1B study area (Site 11 and 12) along Milperra Drain. This assessment used the Riparian, Channel and Environmental Inventory method (RCE) (Chessman et al., 1997), which involved evaluation and scoring of the characteristics of the adjacent land, the condition of riverbanks, channel and bed of the watercourse and degree of disturbance evident at each site. The maximum score (52) indicates a stream with little or no obvious physical disruption and the lowest score (13) indicates a heavily channelled stream without any riparian vegetation and is in poor condition.

A detailed aquatic fauna survey is only required where the proposal is on a Class 1 or 2 watercourse (DPI 2013), where it has been identified there may be a significant impact on a threatened aquatic species or where the proposal crosses 'critical habitat'. Detailed survey is not required for the study area, as the watercourse is not a Class 1 or 2 watercourse (refer to Table 2 of DPI 2013).

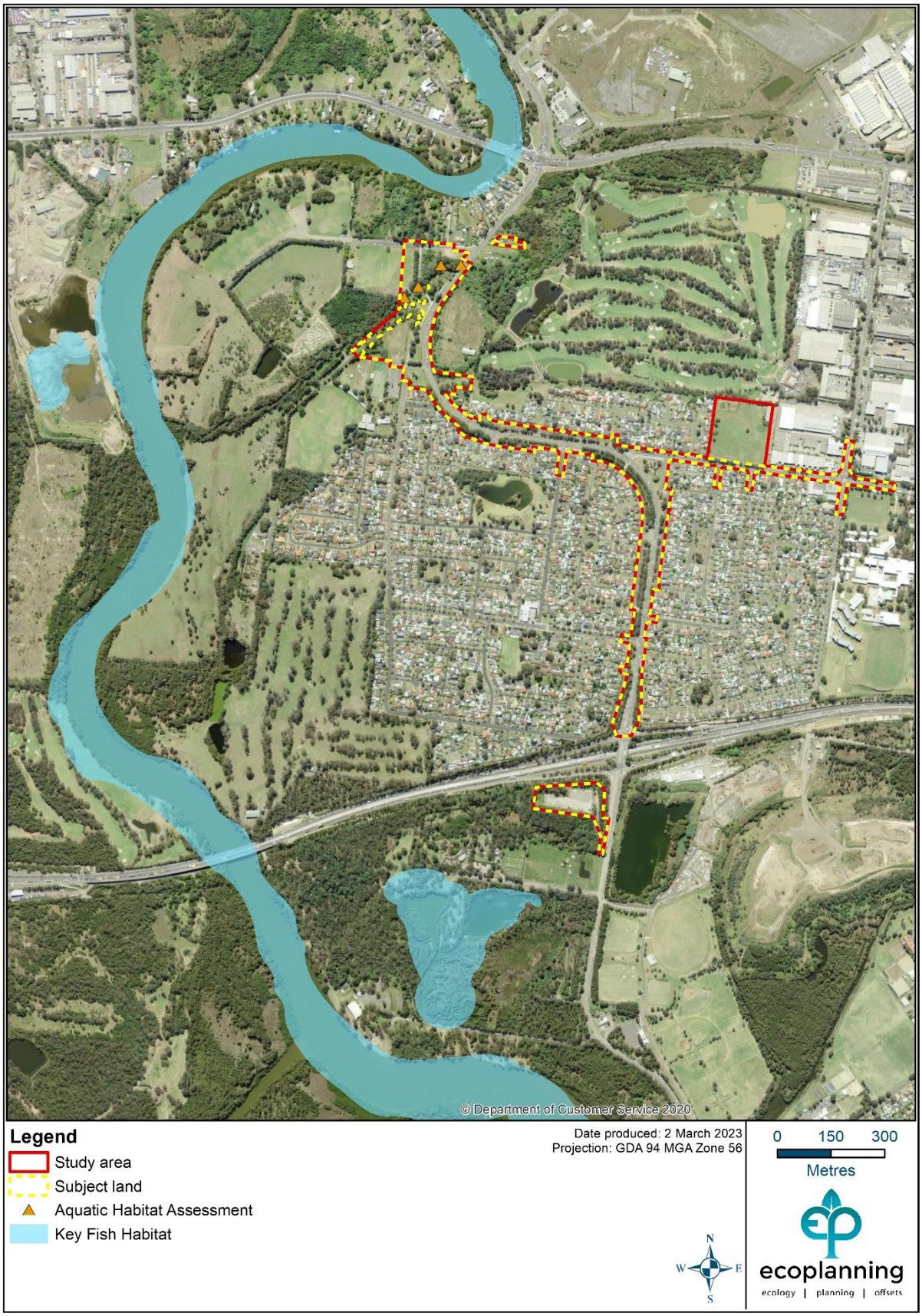

Figure 2-5: Aquatic habitat assessment locations and Key Fish Habitat.

2.7 Limitations

Field surveys and survey effort was performed, where possible, in accordance with the Biodiversity Assessment Method and associated guidelines. Where survey was not undertaken, species with a moderate to high likelihood of occurrence were assumed to be present.

Although a detailed list of flora was recorded during the site survey, this is not comprehensive as it is only restricted to what was observed on the day of survey. A definitive list of the flora and fauna within the study area cannot be gathered without systematic traverses and survey across a number of seasons. Additional species may therefore be recorded during a longer survey over various seasons. However, the techniques used in this investigation are considered adequate to gather the data necessary to validate the vegetation communities and vegetation condition in the study area and assess the likelihood of occurrence of any threatened flora and fauna species.

3. Existing environment

3.1 Landscape features

Landscape features provide a general description of the study area in relation to its topographic and hydrological setting, geology and soils. The landscape features assessed for the study area are outlined below and shown in Figure 1-1.

3.1.1 IBRA regions and subregions

The IBRA (DoEE 2012) represents a landscape-based approach to classifying the land surface, including attributes of climate, geomorphology, landform, lithology, and characteristic flora and fauna species present. The study area is located entirely within the Cumberland IBRA subregion (Version 7), which forms part of the Sydney Basin IBRA region (Version 7) (Figure 1-1).

3.1.2 NSW landscape regions (Mitchell Landscapes)

The study area is situated within the Georges River Alluvial Plain and Ashfield Plains landscapes (Figure 1-1).

The Georges River Alluvial Plain includes channel, floodplain and terraces of the Georges River on Quaternary and Tertiary alluvial sediments. It contains mostly clayey sand and sand with limited gravel on the highest terrace. General elevation is 0 to 30 metres, and local relief is 10 metres. It comprises massive uniform or gradational profiles on yellow brown to orange clayey sand. Podsols with well-developed double pans occur on limited areas of deep quartz sand, stony, harsh, yellow, texture-contrast soils on higher terraces. It contains forests and woodlands of cabbage gum (*Eucalyptus amplifolia*), rough-barked apple (*Angophora floribunda*), broad-leaved ironbark (*Eucalyptus fibrosa* ssp. *Fibrosa*), scribbly gum (*Eucalyptus sclerophylla*) and narrow-leaved apple (*Angophora bakeri*). Extensive area of swamp oak (*Casuarina glauca*) occur along the riverbanks and in low-lying areas often with prickly-leaved paperbark (*Melaleuca styphelioides*). These areas extend to brackish estuarine swamps with grey mangrove (*Avicennia marina*) and limited saltmarsh (DECC 2016).

The Ashfield Plains landscape is characterised by undulating hills and valleys on horizontal Triassic shale and siltstone, and occasional on quartz sandstones (especially near the margin of the Port Jackson landscape). General elevation is 0 to 45m, and local relief is <20m. It is a coastal extension of the Cumberland Plain landscape. It comprises red and brown texture-contrast soils on crests; grading to yellow harsh texture-contrast soils in valleys. It consists of open forest of broad-leaved ironbark (*Eucalyptus fibrosa* ssp. *Fibrosa*), grey box (*Eucalyptus moluccana*); with tea-tree (*Leptospermum* sp.) along creeks; and as well as forests of turpentine (*Syncarpia glomulifera*), red mahogany (*Eucalyptus resinifera*), grey gum (*Eucalyptus punctata*), Sydney blue gum (*Eucalyptus saligna*) and blackbutt (*Eucalyptus pilularis*) (DECC 2016).

3.1.3 Soils and geology

The study area occurs over the following three soil landscapes (DPE 2022c):

- Disturbed terrain (9030xx) – landscape has been disturbed by human activity to a depth of at least 100 centimetres; most areas have been levelled to slopes of <5% and the original vegetation has been completely cleared. The landscape occurs within the northern part of the study area along Henry Lawson Drive down to the intersection with Auld Ave. This disturbance was likely created in relation to the construction of the Bankstown Airport and Bankstown Golf Club and includes the mapped coastal wetlands shown in Figure 1-1.
- Richmond (9030ri) – landscape features Quaternary terraces of the Georges Rivers. Mainly flat land (slopes <1%) with splays and levees of <3 metre local relief. Tree cover is now almost completely cleared and urbanised, but was formerly a low open-woodland (dry sclerophyll). Quaternary alluvium consisting of sand, silt and gravels derived from sandstone and shale. This landscape occurs in the northern part of the study area from Auld Ave to the intersection with Amiens Ave. It also occurs at the ancillary facility south of the M5 Motorway.
- Blacktown (9030bt) – landscape features gently undulating rises on Wianamatta Group shales. Local relief to 30 metres and slopes usually >5% with broad rounded crests and ridges with gently inclined slopes. Cleared eucalypt woodland and tall open-forest (dry sclerophyll forest). Geology includes Wianamatta Group—Ashfield Shale consisting of laminite and dark grey siltstone, Bringelly Shale which consists of shale with occasional calcareous claystone, laminite and infrequent coal, and Minchinbury Sandstone consisting of fine to medium-grained quartz lithic sandstone. This is a widely distributed soil landscape on the Cumberland Plain. Within the study area, it occurs along Henry Lawson Drive from the intersection with Amiens Ave south to the M5 Motorway and also extends east along Bullecourt Avenue and Ashford Avenue, including the ancillary facility between Bullecourt Avenue and the Bankstown Golf Course.

3.1.4 Rivers, streams and estuaries

The study area intersects a second order stream (Strahler 1952) (Milperra Drain) within the northern extent, adjacent to Gordan Parker Reserve. This stream runs westward towards the Georges River, forming part of the Georges River Catchment (Figure 1-1). No other watercourses are present within the study area.

Local and important wetlands

Under the BAM (DPIE 2020a), a local wetland is defined as 'an area of land that is wet by surface water or groundwater, or both, for long enough periods that the plants and animals in it are adapted to, and depend on, moist conditions for at least part of their life cycle. Wetlands may exhibit wet and dry phases, and may be wet permanently, cyclically, or intermittently with fresh, brackish or saline water'. An Important Wetland is a wetland listed under the Directory of Important Wetlands of Australia (DIWA) (DCCEEW 2022b) or an area included under the State Environmental Planning Policy (Resilience and Hazards) (Chapter 2 – Coastal Management). One important wetland occurs along the boundary of the northern ancillary facility and the study area intersects the coastal wetland proximity area (Figure 1-1).

Key fish habitat

No key fish habitat occurs within the study area. However, Key Fish Habitat is mapped along the Georges River north and west of the study area, occurring around 570 metres downstream of the study area. Furthermore, a coastal wetland south of the study area is also mapped as Key Fish Habitat (Figure 1-1).

3.1.5 Areas of geological significance and soil hazard features

No other landscape features including areas of geological significance (including karst, caves, crevices and cliffs) occur within the study area. The study area does comprise areas with a high probability of acid sulfate soil risk (Naylor et al 1998), particularly alluvial sediments associated the Georges River Alluvial Plain Mitchell Landscape (Figure 1-1).

3.2 Plant community types and vegetation zones

Five PCTs were identified and mapped within the study area:

- PCT 725 – Broad-leaved Ironbark – Melaleuca decora shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion.
- PCT 781 – Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion.
- PCT 835 – Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion.
- PCT 1067 – Parramatta Red Gum woodland on moist alluvium of the Cumberland Plain, Sydney Basin Bioregion.
- PCT 1800 – Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley.

In addition, two vegetation zones were assigned that did not conform to a locally occurring PCT:

- Planted native vegetation.
- Exotic vegetation.

The five PCTs were assigned to condition classes aligning with vegetation integrity scores and followed Transport guidelines. A summary of the PCT and vegetation zones within the study area is provided in Table 3-1, Figure 3-1 (northern half of the study area) and Figure 3-2 (southern half of the study area). Table 3-1 also includes patch size, VI score and condition class (for Transport offset thresholds). A description of the vegetation community, including justification for the assigned vegetation community and PCT, is provided in the following sections.

Table 3-1: Plant community types and vegetation zones including patch size, vegetation integrity (VI) score and revised condition.

Plant community type (PCT)	VI score and assigned Transport condition	Patch size	Threatened ecological community (BC Act listed)	Area (ha) in study area
PCT 725 – Broad-leaved Ironbark – Melaleuca decora shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion	11.5 – Low	>100 ha	Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion	0.14
PCT 781 – Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion	51.6 – Good	>100 ha	Not a TEC – artificial wetlands created on previously dry land for purposes such as stormwater management are not regarded as part of the Freshwater Wetlands on Coastal Floodplain TEC.	0.08
PCT 835 – Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	35.4 – Moderate	>100 ha	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	2.20
PCT 1067 – Parramatta Red Gum woodland on moist alluvium of the Cumberland Plain, Sydney Basin Bioregion	15.8 – Moderate	>100 ha	Castlereagh Swamp Woodland Community0	0.13
PCT 1800 – Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley	15.5 – Moderate	>100 ha	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	0.99
N/A	Planted Native Vegetation	N/A	N/A	2.66
N/A	Exotic Vegetation	N/A	N/A	8.47

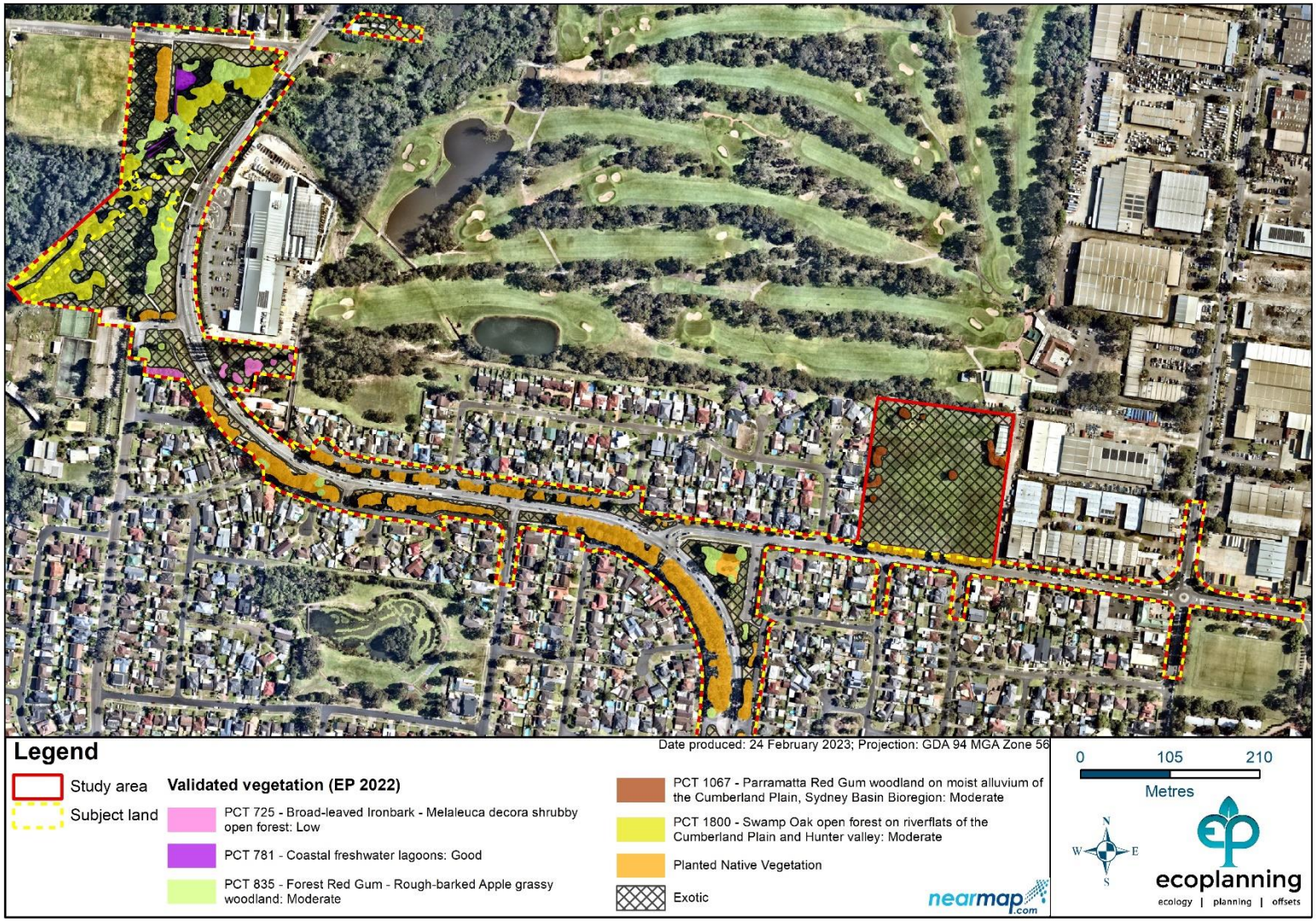

Figure 3-1: Plant community types and vegetation zones (north).

Figure 3-2: Plant community types and vegetation zones (south).

3.2.1 PCT 725 – Broad-leaved Ironbark – Melaleuca decora shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion

Description

PCT 725 Castlereagh Ironbark Forest is one of two closely related ironbark shrub-grass forests found in western Sydney that occur on gravelly-clay soils, the other community being Castlereagh Shale-Gravel Transition Forest. Castlereagh Ironbark Forest is associated with clay soils derived from Tertiary alluvial deposits. The structure ranges from a moderately tall open eucalypt forest or woodland to a low dense thicket of paperbarks with low emergent eucalypts. The latter is prevalent across the catchment of the Cooks River and is recognised in other classifications as Cooks River Clay Plain Scrub. Broad-leaved ironbark (*Eucalyptus fibrosa*) is the most commonly recorded eucalypt although at some sites it may be absent. Woollybutt (*Eucalyptus longifolia*) is a regular associate. A prominent small tree layer of *Melaleuca decora* features above a dense cover of shrubs that include *Melaleuca nodosa*, Blackthorn (*Bursaria spinosa*) and Peach Heath (*Lissanthe strigosa*). The ground layer is a sparse cover of grasses and forbs. These may be very depauperate in locations where dense shrub layers exclude light and suppress plant growth (DPE 2022b).

PCT 725 had a small distribution within the study area, with one small patch situated immediately south of Flower Power and another small strip of planted vegetation on the opposite side of Henry Lawson Drive, that was assigned to this PCT due to the dominance of *Eucalyptus longifolia* (Woollybutt). This PCT was characterised by a canopy of *Eucalyptus fibrosa* (Red Ironbark) and *Eucalyptus longifolia* (Woollybutt) within a mown park. The mid-storey was completely absent from this zone. The ground layer was predominately exotic, dominated by *Cenchrus clandestinus* (Kikuyu Grass), *Eragrostis tenuifolia* (Elastic Grass) and *Axonopus compressus* (Broad-leaved Carpet Grass). Only a small cover of native grasses and forbs were present within the zone, including *Cynodon dactylon* (Common Couch), *Cyperus* sp. and *Einadia polygonoides* (Knotweed Goosefoot).

PCT ID	725
PCT name	Broad-leaved Ironbark – Melaleuca decora shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion
Vegetation class	Cumberland Dry Sclerophyll Forests
Vegetation formation	Dry Sclerophyll Forests (Shrub/grass sub-formation)
Estimate of per cent cleared	95%
Area in study area	0.14 ha
Conservation status	BC Act: Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion (EEC) EPBC Act: Cooks River/Castlereagh Ironbark Forest of the Sydney Basin Bioregion (CEEC) (See Section 3.3 for further discussion of TECs)
Vegetation zones (condition) and plots	Zone 1: 725 Low – Intact canopy with a degraded mid-storey and mown exotic ground layer. Plot 6

Justification for PCT selection:

PCT 725 was selected based on species composition, landscape position and geology. Within the study area, PCT 725 is highly degraded with minimal native species diversity. Species characteristic of this PCT (as per DPE 2022b & OEH 2016) present within the vegetation zone include *Eucalyptus fibrosa*, *Eucalyptus longifolia* and *Melaleuca decora.* A patch of planted native vegetation was also assigned to this vegetation zone based on the dominance of *Eucalyptus longifolia.* *Corymbia maculata* was also presence within this planted patch, but in lower densities.

Within the study area, PCT 725 occurs on the Richmond soil landscape, which is characterised by Quaternary alluvium consisting of sand, silt and gravels derived from sandstone and shale. Similarly, PCT 725 is associated with clay soils derived from Tertiary alluvial deposits (OEH 2016).

Other PCTs considered for selection include the closely related PCT 724, which is mapped by OEH (2016) in proximity to this vegetation zone. PCT 724 occurs on similar substrates to PCT 725 and has similar floristic structure. However, a distinguishing feature of PCT 725 is the presence of *Eucalyptus longifolia*, which is not associated with PCT 724. As *E. longifolia* was present within the vegetation zone, it was considered PCT 725 was the best fit PCT.

Floristic and structural summary of PCT 725 within the study area

Growth form	Typical species
Trees	*Eucalyptus fibrosa* *Eucalyptus longifolia* *Corymbia maculata*
Shrubs	None present
Grass and grass-like	*Cynodon dactylon* *Cyperus* spp.
Forb	*Einadia polygonoides*
Fern	None present
Other	None present
Exotic	*Axonopus compressus* *Cardamine hirsuta* *Eragrostis tenuifolia* *Modiola caroliniana* *Plantago lanceolata* *Sida rhombifolia*
High Threat Exotic	*Cenchrus clandestinus*

Condition states

Following entry of plot data into the BAMC, a VI score of 11.5 places this vegetation zone below the VI score threshold of 15 (for EEC or CEEC) and thus was assigned a 'low' condition for the purposes of determining Transport offsets.

Photo 3-1: Plot 6 showing PCT 725 – Low.

3.2.2 PCT 781 – Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion

Description

PCT 781 Coastal Freshwater Wetland is associated with freshwater lagoons and swamps on alluvial flats and sand depressions across the New South Wales east coast. Lagoons have fluctuating levels of standing water that gives rise to a varied assemblage of species. They include a range of sedges, rushes and aquatic herbs with woody shrubs and small trees found only on the margins of the wetlands in low abundance. Tall reedlands (reaching over three metres in height) may dominate individual wetlands. Cumbungi (*Typha orientalis*) is typically dominant in urban wetlands and may be joined by common reed (*Phragmites australis*). Other tall reeds include *Eleocharis sphacelata* and tall sedges such as twig-rushes (*Baumea* spp.). The margins of open water carry a range of aquatic herbs such as *Isachne gibbosa* and *Persicaria decipiens*. Less frequently inundated wetlands support only a few species of sedges or rushes such as *Carex appressa* and or *Baumea* spp. which do not reach the height of the taller reedlands found elsewhere. In the Sydney metropolitan area Coastal Freshwater Wetland is most commonly found at low elevations less than five metres above sea level on coastal plains and flats. Several swamps occur on highly disturbed floodplains of the Cumberland Plain where elevations reach 20 metres above sea level. Many of the remaining swamps are situated amongst intensely developed urban landuses. In these environments drainage patterns have been altered and weeds may be prolific (DPE 2022b).

PCT 781 had a small distribution within the study area, with only one small patch situated within the northern extent of the study area. This PCT was characterised by the presence of *Phragmites australis* (Common Reed) and *Typha orientalis* (Broad-leaved Cumbungi) along an altered drainage channel, although extended beyond the channel where the soils are periodically waterlogged. Few canopy and mid-storey species were present within the zone, with only a low cover of *Casuarina glauca* (Swamp Oak) and *Melaleuca armillaris* (Bracelet Honey-myrtle). A relatively low diversity of grasses, sedges, rushes, and forbs were present, including *Persicaria decipiens* (Slender Knotweed), *Persicaria hydropiper* (Water Pepper), *Cynodon dactylon* (Common Couch), *Carex* sp., *Juncus* sp. and *Commelina cyanea*. A high cover of exotic species was present, including several high threat weeds such as *Cenchrus clandestinus* (Kikuyu Grass), *Tradescantia fluminensis* (Trad), *Lonicera japonica* (Japanese Honeysuckle), *Cardiospermum grandiflorum* (Balloon Vine) and *Alternanthera philoxeroides* (Alligator Weed).

PCT ID	781
PCT name	Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion
Vegetation class	Coastal Freshwater Lagoons
Vegetation formation	Freshwater Wetlands
Estimate of per cent cleared	74%
Area in study area	0.08 ha
Conservation status	Not a TEC PCT 781 is associated with BC Act: Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (EEC). However, given the location of this PCT along an artificial drainage line, it does not meet the definition of this EEC (see Section 3.3).
Vegetation zones (condition) and plots	Zone 2: 781 Good – Wetland situated along an artificial drainage channel. Plot 5

Justification for PCT selection:

PCT 781 was selected based on species composition, landscape position and geology. Within the study area, PCT 781 is highly degraded, occurring along an altered drainage channel. Species characteristic of this PCT (as per DPE 2022b & OEH 2016) present within the vegetation zone include *Casuarina glauca, Persicaria decipiens, Phragmites australis* and *Typha orientalis.*

Within the study area, PCT 781 occurs on an alluvial plain at an elevation of approximately 4m above sea level (asl), which is characteristic of this PCT. In addition, the vegetation zone is not subject to tidal influences, with freshwater runoff originating from a culvert situated along Auld Avenue.

Other PCTs considered for selection include PCT 1808, which is mapped by OEH (2016) in proximity to the study area. However, PCT 1808 is found in environments inundated by saline or brackish water. These include low-lying swamps on riverbanks, riverflat depressions, and banks on coastal lagoons that are open to tidal influence. As discussed, the vegetation zone is not subject to tidal influences and PCT 1808 was not considered an appropriate fit for the vegetation zone.

Floristic and structural summary of PCT 781 within the study area

Growth form	Typical species
Trees	*Casuarina glauca*
Shrubs	*Melaleuca armillaris*
Grass and grass-like	*Carex* spp. *Cynodon dactylon* *Juncus* spp. *Phragmites australis* *Typha orientalis*
Forb	*Commelina cyanea* *Persicaria decipiens* *Persicaria hydropiper* *Rumex* spp.
Fern	None present
Other	None present
Exotic	*Oxalis pes-caprae* *Sagittaria platyphylla*

	Verbena bonariensis *Sida rhombifolia*
High Threat Exotic	*Cenchrus clandestinus* *Tradescantia fluminensis* *Lonicera japonica* *Cardiospermum grandiflorum* *Alternanthera philoxeroides*

Condition states

Following entry of plot data into the BAMC, a VI score of 51.6 places this vegetation zone above the VI score threshold of 20 (where the PCT does not represent a TEC and is not associated with threatened species habitat) and thus was assigned a 'good' condition for the purposes of determining Transport offsets.

Photo 3-2: Plot 5 showing PCT 781 – Good.

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

Description

PCT 835 Cumberland Riverflat Forest is an open eucalypt forest situated on broad alluvial flats of the Hawkesbury and Nepean River systems. It also forms narrower ribbons alongside streams and creeks that drain the Cumberland Plain. Typically, the canopy includes one of either rough-barked apple (*Angophora floribunda*) or broad-leaved apple (*Angophora subvelutina*) and one or both of forest red gum (*Eucalyptus tereticornis*) and cabbage gum (*Eucalyptus amplifolia*). However, there are a wide variety of other eucalypts that are highly localised. On the Georges River near Bankstown and on Cabramatta and Prospect creeks blue box (*Eucalyptus baueriana*) is commonly encountered, sometimes as a smaller tree beneath the canopy (DPE 2022b).

The understorey is typically characterised by an occasional sparse to open small tree stratum of paperbark (*Melaleuca* spp.) and wattles (*Acacia* spp.). A sparse lower shrub layer features blackthorn (*Bursaria spinosa*) at most sites. The ground layer is characterised by an abundant cover of grasses with small herbs and ferns. Cumberland Riverflat Forest occurs at altitudes between one and 160 metres above sea level and with a mean annual rainfall of 750-1000 millimetres. The largest remaining areas are situated on the Georges River. Highly disturbed examples occur on Prospect and Orphan School creeks (DPE 2022b)

PCT 835 had a common distribution throughout the survey area, primarily as remnant vegetation within the northern and southern most extents and as remnant trees with a mown groundcover or planted vegetation in between, along Henry Lawson Drive. Within the remnant vegetation patches, this PCT was characterised by a canopy dominated by *Eucalyptus moluccana* (Grey Box), *Eucalyptus baueriana* (Blue Box) and *Eucalyptus tereticornis* (Forest Red Gum), with occasional occurrences of *Angophora floribunda* (Rough-barked Apple), *Eucalyptus amplifolia* (Cabbage Gum) and *Casuarina glauca* (Swamp Oak).

Depending on the location within the study area, the mid-storey was either absent (i.e. within mown areas) or predominately exotic, with exotic mid-storey species including *Arundo donax* (Giant Reed), *Cestrum parqui* (Green Cestrum), *Lantana camara* (Lantana), *Ligustrum lucidum* (Large-leaved Privet) and *Ligustrum sinense* (Small-leaved Privet). A low diversity and cover of native ground layer species was present across the zone, including grasses and forbs such as *Cotula australis* (Common Cotula), *Cynodon dactylon* (Common Couch), *Microlaena stipoides* (Weeping Grass), *Oplismenus aemulus* and *Oxalis* spp. Across the zone, the ground layer was predominately comprised of exotic species, including *Tradescantia fluminensis* (Trad), *Cardiospermum grandiflorum*(Balloon Vine), *Poa annua* (Winter Grass), *Cenchrus clandestinus* (Kikuyu Grass) and *Salpichroa origanifolia* (Pampas Lily-of-the-valley).

Areas of immature planted vegetation were present along Henry Lawson Drive with the largest stand present just north of the M5, on both eastern and western sides of Henry Lawson Drive. Some areas with a more mature canopy were present further north of this stand. Although this vegetation zone comprised planted native vegetation, according to Appendix D of the BAM (DPIE 2020), the vegetation could reasonably be assigned to a PCT, forming part of a mosaic of planted and remnant native vegetation. It was therefore allocated to the best-fit PCT, which given the species composition and landscape position was PCT 835.

Due to being mostly historically planted, a number of different canopy species were present within the zone, including *Casuarina glauca, Corymbia maculata* (Spotted Gum), *Eucalyptus amplifolia, Eucalyptus crebra, Eucalyptus longifolia, Eucalyptus moluccana, Eucalyptus sideroxylon* (Mugga Ironbark) and *Eucalyptus tereticornis.* A sparse to moderate shrub layer was present, including *Acacia implexa* (Hickory Wattle) and *Melaleuca decora.* A low diversity and cover of native species was present in the ground layer, including the forbs *Commelina cyanea, Einadia hastata* (Berry Saltbush) and *Tetragonia tetragonioides* (New Zealand Spinach). This stratum was mostly dominated by exotic species including *Ehrharta erecta* (Panic Veldtgrass), *Ehrharta longiflora* (Annual Veldtgrass), *Sida rhombifolia* (Paddy's Lucerne), *Cenchrus clandestinus* and *Araujia sericifera* (Moth Vine). Also assigned to this PCT was areas of colonising *Eucalyptus molucanna* in the southern ancillary facility, occurring on modified terrain.

PCT ID	835
PCT name	Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
Vegetation class	Coastal Floodplain Wetlands
Vegetation formation	Forested Wetlands

Estimate of per cent cleared	93%
Area in study area	2.20 ha
Conservation status	BC Act: River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (EEC) EPBC Act: River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria (CEEC) (See Section 3.3 for further discussion of TECs)
Vegetation zones (condition) and plots	Zone 3: 835 Moderate – Intact canopy with an exotic dominated or absent mid-storey, and exotic dominated ground layer. Also includes characteristic canopy species over a mown groundcover and areas of planted native vegetation. Plot 2, Plot 4 and Plot 7.

Justification for PCT selection:

PCT 835 was selected based on species composition, landscape position and geology. Within the subject land, PCT 835 is highly degraded, although contains some characteristic species representative of this PCT (as per DPE 2022b & OEH 2016), including *Angophora floribunda, Eucalyptus amplifolia, Eucalyptus baueriana, Eucalyptus moluccana, Eucalyptus tereticornis, Microlaena stipoides* and *Oplismenus aemulus.*

Within the study area, PCT 835 predominately occurs on alluvial soils (Richmond soil landscape) on the Georges River floodplain, which is characteristic of this PCT. In addition, it occurs at an elevation below 9m asl, conforming to the known landscape position of this PCT.

Other PCTs considered for selection include PCT 849 and PCT 1800. PCT 849 is associated with soils derived from Wianamatta Group geology (e.g. the Blacktown soil landscape), and rarely occurs on alluvial substrates. PCT 835 within the study area is predominately situated on the Richmond soil landscape, which comprises alluvial soils. In addition, the assemblage of canopy species is more aligned with PCT 835 than PCT 849. Within the study area, PCT 835 has also been mapped within non-alluvial soils, which includes the Blacktown soil landscape. This soil landscape occupies areas at a further distance from the Georges River, or at higher elevations, than the Richmond landscape. PCT 835 has been mapped on these non-alluvial soils where the canopy is highly diagnostic and does not represent the alternative PCT 849 (Cumberland Shale Plains Woodland). This has included occurrences of mature *Angophora floribunda* and *Eucalyptus baueriana,* which do not correlate with PCT 849.

In addition, PCT 1800 is distinguished from PCT 835 by the prominent stands of *Casuarina glauca* found along or near streams. Although PCT 835 had occasional occurrences of *C. glauca,* these did not feature within the zone as a dominant species.

Floristic and structural summary of PCT 835 within the study area

Growth form	Typical species
Trees	*Eucalyptus amplifolia* *Eucalyptus baueriana* *Eucalyptus tereticornis*
Shrubs	Absent apart from condition Moderate, which was not sampled and would not be directly affected
Grass and grass-like	*Cynodon dactylon* *Microlaena stipoides* *Oplismenus aemulus*
Forb	*Cotula australis*
Fern	None present
Other	None present
Exotic	*Eleusine indica* *Lolium* sp.

	Poa annua *Salpichroa origanifolia* *Stellaria media* *Taraxacum officinale*
High Threat Exotic	*Bidens pilosa* *Cardiospermum grandiflorum* *Cenchrus clandestinus* *Cestrum parqui* *Lantana camara* *Tradescantia fluminensis*

Condition states

Following entry of plot data into the BAMC, the VI score of 35.4 places this vegetation zone above the VI score threshold of 15 (for EEC or CEEC) and thus was assigned a 'moderate' condition for the purposes of determining Transport offsets.

Photo 3-3: Plot 2 showing PCT 835 – Moderate within a riparian area.

Photo 3-4: Plot 4 showing PCT 835 – Moderate within a mown park.

Photo 3-5: Plot 7 showing PCT 835 – Moderate (roadside planted).

3.2.4 PCT 1067 – Parramatta Red Gum woodland on moist alluvium of the Cumberland Plain, Sydney Basin Bioregion

Description

PCT 1067 is a swamp sclerophyll forest associated with periodically inundated soils associated with Tertiary, Holocene and Quaternary sand deposits. This includes minor dune swales, creek lines and local depressions. It is characterised by a moderate to dense cover of paperbark trees of which *Melaleuca decora*, *Melaleuca linariifolia* and *Melaleuca nodosa* are most common. They may be joined by various small eucalypt trees. In older stands these eucalypts form a sparse emergent layer. In the Sydney area eucalypt species include drooping red gum (*Eucalyptus parramattensis* subsp. *parramattensis*), ironbark (including *Eucalyptus crebra*) and woollybutt (*Eucalyptus longifolia*). A wide variety of other eucalypt species may be included and these reflect the transition from the surrounding dry woodland communities. The ground layer may be damp or covered by water depending on the time of year and season. This encourages a diversity of grasses as well as a dense cover of water-loving herbs and sedges (DPE 2022b).

Castlereagh Swamp Woodland is found in low-lying situations where elevation is between 10 and 60m above sea level and in areas receiving less than 850 mm of mean annual rainfall. Remnants occur in the Holsworthy and Bankstown areas. Elsewhere the community is found in the sand deposits at Castlereagh near Penrith and amongst the Mellong sand swamps in the Putty area (DECCW 2009). It is included within the dry sclerophyll formation owing to its association with the dry woodlands that form on the same distinctive substrates (DPE 2022b).

PCT 1067 had a small distribution within the study area, occurring in the vacant land bounded by Bullecourt Avenue to the south, Bullecourt Lane to the east, Bankstown Golf Club to the north, and a residential area to the west. The vegetation zone was highly degraded, only comprising isolated canopy trees and shrubs, including *Acacia parramattensis* (Parramatta Wattle), *Eucalyptus parramattensis* subsp. *parramattensis* (Parramatta Red Gum) and *Melaleuca decora.* The ground layer was highly altered, with native species only consisting of *Cynodon dactylon* (Common Couch) and *Digitaria didactyla* (Queensland Blue Couch). These grasses are commonly cultivated and have perhaps been planted or seeded. Exotic species were common within the zone, and included *Cenchrus clandestinus, Soliva sessilis* (Bindyi), *Lotus angustissimus* (Slender Birds-foot Trefoil), *Bidens pilosa* (Cobbler's Pegs) and *Cestrum parqui.*

PCT ID	1067
PCT name	Parramatta Red Gum woodland on moist alluvium of the Cumberland Plain, Sydney Basin Bioregion
Vegetation class	Sydney Sand Flats Dry Sclerophyll Forests
Vegetation formation	Dry Sclerophyll Forests (Shrubby sub-formation)
Estimate of per cent cleared	45%
Area in study area	0.13 ha
Conservation status	BC Act: Castlereagh Swamp Woodland Community (EEC) (See Section 3.3 for further discussion of TECs)
Vegetation zones (condition) and plots	Zone 4: 1067 Moderate – Native canopy and mid-storey species occurring amongst a mown exotic ground layer.

Justification for PCT selection:

PCT 1067 was selected based on species composition, landscape position and geology. Within the study area, PCT 1067 is highly degraded with minimal native species diversity. Species characteristic of this PCT (as per DPE 2022b & OEH 2016) present within the vegetation zone include *Eucalyptus parramattensis* subsp*. parramattensis* and *Melaleuca decora.*

Within the study area, PCT 1067 occurs within a low-lying elevation at around 6m to 7m above sea level, which mostly corresponds with the landscape attributes of this PCT. PCT 1067 is associated with periodically inundated soils associated with Tertiary, Holocene and Quaternary sand deposits. Although the vegetation zone is located on the Blacktown soil landscape, it is situated near the boundary of the Richmond soil landscape which is underlain by Quaternary alluviums. The influence of these alluviums is evident in the canopy vegetation within the zone.

Other PCTs considered for selection include PCT 724, which is mapped by OEH (2016) within the vicinity. The presence of *E. parramattensis* subsp. *parramattensis* differentiated the zone from PCT 724, which is not a diagnostic species of PCT 724. In addition, PCT 883 was considered as it comprises *E. parramattensis* subsp. *parramattensis* and *Melaleuca decora,* both present within the vegetation zone. However, the absence of *Eucalyptus racemosa* (syn. *E. sclerophylla*; Narrow-leaved Scribbly Gum) within the study area and local vicinity (characteristic of PCT 883), as well as the absence of nearby vegetation mapping for PCT 883 (by OEH 2016), deemed it not the best fit PCT for the vegetation zone.

Floristic and structural summary of PCT 1067 within the study area

Growth form	Typical species
Trees	*Eucalyptus parramattensis* subsp. *parramattensis*
Shrubs	*Melaleuca decora*
Grass and grass-like	*Cynodon dactylon* *Digitaria didactyla*
Forb	None present
Fern	None present
Other	None present
Exotic	*Soliva sessilis* *Lotus angustissimus*
High Threat Exotic	*Cenchrus clandestinus* *Bidens pilosa* *Cestrum parqui*

Condition states

Following entry of plot data into the BAMC, a VI score of 15.8 places this vegetation zone just above the VI score threshold of 15 (for EEC or CEEC) and thus was assigned a 'moderate' condition for the purposes of determining Transport offsets.

Photo 3-6: Plot 1 showing PCT 1067 – Moderate.

3.2.5 PCT 1800 – Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley

Description

PCT 1800 Cumberland Swamp Oak Riparian Forest is found on the riverflats of the Cumberland Plain in western Sydney and in the Hunter Valley. The distinguishing feature is the prominent stands of swamp oak (*Casuarina glauca*) found along or near streams. Often these are relatively young trees, swarming amongst a mix of old and young eucalypts such as rough-barked apple (*Angophora floribunda*), forest red gum (*Eucalyptus tereticornis*) and grey box (*Eucalyptus moluccana*). This community features an open grassy and herbaceous understorey, as is typical of riverflat forests (DPE 2022b).

It may be that this is a pioneering community that is re-establishing following clearing. It is known that many creeklines in western Sydney are slightly saline, particularly during drought. Water tables are likely to rise following clearing, bringing salt water closer to the surface. This may explain why the salt tolerant swamp oak is so prolific in these environments and in many instances appears to survive where the eucalypt species do not (DPE 2022b).

PCT 1800 was present within the northern extent of the study area, situated along Milperra Drain. The vegetation zone was characterised by a canopy dominated by *Casuarina glauca.* The mid-storey was devoid of native species, with only a sparse cover of exotic species including *Cestrum parqui, Cinnamomum camphora* (Camphor Laurel) and *Ligustrum sinense.* The ground layer was dominated by exotic species, including *Ageratina adenophora* (Crofton Weed), *Cardiospermum grandiflorum, Megathyrsus maximus* (Guinea Grass) and *Tradescantia fluminensis*. The ground layer comprised minimal native species and cover, with only one native species, *Phragmites australis,* recorded within the zone.

PCT ID	1800
PCT name	Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley
Vegetation class	Coastal Floodplain Wetlands
Vegetation formation	Forested Wetlands
Estimate of per cent cleared	60%
Area in study area	0.99 ha
Conservation status	BC Act: Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (EEC) EPBC Act: Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community (EEC) (See Section 3.3 for further discussion of TECs)
Vegetation zones (condition) and plots	Zone 5: 1800 Moderate: Intact canopy with an absent mid-storey and an exotic dominated ground layer. Plot 3

Justification for PCT selection:

PCT 1800 was selected based on species composition, landscape position and geology. Within the study area, PCT 1800 is highly degraded with minimal native species diversity. Species characteristic of this PCT (as per 2022b & OEH 2016) present within the vegetation zone include *Casuarina glauca.*

PCT 1800 is known to occur on the riverflats of the Cumberland Plain in western Sydney. Within the study area, PCT 1800 occurs on alluvial soils (Richmond soil landscape) on the Georges River floodplain, which corresponds to the landscape attributes of this PCT.

Other PCTs considered for selection include PCT 835, PCT 1232 and PCT 1234. PCT 835 was present within the study area and occurs within a similar landscape position. However, PCT 1800 is distinguished from PCT 835 by the prominent stands of *Casuarina glauca* found along or near streams. PCT 1800 was therefore considered the best fit PCT due to the dominance of *C. glauca* within the vegetation zone. In addition, PCT 1234 occurs immediately above tidal influence in the zonation from mangroves to sclerophyll forests or woodlands and PCT 1232 occurs on sandy saline sediments fringing the high tide mark in

coastal estuaries below 5m. The vegetation zone is not situated near areas of tidal influence and as such these PCTs were not considered to conform with the vegetation zone.

Floristic and structural summary of PCT 1067 within the study area

Growth form	Typical species
Trees	*Casuarina glauca*
Shrubs	None present
Grass and grass-like	*Phragmites australis*
Forb	None present
Fern	None present
Other	None present
Exotic	*Megathyrsus maximus* *Salpichroa origanifolia*
High Threat Exotic	*Ageratina adenophora* *Cardiospermum grandiflorum* *Cestrum parqui* *Ligustrum sinense* *Tradescantia fluminensis*

Condition states

Following entry of plot data into the BAMC, a VI score of 15.5 places this vegetation zone above the VI score threshold of 15 (for EEC or CEEC) and thus was assigned a 'moderate condition for the purposes of determining Transport offsets.

Photo 3-7: Plot 3 showing PCT 1800 – Moderate.

3.2.6 Planted Native Vegetation

This vegetation zone occupied the majority of the study area (2.66 ha), particularly along roadsides. The categorisation of areas of planted native vegetation were determined using the Decision-making key (D.1) in Appendix D of the BAM (Figure 3-3). The decision-making key provides a framework for the assessment of planted native vegetation using the BAM. Areas of planted native vegetation were assigned to a PCT if the species composition was characteristic of a locally occurring PCT. For example, vegetation planted along the southeastern edge of Henry Lawson Drive was assigned to PCT 835 based on the species composition. However, the majority of the native planted vegetation were mature trees and shrubs planted in avenues and rows along Henry Lawson Drive, Bullecourt Ave, Gordon Parker Reserve (south of Auld Ave) and Ashford Ave, and were not planted to recreate a native PCT. A typical example is shown in Photo 3-8.

Species occurring within this vegetation zone include *Banksia integrifolia* (Coast Banksia), *Callistemon salignus* (Willow Bottlebrush), *Callistemon viminalis* (Weeping Bottlebrush), *Casuarina glauca* (Swamp Oak), *Corymbia citriodora* (Lemon-scented Gum), *C. maculata* (Spotted Gum), *C. torelliana* (Cadaghi), *Eucalyptus botryoides* (Bangalay), *E. cinerea* (Argyle Apple), *E. grandis* (Flooded Gum), *E. microcorys* (Tallowwood), *E. punctata* (Grey Gum), *E. sideroxylon* (Mugga Ironbark), *Lophostemon confertus* (Brush Box), *Melaleuca decora*, *M. linariifolia* (Flax-leaved Paperbark), *M. quinquenervia* (Broad-leaved Paperbark), *M. styphelioides* (Prickly-leaved Tea Tree), *Melia azedarach* (White Cedar), *Stenocarpus sinuatus* (Firewheel Tree) and *Tristaniopsis laurina* (Kanooka).

The groundcover below this planted vegetation is regularly slashed / mown and is dominated by exotic groundcovers including *Amaranthus cruentus* (Redshank), *Arctotheca calendula* (Capeweed), *Digitaria* spp. (A Finger Grass), *Eragrostis curvula* (African Lovegrass), *Eragrostis tenuifolia* (Elastic Grass), *Gamochaeta* spp., *Gomphrena celosioides*, *Hypochaeris radicata* (Catsear), *Paspalum dilatatum* (Paspalum), *Senecio madagascariensis* (Fireweed) and *Stenotaphrum secundatum* (Buffalo Grass).

Photo 3-8: Planted native vegetation within the study area

D.1 Decision-making key

1. **Does the planted native vegetation occur within an area that contains a mosaic of planted and remnant native vegetation and which can be reasonably assigned to a PCT known to occur in the same IBRA subregion as the proposal?**
   - i. Yes .... The planted native vegetation must be allocated to the best-fit PCT and the BAM must be applied.
   - ii. No .... Go to 2.
2. **Is the planted native vegetation:**
   - a. **planted for the purpose of environmental rehabilitation or restoration under an existing conservation obligation listed in BAM Section 11.9(2.), and**
   - b. **the primary objective was to replace or regenerate a plant community type or a threatened plant species population or its habitat?**
   - i. Yes .... The planted native vegetation must be assessed in accordance with Chapters 4 and 5 of the BAM.
   - ii. No ..... Go to 3.
3. **Is the planted/translocated native vegetation individuals of a threatened species or other native species planted/translocated for the purpose of providing threatened species habitat under one of the following:**
   - a. **a species recovery project**
   - b. ***Saving our Species* project**
   - c. **other types of government funded restoration project**
   - d. **condition of consent for a development approval that required those species to be planted or translocated for the purpose of providing threatened species habitat**
   - e. **legal obligation as part of a condition or ruling of court. This includes regulatory directed or ordered remedial plantings (e.g. Remediation Order for clearing without consent issued under the BC Act or the Native Vegetation Act)**
   - f. **ecological rehabilitation to re-establish a PCT or TEC that was, or is carried out under a mine operations plan, or**
   - g. **approved vegetation management plan (e.g. as required as part of a Controlled Activity Approval for works on waterfront land under the NSW *Water Management Act 2000*)?**
   - i. Yes .... The planted native vegetation must be assessed in accordance with Chapters 4 and 5 of the BAM.
   - ii. No ..... Go to 4.
4. **Was the planted native vegetation (including individuals of a threatened flora species) undertaken voluntarily for revegetation, environmental rehabilitation or restoration without a legal obligation to secure or provide for management of the native vegetation?**
   - i. Yes ..... Go to D.2 Assessment of planted native vegetation for threatened species habitat (the use of Chapters 4 and 5 of the BAM are not required to be applied).
   - ii. No ..... Go to 5.
5. **Is the native vegetation (including individuals of a threatened flora species) planted for functional, aesthetic, horticultural or plantation forestry purposes? This includes examples such as: windbreaks in agricultural landscapes, roadside plantings (including street trees, median strips, roadside batters), landscaping in parks, gardens and sport fields/complexes, macadamia plantations or teatree farms?**
   - i. Yes .... Go to D.2 Assessment of planted native vegetation for threatened species habitat (the use of Chapters 4 and 5 of the BAM are not required to be applied).
   - ii. No ..... Go to 6.
6. **Is the planted native vegetation a species listed as a widely cultivated native species on a list approved by the Secretary of the Department (or an officer authorised by the Secretary)?**
   - i. Yes .... Go to D.2 Assessment of planted native vegetation for threatened species habitat (the use of Chapters 4 and 5 of the BAM are not required to be applied).
   - ii. No ..... There may be other types of occurrences of planted native vegetation that do not easily fit into the decision-making key above. Assessors should contact the BAM Support mailbox at bam.support@environment.nsw.gov.au for further advice on using the BAM to assess other types of occurrences of planted native vegetation.

Evidence demonstrating the application of the decision-making key to the areas of planted native vegetation must be provided in the BDAR or BCAR.

Figure 3-3: Decision-making key for assessment of planted native vegetation under the BAM (DPIE 2020).

3.2.7 Exotic Vegetation

This vegetation zone was the most common vegetation zone throughout the study area, occupying 8.47 ha. Areas of exotic vegetation included cleared mown areas along roadsides and within proposed ancillary facilities south of Auld Ave and north of Bullecourt Ave and areas of highly disturbed land. Sections of vegetation along Milperra Drain between Auld Ave and Keys Parade were dominated by exotics (Photo 3-9), as was land within the southern ancillary facility south of the M5.

Common species within this exotic zone included *Acacia saligna* (Golden Wreath Wattle), *Acer negundo* (Box Elder), *Anredera cordifolia* (Madeira Vine), *Bidens pilosa* (Cobbler's Pegs), *Cardiospermum grandiflorum* (Balloon Vine), *Cenchrus pennisetiformis* (Buffel Grass), *Cestrum parqui* (Green Cestrum), *Chloris gayana* (Rhodes Grass), *Cinnamomum camphora* (Camphor Laurel), *Cirsium vulgare* (Spear Thistle), *Eleusine indica* (Crowsfoot Grass), *Erythrina crista-galli* (Cockspur Coral Tree), *Foeniculum vulgare* (Fennel), *Lantana camara* (Lantana), *Medicago* spp., *Megathyrsus maximum, Parietaria judaica* (Pellitory), *Ricinus communis* (Castor Oil Plant), *Setaria parviflora, Sida rhombifolia* (Paddy's Lucerne), *Solanum sisymbriifolium, Syagrus romanzoffiana* (Cocos Palm), *Thunbergia alata* (Black-eyed Susan), *Verbena bonariensis* (Purpletop) and *Vicia sativa* (Common vetch).

Photo 3-9: Exotic vegetation in the foreground with PCT 1800 Moderate vegetation zone in the background.

3.3 Threatened ecological communities

Table 3-1 lists four threatened ecological communities (TECs) under the BC Act that occur within the study area, all of which are listed as endangered ecological communities (EEC). The extent of each TEC within the study area is listed in Table 3-1 and is illustrated in Figure 3-4 (northern half of study area) and Figure 3-5 (southern half of the study area). These TECs and their associated PCT within the study area include:

- Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion (EEC) (PCT 725).
- River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (EEC) (PCT 835).
- Castlereagh Swamp Woodland Community (EEC) (PCT 1067).
- Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (EEC) (PCT 1800).

PCT 781 is associated with the TEC *Freshwater Wetlands on Coastal Floodplain* TEC. However, Clause 4 of the final determination for this community states that: *Artificial wetlands created on previously dry land specifically for purposes such as sewerage treatment, stormwater management and farm production, are not regarded as part of this community, although they may provide habitat for threatened species* (NSWSC 2021). PCT 781 occurs along a straight construction stormwater swale drain and includes adjacent areas subject to regular overflow of stormwater. As such, PCT 781 within the subject land is not considered to be part of the TEC *Freshwater Wetlands on Coastal Floodplain*.

The following PCTs mapped within the study area also have equivalent TECs listed under the EPBC Act, including listings as critically endangered ecological community (CEEC) and Endangered ecological community (EEC), as follows:

- Cooks River/Castlereagh Ironbark Forest of the Sydney Basin Bioregion (CEEC) (PCT 725).
- River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria (CEEC) (PCT 835).
- Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community (EEC) (PCT 1800).

The conservation advice for each of these TECs was reviewed to determine if the PCT condition within the subject land is consistent with these listings. Each of the minimum condition thresholds are listed below along with whether these conditions are met within the study area.

- Cooks River/Castlereagh Ironbark Forest of the Sydney Basin Bioregion (CEEC) (PCT 725)
  - Patch size 0.5 ha, and
  - >30% of the perennial understorey vegetation cover is made up of native species, and
  - The patch is contiguous with a native vegetation remnant (any native vegetation where cover in each layer present is dominated by native species) >1ha in area, Or
  - The patch has at least one tree with hollows or at least one large locally indigenous tree (>80 cm dbh) (DotE 2015)
  - PCT 725 within the study area occurs as a small patch over mown exotic lawn and does not conform to the EPBC Act listed CEEC.
- River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria (CEEC) (PCT 835)
  - Patch size 0.5ha within a larger area of native vegetation ≥ 5 ha, and
  - ≥ 30% of its total perennial understorey vegetation cover is comprised of native species, and
  - ground cover richness ≥ 4 native species per 20 x 20m sample plot (DAWE 2020)
  - PCT 835 within the study area is in a degraded state due to the understorey vegetation being dominated by exotic species (only 2.1% native cover). As such, PCT 835 within the study area does not conform to the EPBC Act listed CEEC.
- Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community (EEC) (PCT 1800)
  - The smallest patch is at least 0.5 ha, and
  - has a predominantly native understorey, OR

- A patch size of 2-5ha that has <80% non-native species in the understorey
- The area of this community within the study area is 0.99 ha, which is patchily distributed along Milperra Drain. Native species extent within the understorey was very low (0.1 % cover) within the representative plot. As such, PCT 1800 within the study area does not meet the condition criteria for listing under the EPBC Act.

Figure 3-4: Threatened ecological communities (north).

Figure 3-5: Threatened ecological communities (south).

3.4 Groundwater dependent ecosystems

Groundwater dependent ecosystems (GDEs) are defined as 'ecosystems that need access to groundwater to meet all or some of their water requirements to maintain their communities of plants and animals, ecological processes and ecosystem services'. GDEs include a broad range of environments and can be highly specialised, possessing unique characteristics that 'separate' them from other ecosystems. The dependence of GDEs on groundwater varies from seasonal or episodic, to continual. They can range in size from a few metres to many square kilometres (Commonwealth of Australia 2022).

The Groundwater Dependent Ecosystem Atlas (GDE Atlas) (Commonwealth of Australia 2022) was reviewed in November 2022 to determine any GDE's occurring within the study area and immediate surrounds. The Atlas contains information about three types of ecosystems:

- Aquatic ecosystems that rely on the surface expression of groundwater–this includes surface water ecosystems which may have a groundwater component, such as rivers, wetlands and springs. Marine and estuarine ecosystems can also be groundwater dependent, but these are not mapped in the Atlas.
- Terrestrial ecosystems that rely on the subsurface presence of groundwater–this includes all vegetation ecosystems.
- Subterranean ecosystems– this includes cave and aquifer ecosystems.

The study area contains high potential terrestrial GDE's with the southern ancillary facility (Figure 3-6). High potential GDE's are also mapped just outside sections of the northern section of the study area. The vegetation associated with terrestrial GDE's within the study area include the following PCT 835 Cumberland Riverflat Forest and PCT 1800 Cumberland Swamp Oak Riparian Forest, both of which area associated with fresh water.

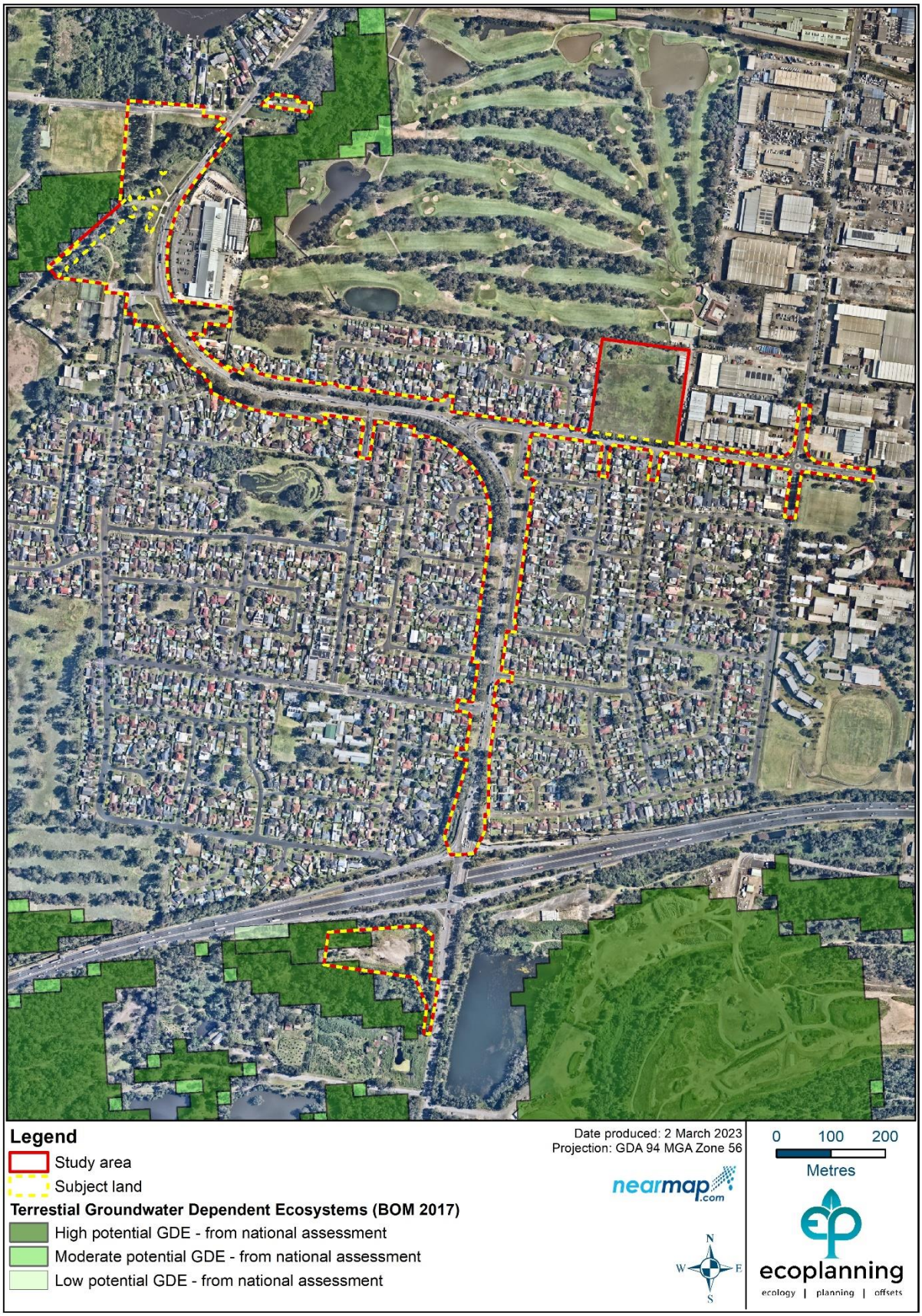

Figure 3-6: Groundwater dependent ecosystems.

3.5 Threatened species

3.5.1 Threatened flora

The habitat suitability assessment revealed five species credit flora species with a moderate likelihood of occurring within the study area:

- Acacia pubescens (Downy Wattle)
- Callistemon linearifolius (Nettled Bottle Brush)
- Dillwynia tenuifolia
- Grevillea juniperina subsp. juniperina (Juniper-leaved Grevillea)
- Haloragis exalata subsp. exalata (Square Raspwort).

Following targeted surveys, none of the targeted flora species were found to occur within the study area (Table 3-2), and therefore have a low likelihood of occurring (Appendix B). The remaining species credit flora species listed in Appendix B were not considered likely to occur within the study area due to unsuitable habitat. Much of the habitat was degraded, with the potential for natural regeneration of even common native species deemed to be limited. For instance, the site does not provide appropriate habitat to support threatened forbs e.g. *Pimelea spicata* and *Wahlenbergia multicaulis,* due to invasive species smothering the groundlayer. In addition, several areas of the study area were mown parklands which would not support a viable population of threatened shrub or forb species due to persistent mowing.

Table 3-2: Threatened flora species surveys results

Species name	EPBC Act	BC Act	Identification method (not recorded, assumed, recorded, expert report)	Survey effort compliant?[1]	Results
Acacia pubescens (Downy Wattle)	V	V	Not recorded	Yes	**Not detected.** Species credit species. Habitat highly degraded, potential for historical records to have died-off and few opportunities for germination due to competition with exotic species.
Callistemon linearifolius (Nettled Bottle Brush)	V	-	Not recorded	Yes – note that survey wasn't completed during flowering	**Not detected.** Species credit species. Habitat highly degraded, little potential for germination due to competition with exotic species. Although the survey was not completed during flowering period, no *Callistemon* spp. were observed within the study area. In addition, a native shrub stratum was almost completely absent from the vegetation zones, which consisted of canopy species over an exotic groundlayer.
Dillwynia tenuifolia	V	-	Not recorded	Yes – note that survey wasn't completed during flowering	**Not detected.** Species credit species. Habitat highly degraded, little potential for germination due to competition with exotic species. Although the survey was not completed during flowering period, no *Dillwynia* spp. or any other similar Fabaceae shrubs were observed within the study area. In addition, a native shrub

Species name	EPBC Act	BC Act	Identification method (not recorded, assumed, recorded, expert report)	Survey effort compliant?[1]	Results
					stratum was almost completely absent from the vegetation zones, which consisted of canopy species over an exotic groundlayer.
Grevillea juniperina subsp. *Juniperina* (Juniper-leaved Grevillea)	V	-	Not recorded	Yes	**Not detected.** Species credit species. Habitat highly degraded, little potential for germination due to competition with exotic species. The native shrub stratum was almost completely absent from the vegetation zones, which consisted of canopy species over an exotic groundlayer.
Haloragis exalata subsp. *Exalata* (Square Raspwort)	V	V	Not recorded	Yes	**Not detected.** Species credit species. Habitat highly degraded, located on an artificial drainage line. High competition from exotic species.

3.5.2 Threatened fauna

The habitat assessment undertaken by Ecoplanning in 2022 mapped one hollow-bearing tree within the study area (Figure 2-3). This tree included one hollow of around 10-centimetre aperture and another small hollow that was occupied by European Honeybees (Photo 3-10). Other fauna habitat features within the study area included freshwater habitat and degraded riparian vegetation along Milperra Drain. Foraging habitat for mobile birds and bats was also present within areas of native canopy (both part of native PCTs and planted native vegetation). The native shrub stratum was virtually absent from the study area and ground covers were dominated by exotic species. No stick nests (breeding habitat for raptors) were observed within the study area and no tree hollows greater than 20 cm were recorded (breeding habitat for owls).

The habitat suitability assessment revealed three species credit fauna species (or dual credit fauna species with potential breeding habitat) with a moderate likelihood of occurring within the study area (Appendix B):

- *Litoria aurea* (Green and Golden Bell Frog)
- *Meridolum corneovirens* (Cumberland Plain Land Snail)
- *Myotis macropus* (Southern Myotis)

Targeted surveys were undertaken for one of these species credit fauna species within the study area: Green and Golden Bell Frog. This species was not found to occur within the study area (Table 3-2). Following targeted surveys, Green and Golden Bell Frog was deemed a low likelihood of occurring within the study area (Appendix B).

Targeted surveys were not conducted for two species credit fauna species: Cumberland Plain Land Snail and Southern Myotis. Based on the Transport guidelines, where a species credit species with a moderate to high likelihood of occurrence has not been adequately surveyed, then the species may be assumed present. Species polygons have been prepared for each of these species (Section 3.5.3). A Test of Significance for each species in accordance with Section 7.3 of the BC Act was undertaken (Appendix D).

In accordance with the BAM, targeted survey is not required for ecosystem credit species. Nonetheless, the habitat suitability assessment in Appendix B revealed fourteen ecosystem credit species (or dual credit species where no breeding habitat is identified) as having a moderate-high likelihood of occurrence within the study area. As such, a Test of Significance in accordance with Section 7.3 of the BC Act was undertaken for each species (Appendix D), and where relevant, Assessments of Significance in accordance with EPBC Act Significant Impact Guidelines 1.1 (DotE 2013; Appendix E):

- *Artamus cyanopterus cyanopterus* (Dusky Woodswallow), Vulnerable BC Act; BAM ecosystem species
- *Daphoenositta chrysoptera* (Varied Sittella), Vulnerable BC Act; BAM ecosystem species
- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle), Vulnerable BC Act; BAM ecosystem species
- *Haliaeetus leucogaster* (White-bellied Sea-Eagle), Vulnerable BC Act; BAM ecosystem species (no breeding habitat (stick nests) was recorded within the study area during habitat assessment).
- *Glossopsitta pusilla* (Little Lorikeet), Vulnerable BC Act; BAM ecosystem species
- *Hirundapus caudacutus* (White-throated Needletail), Vulnerable and Migratory, EPBC Act; BAM ecosystem species
- *Micronomus norfolkensis* (Eastern Coastal Free-tailed Bat), Vulnerable BC Act; BAM ecosystem species
- *Miniopterus australis* (Little Bent-winged Bat), Vulnerable BC Act; BAM ecosystem species (no breeding habitat was recorded within the study area during habitat assessment)
- *Miniopterus orianae oceanensis* (Large Bent-winged Bat), Vulnerable BC Act; BAM ecosystem species (no breeding habitat was recorded within the study area during habitat assessment)
- *Ninox strenua* (Powerful Owl), Vulnerable BC Act; BAM ecosystem species (no breeding habitat was recorded within the study area during habitat assessment)
- *Pandion cristatus* (Eastern Osprey), Vulnerable BC Act; BAM ecosystem species (no breeding habitat (stick nests) was recorded within the study area during habitat assessment).
- *Pteropus poliocephalus* (Grey-headed Flying-fox), Vulnerable BC Act; Vulnerable EPBC Act; BAM ecosystem species (no breeding habitat was recorded within the study area during habitat assessment)
- *Saccolaimus flaviventris* (Yellow-bellied Sheathtail-bat), Vulnerable BC Act; BAM ecosystem species
- *Scoteanax rueppellii* (Greater Broad-nosed Bat), Vulnerable BC Act; BAM ecosystem species

Photo 3-10: Hollow-bearing tree recorded within the study area near Milperra Drain (hollow is magnified).

Table 3-3: Threatened fauna species surveys results

Species name	EPBC Act	BC Act	Identification method (not recorded, assumed, recorded, expert report)	Survey effort compliant?[1]	Results
Green and Golden Bell Frog (*Litoria aurea*) (GGBF)	V	E	Not recorded – Targeted survey by WSP (2021) as part of the 1A assessment	Yes	**Not detected.** Marginal habitat present within the study area in Milperra Drain. Species credit species. Species not recorded during targeted survey of Milperra Drain undertaken in December 2018 by WSP (2021). Unlikely to occur within the study area. Most recent BioNet record (2021) was 8km from the study area, which is likely to be at Greenacre, based on recent surveys by Dr Arthur White (WSP 2021). The closest record is from 1980, where the species was recorded 200m of the study area. The known GGBF population on the lower Georges River occurs in several locations, including in the vicinity of the wetlands at Hammondville, at Holsworthy and East Hills, and along Prospect Creek and Orphan School Creek. The species was likely to have historically occurred within the study area but is unlikely to be present due to loss of habitat and degradation of habitat, predation and poor water quality from urban runoff (DECC 2008).

3.5.3 Species polygons

Where species-credit species are recorded (or assumed present), species polygons should be used to accurately assess the impact of the proposal and, if required, assist in the calculation of offsets. The following two species credit species have been assumed to be present within the subject land:

- *Meridolum corneovirens* (Cumberland Plain Land Snail)
- *Myotis macropus* (Southern Myotis)

Species polygons have been created in accordance with the BAM and specific requirements listed for each species in their TBDC profile. A detailed description of how the species polygon was developed is included below.

***Meridolum corneovirens* (Cumberland Plain Land Snail)**

A species polygon has been prepared for Cumberland Plain Land Snail based on assumed presence within all areas of suitable habitat (Figure 3-7). Areas of potential habitat within the subject land includes unmown areas of PCT 835 Moderate as it contains a good cover of leaf litter and logs. All other associated PCTs do not contain suitable habitat for this species, as they occur in predominately mown areas and did not contain a good cover of leaf litter and logs suitable for the persistence of this species.

A total of 1.02 ha of habitat for Cumberland Plain Land Snail was identified within the subject land.

***Myotis macropus* (Southern Myotis)**

A species polygon has been prepared for Southern Myotis based on assumed presence within all areas of suitable habitat (Figure 3-8). In accordance with OEH (2018), the species polygon for the Southern Myotis includes all habitat on the subject land where the subject land is within 200m of a waterbody with pools/ stretches 3m or wider including rivers, creeks, billabongs, lagoons, dams and other waterbodies on the subject land. This includes all mapped streams and dams in the vicinity of the subject land. The species polygon boundaries align with PCTs on the subject land to which the species is associated (listed in the TBDC) that are within 200m of suitably sized mapped waterbodies.

A total of 2.11 ha of habitat for the Southern Myotis was identified within the subject land.

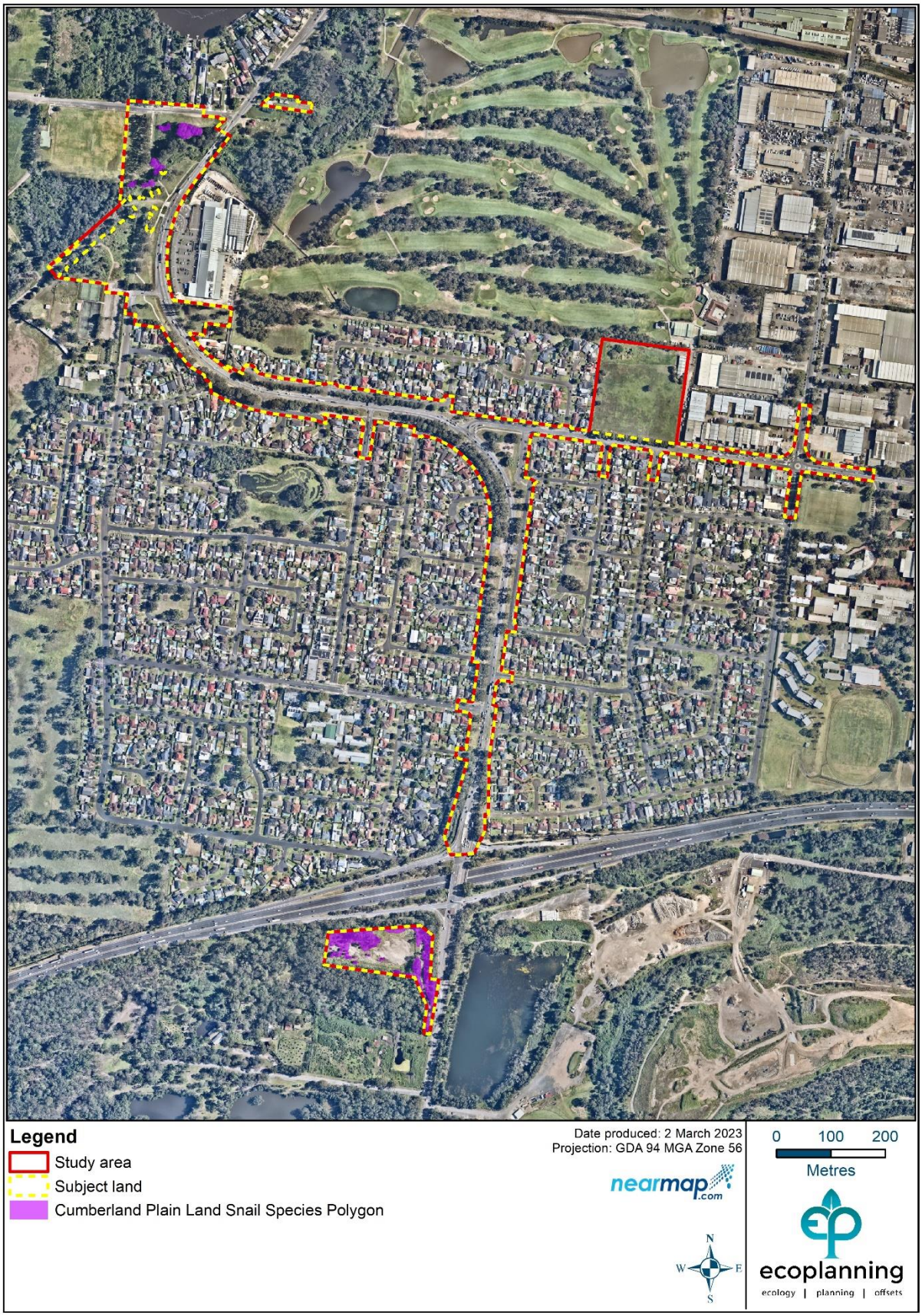

Figure 3-7: Species polygon for Cumberland Plain Land Snail (*Meridolum corneovirens*).

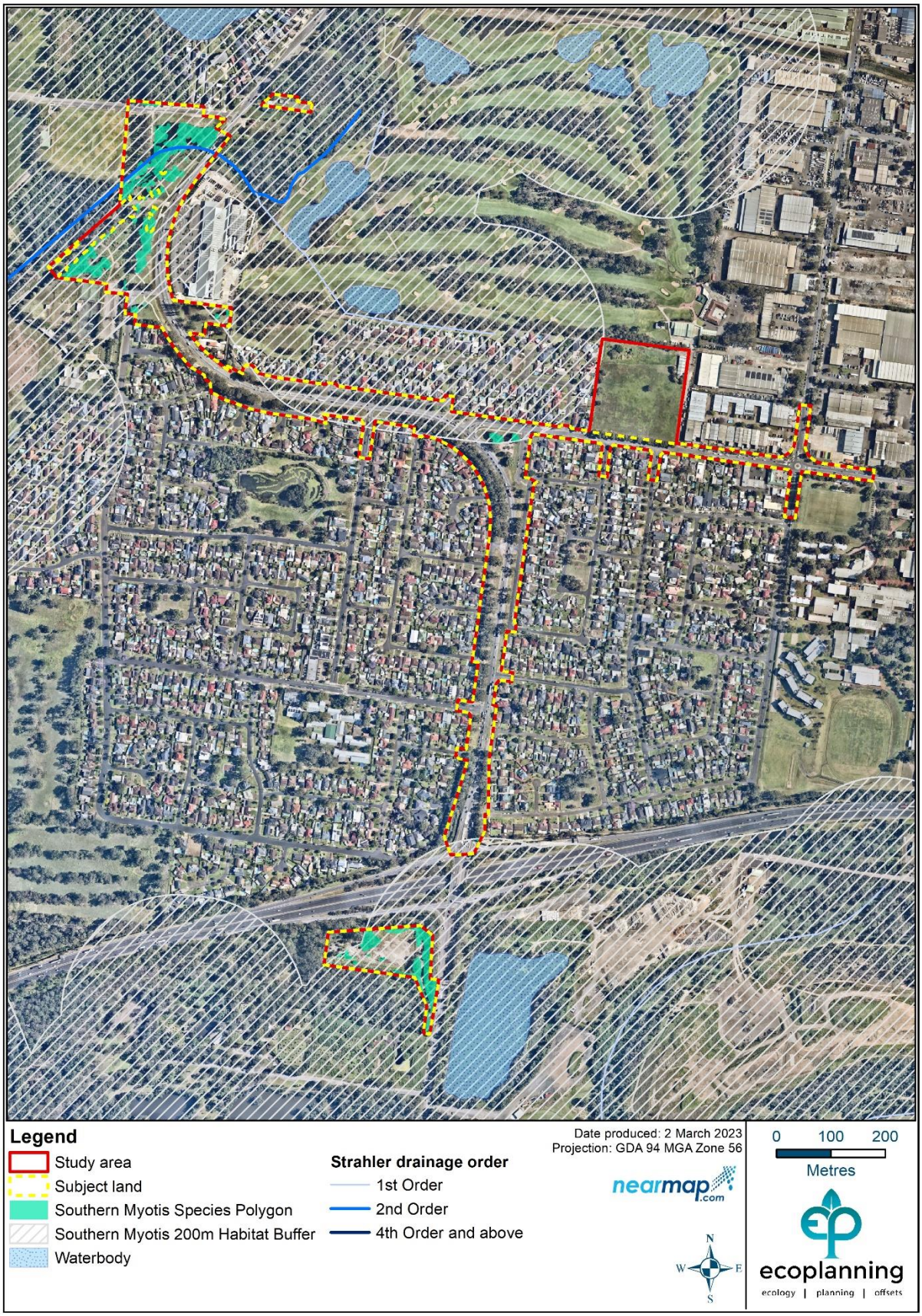

Figure 3-8: Species polygon for Southern Myotis (*Myotis macropus*).

3.6 Aquatic results

One second order watercourse (Milperra Drain) is located within the study area. This watercourse originates northeast of the study area within Bankstown Golf Course and Ashford Reserve, and flows west underneath Henry Lawson Drive, then south of Auld Ave and north of Keys Parade, eventually entering the Georges River. This watercourse is not listed as Key Fish Habitat under the FM Act. An aquatic habitat assessment was undertaken via a visual inspection at the locations shown in Figure 2-5. The results are listed in Table 3-4.

Table 3-4: Aquatic habitat assessment results

Feature / criteria assessed	Results
The ecosystem type (eg wetlands, floodplains, streams, estuaries, lakes)	Second order stream
Dimensions of waterway and depth of water	1-2m wide stream with relatively straight alignment. Water opaque so depth could not be determined. Likely less than 1 m.
Flow characteristics and hydrological features of aquatic habitat, including changes to drainage and filtration and flow regime	Slow water flow to the west at time of survey, but likely to fluctuate based on rainfall (as evidence by some steep bank erosion). Highly altered stream due to changes in surrounding landuse, weed invasion high.
Bed substrate (eg rocks, coral, gravel, sand, mud)	Clay substrate with some visible bank erosion.
Habitat features (eg pools, riffles, billabongs, reefs)	No pools or riffles
Existing infrastructure and barriers to fish movement (natural or artificial)	Culvert below Henry Lawson Drive may present a barrier during times of low flow. Footbridge downstream as no impact on fish passage.
Width and species composition of riparian vegetation including the type of vegetation present (eg macrophytes, snags, seaweeds, seagrasses, mangroves, saltmarsh) and condition	No visible snags or coarse weedy debris. In stream vegetation mostly absent. Riparian vegetation present but dominated by exotic grasses, shrubs and trees. Some native canopy overhanging, including *Casuarina glauca* (Swamp Oak) and *Eucalyptus moluccana* (Grey Box).
Water quality (based on visual observations)	Water clarity was poor with high suspended solids.

The stream is in a degraded condition and is not mapped as Key Fish Habitat. The Fisheries Spatial Data Portal and Protected Matters Search was conducted to determine the likelihood of threatened freshwater aquatic species occurring within or adjacent to the study area (Appendix B). No species were determined to have a moderate to high potential to occur within the study area. As such, no detailed aquatic fauna survey has been conducted.

Aquatic habitat assessment results from WSP (2021) based on the Riparian, Channel and Environmental Inventory method (RCE) (Chessman et al., 1997), resulted in a score of 38 and 35 at habitat assessment site 11 and 12, both of which are located along the second order stream within Stage 1B. Both sites were assigned a moderate condition, as the RCE score of 52 represents an undisturbed habitat and a score of 13 is the lowest condition.

Photo 3-11: Milperra Drain south of Auld Avenue

Photo 3-12: Milperra Drain west of Henry Lawson Drive bridge

3.7 Areas of outstanding biodiversity value

No areas of outstanding biodiversity value are located within the study area.

3.8 Wildlife connectivity corridors

As described in Section 2.4.4, the extent of native vegetation within a 1500 metre buffer around the study area is 20 %. The limited habitat connectivity is present within most of the study area. The study area predominately occurs along a road corridor within an urban area. However, the northern and southern extents do comprise areas of bushland that are directly linked to vegetated corridors. For instance, the southern extent of the study area is directly linked to extensive bushland areas within Deepwater Park. In addition, some connectivity is present within the northern extent of the study area, which provides a direct link from the study area to the vegetated riparian areas along the Georges River.

3.9 SEPPs

3.9.1 Resilience and Hazards SEPP 2022

State Environmental Planning Policy (Resilience and Hazards) 2021 commenced on 1 March 2022 and includes coastal planning provisions. Chapter 2 (Coastal management) of this SEPP implements the objectives of the Coastal Management Act 2016 from a land use planning perspective, by specifying approvals pathways and how development proposals are to be assessed if they fall within the coastal zone.

The SEPP promotes an integrated and coordinated approach to development assessment, with tailored development controls to ensure development proponents and consent authorities consider and address the most important issues for the coastal management area(s) their proposal falls within. The SEPP is supported by detailed mapping. Figure 3-9 shows that part of the northern subject site and the southern ancillary facility intersect the *Proximity area for Coastal Wetlands*.

The southern ancillary facility (south of the M5 Motorway) intersects the proximity area for coastal wetlands. However, the coastal wetland occurs east of the Henry Lawson Drive and is separate from the proposed ancillary facility by hardstand road and there doesn't appear to be any connectivity of habitat or drainage between the wetland and proposed ancillary facility. In addition, the northern ancillary facility located at 439 Henry Lawson Drive occurs wholly within the Proximity area for Coastal Wetlands. The boundary for Stage 1B has been explicitly altered to exclude areas of coastal wetland located within the property. Given the proposed activity (stockpile sites) will occur within an existing disturbed environment, the likelihood of negatively affecting areas of coastal wetland is low. The Construction Environmental Management Plan (CEMP) should address hydrological management of to ensure the adjacent wetland is not affected by the proposed works. Limiting vegetation clearing in the vicinity of the watercourse, sediment and erosion control, acid sulfate soil management and water quality controls should be in place.

3.9.2 SEPP (Biodiversity and Conservation) 2021

City of Canterbury Bankstown is not listed as an LGA to which Chapter 3 (Koala habitat protection 2020) or Chapter 4 (Koala habitat protection 2021) applies. In addition, this chapter only applies to Part 4 developments. The likelihood of koalas occurring within the study area is low (Appendix B). Koala use trees do occur within the study area, but koala habitat is poor and highly disturbed, consisting of mostly planted native vegetation along roadsides. There is a lack of connectivity with the Campbelltown Koala population to the south, as the landscape is fragmented and urbanised, with long established residential areas and busy roads.

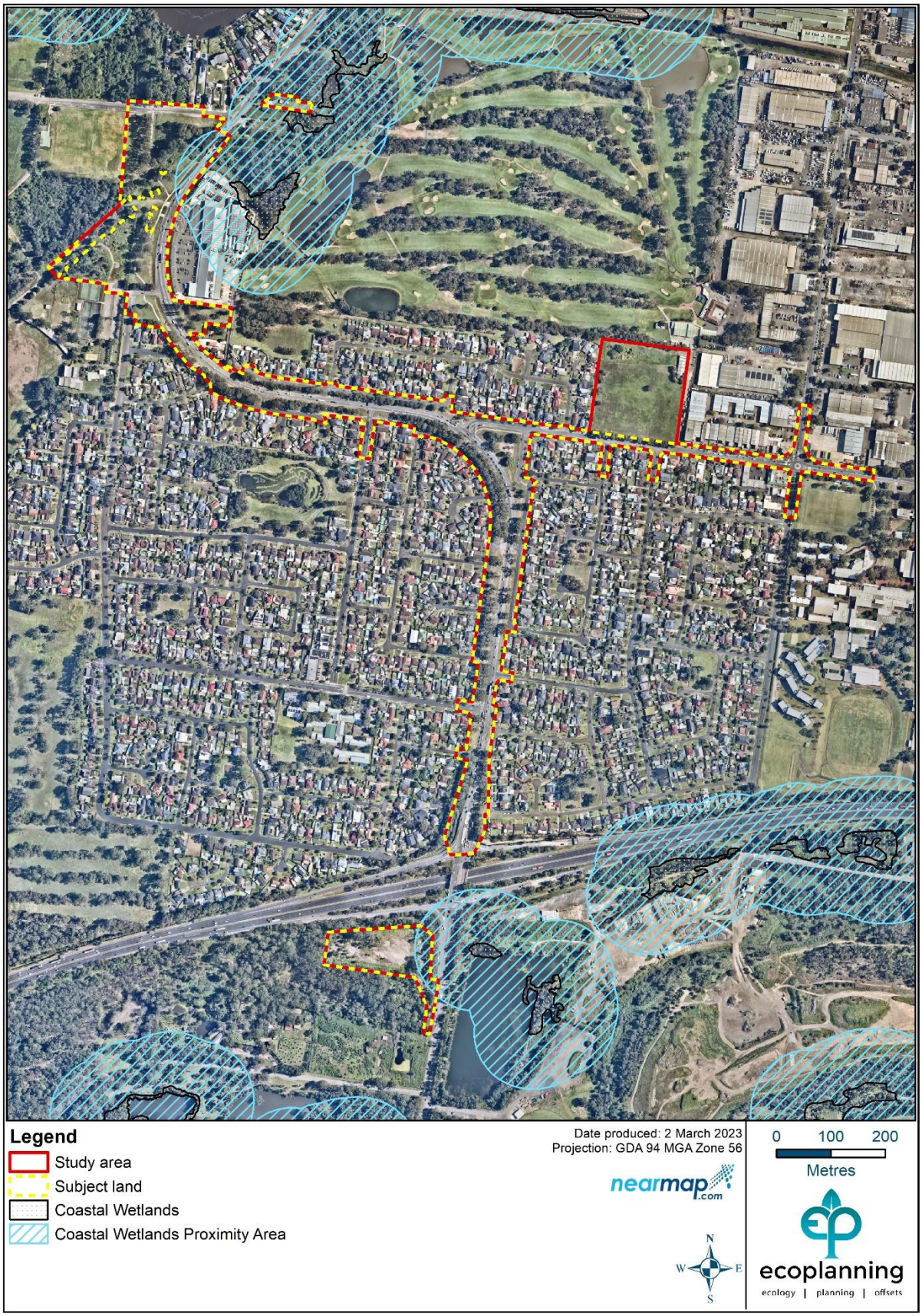

Figure 3-9: Coastal wetland and proximity areas occurring within and/or adjacent to the study area.

3.10 Matters of national environmental significance

The following MNES protected under the EPBC Act have been considered for their relevance to Stage 1B:

- World Heritage Properties
- National Heritage Places
- Wetlands of international importance
- Listed threatened species and communities
- Listed migratory species
- Commonwealth land (for actions outside Commonwealth Land that may impact on the environment on Commonwealth Land)

The following MNES are relevant to Stage 1B:

- Listed threatened species and communities
- Listed migratory species

3.10.1 Threatened Ecological Communities

The PMST report indicated the following twelve EPBC listed TECs have the potential to occur within the study area:

- Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland
- Cooks River/Castlereagh Ironbark Forest of the Sydney Basin Bioregion
- Western Sydney Dry Rainforest and Moist Woodland on Shale
- Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion
- Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest
- Coastal Upland Swamps in the Sydney Basin Bioregion
- Castlereagh Scribbly Gum and Agnes Banks Woodlands of the Sydney Basin Bioregion
- Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community
- River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria
- Subtropical and Temperate Coastal Saltmarsh
- Turpentine-Ironbark Forest of the Sydney Basin Bioregion
- Shale Sandstone Transition Forest of the Sydney Basin Bioregion

As described in Section 2.3.2, vegetation survey and classification were conducted to determine the best-fit PCTs within the study area. The site assessment and subsequent analysis (Section 3.3) established that no TECs listed under the EPBC Act were present within the study area based on the minimum condition criteria not being met.

3.10.2 Threatened species

The PMST database search indicated 94 EPBC listed threatened species and 46 listed migratory species have the potential to occur within the study area. A habitat assessment was subsequently undertaken to assess the likelihood of each threatened and/or migratory species to occur in the study area (Appendix B). The assessment was based on the results of database searches within a 10km radius of the study area. Furthermore, the BioNet 'Threatened Species to Plant Community Types Association' data power query was utilised to assess the threatened species that are associated with the PCTs mapped within the study area for the relevant IBRA subregion. This was later qualified after plot data was entered into the BAMC and a list of threatened species associated with the PCTs was derived.

The site assessment revealed that two threatened species have a moderate to high potential of occurring within the study area. These included:

- *Hirundapus caudacutus* (White-throated Needletail), Vulnerable and Migratory

- *Pteropus poliocephalus* (Grey-headed Flying-fox), Vulnerable

A Significant Impact Assessment was conducted these two species (Appendix E). It was determined that the proposal would not lead to a significant impact on any threatened species listed under the EPBC Act. Therefore, no EPBC Act referral is required.

4. Avoidance and minimisation

Transport address impacts to biodiversity through applications of the 'avoid, minimise, mitigate and offset' hierarchy as follows:

1. Avoid and minimise impacts.
2. Mitigate impacts.
3. Offset impacts in accordance with Transport guidelines.

This chapter of the BAR demonstrates the efforts taken to avoid and minimise impacts on biodiversity values.

The Biodiversity Assessment Report for Strategic Design of the Henry Lawson Drive upgrade program from the M5 Motorway to the Hume Highway (WSP 2019) identified two options for the proposed upgrade – a four lane and six lane option. The four-lane option has been adopted. The concept design illustrated in Figure 1-2 demonstrates that the upgrade will include the widening of the existing route into roadside verges, apart from the construction of a new local link road between Auld Avenue and Keys Parade. As the adopted design involves widening the existing road corridor, the options to avoid and minimise are limited.

Nonetheless, much of the vegetation within the study area is Planted Native Vegetation, which is located in avenues along Henry Lawson Drive. There are small areas of TECs associated with the stream south of Auld Road and within ancillary facilities that will be affected. All of these TECs are in a degraded state, consisting of mature canopy with a mown or exotic dominated groundcover and no shrub layer.

Note that while the final design is still in preparation, the subject land (impact area) is significantly larger than the existing design impact. This has been utilised to provide flexibility with the final design and ensure all ecological constraints are considered during this design phase. As such, the impact discussed in Section 5 of this BAR are likely to be overstated, with the final construction footprint seeking to retain as many areas of native vegetation and fauna habitat as possible. Minimising clearing within TECs, retaining hollow-bearing trees and limiting impacts to riparian vegetation and watercourse would avoid and minimise impacts.

The ancillary facilities identified within the study area each contain TECs which will be retained wherever possible, particularly as some of these areas (eg. Bullecourt Avenue) are isolated trees within exotic cleared grassland. The ancillary facility south of the M5 Motorway would utilise existing fenced and hardstand area and surrounding TEC will be retained. The access road into this area is heavily weed infested either side of the track and will require clearing to widen the access track. The vegetation within the hardstand area is largely regenerating eucalypts that have seeded from the surrounding vegetation and are highly modified and of low biodiversity value and as such, should be used as an ancillary facility while surrounding vegetation in a moderate to high condition located outside of the fenced area would be retained.

5. Impact assessment

5.1 Construction direct impacts

5.1.1 Removal of native vegetation

A summary of the direct impacts of Stage 1B on native vegetation in provided in Table 5-1. The amount of vegetation removal required to facilitate Stage 1B is 11.44 ha, which is comprised of 2.62 ha of native planted vegetation, 5.76 ha of exotic vegetation and 3.06 ha of native vegetation communities. Note that while the final design is still in preparation, the subject land (impact area) is significantly larger than the existing design impact. This has been utilised to provide flexibility with the final design and ensure all ecological constraints are considered during this design phase. As such, the direct impacts outlined below are likely to be overstated, with the final construction footprint seeking to retain as many areas of native vegetation and fauna habitat as possible.

Table 5-1: Summary of direct impacts on native vegetation

Veg. zone	Plant community type (PCT)	Broad condition class	TEC	Area to be impacted (ha)[1]
Zone 1	PCT 725 – Broad-leaved Ironbark – Melaleuca decora shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion	Low	Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion (BC Act listed EEC)	0.14
Zone 2	PCT 781 – Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion	Good	Not at TEC	0.08
Zone 3	PCT 835 – Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Moderate	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (BC Act listed EEC)	2.16
Zone 4	PCT 1067 – Parramatta Red Gum woodland on moist alluvium of the Cumberland Plain, Sydney Basin Bioregion	Moderate	Castlereagh Swamp Woodland Community (BC Act listed EEC)	0
Zone 5	PCT 1800 – Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley	Moderate	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (BC Act listed EEC)	0.68
N/A	N/A	Planted Native Vegetation	N/A	2.62
Total				5.68
NOTE 1: Area to be cleared based on ground-truthed vegetation mapping within the subject land.				

5.1.2 Removal of threatened fauna habitat

Direct impacts on threatened fauna species and their habitat is summarised in Table 5-2. The credit type of each species has been assigned based on the BAMC. However, dual credit species with breeding habitat not present in the subject land have been assigned to the 'ecosystem' credit type. These species include:

- *Haliaeetus leucogaster* (White-bellied Sea-Eagle) and *Pandion cristatus* (Eastern Osprey), as no breeding habitat (large stick nests) was recorded within the study area during the habitat assessment surveys.
- *Ninox strenua* (Powerful Owl) – no hollows greater than 20 cm were recorded within the study area during habitat assessment surveys.
- *Miniopterus australis* (Little Bent-winged Bat) and *Miniopterus orianae oceanensis* (Large Bent-winged Bat), as no cave, tunnel, mine, culvert or other structure were recorded within the study area during habitat assessment surveys, and is known or suspected to be used for breeding.

The area of impact was determined by PCT association with a species, as listed in the BioNet Threatened Species Data Collection (DPE 2022a), which is listed below in Table 5-2. The area of impact for each PCT associated with a species was added to form the impact area. The area of Planted Native Vegetation affected (2.66 ha) has also been added to the impact area for highly mobile species known to forage on or over planted native vegetation, including microbats, Grey-headed Flying-Fox and Little Lorikeet.

Primarily, the proposed impacts would result in the loss of potential foraging habitat for highly mobile threatened bats and birds. Key habitat features affected by Stage 1B include the loss of one hollow-bearing tree that forms potential roosting/breeding habitat for hollow-dependent microbats including *Falsistrellus tasmaniensis* (Eastern False Pipistrelle), *Micronomus norfolkensis* (Eastern Coastal Free-tailed Bat), *Myotis macropus* (Southern Myotis), *Saccolaimus flaviventris* (Yellow-bellied Sheathtail-bat) and *Scoteanax rueppellii* (Greater Broad-nosed Bat). The loss of potential foraging habitat for *Myotis macropus* (Southern Myotis) would result from road works affecting the freshwater aquatic habitat in Milperra Drain. Areas of fallen logs and leaf litter within PCT 835 affected by Stage 1B are potential habitat for *Meridolum corneovirens* (Cumberland Plain Land Snail). The Southern Myotis and Cumberland Plain Land Snail are the only two species credit species that have the potential to be affected by the proposed works.

Relevant key threatening processes related to direct impacts on habitat features include:

- Clearing of native vegetation.
- Loss of hollow-bearing trees.
- Removal of dead wood and dead trees.

Table 5-2: Summary of direct impacts on threatened fauna and habitat

Species name	EPBC Act	BC Act	Credit type[1]	Potential occurrence (Moderate, High, Recorded)	Associated habitat in subject land	Impact (ha)
Artamus cyanopterus cyanopterus (Dusky Woodswallow)	-	Vulnerable	Ecosystem	Moderate	PCT 725 PCT 781 PCT 835 PCT 1800	3.06
Daphoenositta chrysoptera (Varied Sittella)	-	Vulnerable	Ecosystem	Moderate	PCT 725 PCT 835 PCT 1800	2.98
Falsistrellus tasmaniensis (Eastern False Pipistrelle)	-	Vulnerable	Ecosystem	Moderate	PCT 725 PCT 781 PCT 835 Planted Native Vegetation	5.68

Species name	EPBC Act	BC Act	Credit type[1]	Potential occurrence (Moderate, High, Recorded)	Associated habitat in subject land	Impact (ha)
Glossopsitta pusilla (Little Lorikeet)	-	Vulnerable	Ecosystem	Moderate	PCT 725 PCT 781 PCT 835 PCT 1800 Planted Native Vegetation	5.68
Haliaeetus leucogaster (White-bellied Sea-Eagle)	-	Vulnerable	Ecosystem	Moderate	PCT 725 PCT 781 PCT 835 PCT 1800	3.06
Hirundapus caudacutus (White-throated Needletail)	Migratory	Vulnerable	Ecosystem	Moderate	PCT 725 PCT 781 PCT 835 PCT 1800	3.06
Meridolum corneovirens (Cumberland Plain Land Snail)	-	Vulnerable	Species	Moderate	PCT 835 containing leaf litter	1.02*
Micronomus norfolkensis (Eastern Coastal Free-tailed Bat)	-	Vulnerable	Ecosystem	Moderate	PCT 725 PCT 781 PCT 835 PCT 1800 Planted Native Vegetation	5.68
Miniopterus australis (Little Bent-winged Bat)	-	Vulnerable	Ecosystem	Moderate	PCT 725 PCT 781 PCT 835 PCT 1800 Planted Native Vegetation	5.68
Miniopterus orianae oceanensis (Large Bent-winged Bat)	-	Vulnerable	Ecosystem	Moderate	PCT 725 PCT 781 PCT 835 PCT 1800 Planted Native Vegetation	5.68
Myotis macropus (Southern Myotis)	-	Vulnerable	Species	Moderate	All native vegetation within 200 m of water bodies	2.11*
Ninox strenua (Powerful Owl)	-	Vulnerable	Ecosystem	Moderate	PCT 725 PCT 835 PCT 1800	2.98
Pandion cristatus (Eastern Osprey)	-	Vulnerable	Ecosystem	Moderate	PCT 781 PCT 835	2.92

Species name	EPBC Act	BC Act	Credit type[1]	Potential occurrence (Moderate, High, Recorded)	Associated habitat in subject land	Impact (ha)
					PCT 1800	
Pteropus poliocephalus (Grey-headed Flying-fox)	-	Vulnerable	Ecosystem	Moderate	PCT 725 PCT 781 PCT 835 PCT 1800 Planted Native Vegetation	5.68
Saccolaimus flaviventris (Yellow-bellied Sheathtail-bat),	-	Vulnerable	Ecosystem	Moderate	PCT 725 PCT 781 PCT 835 PCT 1800 Planted Native Vegetation	5.68
Scoteanax rueppellii (Greater Broad-nosed Bat)	-	Vulnerable	Ecosystem	Moderate	PCT 725 PCT 835 PCT 1800 Planted Native Vegetation	5.60
*As per species polygon.						

5.1.3 Removal of threatened flora

No threatened flora species were recorded within the study area and none are considered likely to occur. As such, no impacts to threatened flora species are expected to result from Stage 1B.

5.1.4 Aquatic impacts

Aquatic habitat affected by the proposed works will include a new creek crossing (box culvert) along the Auld Ave to Keys Parade local link road and road widening on Henry Lawson Drive south of the existing crossing. Both works will affect Milperra Drain. The new creek crossing on the link road (box culvert) will be in the vicinity of an existing footbridge crossing. The new link road would impact an artificial wetland (PCT 781) and areas of PCT 835 and PCT 1800.

There will be no direct impacts to Key Fish Habitat as a result of the proposed works. Indirect impacts to Key Fish Habitat may result via disturbance to Milperra Drain, as it flows into the Georges River, which is Key Fish Habitat. Disturbance to sediments during construction may affect water quality downstream. However, given the small width of the stream and the distance from the proposed works to the Georges River (600 m), the impact to water quality within Key Fish Habitat is expected to be negligible.

There will be no direct or indirect impact to threatened species, populations, ecological communities and their habitat listed under the FM Act. As such no assessment of significance in accordance with Division 12 of the FM Act is required.

No coastal wetlands are proposed to be impacted by Stage 1B. As the study area intersects the proximity area for coastal wetlands, the Construction Environmental Management Plan (CEMP) should address hydrological management of to ensure adjacent wetlands are not affected by the proposed works.

No FM Act listed threatened fish are considered likely (by DPI Fisheries) to occur within the study area, nor does the study area provide habitat for threatened aquatic species or mapped Key Fish Habitat under the FM Act. However, areas of riparian vegetation (PCT 1800 and PCT 835) will be affected in the form of canopy trees. The shrub and groundcover stratum are dominated by exotic flora.

In stream vegetation was not recorded and no snags were present at the time of the site inspection. However, relocation of any instream habitat and snags should be undertaken (if required) to retain these habitat values within the study area.

Final design and construction methods are to consider the maintenance of fish passage. Urban stream works that may obstruct fish passage include (DPI 2013):

- Any in-stream structures that create a drop or step in the channel greater than 100 mm in height.
- Bank or bed works that constrict flow, reduce the cross-sectional area of the stream or cause hydraulic barriers.
- The installation of pipes within any watercourse.
- Gross pollutant traps, sediment basins and other structures that are placed within a stream.

In regard to the works affecting aquatic habitat and fish passage, NSW DPI:

- Must be consulted in regard to urban stream works that will obstruct fish passage as they may require a permit under the FM Act. As the stream crossing detailed design is yet to be finalised, the obstructions listed above should be avoided if possible.
- Will treat artificial habitats that are linked to natural habitats upstream as 'on-line systems'. As such, NSW DPI will generally require that the created lands provide for connectivity between habitats including continuous fish passage.
- Requires that off-line artificial habitats be designed to have minimal impact on adjacent natural systems or receiving waters. Diversion of flows from natural habitats into off-line artificial wetlands will generally not be approved.
- Requires that detention ponds and other stormwater treatment devices should be located off-stream and at-source to ensure they do not interfere with fish passage.
- Will generally only support the creation of artificial wetlands when they are not at the expense of existing natural habitat

In addition, DPI require the cumulative impacts on water quality, acid sulfate soils (which are likely to be present within the aquatic habitat in the study area), changes in flow velocity and volume and land contamination to be assessed and managed DPI 2013). The use of box culverts to maintain fish passage and the other guidelines listed above should be considered in road design.

Depending on the final design, a permit may be required from DPI for dredging and reclamation and obstruction to fish habitat.

5.1.5 Injury and mortality

The proposal will include road widening, temporary disturbance of ancillary facilities and a new road link between Auld Ave and Keys Parade. Given the existing long established urban landscape, the risk of injury and mortality both during construction and operation of the roads is considered low. Injury threat along Henry Lawson Drive is already present and road widening would not increase this risk.

The new link road between Auld Ave and Keys Parade would present a new collision risk for fauna during construction and operation. However, this risk is expected to be low, given there are no large areas of adjacent habitat that would support a large number of ground dwelling fauna, which are most at risk of injury during movement.

There is always a risk of fauna injury during removal of habitat, which can be reduced through pre-clearance surveys and clearing supervision.

5.1.6 Groundwater dependent ecosystems

The study area contains high potential terrestrial GDE's with the southern ancillary facility (Figure 3-6). High potential GDE's are also mapped just outside the northern section of the study area. The vegetation associated with terrestrial GDE's within the study area include the PCT 835 Cumberland Riverflat Forest and PCT 1800 Cumberland Swamp Oak Riparian Forest, both of which area associated with fresh water. A groundwater assessment was referenced by WSP (2021) in relation to the Stage 1A project. Given Section 1B occurs over a similar landscape and vegetation types as Section 1A, this assessment is likely to apply to the likely impacts to GDEs within Section 1B. The assessment states:

There is potential for impacts to aquatic and terrestrial GDEs through leaching of potential acid sulfate soils into GDE habitats during construction, stormwater discharges leading to burial by sediment and toxicological impacts from potential

contaminants, and through transport of existing contaminant sources through preferential drainage paths (i.e. backfilled utilities trenches) during construction and operational phases.

Due to the relatively minor extent of excavations and the implementation of environmental groundwater safeguards it is unlikely that interception of groundwater flows would significantly affect groundwater dependent ecosystems within the study area. The REF proposal is not expected to substantially interfere with subsurface or groundwater flows associated with the Georges River.

5.2 Indirect and operational impacts

Indirect impacts occur when the proposal or activities relating to the construction, operation and general change in land-use patterns of the proposal affect native vegetation, threatened ecological communities, threatened species and their habitats beyond the subject land (direct impact area). The following subsections identify and discuss any indirect and/or operational impacts relevant to the proposal.

5.2.1 Edge effects on adjacent native vegetation and habitat

The vegetation within the study area is already highly disturbed. There are no large patches of undisturbed vegetation that would contain an undisturbed core. The southern ancillary facility has connectivity to larger areas of native vegetation along the Georges River. However, the ancillary facility will utilise an existing hardstand fenced compound and removal of adjacent native vegetation would not be required. Weed species were prolific in this area, so any clearing along the existing access track will be within heavily disturbed vegetation.

Likewise, the condition of the vegetation within the north and north-west of the study area around Milperra Drain is heavily disturbed, with native vegetation restricted to the canopy and exotic species dominant within the shrub and ground stratum. While new edges would be created in this area due to the proposed new link road and road widening of Henry Lawson Drive, edge effects already extend throughout these patches of vegetation, based on the high cover of exotic species.

5.2.2 Wildlife connectivity and habitat fragmentation

There are no large areas of habitat that would become fragmented by the proposed works. The landscape is already highly fragmented and only likely to be utilised by highly mobile birds and bats, apart from *Meridolum corneovirens* (Cumberland Plain Land Snail) which is a short-range endemic invertebrate that can exist in small populations in small patches of habitat that provide leaf litter and fallen logs. This species was not surveyed by WSP (2021) or Ecoplanning and given it has a moderate likelihood of occurrence, presence within the subject land has been assumed.

The riparian vegetation within the north of the study area currently provides tenuous connectivity between native vegetation to the east and west. However, cleared land and Henry Lawson Drive already present barriers to fauna movements across this corridor, which is likely to be utilised by highly mobile birds and bats. Removal of vegetation within this location would increase the distance between vegetation patches along the riparian corridor, which could be problematic for short-range endemics, including *Meridolum corneovirens* (Cumberland Plain Land Snail). A survey is recommended in this area during the design phase to determine if the species is present. If present, pre-clearing surveys are also recommended to ensure any individuals within the subject land are relocated to areas of native vegetation to be retained. This will minimiseimpacts to individuals of a potentially occurring population (see Table 6-1).

Common peri-urban species such as possums are likely to occur within the study area and would have adapted to navigating through the developed landscape and the risk of predation by feral and domestic animals and vehicle strike. Removal of vegetation within the subject land would remove connectivity for these species.

The vegetation along the roadsides, which is mostly mapped as Planted Native Vegetation provides stepping-stone habitat for highly mobile birds and bats. Removal of this vegetation would increase the distance between patches of planted roadside vegetation. However, other similar habitat is present throughout the urban area as roadside plantings and with golf courses public reserves.

5.2.3 Injury and mortality

As discussed in Section 5.1.5, injury and mortality would be a new risk to wildlife along the proposed local link road from Auld Ave to Keys Parade. However, given the landscape is already highly degraded, the likelihood of vehicle strike during construction or operation of the road is considered low. The landscape is not part of a large corridor of intact vegetation where fauna movements would be common.

5.2.4 Invasion and spread of weeds

Exotic species are dominant throughout the entire study area, particularly within the groundcover and mid-storey. There is always a risk that a new species of weed is introduced to an area. However, given the landscape is already heavily infested with exotic species, this risk if low, as it would not result in competition with native species, but rather already established weeds.

Table 5-3 lists the high threat exotic species identified in the study area. As the cover of exotics was consistent throughout the study area, there are no areas of low cover to map for future protection during construction.

Table 5-3: High threat weeds recorded within the study area.

Family	Species name	Common name
Amaranthaceae	*Alternanthera philoxeroides*	Alligator Weed
Apocynaceae	*Araujia sericifera*	Moth Vine
Asparagaceae	*Asparagus aethiopicus*	Asparagus Fern
Asparagaceae	*Asparagus asparagoides*	Bridal Creeper
Asteraceae	*Ageratina adenophora*	Crofton Weed
Asteraceae	*Bidens pilosa*	Cobbler's Pegs
Caprifoliaceae	*Lonicera japonica*	Japanese Honeysuckle
Commelinaceae	*Tradescantia fluminensis*	Wandering Jew
Cyperaceae	*Cyperus eragrostis*	Umbrella Sedge
Fabaceae (Faboideae)	*Erythrina crista-galli*	Cockspur Coral Tree
Lauraceae	*Cinnamomum camphora*	Camphor Laurel
Oleaceae	*Ligustrum lucidum*	Large-leaved Privet
Oleaceae	*Ligustrum sinense*	Small-leaved Privet
Poaceae	*Arundo donax*	Giant Reed
Poaceae	*Ehrharta erecta*	Panic Veldtgrass
Poaceae	*Eragrostis curvula*	African Lovegrass
Poaceae	*Paspalum dilatatum*	Paspalum
Rosaceae	*Rubus fruticosus* sp. Agg.	Blackberry comples
Sapindaceae	*Cardiospermum grandiflorum*	Balloon Vine
Solanaceae	*Cestrum parqui*	Green Cestrum
Solanaceae	*Solanum seaforthianum*	Climbing Nightshade
Verbenaceae	*Lantana camara*	Lantana

5.2.5 Invasion and spread of pests

Pest species were not recorded during the field survey. However, WSP (2021) recorded *Vulpes vulpes* (European Fox), *Rattus rattus* (Black Rat) and likely *Oryctolagus cuniculus* (Rabbit) within Stage 1A project study area. These species would also occur within Stage 1B. Exotic birds recorded or likely to occur include *Acridotheres tristis* (Indian Myna), *Columba livia* (Feral Pigeon) and *Turdus merula* (Blackbird). The proposed works are unlikely to introduced other pest fauna or increase the spread of pest species.

5.2.6 Invasion and spread of pathogens and disease

The following pathogens and diseases have been recorded within the Sydney Basin and affect biodiversity through illness and death of flora and fauna:

- Plant disease:
  - Phytophthora (*Phytophthora cinnamomi*).
  - Myrtle Rust (*Austropuccinia psidii*).

- Amphibians:
  - Chytrid Fungus (*Batrachochytrium dendrobatidis*).
- Parrots:
  - Psittacine Circoviral Disease (Beak and Feather disease).
- Bats:
  - Australian bat lyssavirus.

There was no evidence of these diseases within the study area observed (eg. Die back, rust on Myrtaceae, dead frogs, bats or parrots). Of most risk to the study area is the introduction of infected soil containing Phytophythora, Myrtle Rust of Chytrid Fungus during the proposed works. Come clean – go clean protocols for plant and equipment, use of clean fill and use of plant material including mulch from plants within the study area would reduce this risk.

5.2.7 Changes to hydrology

The existing hydrology is already altered due to development of the study area and surrounding land. Final design of the proposed road works may result in increased runoff due to a larger area of impervious road surface. Stormwater design should aim to maintain the existing flood regimes and levels and adequately treat stormwater within the pavement drainage system prior to discharge.

5.2.8 Noise, light, dust and vibration

Impacts to biodiversity as a result of noise, light, dust and vibration during the construction and operational phase of the proposed road upgrade would be minimal when considering the existing background levels along roads and adjacent urban areas. Temporary increases in light, dust, noise and vibration during construction are unlikely to displace local fauna or have long-term effects. Existing local fauna would have already adapted to these disturbances.

5.3 Cumulative impacts

Cumulative impacts consider the contribution of the proposal to ecological impacts in a local and regional context. The impacts of other Transport proposals, major proposals and other large-scale proposals are considered, so that cumulative impacts of vegetation and habitat removal, impacts on threatened species and ecological communities and water quality impacts are considered in a regional sense. These cumulative impacts have considered both concurrent and future proposals (where these are known or can be anticipated) and have been documented in Table 5-4. This data is mostly based on data provided for the Section 1A upgrade in WSP (2021).

Table 5-4: Present and future project/proposals

Project/proposal	Project phase	Biodiversity value impacted
Bankstown Airport Redevelopment South West Precinct	Construction phase	• Clearing of 3.5 ha of native vegetation including habitat for Grey-headed Flying Fox, Green and Golden Bell Frog, seven Microchiropteran Bats, Swamp Harrier, Little Eagle, Square-tailed Kite, Eastern Osprey, Varied Sittella, Dusky Woodswallow, Scarlet Robin and Flame Robin
SIMTA Intermodal Facility	Construction phase	• Clearing of 1.23 ha of native vegetation
Milperra Drain Widening	Construction phase	• 0.83 ha of River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-east Corner bioregions • 0.15 ha of Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions
Glenfield Waste Services Materials Recycling Facility	Planning and Assessment phase	• 9.5 ha of critically endangered Cumberland Plain Shale Woodland and Shale Gravel Transition Forest

Project/proposal	Project phase	Biodiversity value impacted
		• 5 threatened bat species recorded
Riverlands subdivision – Milperra	Planning and Assessment phase (approved)	• 0.54 ha River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-east Corner bioregions • 0.48 ha Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions • Southern Myotis • Green and Golden Bell Frog1
Henry Lawson Drive – Intersection Upgrades, Georges Hall	Planning and Assessment phase	• 0.47 ha of River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-east Corner bioregions • 0.02 ha of Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions • Habitat for Grey-headed Flying-fox, White-bellied Sea-eagle, Dusky Woodswallow and Little Lorikeet
Henry Lawson Drive – EIS proposal for Stage 1A	Planning and Assessment phase	• 0.02 ha of Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South-east Corner bioregions • 0.02 ha of River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-east Corner bioregions • 0.21 ha of Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions
Henry Lawson Drive – REF proposal for Stage 1A	Planning and Assessment phase	• 2.28 ha of native removal including PCT 725, PCT 781, PCT 835, PCT 1236, PCT 1234 and PCT 1800 (WSP 2022). However, some of this vegetation overlaps with Stage 1B.
Henry Lawson Drive – REF Stage 1B	This proposal	• Removal of 5.68 ha of native vegetation consisting of 3.06 ha of TEC and 2.62 ha of Planted Native Vegetation • Removal of habitat for threatened microbats, mammals, birds and Cumberland Plain Land Snail.
27 Bullecourt Avenue, Milperra	Planning and Assessment phase (approved)	• No biodiversity report undertaken. Removal of 0.13 ha of TEC and 0.01 ha of Planted Native Vegetation as per Ecoplanning 2022 assessment.
Cumulative total impact		**25.01 ha**

As a proportion of the cumulative impacts to native vegetation removal (excluding planted vegetation), the proposed Stage 1B upgrade represents 23% of the total cumulative impacts for the region. This is a worse-case scenario to allow for flexibility in final design. The actual impact of vegetation removal and habitat loss would likely be less once the final design is implemented.

5.4 Assessments of significance

Assessments of significance have been conducted for threatened species, populations and ecological communities that have been recorded in the study area or are assumed present as they have a moderate to high likelihood of occurrence. Some

species have been grouped into a single assessment where the species share similar life history characteristics and habitat requirements (e.g., threatened woodland birds, cave-roosting microbats, large forest owls, etc.).

Assessments of significance for species, populations and ecological communities listed under the BC Act and EPBC Act have complied with the following guidelines:

- Threatened biodiversity listed under the BC Act: Threatened Species Test of Significance Guidelines (nsw.gov.au).
- Matters of national environmental significance listed under the EPBC Act: Significant Impact Guidelines 1.1 – Matters of National Environmental Significance – DCCEEW.
- Referral guidelines for species listed under the EPBC Act: EPBC Act policy statements – DCCEEW

No threatened species listed under the FM Act were assumed to have a moderate to high likelihood of occurrence within the study area. As such, no Assessment of Significance under the FM Act was required.

'Tests of Significance' under the BC Act are included in Appendix D, and 'Assessments of Significance' under the EPBC Act are included in Appendix E. The results of each significance assessment have been summarised in Table 5-5 (BC Act 5-part test), and Table 5-6 (EPBC Act assessment).

Table 5-5: Summary of BC Act significance assessments findings

Significance assessment question *(per Section 7.2 of the BC Act and Threatened Species Test of Significance Guidelines (OEH 2018))*						
Threatened species, or communities	a	b	c	d	e	Likely significant impact?
Artamus cyanopterus cyanopterus (Dusky Woodswallow)	N	X	N	N	Y	N
Castlereagh Swamp Woodland Community	X	N	N	N	Y	N
Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion	X	N	N	N	Y	N
Daphoenositta chrysoptera (Varied Sittella)	N	X	N	N	Y	N
Falsistrellus tasmaniensis (Eastern False Pipistrelle),	N	X	N	N	Y	N
Glossopsitta pusilla (Little Lorikeet)	N	X	N	N	Y	N
Haliaeetus leucogaster (White-bellied Sea-Eagle)	N	X	N	N	Y	N
Meridolum corneovirens (Cumberland Plain Land Snail)	N	X	N	N	Y	N
Micronomus norfolkensis (Eastern Coastal Free-tailed Bat)	N	X	N	N	Y	N
Miniopterus australis (Little Bent-winged Bat)	N	X	N	N	Y	N
Miniopterus orianae oceanensis (Large Bent-winged Bat)	N	X	N	N	Y	N
Myotis macropus (Southern Myotis)	N	X	N	N	Y	N

Significance assessment question *(per Section 7.2 of the BC Act and Threatened Species Test of Significance Guidelines (OEH 2018))*						
Threatened species, or communities	a	b	c	d	e	Likely significant impact?
Ninox strenua (Powerful Owl)	N	X	N	N	Y	N
Pandion cristatus (Eastern Osprey)	N	X	N	N	Y	N
Pteropus poliocephalus (Grey-headed Flying-fox)	N	X	N	N	Y	N
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	X	N	N	N	Y	N
Saccolaimus flaviventris (Yellow-bellied Sheathtail-bat)	N	X	N	N	Y	N
Scoteanax rueppellii (Greater Broad-nosed Bat)	N	X	N	N	Y	N
Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	X	N	N	N	Y	N
Y *= Yes (negative impact),* ***N*** *= No (no or positive impact),* ***X*** *= Yes/No answer not applicable,* ***?*** *= unknown impact.*						

Table 5-6: Summary of EPBC Act significance assessments findings

Threatened species, or communities	Important population *(per Significant Impact Guidelines 1.1 (DoE 2013))*	Likely significant impact?
Hirundapus caudacutus (White-throated Needletail)	N	N
Pteropus poliocephalus (Grey-headed Flying-fox)	N	N
Y *= Yes (negative impact),* ***N*** *= No (no or positive impact),* ***X*** *= Yes/No answer not applicable,* ***?*** *= unknown impact.*		

6. Mitigation

As all impacts to biodiversity cannot be avoided by Stage 1B, the mitigation measures proposed below in Table 6-1 would assist with ensuring that direct and indirect impacts are mitigated to the highest extent possible. The table includes measures to be implemented before, during and after construction.

Table 6-1: Mitigation measures

ID	Impact	Mitigation measure	Timing and duration	Likely efficacy of mitigation	Residual impacts anticipated?	Responsibility
B01	Removal of native vegetation	Native vegetation removal will be minimised through detailed design and construction.	Detailed design	Effective	Loss of native vegetation	Transport
B02		Pre-clearing surveys will be undertaken in accordance with *Guide 1: Pre-clearing process* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Prior to construction	Effective		
B03		Vegetation removal will be undertaken in accordance with *Guide 4: Clearing of vegetation and removal of bushrock* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective		
B04		Native vegetation will be re-established in accordance with *Guide 3: Re-establishment of native vegetation* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Post construction	Effective		
B05		The unexpected species find procedure is to be followed under *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) if threatened ecological communities, not assessed in the biodiversity assessment, are identified in the proposal site.	During construction	Proven		
B06		A Biodiversity Offset Strategy for vegetation zones requiring offsetting will be prepared.	Detailed design	Effective		
B07		A Tree and Hollow Replacement Plan will be prepared for any residual biodiversity impact that does not requiring offsets in accordance with the No Net Loss Guidelines. Where suitable land is not available for replacement, payment will be made to the Transport Conservation Fund.	Detailed design	Effective		
B08	Removal of threatened fauna habitat	Threatened fauna habitat removal will be minimised through detailed design and construction.	Detailed design	Effective	Loss of threatened fauna habitat	Transport
B09		Fauna will be managed in accordance with *Guide 9: Fauna handling* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective		
B04		Habitat removal will be undertaken in accordance with *Guide 4: Clearing of vegetation and removal of bushrock* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective		

ID	Impact	Mitigation measure	Timing and duration	Likely efficacy of mitigation	Residual impacts anticipated?	Responsibility
B10		Habitat will be replaced or re-instated in accordance with *Guide 5: Re-use of woody debris and bushrock* and *Guide 8: Nest boxes* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Proven		
B11		The unexpected species find procedure is to be followed under *Guide 1: Pre-clearing process* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) if threatened fauna, not assessed in the biodiversity assessment, are identified in the proposal site.	During construction	Proven		
B12		Targeted surveys for Cumberland Plain Land Snail should be undertaken during the design phase to determine impact on any locally occurring populations. If not present during targeted survey, revise BAR and offset liabilities.	Detailed design	Proven		
B02		Pre-clearing surveys will be undertaken in accordance with *Guide 1: Pre-clearing process* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Proven		
B13		Pre-clearing surveys should be undertaken for Cumberland Plain Land Snail should it be found within the subject land during targeted surveys. Any individuals found should be relocated to areas of retained native vegetation. In addition, all large woody debris should be removed from impact areas and relocated to areas of retained native vegetation.	During construction	Proven		
B07		A Tree and Hollow Replacement Plan will be prepared for any residual biodiversity impact that does not requiring offsets in accordance with the No Net Loss Guidelines. Where suitable land is not available for replacement, payment will be made to the Transport Conservation Fund.	Detailed design	Effective		
B02	Removal of threatened flora	Pre-clearing surveys will be undertaken in accordance with *Guide 1: Pre-clearing process* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Proven	Loss of threatened flora	Transport
B05		The unexpected species find procedure is to be followed under *Guide 1: Pre-clearing process* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) if threatened flora species, not assessed in the biodiversity assessment, are identified in the proposal site.	During construction	Proven		
B14	Aquatic impacts	Impacts to aquatic habitat will be minimised through detailed design and construction.	Detailed design	Effective	Loss of aquatic habitat	Transport

ID	Impact	Mitigation measure	Timing and duration	Likely efficacy of mitigation	Residual impacts anticipated?	Responsibility
B15		Aquatic habitat will be protected in accordance with *Guide 10: Aquatic habitats and riparian zones* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) and Section 3.3.2 *Standard precautions and mitigation measures of the Policy and guidelines for fish habitat conservation and management Update 2013* (DPI (Fisheries NSW) 2013).	During construction	Effective		
B16		Depending on the final design, a permit may be required from DPI for dredging and reclamation and obstruction to fish habitat.	Detailed design	Effective		
B17	Groundwater dependent ecosystems	Interruptions to water flows associated with groundwater dependent ecosystems will be minimised through detailed design. No substantial impacts to groundwater flows are anticipated as a result of Stage 1B.	Detailed design	Effective		Transport
B18	Changes to hydrology	Changes to existing surface water flows will be minimised through detailed design. New drainage infrastructure and water quality controls will be installed within the proposal area. This includes upgrading drainage pits and pipes, and the installation of bioretention basins and swales.	Detailed design	Effective		Transport
B19	Fragmentation of identified habitat corridors	For landscape scale connectivity impacts: A Wildlife Connectivity Strategy will be prepared as part of final design in accordance with the requirements of the Transport Biodiversity Policy. Connectivity measures will be implemented in accordance with the *Draft Wildlife Connectivity Guidelines for Road Projects* (RTA 2011) or equivalent updated NSW Guidelines. Connectivity measures will be considered for impacts not considered a landscape scale connectivity impact in accordance with *the Draft Wildlife Connectivity Guidelines for Road Projects (RTA 2011)* or equivalent updated NSW Transport Guidelines.	Detailed design, during construction and post construction	Effective		Transport
B20		Any connectivity measures implemented will be installed under the supervision of an experienced ecologist.	During construction	Effective		Transport
B21	Edge effects on adjacent native vegetation and habitat	Exclusion zones will be set up at the limit of clearing in accordance *with Guide 2: Exclusion zones* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective		Transport
B09	Injury and mortality of fauna	Fauna will be managed in accordance with *Guide 9: Fauna* handling of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective		Transport

ID	Impact	Mitigation measure	Timing and duration	Likely efficacy of mitigation	Residual impacts anticipated?	Responsibility
B22	Invasion and spread of weeds	Weed species will be managed in accordance *with Guide 6: Weed management* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective		Transport
B23	Invasion and spread of pests	Pest species will be managed within the proposal site.	During construction	Effective		Transport
B24	Invasion and spread of pathogens and disease	Pathogens will be managed in accordance with *Guide 2: Exclusion zones* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective		Transport
B25	Noise, light, dust and vibration	Shading and artificial light impacts will be minimised through detailed design.	Detailed design	Effective		Transport
B26	All impacts	A site-specific CEMP will be developed prior to construction taking place and implemented over the life of the project. The CEMP will incorporate adaptive management principles. The CEMP will outline management actions to avoid inadvertently causing additional impacts to those described in this BAR. Management actions will avoid and/or limit the potential for indirect offsite impacts and include an appropriate erosion and sedimentation control plan and weed control activities. Any management actions should follow best practice protocols such as Landcom (2004) or the RTA Biodiversity Guidelines (2011).	Prior to construction	Effective		Transport

7. Offsets and other measures

7.1 Thresholds

This section details the process of identifying the biodiversity impacts in this BAR that trigger thresholds set out by No Net Loss Guidelines (Transport 2022; Table 7-1). Residual impacts that do not exceed offset thresholds must then consider the requirements of the Tree and Hollow Replacement Guidelines (Transport 2022). The direct impacts that require offsetting and any residual impacts that may be subject to tree and hollow replacement (or if works/impacts are excluded in accordance with each guideline) are identified in Table 7-2. Note that 'Moderate to good' condition vegetation is defined in Section 2.3.2 of the BAR.

The assessment of vegetation impacts against thresholds revealed that no vegetation zones trigger the offset thresholds as they either involve clearing <2ha of an EEC in 'moderate to good' condition, or the vegetation zone is in low condition. The extent of Zone 3 (PCT 835 moderate) includes 1.44 ha of remnant / regrowth and 0.72 ha of roadside planted native vegetation that has been assigned to this vegetation zone based on species composition and landscape position. As planted native vegetation does not require offsets under No Net Loss Guidelines, the extent of vegetation zone 3 that may require offsetting is 1.44 ha, which is below the 2 ha threshold.

As the proposed works would involve residual biodiversity impact to these vegetation zones, and do not require offsets in accordance with the No Net Loss Guidelines, these have subsequently been assessed against the requirements of the Tree and Hollow Replacement Guideline. As the proposed works would involve the clearing of hollows and/or trees ≥5cm DBH within each vegetation zone, the threshold has been triggered and tree and hollow replacements would be required (see Section 7.3).

The assessment of impacts to threatened species habitat revealed that the following two species credit species have triggered the offset thresholds, as Stage 1B involves clearing of habitat ≥ 1ha in 'moderate to good' condition (excluding exotic and planted vegetation that cannot be assigned to a plant community type):

- *Meridolum corneovirens* (Cumberland Plain Land Snail).
- *Myotis macropus* (Southern Myotis).

As the threshold has been triggered, offsetting will be required for these species. Preliminary offset calculations are outlined in Section 7.2.

Note that targeted surveys will be undertaken for *Meridolum corneovirens* (Cumberland Plain Land Snail) during the design phase. If this species is not present during targeted surveys, the BAR will be revised, and no offset liabilities will be required.

Table 7-1: Offset thresholds (Transport No Net Loss Guidelines).

Impact	Threshold
Works involving clearing of a CEEC	Where there is any clearing of an CEEC in 'moderate to good' condition
Works involving clearing of an EEC	Where clearing of a EEC ≥ 2ha in 'moderate to good' condition
Works involving clearing of VEC	Where clearing of VEC ≥ 5ha in 'moderate to good' condition
Works involving clearing of any habitat for a known species credit fauna species or clearing of breeding habitat (as defined by the TBDC) for dual-credit fauna species (excluding exotic and planted vegetation that cannot be assigned to a plant community type)	Where clearing ≥ 1ha in 'moderate to good' condition
Works involving removal of known threatened flora species and their habitat	Where loss of individuals is ≥10 or where clearing of habitat is ≥ 1ha
Type 1 or Type 2 key fish habitats	Where there is a net loss of habitat

Any residual biodiversity impact that doesn't require offsets in accordance with the No Net Loss Guideline is to be assessed against the requirements of the Tree and Hollow Replacement Guideline.	Any clearing of hollows and/or trees ≥5cm DBH

Table 7-2: Assessment of vegetation impacts against thresholds

Veg. zone	Plant community type (PCT)	Assigned Transport condition	TEC	Impact area (ha)[1]	Threshold triggered?
Zone 1	PCT 725 – Broad-leaved Ironbark – Melaleuca decora shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion	Low	Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion (BC Act listed EEC)	0.14	**No offset threshold triggered. Tree and hollow replacement required.**
Zone 2	PCT 781 – Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion	Good	Not at TEC	0.08	**No offset threshold triggered. Tree and hollow replacement required.**
Zone 3	PCT 835 – Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Moderate	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (BC Act listed EEC)	2.16 – comprised of 0.72 ha of planted vegetation (no offset required) and 1.44 ha of remnant/ regrowth	**No offset threshold triggered. Tree and hollow replacement required.**
Zone 4	PCT 1067 – Parramatta Red Gum woodland on moist alluvium of the Cumberland Plain, Sydney Basin Bioregion	Moderate	Castlereagh Swamp Woodland Community (BC Act listed EEC)	0	**No threshold triggered.**
Zone 5	PCT 1800 – Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley	Moderate	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (BC Act listed EEC)	0.68	**No offset threshold triggered. Tree and hollow replacement required.**
N/A	Planted Native Vegetation	N/A	N/A	2.62	**No offset threshold triggered. Tree and hollow replacement required.**

7.2 Preliminary offset calculations

A preliminary calculation of offsets for impacts triggering the thresholds identified in Section 7.1 is provided below. Offsets for terrestrial impacts (ie threatened species listed under the BC Act) have been preliminarily calculated as credits using the BAM-C. See Appendix F for a copy of the relevant BAM-C credit reports.

Calculation of tree and hollow replacement requirements requires counting trees and hollows within areas that do not require offsetting. A tree count will be required within each relevant vegetation zone to determine tree replacement requirements. Only one hollow bearing tree was present within the subject land, which will require replacement with three artificial hollows (Transport 2022b).

Table 7-3: Preliminary credit calculations for impacts to species-credit species

Species name	EPBC Act	BC Act	Impact (ha)[1]	Species credits
Meridolum corneovirens (Cumberland Plain Land Snail).	-	E	1.02	18
Myotis macropus (Southern Myotis)	-	V	2.11	32
Total species credits				**50**
NOTE 1: Impact area to be based on species polygons.				

7.3 Biodiversity offset strategy/tree and hollow replacement plan

As biodiversity offsetting thresholds have been reached under the No Net Loss Guideline, a Biodiversity Offset Strategy should be prepared as an environmental safeguard prior to the commencement of works. Additionally, as tree and hollow replacement is required under the Tree and Hollow Replacement Guidelines, a Tree and Hollow Replacement Plan is to also be prepared prior to the commencement of works as an environmental safeguard. Alternatively, where suitable land is not available for replacement, payment will be made to the Transport Conservation Fund prior to the commencement of works.

8. Conclusion

This BAR has assessed the likely biodiversity impacts of the proposal known as the 'Henry Lawson Drive Upgrade, Stage 1B'. The survey revealed five PCTs comprising five vegetation zones within the study area. In addition, two vegetation zones were present that did not conform to a locally occurring PCT. Approximately 5.68 ha of native vegetation would be impacted as a result of Stage 1B, including:

- 0.14 ha of PCT 725, conforming to Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion (BC Act listed EEC).
- 0.08 ha of PCT 781
- 2.16 ha of PCT 835, conforming to River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (BC Act listed EEC)
- 0.68 ha of PCT 1800, conforming to Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (BC Act listed EEC).
- 2.62 ha of Planted Native Vegetation.
- One hollow-bearing tree.

An assessment of significance was conducted for each impacted TEC in accordance with the Threatened Species Test of Significance Guidelines (OEH 2018c; Appendix D). It was determined that Stage 1B would not have a significant impact on any of these TECs. No EPBC Act listed TECs were present within the study area, as they did not conform to the condition thresholds set out in the relevant listing advice.

A habitat assessment was undertaken to assess the likelihood of threatened and/or migratory species to occur in the study area. The habitat assessment formed the basis for determining whether targeted surveys are required. The need for targeted surveys has considered all threatened species-credit species associated with the PCTs in the study area.

Targeted surveys for five species credit flora species and one species credit fauna species with a moderate to high likelihood of occurrence (as per Appendix B) were undertaken in accordance with Section 5.3 of the BAM and the relevant threatened species survey guidelines (DPIE 2020c). None of the targeted flora or fauna species were found to occur within the study area.

Targeted surveys were not conducted for two species credit fauna species: Cumberland Plain Land Snail and Southern Myotis. Based on the Transport guidelines, where a species credit species with a moderate to high likelihood of occurrence has not been adequately surveyed, then the species may be assumed present. Species polygons have been prepared for each of these species (Section 3.5.3). A Test of Significance for each species in accordance with Section 7.3 of the BC Act was undertaken (Appendix D).

Following habitat suitability assessment and targeted surveys for threatened fauna, fourteen BAM ecosystem credit species were deemed as having a moderate to high likelihood of occurrence within the subject land. These species are highly mobile and may intermittently use the subject land for foraging and/or breeding. A Test of Significance in accordance with Section 7.3 of the BC Act was undertaken for each species (Appendix D), and where relevant, Assessments of Significance in accordance with EPBC Act Significant Impact Guidelines 1.1 (DotE 2013; Appendix E) were undertaken. No threatened flora species were deemed to have a moderate or high likelihood of occurring within the subject land.

Transport addresses impacts to biodiversity through applications of the 'avoid, minimise, mitigate and offset' hierarchy. Several measures have been implemented to avoid and minimise impacts to biodiversity within the study area. Where impacts to biodiversity cannot be completely avoided by Stage 1B, several mitigation measures are outlined in this BAR to assist with ensuring that direct and indirect impacts are mitigated to the highest extent possible.

The Transport No Net Loss Guidelines have been consulted to determine the offset thresholds for vegetation and threatened species within the study area. No impacts to vegetation zones exceeded the offset thresholds.

The following species credit species have exceeded the offset threshold for works involving clearing of any habitat for a known species credit fauna species (in this case, assumed present), with species credits generated by the BAM-C:

- *Meridolum corneovirens* (Cumberland Plain Land Snail):
  - Species credits = 18
- *Myotis macropus* (Southern Myotis):

- Species credits = 32

As biodiversity offsetting thresholds have been reached under the No Net Loss Guideline, a Biodiversity Offset Strategy should be prepared as an environmental safeguard. The offset liability may need to be revised following targeted surveys for Cumberland Plain Land Snail, which will be undertaken during the design phase.

The 5.68 ha of vegetation that that does not require offsets in accordance with the No Net Loss Guideline were subsequently assessed against the requirements of the Tree and Hollow Replacement Guideline. All remaining vegetation zones will require tree and hollow replacement. A Tree and Hollow Replacement Plan is to be prepared as an environmental safeguard.

9. Glossary

Term	Definition
Accredited person or assessor	Means as person accredited under section 6.10 (of the BC Act) to prepare reports in accordance with the BAM.
Biodiversity Assessment Method	The Biodiversity Assessment Method is established under section 6.7 of the BC Act. The BAM is established for the purpose of assessing certain impacts on threatened species and threatened ecological communities (TECs), and their habitats, and the impact on biodiversity values.
Biodiversity Assessment Method Calculator	Biodiversity Assessment Method Calculator (BAM-C) – the online computer program that provides decision support to assessors and proponents by applying the BAM and referred to as the BAM-C. The BAM-C contains biodiversity data from the BioNet Vegetation Classification and the Threatened Biodiversity Data Collection that the assessor is required to use in a BAM assessment. The BAM-C applies the equations used in the BAM, including those to determine the number and class of biodiversity credits required to offset the impacts of a development, or created at a biodiversity stewardship site. It is published by the Department (DPIE 2020a).
Biodiversity credit report	The report produced by the BAM-C that sets out the number and class of biodiversity credits required to offset the remaining adverse impacts on biodiversity values at a development site, or on land to be biodiversity certified, or that sets out the number and class of biodiversity credits that are created at a biodiversity stewardship site (DPIE 2020a).
Biodiversity offsets	The gain in biodiversity values achieved from the implementation of management actions on areas of land, to compensate for losses to biodiversity values from the impacts of development (DPIE 2020a).
Biodiversity Offsets and Agreement Management System	The online system used to administer the Biodiversity Offsets Scheme. The BOAMS is used by accredited assessors (to carry out specific BAM-related tasks involving access to the BAM-C to perform assessments, submit data, generate credits and calculate a credit price), by landholders (to apply for a Biodiversity Stewardship Agreement and manage ongoing reporting obligations for their agreement) and by proponents of developments (to view their credit obligation or the payment required to the Biodiversity Conservation Fund).
Biodiversity risk weighting	A factor of the formulas used by the BAM to calculate credits. The biodiversity risk weighting (BRW) is a score given to each vegetation zone and species based on the 'sensitivity to loss' versus the 'sensitivity to gain'. The value is set for threatened species and listed in the TBDC. The BRW for vegetation is calculated for each vegetation zone by the BAM-C using a factor of the 'sensitivity to loss' of the PCT or TEC (located in the BioNet vegetation classification) and the 'sensitivity to gain' of the ecosystem credit species (in the TBDC) that are predicted to occur.
Biodiversity Stewardship site	Refers to land which is the subject to a Biodiversity Stewardship Agreement under the BC Act.
BioNet Atlas	The DPIE database of flora and fauna records (formerly known as the NSW Wildlife Atlas). The Atlas contains records of plants, mammals, birds, reptiles, amphibians, some fungi, some invertebrates (such as insects and snails listed under the BC Act) and some fish (DPIE 2020a).
BioNet Vegetation classification	Refers to the vegetation community-level classification for use in vegetation mapping programs and regulatory biodiversity impact assessment frameworks in NSW. Refer About BioNet Vegetation Classification | NSW Environment and Heritage (DPE 2020a).
Construction footprint	The area to be directly impacted by the proposal during construction activities. See also definition for subject land.

Term	Definition
Cumulative impact	The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Refer to Clause 228(2) of the EP&A Regulation 2000 for cumulative impact assessment requirements.
Direct impact	Direct impacts on biodiversity values include those related to clearing native vegetation and threatened species habitat and impacts on biodiversity values prescribed by the Biodiversity Conservation Regulation 2017 (the BC Regulation) (DPIE 2020a).
Ecosystem credit species	Threatened species or components of species habitat that are identified in the Threatened Species Data Collection as requiring assessment for ecosystem credits. This is analogous with the definition of 'predicted species'.
Ecosystem credits	A measurement of the value of threatened ecological communities, threatened species habitat for species that can be reliably predicted to occur with a PCT, and PCTs generally. Ecosystem credits measure the loss in biodiversity values at a development, activity, clearing or biodiversity certification site and the gain in biodiversity values at a biodiversity stewardship site (DPIE 2020a).
Habitat	An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic component (DPIE 2020a).
Indirect impact	Impacts that occur when the proposal affects native vegetation and threatened species habitat beyond the development footprint or within retained areas (e.g. transporting weeds or pathogens, dumping rubbish). This includes impacts from activities related to the construction or operational phase of the proposal and prescribed impacts (DPIE 2020a).
Landscape assessment area	The area which includes the subject land and a 1500m buffer surrounding the outside edge of the boundary of the subject land or 500m along each side of the centre line of a linear-shaped proposal
Local population	The population that occurs in the study area. The assessment of the local population may be extended to include individuals beyond the study area if it can be clearly demonstrated that contiguous or interconnecting parts of the population continue beyond the study area, according to the following definitions: • *The local population of a threatened plant species comprises those individuals occurring in the study area or the cluster of individuals that extend into habitat adjoining and contiguous with the study area that could reasonably be expected to be cross-pollinating with those in the study area.* • *The local population of resident fauna species comprises those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas (contiguous or otherwise) that are known or likely to utilise habitats in the study area.* • *The local population of migratory or nomadic fauna species comprises those individuals that are likely to occur in the study area from time to time or return year to year (OEH 2018).*
Matter of national environmental significance	A matter of national environmental significance (MNES) is any of the nine defined components protected by a provision of Part 3 of the EPBC Act (Commonwealth).
Mitigation	Action to reduce the severity of an impact.
Native vegetation	Has the same meaning as in section 1.6 of the BC Act and section 60B of the LLS Act. In summary, a) trees (including any sapling or shrub or any scrub) b) understorey plants

Term	Definition
	c) groundcover (being any type of herbaceous vegetation) d) plants occurring in a wetland. A plant is native to New South Wales if it was established in New South Wales before European settlement (BC Act). Native vegetation does not extend to marine vegetation (being mangroves, seagrasses or any other species of plant that at any time in its life cycle must inhabit water other than fresh water). Marine vegetation is covered by the provisions of the FM Act.
NSW (Mitchell) landscape	Landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1:250,000 (DPIE 2020a).
Operational footprint	The area that will be subject to ongoing operational impacts from the proposal. This includes the road, surrounding safety verges and infrastructure, fauna connectivity structures and maintenance access tracks and compounds.
Patch size	An area of native vegetation that: • *occurs on the development site or biodiversity stewardship site* • *includes native vegetation that has a gap of less than 100m from the next area of native vegetation (or ≤30m for non-woody ecosystems).* Patch size may extend onto adjoining land that is not part of the development site or biodiversity stewardship site (DPIE 2020a).
PlantNET	An online database of the flora of New South Wales which contains currently accepted taxonomy for plants found in the State, both native and exotic.
Population	A group of organisms, all of the same species, occupying a particular area (DPIE 2020a).
Spatial datasets	Spatial databases required to prepare a BAR • *BioNet NSW (Mitchell) Landscapes – Version 3.1* • *NSW Interim Biogeographic Regions of Australia (IBRA region and sub-regions) – Version 7* • *NSW soil profiles* • *hydrogeological landscapes* • *acid sulfate soils risk* • *digital cadastral database* • *Vegetation Information Systems maps* • *Geological sites of NSW.*
Species credit species	Threatened species or components of species habitat that are identified in the Threatened Species Data Collection as requiring assessment for species credits (DPIE 2020a). This is analogous with the definition of 'candidate species'.
Species credits	The class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. Species that require species credits are listed in the Threatened Biodiversity Data Collection (DPIE 2020a).
Species polygon	An area of land identified in Chapter 5 (of the BAM) that contains habitat or is occupied by a threatened species (DPIE 2020a).
Study area	The area directly affected by the proposal (subject land or construction footprint) and any additional areas likely to be affected by the proposal, either directly or indirectly.
Subject land	Land subject to a development, activity, clearing, biodiversity certification or a biodiversity stewardship proposal. It excludes the landscape assessment area which surrounds the subject land (i.e., the area of land in the 1500m buffer zone around the subject land or 500m buffer

Term	Definition
	zone for linear proposals). In the case of a biodiversity certification proposal, subject land includes the biodiversity certification assessment area (DPIE 2020a). See also definition for construction footprint.
Threatened Biodiversity Data Collection	A publicly assessable online database (registration required) which contains information for listed threatened species, populations and ecological communities (DPIE 2020a). Part of the BioNet database, published by the EHG and accessible from the BioNet website at www.bionet.nsw.gov.au.
Vegetation integrity (score)	The condition of native vegetation assessed for each vegetation zone against the benchmark for the PCT. The vegetation integrity score is the quantitative measure of vegetation condition calculated by the BAM-C (DPIE 2020a).
Vegetation zone	A relatively homogeneous area of native vegetation on a development site, clearing site, land to be biodiversity certified or biodiversity stewardship site that is the same PCT and has the same broad condition state (DPIE 2020a).

10. Abbreviations

Term	Definition
AOBV	Area of Outstanding Biodiversity Value
BAM	Biodiversity Assessment Method
BAM-C	Biodiversity Assessment Method calculator
BC Act	Biodiversity Conservation Act 2016 (NSW)
BC Regulation	Biodiversity Conservation Regulation 2017 (NSW)
BDAR	Biodiversity Development Assessment Report
BOAMS	Biodiversity Offsets and Agreement Management System
BOS	Biodiversity Offset Scheme
BRW	Biodiversity risk weighting
CEEC	Critically Endangered Ecological Community
CEMP	Construction Environmental Management Plan
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DIWA	Directory of Important Wetlands in Australia
DPE	Department of Planning and Environment
DPI	Department of Primary Industries
EEC	Endangered ecological community
EHG	NSW Environment and Heritage Group within the Department of Planning and Environment
EIS	Environmental Impact Statement
EP&A Act	*Environment Planning and Assessment Act 1979* (NSW)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
Fisheries NSW Policy and guidelines	Fisheries NSW Policy and guidelines for fish habitat conservation and management (Update 2013)
FM Act	Fisheries Management Act 1994 (NSW)
GDE	Groundwater dependent ecosystems
IBRA	Interim Biogeographically Regionalisation of Australia
MNES	Matters of national environmental significance
PCT	Plant community type
PMST	Protected Matters Search Tool
REF	Review of Environmental Factors
SAII	Serious and Irreversible Impacts
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SSD	State Significant Development
SSI	State Significant Infrastructure
TBDC	Threatened Biodiversity Data Collection
TECs	Threatened ecological communities (VECs, EECs and CEECs)
Transport	Transport for NSW
VEC	Vulnerable Ecological Community

11. References

Commonwealth of Australia (2010a), Survey guidelines for Australia's threatened bats: Guidelines for detecting bats listed as threatened under the EPBC Act – DCCEEW.

Commonwealth of Australia (2010b), Survey guidelines for Australia's threatened birds (awe.gov.au).

Commonwealth of Australia (2011a), Survey Guidelines for Australia's threatened frogs (awe.gov.au).

Commonwealth of Australia (2011b), Survey guidelines for Australia's threatened mammals (awe.gov.au).

Commonwealth of Australia (2011c), Survey guidelines for Australia's threatened reptiles (awe.gov.au).

Commonwealth of Australia (2011d), Survey guidelines for Australia's threatened fish (awe.gov.au).

Commonwealth of Australia (2013b), Draft survey guidelines for Australia's threatened orchids (awe.gov.au).

Commonwealth of Australia (2022), Commonwealth Bureau of Meteorology's Atlas of Groundwater Dependent Ecosystems Accessed at: http://www.bom.gov.au/water/groundwater/gde/map.shtml

Department of Agriculture, Water and the Environment (DAWE) 2021. National Recovery Plan for the Grey-headed Flying-fox '*Pteropus poliocephalus*'. Access at: https://www.dcceew.gov.au/sites/default/files/documents/recovery-plan-grey-headed-flying-fox.pdf

DAWE (2020), Conservation Advice for the River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria. Canberra: Department of Agriculture, Water and the Environment. Available from: http://www.environment.gov.au/biodiversity/threatened/communities/pubs/154-conservation-advice.pdf.

DCCEEW (2022a), *Protected Matters Search Tool*. Accessed at: http://www.environment.gov.au/epbc/protected-matters-search-tool

DCCEEW (2022b), National Flying-fox monitoring viewer. Accessed at: http://www.environment.gov.au/webgis-framework/apps/ffc-wide/ffc-wide.jsf

DECC (2016), NSW Mitchell Landscapes – version 3.1.

Department of Environment and Climate Change (2009), Threatened species survey and assessment guidelines: field survey methods for fauna. Amphibians. (nsw.gov.au).

Department of Environment and Conservation (2004) Threatened biodiversity survey and assessment guidelines for developments and activities (working draft).

Department of Environment, Climate Change and Water (2009), Sensitive species data policy | NSW Environment and Heritage.

DoEE (2012), Interim Biogeographic Regionalisation for Australia, Version 7.

DoEE (2018), Conservation advice (incorporating listing advice) for the Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community. Canberra: Department of the Environment and Energy. Available from: http://www.environment.gov.au/biodiversity/threatened/communities/pubs/141-conservation-advice.pdf.

DotE (2013), Matters of National Environmental Significance: Significant Impact Guidelines 1.1 (awe.gov.au) Environment Protection and Biodiversity Conservation Act 1999.

DotE (2015), Approved Conservation Advice (including listing advice) for Cooks River/Castlereagh Ironbark Forest of the Sydney Basin Bioregion. Canberra: Department of the Environment. Available from: http://www.environment.gov.au/biodiversity/threatened/communities/pubs/129-conservation-advice.pdf.

DPE (2022a). BioNet Atlas. Accessed at: http://www.environment.nsw.gov.au/atlaspublicapp/UI_Modules/ATLAS_/AtlasSearch.aspx

DPE (2022b). BioNet Vegetation Classification Database. Accessed at: https://www.environment.nsw.gov.au/NSWVCA20Prapp/LoginPR.aspx

DPE (2022c) eSpade https://www.environment.nsw.gov.au/eSpade2Webapp/

DPE (2022d) NSW ePlanning Spatial Viewer. Accessed at: https://www.planningportal.nsw.gov.au/spatialviewer/#/find-a-property/address

DPE (2022e), Biodiversity Assessment Method 2020 Operational Manual – Stage 1 (nsw.gov.au)

DPE (2022f), Koala (Phascolarctos cinereus): Biodiversity Assessment Method Survey Guide | NSW Environment and Heritage

DPE (2022g), NSW State Vegetation Type Map.

DPI (2008), Threatened Species Assessment Guidelines: The Assessment of significance. Available on the DPI (Fisheries) website: Threatened Species Assessment Guidelines – Assessment of Significance (nsw.gov.au).

DPI (2012), Risk Assessment Guidelines for Groundwater Dependent Ecosystems. Available for download from researchgate.net

DPI (2013), Policy and guidelines for fish habitat conservation and management (Update 2013) (nsw.gov.au).

DPI (2018), Guidelines for controlled activities on waterfront land – Riparian corridor.

DPI (2022). NSW DPI Fisheries Spatial Data Portal. Accessed at: https://webmap.industry.nsw.gov.au/Html5Viewer/index.html?viewer=Fisheries_Data_Portal

DPIE (2019), Biodiversity Assessment Method Operational Manual – Stage 2 (nsw.gov.au).

DPIE (2020a), Biodiversity Assessment Method (nsw.gov.au).

DPIE (2020b), NSW Survey Guide for Threatened Frogs: A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method.

DPIE (2020c), Surveying threatened plants and their habitats: NSW survey guide for the Biodiversity Assessment Method.

Menkorst, P., Rogers D., Clarke R., Davies J., Marsack P. and Franklin K. (2017). The Australian Bird Guide. CSIRO Publishing.

NSWSC (2021), Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions – endangered ecological community listing. Accessed at: https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/nsw-threatened-species-scientific-committee/determinations/final-determinations/2004-2007/freshwater-wetlands-coastal-floodplains-endangered-ecological-community-listing

OEH (2016), The Native Vegetation of the Sydney Metropolitan Area – Version 3.1.

OEH (2017b), Guidance to assist a decision-maker to determine a serious and irreversible impact (nsw.gov.au).

OEH (2018), 'Species credit' threatened bats and their habitats: NSW survey guide for the Biodiversity Assessment Method.

OEH (2018a), Biodiversity Assessment Method Operational Manual – Stage 1.

OEH (2018b), Species credit' threatened bats and their habitats: NSW survey guide for the Biodiversity Assessment Method. Accessed at: https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Threatened-species/species-credit-threatened-bats-survey-guide-180466.pdf

OEH (2018c), Threatened Species Test of Significance Guidelines. Accessed at: https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Threatened-species/threatened-species-test-significance-guidelines-170634.pdf

RTA (2011), Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects. Roads and Traffic Authority, NSW. Available at: Biodiversity Guidelines (nsw.gov.au).

Transport (2019), Transport for NSW Editorial Style Guide

Transport (2022a), No Net Loss Guidelines

Transport (2022b), Tree and Hollow Replacement Guidelines

Transport (2022c), Biodiversity assessment guidelines

TSSC (2009), Commonwealth Listing Advice on Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest. Department of the Environment, Water, Heritage and the Arts. Canberra, ACT: Department of the Environment, Water,

Heritage and the Arts. Available from: http://www.environment.gov.au/biodiversity/threatened/communities/pubs/112-listing-advice.pdf.

WSP (2019), Henry Lawson Drive Upgrade (M5 to Hume Highway) Biodiversity Assessment Report for Strategic Design February 2019. Prepared by WSP and RMS.

WSP (2021), Henry Lawson Drive Upgrade (M5 to Hume Highway) Biodiversity Assessment Report for Strategic Design February 2019. Prepared by WSP and RMS.

WSP (2022), Henry Lawson Drive Upgrade Stage 1A - AREF consistency assessment for biodiversity

Appendix A: Species recorded

Recorded flora

Family	Scientific name	Common name	Weed status	Status		Cover (%) in each plot*						
				BC Act	EPBC Act	1	2	3	4	5	6	7
Aizoaceae	*Tetragonia tetragonioides*	New Zealand Spinach	native									1
Alismataceae	*Sagittaria platyphylla*	Sagittaria	exotic							1		
Alliaceae	*Nothoscordum borbonicum*	Onion Weed	exotic			0.1		0.1				
Amaranthaceae	*Alternanthera philoxeroides*	Alligator Weed	high threat					0.1	0.1	0.5		
Amaranthaceae	*Amaranthus* spp.	Amaranth	native							0.1		
Amaranthaceae	*Gomphrena celosioides*	Gomphrena Weed	exotic			0.1			0.1			
Apiaceae	*Cyclospermum leptophyllum*	Slender Celery	exotic			0.1						
Apocynaceae	*Araujia sericifera*	Moth Vine	high threat				0.5					2
Araceae	*Colocasia* spp.		Exotic			0.1						
Asparagaceae	*Asparagus aethiopicus*	Asparagus Fern	high threat				0.2					1
Asparagaceae	*Asparagus asparagoides*	Bridal Creeper	high threat				0.1					
Asphodelaceae	*Aloe* spp.		Exotic									1
Asteraceae	*Ageratina adenophora*	Crofton Weed	high threat					0.5		0.1		
Asteraceae	*Arctotheca calendula*	Capeweed	exotic			0.1						

Family	Scientific name	Common name	Weed status	Status		Cover (%) in each plot*						
				BC Act	EPBC Act	1	2	3	4	5	6	7
Asteraceae	*Aster subulatus*	Wild Aster	exotic							0.1		
Asteraceae	*Bidens pilosa*	Cobbler's Pegs	high threat			0.5	1	0.1				1
Asteraceae	*Cirsium vulgare*	Spear Thistle	exotic						0.1			
Asteraceae	*Conyza bonariensis*	Flaxleaf Fleabane	exotic				0.1					
Asteraceae	*Conyza* spp.		Exotic						0.1			0.1
Asteraceae	*Cotula australis*	Common Cotula	native						20			
Asteraceae	*Facelis retusa*		exotic						0.1			
Asteraceae	*Gamochaeta coarctata*		exotic			0.1					0.1	
Asteraceae	*Gamochaeta* spp.		Exotic				0.1		0.1			
Asteraceae	*Hypochaeris glabra*	Smooth Catsear	exotic			0.1					0.1	
Asteraceae	*Hypochaeris radicata*	Catsear	exotic						0.1		0.1	
Asteraceae	*Lactuca serriola*	Prickly Lettuce	exotic			0.1			0.1			
Asteraceae	*Soliva sessilis*	Bindyi	exotic			7	0.1				0.1	0.5
Asteraceae	*Sonchus oleraceus*	Common Sowthistle	exotic			0.1	0.1					0.1
Asteraceae	*Taraxacum officinale*	Dandelion	exotic			0.1			1		0.1	0.1
Bignoniaceae	*Jacaranda mimosifolia*	Jacaranda	exotic									1
Brassicaceae	*Barbarea verna*	Wintercress	exotic					0.1				
Brassicaceae	*Brassica rapa* subsp. *Campestris*	Turnip	exotic									1
Brassicaceae	*Brassica* spp.	Brassica	exotic							0.1		

Family	Scientific name	Common name	Weed status	Status		Cover (%) in each plot*						
				BC Act	EPBC Act	1	2	3	4	5	6	7
Brassicaceae	*Capsella bursa-pastoris*	Shepherd's Purse	exotic						0.1			
Brassicaceae	*Cardamine hirsuta*	Common Bittercress	exotic			0.1	0.1		0.1		0.3	
Caprifoliaceae	*Lonicera japonica*	Japanese Honeysuckle	high threat							2		
Caryophyllaceae	*Cerastium glomeratum*	Mouse-ear Chickweed	exotic				0.1					
Caryophyllaceae	*Paronychia brasiliana*	Chilean Whitlow Wort, Brazilian Whitlow	exotic						0.1			
Caryophyllaceae	*Polycarpon tetraphyllum*	Four-leaved Allseed	exotic						0.2			
Caryophyllaceae	*Stellaria media*	Common Chickweed	exotic			0.1			2			0.5
Casuarinaceae	*Casuarina glauca*	Swamp Oak	native				5	35	10	2		25
Chenopodiaceae	*Einadia hastata*	Berry Saltbush	native									0.1
Chenopodiaceae	*Einadia polygonoides*	Knotweed Goosefoot	native								0.1	
Commelinaceae	*Commelina cyanea*	Native Wandering Jew	native							0.1		0.3
Commelinaceae	*Tradescantia fluminensis*	Wandering Jew	high threat				70	90		5		
Crassulaceae	*Kalanchoe* spp.		Exotic									2
Cyperaceae	*Carex* spp.		Native							0.2		
Cyperaceae	*Cyperus eragrostis*	Umbrella Sedge	high threat					0.1				
Cyperaceae	*Cyperus* spp.		Native								0.1	
Euphorbiaceae	*Euphorbia peplus*	Petty Spurge	exotic			0.1						
Fabaceae (Faboideae)	*Erythrina crista-galli*	Cockspur Coral Tree	high threat							0.1		

Family	Scientific name	Common name	Weed status	Status		Cover (%) in each plot*						
				BC Act	EPBC Act	1	2	3	4	5	6	7
Fabaceae (Faboideae)	*Lotus angustissimus*	Slender Birds-foot Trefoil	exotic			1						
Fabaceae (Faboideae)	*Medicago* spp.		Exotic			0.1			0.1			
Fabaceae (Faboideae)	*Trifolium repens*	White Clover	exotic			0.1						
Fabaceae (Mimosoideae)	*Acacia implexa*	Hickory Wattle	native									40
Fabaceae (Mimosoideae)	*Acacia saligna*	Golden Wreath Wattle	exotic									0.1
Juncaceae	*Juncus* spp.		Native							0.2		
Lauraceae	*Cinnamomum camphora*	Camphor Laurel	high threat					0.3				
Malvaceae	*Malva sylvestris*	Tall Mallow	exotic			0.1						
Malvaceae	*Modiola caroliniana*	Red-flowered Mallow	exotic			0.1			0.5		0.5	0.5
Malvaceae	*Sida rhombifolia*	Paddy's Lucerne	exotic				0.5	0.1	0.1	0.3	0.2	15
Myrtaceae	*Eucalyptus amplifolia*	Cabbage Gum	native									15
Myrtaceae	*Eucalyptus baueriana*	Blue Box	native						20			
Myrtaceae	*Eucalyptus crebra*	Narrow-leaved Ironbark	native						2			
Myrtaceae	*Eucalyptus fibrosa*	Red Ironbark	native								15	
Myrtaceae	*Eucalyptus longifolia*	Woollybutt	native								15	
Myrtaceae	*Eucalyptus moluccana*	Grey Box	native				30					
Myrtaceae	*Eucalyptus parramattensis* subsp. *Parramattensis*		native			20						

Family	Scientific name	Common name	Weed status	Status		Cover (%) in each plot*						
				BC Act	EPBC Act	1	2	3	4	5	6	7
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum	native						15			15
Myrtaceae	*Melaleuca armillaris*	Bracelet Honey-myrtle	native							0.5		
Myrtaceae	*Melaleuca decora*		native			5						
Oleaceae	*Ligustrum lucidum*	Large-leaved Privet	high threat				0.2					
Oleaceae	*Ligustrum sinense*	Small-leaved Privet	high threat				0.2	0.5				
Oxalidaceae	*Oxalis corniculata*	Creeping Oxalis	exotic			0.1						
Oxalidaceae	*Oxalis pes-caprae*	Soursob	exotic							3	0.1	
Oxalidaceae	*Oxalis* spp.		Native						0.1			
Passifloraceae	*Passiflora morifolia*		exotic				0.1	0.1				
Passifloraceae	*Passiflora subpeltata*	White Passionflower	exotic							0.1		
Plantaginaceae	*Plantago lanceolata*	Lamb's Tongues	exotic						0.1		0.2	0.3
Poaceae	*Arundo donax*	Giant Reed	high threat				0.5					
Poaceae	*Axonopus compressus*	Broad-leaved Carpet Grass	exotic								2	
Poaceae	*Cenchrus clandestinus*	Kikuyu Grass	exotic			35	0.5	0.1	20	30	30	3
Poaceae	*Cynodon dactylon*	Common Couch	native			5	2		5	1	5	
Poaceae	*Digitaria didactyla*	Queensland Blue Couch	native			35						
Poaceae	*Digitaria sanguinalis*	Crab Grass	exotic			0.1						
Poaceae	*Ehrharta erecta*	Panic Veldtgrass	high threat				0.5		0.1			70
Poaceae	*Ehrharta longiflora*	Annual Veldtgrass	exotic									20

Family	Scientific name	Common name	Weed status	Status		Cover (%) in each plot*						
				BC Act	EPBC Act	1	2	3	4	5	6	7
Poaceae	*Eleusine indica*	Crowsfoot Grass	exotic						2			
Poaceae	*Eragrostis curvula*	African Lovegrass	high threat									0.5
Poaceae	*Eragrostis tenuifolia*	Elastic Grass	exotic				0.2				10	
Poaceae	*Lolium* spp.		Exotic			0.1			2			
Poaceae	*Megathyrsus maximus*		exotic					1		0.1		
Poaceae	*Microlaena stipoides*	Weeping Grass	native						0.1			
Poaceae	*Oplismenus aemulus*		native				0.1					
Poaceae	*Paspalum dilatatum*	Paspalum	high threat			0.1	0.1		0.1			
Poaceae	*Phragmites australis*	Common Reed	native					0.1		35		
Poaceae	*Poa annua*	Winter Grass	exotic			0.1			40			0.5
Poaceae	*Setaria parviflora*		exotic				0.1			0.1		0.1
Polygonaceae	*Persicaria decipiens*	Slender Knotweed	native							2		
Polygonaceae	*Persicaria hydropiper*	Water Pepper	native							2		
Polygonaceae	*Rumex* spp.	Dock	native							0.1		
Rosaceae	*Rubus fruticosus* sp. agg.	Blackberry comples	high threat				0.2	0.1		0.1		
Rubiaceae	*Galium aparine*	Goosegrass	exotic						0.1	0.1		
Rubiaceae	*Richardia* spp.		Exotic			0.1			0.1			
Sapindaceae	*Cardiospermum grandiflorum*	Balloon Vine	high threat				60	25		1		
Solanaceae	*Cestrum parqui*	Green Cestrum	high threat			0.4	1	0.5	0.1	0.1		

Family	Scientific name	Common name	Weed status	Status		Cover (%) in each plot*						
				BC Act	EPBC Act	1	2	3	4	5	6	7
Solanaceae	*Salpichroa origanifolia*	Pampas Lily-of-the-valley	exotic				20	0.3				
Solanaceae	*Solanum nigrum*	Black-berry Nightshade	exotic			0.1	0.5		0.1			0.1
Solanaceae	*Solanum pseudocapsicum*	Madeira Winter Cherry	exotic							0.1		
Solanaceae	*Solanum seaforthianum*	Climbing Nightshade	high threat				0.1					
Solanaceae	*Solanum sisymbriifolium*		exotic				0.5					
Typhaceae	*Typha orientalis*	Broad-leaved Cumbungi	native							10		
Verbenaceae	*Lantana camara*	Lantana	high threat				5					
Verbenaceae	*Verbena bonariensis*	Purpletop	exotic				0.1	0.1		1		1

Recorded fauna

Class	Scientific name	Common name	Status	
			BC Act	EPBC Act
Aves	*Alisterus scapularis*	Australian King-Parrot	Protected	-
Aves	*Cacatua galerita*	Sulphur-crested Cockatoo	Protected	-
Aves	*Cacomantis flabelliformis*	Fan-tailed Cuckoo	Protected	-
Aves	*Corvus coronoides*	Australian Raven	Protected	-
Aves	*Cracticus tibicen*	Australian Magpie	Protected	-
Aves	*Cracticus torquatus*	Grey Butcherbird	Protected	-

Class	Scientific name	Common name	Status	
			BC Act	EPBC Act
Aves	*Egretta novaehollandiae*	White-faced Heron	Protected	-
Aves	*Grallina cyanoleuca*	Magpie-lark	Protected	-
Aves	*Hirundo neoxena*	Welcome Swallow	Protected	-
Aves	*Manorina melanocephala*	Noisy Miner	Protected	-
Aves	*Rhipidura leucophrys*	Willie Wagtail	Protected	-
Aves	*Trichoglossus haematodus*	Rainbow Lorikeet	Protected	-
Aves	*Vanellus miles*	Masked Lapwing	Protected	-

Appendix B: Habitat suitability assessment

The below criteria is used to determine the likelihood that a threatened species could occur in the study area.

Likelihood	Criteria
Recorded	The species was observed in the study area during the current survey or has been recorded within the past five years (known from a reputable source).
High	A species is considered highly likely to occur in the study area if: • *There are previous credible records on BioNet within the study area from the last 10 years and suitable habitat is present.* **OR** • *The species is highly mobile, is dependent on identified suitable habitat within the study area (i.e., for breeding or important life cycle periods such as winter flowering resources) and has been recorded recently (within five years) on BioNet in the locality. This also includes species known or likely to visit the study area during regular seasonal movements or migration.*
Moderate	A species is considered moderately likely to occur in the study area if: • *Any suitable habitat (e.g., foraging) is present in the study area, the species is highly mobile and has been recorded in the locality in the last 10 years on BioNet. The species may be unlikely to maintain sedentary populations, however, may seasonally use resources within the study area opportunistically or during migration. The species is unlikely to be dependent (i.e., for breeding or important life cycle periods such as winter flowering resources) on habitat within the study area.* **OR** • *The species is not highly mobile, is dependent on identified suitable habitat features (e.g., hollows, rocky outcrops) within the study area and has been recorded in the locality in the last 10 years on BioNet.T* **OR** • *For flora species that are associated with PCTs in the study area (see TBDC) or have been recorded in the locality in the last 10 years on BioNet – the associated PCT/habitat present in the study area is not degraded and the species was not targeted by surveys in accordance with the BAM and relevant survey guidelines. In addition, for flora species known to occur in disturbed areas (e.g., orchids), records from any time within the locality may warrant inclusion in this category.*
Low	A species is considered to have a low likelihood of occurring in the study area if: • *For highly mobile species, the species may be an occasional visitor, but habitat similar to the study area is widely distributed in the locality, meaning that the species is not dependent (i.e., for breeding or important life cycle periods such as winter flowering resources) on habitats in the study area and the species has not been recorded in the locality in the last 10 years on BioNet.* **OR** • *The species is not highly mobile, is dependent on identified suitable habitat features (e.g., hollows, rocky outcrops) within the study area and has not been recorded in the locality in the last 10 years on BioNet.* **OR** • *For flora species that are associated with PCTs in the study area (see TBDC) and the species was not identified following targeted surveys in accordance with the BAM and relevant survey guidelines. Flora species that have been recorded in the locality on BioNet at any time, associated suitable habitat (see the TBDC) is not present in the study area, though similar habitats of the same vegetation formation is present in the study area.*
Unlikely	Suitable habitat for the species is absent from the study area.

Habitat suitability assessment table

Flora

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
Acacia bynoeana (Bynoe's Wattle)	E	V	Species		Found in central eastern NSW, from the Hunter District (Morisset) south to the Southern Highlands and west to the Blue Mountains. Occurs in heath or dry sclerophyll forest on sandy soils.	72 – Bionet PMST BAMC – all vegetation zones	Unlikely – suitable habitat (sandy soils) not present within the study area.	Unlikely – no suitable habitat. Targeted survey not required.
Acacia prominens (Gosford Wattle, Hurstville and Kogarah Local Government Areas)	EP	-	Species	BAM-C geographic limitations: LGAs listed in the Determination (inclusive of Georges River LGA))	Occurs at a few sites along the railway line at Penshurst, at Carss Bush Park, Carss Park and there is an unconfirmed siting at Oatley Park, Oatley. This population is disjunct from other populations (Hunter Valley to Gosford region) and at the southern limit of the range of the species. Grows in open situations on clayey or sandy soils.	10 – Bionet BAMC – all vegetation zones	Unlikely – the study area is not located within the Georges River, Hurstville or Kogarah LGAs.	Unlikely – no suitable habitat. Targeted survey not required.
Acacia pubescens (Downy Wattle)	V	V	Species	N/A	Concentrated around the Bankstown-Fairfield-Rookwood area and the Pitt Town area, with outliers occurring at Barden Ridge, Oakdale and Mountain Lagoon. Occurs on alluviums, shales and at the intergrade between shales and sandstones. The soils are characteristically gravely soils, often with ironstone. Occurs in open woodland and forest, in a variety of plant communities, including Cooks River/Castlereagh Ironbark Forest, Shale/Gravel Transition Forest and Cumberland Plain Woodland.	5506 – Bionet PMST PCT 725	Moderate –suitable habitat is present within the study area. Three BioNet records from 2009 occur within the study area.	Low – targeted survey did not identify this species.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
Acacia terminalis subsp. *Terminalis MS* (Sunshine Wattle)	E	E	Species	N/A	Very limited distribution, mainly in near-coastal areas from the northern shores of Sydney Harbour south to Botany Bay, with most records from the Port Jackson area and the eastern suburbs of Sydney. Recorded from North Head, Middle Head, Dover Heights, Parsely Bay, Nielsen Park, Cooper Park, Chifley, Watsons Bays, Wollstonecraft and Waverley. Grows in coastal scrub and dry sclerophyll woodland on sandy soils.	PMST	Unlikely – suitable habitat is absent from the study area.	Unlikely – no suitable habitat. Targeted survey not required.
Allocasuarina diminuta subsp. *Mimica* (Allocasuarina diminuta subsp. Mimica population in the Sutherland Shire and Liverpool City local government areas)	EP	-	Species	N/A	The endangered population occurs along sandstone ridges and upper hillsides in the region northwest from Heathcote, towards Menai and Holsworthy, in heathy and low open woodland communities. It is restricted to the Local Government Areas listed in this instance (Sutherland and Liverpool)	17 – Bionet	Unlikely – suitable habitat is absent from the study area. In addition, the study area is not located within the Sutherland and Liverpool LGAs.	Unlikely – no suitable habitat. Targeted survey not required.
Allocasuarina glareicola	E	E	Species	N/A	Primarily restricted to the Richmond (NW Cumberland Plain) district, but with an outlier population found at Voyager Point, Liverpool.Grows in Castlereagh woodland on lateritic soil. Found in open woodland with *Eucalyptus parramattensis, Eucalyptus fibrosa, Angophora bakeri, Eucalyptus sclerophylla* and *Melaleuca decora*. Common associated understorey species include *Melaleuca nodosa, Hakea dactyloides, Hakea sericea,*	1 – Bionet PMST PCT 725 PCT 1067	Unlikely – this species has not been recorded in the locality within the last 10 years and suitable habitat for this species is not present within the study area (the site is highly degraded).	Unlikely – no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					Dillwynia tenuifolia, Micromyrtus minutiflora, Acacia elongata, Acacia brownii, Themeda australis and *Xanthorrhoea minor.*			
Caesia parviflora var. *minor* (Small Pale Grass-lily)	E	-	Species	N/A	This variety occurs uncommonly in Tasmania, southern Victoria and south-east South Australia with an outlying population in NSW, in Barcoongere State Forest, between Grafton and Coffs Harbour. This variety may be more common than currently known, as Pale Grass-lilies are often not identified to variety level. Found in damp places in open forest on sandstone.	1 – Bionet	Unlikely – suitable habitat is absent from the study area, including no associated PCTs.	Unlikely – no suitable habitat. Targeted survey not required.
Caladenia tessellata (Thick Lip Spider Orchid)	E	V	Species	N/A	The Thick Lip Spider Orchid is known from the Sydney area (old records), Wyong, Ulladulla and Braidwood in NSW. Populations in Kiama and Queanbeyan are presumed extinct. It was also recorded in the Huskisson area in the 1930s. The species occurs on the coast in Victoria from east of Melbourne to almost the NSW border. Generally found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil.	3 – Bionet PMST PCT 725 PCT 1067	Unlikely – this species has not been recorded in the locality within the last 10 years (most recent record is 1948) and suitable habitat for this species is not present within the study area (the site is highly degraded).	Unlikely – no suitable habitat. Targeted survey not required.
Callistemon linearifolius (Netted Bottle Brush)	V	-	Species	N/A	For the Sydney area, recent records are limited to the Hornsby Plateau area near the Hawkesbury River. The species was more widespread in the past, and there are currently only 5-6 populations remaining from the 22 populations historically recorded	37 – Bionet PCT 725 PCT 835	Moderate –suitable habitat is present within the study area.	Low – targeted survey did not identify this species.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					in the Sydney area. Three of the remaining populations are reserved in Ku-ring-gai Chase National Park, Lion Island Nature Reserve and Spectacle Island Nature Reserve. The species has also been recorded from Yengo National Park. Grows in dry sclerophyll forest on the coast and adjacent ranges.			
Calochilus pulchellus (Pretty Beard Orchid)	E	-	Species	N/A	Known from the Sydney Basin Bioregion, where a total of less than 30 adult plants have been recorded in three sites over a range of 40km on the South Coast of NSW, at altitudes from 20-560m above sea level. All currently known sites are within the Shoalhaven Local Government Area. At Vincentia the species grows in low Scribbly Gum dominated woodland with a low wet heath understorey. The soil is a sandy loam overlying sandstone. In Booderee National Park it grows in a tall heathy association. In Morton National Park on the Little Forest Plateau it occurs in low heath among scattered clumps of emergent eucalypts and Banksia in shallow coarse white sand over sandstone, in a near-escarpment area subject to strong orographic precipitation.	PMST	Unlikely – the study area does not occur within the known distribution of this species.	Unlikely – no suitable habitat. Targeted survey not required.
Cryptostylis hunteriana (Leafless Tongue Orchid)	V	V	Species	N/A	Known historically from a number of localities on the NSW south coast and has been observed in recent years at many sites between Batemans Bay and Nowra (although	13 – Bionet PMST	Unlikely – no suitable habitat present within the study area (site is highly degraded), including no associated PCTs.	Unlikely – no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					it is uncommon at all sites). Also recorded at Munmorah State Conservation Area, Nelson Bay, Wyee, Washpool National Park, Nowendoc State Forest, Ku-Ring-Gai Chase National Park and Ben Boyd National Park. Does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland.			
Cynanchum elegans (White-flowered Wax Plant)	E	E	Species	N/A	Usually occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest; Coastal Tea-tree *Leptospermum laevigatum* – Coastal Banksia *Banksia integrifolia* subsp. *Integrifolia* coastal scrub; Forest Red Gum *Eucalyptus tereticornis* aligned open forest and woodland; Spotted Gum *Corymbia maculata* aligned open forest and woodland; and Bracelet Honeymyrtle *Melaleuca armillaris* scrub to open scrub.	PMST PCT 835	Unlikely – this species has not been recorded in the locality and suitable habitat for this species is not present within the study area (the site is highly degraded).	Unlikely – no suitable habitat. Targeted survey not required.
Darwinia biflora	V	V	Species	N/A	Recorded in Ku-ring-gai, Hornsby, Baulkham Hills and Ryde local government areas. The northern, southern, eastern and western limits of the range are at Maroota, North Ryde, Cowan and Kellyville, respectively. Occurs on the edges of weathered shale-capped ridges, where these intergrade with Hawkesbury Sandstone. Associated overstorey species include *Eucalyptus haemastoma, Corymbia gummifera* and/or *E. squamosa*. The vegetation	PMST	Unlikely – suitable habitat is absent from the study area and the study area does not occur within the known distribution of this species.	Unlikely – no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					structure is usually woodland, open forest or scrub-heath.			
Deyeuxia appressa	E	E	Species	N/A	A highly restricted NSW endemic known only from two pre-1942 records in the Sydney area. Was first collected in 1930 at Herne Bay, Saltpan Creek, off the Georges River, south of Bankstown. Was then collected in 1941 from Killara, near Hornsby. Has not been collected since and may now be extinct in the wild due to the level of habitat loss and development that has occurred within these areas.	2 – Bionet PMST PCT 1800	Unlikely – this species has not been recorded in the locality since 1930 and suitable habitat for this species is not present within the study area (the site is highly degraded).	Unlikely – no suitable habitat. Targeted survey not required.
Dillwynia tenuifolia	V	-	Species	N/A	The core distribution is the Cumberland Plain from Windsor and Penrith east to Dean Park near Colebee. Other populations in western Sydney are recorded from Voyager Point and Kemps Creek in the Liverpool LGA, Luddenham in the Penrith LGA and South Maroota in the Baulkham Hills Shire. Disjunct localities outside the Cumberland Plain include the Bulga Mountains at Yengo in the north, and Kurrajong Heights and Woodford in the Lower Blue Mountains. In western Sydney, may be locally abundant particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays. May also be common in transitional areas where these communities	2 – Bionet PCT 725 PCT 1067	Moderate – suitable habitat is present within the study area.	Low – targeted survey did not identify this species.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					adjoin Castlereagh Scribbly Gum Woodland.			
Dillwynia tenuifolia – endangered population (Dillwynia tenuifolia, Kemps Creek)	EP	-	Species	BAM-C geographic limitations: Bounded by Western Road, Elizabeth Drive, Devonshire Road and Cross Street, Kemps Creek in the Liverpool LGA	The endangered population occurs in the area bounded by Western Road, Elizabeth Drive, Devonshire Road and Cross Street, Kemps Creek in the Liverpool Local Government Area.	PCT 725 PCT 1067	Unlikely – the study area does not occur within the known distribution of this endangered population.	Unlikely – the study area does not occur within the known distribution of this endangered population. Targeted survey not required.
Diuris aequalis (Buttercup Doubletail)	E	V	Species	N/A	The buttercup doubletail has been recorded in Kanangra-Boyd National Park, Gurnang State Forest, towards Wombeyan Caves, the Taralga – Goulburn area, and the ranges between Braidwood, Tarago and Bungendore. The type location (from the 19th Century) is Liverpool, west of Sydney. However, this and other questionable records from the Sydney metropolitan area are unlikely based on current knowledge of the species. Recorded in forest, low open woodland with grassy understorey and secondary grassland on the higher parts of the Southern and Central Tablelands (especially on the Great Dividing Range).	1 – Bionet	Unlikely – suitable habitat is absent from the study area and the study area does not occur within the known distribution of this species. Historical records from western Sydney are thought to be erroneous.	Unlikely – no suitable habitat. Targeted survey not required.
Epacris purpurascens var. *purpurascens*	V	-	Species	N/A	Recorded from Gosford in the north, to Narrabeen in the east, Silverdale in the west and Avon Dam vicinity in the South. Found in a range of habitat types, most of which have a strong shale soil influence.	28 – Bionet PCT 725	Unlikely – no suitable habitat is present within the study area. Any areas of associated habitat (PCT 725) comprise a mown park with no native shrub species present.	Unlikely – no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
Eucalyptus camfieldii (Camfield's Stringybark)	V	V	Species	N/A	Restricted distribution in a narrow band with the most northerly records in the the Raymond Terrace area south to Waterfall. Localised and scattered distribution includes sites at Norah Head (Tuggerah Lakes), Peats Ridge, Mt Colah, Elvina Bay Trail (West Head), Terrey Hills, Killara, North Head, Menai, Wattamolla and a few other sites in Royal National Park. Occurs on poor coastal country in shallow sandy soils overlying Hawkesbury sandstone; and coastal heath mostly on exposed sandy ridges.	2 – Bionet PMST	Unlikely – suitable habitat for this species is absent from the study area, including no associated PCTs.	Unlikely – no suitable habitat. Targeted survey not required.
Eucalyptus benthamii (Camden White Gum)	V	V	Species	N/A	Occurs on the alluvial flats of the Nepean River and its tributaries. There are two major subpopulations: in the Kedumba Valley of the Blue Mountains National Park and at Bents Basin State Recreation Area. Several trees are scattered along the Nepean River around Camden and Cobbitty, with a further stand at Werriberri (Monkey) Creek in The Oaks. At least five trees occur on the Nattai River in Nattai National Park. Requires a combination of deep alluvial sands and a flooding regime that permits seedling establishment. Recruitment of juveniles appears to be most successful on bare silt deposits in rivers and streams.	PCT 835	Unlikely – the study area does not occur within the known distribution of this species; and no BioNet records occur within the locality.	Unlikely – no suitable habitat. Targeted survey not required.
Eucalyptus nicholii	V	V	Species	N/A	This species is sparsely distributed but widespread on the New England Tablelands from Nundle to north of	5 – Bionet	Low – although the study area is outside the known natural distribution of this	Low – no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
(Narrow-leaved Black Peppermint)					Tenterfield, being most common in central portions of its range. Found largely on private property and roadsides, and occasionally in conservation reserves. Planted as urban trees, windbreaks and corridors. Typically grows in dry grassy woodland, on shallow soils of slopes and ridges. Found primarily on infertile soils derived from granite or metasedimentary rock.		species, it may occur as a planted urban tree, although few BioNet records exist within the locality.	
Eucalyptus scoparia (Wallangarra White Gum)	E	V	Species	N/A	In NSW it is known from only three locations near Tenterfield, including Bald Rock National Park. Found in open eucalypt forest, woodland and heaths on well-drained granite/rhyolite hilltops, slopes and rocky outcrops, typically at high altitudes.	1 – Bionet	Low – although the study area is outside the known natural distribution of this species, it may occur as a planted urban tree, although few BioNet records exist within the locality.	Low – no suitable habitat. Targeted survey not required.
Genoplesium baueri (Bauer's Midge Orchid)	E	E	Species	N/A	The species has been recorded from locations between Ulladulla and Port Stephens. Grows in dry sclerophyll forest and moss gardens over sandstone.	PMST	Unlikely – suitable habitat for this species is absent from the study area, including no associated PCTs. No BioNet records occur within the locality.	Unlikely – no suitable habitat. Targeted survey not required.
Grevillea beadleana (Beadle's Grevillea)	E	E	Species	BAM-C habitat constraint: Cliffs, escarpments or rocky areas, or within 200m.	Known from four separate areas, all in north-east NSW: the Torrington area west of Tenterfield, Oxley Wild Rivers National Park, Guy Fawkes River National Park and at Chambigne Nature Reserve south-west of Grafton. Occurs within open eucalypt forest and woodland with a shrubby understorey on granite.	1 – Bionet	Unlikely – the study area is not located within the known distribution of this species. Suitable habitat is absent from the study area.	Unlikely – no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
Grevillea juniperina subsp. *Juniperina* (Juniper-leaved Grevillea)	V	-	Species	N/A	Endemic to Western Sydney, centered on an area bounded by Blacktown, Erskine Park, Londonderry and Windsor with outlier populations at Kemps Creek and Pitt Town. Grows on reddish clay to sandy soils derived from Wianamatta Shale and Tertiary alluvium (often with shale influence), typically containing lateritic gravels. Recorded from Cumberland Plain Woodland, Castlereagh Ironbark Woodland, Castlereagh Scribbly Gum Woodland and Shale/Gravel Transition Forest.	PCT 725	Moderate –suitable habitat is present within the study area.	Low – targeted survey did not identify this species.
Grevillea parviflora subsp. *parviflora* (Small-flower Grevillea)	V	V	Species	N/A	Sporadically distributed throughout the Sydney Basin with sizeable populations around Picton, Appin and Bargo (and possibly further south to the Moss Vale area) and in the Hunter at in the Cessnock – Kurri Kurri area (particularly Werakata NP). Separate populations are also known from Putty to Wyong and Lake Macquarie on the Central Coast. Grows in sandy or light clay soils usually over thin shales, often with lateritic ironstone gravels and nodules. Sydney region occurrences are usually on Tertiary sands and alluvium, and soils derived from the Mittagong Formation. Soil landscapes include Lucas Heights or Berkshire Park.	1238 – Bionet PMST PCT 725	Unlikely – no suitable habitat is present within the study area. Any areas of associated habitat (PCT 725) comprise a mown park with no native shrub species present.	Unlikely – no suitable habitat. Targeted survey not required.
Gyrostemon thesioides	E	-	Species	BAM-C habitat constraint: Sandy, alluvial or colluvial soil	Within NSW, the species has recently been recorded near Lake Burragorang in the Blue Mountains	PCT 725 PCT 1800	Unlikely – no suitable habitat is present within the study area, considering the site is	Unlikely – no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
				within 50m of a water course	National Park. It has also been recorded in 2004 in Wollemi National Park, near the Colo River (one male plant), and historically at sites near the Georges and Nepean Rivers (more than 55 and 110 years ago respectively). In NSW, known from hillsides, slopes, terraces and riverbanks within 180 metres of watercourses.		highly degraded with a mostly exotic groundlayer and little native species regeneration potential. In addition, many areas of associated habitat comprise a mown park with a predominately exotic groundcover.	
Haloragis exalata subsp. *Exalata* (Square Raspwort)	V	V	Species	BAM-C habitat constraint: Edges of coastal lakes after flooding has removed other vegetation, creek banks within flood zone, areas close to these features subject to human disturbance including road verges and powerline easements or within 100m.	Square Raspwort occurs in 4 widely scattered localities in eastern NSW. It is disjunctly distributed in the Central Coast, South Coast and North Western Slopes botanical subdivisions of NSW. Square Raspwort appears to require protected and shaded damp situations in riparian habitats.	PCT 781	Moderate –suitable habitat is present within the study area.	Low – targeted survey did not identify this species.
Hibbertia fumana	CE	-	Species	N/A	At the beginning of the species rediscovery the only known extant population was found to occur in the Moorebank area. As a result of recent surveys populations of this species have been detected over a wider range within greater Sydney stretching from Richmond to Mittagong. Species is known to occur in a long intergrade between Castlereagh Scribbly Gum Woodland and Castlereagh Ironbark Forest. Also recently found associated with aeolian sand deposits. Species has	1072 – Bionet PCT 725 PCT 1067	Unlikely – no suitable habitat is present within the study area. Any areas of associated habitat (PCT 725 & PCT 1067) comprise a mown park with no native shrub species present and a predominately exotic groundcover.	Unlikely – no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					been found to occur in a variety of structural habitats including open areas, disturbed sites and also within thick ground cover dominated by a heavy cover of sedges, rushes and grasses.			
Hibbertia puberula	E	-	Species	N/A	Extends from Wollemi National Park south to Morton National Park and the south coast near Nowra. It favours low heath on sandy soils or rarely in clay, with or without rocks underneath. Habitats are typically dry sclerophyll woodland communities, although heaths are also occupied. One of the recently (2012) described subspecies also favours upland swamps.	1274 – Bionet PMST PCT 1067	Unlikely – no suitable habitat is present within the study area. Any areas of associated habitat (PCT 1067) comprise a mown park with no native shrub species present and a predominately exotic groundcover.	Unlikely – no suitable habitat. Targeted survey not required.
Hibbertia sp. *Bankstown*	CE	CE	Species	N/A	This species is endemic to New South Wales and is currently known to occur in only one population at Bankstown Airport in Sydney's southern suburbs, in the Bankstown local government area. The airport site is very heavily modified from the natural state, lacks canopy species and is currently a low grass/shrub association with many pasture grasses and other introduced herbaceous weeds. Soil at the site is a sandy (Tertiary) alluvium with a high silt content.	218 – Bionet PCT 725 PCT 835 PCT 1067	Unlikely – no suitable habitat is present within the study area, considering the site is highly degraded with a mostly exotic groundlayer and little native species regeneration potential. In addition, many areas of associated habitat comprise a mown park with a predominately exotic groundcover. This species is only known from an isolated population in Bankstown Airport, located approximately 1.5km north of the study area.	Unlikely – no suitable habitat. Targeted survey not required.
Hibbertia stricta subsp. *furcatula*	E	-	Species	N/A	*Hibbertia stricta subsp. Furcatula* (Hibbertia sp. nov. 'Menai') is known to occur in two populations, one in	18 – Bionet	Unlikely – suitable habitat for this species is absent from	Unlikely – no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					the southern outskirts of Sydney, and one near Nowra on the mid-South Coast of NSW. The Southern Sydney population occurs on both sides of the Woronora River gorge, near Loftus and in Royal National Park. The southern population is mainly in the vicinity of Nowra Habitat of the Southern Sydney population is broadly dry eucalypt forest and woodland. This population appears to occur mainly on upper slopes and above the Woronora River gorge escarpment, at or near the interface between the Lucas Heights soil landscape and Hawkesbury sandstone.		the study area, including no associated PCTs.	
Isotoma fluviatilis subsp. *Fluviatilis*	-	Extinct	Species	N/A	Listed as Hypsela sessiliflora. Currently known from only two adjacent sites on a single private property at Erskine Park in the Penrith LGA. Previous sightings are all from western Sydney, at Homebush and at Agnes Banks. Known to grow in damp places, on the Cumberland Plain, including freshwater wetland, grassland/alluvial woodland and an alluvial woodland/shale plains woodland (Cumberland Plain Woodland) ecotone.	PCT 781 PCT 835 PCT 1067 PCT 1800	Unlikely – suitable habitat for this species is absent from the study area as the site is highly degraded. PCTs within the study area that are associated with this species are regularly mown and/or primarily comprised of native canopy/mid-storey species only. No BioNet records occur within the locality.	Unlikely – no suitable habitat. Targeted survey not required.
Leucopogon exolasius (Woronora Beard-heath)	V	V	Species	N/A	Found along the upper Georges River area and in Heathcote National Park. Occurs in woodland on sandstone.	6 – Bionet PMST PCT 1067	Unlikely – suitable habitat for this species is absent from the study area as the site is highly degraded. PCTs within the study area that are associated with this species are regularly mown and	Unlikely – no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
							primarily comprised of native canopy/mid-storey species only.	
Macadamia integrifolia (Macadamia Nut)	-	V	Species	N/A	Not known to occur naturally in the wild in NSW.	3 – Bionet	Low – although the study area is outside the known natural distribution of this species, it may occur as a planted urban tree, although few BioNet records exist within the locality.	Low – no suitable habitat. Targeted survey not required.
Marsdenia viridiflora subsp. *Viridiflora* (Marsdenia viridiflora R. Br. Subsp. Viridiflora population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas)	EP	-	Species	BAM-C geographic limitations: Blacktown, Camden, Campbelltown, Canterbury-Bankstown, Cumberland, Fairfield, Liverpool and Penrith LGAs (as amended from the Determination))	Recent records are from Prospect, Bankstown, Smithfield, Cabramatta Creek and St Marys. Previously known north from Razorback Range. Grows in vine thickets and open shale woodland.	471 – Bionet BAMC PCT 725 PCT 835 PCT 1800	Unlikely – no suitable habitat is present within the study area, considering the site is highly degraded with a mostly exotic groundlayer and little native species regeneration potential. In addition, many areas of associated habitat comprise a mown park with a predominately exotic groundcover.	Unlikely – no suitable habitat. Targeted survey not required.
Maundia triglochinoides	V	-	Species	BAM-C habitat constraints: Riparian areas/drainage lines, water ponding, man-made dams and drainage channels up to 1m deep; Semi-permanent/ephemeral wet area; swamps; Shallow swamps up to 1m deep;	Restricted to coastal NSW and extending into southern Queensland. The current southern limit is Wyong; former sites around Sydney are now extinct. Grows in swamps, lagoons, dams, channels, creeks or shallow freshwater 30 – 60 cm deep on heavy clay, low nutrients. BAM-C habitat constraint: Riparian areas/drainage lines, water ponding,	PCT 781 PCT 1800	Unlikely – the study area does not occur within the known distribution of this species (former sites around Sydney are now extinct).	Unlikely – no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
				Waterbodies; Shallow waterbodies up to 1m deep	man-made dams and drainage channels up to 1m deep; Shallow swamps up to 1m deep; Shallow waterbodies up to 1m deep.			
Melaleuca biconvexa (Biconvex Paperbark)	V	V	Species	N/A	Biconvex Paperbark is only found in NSW, with scattered and dispersed populations found in the Jervis Bay area in the south and the Gosford-Wyong area in the north. Generally grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects.	PMST	Unlikely – suitable habitat is absent from the study area, including no associated PCTs. No BioNet records occur within the locality.	Unlikely – no suitable habitat. Targeted survey not required.
Melaleuca deanei (Deane's Paperbark)	V	V	Species	N/A	Occurs in two distinct areas, in the Ku-ring-gai/Berowra and Holsworthy/Wedderburn areas respectively. There are also more isolated occurrences at Springwood (in the Blue Mountains), Wollemi National Park, Yalwal (west of Nowra) and Central Coast (Hawkesbury River) areas. The species occurs mostly In ridgetop woodland, with only 5% of sites in heath on sandstone.	22 – Bionet PMST	Unlikely – suitable habitat is absent from the study area, including no associated PCTs.	Unlikely – no suitable habitat. Targeted survey not required.
Micromyrtus minutiflora	E	V	Species	N/A	Restricted to the general area between Richmond and Penrith, western Sydney. Grows in Castlereagh Scribbly Gum Woodland, Ironbark Forest, Shale/Gravel Transition Forest, open forest on tertiary alluvium and consolidated river sediments.	PCT 725 PCT 1067	Unlikely – the study area does not occur within the known distribution of this species. No BioNet records occur within the locality.	Unlikely – no suitable habitat. Targeted survey not required.
Persicaria elatior (Tall Knotweed)	V	V	Species	BAM-C habitat constraint: Semi-permanent/ephemeral	Tall Knotweed has been recorded in south-eastern NSW (Mt Dromedary (an old record), Moruya State Forest	PMST PCT 781 PCT 835	Unlikely – the study area does not occur within the known distribution of this	Unlikely – no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
				wet areas (or within 50m); Swamps (or within 50m); Waterbodies, including wetlands (or within 50m)	near Turlinjah, the Upper Avon River catchment north of Robertson, Bermagui, and Picton Lakes. In northern NSW it is known from Raymond Terrace (near Newcastle) and the Grafton area (Cherry Tree and Gibberagee State Forests). This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.	PCT 1800	species, with no BioNet records within the locality. The nearest records are from Picton (1949) and Thirlmere Lakes NP (2010).	
Persoonia hirsuta (Hairy Geebung)	E	E	Species	N/A	Has a scattered distribution around Sydney. The species is distributed from Singleton in the north, along the east coast to Hilltop in the south west, Dombarton in the south east and the Blue Mountains to the west. Found in clayey and sandy soils in dry sclerophyll open forest, woodland and heath, primarily on the Mittagong Formation and on the upper Hawkesbury Sandstone.	5 – Bionet PMST	Unlikely – suitable habitat is absent from the study area, including no associated PCTs. Few BioNet records occur within the locality.	Unlikely – no suitable habitat. Targeted survey not required.
Persoonia nutans (Nodding Geebung)	E	E	Species	N/A	Restricted to the Cumberland Plain in western Sydney, between Richmond in the north and Macquarie Fields in the south. The species has a disjunct distribution, with the majority of populations (and 99% of individuals) occurring in the north of the species range in the Agnes Banks, Londonderry, Castlereagh, Berkshire Park and Windsor Downs areas. Core distribution occurs within the Penrith, and to a lesser extent Hawkesbury, local government areas, with isolated and relatively	393 – Bionet PMST PCT 725 PCT 1067	Unlikely – no suitable habitat is present within the study area, considering the site is highly degraded with a mostly exotic groundlayer and little native species regeneration potential. In addition, many areas of associated habitat comprise a mown park with a predominately exotic groundcover.	Unlikely – no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					small populations also occurring in the Liverpool, Campbelltown, Bankstown and Blacktown local government areas. The southern and northern populations have distinct habitat differences. Northern populations are confined to aeolian and alluvial sediments and occur in a range of sclerophyll forest and woodland vegetation communities, with the majority of individuals occurring within Agnes Banks Woodland or Castlereagh Scribbly Gum Woodland and some in Cooks River / Castlereagh Ironbark Forests. Southern populations also occupy tertiary alluvium, but extend onto shale sandstone transition communities and into Cooks River / Castlereagh Ironbark Forest.			
Pilularia novae-hollandiae (Austral Pillwort)	E	-	Species	N/A	In NSW, Austral Pillwort has been recorded from suburban Sydney, Khancoban, the Riverina between Albury and Urana (including Henty, Walbundrie, Balldale and Howlong), Oolambeyan National Park near Carrathool and at Lake Cowal near West Wyalong. The populations at Lake Cowal and Oolambeyan NP are the only known extant populations in NSW, although the species is obscure and has possibly been overlooked elsewhere. Grows in shallow swamps and waterways, often among grasses and sedges. It is most often	PCT 835 PCT 1800	Unlikely – the study area does not occur within the known distribution of this species (Lake Cowal and Oolambeyan NP are the only known extant populations in NSW). In addition, suitable habitat is absent from the study area (the site is highly degraded). No BioNet records occur within the locality.	Unlikely – no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					recorded in drying mud as this is when it is most conspicuous.			
Pimelea curviflora var. *curviflora*	V	V	Species	N/A	Confined to the coastal area of the Sydney and Illawarra regions. Populations are known between northern Sydney and Maroota in the north-west. New population discovered at Croom Reserve near Albion Park in Shellharbour LGA in August 2011. Formerly recorded around the Parramatta River and Port Jackson region including Five Dock, Bellevue Hill and Manly. Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands. Also recorded in Illawarra Lowalnd Grassy Woodland habitat at Albion Park on the Illawaraa coastal plain.	PMST	Unlikely – the study area does not contain suitable habitat for this species, and no BioNet records occur within the locality.	Unlikely – no suitable habitat. Targeted survey not required.
Pimelea spicata (Spiked Rice-flower)	E	E	Species	N/A	Occurs in two disjunct areas; the Cumberland Plain (Marayong and Prospect Reservoir south to Narellan and Douglas Park) and the Illawarra (Landsdowne to Shellharbour to northern Kiama).	148 – Bionet	Unlikely – no suitable habitat is present within the study area, considering the site is highly degraded with a mostly exotic groundlayer and little native species regeneration potential. In addition, many areas of associated habitat comprise a mown park with a predominately exotic groundcover.	Unlikely – no suitable habitat. Targeted survey not required.
Pomaderris brunnea (Brown Pomaderris)	E	V	Species	N/A	Found in a very limited area around the Colo, Nepean and Hawkesbury Rivers, including the Bargo area and near Camden. It also occurs near Walcha on the New England	11 – Bionet PMST PCT 835 PCT 1067 PCT 1800	Unlikely – the study area does not occur within the known distribution of this species. Few BioNet records occur within locality.	Unlikely – no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					tablelands and in far eastern Gippsland in Victoria. Grows in moist woodland or forest on clay and alluvial soils of flood plains and creek lines.		Marginal habitat present within the study area (the site is highly degraded).	
Pomaderris prunifolia (P. prunifolia in the Parramatta, Auburn, Strathfield and Bankstown Local Government Areas)	EP	-	Species	BAM-C geographic limitations: LGAs in the Determination listing	Known from only three sites within the listed local government areas, at Rydalmere, within Rookwood Cemetery and at The Crest of Bankstown. At Rydalmere it occurs along a road reserve near a creek, among grass species on sandstone. At Rookwood Cemetery it occurs in a small gully of degraded Cooks River / Castlereagh Ironbark Forest on shale soils.	17 – Bionet PCT 725	Unlikely – the study area does not occur within the known distribution of this species. Few BioNet records occur within locality. Marginal habitat present within the study area (the site is highly degraded).	Unlikely – no suitable habitat. Targeted survey not required.
Prostanthera densa (Villous Mintbush)	V	V	Species	N/A	This species has been recorded from the Currarong area in Jervis Bay, Royal National Park (Marley), Cronulla, Helensburgh and Port Stephens (Nelson Bay). The Sydney and Royal National Park populations were thought possibly extinct, but the species is now known to occur at Bass and Flinders Point in Cronulla. Generally grows in sclerophyll forest and shrubland on coastal headlands and near coastal ranges, chiefly on sandstone, and rocky slopes near the sea.	PMST	Unlikely – suitable habitat for this species is absent from the study area, including no associated PCTs. No BioNet records occur within the locality.	Unlikely – no suitable habitat. Targeted survey not required.
Prostanthera saxicola (Prostanthera saxicola population in Sutherland and	EP	-	Species	N/A	Primarily in Eucalypt forest, heath and low shrubland, often in damp or moist sites. This population is restricted to the named local government areas (Liverpool and Sutherland) in the southern to	4 – Bionet	Unlikely – suitable habitat is absent from the study area. In addition, the study area is not located within the Sutherland and Liverpool LGAs.	Unlikely – no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
Liverpool local government areas)					south-western parts of Sydney. Recorded occurrences are mainly between Holsworthy station and Sutherland station, north from Lucas Heights and south of the Georges River.			
Pterostylis gibbosa (Illawarra Greenhood)	E	E	Species	N/A	Known from a small number of populations in the Hunter region (Milbrodale), the Illawarra region (Albion Park and Yallah) and the Shoalhaven region (near Nowra). It is apparently extinct in western Sydney which is the area where it was first collected (1803). All known populations grow in open forest or woodland, on flat or gently sloping land with poor drainage.	1 – Bionet PMST	Unlikely – the study area does not occur within the known distribution of this species (apparently extinct from western Sydney). The study area does not contain suitable habitat for this species, including no associated PCTs.	Unlikely – no suitable habitat. Targeted survey not required.
Pterostylis nigricans (Dark Greenhood)	V	-	Species	N/A	Occurs in north-east NSW north from Evans Head, and in Queensland. Occurs in coastal heathland with Heath Banksia (Banksia ericifolia), and lower-growing heath with lichen-encrusted and relatively undisturbed soil surfaces, on sandy soils.	1 – Bionet	Unlikely – the study area does not occur within the known distribution of this species. The study area does not contain suitable habitat for this species, including no associated PCTs.	Unlikely – no suitable habitat. Targeted survey not required.
Pterostylis saxicola (Sydney Plains Greenhood)	E	E	Species	N/A	Restricted to western Sydney between Freemans Reach in the north and Picton in the south. There are very few known populations and they are all very small and isolated. Two populations occur within a conservation reserve (Georges River National Park; Scheyville NP). Most commonly found growing in small pockets of shallow soil in depressions on sandstone rock	91 – Bionet PMST	Unlikely – no suitable habitat is present within the study area, considering the site is highly degraded with a mostly exotic groundlayer and little native species regeneration potential. In addition, many areas of associated habitat comprise a mown park with a	Unlikely – no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					shelves above cliff lines. The vegetation communities above the shelves where *Pterostylis saxicola* occurs are sclerophyll forest or woodland on shale/sandstone transition soils or shale soils.		predominately exotic groundcover.	
Pultenaea aristata (Prickly Bush-pea)	V	V	Species	N/A	Restricted to the Woronora Plateau, a small area between Helensburgh, south of Sydney, and Mt Kiera above Wollongong. Occurs in either dry sclerophyll woodland or wet heath on sandstone.	1 – Bionet	Unlikely – the study area does not occur within the known distribution of this species. Suitable habitat for this species is absent from the study area, including no associated PCTs.	Unlikely – no suitable habitat. Targeted survey not required.
Pultenaea parviflora	E	V	Species	N/A	Endemic to the Cumberland Plain. Core distribution is from Windsor to Penrith and east to Dean Park. Outlier populations are recorded from Kemps Creek and Wilberforce. May be locally abundant, particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays. May also be common in transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland.	2 – Bionet PCT 725	Unlikely – no suitable habitat is present within the study area, considering the site is highly degraded with a mostly exotic groundlayer and little native species regeneration potential. In addition, many areas of associated habitat comprise a mown park with a predominately exotic groundcover.	Unlikely – no suitable habitat. Targeted survey not required.
Pultenaea pedunculata (Matted Bush-pea)	E	-	Species	N/A	In NSW, it is represented by just three disjunct populations, in the Cumberland Plains in Sydney, the coast between Tathra and Bermagui and the Windellama area south of Goulburn (where it is locally abundant). The Cumberland Plain occurrences were more widespread (Yennora, Canley Vale and	26 – Bionet PCT 725	Unlikely – no suitable habitat is present within the study area, considering the site is highly degraded with a mostly exotic groundlayer and little native species regeneration potential. In addition, many areas of associated habitat comprise	Unlikely – no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					Cabramatta were lost to development) and is now found at Villawood and Prestons, and north-west of Appin between the Nepean River and Devines Tunnel number 2 (Upper Sydney Water Supply Canal). In the Cumberland Plain the species favours sites in clay or sandy-clay soils (Blacktown Soil Landscape) on Wianamatta Shale-derived soils, usually close to patches of Tertiary Alluvium (Liverpool area) or at or near the Shale-Sandstone interface (Appin). All sites have a lateritic influence with ironstone gravel (nodules) present.		a mown park with a predominately exotic groundcover.	
Rhizanthella slateri (Eastern Underground Orchid)	V	E	Species	N/A	In NSW, currently known from fewer than 10 locations, including near Bulahdelah, the Watagan Mountains, the Blue Mountains, Wisema''s Ferry area, Agnes Banks and near Nowra. Habitat requirements are poorly understood and no particular vegetation type has been associated with the species, although it is known to occur in sclerophyll forest.	PMST PCT 1067	Unlikely – suitable habitat for this species is absent from the study area as the site is highly degraded. PCTs within the study area that are associated with this species are regularly mown and primarily comprised of native canopy/mid-storey species only. No BioNet records in locality.	Unlikely – no suitable habitat. Targeted survey not required.
Rhodamnia rubescens (Scrub Turpentine)	CE	CE	Species	N/A	Occurs in coastal districts north from Batemans Bay in New South Wales, approximately 280km south of Sydney, to areas inland of Bundaberg in Queensland. Populations of R. rubescens typically occur in coastal regions and occasionally extend inland onto escarpments up to 600m a.s.l. in areas with rainfall of 1,000-1,600 mm.	6 – Bionet PMST	Unlikely – suitable habitat for this species is absent from the study area, including no associated PCTs. Few BioNet records in the locality.	Unlikely – no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils.			
Rhodomyrtus psidioides (Native Guava)	CE	CE	Species	N/A	Occurs from Broken Bay, approximately 90km north of Sydney, New South Wales, to Maryborough in Queensland. Populations are typically restricted to coastal and sub-coastal areas of low elevation however the species does occur up to c. 120km inland in the Hunter and Clarence River catchments and along the Border Ranges in NSW. Pioneer species found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest often near creeks and drainage lines.	PMST	Unlikely – the study area does not occur within the known distribution of this species. Suitable habitat for this species is absent from the study area, including no associated PCTs. No BioNet records in the locality.	Unlikely – no suitable habitat. Targeted survey not required.
Syzygium paniculatum (Magenta Lilly Pilly)	E	V	Species	N/A	Found only in NSW, in a narrow, linear coastal strip from Upper Lansdowne to Conjola State Forest. 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.	7 – Bionet PMST	Low – although suitable habitat for this species is absent from the study area, including no associated PCTs, it may occur as a planted urban tree, although few BioNet records exist within the locality.	Low–- no suitable habitat. Targeted survey not required.
Tetratheca glandulosa	V	-	Species	N/A	Restricted to the following Local Government Areas: Baulkham Hills, Gosford, Hawkesbury, Hornsby, Ku-ring-gai, Pittwater, Ryde, Warringah, and Wyong.	1 – Bionet	Unlikely – the study area does not occur within the known distribution of this species. Suitable habitat for this species is absent from	Unlikely – no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					Associated with shale-sandstone transition habitat where shale-cappings occur over sandstone, with associated soil landscapes such as Lucas Heights, Gymea, Lambert and Faulconbridge. Topographically, the plant occupies ridgetops, upper-slopes and to a lesser extent mid-slope sandstone benches. Soils are generally shallow, consisting of a yellow, clayey/sandy loam. Stony lateritic fragments are also common in the soil profile on many of these ridgetops.		the study area, including no associated PCTs.	
Tetratheca juncea (Black-eyed Susan)	V	V	Species	N/A	Confined to the northern portion of the Sydney Basin bioregion and the southern portion of the North Coast bioregion in the local government areas of Wyong, Lake Macquarie, Newcastle, Port Stephens, Great Lakes and Cessnock. It is usually found in low open forest/woodland with a mixed shrub understorey and grassy groundcover. However, it has also been recorded in heathland and moist forest.	1 – Bionet	Unlikely – the study area does not occur within the known distribution of this species. Suitable habitat for this species is absent from the study area, including no associated PCTs.	Unlikely – no suitable habitat. Targeted survey not required.
Thelymitra kangaloonica (Kangaloon Sun Orchid)	CE	CE	Species		Thelymitra kangaloonica (Thelymitra sp. Kangaloon) is only known to occur on the southern tablelands of NSW in the Moss Vale / Kangaloon / Fitzroy Falls area at 550-700m above sea level. It is known to occur at three swamps that are above the Kangaloon Aquifer. These swamps are a part of the ecological community“"Coastal Upland Swam”".	PMST	Unlikely – the study area does not occur within the known distribution of this species. Suitable habitat for this species is absent from the study area, including no associated PCTs. No BioNet records occur in the locality.	Unlikely – no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
Thesium australe (Austral Toadflax)	V	V	Species	N/A	Austral Toad-flax is found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. Although originally described from material collected in the SW Sydney area, populations have not been seen in a long time. Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast.	PMST	Unlikely – suitable habitat for this species is absent from the study area as the site is highly degraded. PCTs within the study area that are associated with this species are regularly mown and primarily comprised of native canopy/mid-storey species only. No BioNet records occur within the locality.	Unlikely – no suitable habitat. Targeted survey not required.
Wahlenbergia multicaulis (Tadgel''s Bluebell in the local government areas of Auburn, Bankstown, Baulkham Hills, Canterbury, Hornsby, Parramatta and Strathfield)	EP	-	Species	BAM-C habitat constraint: Check for updated LGA names	There are 13 known sites, two of which are in northern Sydney (Thornleigh and Mt Ku-Ring-Gai) with the remainder in western Sydney (Rookwood, Chullora, Bass Hill, Bankstown, Georges Hall, Campsie, South Granville and Greenacre). There are likely to be more sites than those listed here.	126 – Bionet PCT 725 PCT 835	Unlikely – no suitable habitat is present within the study area, considering the site is highly degraded with a mostly exotic groundlayer and little native species regeneration potential. In addition, many areas of associated habitat comprise a mown park with a predominately exotic groundcover. Although the study area occurs in close proximity to a 2015 BioNet record of this species, the habitat within the study area is degraded to the point that it would not support this species.	Unlikely – no suitable habitat. Targeted survey not required.
Wilsonia backhousei (Narrow-leafed Wilsonia)	V	-	Species	BAM-C habitat constraint: Beaches and rock platforms adjacent to beaches, or anywhere saline; Margins of salt marshes and lakes on the coast.	In NSW Narrow-leaf Wilsonia is found on the coast between Mimosa Rocks National Park and Wamberal north of Sydney (Nelso''s Lake, Potato Point, Sussex Inlet, Wowly Gully, Parramatta River at Ermington, Clovelly, Voyager Point,	6 – Bionet	Unlikely – suitable habitat is absent from the study area, including no associated PCTs. Few BioNet records occur within the locality.	Unlikely – no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					Wollongong and Royal National Park). This is a species of the margins of salt marshes and lakes.			
Zannichellia palustris	E	-	Species	BAM-C habitat constraint: Freshwater or slightly brackish estuarine areas (10%)	In NSW, known from the lower Hunter and in Sydney Olympic Park. Grows in fresh or slightly saline stationary or slowly flowing water.	PCT 781	Unlikely – the study area does not occur within the known distribution of this species. No BioNet records occur in the locality.	Unlikely – no suitable habitat. Targeted survey not required.

Fauna

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
Birds								
Anthochaera Phrygia (Regent Honeyeater)	CE	CE	Dual	BAM-C habitat constraint: As per Important Habitat Map.	Mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. Birds are also found in drier coastal woodlands and forests in some years. The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes.	16 – Bionet PMST BAMC PCT 725 PCT 835 PCT 1067 PCT 1800	Low – this species is highly mobile and may intermittently use the study area for foraging. However, it is unlikely considering the study area is fragmented and degraded. Additionally, there are no valid BioNet records of this species within the locality in the last 10 years. The study area is also not located on the Important Habitat Map for this species.	Low – suboptimal foraging and breeding habitat present. Targeted survey not required.
Artamus cyanopterus cyanopterus (Dusky Woodswallow)	V	-	Ecosystem	N/A	Widespread in eastern, southern and south western Australia. Primarily inhabit dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris. It has also been recorded in shrublands, heathlands and very occasionally in moist forest or rainforest. Also found in farmland, usually at the edges of forest or woodland.	28 – Bionet BAMC PCT 725 PCT 781 PCT 835 PCT 1067 PCT 1800	Moderate – suitable foraging habitat is present within the study area, the species is highly mobile, and has been recorded in the locality in the last 10 years on BioNet.	Moderate – suitable habitat present. Ecosystem credit species – targeted survey not required. Test of Significance undertaken (Appendix D).

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
Botaurus poiciloptilus (Australasian Bittern)	E	E	Ecosystem	BAM-C habitat constraint: Waterbodies brackish or freshwater wetlands.	Widespread but uncommon over south-eastern Australia. In NSW they may be found over most of the state except for the far north-west. Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (*Typha* spp.) and spikerushes (*Eleocharis* spp.).	1 – Bionet PMST BAMC PCT 781 PCT 835	Unlikely – suitable habitat for this species is absent from the study area.	Unlikely – no suitable habitat. Targeted survey not required.
Burhinus grallarius (Bush Stone-curlew)	E	-	Species	Fallen/standing dead timber including logs	The Bush Stone-curlew is 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 groundlayer and fallen timber.	5 – Bionet BAMC PCT 725 PCT 781 PCT 835 PCT 1067 PCT 1800	Low – suboptimal habitat is present within the study area. Closest record (2.8 km from the study area) is from 1996.	Low – suboptimal foraging and breeding habitat present. Targeted survey not required
Calidris canutus (Red Knot)	-	E	Dual	BAM-C habitat constraint: As per Important Habitat Map.	The Red Knot is a non-breeding migratory visitor from Arctic regions of Siberia. In NSW it is recorded in small numbers along some of the major river estuaries and sheltered embayments of the coastline, in particular the Hunter River estuary. In NSW the Red Knot mainly occurs in small numbers on intertidal mudflats, estuaries, bays, inlets, lagoons, harbours and sandflats and sandy beaches of sheltered coasts. It is occasionally found on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms and is a rare visitor to terrestrial saline wetlands and freshwater swamps.	PMST BAMC PCT 781	Unlikely – suitable habitat for this species is absent from the study area. The study area is also not located on the Important Habitat Map for migratory shorebirds.	Unlikely – no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
Calidris ferruginea (Curlew Sandpiper)	E	CE	Dual	BAM-C habitat constraint: As per Important Habitat Map.	Occurs along the entire coast of NSW, particularly in the Hunter Estuary, and sometimes in freshwater wetlands in the Murray-Darling Basin. Inland records are probably mainly of birds pausing for a few days during migration. It generally occupies littoral and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats of sheltered coasts.	PMST BAMC PCT 781	Unlikely – suitable habitat for this species is absent from the study area. The study area is also not located on the Important Habitat Map for migratory shorebirds.	Unlikely – no suitable habitat. Targeted survey not required.
Callocephalon fimbriatum (Gang-gang Cockatoo)	V	E	Dual	BAM-C habitat constraints (species): Eucalypt tree species with hollows greater than 9cm diameter.	In New South Wales, 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. 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 located in hollows that are 10cm in diameter or larger in eucalypts.	3 – Bionet PMST BAMC PCT 725 PCT 835 PCT 1067	Low – this species is highly mobile and may intermittently use the study area for foraging and breeding. However, such habitat is widely available in the locality and as such, this species would not be dependent on the study area for breeding or foraging. Additionally, there are no BioNet records of this species within the locality in the last 10 years.	Low – suboptimal foraging and breeding habitat present. Targeted survey not required as marginal breeding habitat present and no BioNet records in locality in the last 10 years.
Calyptorhynchus lathami (Glossy Black-Cockatoo)	V	-	Dual	BAM-C habitat constraints (ecosystem): Presence	The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East	7 – Bionet PMST BAMC PCT 725	Low – favoured food trees Black Sheoak (*Allocasuarina littoralis*) and Forest Sheoak (*A. torulosa)* are not present	Low – suboptimal foraging habitat and no breeding habitat present. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
				of Allocasuarina and casuarina species. BAM-C habitat constraints (species): Living or dead tree with hollows greater than 15cm diameter and greater than 8m above ground.	Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina. Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. Black Sheoak (*Allocasuarina littoralis*) and Forest Sheoak (*A. torulosa)* are important foods.	PCT 835 PCT 1067	within the study area. This species has been recorded in the locality in the last 10 years on BioNet but only as low numbers.	
Charadrius leschenaultii (Greater Sand Plover)	V	V	Dual	BAM-C habitat constraint: As per Important Habitat Map.	The Greater Sand-plover breeds in central Asia from Armenia to Mongolia, moving further south for winter. In Australia the species is commonly recorded in parties of 10-20 on the west coast, with the far northwest being the stronghold of the population. The species is apparently rare on the east coast, usually found singly. In NSW, the species has been recorded between the northern rivers and the Illawarra, with most records coming from the Clarence and Richmond estuaries. Almost entirely restricted to coastal areas in NSW, occurring mainly on sheltered sandy, shelly or muddy beaches or estuaries with large intertidal mudflats or sandbanks.	PMST	Unlikely – suitable habitat for this species is absent from the study area. The study area is also not located on the Important Habitat Map for migratory shorebirds.	Unlikely–- no suitable habitat. Targeted survey not required.
Chthonicola sagittata (Speckled Warbler)	V	-	Ecosystem	N/A	The Speckled Warbler has a patchy distribution throughout south-eastern Queensland, the eastern half of NSW and into Victoria, as far west as the Grampians. The species is most frequently reported from the hills and tablelands of the Great	BAMC PCT 725 PCT 835 PCT 1067 PCT 1800	Low – this species is highly mobile and may intermittently use the study area for foraging and breeding. However, it is unlikely considering the study area is fragmented and degraded, and this species is	Low – suboptimal foraging and breeding habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					Dividing Range, and rarely from the coast. The Speckled Warbler lives in a w"de range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy.		less commonly found within coastal regions. This species would not be dependent on the study area for breeding or foraging. Additionally, there are no BioNet records of this species within the locality.	
Circus assimilis (Spotted Harrier)	V	-	Ecosystem	N/A	The Spotted Harrier occurs throughout the Australian mainland, except in137peciesy forested or wooded habitats of the coast, escarpment and ranges, and rarely in Tasmania. Individuals disperse widely in NSW and comprise a single population. 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.	6 – Bionet BAMC PCT 781	Low – suitable foraging and breeding habitat is present within the study area, however the species occurs primarily within semi-arid county and is unlikely to occur within the study area. The species has been recorded in the locality in the last 10 years on BioNet.	Low – suboptimal foraging and breeding habitat. Targeted survey not required.
Climacteris picumnus victoriae (Brown Treecreeper (eastern subspecies))	V	-	Ecosystem	N/A	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. Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great	1 – Bionet BAMC PCT 725 PCT 835 PCT 1067 PCT 1800	Low – this species is highly mobile and may intermittently use the study area for foraging and breeding habitat. However, it is unlikely considering the study area is fragmented and degraded, and this species is less commonly found within coastal regions. This species	Low – suboptimal foraging and137pecies137g habitat. Targeted survey not required

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					Dividing Range; 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. Only if within 100m of moderate to good condition vegetation of suitable type.		would not be dependent on the study area for breeding or foraging. Additionally, there are no BioNet records of this species within the locality in the last 10 years.	
Daphoenositta chrysoptera (Varied Sittella)	V	-	Ecosystem	N/A	Inhabits most of mainland Australia except the treeless deserts and open grasslands. Distribution in NSW is nearly continuous from the coast to the far west. Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland.	32 – Bionet BAMC PCT 725 PCT 835 PCT 1067 PCT 1800	Moderate – suitable foraging and breeding habitat is present within the study area. This species has been recorded in the locality in the last 10 years on BioNet.	Moderate – suitable habitat present. Ecosystem credit species – targeted survey not required. Test of Significance undertaken (Appendix D).
Dasyornis brachypterus (Eastern Bristlebird)	E	E	Species	N/A	The distribution of the Eastern Bristlebird has contracted to three disjunct areas of south-eastern Australia. There are three main populations: Northern–- southern Queensland/northern NSW, Central–- Barren Ground NR, Budderoo NR,	PMST	Unlikely – suitable habitat for this species is absent from the study area, including no associated PCTs. No BioNet records in the locality.	Unlikely–- no suitable habitat. Targeted survey not required

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					Woronora Plateau, Jervis Bay NP, Booderee NP and Beecroft Peninsula and Southern–- Nadgee NR and Croajingalong NP in the vicinity of the NSW/Victorian border. Habitat for central and southern populations is characterised by dense, low vegetation including heath and open woodland with a heathy understorey. In northern NSW the habitat occurs in open forest with dense tussocky grass understorey and sparse mid-storey near rainforest ecotone; all of these vegetation types are fire prone.			
Ephippiorhynchus asiaticus (Black-necked Stork)	E	-	Ecosystem	BAM-C habitat constraint: Swamps–- Shallow, open freshwater or saline wetlands or shallow edges of deeper wetlands within 300m of these swamps; Waterbodies–- Shallow lakes, lake margins and estuaries within 300m of these waterbodies	Widespread in coastal and subcoastal northern and eastern Australia, as far south as central NSW (although vagrants may occur further south or inland, well away from breeding areas). In NSW, the species becomes increasingly uncommon south of the Clarence Valley, and rarely occurs south of Sydney. Floodplain wetlands (swamps, billabongs, watercourses and dams) of the major coastal rivers are the key habitat in NSW for the Black-necked Stork. Secondary habitat includes minor floodplains, coastal sandplain wetlands and estuaries.	3 – Bionet BAMC PCT 781	Unlikely – suitable habitat for this species is absent from the study area. No BioNet records in the locality in the last 10 years.	Unlikely–- no suitable habitat. Targeted survey not required
Epthianura albifrons (White-fronted Chat population	EP	-	Species	N/A	Two isolated sub-populations of White-fronted Chats are currently known from the Sydney Metropolitan Catchment	2 – Bionet	Low – this species is highly mobile and may intermittently use the study area for foraging and	Low – suboptimal foraging and breeding habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
in the Sydney Metropolitan Catchment Management Area)					Management Authority (CMA) area; one at Newington Nature Reserve on the Parramatta River and one at Towra Point Nature Reserve in Botany Bay. These sub-populations are separated from each other by 25km of140pecies140rd land, across which the Chats are unlikely to fly.		breeding habitat. However, it is unlikely considering the study area is fragmented and degraded and does not occur within the known distribution of this population. This population would not be dependent on the study area for breeding or foraging. Additionally, there are no BioNet records of this population within the locality in the last 10 years.	
Epthianura albifrons (White-fronted Chat)	V	-	Ecosystem	N/A	In NSW, it occurs mostly in the southern half of the state, in damp open habitats along the coast, and near waterways in the western part of the state. Along the coastline, it is found predominantly in saltmarsh vegetation but also in open grasslands and sometimes in low shrubs bordering wetland areas. Gregarious species, usually found foraging on bare or grassy ground in wetland areas,	2 – Bionet BAMC PCT 781	Low – this species is highly mobile and may intermittently use the study area for foraging and breeding habitat. However, it is unlikely considering the study area is fragmented and degraded. This species would not be dependent on the study area for breeding or foraging. Additionally, there are no BioNet records of this species within the locality in the last 10 years.	Low – suboptimal foraging and breeding habitat. Targeted survey not required.
Erythrotriorchis radiatus (Red Goshawk)	CE	V	Species	N/A	The species is very rare in NSW, extending south to about 30°S, with most records north of this, in the Clarence River Catchment, and a few around the lower Richmond and Tweed Rivers. Formerly, it was at least occasionally reported as far south as Port Stephens. In NSW, preferred habitats include mixed subtropical rainforest, Melaleuca	PMST	Unlikely – suitable habitat for this species is absent from the study area, including no associated PCTs. No BioNet records in the locality.	Unlikely–- no suitable habitat. Targeted survey not required

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					swamp forest and riparian Eucalyptus forest of coastal rivers.			
Falco hypoleucos (Grey Falcon)	E	-	Ecosystem	N/A	The Grey Falcon is sparsely distributed in NSW, chiefly throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing Range. The breeding range has contracted since the 1950s with most breeding now confined to arid parts of the range. Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast.	PMST	Unlikely – suitable habitat for this species is absent from the study area, including no associated PCTs. No BioNet records in the locality.	Unlikely–- no suitable habitat. Targeted survey not required
Falco subniger (Black Falcon)	V	-	Ecosystem	N/A	The Black Falcon is widely, but sparsely, distributed in New South Wales, mostly occurring in inland regions. Some reports of 'Black Falcons' on the tablelands and coast of New South Wales are likely to be referable to the Brown Falcon.	1 – Bionet	Unlikely – suitable habitat for this species is absent from the study area, including no associated PCTs. Only 1 BioNet record in the locality (from 2000).	Unlikely–- no suitable habitat. Targeted survey not required
Glossopsitta pusilla (Little Lorikeet)	V	-	Ecosystem	N/A	Distributed widely across the coastal and Great Divide regions of eastern Australia from Cape York to South Australia. NSW provides a large portion of the specie'' core habitat, with lorikeets found westward as far as Dubbo and Albury. Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophora, Melaleuca and other tree species. Riparian habitats are particularly used, due to higher soil	62 – Bionet BAMC PCT 725 PCT 781 PCT 835 PCT 1067 PCT 1800	Moderate – suitable foraging habitat is present within the study area. This species has been recorded in the locality in the last 10 years on BioNet.	Moderate – suitable habitat present. Ecosystem credit species – targeted survey not required. Test of Significance undertaken (Appendix D).

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					fertility and hence greater productivity.			
Grantiella picta (Painted Honeyeater)	V	V	Ecosystem	BAM-C habitat constraints (ecosystem): Mistletoes present at a density of greater than five mistletoes per hectare	The greatest concentrations of the bird and almost all breeding occurs on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland. Inhabits Boree/ Weeping Myall (*Acacia pendula*), Brigalow (*A. harpophylla*) and Box-Gum Woodlands and Box-Ironbark Forests.	PMST BAMC PCT 725 PCT 835 PCT 1067 PCT 1800	Unlikely–- suitable habitat for this species is absent from the study area, including no mistletoe species. No BioNet records within the locality.	Unlikely–- no suitable habitat. Targeted survey not required.
Haematopus longirostris (Pied Oystercatcher)	E	-	Species	BAM-C habitat constraints (species): Within 100m of estuarine areas and the ocean	In NSW the species is thinly scattered along the entire coast, with fewer than 200 breeding pairs estimated to occur in the State. Favours intertidal flats of inlets and bays, open beaches and sandbanks.	14 – Bionet	Unlikely–- suitable habitat for this species is absent from the study area, including no associated PCTs.	Unlikely–- no suitable habitat. Targeted survey not required.
Haliaeetus leucogaster (White-bellied Sea-Eagle)	V	-	Dual	BAM-C habitat constraints (ecosystem): Within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines (foraging) BAM-C habitat constraints (species): Living or dead mature trees within suitable vegetation within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines (breeding)	In New South Wales it is widespread along the east coast, and along all major inland rivers and waterways. Habitats are characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea. Occurs at sites near the sea or sea-shore, such as around bays and inlets, beaches, reefs, lagoons, estuaries and mangroves; and at, or in the vicinity of freshwater swamps, lakes, reservoirs, billabongs and saltmarsh.	60 – Bionet BAMC PCT 725 PCT 781 PCT 835 PCT 1067 PCT 1800	Moderate – suitable foraging and habitat is present within the study area. No large stick nests recorded, so unlikely to breed within the study area. This species has been recorded in the locality in the last 10 years on BioNet.	Moderate – ecosystem credit species as no suitable breeding habitat (large stick nests) recorded during habitat surveys. Potential foraging habitat present. Test of Significance undertaken (Appendix D).

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
Hieraaetus morphnoides (Little Eagle)	V	-	Dual	BAM-C habitat constraints (species): Nest trees–- live (occasionally dead) large old trees within vegetation.	Found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. Occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used.	20 – Bionet BAMC PCT 725 PCT 781 PCT 835 PCT 1067 PCT 1800	Low – marginal foraging habitat is present within the study area. This species has been recorded in the locality in the last 10 years on BioNet but is considered unlikely to occur due to degraded and fragmented habitat.	Low–- suboptimal foraging and breeding habitat. Targeted survey not required
Hirundapus caudacutus (White-throated Needletail)	-	V, Marine, Migratory	Ecosystem	N/A	Migratory and usually seen in eastern Australia from October to April. Breeds in forests in south-eastern Siberia, Mongolia, the Korean Penninsula and northern Japan June-August. Most often seen in eastern Australia before storms, low pressure troughs and approaching cold fronts and occasionally bushfire. These conditions are often used by insects to swarm (eg termites and ants) or tend to lift insects away from the surface which favours sighting of White-throated Needletails as they feed. More common in coastal areas, less so inland.	7 – Bionet PMST BAMC PCT 725 PCT 781 PCT 835 PCT 1067 PCT 1800	Moderate – suitable foraging habitat is present within the study area. This species has been recorded in the locality in the last 10 years on BioNet.	Moderate – suitable habitat present. Ecosystem credit species – targeted survey not required. Test of Significance undertaken (Appendix D).
Irediparra gallinacea (Comb-crested Jacana)	V	-	Ecosystem	BAM-C habitat constraints: Waterbodies–- Freshwater wetlands with a good surface cover of floating aquatic vegetation	The Comb-crested Jacana occurs on freshwater wetlands in northern and eastern Australia, mainly in coastal and subcoastal regions, from the north-eastern Kimberley Division of Western Australia to Cape York Peninsula then south along the east coast to the Hunter region of NSW, with stragglers recorded in south-eastern NSW.	BAMC PCT 781	Unlikely–- suitable habitat for this species is absent from the study area. No BioNet records in the locality.	Unlikely–- no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					Inhabit permanent freshwater wetlands, either still or slow-flowing, with a good surface cover of floating vegetation, especially water-lilies, or fringing and aquatic vegetation.			
Ixobrychus flavicollis (Black Bittern)	V	-	Ecosystem	BAM-C habitat constraints: Waterbodies–- Land within 40m of freshwater and estuarine wetlands, in areas of permanent water and dense vegetation	In NSW, records of the species are scattered along the east coast, with individuals rarely being recorded south of Sydney or inland. Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves.	9 – Bionet BAMC PCT 781 PCT 835 PCT 1800	Unlikely – BioNet records indicate this species was recorded in proximity to the study area within Vale of Ah Reserve in 2013. However, only poor habitat is present within the study area.	Unlikely–- no suitable habitat. Targeted survey not required.
Lathamus discolor (Swift Parrot)	E	CE	Dual	BAM-C habitat constraints (species): As per Important Habitat Map.	Breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW mostly occurs on the coast and southwest slopes. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata*, Red Bloodwood *C. gummifera*, Forest Red Gum *E. tereticornis*, Mugga Ironbark *E. sideroxylon*, and White Box *E. albens.*	23 – Bionet PMST BAMC PCT 725 PCT 835 PCT 1067 PCT 1800	Unlikely – suitable foraging habitat is present within the study area. This species has been recorded in the locality in the last 10 years on BioNet. The study area is however not located on the Important Habitat Map for this species.	Unlikely–- no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
Limicola falcinellus (Broad-billed Sandpiper)	V	-	Dual	BAM-C habitat constraints (species): As per Important Habitat Map.	The eastern form of this species breeds in northern Siberia before migrating southwards in winter to Australia. In Australia, Broad-billed Sandpipers overwinter on the northern coast, particularly in the north-west, with birds located occasionally on the southern coast. In NSW, the main site for the species is the Hunter River estuary, with birds occasionally reaching the Shoalhaven estuary. There are few records for inland NSW. Favour sheltered parts of the coast such as estuarine sandflats and mudflats, harbours, embayments, lagoons, saltmarshes and reefs as feeding and roosting habitat. Occasionally, individuals may be recorded in sewage farms or within shallow freshwater lagoons. Broad-billed Sandpipers roost on banks on sheltered sand, shell or shingle beaches.	BAMC PCT 781	Low – this species is highly mobile and may intermittently use the study area for foraging. However, it is unlikely considering the foraging habitat is suboptimal. There are no BioNet records of this species within the locality. The study area is also not located on the Important Habitat Map for this species.	Low – suboptimal foraging habitat and no breeding habitat present. Targeted survey not required.
Limosa lapponica (Bar-tailed Godwit)	-	V	Dual	BAM-C habitat constraints (species): As per Important Habitat Map.	Most frequently recorded along major coastal river estuaries and sheltered embayments, particularly the Tweed, Richmond, Clarence, Macleay, Hastings, Hunter and Shoalhaven river estuaries, Port Stephens and Botany Bay. It is a rare visitor to wetlands away from the coast with scattered records as far west as along the Darling River and the Riverina. It is found mainly in coastal hab”tats such as large intertidal sandflats, banks, mudflats, estuaries, inlets,	14 – Bionet PMST BAMC PCT 781	Unlikely–- suitable habitat for this species is absent from the study area, including no associated PCTs. The study area is not located on the Important Habitat Map for this species.	Unlikely–- no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					harbours, coastal lagoons and bays. Less frequently it occurs in salt lakes and brackish wetlands, sandy ocean beaches and rock platforms.			
Limosa limosa (Black-tailed Godwit)	V	-	Dual	BAM-C habitat constraints (species): As per Important Habitat Map.	The Black-tailed Godwit is a migratory wading bird that breeds in Mongolia and Eastern Siberia and flies to Australia for the southern summer, arriving in August and leaving in March. In NSW, it is most frequently recorded at Kooragang Island (Hunter River estuary), with occasional records elsewhere along the coast, and inland. Primarily a coastal species. Usually found in sheltered bays, estuaries and lagoons with large intertidal mudflats and/or sandflats.	1 – Bionet BAMC PCT 781	Unlikely–- suitable habitat for this species is absent from the study area. The study area is not located on the Important Habitat Map for this species.	Unlikely–- no suitable habitat. Targeted survey not required.
Lophoictinia isura (Square-tailed Kite)	V	-	Dual	BAM-C habitat constraints (species): Nest trees.	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.	11 – Bionet BAMC PCT 725 PCT 781 PCT 835 PCT 1067 PCT 1800	Low – marginal foraging habitat is present within the study area. This species has been recorded in the locality in the last 10 years on BioNet but is considered unlikely to occur due to degraded habitat.	Low–- suboptimal foraging and breeding habitat. Targeted survey not required.
Melanodryas cucullata cucullata	V	-	Ecosystem	N/A	The Hooded Robin is widespread, found across Australia, except for the driest deserts and the wetter coastal areas–- northern and eastern coastal Queensland and Tasmania.	BAMC PCT 725 PCT 835 PCT 1067 PCT 1800	Unlikely – suitable habitat for this species is absent from the study area. No BioNet records in the locality.	Unlikely–- no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
(Hooded Robin, south-eastern form)					However, it is common in few places, and rarely found on the coast. Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses.			
Melithreptus gularis gularis (Black-chinned Honeyeater, eastern subspecies)	V	-	Ecosystem	N/A	The eastern subspecies extends south from central Queensland, through NSW, Victoria into south-eastern South Australia, though it is very rare in the last state. In NSW it is widespread, with records from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. It is rarely recorded east of the Great Dividing Range, although regularly observed from the Richmond and Clarence River areas. It has also been recorded at a few scattered sites in the Hunter, Central Coast and Illawarra regions, though it is very rare in the latter. Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (*Eucalyptus sideroxylon*), White Box (*E. albens*), Inland Grey Box (*E. microcarpa*), Yellow Box (*E. melliodora*), Blakel''s Red Gum (*E.*	4 – Bionet BAMC PCT 781 PCT 725 PCT 835 PCT 1067 PCT 1800	Low – this species is highly mobile and may intermittently use the study area for foraging and breeding habitat. However, it is unlikely considering the study area is fragmented and degraded, and this species is rarely encountered east of the Great Diving Range. This species would not be dependent on the study area for breeding or foraging. Additionally, there are no BioNet records of this species within the locality in the last 10 years.	Low – suboptimal foraging/breeding habitat. Targeted survey not required

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					blakelyi) and Forest Red Gum (*E. tereticornis*).			
Neophema chrysogaster (Orange-bellied Parrot)	CE	CE	Species	N/A	The Orange-bellied Parrot breeds in the south-west of Tasmania and migrates in autumn to spend the winter on the mainland coast of south-eastern South Australia and southern Victoria. There are occasional reports from NSW, with the most recent records from Shellharbour and Maroubra in May 2003. It is expected that NSW habitats may be being more frequently utilised than observations suggest. Typical winter habitat is saltmarsh and strandline/foredune vegetation communities either on coastlines or coastal lagoons. On the mainland, the Orange-bellied Parrot spends winter mostly within 3km of the coast in sheltered coastal habitats including bays, lagoons, estuaries, coastal dunes and saltmarshes. The species also inhabits small islands and peninsulas and occasionally saltworks and golf courses. Birds forage in low samphire herbland or taller coastal shrubland.	PMST	Unlikely – suitable habitat for this species is absent from the study area, including no associated PCTs. No BioNet records in the locality.	Unlikely–- no suitable habitat. Targeted survey not required
Neophema pulchella (Turquoise Parrot)	V	-	Ecosystem	N/A	The Turquoise Parrot's range extends from southern Queensland through to northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range. Lives on the edges of eucalypt woodland adjoining clearings,	2 – Bionet BAMC PCT 725 PCT 835 PCT 1067 PCT 1800	Low – this species is highly mobile and may intermittently use the study area for foraging and breeding habitat. However, it is unlikely considering the study area is fragmented and degraded. This species would	Low – suboptimal foraging/breeding habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					timbered ridges and creeks in farmland.		not be dependent on the study area for breeding or foraging. Additionally, there are few BioNet records in the locality.	
Ninox connivens (Barking Owl)	V	-	Dual	BAM-C habitat constraints (species): Living or dead trees with hollows greater than 20 cm diameter and greater than 4m above the ground.	Found throughout continental Australia except for the central arid regions. Core populations exist on the western slopes and plains and in some northeast coastal and escarpment forests. Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g. western NSW) due to the higher density of prey found on these fertile riparian soils.	2 – Bionet BAMC PCT 725 PCT 835 PCT 1067 PCT 1800	Low – this species is highly mobile (home range ~ 2000ha in NSW) and may intermittently use the study area for foraging. However, it is unlikely considering the study area is fragmented and degraded, and there are few BioNet records of this species within the locality. No breeding habitat is present in the study area, as suitably sized HBT's are absent.	Low–- suboptimal foraging habitat and no breeding habitat present. Targeted survey not required.
Ninox strenua (Powerful Owl)	V	-	Dual	BAM-C habitat constraints (species): Living or dead trees with hollow greater than 20cm diameter	The Powerful Owl is endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range from Mackay to south-western Victoria. In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered records on the western slopes and plains suggesting occupancy prior to land clearing. Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest.	131 – Bionet BAMC PCT 725 PCT 835 PCT 1067 PCT 1800	Moderate – this species had moderate mobility (home range ~ 400ha in good habitats) and may intermittently use the study area for foraging. No breeding habitat is present in the study area, as suitably sized HBT's are absent. Numerous records of this species within the locality, including within the previous 5 years.	Moderate – dual credit species. No suitable breeding habitat as no suitably sized hollows recorded during habitat assessment survey. Potential foraging habitat present. Test of Significance undertaken (Appendix D).

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
Numenius madagascariensis (Eastern Curlew)	-	CE	Dual	BAM-C habitat constraints (species): As per Important Habitat Map.	Has a primarily coastal distribution. The species is found in all states, particularly the north, east, and south-east regions including Tasmania. Eastern Curlews are rarely recorded inland. In NSW the species occurs across the entire coast but is mainly found in estuaries such as the Hunter River, Port Stephens, Clarence River, Richmond River and ICOLLs of the south coast. It generally occupies coastal lak"s, inlets, bays and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats and sometimes saltmarsh of sheltered coasts.	30 – Bionet PMST	Unlikely–- suitable habitat for this species is absent from the study area, including no associated PCTs. The study area is not located on the Important Habitat Map for this species.	Unlikely–- no suitable habitat. Targeted survey not required.
Pandion cristatus (Eastern Osprey)	V	-	Dual	BAM-C habitat constraints (species): Presence of stick-nests in living and dead trees (>15m) or artificial structures within 100m of a floodplain for nesting.	Eastern Ospreys are found right around the Australian coastline, except for Victoria and Tasmania. They are common around the northern coast, especially on rocky shorelines, islands and reefs. The species is uncommon to rare or absent from closely settled parts of south-eastern Australia. There are a handful of records from inland areas. Favour coastal areas, especially the mouths of large rivers, lagoons and lakes.	26 – Bionet PCT 781 PCT 835 PCT 1800 PMST	Moderate – this species had high mobility and may intermittently use the study area for foraging and breeding. Several records of this species within the locality, including within the previous 5 years.	Moderate – ecosystem credit species as no suitable breeding habitat (large stick nests) recorded during habitat surveys. Potential foraging habitat present. Test of Significance undertaken (Appendix D).
Petroica boodang (Scarlet Robin)	V	-	Ecosystem	N/A	In NSW, it occurs from the coast to the inland slopes. After breeding, some Scarlet Robins disperse to the lower valleys and plains of the tablelands and slopes. Lives in dry eucalypt forests and woodlands. The understorey is	6 – Bionet PCT 725 PCT 835 PCT 1067 PCT 1800	Low – this species is highly mobile and may intermittently use the study area for foraging. However, it is unlikely considering the foraging habitat is suboptimal. There are few	Low–- suboptimal foraging/breeding habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					usually open and grassy with few scattered shrubs.		BioNet records of this species within the locality.	
Petroica phoenicea (Flame Robin)	V	-	Ecosystem		In NSW, it breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes. In winter, many birds move to the inland slopes and plains. The groundlayer of the breeding habitat is dominated by native grasses and the shrub layer may be either sparse or dense. Occasionally occurs in temperate rainforest, and also in herbfields, heathlands, shrublands and sedgelands at high altitudes.	7 – Bionet PCT 725 PCT 835 PCT 1067 PCT 1800	Low – this species is highly mobile and may intermittently use the study area for foraging. However, it is unlikely considering the foraging habitat is suboptimal. There are few BioNet records of this species within the locality, and none within the previous 10 years.	Low – suboptimal foraging/breeding habitat. Targeted survey not required
Petroica rodinogaster (Pink Robin)	V	-	Species	N/A	The Pink Robin is found in Tasmania and the uplands of eastern Victoria and far south-eastern NSW, almost as far north as Bombala. On the mainland, the species disperses north and west and into more open habitats in winter, regularly as far north as the ACT area, and sometimes being found as far north as the central coast of NSW. Inhabits rainforest and tall, open eucalypt forest, particularly in densely vegetated gullies.	1 – Bionet	Unlikely–- suitable habitat for this species is absent from the study area, including no associated PCTs. One BioNet record in the locality from 1972.	Unlikely–- no suitable habitat. Targeted survey not required.
Ptilinopus superbus (Superb Fruit-Dove)	V	-	Ecosystem	N/A	The Superb Fruit-dove occurs principally from north-eastern in Queensland to north-eastern NSW. It is much less common further south, where it is largely confined to pockets of suitable habitat as far south as Moruya. Inhabits rainforest and similar closed forests.	1 – Bionet	Unlikely–- suitable habitat for this species is absent from the study area, including no associated PCTs. One BioNet record in the locality from 1996.	Unlikely–- no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
Pycnoptilus floccosus (Pilotbird)	-	V	N/A	N/A	Pilotbirds are endemic to south-east Australia. Upland Pilotbirds occur above 600m in the Brindabella Ranges in the Australian Capital Territory, and in the Snowy Mountains in New South Wales and north-east Victoria. Lowland Pilotbirds occur in forests from the Blue Mountains west of Newcastle, around the wetter forests of eastern Australia, to Dandenong near Melbourne. Habitat critical to the survival of the Pilotbird includes: • wet sclerophyll forests in temperate zones in moist gullies with dense undergrowth, and • dry sclerophyll forests and woodlands occupying dry slopes and ridges.	PMST	Unlikely–- suitable habitat for this species is absent from the study area. No BioNet records in the locality.	Unlikely–- no suitable habitat. Targeted survey not required.
Rostratula australis (Australian Painted Snipe)	E	E	Ecosystem	N/A	In NSW many records are from the Murray-Darling Basin including the Paroo wetlands, Lake Cowal, Macquarie Marshes, Fivebough Swamp and more recently, swamps near Balldale and Wanganella. Other important locations with recent records include wetlands on the Hawkesbury River and the Clarence and lower Hunter Valleys. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	1 – Bionet PMST BAMC PCT 781	Low – this species is highly mobile and may intermittently use the study area for foraging and/or breeding. However, it is unlikely considering the foraging habitat is suboptimal. There are few BioNet records of this species within the locality.	Low – suboptimal foraging/breeding habitat. Targeted survey not required
Stagonopleura guttata (Diamond Firetail)	V	-	Ecosystem	N/A	It is widely distributed in NSW, with a concentration of records from the Northern, Central and Southern Tablelands, the Northern,152peciesl	BAMC PCT 725 PCT 835 PCT 1067	Low – this species is highly mobile and may intermittently use the study area for foraging and/or	Low–- suboptimal foraging/breeding habitat. Targeted survey not required

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					and South Western Slopes and the North West Plains and Riverina. Not commonly found in coastal districts, though there are records from near Sydney, the Hunter Valley and the Bega Valley. This species has a scattered distribution over the rest of NSW, though is very rare west of the Darling River. Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum *Eucalyptus pauciflor*a Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities.	PCT 1800	breeding. However, it is unlikely considering foraging/breeding habitat is suboptimal. There are no BioNet records of this species within the locality.	
Stictonetta naevosa (Freckled Duck)	V	-	Ecosystem	N/A	The Freckled Duck is found primarily in south-eastern and south-western Australia, occurring as a vagrant elsewhere. It breeds in large temporary swamps created by floods in the Bulloo and Lake Eyre basins and the Murray-Darling system, particularly along the Paroo and Lachlan Rivers, and other rivers within the Riverina. The duck is forced to disperse during extensive inland droughts when wetlands in the Murray River basin provide important habitat. The species may also occur as far as coastal NSW and Victoria during such times. Prefer permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-	BAMC PCT 781	Unlikely–- suitable habitat for this species is absent from the study area. No BioNet records in the locality.	Unlikely–- no suitable habitat. Targeted survey not required

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds.			
Sternula nereis nereis (Australian Fairy Tern)	-	V	Species	N/A	Within Australia, the Fairy Tern occurs along the coasts of Victoria, Tasmania, South Australia and Western Australia; occurring as far north as the Dampier Archipelago near Karratha. The subspecies has been known from New South Wales (NSW) in the past, but it is unknown if it persists there. Forages in shallow (>10 cm deep) water of sheltered coasts, embayments and estuaries. Breads in areas above high water mark on sheltered beaches, spits, bars, banks and ridges, usually of sand but also of shell grit or coral. Either on mainland or inshore islands, often within estuaries.	PMST	Unlikely–- suitable habitat for this species is absent from the study area. No BioNet records in the locality.	Unlikely–- no suitable habitat. Targeted survey not required
Tyto novaehollandiae (Masked Owl)	V	-	Dual	BAM-C habitat constraints (species): Living or dead trees with hollows greater than 20cm diameter.	Extends from the coast where it is most abundant to the western plains. Lives in dry eucalypt forests and woodlands from sea level to 1100 m.	2 – Bionet BAMC PCT 725 PCT 835 PCT 1067 PCT 1800	Low – this species is highly mobile (home range ~ 500-1000ha) and may intermittently use the study area for foraging. However, it is unlikely considering the study area is fragmented and degraded, and there are few BioNet records of this species within the locality. No breeding habitat is present within the study area, as suitably sized HBTs are absent.	Low–- suboptimal foraging habitat and no breeding habitat present. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
Tyto tenebricosa (Sooty Owl)	V	-	Dual	BAM-C habitat constraints (species): Caves or clifflines/ledges; Living or dead trees with hollows greater than 20cm diameter.	Occupies the easternmost one-eighth of NSW, occurring on the coast, coastal escarpment and eastern tablelands. Territories are occupied permanently. Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests.	9 – Bionet	Unlikely – suitable habitat for this species is absent from the study area. Few BioNet records within the locality.	Unlikely–- no suitable habitat. Targeted survey not required.
Mammals								
Cercartetus nanus (Eastern Pygmy-possum)	V	-	Species	N/A	In NSW it extends 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. They may occupy small patches of vegetation in fragmented landscapes and although the species prefers habitat with a rich shrub understory, they are known to occur in grassy woodlands and the presence of Eucalypts alone is sufficient to support populations in low densities.	8 – Bionet BAMC PCT 835 PCT 1067	Unlikely – suitable habitat for this species is absent from the study area as the site is highly degraded and fragmented. Few BioNet records within the locality; none within the previous 10 years.	Unlikely–- no suitable habitat. Targeted survey not required.
Chalinolobus dwyeri (Large-eared Pied Bat)	V	V	Species	BAM-C habitat constraints (species): Within two kilometres of rocky areas containing caves,	Found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a	7 – Bionet PCT 725 PCT 835 PCT 1067 PCT 1800	Low – BioNet records of this species within the locality, including within the previous 5 years. However, breeding habitat is absent from the	Low–- suboptimal foraging habitat present and no breeding habitat present within 2km of the study area.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
				overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels.	very patchy distribution in NSW. There are scattered records from the New England Tablelands and North West Slopes. Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Petrochelidon ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves and overhangs. They remain loyal to the same cave over many years.	PMST	study area and none is likely to occur within 2km of the study area.	Targeted survey not required as habitat constraints not present.
Dasyurus maculatus (Spotted-tailed Quoll)	V	E	Ecosystem	N/A	Found in eastern NSW, eastern Victoria, south-east and north-eastern Queensland, and Tasmania. Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline.	4 – Bionet PCT 725 PCT 781 PCT 835 PCT 1067 PCT 1800 PMST	Unlikely – suitable habitat for this species is absent from the study area as the site is highly degraded and fragmented. Few BioNet records within the locality; none within the previous 10 years.	Unlikely–- no suitable habitat. Targeted survey not required.
Falsistrellus tasmaniensis (Eastern False Pipistrelle)	V	-	Ecosystem	N/A	Found on the south-east coast and ranges of Australia, from southern Queensland to Victoria and Tasmania. Prefers moist habitats, with trees taller than 20 m. Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings.	39 – Bionet TSDC: PCT 725 PCT 781 PCT 835	Moderate – this species had high mobility and may intermittently use the study area for foraging and breeding. Several records of this species within the locality, including within the previous 5 years.	Moderate – suitable habitat present. Ecosystem credit species – targeted survey not required. Test of Significance undertaken (Appendix D).

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
Isoodon obesulus obesulus (Southern Brown Bandicoot (eastern))	E	E	Species	BAM-C habitat constraints (species): Requires dense ground cover in a variety of habitats.	Found in south-eastern NSW, east of the Great Dividing Range south from the Hawkesbury River, southern coastal Victoria and the Grampian Ranges, south-eastern South Australia, south-west Western Australia and the northern tip of Queensland. Generally only found in heath or open forest with a heathy understorey on sandy or friable soils.	1 – Bionet PMST	Unlikely – suitable habitat for this species is absent from the study area, including no associated PCTs. In addition, the site is highly degraded and fragmented. Few BioNet records within the locality.	Unlikely–- no suitable habitat. Targeted survey not required.
Micronomus norfolkensis (Eastern Coastal Free-tailed Bat)	V	-	Ecosystem	N/A	The Eastern Freetail-bat is found along the east coast from south Queensland to southern NSW. Occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roost maily in tree hollows but will also roost under bark or in man-made structures.	29 – Bionet BAMC PCT 725 PCT 781 PCT 835 PCT 1067 PCT 1800	Moderate – this species had high mobility and may intermittently use the study area for foraging and breeding. Several records of this species within the locality, including within the previous 5 years.	Moderate – suitable habitat present. Ecosystem credit species – targeted survey not required. Test of Significance undertaken (Appendix D).
Miniopterus australis (Little Bent-winged Bat)	V	-	Dual	BAM-C habitat constraints (species): Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding.	Occurs along east coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW. Occupies 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.	15 – Bionet BAMC PCT 725 PCT 781 PCT 835 PCT 1067 PCT 1800	Moderate – this species had high mobility and may intermittently use the study area for foraging. BioNet records of this species within the locality, including within the previous 5 years. Breeding habitat is absent from the study area.	Moderate – dual credit species. No suitable breeding habitat as habitat constraints absent from study area. Potential foraging habitat present. Test of Significance undertaken (Appendix D).
Miniopterus orianae oceanensis (Large Bent-winged Bat)	V	-	Dual	BAM-C habitat constraints (species): Cave, tunnel, mine, culvert or other structure known or	Occur along the east and north-west coasts of Australia. Hunt in forested areas. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels,	67 – Bionet BAMC PCT 725 PCT 781 PCT 835	Moderate – this species had high mobility and may intermittently use the study area for foraging. Several BioNet records of this species	Moderate – dual credit species. No suitable breeding habitat as habitat constraints absent from study area.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
				suspected to be used for breeding.	buildings and other man-made structures.	PCT 1067 PCT 1800	within the locality, including within the previous 5 years. Breeding habitat is absent from the study area.	Potential foraging habitat present. Test of Significance undertaken (Appendix D).
Myotis macropus (Southern Myotis)	V	-	Species	BAM-C habitat constraints (species): Waterbodies with permanent pools/stretches 3m or wider, including rivers, large creeks, billabongs, lagoons, estuaries, dams and other waterbodies, on or within 200m of the site.	Found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100km inland, except along major rivers. Generally roost in groups of 10–- 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools.	38 – Bionet BAMC PCT 725 PCT 781 PCT 835 PCT 1067 PCT 1800	High – this species had high mobility and may intermittently use the study area for foraging and breeding. Several records of this species within the locality in the previous 5 years, including in very close proximity to the study area.	High – species credit species to be assumed present. Suitable foraging and breeding habitat within the study area. Targeted survey not undertaken due to project timing. Species was recorded during the assessment for Stage 1A. Test of Significance undertaken (Appendix D).
Notamacropus parma / Macropus parma (Parma Wallaby)	V	V	Species	N/A	The species once occurred in north-eastern NSW from the Queensland boarder to the Bega area in the southeast. Their range is now confined to the coast and ranges of central and northern NSW from the Gosford district to south of the Bruxner Highway between Tenterfield and Casino. Preferred habitat is moist eucalypt forest with thick, shrubby understorey, often with nearby grassy areas, rainforest margins and occasionally drier eucalypt forest.	PMST	Unlikely – suitable habitat for this species is absent from the study area, including no associated PCTs. In addition, the study area does not occur within the known distribution of this species. No BioNet records within the locality.	Unlikely–- no suitable habitat. Targeted survey not required.
Petauroides volans (Greater Glider)	-	E	Species	N/A	An arboreal nocturnal marsupial, predominantly solitary and largely restricted to eucalypt forests and woodlands of eastern Australia. It is typically found in highest abundance in taller, montane, moist eucalypt forests on fertile soils, with relatively	1 – Bionet PMST BAMC PCT 725 PCT 835 PCT 1067 PCT 1800	Unlikely – suitable habitat for this species is absent from the study area as the site is highly degraded and fragmented. Only one BioNet record within the locality (from 2014 at Lucas Heights).	Unlikely–- no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					old trees and abundant hollows. Hollow dependent species that will have large trees with hollows within its home range. Home range is < 5ha and typically 1 to 3 ha.			
Petaurus australis (Yellow-bellied Glider)	V	V	Ecosystem	N/A	Found along the eastern coast to the western slopes of the Great Dividing Range, from southern Queensland to Victoria. Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils.	1 – Bionet PMST	Unlikely – suitable habitat for this species is absent from the study area as the site is highly degraded and fragmented. Only one BioNet record within the locality (from 1999 at Menai).	Unlikely–- no suitable habitat. Targeted survey not required.
Petaurus norfolcensis (Squirrel Glider)	V	-	Species	N/A	The species is widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria. 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.	1 – Bionet PCT 725 PCT 835 PCT 1067	Unlikely – suitable habitat for this species is absent from the study area as the site is highly degraded and fragmented. Only one BioNet record within the locality (from 2006 at Holsworthy).	Unlikely–- no suitable habitat. Targeted survey not required.
Petrogale penicillata (Brush-tailed Rock-wallaby)	E	V	Species	BAM-C habitat constraints (species): Land within 1km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or clifflines.	In NSW they occur from the Queensland border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit. Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north	1 – Bionet PMST	Unlikely – suitable habitat for this species is absent from the study area, including no associated PCTs. Only one BioNet record within the locality (from 1996 at Holsworthy).	Unlikely–- no suitable habitat. Targeted survey not required.
Phascolarctos cinereus (Koala)	E	E	Species	BAM-C habitat constraints (species): Presence of koala use trees.	In New South Wales, koala populations are found on the central and north coasts, southern highlands, southern and northern tablelands, Blue Mountains,	277 – Bionet PMST BAMC PCT 725 PCT 781	Low – this species is highly mobile and may intermittently use the study area for foraging and/or breeding. However, it is	Low–- suboptimal foraging and breeding habitat present. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					southern coastal forests, with some smaller populations on the plains west of the Great Dividing Range. Inhabit eucalypt woodlands and forests.	PCT 835 PCT 1067 PCT 1800	unlikely considering foraging/breeding habitat is suboptimal and there is inadequate connectivity to existing populations. The majority of BioNet records in the locality are situated around Moorebank, Sandy Point and Lucas Heights, all located on the other side of the Georges River and associated with the Campbelltown Koala population.	
Pseudomys novaehollandiae (New Holland Mouse)	-	V	Species	N/A	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.	7 – Bionet PMST BAMC PCT 1067	Unlikely – suitable habitat for this species is absent from the study area as the site is highly degraded and fragmented, with no heathland vegetation. Few BioNet record within the locality, restricted to the Holsworthy Defence Area.	Unlikely–- no suitable habitat. Targeted survey not required.
Pteropus poliocephalus (Grey-headed Flying-fox)	V	V	Dual	BAM-C habitat constraints (species): Breeding camps	Generally found within 200km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops.	1017 – Bionet PMST BAMC PCT 725 PCT 781 PCT 835 PCT 1067 PCT 1800	High – this species had high mobility and may intermittently use the study area for foraging. Several BioNet records of this species within the locality, including within the previous 5 years. Breeding habitat is absent from the study area.	High – dual credit species. No suitable breeding habitat as habitat constraints absent from study area. Potential foraging habitat present. Test of Significance undertaken (Appendix D).
Saccolaimus flaviventris (Yellow-bellied Sheathtail-bat)	V	-	Ecosystem	N/A	The Yellow-bellied Sheathtail-bat is a wide-ranging species found across northern and eastern Australia. In the most southerly part of its range–	26 – Bionet PCT 725 PCT 781 PCT 835	Moderate – this species had high mobility and may intermittently use the study area for foraging and	Moderate – suitable habitat present. Ecosystem credit species – targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					- most of Victoria, south-western NSW and adjacent South Australia–- it is a rare visitor in late summer and autumn. There are scattered records of this species across the New England Tablelands and North West Slopes. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.	PCT 1067 PCT 1800	breeding. Several records of this species within the locality, including within the previous 5 years.	Test of Significance undertaken (Appendix D).
Scoteanax rueppellii (Greater Broad-nosed Bat)	V	-	Ecosystem	N/A	Found mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland. Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is mostly found in tall wet forest.	40 – Bionet TSDC: PCT 725 PCT 835 PCT 1800	Moderate – this species had high mobility and may intermittently use the study area for foraging and breeding. Several records of this species within the locality, including within the previous 5 years.	Moderate – suitable habitat present. Ecosystem credit species – targeted survey not required. Test of Significance undertaken (Appendix D).
Amphibians								
Heleioporus australiacus (Giant Burrowing Frog)	V	V	Species	N/A	The Giant Burrowing Frog is distributed in south eastern NSW and Victoria, and appears to exist as two distinct populations: a northern population largely confined to the sandstone geology of the Sydney Basin and extending as far south as Ulladulla, and a southern population occurring from north of Narooma through to Walhalla, Victoria. Found in heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based.	PMST	Unlikely – suitable habitat for this species is absent from the study area as no suitable geology/soils present. No BioNet records within the locality.	Unlikely–- no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
Litoria aurea (Green and Golden Bell Frog)	E	V	Species	BAM-C habitat constraints (species): Within 1km of wet areas; Within 1km of swamp; Within 1km of waterbody	Since 1990 there have been approximately 50 recorded locations in NSW, most of which are small, coastal, or near coastal populations. These locations occur over the species' former range, however they are widely separated and isolated. Large populations in NSW are located around the metropolitan areas of Sydney, Shoalhaven and mid north coast (one an island population). There is only one known population on the NSW Southern Tablelands. Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (*Gambusia holbrooki*), have a grassy area nearby and diurnal sheltering sites available. Some sites, particularly in the Greater Sydney region occur in highly disturbed areas.	96 – Bionet PMST BAMC PCT 725 PCT 781 PCT 835 PCT 1067 PCT 1800	Moderate – this species may intermittently use the study area for foraging and breeding. Potential habitat includes Milperra Drain which contains emergent aquatic vegetation. Several records of this species within the locality, including within the previous 5 years.	Low – suboptimal foraging and breeding habitat present. Areas of potential habitat within the study area (Milperra Drain) were surveyed by WSP in December 2018 for Stage 1A assessment. This species was not detected and therefore presumed unlikely to occur.
Litoria littlejohni (Littlejoh''s Tree Frog, Heath Frog)	V	V	Species	N/A	Occurs on the plateaus and eastern slopes of the Great Dividing Range from Watagan State Forest (90km north of Sydney) south to Buchan in Victoria. The majority of records are from within the Sydney Basin Bioregion with only scattered records south to the Victorian border and this species has not been recorded in southern NSW within	PMST	Unlikely – suitable habitat for this species is absent from the study, including no associated PCTs. No BioNet records within the locality.	Unlikely–- no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					the last decade. Records are isolated and tend to be at high altitude. This species breeds in the upper reaches of permanent streams and in perched swamps. Non-breeding habitat is heath based forests and woodlands where it shelters under leaf litter and low vegetation, and hunts for invertebrate prey either in shrubs or on the ground.			
Mixophyes balbus (Stuttering Frog)	E	V	Species	N/A	Considered to have disappeared from Victoria and to have undergone considerable range contraction in NSW, particularly in south-east NSW. It is the only Mixophyes species that occurs in south-east NSW and in recent surveys it has only been recorded at three locations south of Sydney. The Dorrigo region, in north-east NSW, appears to be a stronghold for this species. Found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range. Outside the breeding season adults live in deep leaf litter and thick understorey vegetation on the forest floor.	PMST	Unlikely – suitable habitat for this species is absent from the study, including no associated PCTs. No BioNet records within the locality.	Unlikely–- no suitable habitat. Targeted survey not required.
Pseudophryne australis (Red-crowned Toadlet)	V	-	Species	N/A	The Red-crowned Toadlet has a restricted distribution. It is confined to the Sydney Basin, from Pokolbin in the north, the Nowra area to the south, and west to Mt Victoria in the Blue Mountains.	11 – Bionet	Unlikely – suitable habitat for this species is absent from the study, including no associated PCTs. Few BioNet records within the locality.	Unlikely–- no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					Occurs in open forests, mostly on Hawkesbury and Narrabeen Sandstones. nhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings.			
Reptiles								
Caretta caretta (Loggerhead Turtle)	E	E	Species	BAM-C habitat constraints (species): Dunes–- Elevated sand dune above watertable and high tide	Loggerhead Turtles are found in tropical and temperate waters off the Australian coast. In NSW they are seen as far south as Jervis Bay and have been recorded nesting on the NSW north coast and feeding around Sydney. Ocean-dwellers, foraging in deeper water for fish, jellyfish and bottom-dwelling animals. The female comes ashore to lay her eggs in a hole dug on the beach in tropical regions during the warmer months.	2 – Bionet PMST	Unlikely – suitable habitat for this species is absent from the study, including no associated PCTs. Few BioNet records within the locality.	Unlikely–- no suitable habitat. Targeted survey not required.
Chelonia mydas (Green Turtle)	V	V	Species	BAM-C habitat constraints (species): Dunes–- Elevated sand dune above watertable and high tide	Widely distributed in tropical and sub-tropical seas.Usually found in tropical waters around Australia but also occurs in coastal waters of NSW, where it is generally seen on the north or central coast, with occasional records from the south coast. Ocean-dwelling species spending most of its life at sea. Eggs laid in holes dug in beaches throughout their range.	PMST	Unlikely – suitable habitat for this species is absent from the study, including no associated PCTs. The study area does not occur within the known distribution of this species. No BioNet records within the locality.	Unlikely–- no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
Delma impar (Striped Legless Lizard, Striped Snake-lizard)	V	V	Species	N/A	The Striped Legless Lizard occurs in the Southern Tablelands, the South West Slopes, the Upper Hunter and possibly on the Riverina. Populations are known in the Goulburn, Yass, Queanbeyan, Cooma, Muswellbrook and Tumut areas. Also occurs in the ACT, Victoria and south-eastern South Australia. Found mainly in Natural Temperate Grassland but has also been captured in grasslands that have a high exotic component. Also found in secondary grassland near Natural Temperate Grassland and occasionally in open Box-Gum Woodland.	PMST	Unlikely – suitable habitat for this species is absent from the study, including no associated PCTs. The study area does not occur within the known distribution of this species. No BioNet records within the locality.	Unlikely–- no suitable habitat. Targeted survey not required.
Dermochelys coriacea (Leatherback Turtle, Leathery Turtle)	E	E	Species	BAM-C habitat constraints (species): Dunes–- Elevated sand dune above watertable and high tide	Throughout the worl''s tropical and temperate seas and in all coastal waters of Australia. Most sightings are in temperate waters. Large numbers of Leatherback Turtles feed in coastal waters from southern Queensland to the central coast of NSW. Occurs in inshore and offshore marine waters. Rarely breeds in Australia, with the nearest regular nesting sites being the Solomon Islands and Malayan Archipelago. Occasional breeding records from NSW coast, including between Ballina and Lennox Head in northern NSW.	PMST	Unlikely – suitable habitat for this species is absent from the study, including no associated PCTs. The study area does not occur within the known distribution of this species. No BioNet records within the locality.	Unlikely–- no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
Hoplocephalus bungaroides (Broad-headed Snake)	E	V	Dual	BAM-C habitat constraints (species): Rocky areas, including escarpments, outcrops and pagodas within the Sydney Sandstone geologies.	Largely confined to Triassic and Permian sandstones, including the Hawkesbury, Narrabeen and Shoalhaven groups, within the coast and ranges in an area within approximately 250km of Sydney. Shelters in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter and spring. Moves from the sandstone rocks to shelters in crevieces or hollows in large trees within 500m of escarpments in summer.	1 – Bionet PMST	Unlikely – suitable habitat for this species is absent from the study, including no associated PCTs. Only one BioNet record within the locality.	Unlikely–- no suitable habitat. Targeted survey not required.
Varanus rosenbergi (Rosenber''s Goanna)	V	-	Ecosystem	N/A	Rosenber''s Goanna occurs on Sydney Sandstone in Wollemi National Park to the north-west of Sydney, in the Goulburn and ACT regions and near Cooma in the south. Found in heath, open forest and woodland	2 – Bionet BAMC PCT 725 PCT 1067	Unlikely – suitable habitat for this species is absent from the study area as no suitable geology/soils present and the study area is highly fragmented and degraded. Few BioNet records within the locality (none within the previous 10 years).	Unlikely–- no suitable habitat. Targeted survey not required.
Invertebrates								
Meridolum corneovirens (Cumberland Plain Land Snail)	E	-	Species	N/A	Lives in small areas on the Cumberland Plain west of Sydney, from Richmond and Windsor south to Picton and from Liverpool west to the Hawkesbury and Nepean Rivers at the base of the Blue Mountains. Known from over 100 different locations, but not all are currently occupied, and they are usually isolated from each other as a result of land use patterns. Primarily inhabits Cumberland Plain Woodland (a critically endangered	133 – Bionet PCT 725 PCT 835 PCT 1067	Moderate – marginal habitat (i.e. leaf litter, logs) is present within the study area. Numerous records of this species within the locality, including within the previous 5 years.	Moderate – species credit species to be assumed present. Suitable foraging and breeding habitat within unmown areas of PCT 835, including leaf litter and logs. All other associated PCTs did not have suitable habitat for this species, as they are predominately mown and/or lacked a good cover of leaf litter and logs.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					ecological community). This community is a grassy, open woodland with occasional dense patches of shrubs. It is also known from Shale Gravel Transition Forests, Castlereagh Swamp Woodlands and the margins of River-flat Eucalypt Forest, which are also listed communities. Lives under litter of bark, leaves and logs, or shelters in loose soil around grass clumps. Occasionally shelters under rubbish.			Targeted survey required prior to project commencement. Test of Significance undertaken (Appendix D).
Pommerhelix duralensis (Dural Land Snail)	E	E	Species	N/A	The species is a shale-influenced-habitat specialist, which occurs in low densities along the western and northwest fringes of the Cumberland IBRA subregion on shale-sandstone transitional landscapes. The species has a strong affinity for communities in the interface region between shale-derived and sandstone-derived soils, with forested habitats that have good native cover and woody debris.	PCT 725 PMST	Unlikely – the study area does not occur within the known distribution of this species. No BioNet records within the locality.	Unlikely - no suitable habitat. Targeted survey not required.
Migratory species								
Actitis hypoleucos (Common Sandpiper)	-	Marine, Migratory	N/A	N/A	Found along all coastlines of Australia and in many areas inland, the Common Sandpiper is widespread in small numbers. The population that migrates to Australia breeds in the Russian far east. The species utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around	2 – Bionet PMST	Unlikely – suitable habitat for this species is absent from the study area. Few BioNet records in the locality.	Unlikely - no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					muddy margins or rocky shores and rarely on mudflats. Generally the species forages in shallow water and on bare soft mud at the edges of wetlands; often where obstacles project from substrate, e.g. rocks or mangrove roots. Birds sometimes venture into grassy areas adjoining wetlands			
Ardenna tenuirostris (Short-tailed Shearwater)	-	Marine, Migratory	N/A	N/A	In summer months, the Short-tailed Shearwater is the most common shearwater along the south and south-east coasts of Australia. The Short-tailed Shearwater is found in coastal waters.	1 – Bionet	Unlikely – suitable habitat for this species is absent from the study area. Few BioNet records in the locality.	Unlikely - no suitable habitat. Targeted survey not required.
Calidris acuminata (Sharp-tailed Sandpiper)		Marine, Migratory	N/A	N/A	Spends the non-breeding season in Australia with small numbers occurring regularly in New Zealand. Most of the population migrates to Australia, mostly to the south-east and are widespread in both inland and coastal locations and in both freshwater and saline habitats. Prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline saltlakes inland. They also occur in saltworks and sewage farms.	1 – Bionet PMST	Unlikely – suitable habitat for this species is absent from the study area. Few BioNet records in the locality.	Unlikely - no suitable habitat. Targeted survey not required.
Calidris melanotos	-	Marine, Migratory	N/A	N/A	In New South Wales (NSW), the Pectoral Sandpiper is widespread, but scattered. Records exist east of	PMST	Unlikely – suitable habitat for this species is absent from	Unlikely - no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
(Pectoral Sandpiper)					the Great Divide, from Casino and Ballina, south to Ulladulla. West of the Great Divide, the species is widespread in the Riverina and Lower Western regions. Prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands.		the study area. No BioNet records in the locality.	
Cuculus optatus (Oriental Cuckoo)	-	Migratory	N/A	N/A	Regular non-breeding migrant (Sept-May) to coastal northern and eastern Australia and islands. Occupies monsoon forest, rainforest edges, leafy trees in paddocks, river flats, roadsides, mangroves and islands.	3 – Bionet PMST	Low – this species is highly mobile and may intermittently use the study area for foraging habitat. However, it is unlikely considering the study area is fragmented and degraded. Additionally, there are no BioNet records of this species within the locality in the last 10 years.	Low - suboptimal foraging habitat present and no breeding habitat present. Targeted survey not required.
Gallinago hardwickii (Latham's Snipe)	-	Marine, Migratory	N/A	N/A	Non-breeding visitor to south-eastern Australia. The species has been recorded along the east coast of Australia from Cape York Peninsula through to south-eastern South Australia (including the Adelaide plains and Mount Lofty Ranges, and the Eyre Peninsula). The range extends inland over the eastern tablelands in south-eastern Queensland (and occasionally from Rockhampton in the north), and to west of the Great Dividing Range in New South Wales.	81 – Bionet PMST	Low – suboptimal foraging and breeding habitat is present within the study area. This species has been recorded in the locality in the last 10 years on BioNet. However, this species prefers wetlands with abundant aquatic vegetation for protection, this is limited within study area.	Low - suboptimal foraging and breeding habitat present. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					Occurs in permanent and ephemeral wetlands up to 2000m above sea-level. They usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies). However, they can also occur in habitats with saline or brackish water, in modified or artificial habitats, and in habitats located close to humans or human activity.			
Hydroprogne caspia (Caspian Tern)	-	Marine, Migratory	N/A	N/A	Has a widespread occurrence and can be found in both coastal and inland habitat. Widespread east of the Great Divide, mainly in coastal regions, and also in the Riverina and Lower and Upper Western Regions, with occasional records elsewhere. Mostly found in sheltered coastal embayments (harbours, lagoons, inlets, bays, estuaries and river deltas) and those with sandy or muddy margins are preferred. They also occur on near-coastal or inland terrestrial wetlands that are either fresh or saline, especially lakes (including ephemeral lakes), waterholes, reservoirs, rivers and creeks. They also use artificial wetlands, including reservoirs, sewage ponds and saltworks	7 – Bionet	Unlikely – suitable habitat for this species is absent from the study area. No BioNet records in the locality in the past 10 years.	Unlikely - no suitable habitat. Targeted survey not required.
Monarcha melanopsis (Black-faced Monarch)	-	Marine, Migratory	N/A	N/A	The Black-faced Monarch is found along the coast of eastern Australia, becoming less common further south. The Black-faced Monarch is found in rainforests, eucalypt woodlands, coastal scrub and damp	PMST	Low – this species is highly mobile and may intermittently use the study area for foraging habitat. However, it is unlikely considering the study area is	Low - suboptimal foraging habitat present. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					gullies. It may be found in more open woodland when migrating.		fragmented and degraded. Few BioNet records in the locality.	
Motacilla flava (Yellow Wagtail)	-	Marine, Migratory	N/A	N/A	Has an extremely large range, extending from Europe, east through Siberia to west Asia and northwestern China; and south through the Arabian Peninsula to Egypt. Vagrant to Australia.	PMST	Unlikely – vagrant to Australia. No BioNet records in the locality.	Unlikely - no suitable habitat. Targeted survey not required.
Myiagra cyanoleuca (Satin Flycatcher)	-	Marine, Migratory	N/A	N/A	Found along the east coast of Australia from far northern Queensland to Tasmania, including south-eastern South Australia. It is also found in New Guinea. The Satin Flycatcher is not a commonly seen species, especially in the far south of its range, where it is a summer breeding migrant. The Satin Flycatcher is found in tall forests, preferring wetter habitats such as heavily forested gullies, but not rainforests.	PMST	Unlikely – suitable habitat for this species is absent from the study area. No BioNet records of this species in the locality. Few BioNet records in the locality.	Unlikely - no suitable habitat. Targeted survey not required.
Numenius phaeopus (Whimbrel)	-	Marine, Migratory	N/A	N/A	A regular migrant to Australia and New Zealand, with a primarily coastal distribution. There are also scattered inland records of Whimbrels in all regions. It is found in all states but is more common in the north. The Whimbrel is often found on the intertidal mudflats of sheltered coasts. It is also found in harbours, lagoons, estuaries and river deltas, often those with mangroves, but also open, unvegetated mudflats. It is occasionally found on sandy or rocky beaches, on coral or rocky	3 – Bionet	Unlikely – suitable habitat for this species is absent from the study area. Few BioNet records in the locality.	Unlikely - no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					islets, or on intertidal reefs and platforms.			
Pluvialis squatarola (Grey Plover)	-	Marine, Migratory	N/A	N/A	n Australia, the Grey Plover has been recorded in all states, where it is found along the coasts. The species is only occasionally recorded along the coast of NSW. They usually inhabit sheltered embayments, estuaries and lagoons with mudflats and sandflats, and occasionally on rocky coasts with wave-cut platforms or reef-flats, or on reefs within muddy lagoons. They also occur around terrestrial wetlands such as near-coastal lakes and swamps, or salt-lakes.	2 – Bionet	Unlikely – suitable habitat for this species is absent from the study area. Few BioNet records in the locality.	Unlikely - no suitable habitat. Targeted survey not required.
Rhipidura rufifrons (Rufous Fantail)	-	Marine, Migratory	N/A	N/A	Found in northern and eastern coastal Australia, being more common in the north. It is also found in New Guinea, the Solomon Islands, Sulawesi and Guam. Found in rainforest, dense wet forests, swamp woodlands and mangroves, preferring deep shade, and is often seen close to the ground. During migration, it may be found in more open habitats or urban areas.	PMST	Low – this species is highly mobile and may intermittently use the study area for foraging habitat. However, it is unlikely considering the study area is fragmented and degraded. Few BioNet records in the locality.	Low - suboptimal foraging and breeding habitat present. Targeted survey not required.
Symposiachrus trivirgatus (Spectacled Monarch)	-	Marine, Migratory	N/A	N/A	Found in coastal north-eastern and eastern Australia, including coastal islands, from Cape York, Queensland to Port Stephens, New South Wales. It is much less common in the south. It is also found in Papua New Guinea, the Moluccas and Timor. The Spectacled Monarch prefers thick understorey in rainforests, wet	PMST	Unlikely – suitable habitat for this species is absent from the study area. No BioNet records in the locality.	Unlikely - no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					gullies and waterside vegetation, as well as mangroves.			
Thalasseus bergii (Crested Tern)	-	Marine, Migratory	N/A	N/A	Breed in colonies on small offshore islands where their nests are so densely packed together that adjacent owners can touch each other's bills. Though the Crested Tern is usually a strictly coastal species, there are occasional records in the arid interior of Australia	5 – Bionet	Unlikely – suitable habitat for this species is absent from the study area. No BioNet records within the locality in the last 10 years.	Unlikely - no suitable habitat. Targeted survey not required.
Tringa nebularia (Common Greenshank)	-	Marine, Migratory	N/A	N/A	The Common Greenshank does not breed in Australia, however, the species occurs in all types of wetlands and has the widest distribution of any shorebird in Australia. In NSW, the species has been recorded in most coastal regions. It is widespread west of the Great Dividing Range, especially between the Lachlan and Murray Rivers and the Darling River drainage basin, including the Macquarie Marshes, and north-west regions. The Common Greenshank is found in a wide variety of inland wetlands and sheltered coastal habitats of varying salinity. It occurs in sheltered coastal habitats, typically with large mudflats and saltmarsh, mangroves or seagrass. Habitats include embayments, harbours, river estuaries, deltas and lagoons and are recorded less often in round tidal pools, rock-flats and rock platforms. The species uses both permanent and ephemeral terrestrial wetlands, including	2 – Bionet PMST	Unlikely – suitable habitat for this species is absent from the study area. No BioNet records within the locality in the last 10 years.	Unlikely - no suitable habitat. Targeted survey not required.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence	
	BC Act	EPBC Act					Prior to targeted survey	Post targeted survey
					swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, claypans and saltflats. It will also use artificial wetlands, including sewage farms and saltworks dams, inundated rice crops and bores.			

Habitat suitability assessment table – Fisheries assessment

Scientific name	Status		Distribution and habitat	Likelihood of occurrence
	FM Act	EPBC Act		
Ambassis agassizii (Western Population of Olive Perchlet)	EP	-	The western population of the Olive Perchlet was once widespread throughout the Murray-Darling system of South Australia, Victoria, western New South Wales and southern Queensland. This population has suffered a serious decline and is now found only at a few sites in the Darling River drainage.	Unlikely – the study area does not occur within the known distribution of this species.
Archaeophya adamsi (Adams Emerald Dragonfly)	E	-	It breeds in rivers and streams in coastal areas. Found in narrow, shaded riffle zones with moss and abundant riparian vegetation (often closed canopy) in small to moderate sized creeks with gravel or sandy bottoms.	Unlikely – suitable habitat for this species is absent from the study area.
Austrocordulia leonardi (Sydney Hawk Dragonfly)	E	E	The known distribution of the species includes three locations in a small area south of Sydney, from Audley to Picton. The species is also known from the Hawkesbury-Nepean, Georges River and Port Hacking drainages.	Unlikely – the study area does not occur within the known distribution of this species.
Austropetalia tonyana (Alpine Redspot Dragonfly)	V	-	Endemic to high-altitude mountain areas of Victoria and New South Wales, Australia that reach above 600 – 1,800 metres above sea level.	Unlikely – the study area does not occur within the known distribution of this species.
Bidyanus bidyanus *(*Silver Perch)	V	-	Once widespread and abundant throughout most of the Murray-Darling river system. Only one remaining secure and self sustaining population occurs in NSW in the central Murray River downstream of Yarrawonga weir, as well as several anabranches and tributaries.	Unlikely – the study area does not occur within the known distribution of this species.
Branchinella buchananensis (Buchanans Fairy Shrimp)	V	-	Only from Lake Buchanan in southwest Queensland, and Gidgee and Burkanoko Lakes in the north-west of NSW (approximately 130km north-west of Bourke).	Unlikely – the study area does not occur within the known distribution of this species.
Craterocephalus amniculus (Darling River Hardyhead in the Hunter River catchment)	EP	-	A small population found in the Hunter catchment.	Unlikely – the study area does not occur within the known distribution of this species.
Craterocephalus fluviatilis (Murray Hardhead)	CE	-	Native to inland parts of south-eastern Australia. They were once widespread and abundant in the Murray and Murrumbidgee River systems in southern NSW and northern Victoria; however, they have suffered a serious population decline, and now seem to be limited to a few sites, mainly in northern Victoria. There are very few recent records of Murray Hardyhead in NSW.	Unlikely – the study area does not occur within the known distribution of this species.
Epinephelus daemelii (Black Rockcod, Black Cod, Saddled Rockcod)	-	V	The species is found in warm temperate and subtropical parts of the south-western Pacific. In NSW, it occurs along the coast, including Lord Howe Island.	Unlikely – the study area does not occur within the known distribution of this species.

Scientific name	Status		Distribution and habitat	Likelihood of occurrence
	FM Act	EPBC Act		
Euastacus armatus (Murray Crayfish)	V	-	Endemic to the southern tributaries of the Murray-Darling Basin.	Unlikely – the study area does not occur within the known distribution of this species.
Euastacus dharawalus (Fitzroy Falls Spiny Crayfish)	CE	-	The species is only found in Wildes Meadow Creek NSW, surviving as a remnant population, restricted to a small length of the waterway upstream from Fitzroy Falls.	Unlikely – the study area does not occur within the known distribution of this species.
Gadopsis marmoratus (River Blackfish population in the Snowy River catchment)	EP	-	A medium-sized native fish that occurs in the Snowy River catchment of the eastern (coastal) flowing drainages and the Murray-Darling basin in NSW.	Unlikely – the study area does not occur within the known distribution of this species.
Galaxias rostratus (Flathead Galaxias)	CE	-	Known from the southern part of the Murray Darling Basin. They have been recorded in the Macquarie, Lachlan, Murrumbidgee and Murray Rivers in NSW.	Unlikely – the study area does not occur within the known distribution of this species.
Galaxias tantangara (Stocky Glaxias)	CE	-	Only known from one locality – the headwaters of Tantangara Creek, upstream of the Tantangara Reservoir, Kosciusko National Park NSW.	Unlikely – the study area does not occur within the known distribution of this species.
Maccullochella ikei (Eastern Freshwater Cod)	E	-	Only found in the Clarence and Richmond River catchments of northern NSW.	Unlikely – the study area does not occur within the known distribution of this species.
Maccullochella macquariensis (Trout Cod)	E	E	Endemic to the southern Murray-Darling river system, including the Murrumbidgee and Murray Rivers, and the Macquarie River in central NSW.	Unlikely – the study area does not occur within the known distribution of this species.
Maccullochella peelii (Murray Cod)	-	V	Occurs naturally in the waterways of the Murray-Darling Basin.	Unlikely – the study area does not occur within the known distribution of this spec3EVYO]ies.=[
Macquaria australasica (Macquarie Perch)	E	E	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.	Unlikely – the study area does not occur within the known distribution of this species.
Mogurnda adspersa (Southern Purple Spotted Gudgeon)	E		Occurs in the Murray-Darling basin as well as parts of coastal northern NSW and Queensland.	Unlikely – the study area does not occur within the known distribution of this species.
Nannoperca australis (Southern Pygmy Perch)	E		Formerly found in the Murray and lower Murrumbidgee River systems. Populations have recently been discovered in tributaries of the upper Lachlan and upper Murray River catchments.	Unlikely – the study area does not occur within the known distribution of this species.
Nannoperca oxleyana (Oxleyan Pygmy Perch)	E		Endemic to the coastal region of eastern Australia from northern NSW to south-eastern Queensland.	Unlikely – the study area does not occur within the known distribution of this species.

Scientific name	Status		Distribution and habitat	Likelihood of occurrence
	FM Act	EPBC Act		
Notopala hanleyi (Hanley's River Snail)	CE		Once common and widespread in the Murray River catchment, including the Lachlan and Murrumbidgee Rivers. They are now virtually extinct throughout their natural range and living specimens have only been found from within irrigation pipelines in South Australia and Far South-West NSW.	Unlikely – the study area does not occur within the known distribution of this species.
Notopala sublineata (Darling River Snail)	CE		Once common and widely distributed in the Darling River and its tributaries. The species is now restricted to a few populations in irrigation pipes near Bourke, Brewarrina, and Walgett.	Unlikely – the study area does not occur within the known distribution of this species.
Prototrocetes marena (Australian Grayling)	E	V	In NSW its most northern limit is now the Clyde River.	Unlikely – the study area does not occur within the known distribution of this species.
Tandanus tandanus (Eel-Tailed Catfish in the Murray-Darling Basin)	EP		Eel Tailed Catfish are naturally distributed throughout the Murray-Darling Basin and in the Eastern drainages NSW north of Newcastle.	Unlikely – the study area does not occur within the known distribution of this species.

Appendix C: Plot-based field data sheets

400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 26 05 22	HLDrMilpara	Plot 1	KS SC

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
	1 Eucalyptus parramattensis subsp. parra		20	2		
	2 Cenchrus clandestinum		35	1000		
	3 Bidens pilosa		0.5	20		
	4 Centrum pargui		0.4	2		
	5 ~~Cerastium glomeratum~~ Euphorbia peplus		0.1	20		
	6 Sonchus oleraceus		0.1	2		
	7 Taraxacum officinale		0.1	2		
	8 Medicago sp.		0.1	20		
	9 Lactuca serriolic		0.1	20		
	10 Modiola cardinana		0.1	20		
	11 Melalenca decora		5	1		
	12 Cardamine hirsuta		0.1	10		
	13 Poa annua		0.1	20		
	14 Lolium sp.		0.1	5		
	15 Gamochaeta coarctata		0.1	1		
	16 Digitaria didactylla		35	1000		
	17 Oxalis sp. (weed)		0.1	20		
	18 Cyclospermum leptophyllum		0.1	1		
	19 Gomphrena celosioides		0.1	1		
	20 Cynodon dactylon		5	500		
	21 Trifolium repens		0.1	20		
	22 Lotus sp.		1	100		
	23 Solanum nigrum		0.1	1		
	24 Paspalum dilatatum		0.1	1		
	25 Soliva sessilis		7	1000		
	26 Digitaria sanguinalis		0.1	10		
	27 Northoscordum sp. (Onion weed)		0.1	10		
	28 Hypochaeris glabra		0.1	5		
	29 Stellaria media		0.1	10		
	30 Malva silvestrus Tall Mallow		0.1	5		
	31 Elephant Ears (see photo.) Xanthosoma sp.		0.1	1		
	32 Arctotheca calendula		0.1	2		
	33 Richardia sp.		0.1	1		
	34					
	35					
	36					
	37					
	38					
	39					
	40					

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

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, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

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BAM Plot – Field Survey Form

Site Sheet no: 1 of

Date	26/5/22	Survey Name: HLD	Plot Identifier: 1	Recorders	
Zone	Datum	IBRA region	Photo #	Zone ID	
Easting	Northing	Dimensions		Orientation of midline from the 0 m point.	Magnetic °
Vegetation Class		Castlereagh Swamp Woodland ?			Confidence: H M L
Plant Community Type		E. parramattensis + M. decora		EEC:	Confidence: H M L

Record easting and northing from the plot marker. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
Sum of Cover of native vascular plants by growth form group	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
High Threat Weed cover		

BAM Attribute (20 x 50 m plot) dbh	Euc*	Stem Classes and Hollows: Non Euc	Hollows†	20cm+
large trees for Euc* & Non Euc: 80 + cm	—	Non Euc		
50 – 79 cm	11			
30 – 49 cm	—			
20 – 29 cm	—			
10 – 19 cm	—			n/a
5 – 9 cm	—		n/a	
< 5 cm	—		This size class records tree regeneration	
Length of logs (m) (≥10 cm diameter, >50 cm in length)	3m	Tally space		total

Record **living** eucalypt* (Euc*) and **living native** non-eucalypt (Non Euc) stems separately

Data needed is presence only, unless a 'large tree' for that class.

* includes all species of *Eucalyptus*, *Corymbia*, *Angophora*, *Lophostemon* and *Syncarpia*

† Record stems by size class with hollows (including dead stems/trees)

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a class.

For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	1 1 5 2 1			
Average of the 5 subplots				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)		
Cultivation (inc. pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (identify native/stock)		
Fire damage		
Storm damage		
Weediness		
Other		

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Free Text Section for brief site description

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

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400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 26/5/22	HLD BAM 2	PCT 835 Riparian	

	GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
1		Eucalyptus nolucanna		30	20		
2		Casuarina glauca		5	1		
3		Solanum ingum		0.5	10		
4		Cardiospermum grandiflorum		60	100		
5		Araujia sericifera		0.5	2		
6		Sida rhombifolia		0.5	50		
7		Solanum sisymbrifolium		0.5	10		
8		Trad Fluminensis		70	1000		
9		Passiflora p/s		0.1	2		
10		Bidens pilosa		1	50		
11		Ehrharta erecta		0.5	50		
12		Salvia sessilis (bindii)		0.1	10		
13		Setaria parviflora		0.1	5		
14		Paspalum dilatatum		0.1	1		
15		Cynodon dactylon		2	1000		
16		Eragrostis sp. p/s		0.2	30		
17		Lantana camara		5	10		
18		Cardamine hirsuta		0.1	5		
19		Conyza bonariensis		0.1	5		
20		Gamochaeta sp.		0.1	5		
21		Cerastium glomeratum		0.1	10		
22		Asparagus aethiopicus		0.2	1		
23		Centaurium clandestinum		0.5	30		
24		Verbena bonariensis		0.1	5		
25		Cestrum parqui		1	10		
26		Asparagus asparagoides		0.1	1		
27		Salpichroa origanifolia (Lily of the valley vine)		20	100		
28		Blackberry		0.2	2		
29		Ligustrum sinense		0.2	10		
30		Ligustrum lucidum		0.2	10		
31		Solanum seaforthianum		0.1	1		
32		Arundo donax		0.5	5		
33		Sonchus oleraceus		0.1	5		
34		Oplismenus aemulus		0.1	10		
35							
36							
37							
38							
39							
40							

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

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, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

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BAM Plot – Field Survey Form

Site Sheet no: 1 of

Survey Name	Plot Identifier	Recorders
HL Dr Milperra	Plot 2	KS SC

Date	26.05.22	IBRA region		Photo #		Zone ID	
Zone	Datum				
Easting	Northing	Dimensions		Orientation of midline from the 0 m point.	Magnetic °

Vegetation Class			Confidence: H M L
Plant Community Type	835 Alluvial Woodland	EEC:	Confidence: H M L

Record easting and northing from the plot marker. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
Sum of Cover of native vascular plants by growth form group	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
High Threat Weed cover		

BAM Attribute (20 x 50 m plot) dbh	Euc*	Stem Classes and Hollows: Non Euc	Hollows[1]	20cm+
large trees for Euc* & Non Euc: 80 + cm	11			
50 – 79 cm	1			
30 – 49 cm	Y			
20 – 29 cm	Y			
10 – 19 cm	Y			n/a
5 – 9 cm	Y		n/a	
< 5 cm			This size class records tree regeneration	
Length of logs (m) (≥10 cm diameter, >50 cm in length)	25 5 4 3	Tally space		total 37m

Record living eucalypt* (Euc*) and living native non-eucalypt (Non Euc) stems separately.

Data needed is presence only, unless a 'large tree' for that class.

* includes all species of *Eucalyptus*, *Corymbia*, *Angophora*, *Lophostemon* and *Syncarpia*.

[1] Record stems by size class with hollows (including dead stems/trees).

Each size class is noted as present by the living tree stems only. Depending on the Vegetation Class, DBH values and counts may be needed for a class.

For a multi-stemmed tree, only the largest living stem is included in the count/estimate. For hollows count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	20 10 40 25 35	a b c d e	a b c d e	a b c d e
Average of the 5 subplots	26			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)		
Cultivation (inc. pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (identify native/stock)		
Fire damage		
Storm damage		
Weediness		
Other		

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe. Age: R=recent (<3yrs), M=not recent (3-10yrs), O=old (>10yrs)

Free Text Section for brief site description

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400 m² plot: Sheet _ of _

Date	Survey Name	Plot Identifier	Recorders
26 05	HL	Plot 3	KS BC

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
	1 Megathyrsus maximus		1	500		
	2 Casuarina glauca		35	20		
	3 Tradescantia ~~albi~~ fluminensis		90	2000		
	4 Cardiospermum grandiflorum		25	2000		
	5 Ageratina adenophora		0.5	20		
	6 Cestrum parqui		0.5	20		
	7 Cinnamomum camphora		0.3	1		
	8 Ligustrum sinense		0.5	20		
	9 Sida rhombifolia		0.1	5		
	10 ~~Erythrina crista-galli~~					
	11 Phragmites australis		0.1	10		
	12 Rubus fruticosus		0.1	2		
	13 Onion weed - Nothoscordum sp.		0.1	5		
	14 Bidens pilosa		0.1	10		
	15 Cenchrus clandestinum		0.1	10		
	16 Passiflora subpeltata		0.1	1		
	17 Lilly of the valley - Salpichroa origanifolia		0.3	5		
	18 Verbena bonariensis		0.1	2		
	19 Alligator weed Alternanthera philixiodes		0.1	5		
	20 Cyperus (eragrostis)		0.1	5		
	21 Brassica sp. (L) Barbarea vernea		0.1	5		
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					
	36					
	37					
	38					
	39					
	40					

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

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, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

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BAM Plot – Field Survey Form

Site Sheet no: 1 of

Survey Name	Plot Identifier	Recorders
HLD BAM	Plot 3	

Date	26 5 22	IBRA region		Photo #		Zone ID	
Zone	Datum				
Easting	Northing	Dimensions		Orientation of midline from the 0 m point.	200° Magnetic

Vegetation Class	PCT 1800 Cas glauca canopy Riparian.		Confidence: H M L
Plant Community Type	Degraded understorey	EEC:	Confidence: H M L

Record easting and northing from the plot marker. If applicable, orient picket so that perforated nb points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
Sum of Cover of native vascular plants by growth form group	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
High Threat Weed cover		

BAM Attribute (20 x 50 m plot)		Stem Classes and Hollows		
dbh	Euc*	Non Euc	Hollows†	20cm+
large trees for Euc* & Non Euc: 80 + cm			C. glauca	
50 – 79 cm	1	IIII	Nil	
30 – 49 cm		P		
20 – 29 cm		P		
10 – 19 cm		P		n/a
5 – 9 cm		P	n/a	
< 5 cm		P	This size class records tree regeneration	
Length of logs (m) (≥10 cm diameter, >50 cm in length)	0.5 + 3m +			total 3.5m

Record living eucalypt* (Euc*) and living native non-eucalypt (Non Euc) stems separately

Data needed is presence only, unless a 'large tree' for that class.

* includes all species of *Eucalyptus*, *Corymbia*, *Angophora*, *Lophostemon* and *Syncarpia*

† Record stems by size class with hollows (including dead stems/trees)

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a class.

For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.

BAM Attribute (1 x 1 m plots)	Litter cover (%)*					Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	95	50	30	50	99			
Average of the 5 subplots								

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)		
Cultivation (inc. pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (identify native/stock)		
Fire damage		
Storm damage		
Weediness		
Other		

Severity: 0=no evidence, 1=slight, 2=moderate, 3=severe

Free Text Section for brief site description

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

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400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 26 / 5 / 22	HLD BAM 4	PCT 835	Mowed.

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
	1 Eucalyptus bauerana		20	1		
	2 Casuarina glauca		10	3		
	3 ☆ Ironbark - Eucalyptus crebra		2	1		
	4 Taraxacum officinale		1	100		
	5 Cotula australis		20	1000		
	6 Cenchrus clandestinus		20	200		
	7 Paronychia brasiliana		0.1	50		
	8 Oxalis sp.		0.1	50		
	9 Conyza sp.		0.1	5		
	10 Stellaria media		2	500		
	11 Modiola caroliniana		0.5	30		
	12 Hypochoeris radicata		0.1	10		
	13 Cynodon dactylon.		5	1000		
	14 Crab grass Eleusine pic		2	100		
	15 Gomphrena celesioides.		0.1	1		
	16 Poa annua		40	1000		
	17 Carrot weed p/s.		0.1	1		
	18 Polycarpon tetraphyllum		0.2	100		
	19 Microlaena stipoides		0.1	10		
	20 Sida rhombifolia		0.1	10		
	21 Faeculis retusa		0.1	1		
	22 Cirsium vulgare.		0.1	5		
	23 Cestrum parqui.		0.1	1		
	24 Paspalum dilatatum		0.1	1		
	25 Richardia funy		0.1	1		
	26 Solanum nigrum		0.1	1		
	27 Gamochaeta sp.		0.1	10		
	28 Galum aparine - exotic - velcro weed		0.1	5		
	29 Lactuca sp.		0.1	1		
	30 Ehrharta erecta		0.1	10		
	31 Medicago sp.		0.1	10		
	32 Plantago lanceolata		0.1	20		
	33 Eucalyptus tereticornis		15	1		
	34 Alternanthera philoxeroides		0.1	2		
	35 Lolium sp.		2	50		
	36 Cardamine hirsuta		0.1	1		
	37 Shepherd's purse		0.1	1		
	38					
	39					
	40					

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

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, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

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BAM Plot – Field Survey Form

Site Sheet no: 1 of

Date	26 05 22	Survey Name: HLDr Milpera	Plot Identifier: Plot 4	Recorders: KS SC	
Zone	Datum	IBRA region	Photo #	Zone ID	
Easting	Northing	Dimensions: 20 x 50		Orientation of midline from the 0 m point: 185 Magnetic	
Vegetation Class					Confidence: H M L
Plant Community Type		PCT 835 - Mown		EEC: ✓	Confidence: H M L

Record easting and northing from the plot marker. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
Sum of Cover of native vascular plants by growth form group	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
High Threat Weed cover		

Casuarina glauca

BAM Attribute (20 x 50 m plot) dbh	Euc*	Stem Classes and Hollows: Non Euc	Hollows†	20cm+
large trees for Euc* & Non Euc: 80 + cm	IIII		None	
50 – 79 cm	3 –	1		
30 – 49 cm	Y	Y		
20 – 29 cm	—	Y		
10 – 19 cm	—			n/a
5 – 9 cm	—		n/a	
< 5 cm	—		This size class records tree regeneration	
Length of logs (m) (≥10 cm diameter, >50 cm in length)	0 Tally space			total 0

Record living eucalypt* (Euc*) and living native non-eucalypt (Non Euc) stems separately.

Data needed is presence only, unless a 'large tree' for that class.

* includes all species of *Eucalyptus*, *Corymbia*, *Angophora*, *Lophostemon* and *Syncarpia*

† Record stems by size class with hollows (including dead stems/trees)

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a class.

For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	15 8 20 40 3	a b c d e	a b c d e	a b c d e
Average of the 5 subplots	17.2			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)		
Cultivation (inc. pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (identify native/stock)		
Fire damage		
Storm damage		
Weediness		
Other		

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Free Text Section for brief site description

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Form version designed September 2017

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400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 26 05 22	HL Dr Milpera	plot 5	KS SC

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
	1 Cynodon dactylon		30	5000		
	2 Verbena bonariensis		1	50		
	3 Phragmites australis		35	500		
	4 Persicaria decipens		2	50		
	5 Sida rhombifolia		0.3	20		
	6 Alternanthera philoxeroides		0.5	50		
	7 Aster subulatus		0.1	5		
	8 Juncus sp.		0.2	50		
	9 Rubus fruticosus		0.1	5		
	10 Lonicera japonica		2	50		
	11 Passiflora subpeltata		0.1	5		
	12 Galium aparine		0.1	10		
	13 Carex spp		0.2	5		
	14 Cestrum parqui		0.1	5		
	15 Tradescantia fluminensis		5	100		
	16 Cardiospermum grandiflorum		1	5		
	17 Oxalis pes-capri		3	500		
	18 Megathyrsus maximus		0.1	5		
	19 Solanum pseudocapsicum		0.1	5		
	20 Amaranth (lobed leaves)		0.1	1		
	21 Cynodon dactylon		1	100		
	22 Persicaria hydropiper		2	100		
	23 Typha orientalis		10	100		
	24 Melaleuca ~~nodosa~~ ~~decora~~ decora ~~armillaris (plant)~~		0.5	2		
	25 Casuarina glauca		2	5		
	26 Setaria parviflora		0.1	5		
	27 Sagittaria platyphylla		1	50		
	28 Commelina cyanea		0.1	1		
	29 Ageratina adenophora		0.1	5		
	30 Rumex sp. (weed)		0.1	5		
	31 Brassica from Plot 3		0.1	5		
	32 Erythrina crista-galli		0.1	1		
	33					
	34					
	35					
	36					
	37					
	38					
	39					
	40					

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

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, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

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4 modified 50m x 8m floristic plot for PCT 781 wetland.

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BAM Plot – Field Survey Form

Site Sheet no: 1 of

Date	26 05 22	Survey Name: HL Dr Milpera	Plot Identifier: Plot 5	Recorders: KS SC	
Zone	Datum	IBRA region	Photo # on corners of Plots	Zone ID	
Easting	Northing	Dimensions: 50 x 8 = 400 m²	Orientation of midline from the 0 m point.	SE along drainage line	
Vegetation Class		Floristic plot only			Confidence: H M L
Plant Community Type		PCT 781 Wetland		EEC:	Confidence: H M L

Record easting and northing from the plot marker. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
Sum of Cover of native vascular plants by growth form group	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
High Threat Weed cover		

Cas glauca

BAM Attribute (20 x 50 m plot) dbh	Euc*	Non Euc	Stem Classes and Hollows: Hollows[1]	20cm+
large trees for Euc* & Non Euc: 80 + cm				
50 – 79 cm				
30 – 49 cm				
20 – 29 cm				
10 – 19 cm				n/a
5 – 9 cm		Y	n/a	
< 5 cm			This size class records tree regeneration	
Length of logs (m) (≥10 cm diameter, >50 cm in length)	2	Tally space		total 2

Record **living** eucalypt* (Euc*) and **living native** non-eucalypt (Non Euc) stems separately

Data needed is presence only, unless a 'large tree' for that class.

* includes all species of *Eucalyptus*, *Corymbia*, *Angophora*, *Lophostemon* and *Syncarpia*

[1] Record stems by size class with hollows (including dead stems/trees)

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a class.

For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	10 3 20 5 50	a b c d e	a b c d e	a b c d e
Average of the 5 subplots	17.6			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)		
Cultivation (inc. pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (identify native/stock)		
Fire damage		
Storm damage		
Weediness		
Other		

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Free Text Section for brief site description

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

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* Modified plot 50x8m floristic plot. Did function data with floristic only due to lack of space.

400 m² plot: Sheet _ of _

Date	Survey Name	Plot Identifier	Recorders
20/07/22	HLDr	Plot 6 – 725	~~Plot 6~~ Deco + Kaz

GF Code	Top 3 native species in each growth form group: Full species name mandatory. All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
	1 Eucalyptus fibrosa		15	2	U	
	2 Eucalyptus longifolia		15	3	G	
	3 Cenchrus clandestinum – likely eradicable		30			
	4 Cyperus spp (see photo) – as in the weed		0.1			
	5 Persicaria polygonoides		0.1			
	6 Soliva sessilis		0.1			
	7 Hypochaeris glabra		0.1			
	8 Cynodon dactylon		5			
	9 Broad-leaf grass (photo) Axonopus compressus		2			
	10 Modiola caroliniana		0.5			
	11 Cardamine hirsuta		0.3			
	12 Sida rhombifolia		0.2			
	13 Plantago lanceolata		0.2			
	14 Oxalis pes-caprae		0.1			
	15 Eragrostis tenuifolia		10			
	16 Hypochaeris radicata		0.1			
	17 Taraxacum officinale		0.1			
	18 ~~Fum~~ Gamochaeta coarctata		0.1			
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34 N.B. half the plot is flooded					
	35 mown regularly					

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BAM Plot – Field Survey Form

Site Sheet no: 1 of

Date	20.7.22	Survey Name: Plot 6 - Henry Lawson Drive	Plot Identifier	Recorders: Karen S, Declan M	
Zone	Datum	IBRA region	Photo #	Zone ID	
Easting	Northing	Dimensions: 20 x 50		Orientation of midline from the 0 m point.	Magnetic °
Vegetation Class					Confidence: H M L
Plant Community Type				EEC:	Confidence: H M L

Record easting and northing from the plot marker. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
Sum of Cover of native vascular plants by growth form group	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
High Threat Weed cover		

BAM Attribute (20 x 50 m plot) dbh		Euc*	Non Euc	Hollows†	20cm+
		Stem Classes and Hollows			
large trees for Euc* & Non Euc	80 + cm	—	Non Euc	—	
	50 – 79 cm	✓ 1			
30 – 49 cm		✓			
20 – 29 cm		—			
10 – 19 cm		—			n/a
5 – 9 cm		—		n/a	
< 5 cm		—		This size class records tree regeneration	
Length of logs (m) (≥10 cm diameter, >50 cm in length)		— Tally space			total 0

Record **living** eucalypt* (Euc*) and **living native** non-eucalypt (Non Euc) stems separately

Data needed is presence only, unless a 'large tree' for that class.

* includes all species of *Eucalyptus*, *Corymbia*, *Angophora*, *Lophostemon* and *Syncarpia*

† Record stems by size class with hollows (including dead stems/trees)

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a class.

For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	8 4 2 8 1	0 0 5 0 2	0 0 0 0 0	0 0 0 0 0
Average of the 5 subplots	4.6	1.4	0	0

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)	3	R
Cultivation (inc. pasture)	0	
Soil erosion	0	
Firewood / CWD removal	0	
Grazing (identify native/stock)	0	
Fire damage	0	
Storm damage	2	R
Weediness	2	R
Other		

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Free Text Section for brief site description

mown lawn w/ scattered eucs. relatively flat terrain, flooding damage

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

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849_roadside

400 m² plot: Sheet _ of _

Date	Survey Name	Plot Identifier	Recorders
20/07/22	HLDr	Plot 7	Deco + Kaz

	GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
1		Ehrharta erecta		70	5000	G	
2		Araujia ~~sericifera~~ sericifera		2			
3		Bidens pilosa		1			
4		Casuarina glauca		25			
5		~~Acacia falcata~~					
6		Conyza sp.		0.1			
7		Modiola carolinjana		0.5			
8		Brassica rapa		1			
9		Sonchus oleareus		0.1			
10		Salvia sessilis		0.5			
11		Taraxacum officinale		0.1			
12		Sida rhomb		25			
13		Tetragonia tetragonioides		1			
14		Acacia implexa		40			
15		Plantago lanceolata		0.3			
16		Stellaria media		0.5			
17		Solanum nigrum		0.1			
18		Cenchrus clandestinum		3			
19		Aloe sp. (garden escape)		1			
20		Poa annua		0.5			
21		Eucalyptus amplifolia		15			
22		Jacaranda mimosaides		1			
23		Einadia hastata		0.1			
24		Verbena bonariensis		1			
25		Ene tereticornis		15			
26		Kalanchoe sp (garden escape)		2			
27		~~Megathyrsus maximus~~ Ehrharta longifolia		20			
28		Eucalypt sp. (G)		5			
29		Acacia saligna		0.1			
30		Asparagus aethiopicus		1			
31		Eragrostis curvula		0.5			
32		Commelina cyanea		0.3			
33		Setaria parvi		0.1			
34							
35							
36							
37		N.B. modified plot 100 x 10m					
38		w/ 10x40m floristic					
39		Planted roadside bank with crow species.					
40							

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BAM Plot – Field Survey Form

Site Sheet no: 1 of

Date	20/07/22	Survey Name: Henry Lawson Drive	Plot Identifier: Plot 7	Recorders: Karen S, Declan M	
Zone	Datum	IBRA region	Photo #	Zone ID	
Easting	Northing	Dimensions: 100 x 10	Orientation of midline from the 0 m point: Magnetic °		
Vegetation Class					Confidence: H M L
Plant Community Type				EEC:	Confidence: H M L

Record easting and northing from the plot marker. If applicable, orient picket so that perforated rib points along direction of midline. Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified; magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
Sum of Cover of native vascular plants by growth form group	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
High Threat Weed cover		

BAM Attribute (20 x 50 m plot)		Stem Classes and Hollows		
dbh	Euc*	Non Euc	Hollows†	20cm+
large trees for Euc* & Non Euc: 80 + cm	4	Non-euc	—	
large trees for Euc* & Non Euc: 50 – 79 cm	11	—		
30 – 49 cm	✓	✓		
20 – 29 cm	✓	✓		
10 – 19 cm	✓	✓		n/a
5 – 9 cm	✓	✓	n/a	
< 5 cm	✓	✓	This size class records tree regeneration	
Length of logs (m) (≥10 cm diameter, >50 cm in length)	|	Tally space		total |

Record living eucalypt* (Euc*) and living native non-eucalypt (Non Euc) stems separately

Data needed is presence only, unless a 'large tree' for that class.

* Includes all species of *Eucalyptus*, *Corymbia*, *Angophora*, *Lophostemon* and *Syncarpia*

† Record stems by size class with hollows (including dead stems/trees)

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a class.

For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.

10 30 50 70 90

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	0 20 10 20 40	0 0 0 0 5	0 0 0 0 0	0 0 0 0 0
Average of the 5 subplots				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)	2	O
Cultivation (inc. pasture)	0	
Soil erosion	0	
Firewood / CWD removal	0	
Grazing (identify native/stock)	0	
Fire damage	0	
Storm damage	0	
Weediness	3	R
Other:	2	R

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe. Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

→ Rubbish

Free Text Section for brief site description

Slope ~ 45° beside road
weedy understorey

Form version designed September 2017

Printed 6 May 2022

Appendix D: Tests of Significance (BC Act)

The below Tests of Significance assessments have been prepared in accordance with the 'Threatened Species Test of Significance Guidelines' (OEH 2018). The guidelines are made under section 7.3(2) of the BC Act and relate to the determination of whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats, within the meaning of that phrase in section 7.3.

Threatened woodland birds: *Artamus cyanopterus cyanopterus* (Dusky Woodswallow) and *Daphoenositta chrysoptera* (Varied Sittella).

These species have been grouped together based on similarities in habitat and species ecology. Both species are listed as vulnerable under the BC Act.

Varied Sittella live in eucalypt forests and woodlands, occurring across most of NSW from coastal environments to the far west, excluding the treeless deserts and open grasslands. Varied Sittella inhabit eucalypt forest and woodlands, preferring those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and *Acacia* woodland. Varied Sittella forage in rough or decorticating bark, dead branches, standing dead trees and small branches and twigs in the tree canopy for arthropods on which they feed. Varied Sittella build nests (cup-shaped) out of plant fibres and cobwebs in an upright tree fork high in the living canopy, and often continue to use the same fork or tree in successive years.

The Dusky Woodswallow occupies a variety of habitats, including open forest, woodlands and disturbed lands, such as roadsides and golf courses. The Dusky Woodswallow is separated into two separate populations. The western population occurs in southwestern Australia and the eastern population is found from the Atherton Tableland in Queensland, south to Tasmania and west to the Eyre Peninsula, South Australia. Dusky Woodswallow nests colonially in 'neighbourhoods', although are nomadic and migrate north during autumn (specifically the eastern population). The main source of food for Dusky Woodswallow is insects, which are taken on the wing, from foliage and on the ground, however, they also consume small amount of nectar from *Eucalyptus* spp.

Specific impacts:

- Approximately 3.06 ha of potential habitat foraging and/or breeding for *Artamus cyanopterus cyanopterus* (Dusky Woodswallow).
- Approximately 2.98 ha of potential foraging and/or breeding habitat for *Daphoenositta chrysoptera* (Varied Sittella).

a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

These species are highly mobile and may intermittently use the study area for foraging and/or breeding. No records of these species currently exist for within the study area, with the nearest records occurring 1.2km from the study area for Dusky Woodswallow, and 0.3km from the study area for Varied Sittella. These species were also not incidentally recorded during field surveys. The study area is predominately degraded and fragmented, although areas of habitat connectivity exist within the northern and southern portions. Given large areas of potential habitat exist to the south-west of the study area, it is unlikely these species would solely rely on the study area for foraging and/or breeding. Stage 1B is therefore unlikely to have an adverse effect on the life cycle of these species such that a viable local population of the species is likely to be placed at risk of extinction.

b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

N/A

c) in relation to the habitat of a threatened species or ecological community

i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,

Stage 1B will impact approximately 3.06 ha of potential foraging and/or breeding habitat for Dusky Woodswallow and approximately 2,92 ha of potential foraging and/or breeding habitat for Varied Sitella. Stage 1B is situated within an urban area, with most impacts affecting roadside vegetation that is highly degraded and fragmented. Nonetheless, vegetated areas adjacent to the northern and southern boundaries of the study area may provide some connectivity to the vegetation to the east of Henry Lawson Drive. The removal of vegetation within the study area may therefore lead to habitat fragmentation between the east and west of Henry Lawson Drive. The impact is however considered to be minor given the low extent and quality of the habitat to the east.

Whilst foraging and breeding habitat is important for these species, larger areas of similar habitat extend beyond the study area, particularly to the southwest. Therefore, in the context of available foraging and breeding resources within the locality, the habitat in the study area is not considered important for the long-term survival of these species.

d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

No declared areas of outstanding biodiversity occur within the study area or locality.

e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

The following key threatening processes are of relevance to this species:

- Clearing of native vegetation
- Removal of dead wood and trees.

Conclusion

Although potential habitat exists for Dusky Woodswallow and Varied Sittella within the study area, this habitat is marginal and potentially used intermittently for foraging. Larger and more suitable areas of habitat exist within the locality, particularly in the vegetation directly southwest of the study area. As such, removal of vegetation within the study area is unlikely to result in a significant impact on these species.

Glossopsitta pusilla (Little Lorikeet)

Glossopsitta pusilla (Little Lorikeet) is a vulnerable species listed under the BC Act. It is a small parrot which is distributed widely across coastal areas of eastern Australia and the Great Divide from Cape York to South Australia. Within NSW the species occurs from coastal areas to as far west as Dubbo and Albury.

The species primarily forages in the canopy of open eucalypt forest and woodland, though it also utilises other trees including Angophora spp., Melaleuca spp. and other tree species. Riparian habitats are commonly used, due to higher soil fertility and greater productivity. It forages mostly on nectar and pollen and only occasionally on native fruits such as mistletoes.

The species roosts in canopy vegetation and nesting occurs in hollow bearing eucalypts in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of smooth-barked Eucalypts. Hollows are typically small and located high above the ground with riparian trees often chosen, including *Allocasuarina* spp.

The Little Lorikeet is threatened by a number of processes including the extensive clearing of woodlands for agriculture, particularly large old Eucalypt trees on fertile soils which produce more nectar. Additionally, the loss of old HBTs has reduced nest sites, and increased competition with other native and exotic species including the introduced Honeybee.

Specific impacts:

- Approximately 5.68 ha of potential foraging and/or breeding habitat for *Glossopsitta pusilla* (Little Lorikeet).

a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

This species is highly mobile and may intermittently use the study area for foraging and/or breeding. Although no records of this species currently exist within the study area, several exist within the wider locality, including in proximity to the study area. The study area is predominately degraded and fragmented, although areas of habitat connectivity exist within the northern and southern portions. Given large areas of potential habitat exist to the south-west of the study area, and the high mobility of this species, it is unlikely this species would solely rely on the study area for foraging and/or breeding. Stage 1B is therefore unlikely to have an adverse effect on the life cycle of this species, such that a viable local population of the species is likely to be placed at risk of extinction.

b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

N/A

c) in relation to the habitat of a threatened species or ecological community

i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,

Stage 1B will impact approximately 5.68 ha of potential foraging habitat for this species, as well as the removal of one hollow-bearing tree. Stage 1B is situated within an urban area, with most impacts to occur within roadside vegetation that is degraded and fragmented. Nonetheless, vegetated areas adjacent to the northern and southern boundaries of the study area may provide some connectivity to native vegetation east of Henry Lawson Drive. The removal of vegetation within the study area may therefore lead to habitat fragmentation between the east and west of Henry Lawson Drive. The impact is considered to be minor given the low extent and quality of the habitat to the east, and the high mobility of this species.

Whilst foraging and breeding habitat is important for this species, larger areas of more suitable habitat exist beyond the study area, particularly to the southwest. Therefore, in the context of available foraging and breeding resources within the locality, the habitat in the study area is not considered to be important for the long-term survival of this species.

d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

No declared areas of outstanding biodiversity occur within the study area or locality.

e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

The following key threatening processes are of relevance to this species:

- Clearing of native vegetation
- Removal of dead wood and trees.
- Loss of Hollow-bearing Trees.

Conclusion

Although potential habitat exists for Little Lorikeet within the study area, this habitat is thought to be marginal, potentially used intermittently for foraging. Larger and more suitable areas of habitat exist within the locality, particularly wtihin vegetation directly southwest of the study area. As such, removal of vegetation within the study area is unlikely to result in a significant impact on this species.

Pteropus poliocephalus (Grey-headed Flying-fox)

Pteropus poliocephalus (Grey-headed Flying-fox) is a vulnerable species listed under the BC Act. It occurs within 200km of the eastern coastline of Australia, from Rockhampton in Queensland to Adelaide in South Australia. It prefers subtropical and temperate rainforest, tall sclerophyll forests and woodlands, as well as heaths and swamps. Roosting areas are often selected upon their proximity to a regular food source (within 20km), often in gullies, close to water, or in vegetation with a dense canopy. This species roosts communally in large, established camps which support several thousand individuals. The Grey-headed Flying-fox can travel up to 50km from camp to forage (typically <20km), where they feed on nectar and pollen from Eucalyptus, Banksia and Melaleuca spp., as well as the fruits of native and exotic species.

Specific impacts:

- Approximately 5.68 ha of potential foraging habitat for *Pteropus poliocephalus* (Grey-headed Flying-fox).

a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

This species is highly mobile and may intermittently use the study area for foraging. Although no records of this species currently exist within the study area, multiple records exist within the wider locality, including proximity to the study area. The study area is predominately degraded and fragmented, although areas of habitat connectivity exist within the northern and southern portions. Given large areas of potential habitat exist to the south-west of the study area, and the high mobility of this species, it is unlikely this species would solely rely on the study area for foraging. The species does not breed within the study area and the closest camp is located approximately 4.5km northwest of the study area at Cabramatta. Stage 1B is therefore unlikely to have an adverse effect on the life cycle of this species such that a viable local population of the species is likely to be placed at risk of extinction.

b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

N/A

c) in relation to the habitat of a threatened species or ecological community

i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,

Stage 1B will impact approximately 5.68 ha of potential foraging habitat for Grey-headed Flying-fox. No breeding camps are present within the study area. Stage 1B is situated within an urban area, with most impacts to occur within roadside vegetation that is highly degraded and fragmented. Nonetheless, vegetated areas adjacent to the northern and southern boundaries of the study area may provide some connectivity to the vegetation to the east of Henry Lawson Drive. The removal of vegetation within the study area may therefore lead to habitat fragmentation between the east and west of Henry Lawson Drive. The impact is considered minor given the low extent and quality of the habitat to the east, and the high mobility of this species.

Whilst foraging habitat is important for this species, larger areas of suitable habitat extend beyond the study area, particularly to the southwest. Therefore, in the context of available foraging resources within the locality, the habitat in the study area has not been assessed as important for the long-term survival of this species.

d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

No declared areas of outstanding biodiversity occur within the study area or locality.

e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

The following key threatening processes are of relevance to this species:

- Clearing of native vegetation

Conclusion

Although potential habitat exists for Grey-headed Flying-fox within the study area, this habitat would be used intermittently for foraging during flowering of native and planted native vegetation. Larger and more suitable areas of habitat exist within the locality, particularly in the vegetation directly southwest of the study area. As such, removal of vegetation within the study area is unlikely to result in a significant impact on this species.

Threatened raptors: *Haliaeetus leucogaster* (White-bellied Sea-Eagle) and *Pandion cristatus* (Eastern Osprey)

These species have been grouped together based on similarities in habitat and species ecology. All species are listed as Vulnerable under the BC Act.

The White-bellied Sea-Eagle is found along the coastline of mainland Australia and Tasmania, as well as extending into some larger inland waterways, especially those found in eastern Australia. The habitats used by this species are found around large areas of open water including large rivers, lakes, by the sea and have been found in areas such as swamps, saltmarsh, inlets, lagoons and mangroves. Feeding and diet includes mainly aquatic animals such as turtles and fish as well as being known to feed on dead prey found along the waterline. White-bellied Sea-Eagles commonly use trees for observing prey and for building stick nests, which can be used for multiple breeding seasons. They breed between May and October. They are known to become very sensitive to human presence when breeding (Menkhorst et al., 2017).

The Eastern Osprey is found around the entire Australia coastline, except for Victoria and Tasmania. They are common around the northern coast, especially on rocky shorelines, islands and reefs. The species is uncommon to rare or absent from closely settled parts of south-eastern Australia. There are a handful of records from inland areas. Eastern Ospry favour coastal areas, especially the mouths of large rivers, lagoons and lakes.

Specific impacts:

- Approximately 3.06 ha of potential foraging habitat for *Haliaeetus leucogaster* (White-bellied Sea-Eagle).
- Approximately 2.92 ha of potential foraging habitat for *Pandion cristatus* (Eastern Osprey).

a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Both these species are highly mobile and may intermittently use the study area for foraging. No records of these species currently exist for within the study area, and the species was not recorded during targeted fauna surveys, including no stick nests (breeding habitat). Both species have been recorded 0.3km from the study area. The study area is predominately degraded and fragmented, although areas of habitat connectivity exist within the northern and southern portions. Given large areas of potential habitat exist to the south-west of the study area, it is unlikely these species would solely rely on the study area for foraging. No breeding habitat was evident within the study area, as no stick nests were observed during the habitat assessment survey. Stage 1B is therefore unlikely to have an adverse effect on the life cycle of these species such that a viable local population of these species is likely to be placed at risk of extinction.

b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

N/A

c) in relation to the habitat of a threatened species or ecological community

i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,

Stage 1B will impact approximately 3.06 ha of potential foraging habitat for White-bellied Sea-Eagle and approximately 2.92 ha of potential foraging habitat for Eastern Osprey. Stage 1B is situated within an urban area, with most impacts to occur within roadside vegetation that is highly degraded and fragmented. Nonetheless, vegetated areas adjacent to the northern and southern boundaries of the study area may provide some connectivity to the vegetation to the east of Henry Lawson Drive. The removal of vegetation within the study area may therefore lead to habitat fragmentation between the east and west of Henry Lawson Drive. The impact is however considered to be minor given the low extent and quality of the habitat to the east.

Whilst foraging habitat is important for these species, larger areas of suitable habitat extend beyond the study area, particularly to the southwest and along the Georges River corridor. Therefore, in the context of available foraging resources within the locality, the habitat in the study area is not considered important for the long-term survival of these species.

d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

No declared areas of outstanding biodiversity occur within the study area or locality.

e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

The following key threatening processes are of relevance to this species:

- Clearing of native vegetation
- Removal of dead wood and trees.

Conclusion

Although potential habitat exists for White-bellied Sea Eagle and Eastern Osprey within the study area, this habitat is thought to be marginal, potentially used intermittently for foraging. Larger areas of more suitable habitat exist within the locality, particularly in the vegetation directly southwest of the study area along the Georges River corridor. As such, removal of vegetation within the study area is unlikely to result in a significant impact on these species.

Ninox strenua (Powerful Owl)

The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. It requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as *Syncarpia glomulifera* (Turpentine), *Allocasuarina littoralis* (Black She-oak), *Acacia melanoxylon* (Blackwood), *Angophora floribunda* (Rough-barked Apple), *Exocarpus cupressiformis* (Cherry Ballart) and several eucalypt species. The main prey items are medium-sized arboreal marsupials, particularly the Greater Glider, Common Ringtail Possum and Sugar Glider. Powerful Owls nest in large tree hollows (at least 0.5m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old. While the female and young are in the nest hollow the male Powerful Owl roosts nearby (10-200 m) guarding them, often choosing a dense "grove" of trees that provide concealment from other birds.

Specific impacts:

- Approximately 2.98 ha of potential foraging habitat for *Ninox strenua* (Powerful Owl).

a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

This species has moderate mobility (home range ~ 400ha in good habitats) and may intermittently use the study area for foraging. No breeding habitat is present within the study area, as suitable sized hollows are absent. Although no records of this species currently exist within the study area, several exist within the wider locality, including in close proximity to the study area. The study area is predominately degraded and fragmented, although areas of habitat connectivity exist within the northern and southern portions. While Stage 1B may remove some habitat for prey species such as *Pseudocheirus peregrinus* (Common Ringtail Possum), common birds such as *Trichoglossus moluccanus* (Rainbow Lorikeets), *Cacatua galerita* (Sulphur-crested Cockatoo), *Gymnorhina tibicen* (Australian Magpie) and the Grey-headed Flying-fox (*Pteropus poliocephalus*), these species are likely to continue to be present within the surrounding area and within the locality. Furthermore, given large areas of more suitable habitat exist to the south-west of the study area, as well as the mobility of this species, it is unlikely this species would solely rely on the study area for foraging. Stage 1B is therefore unlikely to have an adverse effect on the life cycle of this species such that a viable local population of the species is likely to be placed at risk of extinction.

b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

N/A

c) in relation to the habitat of a threatened species or ecological community

i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,

Stage 1B will impact approximately 2.98 ha of potential foraging habitat for this species. No breeding habitat will be impacted, as no suitably sized hollow-bearing trees are present within the study area. Stage 1B is situated within an urban area, with most impacts to occur within roadside vegetation that is highly degraded and fragmented. Nonetheless, vegetated areas adjacent to the northern and southern boundaries of the study area may provide some connectivity to the vegetation to the east of Henry Lawson Drive. The removal of vegetation within the study area may therefore lead to habitat fragmentation between the east and west of Henry Lawson Drive. The impact is however considered to be minor given the low extent and quality of the habitat to the east, and the mobility of this species.

Whilst foraging habitat is important for this species, larger areas of more suitable habitat exist beyond the study area, particularly to the southwest. Therefore, in the context of available foraging resources within the locality, the habitat in the study area has not been assessed as important for the long-term survival of this species.

d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

No declared areas of outstanding biodiversity occur within the study area or locality.

e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

The following key threatening processes are of relevance to this species:

- Clearing of native vegetation
- Removal of dead wood and trees.

Conclusion

Although foraging potential habitat exists for Powerful Owl within the study area, this habitat is thought to be marginal, potentially used intermittently for foraging. Larger and more suitable areas of habitat exist within the locality, particularly in the vegetation directly southwest of the study area. As such, it is not thought that the removal of vegetation within the study area is likely to result in a significant impact on this species.

Cave-dwelling microbats: *Miniopterus australis* (Little Bent-winged Bat) and *Miniopterus orianae oceanensis* (Large Bent-winged Bat)

These species have been grouped together based on similarities in habitat and species ecology. Both species are listed as Vulnerable under the BC Act.

The Little Bent-winged Bat occurs along the east coast of Australia ranging from Cape York Qld south to Wollongong, NSW. They are generally found in well-timbered areas of moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. It can be distinguished from the Common Bentwing-Bat by its smaller size. They roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts and bridges with foraging occurring at night for small insects beneath the canopy of densely vegetated habitats. They often share roosting sites with the Large Bentwing-bat and, in winter, the two species may form mixed clusters. In NSW the largest maternity colony is in close association with a large maternity colony of Large Bentwing-bats and appears to depend on the large colony to provide the high temperatures needed to rear its young. Maternity colonies form in spring and birthing occurs in early summer. Males and juveniles disperse in summer. Only five nursery sites /maternity colonies are known in Australia.

The Large Bent-winged Bat occupies a range of forested environments (including wet and dry sclerophyll forests), along the coastal portion of eastern Australia, and through the Northern Territory and Kimberley area (subject to subdivision of this species). This species forages from just above the tree canopy, to many times the canopy height in forested areas, and will use open areas where it is known to forage at lower levels. Moths appear to be the main dietary component. This highly mobile species is capable of large regional movements in relation to seasonal differences in reproductive behaviour and winter hibernation. Though, individuals often use numerous roosts (including, mines, culverts, stormwater channels, buildings, and occasionally tree-hollows), it congregates in large numbers at a small number of nursery caves to breed and hibernate.

Specific impacts:

- Approximately 5.68 ha of potential foraging habitat for *Miniopterus australis* (Little Bent-winged Bat).
- Approximately 5.68 ha of potential foraging habitat for *Miniopterus orianae oceanensis* (Large Bent-winged Bat).

a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

These species are highly mobile and may intermittently use the study area for foraging. No breeding habitat is present within the study area. While there are no records of these species within the study area, several records exist within the wider locality, including in proximity to the study area. The study area is predominately degraded and fragmented, although areas of habitat connectivity exist within the northern and southern portions. Given large areas of more suitable habitat exist to the south-west of the study area, and the high mobility of these species, it is unlikely these species would solely rely on the study area for foraging. Stage 1B is therefore unlikely to have an adverse effect on the life cycle of this species such that a viable local population of these species is likely to be placed at risk of extinction.

b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

N/A

c) in relation to the habitat of a threatened species or ecological community

i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,

Stage 1B will impact approximately 5.68 ha of potential foraging habitat for Little Bent-winged Bat and Large Bent-winged Bat. No breeding habitat will be impacted, as no caves or other breeding structures were present within the study area. Stage 1B is situated within an urban area, with most impacts to occur within roadside vegetation that is highly degraded and fragmented. Nonetheless, vegetated areas adjacent to the northern and southern boundaries of the study area may provide some

connectivity to the vegetation to the east of Henry Lawson Drive. The removal of vegetation within the study area may therefore lead to habitat fragmentation between the east and west of Henry Lawson Drive. The impact is however considered to be minor given the low extent and quality of the habitat to the east, and the mobility of these species.

Whilst foraging habitat is important for this species, larger areas of more suitable habitat exist beyond the study area, particularly to the southwest. Therefore, in the context of available foraging resources within the locality, the habitat within the study area is not considered important for the long-term survival of these species.

d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

No declared areas of outstanding biodiversity occur within the study area or locality.

e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

The following key threatening processes are of relevance to this species:

- Clearing of native vegetation
- Removal of dead wood and trees.

Conclusion

Although foraging potential habitat exists for Little Bent-winged Bat and Large Bent-winged Bat within the study area, this habitat is thought to be marginal, potentially used intermittently for foraging. Larger and more suitable areas of habitat exist within the locality, particularly in the vegetation directly southwest of the study area. As such, it is not thought that the removal of vegetation within the study area is likely to result in a significant impact on this species.

Hollow-dependent microbats: *Falsistrellus tasmaniensis* (Eastern False Pipistrelle), *Micronomus norfolkensis* (Eastern Coastal Free-tailed Bat), *Myotis macropus* (Southern Myotis), *Saccolaimus flaviventris* (Yellow-bellied Sheathtail-bat) and *Scoteanax rueppellii* (Greater Broad-nosed Bat).

These species have been grouped together based on similarities in habitat and species ecology. All species are listed as Vulnerable under the BC Act.

The Eastern False Pipistrelle is a wide-ranging species, occurring along the southeast coast of Australia with records from Southeast Queensland, New South Wales, Victoria and Tasmania. The species occurs in sclerophyll forests from the Great Dividing Range to the coast, and generally prefers wet habitats where trees are more than 20m high. Roosting occurs in hollow trunks of eucalypt trees, usually in single sex colonies, but the species has been recorded roosting in caves, under loose bark and occasionally in old wooden buildings. Their flight pattern is high and fast and they forage within or just below the tree canopy. They feed on a variety of prey including moths, rove beetles, weevils, plant bugs, flies and ants.

The Eastern Coastal Free-tail bat occurs along the coastal regions of eastern Australia. In NSW its range expands west out over the Great Diving Range. The habitat preference of the Eastern Coastal Freetail-bat is poorly known, however it has been observed to occur in dry eucalypt forest, coastal woodland, riparian zones and wet sclerophyll forests. This species forages for moths above forest canopy and along forest edges, and also consumes ground-based invertebrates (e.g. ants and beetles). Hollow bearing trees are their preferred roosting sites.

The Southern Myotis is found along the coastal band from the north-west of Australia, across to the top end and south to western Victoria. This species forages over streams and pools, catching insects and small fish by raking their feet across the water surface. Southern Myotis roost in tree hollows, caves, culverts and under bridges, in groups of 10 – 15 individuals, often close to water. Potential threats to the Southern Myotis include, clearing adjacent to foraging areas, reduction in stream water quality, affecting food resources and the loss or disturbance of roosting sites.

The Yellow-bellied Sheathtail-bat is a wide-ranging species that is found across northern and eastern Australia. They forage for insects across a range of habitats, including land with and without trees. It roosts in tree hollows and buildings, and in treeless areas are known to use mammal burrows. The Yellow-bellied Sheathtail-bat is quite distinctive and grow up to 87 mm long. It has long, narrow wings a jet-black, glossy back and a yellow belly that extends to the shoulders and a small portion of the ear.

The Greater Broad-nosed Bat occurs from north-eastern Victoria to the Atherton Tableland. In NSW, it occurs along the entire east coast but does not occur at altitudes above 500 m. It utilises a variety of habitat from woodlands through to moist and dry eucalypt forest and rainforest. It is most commonly found in tall wet forest. It usually roosts in tree hollows but has also been found in buildings.

Specific impacts:

- Approximately 5.68 ha of potential foraging and/or breeding habitat for *Falsistrellus tasmaniensis* (Eastern False Pipistrelle).
- Approximately 5.68 ha of potential foraging and/or breeding habitat for *Micronomus norfolkensis* (Eastern Coastal Free-tailed Bat).
- Approximately 2.11 ha of potential foraging and/or breeding habitat for *Myotis macropus* (Southern Myotis).
- Approximately 5.68 ha of potential foraging and/or breeding habitat for *Saccolaimus flaviventris* (Yellow-bellied Sheathtail-bat).
- Approximately 5.60 ha of potential foraging and/or breeding habitat for *Scoteanax rueppellii* (Greater Broad-nosed Bat).

a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

These species were not recorded during targeted surveys (WSP 2021). Although no records of these species currently exist within the study area, several records exist within the wider locality, including in proximity to the study area. These species are highly mobile and may intermittently use the study area for foraging and/or breeding. However, only one hollow-bearing tree was recorded during the field survey, so this roosting/breeding habitat if very limited within the study area.

In terms of foraging habitat, the study area is predominately degraded and fragmented, although areas of habitat connectivity exist within the northern and southern portions. Given large areas of more suitable habitat exist to the south-west of the study area, and the high mobility of these species, it is unlikely these species would solely rely on the study area for foraging

and/or breeding. Stage 1B is therefore unlikely to have an adverse effect on the life cycle of this species such that a viable local population of the species is likely to be placed at risk of extinction.

b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

N/A

c) in relation to the habitat of a threatened species or ecological community

i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,

Stage 1B will impact approximately 2.11 ha of potential foraging habitat for Southern Myotis; 5.68 ha of potential foraging habitat for Eastern False Pipistrelle; 5.60 ha of potential foraging habitat for Greater Broad-nosed Bat; and 5.68 ha of potential foraging habitat for Eastern Coastal Free-tailed Bat and Yellow-bellied Sheathtail-bat. Stage 1B may also result in the removal of one hollow-bearing tree which may be used as breeding habitat for these species.

Stage 1B is situated within an urban area, with most impacts affecting roadside planted native vegetation that is degraded and fragmented. Nonetheless, vegetated areas adjacent to the northern and southern boundaries of the study area may provide some connectivity to vegetation east of Henry Lawson Drive. The removal of vegetation within the study area may therefore lead to habitat fragmentation between the east and west of Henry Lawson Drive. However, the impact is considered to be minor given the low extent and quality of the habitat to the east, and the high mobility of these species.

Whilst foraging and breeding habitat is important for this species, larger areas of more suitable habitat exist beyond the study area, particularly to the southwest. Therefore, in the context of available foraging and breeding resources within the locality, the habitat in the study area has not been assessed as important for the long-term survival of this species.

d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

No declared areas of outstanding biodiversity occur within the study area or locality.

e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

The following key threatening processes are of relevance to this species:

- Clearing of native vegetation
- Removal of dead wood and trees.
- Loss of Hollow-bearing Trees.

Conclusion

Although potential habitat exists for these species within the study area, this habitat is thought to be marginal, potentially used intermittently for foraging, and less likely for breeding. Larger and more suitable areas of habitat exist within the locality, particularly in the vegetation directly southwest of the study area. As such, it is not thought that the removal of vegetation within the study area is likely to result in a significant impact on these species.

Meridolum corneovirens (Cumberland Plain Land Snail)

Meridolum corneovirens (Cumberland Plain Land Snail) is an endangered species listed under the BC Act.

The Cumberland Plain Land Snail lives in small areas on the Cumberland Plain west of Sydney, from Richmond and Windsor south to Picton and from Liverpool west to the Hawkesbury and Nepean Rivers at the base of the Blue Mountains. It is known from over 100 different locations, but not all are currently occupied, and they are usually isolated from each other as a result of land use patterns.

It primarily inhabits Cumberland Plain Woodland (a critically endangered ecological community). This community is a grassy, open woodland with occasional dense patches of shrubs. It is also known from Shale Gravel Transition Forests, Castlereagh Swamp Woodlands and the margins of River-flat Eucalypt Forest, which are also listed communities. The species lives under litter of bark, leaves and logs, or shelters in loose soil around grass clumps and occasionally shelters under rubbish.

Specific impacts:

- Approximately 1.02 ha of potential foraging and/or breeding habitat for *Meridolum corneovirens* (Cumberland Plain Land Snail).

a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

This species has the potential to use the study area for foraging and breeding. Although no records of this species currently exist within the study area, several exist within the wider locality, yet none in proximity to the study area. The closest record is 1km from the study area recorded in 2006. The most recent record from 2021 was 8.3km from the study area.

The study area is predominately degraded and fragmented. Areas of native vegetation and planted native vegetation with a mown groundcover is considered poor habitat given the paucity of fallen leaf litter and logs. Marginal habitat is present along the northern riparian corridor and around the southern ancillary facility, where groundcovers, litter and logs are present (within PCT 835 Moderate). Given this species is a short-range endemic and can exist in small areas of habitat, the removal of vegetation within these locations may impact a viable local population. As such, a number of mitigation measures will be implemented to prevent any impact to a local viable population (see Table 6-1). This includes undertaking a targeted survey during the design phase. If this species is found during targeted survey, a pre-clearance survey will be required prior to construction works to relocate individuals into adjacent areas of retained native vegetation. In addition, the pre-clearance survey will relocate any fallen logs into retained areas of native vegetation to provide habitat for this species. With the implementation of such mitigation measures, the proposed activity is unlikely to have a significant effect on a local viable population.

b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

N/A

c) in relation to the habitat of a threatened species or ecological community

i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,

Stage 1B will impact approximately 1.02 ha of marginal habitat for this species. Larger areas of more suitable intact habitat exist beyond the study area, particularly to the southwest (within Deepwater Park). Nonetheless, if this species was to occur within the study area, the removal of vegetation may be detrimental to a local population. As such, Table 6-1 outlines several mitigation measures to reduce any potential impacts to this species. This includes undertaking a targeted survey during the design phase. If this species is found during targeted survey, a pre-clearance survey will be required prior to construction

works to relocate individuals into adjacent areas of retained native vegetation. In addition, the pre-clearance survey will relocate any fallen logs into retained areas of native vegetation to provide habitat for this species.

d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

No declared areas of outstanding biodiversity occur within the study area or locality.

e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

The following key threatening processes are of relevance to this species:

- Clearing of native vegetation
- Removal of dead wood and trees.

Conclusion

Although potential habitat exists for the Cumberland Land Snail within the study area, this habitat is thought to be marginal, as the site is highly degraded and fragmented. However, should the species be present within the subject land, the removal of vegetation may have a detrimental impact to a local population of this species. As discussed, several mitigation measures are outlined in Table 6-1 to reduce the impact on a potentially occurring local population. It is thought with the implementation of such mitigation measures, the proposal is unlikely to result in a significant impact on this species.

Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion

Cooks River/Castlereagh Ironbark Forest (CRCIF) is listed as an endangered ecological community under the BC Act. It ranges from open forest to low woodland, with a canopy dominated by Broad-leaved Ironbark (*Eucalyptus fibrosa*) and Paperbark (*Melaleuca decora*). The canopy may also include other eucalypts such as Woollybutt (*E. longifolia*). The dense shrubby understorey consists of Prickly-leaved Paperbark (*Melaleuca nodosa*) and Peach Heath (*Lissanthe strigosa*), with a range of 'pea' flower shrubs, such as *Dillwynia tenuifolia*, Hairy Bush-pea (*Pultenaea villosa*) and Gorse Bitter Pea (*Daviesia ulicifolia*) (can be locally abundant). The sparse ground layer contains a range of grasses and herbs.

Specific impacts:

- Approximately 0.14ha of CRCIF will be impacted by Stage 1B.

a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

N/A

b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

The local occurrence of CRCIF includes all areas mapped as PCT 725 within the study area, plus a large area mapped directly to the east as CRCIF by DPE (2022g), occurring within the confines of Bankstown Golf Course (a total of 10.43 ha). The proposed works will impact approximately 0.14 ha within a mown park, situated directly south of Flower Power and a small strip of native vegetation assigned to PCT 725equating to 1.34% of the local occurrence of CRCIF. This occurs within the western most extent of the local occurrence. The removal of 0.14ha of CRCIF from the study area is unlikely to place the local occurrence at risk of extinction, as only a relatively small, degraded patch on the periphery of a larger patch is proposed to be removed.

The TEC within the study area has already been largely modified to the extent it only occurs as native canopy trees, as the midstorey is absent and the ground layer is exotic. The other patch of the TEC is immature plantings of canopy species characteristic of this community. The removal of CRCIF within the study area is therefore unlikely to substantially and adversely modify the composition of CRCIF, such that its local occurrence is likely to be placed at risk of extinction. The local occurrence beyond the study area will not be affected by the proposed works, and is likely to already be substantially modified as it occurs within the confines of a golf course.

c) in relation to the habitat of a threatened species or ecological community

i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,

Approximately 0.14ha of poor condition CRCIF will be removed as part of the proposed works (1.34% of the local occurrence). The CRCIF within the study area occurs within the western extent of a much larger local occurrence mapped by DPE 2022g. The removal of CRCIF will reduce the extent of the local occurrence but as it occurs on the periphery of a larger patch, will not result in fragmentation from other areas of CRCIF. It is not considered that the CRCIF within the study area is significant to the long-term survival of the TEC within the locality, considering it is highly degraded, consisting of native canopy trees with an exotic, mown ground layer.

d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

No declared areas of outstanding biodiversity occur within the study area or locality.

e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

The following key threatening processes are of relevance to this TEC:

- Clearing of native vegetation
- Removal of dead wood and trees.

Conclusion

Stage 1B is unlikely to significantly impact the local occurrence of CRCIF, as only a small amount of vegetation is proposed for removal on the edge of a larger patch that extends to the east into Bankstown Golf Club. Large areas of CRCIF directly to the east of the study area will be retained, allowing for the persistence of CRCIF within the locality.

River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions

River-flat Eucalypt Forest (RFEF) is listed as an endangered ecological community under the BC Act. As the name suggests, this EEC is found on the river flats of the coastal floodplains. It has a tall open tree layer of eucalypts, which may exceed 40m in height, but can be considerably shorter in regrowth stands or under conditions of lower site quality. While the composition of the tree stratum varies considerably, the most widespread and abundant dominant trees include *Eucalyptus tereticornis* (forest red gum), *E. amplifolia* (cabbage gum), *Angophora floribunda* (rough-barked apple) and *A. subvelutina* (broad-leaved apple). *Eucalyptus baueriana* (blue box), *E. botryoides* (bangalay) and *E. elata* (river peppermint) may be common south from Sydney, *E. ovata* (swamp gum) occurs on the far south coast, *E. saligna* (Sydney blue gum) and *E. grandis* (flooded gum) may occur north of Sydney, while *E. benthamii* is restricted to the Hawkesbury floodplain.

A layer of small trees may be present, including *Melaleuca decora*, *M. styphelioides* (prickly-leaved teatree), *Backhousia myrtifolia* (grey myrtle), *Melia azaderach* (white cedar), *Casuarina cunninghamiana* (river oak) and *C. glauca* (swamp oak). Scattered shrubs include *Bursaria spinosa, Solanum prinophyllum, Rubus parvifolius, Breynia oblongifolia, Ozothamnus diosmifolius, Hymenanthera dentata, Acacia floribunda* and *Phyllanthus gunnii.*

The groundcover is composed of abundant forbs, scramblers and grasses including *Microlaena stipoides, Dichondra repens, Glycine clandestina, Oplismenus aemulus, Desmodium gunnii, Pratia purpurascens, Entolasia marginata, Oxalis perennan*s and *Veronica plebeia*. The composition and structure of the understorey is influenced by grazing and fire history, changes to hydrology and soil salinity and other disturbance, and may have a substantial component of exotic shrubs, grasses, vines and forbs.

Specific impacts:

- Approximately 2.16 ha of RFEF will be impacted by Stage 1B, including 0.72 ha of planted vegetation assigned to PCT 835

a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

N/A

b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

The local occurrence of RFEF includes all areas mapped as PCT 835 within the study area, plus extensive areas mapped as RFEF by DPE (2022) along the Georges River corridor (a total of 109.41 ha). The proposed works will impact on approximately 1.44 ha of degraded RFEF and 0.72 ha of planted vegetation assigned to PCT 835, equating to 1.96% of the local occurrence. This area forms a minor component to the extensive coverage of RFEF that forms part of the local occurrence. The removal of 2.16 ha of RFEF from the study area is unlikely to place the local occurrence at risk of extinction, as only a small, degraded patch on the peripheries of a larger patch is proposed to be removed.

The TEC within the study area has already been largely modified to the extent it is highly weed infested and is predominately occurring as remnant native canopy trees. A native mid-storey is absent and the ground layer is mostly exotic. The removal of RFEF within the study area is unlikely to substantially and adversely modify the composition of RFEF, such that its local occurrence is likely to be placed at risk of extinction. The local occurrence beyond the study area will not be impacted by the proposed works and is likely to already be heavily modified due to its proximity to a developed urban area.

c) in relation to the habitat of a threatened species or ecological community

i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,

The proposed works will impact on approximately 2.16 ha of moderate condition RFEF (1.96% of the local occurrence). The RFEF within the study area predominately occurs along the eastern extent of the local occurrence, which extends west to the Georges River and occurs north and south of the riparian corridor. The removal of RFEF will reduce the extent of the local occurrence but as it mostly occurs on the periphery of a larger patch, will not result in significant fragmentation from other areas of RFEF. The exception being within the northern extent of the study area, where RFEF occurs to the west and east of Henry Lawson Drive. The removal of RFEF within the subject land may increase the fragmentation by extending the road corridor width.

It is not considered that the RFEF within the study area is significant to the long-term survival of the TEC within the locality, considering the large extent of RFEF within the locality, and the degraded quality of RFEF within the study area, primarily consisting of native canopy trees with a predominately exotic ground layer.

d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

No declared areas of outstanding biodiversity occur within the study area or locality.

e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

The following key threatening processes are of relevance to this TEC:

- Clearing of native vegetation
- Removal of dead wood and trees.

Conclusion

Stage 1B is unlikely to significantly impact RFEF, as only a small amount of vegetation is proposed for removal, predominately on the peripheries of a larger patch. Large areas of RFEF to the west of the study area along the Georges River will be retained, allowing for the persistence of RFEF within the locality.

Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions

Swamp Oak Floodplain Forest (SOFF) is listed as an endangered ecological community under the BC Act. It is found on the coastal floodplains of NSW. It has a dense to sparse tree layer in which *Casuarina glauca* (swamp oak) is the dominant species northwards from Bermagui. Other trees including *Acmena smithii* (lilly pilly), *Glochidion* spp. (cheese trees) and *Melaleuca* spp. (paperbarks) may be present as subordinate species, and are found most frequently in stands of the community northwards from Gosford. Tree diversity decreases with latitude, and *Melaleuca ericifolia* is the only abundant tree in this community south of Bermagui.

The understorey is characterised by frequent occurrences of vines, *Parsonsia straminea, Geitonoplesium cymosum* and *Stephania japonica* var. *discolor*, a sparse cover of shrubs, and a continuous groundcover of forbs, sedges, grasses and leaf litter.

The composition of the ground stratum varies depending on levels of salinity in the groundwater. Under less saline conditions prominent ground layer plants include forbs such *Centella asiatica, Commelina cyanea, Persicaria decipiens* and *Viola banksii*; graminoids such as *Carex appressa, Gahnia clarkei, Lomandra longifolia, Oplismenus imbecillis*; and the fern *Hypolepis muelleri.*

On the fringes of coastal estuaries, where soils are more saline, the ground layer may include the threatened grass species, *Alexfloydia repens*, as well as *Baumea juncea, Juncus kraussii, Phragmites australis, Selliera radicans* and other saltmarsh species.

Specific impacts:

- Approximately 0.68 ha of SOFF will be impacted by Stage 1B.

a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

N/A

b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

The local occurrence of SOFF includes all areas mapped as PCT 1800 within the study area, plus extensive areas mapped as SOFF by DPE (2022g) along the Georges River corridor and a small patch to the east of Henry Lawson Drive (a total of 58.19 ha). It was noted during the site assessment that some areas mapped by DPE (2022g) as RFEF may actually conform to SOFF, and as such, the local occurrence may be greater than that mapped by DPE (2022g).

The proposed works will impact on approximately 0.68 ha of degraded SOFF, equating to 1.08% of the local occurrence. The area of SOFF within the subject land comprised a native canopy dominated by *Casuarina glauca,* and a predominately exotic midstorey and groundlayer. These areas form a minor component to the extensive coverage of SOFF that forms part of the local occurrence. The removal of 0.68 ha of SOFF from the study area is unlikely to place the local occurrence at risk of extinction, as only a small, degraded patch that forms part of a larger patch is proposed to be removed.

The TEC within the study area has already been largely modified to the extent it is highly weed infested and is predominately occurring as remnant native canopy trees. A native mid-storey is absent and the groundlayer is mostly exotic. The removal of SOFF within the study area is therefore unlikely to substantially and adversely modify the composition of SOFF, such that its local occurrence is likely to be placed at risk of extinction. The local occurrence beyond the study area will not be impacted by the proposed works and is likely to already be heavily modified due to its positioning within an urban area and along degraded watercourses.

c) in relation to the habitat of a threatened species or ecological community

i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,

The proposed works will impact on approximately 0.68 ha of poor condition SOFF, equating to 1.08% of the local occurrence. The SOFF within the study area predominately occurs along the western extent of the local occurrence patch, which is predominately situated along the Georges River corridor. The removal of SOFF will therefore reduce the extent of the local occurrence but as it mostly occurs on the peripheries of a larger patch, will not result in significant fragmentation from other areas of SOFF. The exception being within the northern extent of the study area, where SOFF occurs to the west and east of Henry Lawson Drive. The removal of SOFF within the study area may increase the fragmentation by extending the road corridor width.

It is not considered that the RFEF within the study area is significant to the long-term survival of the TEC within the locality, considering the large extent of SOFF within the locality, and the degraded quality of SOFF within the study area, primarily consisting of native canopy trees with a predominately exotic groundlayer.

d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

No declared areas of outstanding biodiversity occur within the study area or locality.

e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

The following key threatening processes are of relevance to this TEC:

- Clearing of native vegetation
- Removal of dead wood and trees.

Conclusion

Stage 1B is unlikely to significantly impact SOFF, as only a small amount of vegetation is proposed for removal, predominately on the peripheries of a larger patch. Large areas of SOFF to the west of the study area along the Georges River will be retained, allowing for the persistence of SOFF within the locality.

Appendix E: Assessments of significance (EPBC Act)

The below Assessments of Significance have been prepared in accordance with the 'Matters of National Environmental Significance - Significant impact guidelines 1.1 - Environment Protection and Biodiversity Conservation Act 1999' (DotE 2013).

Hirundapus caudacutus (White-throated Needletail)

White-throated Needletail is listed as vulnerable and migratory under the EPBC Act. Approximately 3.06 ha of potential habitat for this species occurs within the study area.

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

- ***lead to a long-term decrease in the size of an important population of a species***

Stage 1B is unlikely to lead to a long-term decrease in the size of an important population of this species, as the study area does not contain breeding habitat and this species would only intermittently forage aerially within the study area. The study area is predominately degraded and fragmented, although areas of habitat connectivity exist within the northern and southern portions. Given large areas of more suitable habitat exist to the south-west of the study area (e.g. within Deepwater Park, Voyager Point), and the high mobility of this species, it is unlikely the removal of vegetation within the study area would have a long-term impact on a population.

- ***reduce the area of occupancy of an important population***

Stage 1B is unlikely to reduce the area of occupancy of White-throated Needletail, particularly as very few records of this species exist within the locality, and this species is highly mobile, being a migratory species. The study area may be used intermittently for aerial foraging by this species, but as similar or greater quality habitat exists elsewhere within the locality, the removal of such habitat is not anticipated to significantly impact on this species.

- ***fragment an existing important population into two or more populations***

Considering the high mobility of this species, the removal of vegetation within the study area is unlikely to fragment an existing important population into two or more populations. Extensive areas of habitat will persist along the Georges River corridor and southwest of the study area, particularly within Deepwater Park and Voyager Point.

- ***adversely affect habitat critical to the survival of a species***

The habitat within the site does not provide breeding resources for this species and represents only very small portion of potential foraging habitat for this species. Therefore, Stage 1B would not adversely affect habitat critical to the survival of this species.

- ***disrupt the breeding cycle of an important population***

This species does not breed in Australia and therefore the removal of vegetation within the study area will not impact on the breeding cycle of this species.

- ***modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline***

Approximately 3.06 ha of potential habitat for this species occurs within the study area, which this species may utilise intermittently for aerial foraging. Given this species is migratory, highly mobile and forages widely, as well as extensive areas of potential foraging habitat elsewhere within the locality, it is unlikely that Stage 1B would decrease habitat to the extent that the species is likely to decline.

- ***result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat***

Stage 1B will not result in invasive species become established in areas of habitat for this species. Such issues would already be apparent in retained areas within the locality, as the locality is situated within a mostly urban environment. This species would also predominately aerially forage within the study area and therefore would be less likely to be impacted by invasive species.

- ***introduce disease that may cause the species to decline, or***

It is unlikely that Stage 1B would introduce disease that may cause this species to decline

- ***interfere substantially with the recovery of the species.***

Stage 1B is not likely to interfere substantially with the recovery of this species as only a small area of suboptimal foraging habitat will be removed.

Conclusion

Although potential foraging habitat exists for White-throated Needletail within the study area, this habitat is thought to be marginal, potentially used intermittently for aerial foraging. Larger and more suitable areas of habitat exist within the locality, particularly in the vegetation directly southwest of the study area. As such, it is not thought that the removal of vegetation within the study area is likely to result in a significant impact on this species.

Pteropus poliocephalus (Grey-headed Flying-fox)

Grey-headed Flying Fox is listed as vulnerable under the EPBC Act. Approximately 5.68 ha of potential habitat for this species occurs within the study area.

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

- ***lead to a long-term decrease in the size of an important population of a species***

An 'important population' is defined by DotE (2013) as a population that is necessary for a species' long-term survival and recovery.

This may include populations identified as such in recovery plans, and/or that are:

- key source populations either for breeding or dispersal
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range.

The Grey-headed Flying-fox is considered to be a single, mobile population with individuals distributed across Queensland, New South Wales, Victoria, South Australia, Tasmania and the ACT (DAWE 2021). As such, any individual of this species is considered to be part of an important population.

Stage 1B is unlikely to lead to a long-term decrease in the size of an important population of this species, as the study area does not contain breeding habitat and this species would only intermittently forage within the study area. The study area is predominately degraded and fragmented, although areas of habitat connectivity exist within the northern and southern portions. Given large areas of more suitable habitat exist to the south-west of the study area (e.g. within Deepwater Park, Voyager Point), and the high mobility of this species, it is unlikely the removal of vegetation within the study area would have a long-term impact on a population.

- ***reduce the area of occupancy of an important population***

Stage 1B is unlikely to reduce the area of occupancy of Grey-headed Flying-fox, particularly given this species is highly mobile. Stage 1B is situated within an urban area, with most impacts to occur within roadside vegetation that is highly degraded and fragmented. The study area may be used intermittently for aerial foraging by this species, but as similar or greater quality habitat exists elsewhere within the locality, the removal of such habitat is not anticipated to significantly impact on this species.

- ***fragment an existing important population into two or more populations***

Considering the high mobility of this species, the removal of vegetation within the study area is unlikely to fragment an existing important population into two or more populations. Extensive areas of habitat will persist along the Georges River corridor and southwest of the study area, particularly within Deepwater Park and Voyager Point.

- ***adversely affect habitat critical to the survival of a species***

The recovery plan for Grey-headed Flying-fox (DAWE 2021) states that habitat critical to the survival of the Grey-headed Flying-fox includes winter and spring vegetation communities that contain *Eucalyptus tereticornis, E. albens, E. crebra, E. fibrosa, E. melliodora, E. paniculata, E. pilularis, E. robusta, E. seeana, E. sideroxylon, E. siderophloia, Banksia integrifolia, Castanospermum australe, Corymbia citriodora, C. eximia, C. maculata, Grevillea robusta, Melaleuca quinquenervia* or *Syncarpia glomulifera*. These species can provide food resources during in winter and spring, during critical periods in the reproductive cycle of the Grey-headed Flying-fox (DAWE 2021).

Habitat critical to the survival of the Grey-headed Flying-fox may also be vegetation communities not containing the above tree species but which:

- contain native species that are known to be productive as foraging habitat during the final weeks of gestation, and during the weeks of birth, lactation and conception (August to May);
- contain native species used for foraging and occur within 20 km of a nationally important camp as identified on the Department's interactive flying-fox web viewer, or
- contain native and or exotic species used for roosting at the site of a nationally important Grey-Headed Flying-Fox camp, as identified on the Department's interactive flying-fox web viewer.

The subject land contains some important winter flowering resources for Grey-headed Flying-fox, including *Eucalyptus tereticornis, E. crebra, E. fibrosa* and *Corymbia maculata.* The study area occurs within 4.5km of the Cabramatta breeding camp, so foraging habitat within the study is likely to be regularly used during flowering.

However, the habitat within the site does not provide breeding resources for this species and represents a very small portion of potential foraging habitat for this species within the locality. Therefore, the proposal is unlikely to adversely affect habitat critical to the survival of this species.

- ***disrupt the breeding cycle of an important population***

This closest known camp to the study area is situated along Cabramatta Creek in Warwick Farm, approximately 4.5km north-west of the study area. As such, it is not anticipated that the removal of vegetation within the study area will not impact on the breeding cycle of this species.

- ***modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline***

Approximately 5.68 ha of potential habitat for this species occurs within the study area, which this species may utilise intermittently for foraging. Given this species is highly mobile and forages widely, as well as extensive areas of potential foraging habitat elsewhere within the locality, it is unlikely that Stage 1B would decrease habitat to the extent that the species is likely to decline.

- ***result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat***

Stage 1B will not result in invasive species become established in areas of habitat for this species. Such issues would already be apparent in retained areas within the locality, as the locality is situated within a mostly urban environment.

- ***introduce disease that may cause the species to decline, or***

Australian flying-foxes, including the Grey-headed Flying-fox, are natural reservoirs for at least three zoonotic diseases, meaning that they carry a disease agent that can affect humans. These include Australian Bat Lyssavirus, a rabies-like disease, and two paramyxoviruses – Hendra virus and Menangle virus (DAWE 2021). The proposed activity will not introduce such diseases to the study area. It is unlikely that Stage 1B would introduce disease that may cause this species to decline.

- ***interfere substantially with the recovery of the species.***

Stage 1B is not likely to interfere substantially with the recovery of this species as only a small area of foraging habitat will be removed.

Conclusion

Although foraging potential habitat exists for the Grey-headed Flying-fox within the study area, this habitat is thought to be marginal, potentially used intermittently for foraging. Larger and more suitable areas of habitat exist within the locality, particularly in the vegetation directly southwest of the study area. As such, it is not thought that the removal of vegetation within the study area is likely to result in a significant impact on this species.

Appendix F: Biodiversity credit reports

Copies of the following BAM-C credit reports will be provided as separate PDFs.

- Credits summary report
- Biodiversity credit report (Like-for-like)
- Candidate threatened species report
- Predicted species report.

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00036824/BAAS18141/22/00036825	Henry Lawson Drive Upgrade Stage 1B	01/02/2023
Assessor Name	**Report Created**	**BAM Data version ***
Karen Leigh Spicer	28/02/2023	57
Assessor Number	**BAM Case Status**	**Date Finalised**
BAAS18141	Open	To be finalised
Assessment Revision	**Assessment Type**	
0	Part 5 Activities	

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

Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	Sensitivity to loss (Justification)	Species sensitivity to gain class	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAII	Ecosystem credits

Castlereagh Ironbark forest												
4	725_Low	Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion	12.7	12.7	0.14	Population size	High Sensitivity to Gain	Endangered Ecological Community	Not Listed	2.00	True	0
											Subtotal	**0**
Coastal freshwater wetland												
3	781_Good	Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	63.6	63.6	0.08	Biodiversity Conservation Act listing status	High Sensitivity to Gain	Endangered Ecological Community	Not Listed	2.00		3
											Subtotal	**3**

Cumberland riverflat forest												
1	835_Moderate	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	34.8	34.8	2.2	Biodiversity Conservation Act listing status	High Sensitivity to Gain	Endangered Ecological Community	Not Listed	2.00		38
											Subtotal	**38**
Cumberland Swamp Oak riparian forest												
2	1800_Moderate	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	15.3	15.3	0.68	Biodiversity Conservation Act listing status	High Sensitivity to Gain	Endangered Ecological Community	Not Listed	2.00		5
											Subtotal	**5**
											Total	**46**

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	Sensitivity to loss (Justification)	Sensitivity to gain (Justification)	BC Act Listing status	EPBC Act listing status	Potential SAII	Species credits
Meridolum corneovirens / Cumberland Plain Land Snail (Fauna)									
835_Moderate	34.8	34.8	1	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Not Listed	False	18
								Subtotal	**18**
Myotis macropus / Southern Myotis (Fauna)									
835_Moderate	34.8	34.8	1.3	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	23
1800_Moderate	15.3	15.3	0.68	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	5
781_Good	63.6	63.6	0.08	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	3
725_Low	12.7	12.7	0.02	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	1
								Subtotal	**32**

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id 00036824/BAAS18141/22/00036825	Proposal Name Henry Lawson Drive Upgrade Stage 1B	BAM data last updated * 01/02/2023
Assessor Name Karen Leigh Spicer	Assessor Number BAAS18141	BAM Data version * 57
Proponent Names	Report Created 28/02/2023	BAM Case Status Open
Assessment Revision 0	Assessment Type Part 5 Activities	Date Finalised To be finalised

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Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion	Endangered Ecological Community	725-Castlereagh Ironbark forest

Species
Nil

Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
No Changes

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

BAM Biodiversity Credit Report (Like for like)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
835-Cumberland riverflat forest	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	2.2	0	38	38
1800-Cumberland Swamp Oak riparian forest	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	0.7	0	5	5
781-Coastal freshwater wetland	Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	0.1	0	3	3
725-Castlereagh Ironbark forest	Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion	0.1	0	0	0

725-Castlereagh Ironbark forest

Like-for-like credit retirement options

Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion This includes PCT's: 725, 808	-	725_Low	No	0	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.

725-Castlereagh Ironbark forest						
781-Coastal freshwater wetland	**Like-for-like credit retirement options**					
	Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
	Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions This includes PCT's: 780, 781, 782, 828, 1071, 1735, 1736, 1737, 1738, 1739, 1740, 1741, 1742, 1911	-	781_Good	No	3	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.
835-Cumberland riverflat forest	**Like-for-like credit retirement options**					
	Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region

	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions This includes PCT's: 686, 828, 835, 941, 1108, 1109, 1212, 1228, 1293, 1318, 1326, 1386, 1504, 1556, 1594, 1618, 1720, 1794	-	835_Moderate	No	38	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.
1800-Cumberland Swamp Oak riparian forest	**Like-for-like credit retirement options**					
	Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region

	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions This includes PCT's: 915, 916, 917, 918, 919, 1125, 1230, 1232, 1234, 1235, 1236, 1726, 1727, 1728, 1729, 1731, 1800, 1808	-	1800_Moderate	No	5	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

Species	Vegetation Zone/s	Area / Count	Credits
Meridolum corneovirens / Cumberland Plain Land Snail	**835_Moderate**	1.0	18.00
Myotis macropus / Southern Myotis	**835_Moderate, 1800_Moderate, 781_Good, 725_Low**	2.1	32.00

Credit Retirement Options

Like-for-like credit retirement options

Meridolum corneovirens / Cumberland Plain Land Snail	Spp	IBRA subregion
	Meridolum corneovirens / Cumberland Plain Land Snail	Any in NSW
Myotis macropus / Southern Myotis	Spp	IBRA subregion
	Myotis macropus / Southern Myotis	Any in NSW

BAM Candidate Species Report

Proposal Details

Assessment Id 00036824/BAAS18141/22/00036825	Proposal Name Henry Lawson Drive Upgrade Stage 1B	BAM data last updated * 01/02/2023
Assessor Name Karen Leigh Spicer	Report Created 28/02/2023	BAM Data version * 57
Assessor Number BAAS18141	Assessment Type Part 5 Activities	BAM Case Status Open
Assessment Revision 0	Date Finalised To be finalised	

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List of Species Requiring Survey

Name	Presence	Survey Months
Meridolum corneovirens Cumberland Plain Land Snail	Yes (assumed present)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Myotis macropus Southern Myotis	Yes (assumed present)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

Threatened species Manually Added

None added

Threatened species assessed as not on site

Refer to BAR for detailed justification

Common name	Scientific name	Justification in the BAM-C
Allocasuarina glareicola	Allocasuarina glareicola	Refer to BAR
Austral Pillwort	Pilularia novae-hollandiae	Refer to BAR
Barking Owl	Ninox connivens	Habitat constraints
Black-tailed Godwit	Limosa limosa	Habitat constraints
Broad-billed Sandpiper	Limicola falcinellus	Habitat constraints
Brown Pomaderris	Pomaderris brunnea	Refer to BAR
Bush Stone-curlew	Burhinus grallarius	Habitat constraints
Bynoe's Wattle	Acacia bynoeana	Refer to BAR
Camden White Gum	Eucalyptus benthamii	Refer to BAR
Curlew Sandpiper	Calidris ferruginea	Habitat constraints
Deyeuxia appressa	Deyeuxia appressa	Refer to BAR
Dillwynia tenuifolia	Dillwynia tenuifolia	Refer to BAR
Dillwynia tenuifolia, Kemps Creek	Dillwynia tenuifolia - endangered population	Refer to BAR
Downy Wattle	Acacia pubescens	Refer to BAR
Dural Land Snail	Pommerhelix duralensis	Refer to BAR
Eastern Osprey	Pandion cristatus	Habitat constraints
Eastern Pygmy-possum	Cercartetus nanus	Refer to BAR
Epacris purpurascens var. purpurascens	Epacris purpurascens var. purpurascens	Refer to BAR
Gang-gang Cockatoo	Callocephalon fimbriatum	Refer to BAR
Gosford Wattle, Hurstville and Kogarah Local Government Areas	Acacia prominens - endangered population	Refer to BAR
Green and Golden Bell Frog	Litoria aurea	Habitat constraints
Grey-headed Flying-fox	Pteropus poliocephalus	Habitat constraints
Gyrostemon thesioides	Gyrostemon thesioides	Habitat constraints
Hairy Geebung	Persoonia hirsuta	Refer to BAR
Hibbertia fumana	Hibbertia fumana	Refer to BAR
Hibbertia sp. Bankstown	Hibbertia sp. Bankstown	Refer to BAR

Juniper-leaved Grevillea	Grevillea juniperina subsp. juniperina	Refer to BAR
Koala	Phascolarctos cinereus	Habitat constraints
Large Bent-winged Bat	Miniopterus orianae oceanensis	Habitat constraints
Large-eared Pied Bat	Chalinolobus dwyeri	Habitat constraints
Little Bent-winged Bat	Miniopterus australis	Habitat constraints
Little Eagle	Hieraaetus morphnoides	Habitat constraints
Marsdenia viridiflora R. Br. subsp. viridiflora population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	Marsdenia viridiflora subsp. viridiflora - endangered population	Refer to BAR
Masked Owl	Tyto novaehollandiae	Habitat constraints
Matted Bush-pea	Pultenaea pedunculata	Refer to BAR
Maundia triglochinoides	Maundia triglochinoides	Habitat constraints
Micromyrtus minutiflora	Micromyrtus minutiflora	Refer to BAR
Netted Bottle Brush	Callistemon linearifolius	Refer to BAR
Nodding Geebung	Persoonia nutans	Refer to BAR
P. prunifolia in the Parramatta, Auburn, Strathfield and Bankstown Local Government Areas	Pomaderris prunifolia - endangered population	Refer to BAR
Powerful Owl	Ninox strenua	Habitat constraints
Pultenaea parviflora	Pultenaea parviflora	Refer to BAR
Regent Honeyeater	Anthochaera phrygia	Habitat constraints
Small-flower Grevillea	Grevillea parviflora subsp. parviflora	Refer to BAR
Square Raspwort	Haloragis exalata subsp. exalata	Habitat constraints
Square-tailed Kite	Lophoictinia isura	Habitat constraints
Squirrel Glider	Petaurus norfolcensis	Refer to BAR
Swift Parrot	Lathamus discolor	Habitat constraints

Tadgell's Bluebell in the local government areas of Auburn, Bankstown, Baulkham Hills, Canterbury, Hornsby, Parramatta and Strathfield	Wahlenbergia multicaulis - endangered population	Refer to BAR
Tall Knotweed	Persicaria elatior	Habitat constraints
Thick Lip Spider Orchid	Caladenia tessellata	Refer to BAR
White-bellied Sea-Eagle	Haliaeetus leucogaster	Habitat constraints
White-flowered Wax Plant	Cynanchum elegans	Refer to BAR
Zannichellia palustris	Zannichellia palustris	Habitat constraints

BAM Predicted Species Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00036824/BAAS18141/22/00036825	Henry Lawson Drive Upgrade Stage 1B	01/02/2023
Assessor Name	**Report Created**	**BAM Data version ***
Karen Leigh Spicer	28/02/2023	57
Assessor Number	**Assessment Type**	**BAM Case Status**
BAAS18141	Part 5 Activities	Open
Assessment Revision		**Date Finalised**
0		To be finalised

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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-Cumberland riverflat forest
		781-Coastal freshwater wetland
Australian Painted Snipe	Rostratula australis	781-Coastal freshwater wetland
Barking Owl	Ninox connivens	835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
		725-Castlereagh Ironbark forest
Black Bittern	Ixobrychus flavicollis	835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
		781-Coastal freshwater wetland
Black-chinned Honeyeater (eastern subspecies)	Melithreptus gularis gularis	835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
		725-Castlereagh Ironbark forest
Black-necked Stork	Ephippiorhynchus asiaticus	781-Coastal freshwater wetland
Black-tailed Godwit	Limosa limosa	781-Coastal freshwater wetland
Broad-billed Sandpiper	Limicola falcinellus	781-Coastal freshwater wetland

Brown Treecreeper (eastern subspecies)	Climacteris picumnus victoriae	835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
		725-Castlereagh Ironbark forest
Comb-crested Jacana	Irediparra gallinacea	781-Coastal freshwater wetland
Curlew Sandpiper	Calidris ferruginea	781-Coastal freshwater wetland
Diamond Firetail	Stagonopleura guttata	835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
		725-Castlereagh Ironbark forest
Dusky Woodswallow	Artamus cyanopterus cyanopterus	835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
		781-Coastal freshwater wetland
		725-Castlereagh Ironbark forest
Eastern Coastal Free-tailed Bat	Micronomus norfolkensis	835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
		781-Coastal freshwater wetland
		725-Castlereagh Ironbark forest
Eastern Osprey	Pandion cristatus	835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
		781-Coastal freshwater wetland
Flame Robin	Petroica phoenicea	835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
		725-Castlereagh Ironbark forest
Freckled Duck	Stictonetta naevosa	781-Coastal freshwater wetland
Gang-gang Cockatoo	Callocephalon fimbriatum	835-Cumberland riverflat forest
		725-Castlereagh Ironbark forest
Grey-headed Flying-fox	Pteropus poliocephalus	835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
		781-Coastal freshwater wetland
		725-Castlereagh Ironbark forest
Hooded Robin (south-eastern form)	Melanodryas cucullata cucullata	835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
		725-Castlereagh Ironbark forest
Large Bent-winged Bat	Miniopterus orianae oceanensis	835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest

Large Bent-winged Bat	Miniopterus orianae oceanensis	781-Coastal freshwater wetland
		725-Castlereagh Ironbark forest
Little Bent-winged Bat	Miniopterus australis	835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
		781-Coastal freshwater wetland
		725-Castlereagh Ironbark forest
Little Eagle	Hieraaetus morphnoides	835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
		781-Coastal freshwater wetland
		725-Castlereagh Ironbark forest
Little Lorikeet	Glossopsitta pusilla	835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
		781-Coastal freshwater wetland
		725-Castlereagh Ironbark forest
Masked Owl	Tyto novaehollandiae	835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
		725-Castlereagh Ironbark forest
Painted Honeyeater	Grantiella picta	835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
		725-Castlereagh Ironbark forest
Powerful Owl	Ninox strenua	835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
		725-Castlereagh Ironbark forest
Regent Honeyeater	Anthochaera phrygia	835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
		725-Castlereagh Ironbark forest
Rosenberg's Goanna	Varanus rosenbergi	725-Castlereagh Ironbark forest
Scarlet Robin	Petroica boodang	835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
		725-Castlereagh Ironbark forest
Speckled Warbler	Chthonicola sagittata	835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
		725-Castlereagh Ironbark forest
Spotted Harrier	Circus assimilis	781-Coastal freshwater wetland
Spotted-tailed Quoll	Dasyurus maculatus	835-Cumberland riverflat forest

Spotted-tailed Quoll	Dasyurus maculatus	1800-Cumberland Swamp Oak riparian forest
		781-Coastal freshwater wetland
		725-Castlereagh Ironbark forest
Square-tailed Kite	Lophoictinia isura	835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
		781-Coastal freshwater wetland
		725-Castlereagh Ironbark forest
Swift Parrot	Lathamus discolor	835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
		725-Castlereagh Ironbark forest
Turquoise Parrot	Neophema pulchella	835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
		725-Castlereagh Ironbark forest
Varied Sittella	Daphoenositta chrysoptera	835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
		725-Castlereagh Ironbark forest
White-bellied Sea-Eagle	Haliaeetus leucogaster	835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
		781-Coastal freshwater wetland
		725-Castlereagh Ironbark forest
White-fronted Chat	Epthianura albifrons	781-Coastal freshwater wetland
White-throated Needletail	Hirundapus caudacutus	835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
		781-Coastal freshwater wetland
		725-Castlereagh Ironbark forest
Yellow-bellied Sheathtail-bat	Saccolaimus flaviventris	835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
		781-Coastal freshwater wetland
		725-Castlereagh Ironbark forest

Threatened species Manually Added

None added

Threatened species assessed as not within the vegetation zone(s) for the PCT(s)

Refer to BAR for detailed justification

Common Name	Scientific Name	Justification in the BAM-C

NSW GOVERNMENT