

Westmead to The Bays and Sydney CBD

Environmental Impact Statement
Concept and Stage 1

**Technical Paper 10
Biodiversity development
assessment report**

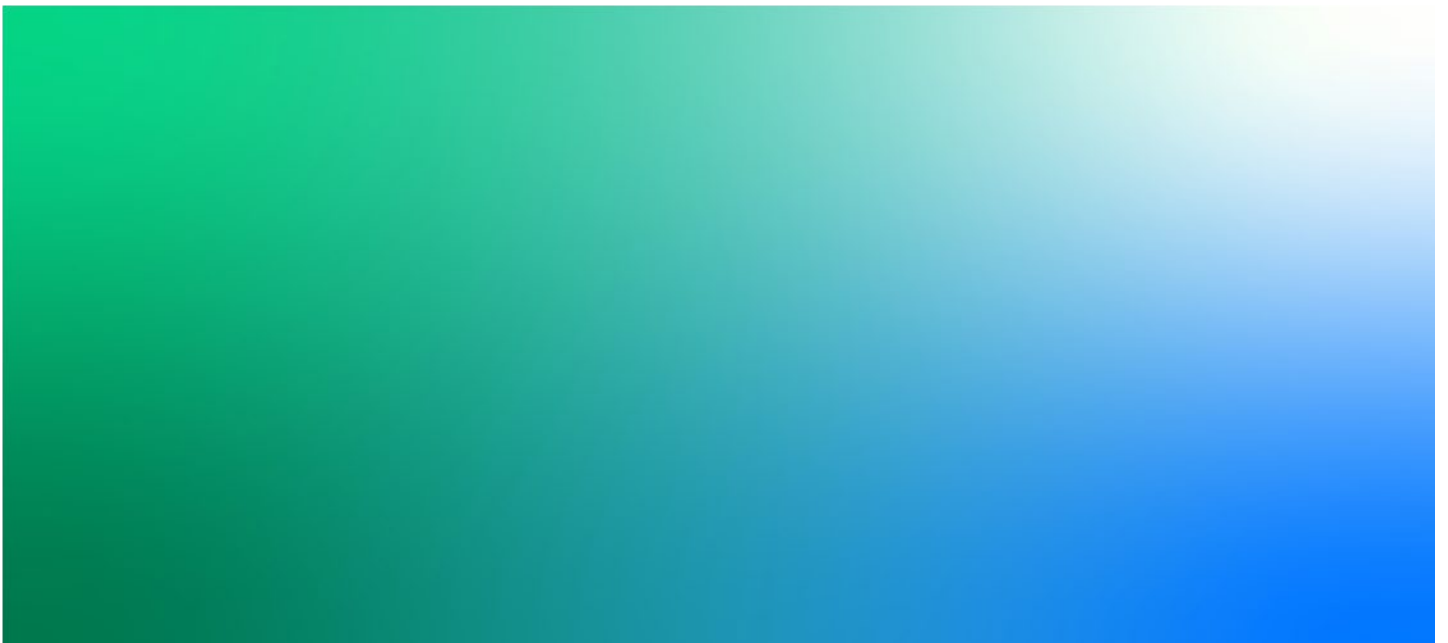


Sydney Metro West – Stage 1

Technical Paper 10: Biodiversity Development Assessment Report

Final

Sydney Metro



Sydney Metro West – Stage 1

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Glossary of terms

Definitions	
Biodiversity Assessment Method	<p>The Biodiversity Assessment Method (BAM) is the assessment manual that outlines how an accredited person assesses impacts on biodiversity at development sites and stewardship sites. It is a scientific document that provides:</p> <ul style="list-style-type: none"> • a consistent method for the assessment of biodiversity on a proposed development or major project, or clearing site, • guidance on how a proponent can avoid and minimise potential biodiversity impacts, and • the number and class of biodiversity credits that need to be offset to achieve a standard of 'no net loss' of biodiversity.
Biodiversity credits	Ecosystem credits or species credits
Biodiversity credit report	The report produced by the Biodiversity Credit Calculator that sets out the number and class of biodiversity credits required to offset the remaining adverse impacts on biodiversity values at a development site, or on land to be biodiversity certified, or that sets out the number and class of biodiversity credits that are created at a biodiversity stewardship site.
Biodiversity offsets	Management actions that are undertaken to achieve a gain in biodiversity values on areas of land in order to compensate for losses to biodiversity values from the impacts of development.
Biodiversity Credit Calculator (BCC)	The computer program that provides decision support to assessors and proponents by applying the Biodiversity Assessment Method, which calculates the number and class of biodiversity credits required to offset the impacts of a development or created at a biodiversity stewardship site.
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 the project Secretary's Environmental Assessment Requirements for cumulative impact assessment requirements.
Development site	The area of land that is directly impacted on by a proposed development, including access roads, and areas used to store construction materials.
Direct impact	An impact on biodiversity values that is a direct result of vegetation clearance and loss of habitat for a development. It is predictable, usually occurs at or near to the development site and can be readily identified during the planning, design, construction, and operational phases of a development.
Ecological community	An ecological community is a naturally occurring group of native plants, animals and other organisms living in a unique location. Ecological communities can be listed as threatened under the EPBC Act and/or BC Act.
Ecosystem credit	A measurement of the value of endangered ecological communities (EECs), critically endangered ecological communities (CEECs) and threatened species habitat for species that can be reliably predicted to occur with a plant community type (PCT). Ecosystem credits measure the loss in biodiversity values at a development site and the gain in biodiversity values at a biodiversity stewardship site.

Definitions	
Ecosystem credit species	Threatened species that can be reliably predicted to occur with a PCT, for which species-specific biodiversity credits are not required.
Habitat	An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic component.
Indirect impact	<p>An impact on biodiversity values that occurs when development related activities affect threatened species, threatened species habitat, or ecological communities in a manner other than direct impact. Compared to direct impacts, indirect impacts often:</p> <ul style="list-style-type: none"> • occur over a wider area than just the site of the development • have a lower intensity of impact in the extent to which they occur compared to direct impacts • occur off site • have a lower predictability of when the impact occurs • have unclear boundaries of responsibility.
Local population	The population that occurs in the development site. In cases where multiple populations occur in the development site and/or a population occupies part of the development site, impacts on the entirety of each population must be assessed separately.
MNES	A matter of national environmental significance (MNES) protected by a provision of Part 3 of the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act).
Mitchell landscape	Landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1: 250,000.
Mitigation	Action to reduce the severity of an impact.
Mitigation measure	Any measure that facilitates the safe movement of wildlife and/or prevents wildlife mortality.
Plant community type	A NSW plant community type identified using the plant community type (PCT) classification system. The PCT classification was created in 2011 by consolidating two existing community-level classifications: the NSW Vegetation Classification and Assessment database; and the BioMetric Vegetation Types database used in NSW regulatory programs. The PCT classification is now maintained in the BioNet Vegetation Classification application. It is a way to classify vegetation types.
Population	A group of organisms, all of the same species, occupying a particular area.
Project area/ Project site	The area of land that is directly impacted on by a proposed Major Project that is under the NSW <i>Environmental Planning and Assessment Act 1979</i> (EP&A Act), including access roads, and areas used to store construction materials.
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.
Species credit species	Threatened species that are assessed according to section 6.4 of the BAM which may generate species-specific biodiversity credit requirements.
Study area	The development site and any other areas surveyed and assessed for biodiversity values which may be subject to indirect impacts.

Definitions	
Target species	A species that is the focus of a study or intended beneficiary of a conservation action or connectivity measure.
Threatened Biodiversity Data Collection	Part of the BioNet database, accessible from the BioNet website at www.bionet.nsw.gov.au .
Threatened species	A species listed under the NSW <i>Biodiversity Conservation Act 2016</i> (BC Act), <i>Fisheries Management Act 1994</i> (FM Act) or EPBC Act.
Threatened ecological community	A community of different species associated with one another and sharing the same habitat, that is listed under the NSW <i>Biodiversity Conservation Act 2016</i> (BC Act), <i>Fisheries Management Act 1994</i> (FM Act) and Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act). Threatened ecological communities are listed as endangered or critically endangered under the NSW <i>Biodiversity Conservation Act 2016</i> (BC Act), or may be listed as vulnerable, endangered or critically endangered under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act).

Abbreviations	
BAM	Biodiversity Assessment Method
BCC	Biodiversity Credit Calculator
BC Act	<i>Biodiversity Conservation Act 2016</i> (NSW)
BDAR	Biodiversity Development Assessment Report
CEEC	Critically Endangered Ecological Community
CEMP	Construction Environmental Management Plan
DPI	Department of Primary Industries
EEC	Endangered ecological community
EIS	Environmental Impact Statement
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i> (NSW)
EPBC Act	<i>Environmental Protection and Biodiversity Conservation Act 1999</i> (Federal)
FM Act	<i>Fisheries Management Act 1994</i> (NSW)
IBRA	Interim Biogeographically Regionalisation of Australia
MNES	Matters of National Environmental Significance
PCT	plant community type
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SSI	State Significant Infrastructure
TECs	Threatened Ecological Communities
VIS	Vegetation information system (BioNet Vegetation Classification)

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Executive Summary

Sydney Metro (as 'the proponent') is seeking approval for the Sydney Metro West Concept and for construction of the first stage (Stage 1). Planning approvals for Sydney Metro West are expected to be staged as follows:

- Stage 1 would involve the major civil construction works between Westmead and The Bays (further described in Chapter 20 (Stage 1 Project description) of this Environmental Impact Statement) and is being assessed concurrently with the Concept
- Future stage(s) would include the remaining major civil construction works from The Bays to Sydney CBD North, rail systems fit-out, station fit-out and aboveground building construction, and operation of the metro line.

Sydney Metro is seeking a specific declaration for Sydney Metro West to be declared as State significant infrastructure and critical State significant infrastructure under sections 5.12(4) and 5.13 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), respectively.

This Biodiversity Development Assessment Report (BDAR) has been prepared for Stage 1 of Sydney Metro West in accordance with the requirements of the *Biodiversity Conservation Act 2016* (BC Act) and the Biodiversity Assessment Method (BAM). This BDAR documents the results of the biodiversity assessment carried out for Stage 1 in line with the relevant State and Commonwealth environmental and threatened species legislation and policy. It also considers relevant matters under the *Fisheries Management Act 1994*.

Existing environment

Most of the development site (being the construction footprint of Stage 1 construction sites) contains existing residential, commercial and industrial development with limited areas of existing natural vegetation but there are two plant community types (PCTs) present:

- Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849) at the Westmead metro station construction site
- Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion (PCT 920) at the Clyde stabling and maintenance facility construction site.

The target threatened plant species were not found within or adjacent to the development site. *Wilsonia backhousei* was also not found within the development site, however a small sub-population of this species was found within saltmarsh habitat approximately 1.2 kilometres downstream of the Clyde stabling and maintenance facility construction site along Duck River in four separate clumps.

The following threatened fauna species are assumed to be present within the development site:

- Dusky Woodswallow (*Artamus cyanopterus cyanopterus*)
- Eastern Bentwing-bat (*Miniopterus orianae oceanensis*)
- Eastern Freetail-bat (*Mormopterus norfolkensis*)
- Grey-headed Flying-fox (*Pteropus poliocephalus*)
- Little Bentwing-bat (*Miniopterus australis*)
- Little Lorikeet (*Glossopsitta pusilla*)
- Southern Myotis (*Myotis macropus*)
- Swift Parrot (*Lathamus discolor*).

Of these, only the Southern Myotis is a species credit species, for which a biodiversity credit requirement may be generated. In the absence of breeding habitat, the remaining species are only ecosystem credit species for the purposes of this assessment.

Impacts to biodiversity

Stage 1 is located within a highly urbanised area that does not possess large expanses of intact native vegetation with high biodiversity value. As the majority of Stage 1 would be underground or in pre-existing built-up areas, direct impacts to terrestrial biodiversity has been avoided and/or minimised. Stage 1 would result in minimal disturbance of native vegetation. Where this disturbance cannot be avoided, the vegetation is of poor to moderate quality and/or provides limited habitat for threatened species.

The only areas of Stage 1 with the potential for notable direct biodiversity impacts would be a portion of Duck Creek and A'Becketts Creek. No other areas impacted by Stage 1 would contain important biodiversity attributes.

Stage 1 would not impact any areas of land that the Minister for Energy and Environment has declared as an area of outstanding biodiversity value in accordance with section 3.1 of the BC Act. Importantly, the areas proposed for clearing would be refined during detailed design and reviewed as part of the pre-clearing process.

Plant community types

Despite avoidance measures, Stage 1 would result in the direct removal of some native vegetation. The estimated clearing of PCT and threatened species habitats is approximately 0.18 hectares consisting of the following PCTs:

- Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849) – 0.03 hectares. This impact would be limited to the Westmead metro station construction site
- Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion (PCT 920) – 0.15 hectares. This impact would be limited to the Clyde stabling and maintenance facility construction site. This PCT is also considered to be marine vegetation under the *Fisheries Management Act 1994*.

Marine vegetation (e.g. mangroves) is protected under the *Fisheries Management Act 1994* but a permit under section 205 of the *Fisheries Management Act 1994* (permit to harm marine vegetation) is not required for State significant infrastructure projects as outlined in section 5.23 of the EP&A Act.

Threatened species

The potential prescribed biodiversity impacts on threatened species associated with Stage 1 include:

- Impacts on the habitat of threatened species or ecological communities associated with non-native vegetation including habitat potentially used by the Grey-headed Flying-fox and Swift Parrot
- Impacts to sensitive receiving water bodies, water quality and hydrological processes including some groundwater drawdown, oxidation of acid sulfate soils which underlie most mangrove areas, and collapse of soil profile.

Mitigation and management

Once all practicable steps to avoid or minimise impacts have been implemented at the detailed design phase, mitigation and management measures would be implemented to further lessen the potential ecological impacts of Stage 1. Mitigation measures would be implemented during construction and would be outlined in a Flora and Fauna Management Plan (refer to Appendix D (Construction Environmental Management Framework) of the Environmental Impact Statement).

Offsetting biodiversity impacts

An offset is required for the impacts to PCTs and threatened (species credit) species and the biodiversity credit obligation has been calculated using the Biodiversity Assessment Calculator and presented in this BDAR. Areas of the development site that do not possess PCTs have not been assessed and offset credits are not required. A summary of the biodiversity credit requirements for Stage 1 are as follows:

- Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion (PCT 920) – three credits
- *Myotis macropus* (Southern Myotis) – three credits.

For marine vegetation such as mangroves, the offsetting rules of the The Policy and guidelines for fish habitat conservation and management – Update 2013 (NSW Department of Primary Industries, 2013) are applicable as the guidelines are intended to feed into the assessment of State significant infrastructure projects to ensure the sustainable management, and “no net loss”, of key fish habitats in NSW.

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1. Introduction

1.1 Sydney Metro West

Sydney Metro West is a critical step in the delivery of Future Transport Strategy 2056. It would provide fast, reliable and frequent rail service between Greater Parramatta and the Sydney CBD.

Sydney Metro (as 'the proponent') is seeking planning approvals as follows:

- Approval for the whole Sydney Metro West (at concept level) concurrent with Stage 1. Stage 1 involves the major civil construction works between Westmead and The Bays (and is the subject of this technical paper)
- Future stage(s) would include the remaining major civil construction works from The Bays to the Sydney CBD, rail systems fit-out, station fit-out and aboveground building construction, and operation of the metro line (future application(s)).

Sydney Metro is seeking a specific declaration for Sydney Metro West to be declared as State significant infrastructure and critical State significant infrastructure under sections 5.12(4) and 5.13 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), respectively.

1.1.1 Location

Sydney Metro West would mainly be located underground in twin tunnels. Stage 1, which is subject of this assessment, extends from Westmead to The Bays (refer to Figure 1-1).

1.1.2 Overview of Stage 1

Stage 1 of Sydney Metro West (Stage 1) would involve the major civil construction work between Westmead and The Bays, including:

- Enabling works such as demolition, utility supply to construction sites, utility adjustments and modifications to the existing transport network
- Tunnel excavation including tunnel support activities
- Station excavation for new metro stations at Westmead, Parramatta, Sydney Olympic Park, North Strathfield, Burwood North, Five Dock and The Bays
- Shaft excavation for services facilities at (within the Clyde stabling and maintenance facility construction site), Silverwater and between Five Dock Station and The Bays Station construction sites
- Civil work for the stabling and maintenance facility at Clyde including earthworks and structures for crossings of A'Becketts Creek and Duck Creek
- A concrete segment facility for use during construction located at the Clyde stabling and maintenance facility construction site
- Excavation of a tunnel dive structure and associated tunnels at Rosehill to support a connection between the Clyde stabling and maintenance facility and the mainline metro tunnels.

The Stage 1 is further described in Chapter 9 (Stage 1 description) of the Environmental Impact Statement.

The location of the services facility between Five Dock Station and The Bays Station is currently being investigated, and is not assessed within this technical paper. Further detail on the locational and design criteria that would be used as part of determining the preferred location is detailed in Chapter 9 (Stage 1 description) of the Environmental Impact Statement.

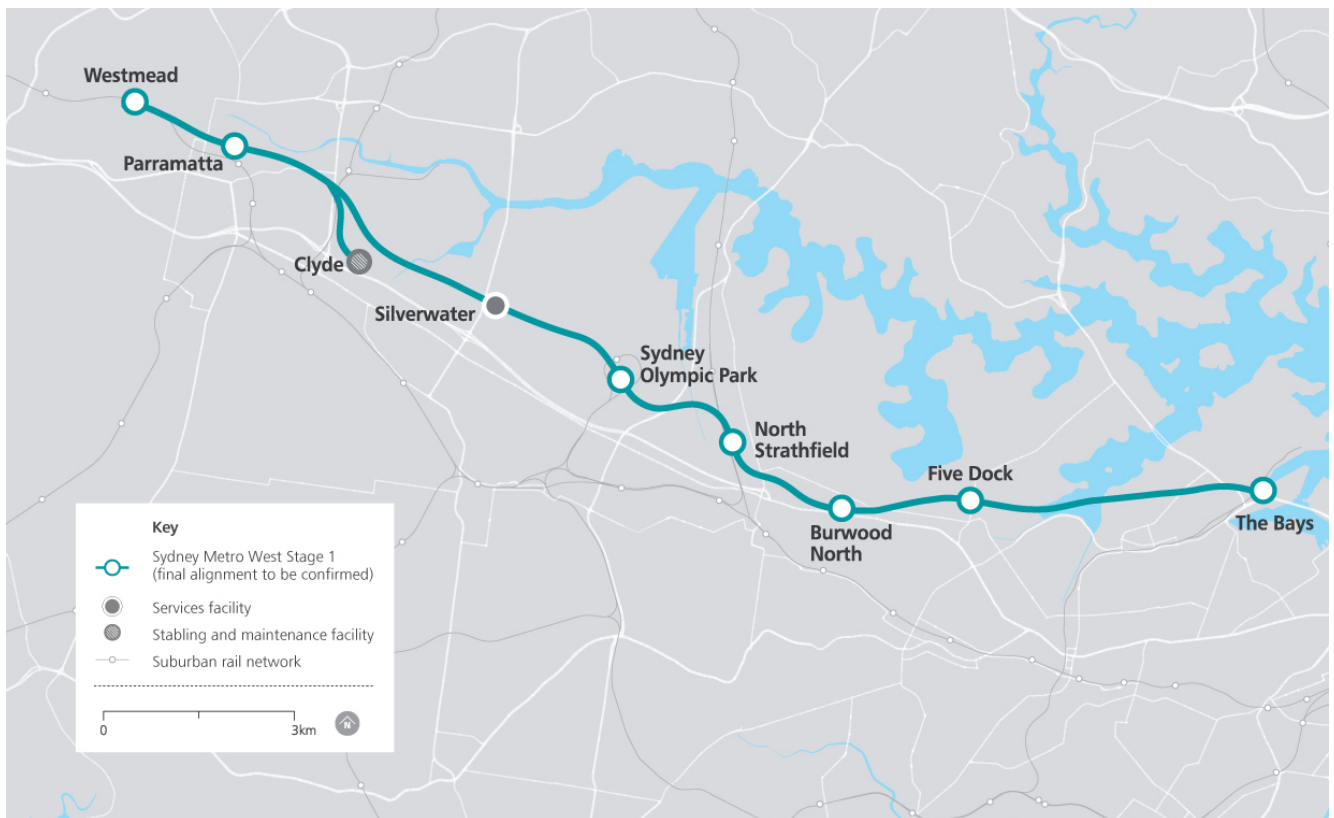


Figure 1-1: Sydney Metro West – Stage 1 overview

1.2 Purpose and scope of this report

This technical paper, Technical Paper 10: Biodiversity Development Assessment Report (BDAR) is one of a number of technical documents that form part of the Environmental Impact Statement. The purpose of the BDAR is to identify and assess the biodiversity impacts of Stage 1. In doing so it responds directly to the Secretary's Environmental Assessment Requirements outlined in Section 1.3.

1.3 Secretary's Environmental Assessment Requirements

The Secretary's Environmental Assessment Requirements were issued for Stage 1 on 11 December 2019. The requirements specific to biodiversity, and where these requirements are addressed in this BDAR, are outlined in Table 1-1. Further, the investigations and assessments identified in the Sydney Metro West Scoping Report – Westmead to The Bays and Sydney CBD (Sydney Metro, 2019), and where these requirements are addressed, are outlined in Table 1-2.

Table 1-1: Sydney Metro West Stage 1 Secretary's Environmental Assessment Requirements – Biodiversity

Requirement	Where addressed
1. Biodiversity impacts in accordance with section 7.9 of the <i>Biodiversity Conservation Act 2016</i> (BC Act), the Biodiversity Assessment Method (BAM), and be documented in a Biodiversity Development Assessment Report (BDAR).	<p>This report is the BDAR as required under Section 7.9 of the BC Act. The BDAR was prepared in accordance with the Biodiversity Assessment Method (Office of Environment and Heritage, 2017) and guidance provided in the Biodiversity Assessment Method Operation Manual Stage 1 (State of NSW and Office of Environment and Heritage, 2018) and Biodiversity Assessment Method Operation Manual Stage 2 (State of NSW and Department of Planning Industry and Environment, 2019) (see Section 2).</p> <p>The Biodiversity Assessment calculator case associated with this BDAR is 00015222/BAAS17060/19/00015225.</p> <p>The biodiversity surveys undertaken during preparation of this BDAR were guided by the Threatened Species Survey and Assessment Guidelines (see Section 2).</p>
2. Impacts on biodiversity values not covered by the BAM. This includes a threatened aquatic species assessment (Part 7A of the <i>Fisheries Management Act 1994</i>) to address whether there are likely to be any significant impact on listed threatened species, populations or ecological communities listed under the <i>Fisheries Management Act 1994</i> (FM Act).	<p>Biodiversity values not assessed under the BAM include:</p> <ul style="list-style-type: none"> a) marine mammals b) wandering sea birds c) biodiversity that is endemic to Lord Howe Island d) biodiversity values associated with the assessment of the impacts of any clearing of native vegetation and loss of habitat on category 1-exempt land (within the meaning of Part 5A of the <i>Local Land Services Act 2013</i>), other than the additional biodiversity impacts in accordance with clause 6.1 of the BC regulation. <p>The BDAR addresses potential impacts to marine mammals and wandering marine birds through habitat assessment (see Appendix A). Items c and d in the above list are not applicable to Sydney Metro West as it is on mainland Australia and category 1-exempt land would not be affected.</p> <p>This BDAR also includes a threatened aquatic species assessment, in the form of a habitat assessment and review of past studies, to address whether there are likely to be any significant impact on listed threatened species, populations or ecological communities listed under the <i>Fisheries Management Act 1994</i> (FM Act). This assessment is presented in Section 6 and Appendix A. The Aquatic Ecology in Environmental Impact Assessment – EIA Guideline (Lincoln Smith, 2003) was used to guide the level of aquatic assessment required.</p>
3. If the project, or any component of the project, would be classified as a KTP in accordance with the listings in the BC Act, FM Act and the <i>Environment Protection and the Biodiversity Conservation Act 1999</i> (EPBC Act).	Refer to Section 9.3.

Table 1-2: Proposed investigations and assessments for biodiversity, as identified in Sydney Metro West Scoping Report – Westmead to The Bays and Sydney CBD (Sydney Metro, 2019)

Requirement	Where addressed
The biodiversity assessment will:	
Identify and describe the flora and fauna species, habitat, populations and ecological communities (including groundwater dependent ecosystems) that occur or are considered likely to occur	Refer to Section 3, Section 4, Section 5, Section 6, Section 7 and Appendix A.
Assess any direct and indirect impacts of Stage 1 on terrestrial and aquatic flora and fauna species, populations, ecological communities and their habitats, and groundwater dependent ecosystems	Refer to Section 9.
Assess the significance of the impacts of Stage 1 on species, ecological communities and populations, and groundwater dependent ecosystems listed under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> , the <i>Biodiversity Conservation Act 2016</i> and the <i>Fisheries Management Act 1994</i> that occur or are considered likely to occur	Refer to Section 9 and Appendix D.
Identify and describe mitigation measures using the principles of 'avoid, minimise, mitigate', and propose offsets where residual impacts would occur. Offsets would be determined in accordance with the NSW Biodiversity Offsets Policy for Major Projects (NSW Office and Environment and Heritage, 2014b).	Refer to Section 8, Section 10 and Section 12. The NSW Biodiversity Offsets Scheme (Office and Environment and Heritage, 2017b) replaced the NSW Biodiversity Offsets Policy for Major Projects (NSW Office and Environment and Heritage, 2014b), and therefore has been applied.

1.4 Key terms used in this report

The following areas are discussed throughout the technical paper which aligns with terminology of the Biodiversity Assessment Method (BAM) are defined as:

- **Development site:** this area includes all areas to be directly impacted by above ground features of Stage 1 including the locations of any enabling works, construction sites, and the civil works at the stabling and maintenance facility (see Figure 1-1). The development site is also known as the 'subject land' in the BAM. For the purposes of this BDAR, the term *development site* is used. The Stage 1 construction sites are the development sites for the purposes of the BDAR which are described in Chapter 9 (Stage 1 description) of the Environmental Impact Statement.
- **Study area:** the study area is much larger than the development site and includes the development site and surrounding area within a 50 metre buffer (see Figure 2-1) that may be subject to surface indirect impacts, as well as areas that may be subject to potential groundwater drawdown. The study area also includes the area above and adjacent to the Stage 1 tunnel alignment (the alignment) including a 50 metre buffer for the land above the alignment.
- **Locality:** This is defined as the area within a 10 kilometre radius surrounding the development site

- **Bioregion:** The study area is located in the Sydney Basin bioregion, with the majority located within the Cumberland subregion (Thackway and Cresswell, 1995). The eastern extent of the study area from approximately William Street Five Dock to The Bays is located in the Pittwater subregion (Thackway and Cresswell, 1995).
- **1,500 metre landscape buffer:** The assessment area surrounding the development site (or subject land) includes the area of land in the 1,500 metre landscape buffer around the development site. The study area is situated within the 1,500 metre landscape buffer. The landscape buffer is an assessment area used to identify landscape features surrounding the development site to provide site context and to inform the likely habitat suitability of the development site.

1.5 Authors

The work to prepare this BDAR was undertaken by appropriately qualified and experienced ecologists as outlined in Table 1-3.

Table 1-3 : Personnel, role and qualifications

Name	Role	Qualifications
Lukas Clews	Associate Ecologist – Technical lead, Vegetation Integrity Surveys and targeted plant searches, reporting, GIS analysis	Master of Scientific Studies Graduate Certificate in Applied Science Bachelor of Science Diploma in Conservation and Land Management Certified Environmental Practitioner (CEnvP) by the Environment Institute of Australia and New Zealand (EIANZ) Accredited under section 6.10 of the <i>Biodiversity Conservation Act 2016</i> as a Biodiversity Assessment Method Assessor (No. BAAS17060)
Paul Rossington	Senior Ecologist – Vegetation Integrity Surveys and targeted plant searches, reporting, technical review	Master of Wildlife Management Bachelor of Science (Biology) Accredited under section 6.10 of the <i>Biodiversity Conservation Act 2016</i> as a Biodiversity Assessment Method Assessor (No. BAAS18065)
Tim Maher	Ecologist – Field surveys and reporting	Bachelor of Advanced Science (Biology) Master of Research (Plant Ecology)
Chris Thomson	Principal Ecologist – Technical review	Graduate Certificate in Natural Resources Bachelor of Applied Science (Environmental Management) Accredited under section 6.10 of the <i>Biodiversity Conservation Act 2016</i> as a Biodiversity Assessment Method Assessor (No. BAAS18058)

2. Methodology

This section documents the methodology applied in the preparation of the BDAR. The BDAR was prepared in accordance with the the *Biodiversity Assessment Method* (Office of Environment and Heritage, 2017) and guidance provided in the *Biodiversity Assessment Method Operation Manual Stage 1* (State of NSW and Office of Environment and Heritage, 2018) and *Biodiversity Assessment Method Operation Manual Stage 2* (State of NSW and Department of Planning Industry and Environment, 2019). Further detail on the methodology for aquatic environments is provided in Section 6.

2.1 Study area

As defined in Section 1.4, the study area includes the development site, and areas above and adjacent to the alignment with a 50 metre buffer applied to capture areas around the development sites and alignment that may be subject to indirect impacts from activities at the surface. Areas that may be subject to potential groundwater drawdown are also included in the study area (see Figure 2-1). Utilities such as power would need to be supplied to each of the construction sites. These would be located within existing road reserves, so no biodiversity impacts are predicted. The study area is located in the local government areas (LGAs) of Cumberland, City of Parramatta, Strathfield, Canada Bay, Burwood, and Inner West.

2.2 Background research and data sources

A background review of existing information was carried out to identify the existing environment within a nominal search area of 10 kilometres surrounding the development site. The review focussed on database searches, relevant ecological reports pertaining to the development site (where publicly available) and relevant GIS layers. The review was used to prepare a list of plant community types (PCTs), threatened species, populations and communities as well as important habitat for migratory species with a likelihood of occurrence in the survey area and locality. The searches were also carried out to identify if any Areas of Outstanding Biodiversity Value were present.

The following databases were searched or viewed:

- BioNet – the website for the Atlas of NSW Wildlife and Threatened Species Data Collection (searched April 2019)
- NSW Department of Primary Industries (DPI) freshwater threatened species distribution maps (viewed December 2019)
- The federal Department of the Environment and Energy's Protected Matters Search Tool (PMST) (searched December 2019) (refer to Appendix F)
- BioNet NSW Vegetation Classification database (viewed December 2019)
- Atlas of Living Australia (viewed December 2019)
- The federal Bureau of Meteorology's Atlas of Groundwater Dependent Ecosystems (GDE) (viewed December 2019)
- Department of the Environment and Energy's directory of important wetlands (viewed December 2019).

Regional vegetation mapping, geology and soil mapping projects were reviewed including:

- *The Native Vegetation of the Sydney Metropolitan Area – Version 3.1* (State Government of NSW and Office of Environment and Heritage, 2016)
- *Southeast NSW Native Vegetation Classification and Mapping – SCIVI* (State Government of NSW and Office of Environment and Heritage (OEH), 2010)
- *Penrith 1:100 000 Geological Sheet 9030* (Clarke and Jones, 1991)
- *Soil landscapes of the Penrith 1:100,000 Sheet 9030* (Hazelton et al., 1989)
- *Sydney 1:100 000 Geological Sheet 9130* (Herbert, 1983)
- *Soil landscapes of the Sydney 1:100,000 Sheet* (Chapman and Murphy, 1989)
- *Australian Soil Classification (ASC) Soil Type map of NSW* (State Government of NSW and Office of Environment and Heritage (OEH), 2012).

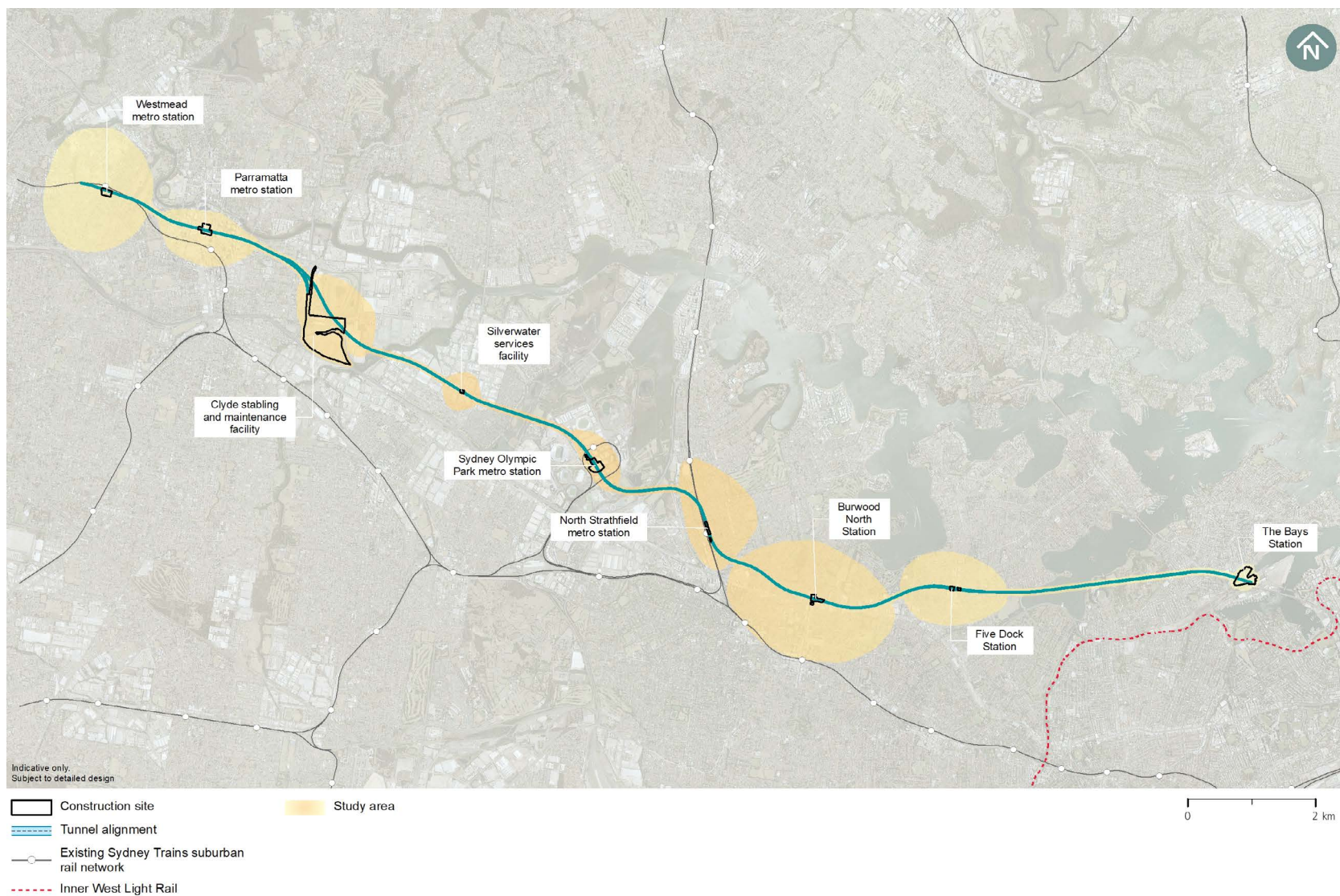


Figure 2-1: Study area

Preliminary and provisional determinations to list species and ecological communities as threatened under the BC Act were viewed from the NSW Threatened Species Scientific Committee web resources. At the time of writing, there are no preliminary or provisional listings of relevance to Stage 1. The annual Final Priority Assessment List of nominated species and ecological communities that have been approved for assessment by the Minister responsible for the EPBC Act was reviewed.

The ecological assessment for the *Clyde Terminal Conversion Environmental Impact Statement* (AECOM Australia Pty Ltd, 2013), the BDAR for the Viva Energy Clyde Western Area Remediation Project (Biosis, 2018) and the Biodiversity Assessment Report for the Parramatta Light Rail (Stage 1) project (WSP, 2017) were also reviewed. The relevant data from these assessments have been used to supplement the work carried out for this BDAR.

2.3 Mapping extent of native vegetation cover

The extent of native vegetation in the development site was ground-truthed and mapped using up to date aerial imagery. Polygons were digitised in a GIS (ArcGIS 10.5) at a scale of between 1:1,000 and 1:5,000. The vegetation extent within the development site has been mapped as accurately as possible although some boundary errors may still exist.

To assess per cent of current extent of native vegetation, a landscape buffer of 1,500 metres was placed around the boundary of the development site in order to capture all Stage 1 features (alignment and site-based surface features).

2.3.1 Definition of native vegetation

Under the BAM, native vegetation has the same meaning as in section 1.6 of the BC Act which states that native vegetation and clearing native vegetation have the same meanings as in Part 5A of the *Local Land Services Act 2013*. Part 5A 60B of the *Local Land Services Act 2013* defines the meaning of native vegetation as any of the following types of plants native to New South Wales:

- a) trees (including any sapling or shrub or any scrub)
- b) understorey plants
- 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. This includes planted vegetation. Importantly for Stage 1, for the purposes of the *Local Land Services Act 2013*, 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). A declaration under section 14.7 of the BC Act that specified vegetation is or is not marine vegetation also has effect for the purposes of this Part.

2.4 Plant community type identification

The type and distribution of PCTs within the Stage 1 development site were identified and mapped progressively during the field surveys. The identification of PCTs presented here in this BDAR is according to the NSW PCT classification as described in the BioNet Vegetation Classification database. Each PCT was assigned to the relevant corresponding Threatened Ecological Community (TEC) where applicable. A plot-based floristic vegetation survey as described in section 5.2 of the BAM was carried out in areas where the vegetation was of sufficient size and shape to allow for plots to be completed. In other areas, rapid plotless vegetation assessments were carried out where natural vegetation did not occur to identify street trees and habitats. The field surveys were carried out over three days in January, March and June 2019.

2.4.1 Stratification of native vegetation into survey units

Using existing vegetation mapping, survey sites (plots/midlines) were established within each area of mapped vegetation to provide a representative assessment of the vegetation prior to the field survey. Plots were also positioned to provide a wide spatial coverage of the development site. Once the identification of PCTs had been finalised, each PCT was then divided into vegetation zones (an area of native vegetation that is the same PCT and has a similar broad condition state). The PCTs identified within the development site are described in detail in Section 4 of this BDAR.

The vegetation within the development site has been assigned to a PCT as listed in the BioNet Vegetation Classification database based on the observed plant species composition, vegetation structure, landscape position, and underlying geology and soils.

There is approximately 0.18 hectares of native vegetation assigned to PCTs within the development site.

2.4.2 Plot based floristic vegetation survey and Vegetation Integrity Assessment

A plot-based full floristic survey and Vegetation Integrity Assessment was carried out according to the BAM using a series of 20 x 20 metre plots (or equivalent 400 square metre area) nested inside a 20 x 50 metre plot (or equivalent 1,000 square metre area). In some situations, along narrow PCT patches, 10 x 40 metre floristic plots were used. The location of each plot/mid-line completed during the survey is illustrated in Figure 2-2. Plots/mid-lines were established to provide a representative assessment of the vegetation integrity of the vegetation zone, accounting for the level of variation in the broad condition state of the vegetation zone.

A summary of the survey effort completed in each vegetation zone is provided in Table 2-1. Three combined plot-based full floristic surveys and Vegetation Integrity Assessment plots were completed.

Table 2-1: Plant community types and vegetation zones identified in the development site

Vegetation zone	Plant community type ID No.	Plant community type name	Broad condition class	Vegetation zone area in development site (ha)	Minimum number of plots/mid-lines required	Number of plots/mid-lines completed
1	920	Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	Poor	0.15 (1,450 m ²)	1	2
2	849	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Poor	0.03 (277 m ²)	1	1

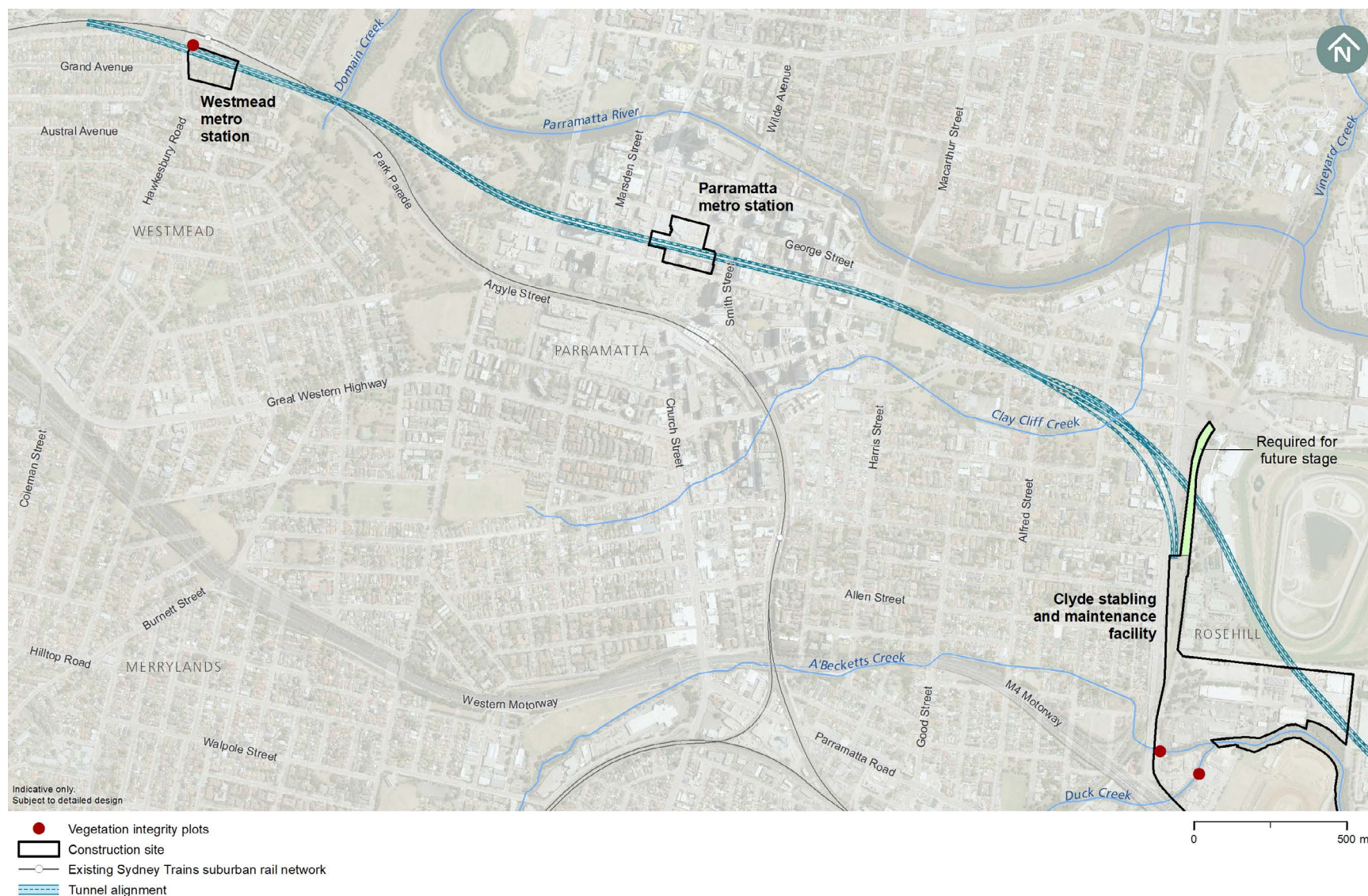


Figure 2-2: Location of plot based floristic vegetation survey and vegetation integrity assessments

2.5 Patch size

A patch is defined in the BAM as an area of intact native vegetation that occurs on the development site. The patch may extend onto adjoining land beyond the footprint of the development site, and for woody ecosystems, includes native vegetation separated by less than or equal to 100 metres from the next area of intact native vegetation. For non-woody vegetation, this gap is reduced to less than or equal to 30 metres. Patch size for each vegetation zone located on the development site was mapped in accordance with subsection 5.3.2 of the BAM using the following steps:

- Identify vegetation zones that will be included in the same patch
- Identify the boundary of any adjoining intact native vegetation which extends beyond the limit of the development site
- Digitise each patch in a GIS using separate polygons where multiple patches exist
- Calculate the area of each patch in hectares in a GIS.

The patch was then allocated to a patch size class (being less than five hectares, five to 24 hectares, 25 to 100 hectares and greater than 100 hectares). Patch size class is used as a filter in the Biodiversity Assessment Calculator to predict threatened species likely to occur or use habitat on the development site.

2.6 Threatened species habitat assessment – creating a candidate species list

Once the development site had been assessed for landscape context, and the PCTs present and vegetation integrity known, the list of candidate threatened species for assessment was developed. As outlined in section 6.4.1.3 of the BAM, the following criteria (a – f) were used to predict the threatened species that require assessment:

- a) The distribution of the species includes the IBRA subregion which the development site is, in the opinion of the assessor, mostly located within, and
- b) The development site is within any geographic constraints of the distribution of the species within the IBRA subregion, and
- c) The species is associated with any of the PCTs identified by the assessor under Chapter 5 as occurring within the development site, and
- d) The native vegetation cover within an assessment area 1,500 metres wide surrounding the boundary of the subject site as determined by the assessor in accordance with subsection 4.3.2 of the BAM is equal to or greater than the minimum class that is required for the species (unless the development is, or is part of, a linear shaped development), and
- e) The patch size which the vegetation zone is part of, as identified in subsection 5.3.2 of the BAM is equal to or greater than the minimum specified for that species, and
- f) The species is identified as an ecosystem or species credit species in the Threatened Biodiversity Data Collection.

A threatened species was predicted as requiring assessment if that species meets all the criteria (a to f) that are relevant to the species. The Biodiversity Assessment Calculator was used to derive the list of candidate species based on criteria a to f. If any one of the criteria (a to f) relevant to a species was not met, the development site was considered not to be suitable habitat for the threatened species and no further assessment was undertaken for that species.

The results of the BioNet search and the PMST search were also used to inform development of the candidate species list. Some species returned from the database searches (i.e. BioNet and the PMST) were removed from the assessment due to the absence of suitable habitat in the development site. The development site is highly

urbanised and lacks high quality natural habitats and species that are known to no longer occur in the Sydney urban area were removed from the assessment based on the lack of these habitat types from the development site.

The threatened species habitat suitability assessment is provided in Section 5 and Appendix A. The candidate list of threatened species for assessment is provided in Section 5.

2.7 Targeted threatened species surveys

After the candidate species list had been developed (see Section 5.3), targeted threatened species surveys were undertaken where possible. The surveys carried out for candidate threatened species of plants and animals are outlined in Section 2.7.1 and 2.7.2. The habitat assessment identified that there is limited habitat in the development site for most threatened species. Surveys were undertaken in January, March and June 2019.

2.7.1 Threatened plants

After the PCTs and finer scale habitats within the development site had been identified, and the threatened species habitat assessment had been undertaken, threatened plant surveys were undertaken (refer to Table 2-2). The threatened flora surveys were guided by the methodology and effort as outlined in the NSW Guide to Surveying Threatened Plants (Office of Environment and Heritage, 2016).

Where possible, transects were walked through the habitats within the development site at 10 metre spacing. Habitats directly adjacent to the development site were also surveyed where possible to provide context for consideration of any potential indirect and/or off-site impacts.

Table 2-2: Summary of survey effort for threatened plant species (V = Vulnerable species, E = Endangered species)

Species name	Common name	EPBC Act	BC Act	Required survey period	Survey completed
<i>Acacia pubescens</i>	Downy Wattle	V	V	All year	Surveys completed in January, March and July 2019.
<i>Cynanchum elegans</i>	White-flowered Wax Plant	E	E	All year	Surveys completed in January, March and July 2019.
<i>Dillwynia tenuifolia</i>	Dillwynia tenuifolia	-	V	All year	Surveys completed in January, March and July 2019. However, species can be identified year-round.
<i>Grevillea juniperina</i> subsp. <i>juniperina</i>	Juniper-leaved Grevillea	-	V	All year	Surveys completed in January, March and July 2019.
<i>Haloragis exalata</i> subsp. <i>exalata</i>	Square Raspwort	V	V	All year	Surveys completed in January, March and July 2019.

Species name	Common name	EPBC Act	BC Act	Required survey period	Survey completed
<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> - endangered population	Marsdenia viridiflora R. Br. subsp. viridiflora population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	-	EP	All year	Surveys completed in January, March and July 2019.
<i>Pultenaea pedunculata</i>	Matted Bush-pea	-	V	September, October, November	Surveys completed in January, March and July 2019. However, species can be identified year-round.
<i>Wilsonia backhousei</i>	Narrow-leaved Wilsonia	-	V	All year	Surveys completed in January, March and July 2019.

2.7.2 Threatened animals

Targeted threatened species surveys were not undertaken for animals. The habitat assessment identified that there is limited habitat in the development site for most threatened species. However, where suitable habitat for a threatened species was found to be present, the species was assumed to be present.

2.8 Survey limitations

The desktop assessment and field survey carried out for this BDAR provides a limited view into the ecological values of the development site. The diversity of flora and fauna species recorded from this study should not be seen to be comprehensive. It is unlikely that every species present within the development site has been recorded. The field survey aimed to sample the development site and a comprehensive inventory of species was not made. A period of several seasons or years is often needed to identify all the species present in an area, especially as some species are only apparent at certain times of the year (e.g. orchids or migratory birds) and require specific weather conditions for optimum detection (e.g. breeding and flowering periods). The conclusions of this report are therefore based upon available data and are indicative of the environmental condition of the development site at the time of the survey. Site conditions, including the presence of threatened species, can change with time. To address this limitation, the assessment has aimed to identify the presence and suitability of the habitat for threatened species.

The vegetation within the development site has been assigned to the most likely PCT as they are described in the BioNet Vegetation Classification database. In many cases there are no sharp boundaries defining the transition between PCTs, so the mapping provided in this BDAR is supported by on ground floristic surveys and observations of potential ecotones. Plant communities are naturally variable and the boundaries between different PCTs on this site overlap considerably with a gradual transition from one community to another. However, a choice must be made to map and assign a PCT to an area of the site. As mapping necessitates that a hard boundary is drawn to separate PCTs, boundaries of PCTs and vegetation zones have been mapped as best as possible based on observations made during the field survey and based on patterns observed on aerial

photography. It is likely that the boundaries of PCTs and vegetation zones will change with time and in response to long-term variation in biophysical conditions on the site such as rainfall and surface drainage patterns.

Access to private property during the survey periods was limited and as such the entirety of all the development sites were not able to be surveyed. Safe access to some areas was not available.

3. Landscape features

3.1 IBRA Bioregions and sub-regions

The development site is located in the Sydney Basin bioregion, with the majority located within the Cumberland subregion (Thackway and Cresswell, 1995). The eastern extent of the development site from approximately William Street, Five Dock to The Bays is located in the Pittwater subregion (Thackway and Cresswell, 1995) (see Figure 3-1 and 3-2).

3.2 BioNet NSW Landscapes

Stage 1 crosses two landscapes as mapped by the NSW National Parks and Wildlife Service (NPWS) (2002) and described by the then NSW Department of Environment and Climate Change (2001) as follows from west to east:

- Ashfield Plains – Undulating hills and valleys on horizontal Triassic shale and siltstone, occasional quartz sandstones especially near the margin of the Port Jackson landscape. General elevation 0 to 45 metres, local relief less than 20 metres. Coastal extension of the Cumberland Plain landscape. Red and brown texture-contrast soils on crests grading to yellow harsh texture-contrast soils in valleys. Open forest of broad-leaved ironbark (*Eucalyptus fibrosa* ssp. *fibrosa*), grey box (*Eucalyptus moluccana*), with tea-tree (*Leptospermum* sp.) along creeks and forests of turpentine (*Syncarpia glomulifera*), red mahogany (*Eucalyptus resinifera*), grey gum (*Eucalyptus punctata*), Sydney blue gum (*Eucalyptus saligna*) and blackbutt (*Eucalyptus pilularis*) with a grassy understorey of kangaroo grass (*Themeda triandra*) on moister sites.
- Port Jackson Basin – Deep elongated harbour with steep cliffed margins on horizontal Triassic quartz sandstone. Small pocket beaches and more extensive Quaternary estuary fill of muddy sand at the head of most tributary streams. General elevation 0 to 80 metres, local relief 10 to 50 metres. Sandstone slopes and cliffs have patches of uniform or gradational sandy soil on narrow benches and within joint crevices that support forest and woodland of Sydney peppermint (*Eucalyptus piperita*), smooth-barked apple (*Angophora costata*), red bloodwood (*Corymbia gummifera*) and blackbutt (*Eucalyptus pilularis*). Sheltered gullies contain some turpentine (*Syncarpia glomulifera*), coachwood (*Ceratopetalum apetalum*) and water gum (*Tristanopsis laurina*). Estuarine sands were originally dominated by saltmarsh but have been taken over by grey mangrove (*Avicennia marina*) in the past century.

3.3 Rivers, streams and estuaries

The development site is located entirely within the Sydney Metro catchment (Port Jackson). The tunnel alignment would pass beneath Domain Creek, Clay Cliff Creek, Duck River, Haslams Creek, Saleyards Creek, Powells Creek and Iron Cove. As part of Stage 1, structures would be built within and over A'Becketts Creek and Duck Creek. Other waterways in the 1,500 metre landscape buffer include Coopers Creek, Toongabbie Creek, Finlaysons Creek, Parramatta River, Darling Mills Creek, Vineyard Creek, Subiaco Creek, Saltwater Creek, St Lukes Canal, Iron Cove Creek, Hawthorne Canal, Whites Creek, Johnstons Creek and a number of unnamed tributaries and canals (see Figure 3-1 and Figure 3-2).

The 1,500 metre landscape buffer includes the upper reaches of the Parramatta River estuary, Homebush Bay, Exile Bay, Canada Bay, Kings Bay, Hen and Chicken Bay, Iron Cove, Rozelle Bay, Johnstons Bay, White Bay and Elizabeth Macarthur Bay (see Figure 3-1 and Figure 3-2).

3.4 Wetlands

The 1,500 metre landscape buffer contains several wetlands, some of which are known to be regularly used by migratory bird species and threatened species (see Figure 3-1 (Map 1 to Map 5) and Figure 3-2 (Map 1 to Map 9)). Of these wetlands, Mason Park wetlands adjacent to Powells Creek, Bicentennial Park wetlands, Newington Wetlands, the Brickpit at Sydney Olympic Park, Haslams Creek, and wetlands off Duck River including the Clyde Wetland are the most important. Mapped areas of wetlands listed under State Environmental Planning Policy (Coastal Management) 2018 are present within 200 metres of the study area which includes vegetation along Duck River and Mason Park wetlands.

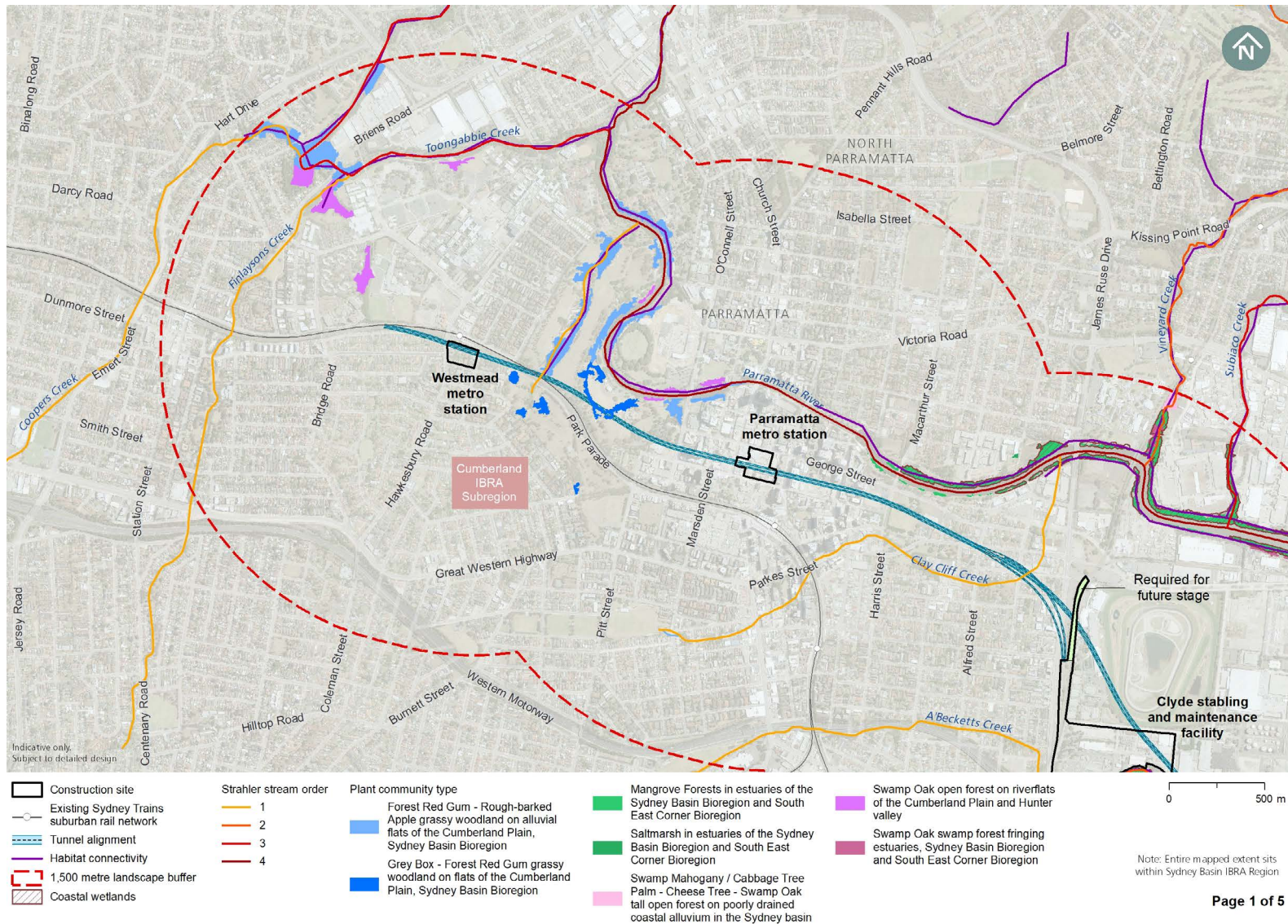


Figure 3-1: Location map – Map 1

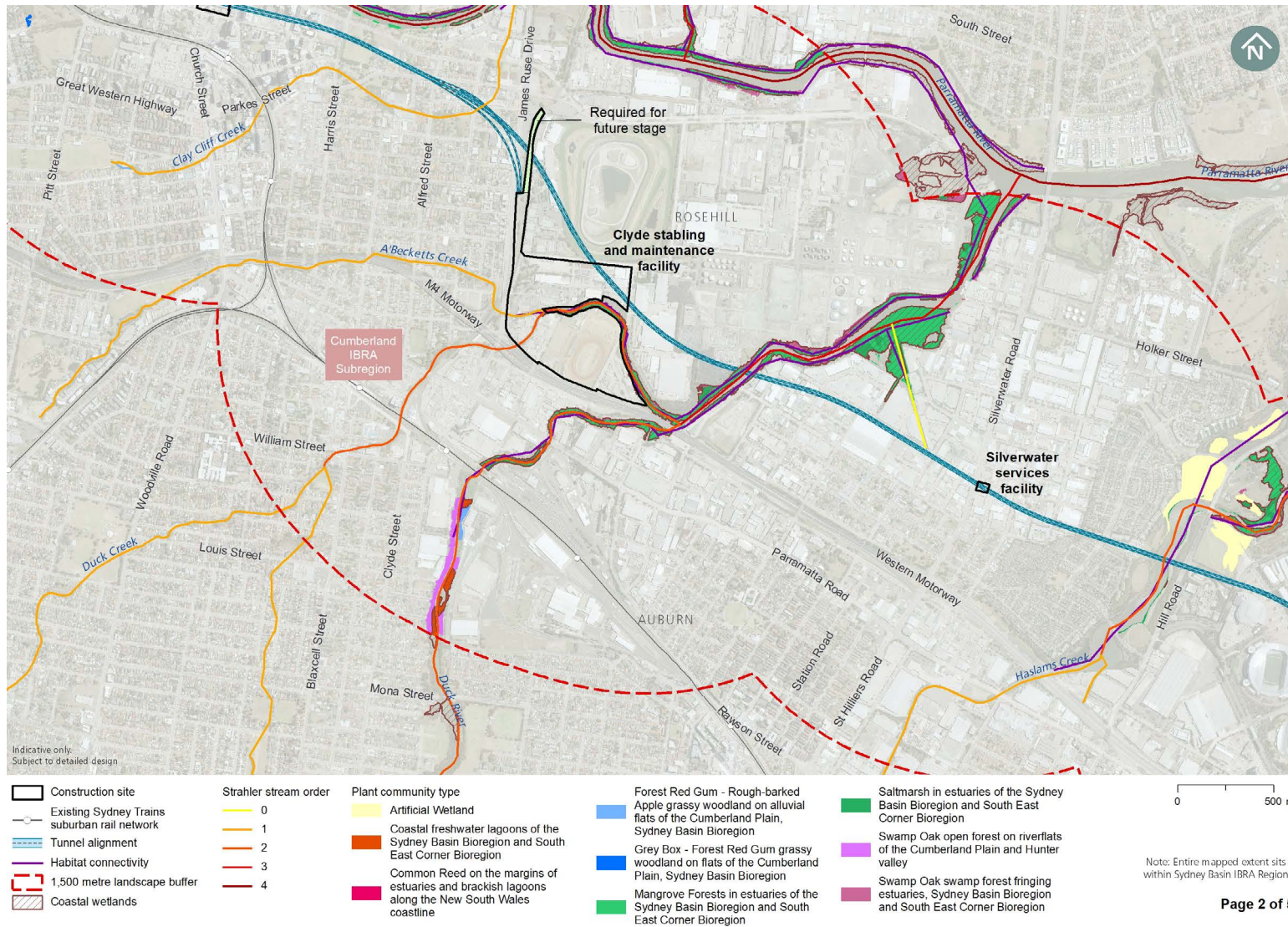


Figure 3-1: Location map – Map 2

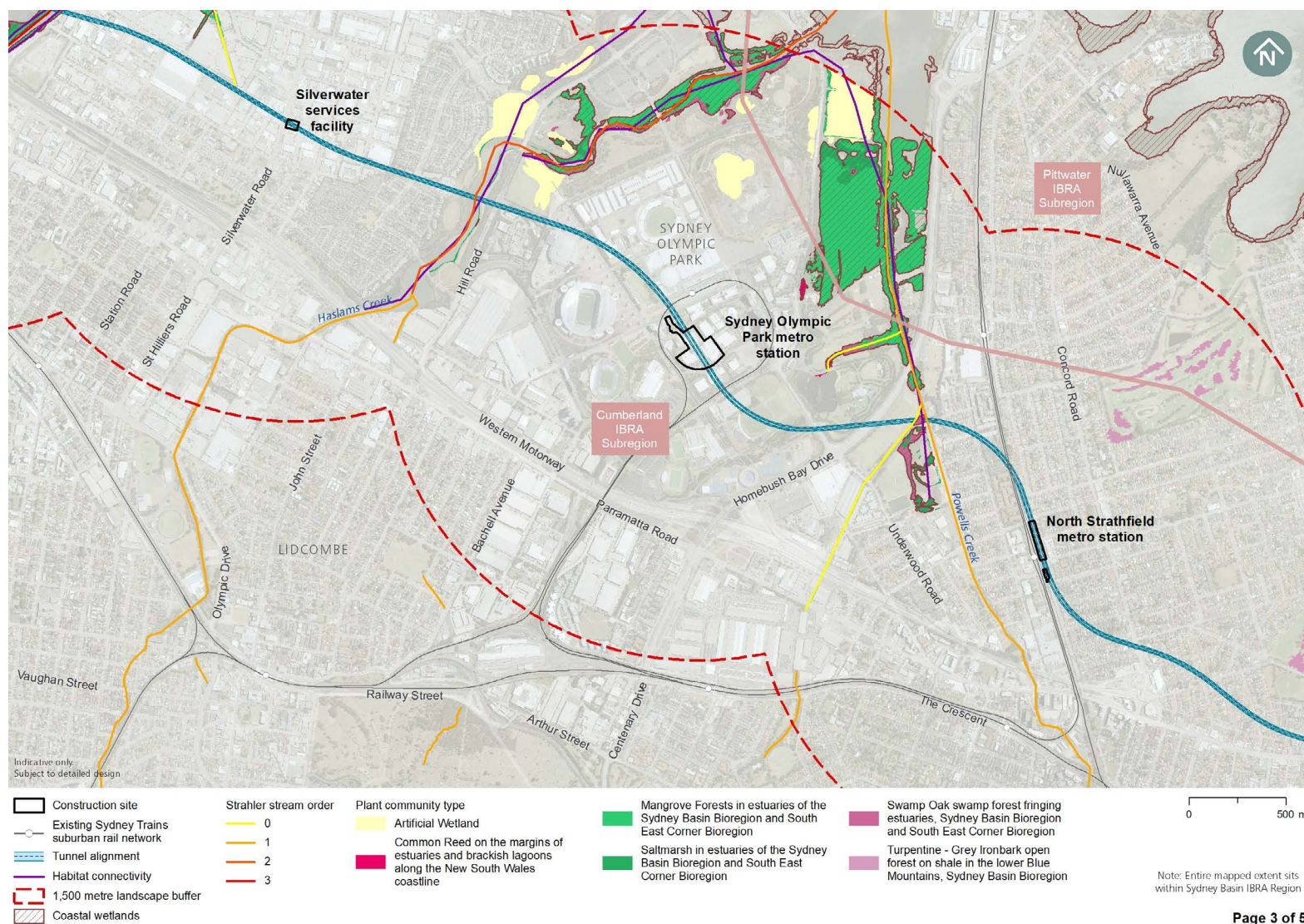


Figure 3-1: Location map – Map 3

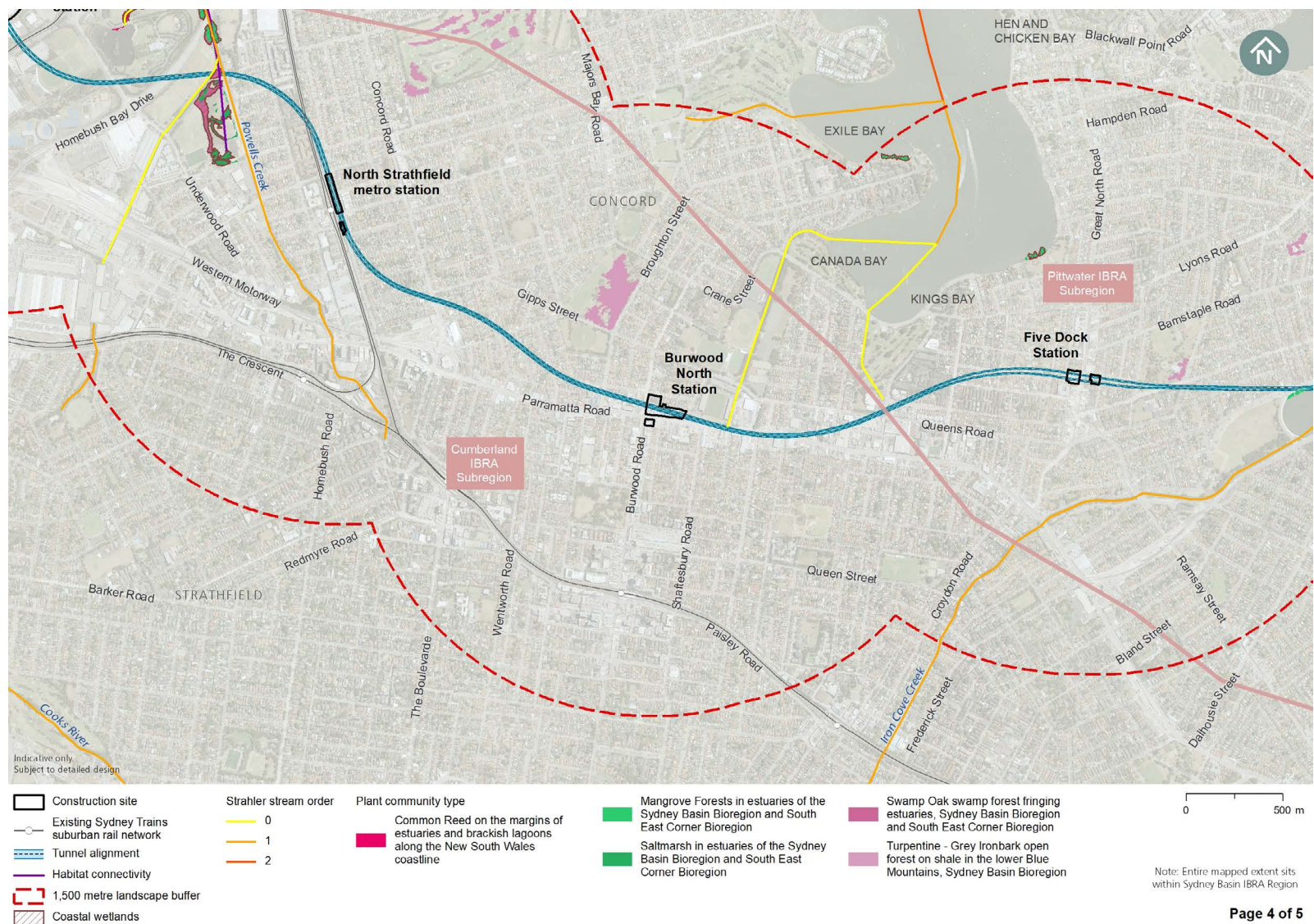


Figure 3-1: Location map – Map 4

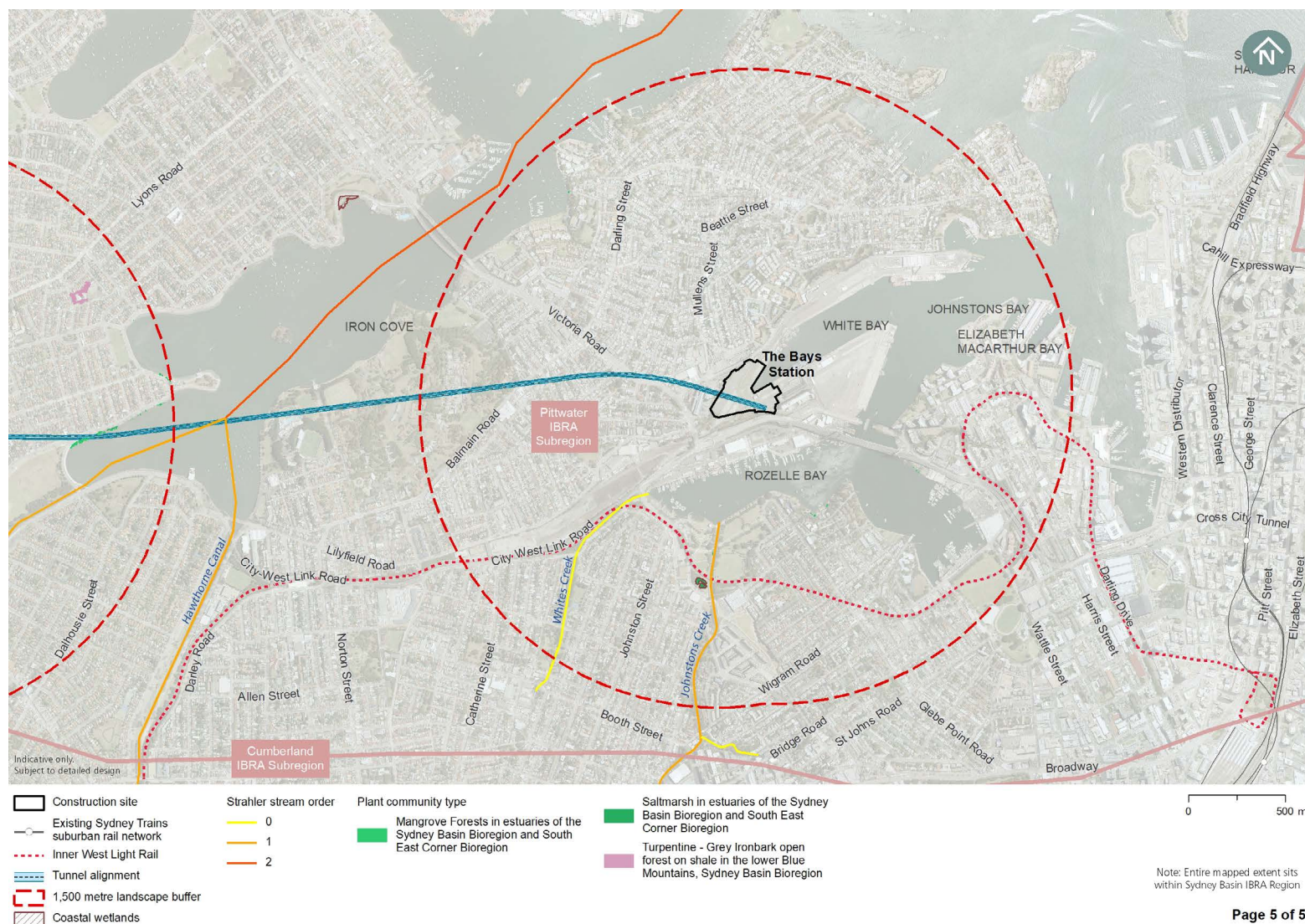
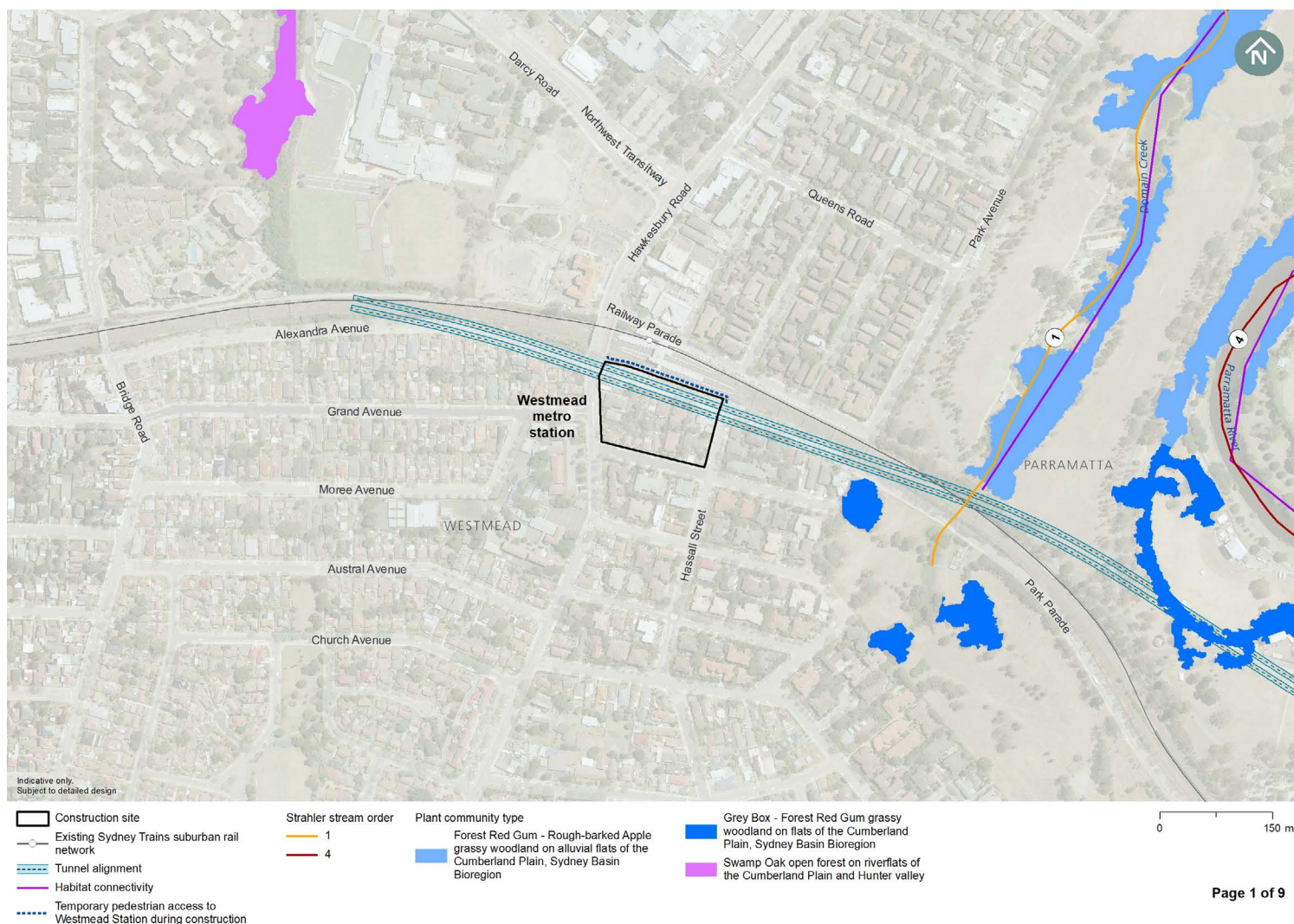


Figure 3-1: Location map – Map 5



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Figure 3-2: Site map – Map 1

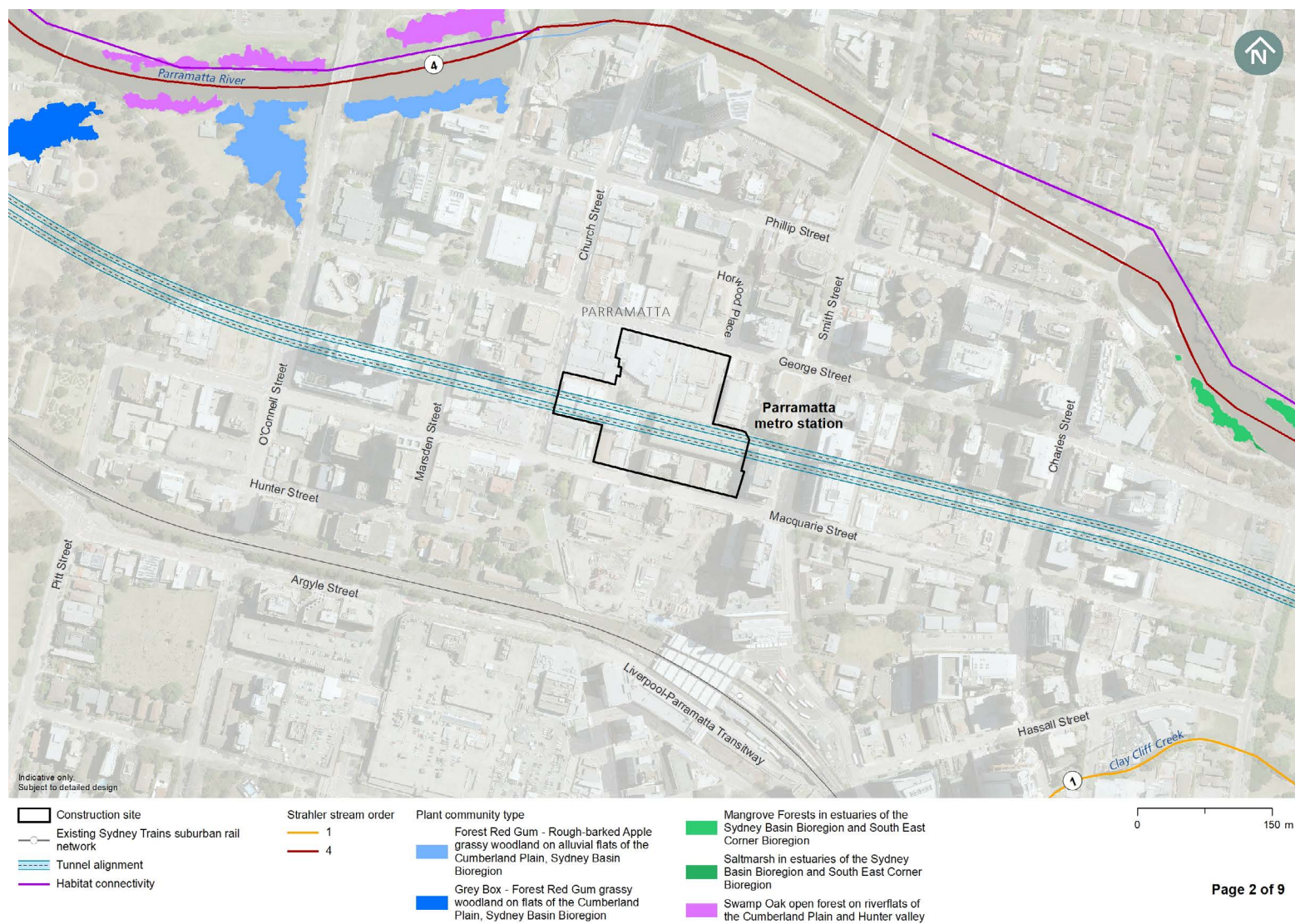


Figure 3-2: Site map – Map 2

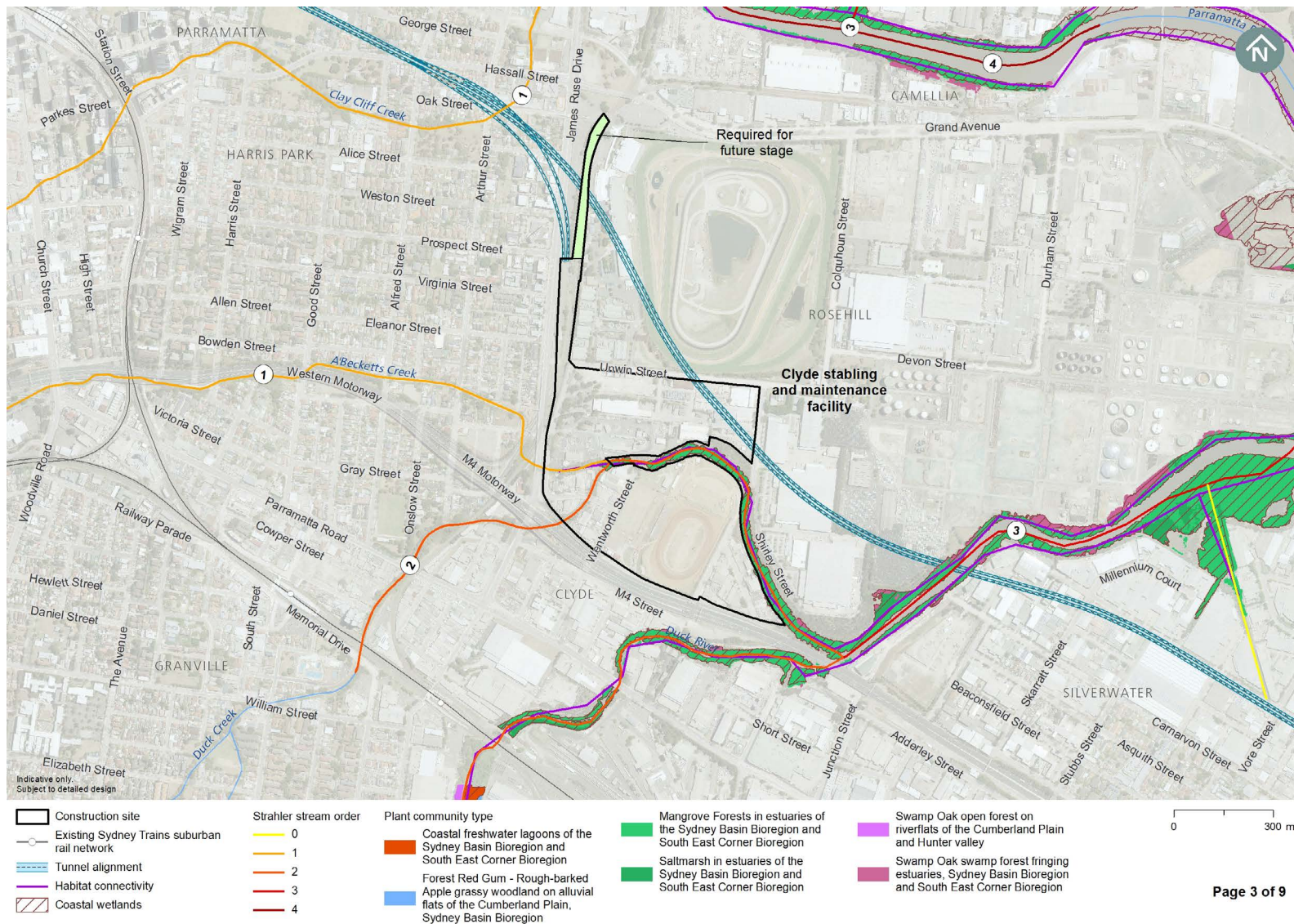


Figure 3-2: Site map – Map 3

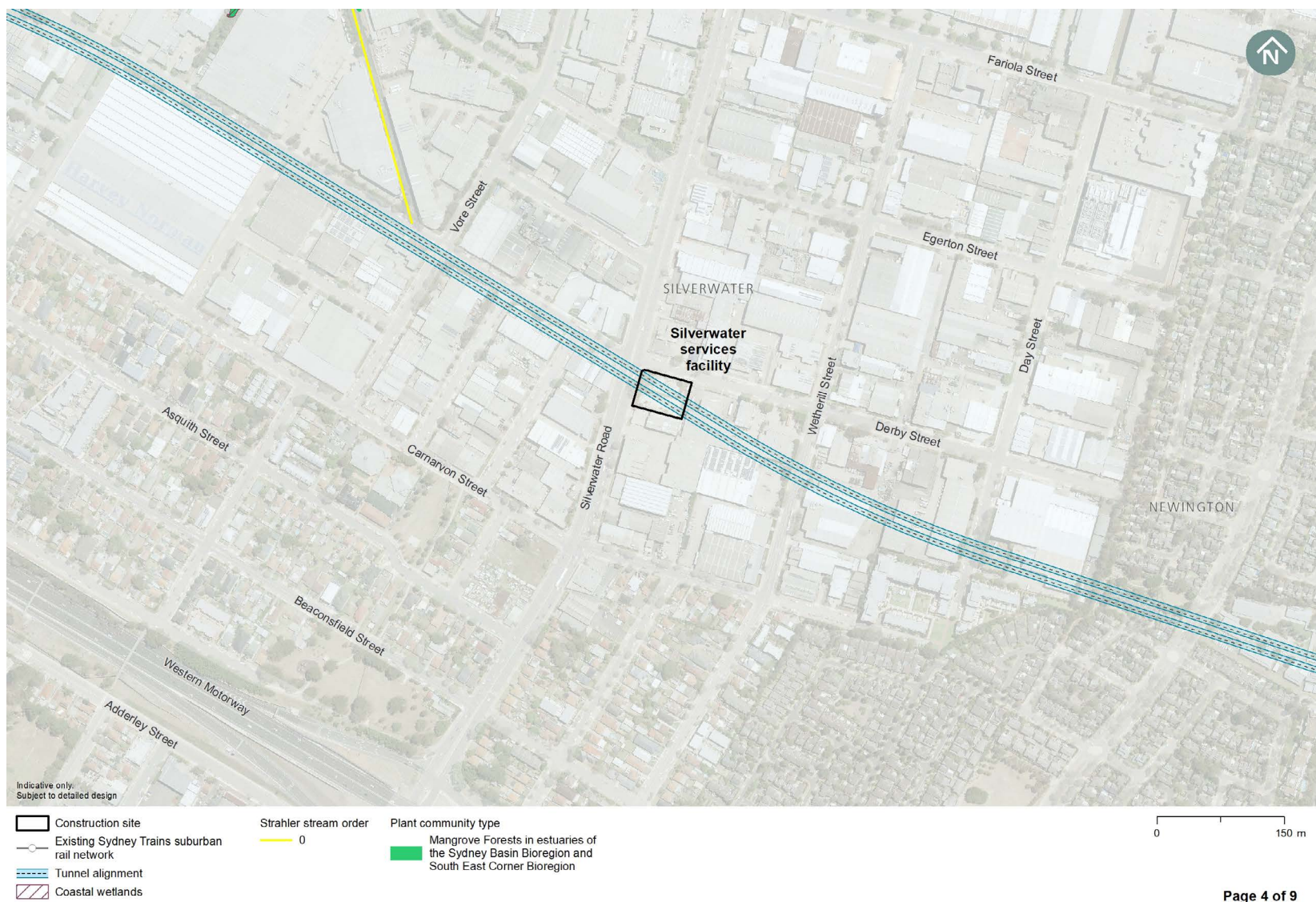


Figure 3-2: Site map – Map 4

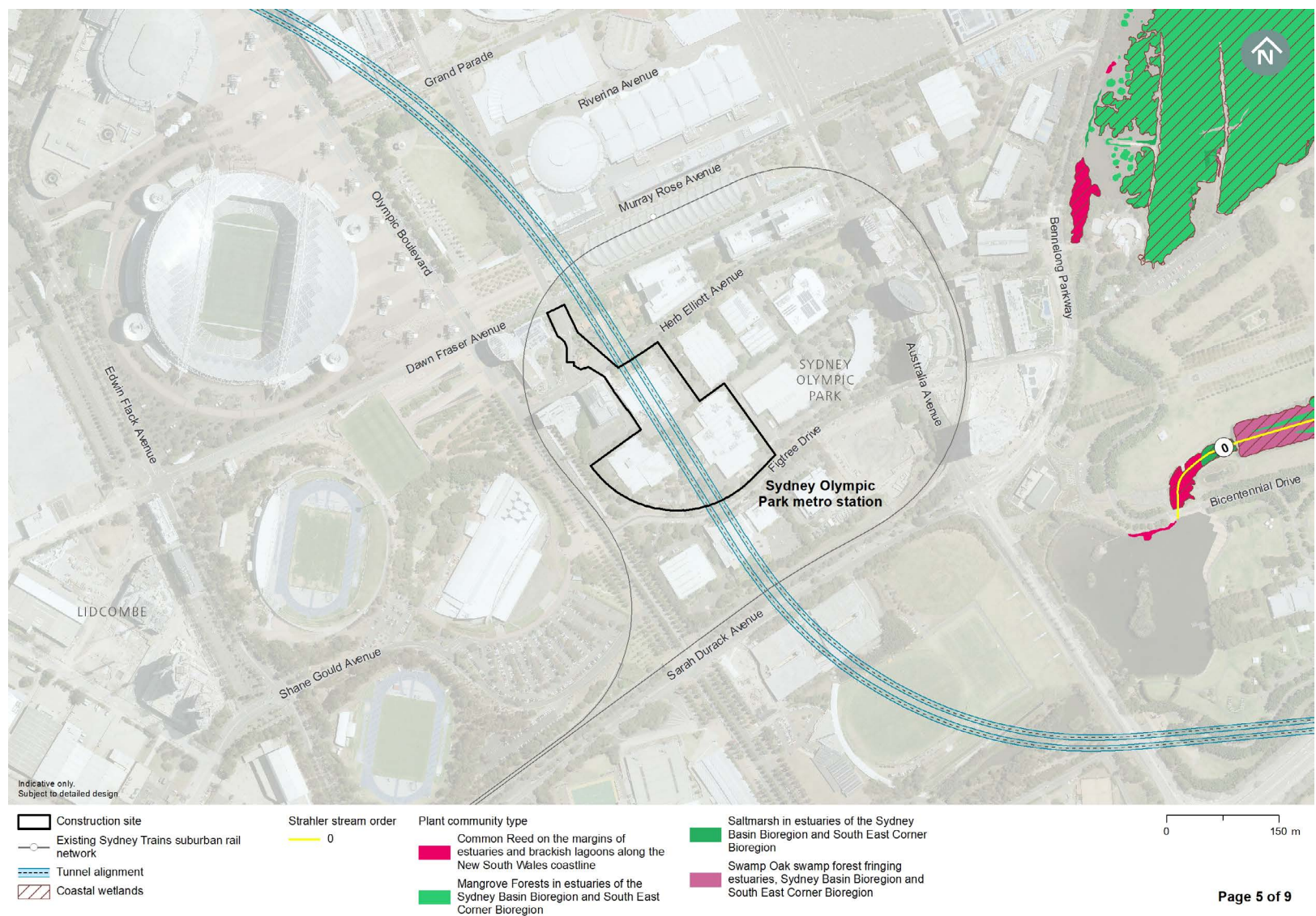
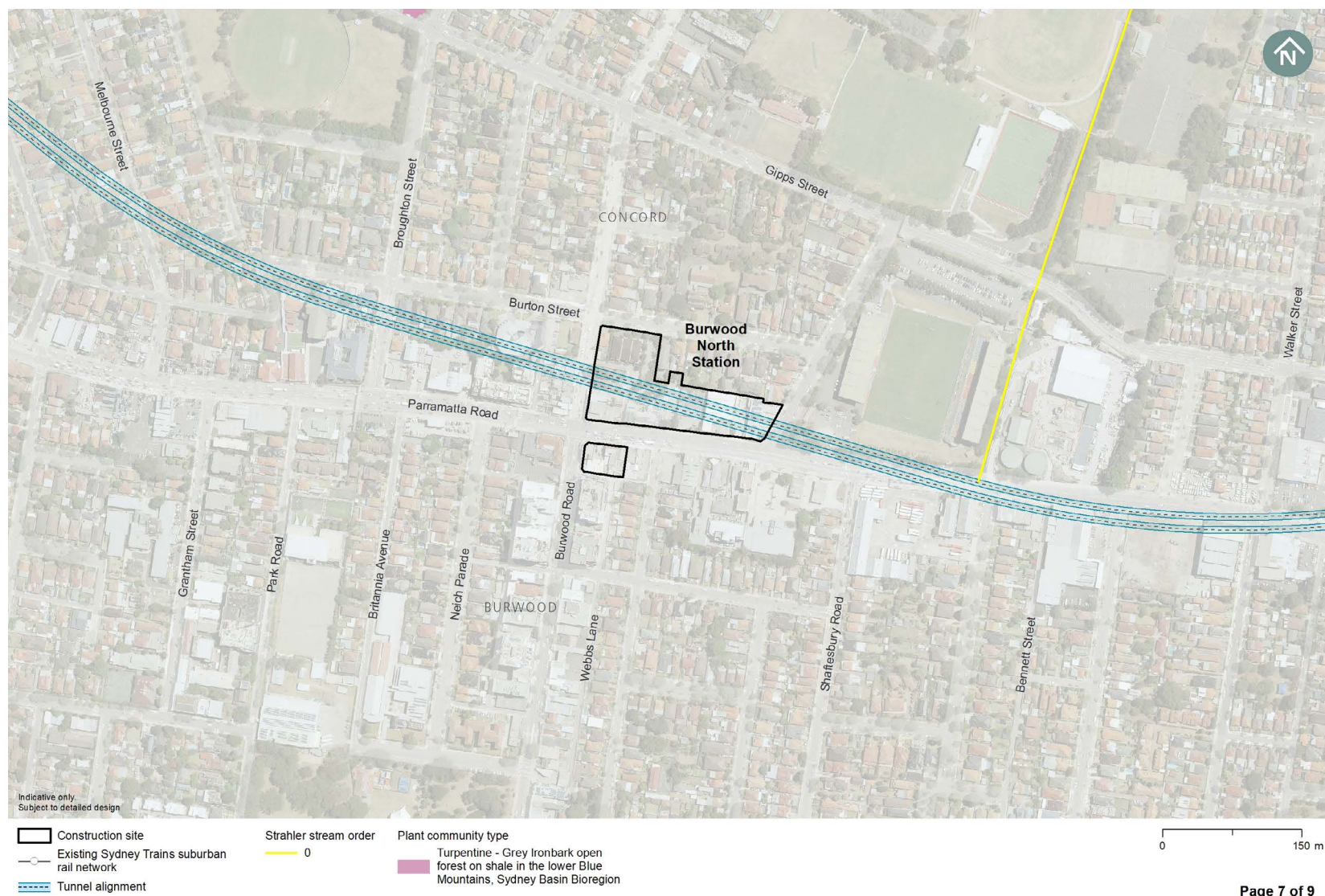


Figure 3-2: Site map – Map 5



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Figure 3-2: Site map – Map 6



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Figure 3-2: Site map – Map 7

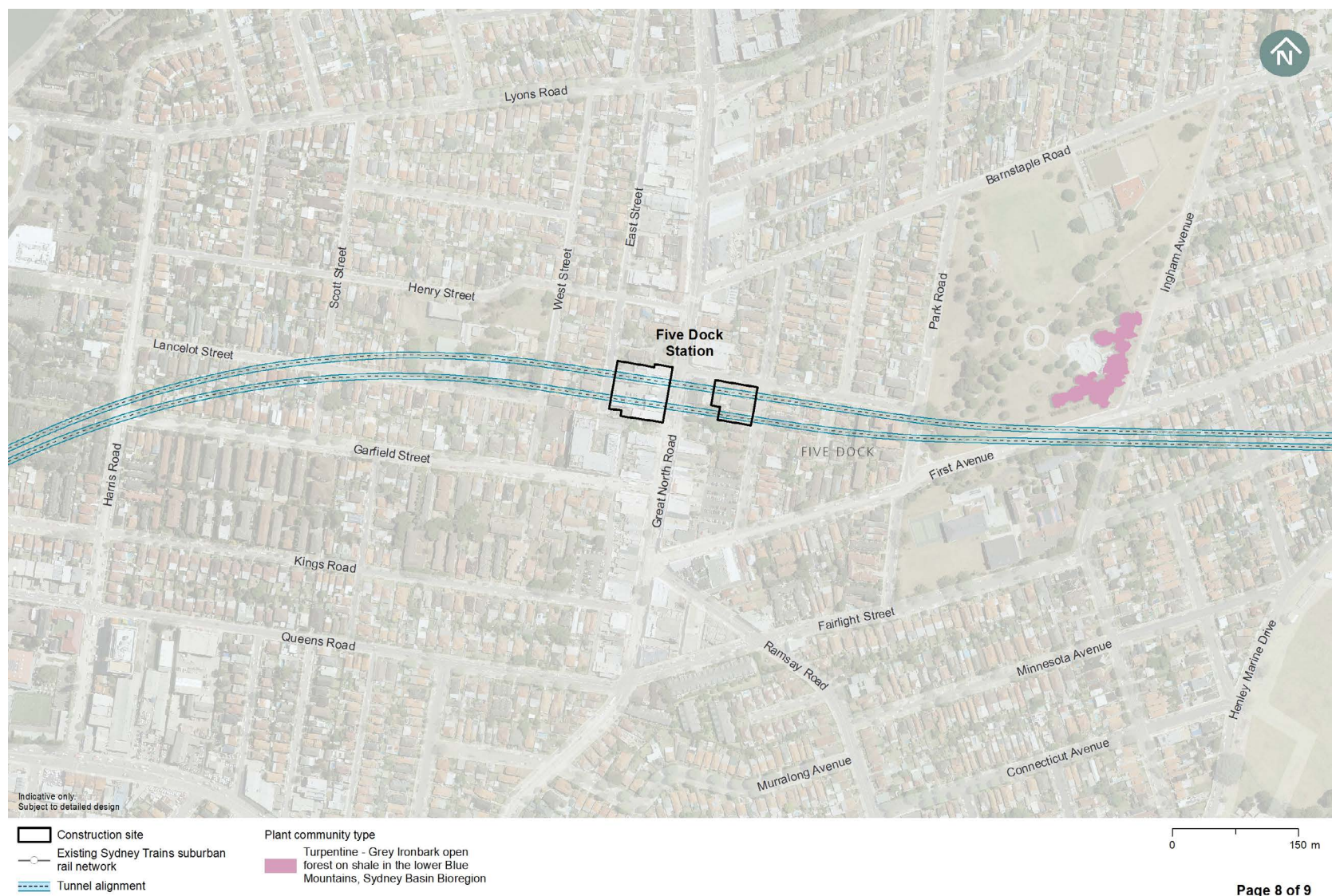


Figure 3-2: Site map – Map 8

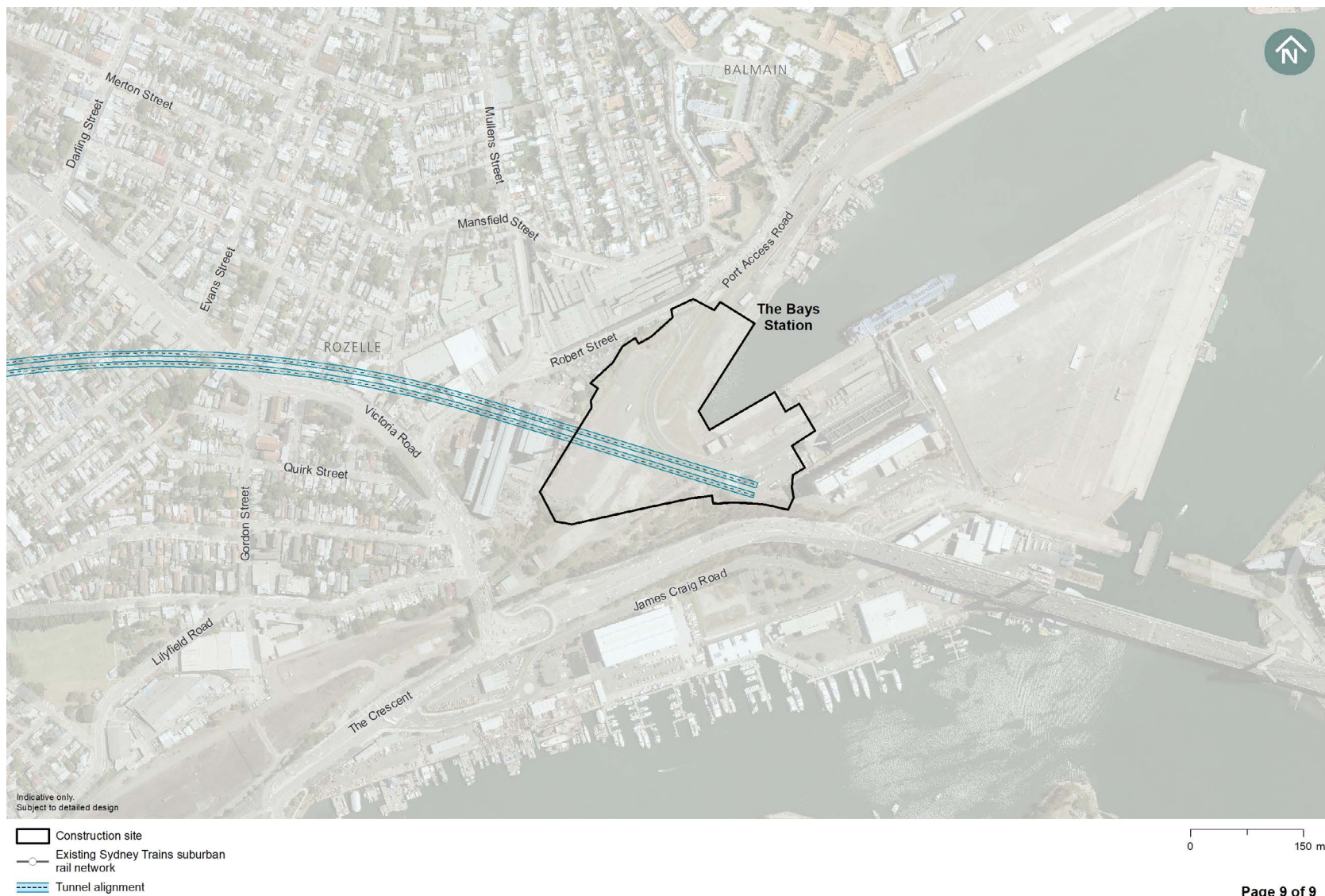


Figure 3-2: Site map – Map 9

3.5 Connectivity of habitat

According to the BAM, for development sites, the assessor must identify the connectivity of different areas of habitat that may facilitate the movement of threatened species across their range. The habitat within the development site has a low degree of connectivity to other areas of habitat due to the impacts of urbanisation. The habitats that do remain within the 1,500 metre landscape buffer, and beyond are generally small isolated fragments within the urban matrix of residential, commercial and industrial development.

The riparian habitats form the most obvious habitat corridors within the 1,500 metre landscape buffer, particularly vegetation along Duck River. There is a broken corridor of habitat that connects Coopers Creek and Toongabbie Creek to Darling Mills Creek and eventually the Parramatta River. This corridor is located in the north-western portion of the 1,500 metre landscape buffer, but is not within the development site. The corridor then follows Duck River south and it forks at Rosehill / Clyde into Duck Creek and A'Becketts Creek where physical connectivity is broken by roadways at Kay Street, the M4 Motorway, Unwin Street and James Ruse Drive. The wide tidal channel of Duck River is a barrier to connectivity for most terrestrial species. Parts of the development site contains a section of Duck Creek and A'Becketts Creek and the tunnel would pass beneath Duck River. The tunnel would also pass beneath Haslams Creek which provides a north south corridor linking the Parramatta River to the vegetation along the M4 Motorway. Haslams Creek is linked to Powells Creek forming a wetland corridor. The tunnel would pass beneath Powells Creek.

The patchwork of planted trees and gardens surrounding the development site allows for some landscape permeability for mobile species such as bats and birds that can exploit the resources available in urban areas.

3.6 Areas of geological significance and soil hazard features

Areas of geological significance generally include karst, caves, crevices and cliffs. There are no areas of geological significance within or adjacent to the development site.

3.7 Areas of outstanding biodiversity value

Areas of declared critical habitat that were listed under the now repealed *Threatened Species Conservation Act 1995* have become the first declared areas of outstanding biodiversity value in NSW with the commencement of the BC Act. To date, there are only four declared areas of outstanding biodiversity value and these areas are not located in or near the development site.

The proposed development site does not contain any areas of outstanding biodiversity value listed on the register of declared areas of outstanding biodiversity value.

3.8 Native vegetation extent

To assess per cent current extent of native vegetation, a buffer of 1,500 metres was placed around the boundary of the development site. While the tunnels are a linear underground feature, the development site contains individual site-based surface features located at each of the construction sites. As such, a 500 metre buffer from the centre line of the alignment would not be appropriate to capture all Stage 1 features. Therefore, the 1,500 metre landscape buffer around all individual site-based surface features located at each of the construction sites was chosen. Native over-storey vegetation was derived from the polygons in *The Native Vegetation of the Sydney Metropolitan Area – Version 3* (State Government of NSW and Office of Environment and Heritage, 2016). This layer was clipped to the 1,500 metre landscape buffer and edited to show only areas of native vegetation. Obviously cleared areas were excluded from the mapping.

The 1,500 metre landscape buffer is approximately 6,200 hectares in size. There is approximately 160 hectares of native vegetation (woody and non-woody vegetation) within the 1,500 metre landscape buffer. This results in a per cent native vegetation cover in the landscape of approximately 2.5 per cent. Native vegetation cover in the

landscape is very low and in the 0 – 10 per cent cover class. These calculations are an approximation only. The purpose of the percentage vegetation cover calculation is to create a figure of native vegetation cover that is used in the Biodiversity Assessment Calculator to predict threatened species likely to occur or use habitat on a site. Minor adjustments to polygon boundaries would not affect the outcome.

4. Native vegetation and vegetation integrity

This section outlines the native vegetation within and directly adjacent to the development site. The surface disturbance associated with Stage 1 occurs across multiple, relatively small, discreet areas associated with the proposed construction sites. A description of the vegetation present at each construction site is provided below. A broad description of the native vegetation present above the alignment is also provided.

4.1 Description by site

4.1.1 Westmead metro station construction site

The Westmead metro station construction site consists of residential and commercial development and infrastructure (road and rail).

There are limited areas of existing natural vegetation within the construction site, and the majority of vegetation is exotic vegetation. Street trees and garden plantings do contain native species from NSW, particularly *Corymbia citriodora*, *Corymbia maculata*, and *Lophostemon confertus*, and there is a small area within the rail corridor north of Alexandra Avenue that contains regrowth native plant species amongst plantings and weeds. The native species present include *Angophora floribunda*, *Eucalyptus tereticornis*, *Acacia falcata*, *Acacia parramattensis*, *Acacia floribunda*, *Melia azedarach*, *Bursaria spinosa*, *Dodonaea triquetra*, *Indigofera australis*, *Lomandra longifolia*, and *Themeda triandra* which are typical of the Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion PCT (PCT 849) which would have once occurred at the location. This vegetation is shown in Photo 1 and discussed further in Section 4.2.2.



Photo 1: The regrowth vegetation in the rail corridor at existing Westmead Station contains native species likely from PCT 849

4.1.2 Parramatta metro station construction site

The Parramatta metro station construction site consists of commercial development with no existing natural vegetation. Street trees and plantings along Horwood Place include the native species *Eucalyptus botryoides* and *Acacia binervia*. The remainder of the vegetation consist of exotic trees and opportunistic weeds occurring in garden beds and alongside buildings and the roadside (See Photo 2).



Photo 2: Horwood Place in Parramatta showing some plantings outside of the City Centre car park

4.1.3 Clyde stabling and maintenance facility construction site

The Clyde stabling and maintenance facility construction site is mostly occupied by commercial and industrial development with no existing natural vegetation. Planted native vegetation occurs along Wentworth Street including *Eucalyptus robusta* and *Callistemon* cultivars. Planted trees are also present along Unwin Street, towards the north-west corner of the construction site, including *Lophostemon confertus*, *Eucalyptus microcorys*, *Eucalyptus saligna*, *Melaleuca quinquenervia*, *Melaleuca linariifolia*, *Ficus benjamina*, *Hibiscus* sp., *Grevillea* cultivars, *Phoenix canariensis*, *Angophora costata*, *Eucalyptus camaldulensis*, *Eucalyptus robusta*, *Corymbia maculata* among others.

Vegetation along A'Becketts Creek and Duck Creek was surveyed in June 2019 near the area of the proposed crossing locations.

The riparian zone of A'Becketts Creek in the footprint is weed-dominated consisting of the weed species: *Ricinus communis*, *Tropaeolum majus*, *Malva parviflora*, *Galinsoga parviflora*, *Cardiosperma grandiflorum*, *Lantana camara*, *Cestrum parqui*, *Morus alba*, *Ageratina adenophora*, *Ludwigia peploides*, *Rumex crispus*, *Asparagus scandens*, *Cinnamomum camphora*, *Nephrolepis cordifolia*. A few planted native species also occur along the creek bank including *Eucalyptus saligna* and *Eucalyptus robusta* and patches of *Avicennia marina* (Mangroves) occur in A'Becketts Creek.

The vegetation surveyed along Duck Creek is dominated by weeds including *Ricinus communis*, *Ipomoea indica*, *Cardiospermum grandiflorum*, *Acetosa sagittata*, *Phyllostachys* sp., *Morus alba*, *Casuarina glauca*, *Callistemon salignus*, *Arundo donax* and *Parietaria judaica*. Native species *Eucalyptus saligna* and *Eucalyptus robusta* were present on the banks and patches of *Avicennia marina* (Mangroves) occur in the creek (see photo 3).

The mangrove vegetation in both creeks corresponds to the plant community type: Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion (PCT 920). It is not classified as a TEC; however, it is considered protected marine vegetation under the *Fisheries Management Act 1994*.



Photo 3: The vegetation along Duck Creek at the existing bridge on Kay Street

4.1.4 Silverwater services facility construction site

The Silverwater services facility construction site consists of unoccupied but previously disturbed land with no existing natural vegetation (see Photo 4). Woody vegetation on the site includes *Corymbia citriodora*, saplings of *Casuarina glauca*, and a mature specimen of the introduced shrub *Acacia saligna*. Adjacent street trees include *Melaleuca quinquenervia* and *Callistemon viminalis*. The ground is largely bare, with some patches of groundcover vegetation dominated by introduced grasses and herbaceous weeds.



Photo 4: The vegetation at the Silverwater services facility construction site

4.1.5 Sydney Olympic Park metro station construction site

The Sydney Olympic Park metro station construction site consists largely of commercial development with no existing natural vegetation. The street trees and plantings in the confirmed footprint and areas of temporary occupation are predominantly planted trees including the native species *Eucalyptus microcorys*, *Corymbia citriodora* and *Lophostemon confertus*. Planted street trees and gardens line the roads and carparks of the area. Some hedges are made from *Acmena smithii* cultivars. Native species including *Acacia floribunda* and *Melaleuca bracteata* are present in the gardens and have been planted. The garden between Herb Elliott Avenue and Showground Road is planted with a variety of palm trees including the native species *Livistona australis*, *Archontophoenix cunninghamiana*, and *Howea forsteriana*. Photo 5 and 6 illustrate the vegetation in this construction site.



Photo 5: The garden between Herb Elliott Avenue and Showground Road is planted with a variety of palm trees



Photo 6: *Corymbia citriodora* and gardens along Herb Elliott Avenue

4.1.6 North Strathfield metro station constructions site

The majority of the North Strathfield metro station construction site is within the existing rail corridor. The plantings at the edge of Queen Street within the construction site include a mix of species including the native species *Lophostemon confertus*, *Tristaniopsis laurina*, *Brachychiton acerifolius*, *Elaeocarpus reticulatus*, and *Casuarina glauca* (see Photo 7).



Photo 7: Planted vegetation along Queen Street within the North Strathfield metro station construction site

4.1.7 Burwood North Station construction site

The Burwood North Station northern and southern construction sites consist of residential and commercial development. No PCTs are present. The vegetation consists of plantings including some native species such as *Allocasuarina torulosa*, *Melaleuca quinquenervia*, *Tristaniopsis laurina*, *Melaleuca quinquenervia*, *Casuarina glauca*, *Eucalyptus microcorys* and *Lophostemon confertus* (see Photo 8).



Photo 8: Plantings along the entry to the Pine Inn Hotel on Burton Street

4.1.8 Five Dock Station construction site

The Five Dock Station western and eastern construction sites consist of commercial and residential development. No PCTs are present in the footprints. Few planted trees and shrubs are present, consisting of exotic and native species. This area is illustrated in Photo 9.



Photo 9: Plantings at the Five Dock Station eastern construction site

4.1.9 The Bays Station construction site

The Bays Station construction site is in a highly disturbed landscape that is almost devoid of vegetation apart from opportunistic weed species such as *Ricinus communis* and *Acacia saligna* that have grown on the abandoned disturbed land. The land directly adjacent to the site contains a mix of planted vegetation and weeds

including *Lantana camara*, *Olea europaea*, *Cortaderia selloana*, and *Cinnamomum camphora*. This area is illustrated in Photo 10.



Photo 10: The vegetation in and surrounding The Bays Station construction site is a mix of planting and weeds

4.2 Plant community type descriptions

This BDAR describes PCTs in terms of their floristic composition, geological substrate and relevant regional vegetation classification. The distribution of PCTs within the development site is outlined in Figure 4-1. Descriptions of the vegetation that occurs in the development site are provided below and matched to the most likely PCT as described in the BioNet Vegetation Classification database.

Table 4-1 provides a summary of the PCTs found within and adjacent to the development site. Native vegetation is very limited within the development site, restricted to small areas along A'Becketts Creek and Duck Creek in the footprint of the Clyde stabling and maintenance facility construction site, and a small area of regrowth in the rail corridor which is within the footprint of the Westmead metro station construction site. The majority of the development site lacks vegetation or contains only planted vegetation or weed growth. There are no large areas of native vegetation present within any of the development site.

Table 4-1: Plant community types and vegetation zones identified at the development site

Vegetation zone	Plant community type ID No.	Plant community type name	Broad condition class	Vegetation zone area in development site (ha)	Location
1	920	Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	Poor	0.15	Clyde stabling and maintenance facility construction site and downstream.

Vegetation zone	Plant community type ID No.	Plant community type name	Broad condition class	Vegetation zone area in development site (ha)	Location
2	849	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Poor	0.03	Westmead metro station construction site

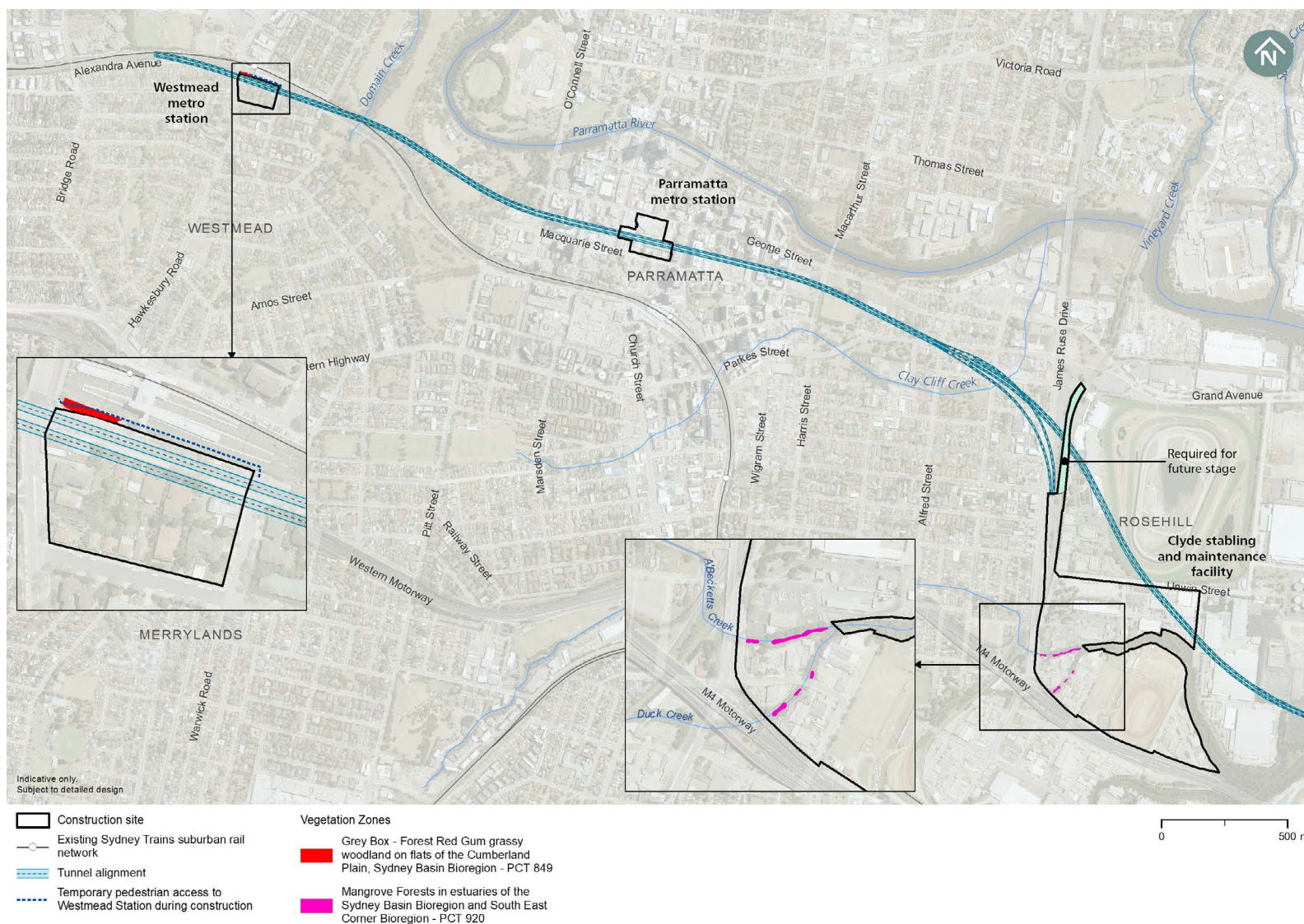


Figure 4-1: Map of plant community types and vegetation zones

4.2.1 Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion (PCT 920)

Vegetation formation: Saline Wetlands

Vegetation class: Mangrove Swamps PCT ID: 920

The Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion PCT (PCT 920) are described in the BioNet Vegetation Classification database as stands of mangroves forming a low closed to open forest on mudflats in Sydney's harbour, river coves and estuaries. *Avicennia marina* (Grey mangrove) is the taller and more common of the mangrove species found in Sydney and is often seen in pure stands. Stands of grey mangrove comprise very few species other than the canopy, with the understorey mostly an open mudflat sometimes with scattered saltmarsh herbs (State Government of NSW and Office of Environment and Heritage, 2016). The upper stratum of this PCT is typically composed of *Avicennia marina* with some stands of *Aegiceras corniculatum* also found upstream in areas of freshwater influence. The ground layer may contain *Sarcocornia quinqueflora*.

The Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion PCT (PCT 920) directly corresponds to the Estuarine Mangrove Forest (SL p109) as described in the Southeast NSW Native Vegetation Classification and Mapping – SCIVI (State Government of NSW and Office of Environment and Heritage (OEH), 2010) and the Estuarine Mangrove Forest (S_SW01) as described in The Native Vegetation of the Sydney Metropolitan Area – Version 3 (State Government of NSW and Office of Environment and Heritage, 2016).

This vegetation within and adjacent to the development site is most likely to be representative of PCT 920 for the following reasons:

- The creeks contain stands of *Avicennia marina*
- In the creeks the mid stratum is absent apart from juvenile *Avicennia marina* trees
- In the creeks the ground cover is very sparse and consists of mud flats.
- No other PCTs as described in the BioNet Vegetation Classification database provide a better fit for the description of this vegetation. A summary of the vegetation structure and floristics of PCT 920 within the development site is given below in Table 4-2. This list of species reflects the local variation gathered from floristic plots undertaken within the development site and includes incidental observations.
- Mangroves are also discussed in Section 6 as they relate to protected marine vegetation and fish habitat protected under the *Fisheries Management Act 1994*.

Table 4-2: Floristic and structural summary of PCT 920 within the development site

Vegetation layer	Dominant species
Tree canopy (upper stratum)	Monospecific stands of <i>Avicennia marina</i> in the creek bed. Occasional <i>Casuarina glauca</i> at edges. Planted trees including <i>Eucalyptus saligna</i> and <i>Eucalyptus robusta</i> on upper banks.
Midstorey (mid-stratum)	<i>Avicennia marina</i> juveniles, <i>Callistemon salignus</i> .
Groundcovers (ground stratum)	<i>Avicennia marina</i> seedlings, <i>Ludwigia peploides</i> , <i>Nephrolepis cordifolia</i> , <i>Commelina cyanea</i> .
Exotic species	<i>Tropaeolum majus</i> , <i>Malva parviflora</i> , <i>Galinsoga parviflora</i> , <i>Parietaria judaica</i> , <i>Morus alba</i> , <i>Rumex crispus</i> , <i>Sonchus oleraceus</i> , <i>Lactuca serriola</i> .
High Threat Weeds	<i>Ricinus communis</i> , <i>Cardiospermum grandiflorum</i> , <i>Lantana camara</i> , <i>Cestrum parqui</i> , <i>Ageratina adenophora</i> , <i>Asparagus scandens</i> , <i>Cinnamomum camphora</i> , <i>Arundo donax</i> , <i>Erythrina crista-galli</i> , <i>Ipomoea indica</i> , <i>Acetosa sagittata</i> , <i>Anredera cordifolia</i> , <i>Phyllostachys</i> sp., <i>Populus alba</i> .

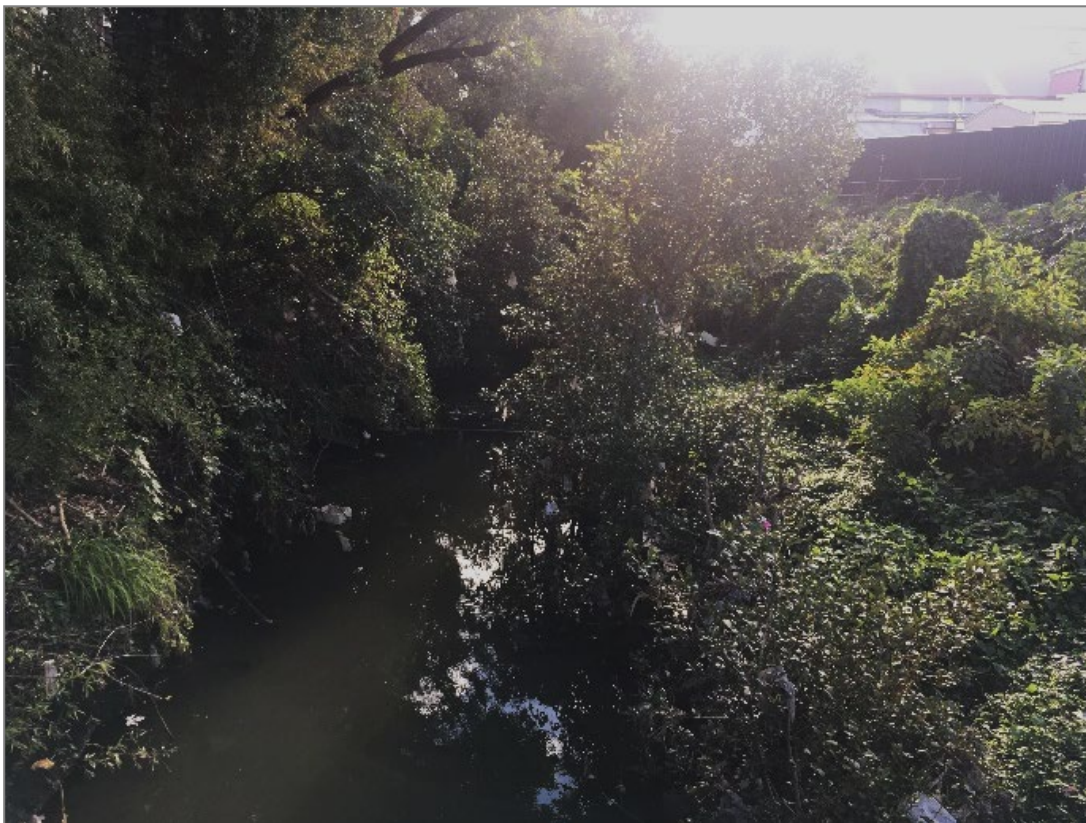


Photo 11: PCT 920 on Duck Creek showing a small number of mangroves amongst weed growth and planted trees



Photo 12: PCT 920 along A'Becketts Creek showing a dense stand of mangroves in the creek with weed growth and planted trees on the creek banks

4.2.2 Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion – PCT 849

Vegetation formation: Grassy Woodlands

Vegetation class: Coastal Valley Grassy Woodlands **PCT ID:** 849

The Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion PCT (PCT 849) is described in the BioNet Vegetation Classification database as a grassy woodland located on the gentle topography associated with the shale plains of western Sydney. The open grassy woodland is dominated by *Eucalyptus moluccana*, *Eucalyptus tereticornis*, and *Eucalyptus crebra*/*Eucalyptus fibrosa*, with localised patches of *Corymbia maculata*. It is typified by a sparse to moderate cover of shrubs and a high cover of grasses and forbs (State Government of NSW and Office of Environment and Heritage, 2016).

The Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion PCT (PCT 849) directly corresponds to the Cumberland Shale Plains Woodland (GW p29) as described in the *Southeast NSW Native Vegetation Classification and Mapping – SCIVI* (State Government of NSW and Office of Environment and Heritage (OEH), 2010) and the Cumberland Shale Plains Woodland (S_GW03) as described in *The Native Vegetation of the Sydney Metropolitan Area – Version 3* (State Government of NSW and Office of Environment and Heritage, 2016).

This vegetation within the development site at the Westmead metro station construction site is most likely to be regrowth of PCT 849 for the following reasons:

- The upper stratum contains typical species including *Eucalyptus tereticornis* and *Angophora floribunda*, and *Acacia parramattensis* which are species commonly found in this PCT
- The mid stratum contains regrowth of typical species including *Bursaria spinosa*, *Acacia falcata*, and *Indigofera australis*
- The ground cover contains typical species including *Themeda triandra*
- The vegetation occurs on shale on the Cumberland Plain and the native species that are present are likely regrowth from the soil seedbank.
- No other PCTs as described in the BioNet Vegetation Classification database provide a better fit for the description of this vegetation. A summary of the vegetation structure and floristics of PCT 849 within the development site is given below in Table 4-3. This list of species reflects the local variation gathered from floristic plots undertaken within the development site and includes incidental observations while moving through the vegetation.
- This PCT is part of the Cumberland Plain Woodland in the Sydney Basin Bioregion which is listed as a Critically Endangered Ecological Community under the BC Act.

Table 4-3: Floristic and structural summary of PCT 849 within the development site

Vegetation layer	Dominant species
Tree canopy (upper stratum)	<i>Eucalyptus tereticornis</i> , <i>Angophora floribunda</i> , <i>Acacia parramattensis</i> and <i>Melia azedarach</i> with planted trees including <i>Grevillea robusta</i> .
Midstorey (mid-stratum)	<i>Bursaria spinosa</i> , <i>Acacia falcata</i> , <i>Acacia floribunda</i> , <i>Indigofera australis</i> , <i>Grevillea</i> cultivars, <i>Westringia fruticosa</i> , <i>Dodonaea triquetra</i> , <i>Callistemon</i> cultivars, <i>Banksia marginata</i> , <i>Tristaniopsis laurina</i> .
Groundcovers (ground stratum)	<i>Themeda triandra</i> , <i>Dianella caerulea</i> , <i>Cenchrus alopecuroides</i> , <i>Lomandra longifolia</i> .
Exotic species	<i>Murraya paniculata</i> , <i>Jacaranda mimosifolia</i> , <i>Bidens pilosa</i> .
High Threat Weeds	<i>Senna pendula</i> , <i>Cinnamomum camphora</i> .



Photo 13: PCT 849 at Westmead Station looking east into the rail corridor from Hawkesbury Road



Photo 14: PCT 849 at Westmead Station looking west into the rail corridor from the station access ramp off Alexandra Avenue

4.3 Vegetation zones and vegetation integrity score

A description of the vegetation zones identified within the development site and the corresponding vegetation integrity score developed from the Biodiversity Assessment Calculator is presented in Table 4-4. The vegetation integrity survey plot data is provided in Appendix C.

The two identified vegetation zones are in poor condition as reflected by the vegetation integrity scores. Vegetation zone 2 (PCT 849) has a vegetation integrity score less than 15.

Table 4-4: Vegetation zones and vegetation integrity scores

Vegetation zone	Plant community type ID No.	Plant community type name	Broad condition class	Vegetation zone area in development site (ha)	Vegetation integrity score
1	920	Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	Poor	0.15	34.6
2	849	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Poor	0.03	11.4

4.4 Patch size

The main area of native vegetation affected by Stage 1 is along A'Becketts Creek and Duck Creek which is attached to vegetation along the Duck River. This patch is approximately 62 hectares in size. The patch includes vegetation on either side of Duck River and Parramatta River. The rivers are less than 100 metres wide in sections meaning that the vegetation on either side is part of the same patch as defined in the BAM. The patch is in the 25 to 100 hectare size class.

The vegetation at Westmead metro station construction site is isolated and part of a small patch of less than one hectare in size so is assigned to the less than five hectares size class.

4.5 Threatened ecological communities

There is one Threatened Ecological Community (TEC) listed under the BC Act that occurs in the development site, located in the rail corridor at the Westmead metro station construction site: Cumberland Plain Woodland in the Sydney Basin Bioregion. This corresponds to PCT 849 and the TEC is in poor condition represented by regrowth native species amongst plantings and weed growth.

There are also two TECs downstream of the development site along Duck River including:

- Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
- Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions.

The vegetation downstream of the development footprint along A'Becketts Creek, Duck Creek and Duck River may also contain the Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions TEC.

4.6 Groundwater dependent ecosystems

Available data from site investigations undertaken for Sydney Metro West indicates that groundwater levels in the vicinity of the alignment vary from one metre to 33 metres below ground surface. Where neighbouring piezometers are screened separately in soil and rock horizons, the data indicate that there is generally hydraulic connection between the soil and rock aquifers. At some locations a perched water table may be present within the soils.

Interaction between groundwater and surface water is generally expected to be limited along the alignment to (1) surface water infiltration that contributes to groundwater, (2) and discharge from groundwater to surface watercourses and waterbodies, or leakage from surface watercourses to groundwater. There is potential for groundwater to contribute to streamflow (baseflow) and surface water bodies in low lying areas or deeply incised channels. There is potential for groundwater to contribute baseflow to the watercourses and water bodies (the watercourses are detailed in Section 6) in and adjacent to the development site; however, some portions of these watercourses are lined and therefore have limited connection with the groundwater system in those portions.

The level of groundwater dependence of vegetation communities in the development site has been identified using the *Atlas of Groundwater Dependent Ecosystems* (GDEs) (Bureau of Meteorology, 2017) and the Risk Assessment Guidelines for Groundwater Dependant Ecosystems released by the former NSW Department of Primary Industries (Kuginis et al., 2012). The list of high priority GDEs provided in Schedule 4 of the Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011 was also reviewed. The mapping of GDEs provided by the Atlas of GDEs provides an indication whether a GDE may be present but the mapping is based on a coarse regional vegetation mapping dataset and does not accurately reflect on-ground conditions.

There are no mapped aquatic GDEs within the development site or the 1,500 metre landscape buffer. However, the *Atlas of GDEs* (Bureau of Meteorology, 2017) identifies portions of the locality as containing some areas of high potential groundwater dependent terrestrial vegetation. Based on the results of the field surveys undertaken for this BDAR and examination of the *Native Vegetation of the Sydney Metropolitan Area – Version 3* vegetation map (State Government of NSW and Office of Environment and Heritage, 2016), there is potential for groundwater dependent terrestrial vegetation types to be present.

Table 4-5 outlines the GDE (terrestrial vegetation) types that may be impacted by groundwater drawdown at the GDE due to drawdown induced by Stage 1 excavations (as identified in Technical Paper 7 (Hydrogeology)).

Table 4-5: GDE (terrestrial vegetation) types that may be impacted by Stage 1 groundwater drawdown from station and shaft excavations

Groundwater Dependent Ecosystem	Location
Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion PCT (PCT 849)	This PCT is located within the Westmead metro station construction site and in Parramatta Park (within the former Parramatta Golf Course) approximately 200 metres east of the Westmead metro station construction site.

Groundwater Dependent Ecosystem	Location
Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion PCT (PCT 835)	<p>This PCT is located in the following areas:</p> <ul style="list-style-type: none"> • Toongabbie Creek approximately 1.2 kilometres north-west of the Westmead metro station construction site • Domain Creek in Parramatta Park approximately 350 metres east of the Westmead metro station construction site • Parramatta River approximately 650 metres east of the Westmead metro station construction site and approximately 360 metres north-west of the Parramatta metro station construction site.
Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley PCT (PCT 1800)	<p>This PCT is located in the following areas:</p> <ul style="list-style-type: none"> • Toongabbie Creek at two locations, one is approximately 1.2 kilometres north-west and the other is one kilometre north of the Westmead metro station construction site. • Finlaysons Creek approximately one kilometre north-west of the Westmead metro station construction site • Immediately west of Mother Teresa Primary School at Westmead approximately 500 metres north-west of the Westmead metro station construction site • Along Parramatta River approximately 460 metres north-west of the Parramatta metro station construction site.
Turpentine – Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin Bioregion PCT (PCT 1281)	<p>This PCT is located in the following areas:</p> <ul style="list-style-type: none"> • Concord Golf Club approximately 650 metres north-east of the North Strathfield metro station footprint • Queen Elizabeth Park located approximately 450 metres north-west of the Burwood North Station construction site • Five Dock Park located approximately 350 metres east of the Five Dock Station construction site.

These PCTs outlined above in Table 4-5 are considered with a moderate to high likelihood to be terrestrial GDEs. However, these PCTs are not obligate GDEs (i.e. they are not entirely dependent on groundwater). These PCTs are likely to be opportunistic facultative GDEs that may depend on the subsurface presence of groundwater (often accessed via the capillary fringe – subsurface water just above the water table) in some locations but not in others. This capillary water may be accessed by the plants where an alternative source of water (i.e. rainfall) cannot be accessed to maintain ecological function. As the plants within these PCTs may at times rely on capillary water in the soil that rises from the water table, any lowering of the water table may result in a reduction in groundwater availability and declining vegetation health during low rainfall periods.

However, if the groundwater table is shallow where the potential GDE occurs, and there is no perched aquifer above the water table (separated from the water table by a layer of impermeable rock or sediment), then impacts on vegetation health may occur.

Further, since a conservative approach has been adopted for the groundwater modelling, the magnitude of potential drawdown is considered to be a conservative estimate. Therefore, the likelihood of these ecosystems being impacted by the groundwater level drawdown associated with Stage 1 is therefore low. However, further investigations are proposed to confirm if impacts could occur during detailed design (refer to Section 10).

Stage 1 may also potentially reduce the groundwater baseflow to, and thereby reduce the surface water flow of Toongabbie Creek, Domain Creek, A'Becketts Creek, Duck Creek, Haslams Creek and the tributaries of Powells Creek. The existing groundwater baseflow contribution to creeks (if any) is unknown. However, as baseflows are

likely to be a minor component of streamflow, the significance of this impact to surface water flow is likely to be low. As detailed in Technical Paper 7 (Hydrogeology), additional site investigations would be carried out during detailed design to confirm potential impacts to baseflow. Where significant reduction in baseflow is confirmed, measures would be implemented at the station excavation to reduce the potential for baseflow loss.

Potential impacts to GDEs (terrestrial vegetation) due to Stage 1 would be associated with groundwater drawdown at the location of the GDE and/or impacts to the groundwater baseflow contribution to surface waterways (where applicable).

Table 4-6 provides a more detailed description of GDE (terrestrial vegetation) types within the 1,500 metre buffer (including GDEs (terrestrial vegetation) that are unlikely to be impacted by Stage 1). The location of GDEs (terrestrial vegetation) types within the 1,500 metre landscape buffer is shown in Figure 4-2 (Map 1 to Map 5).

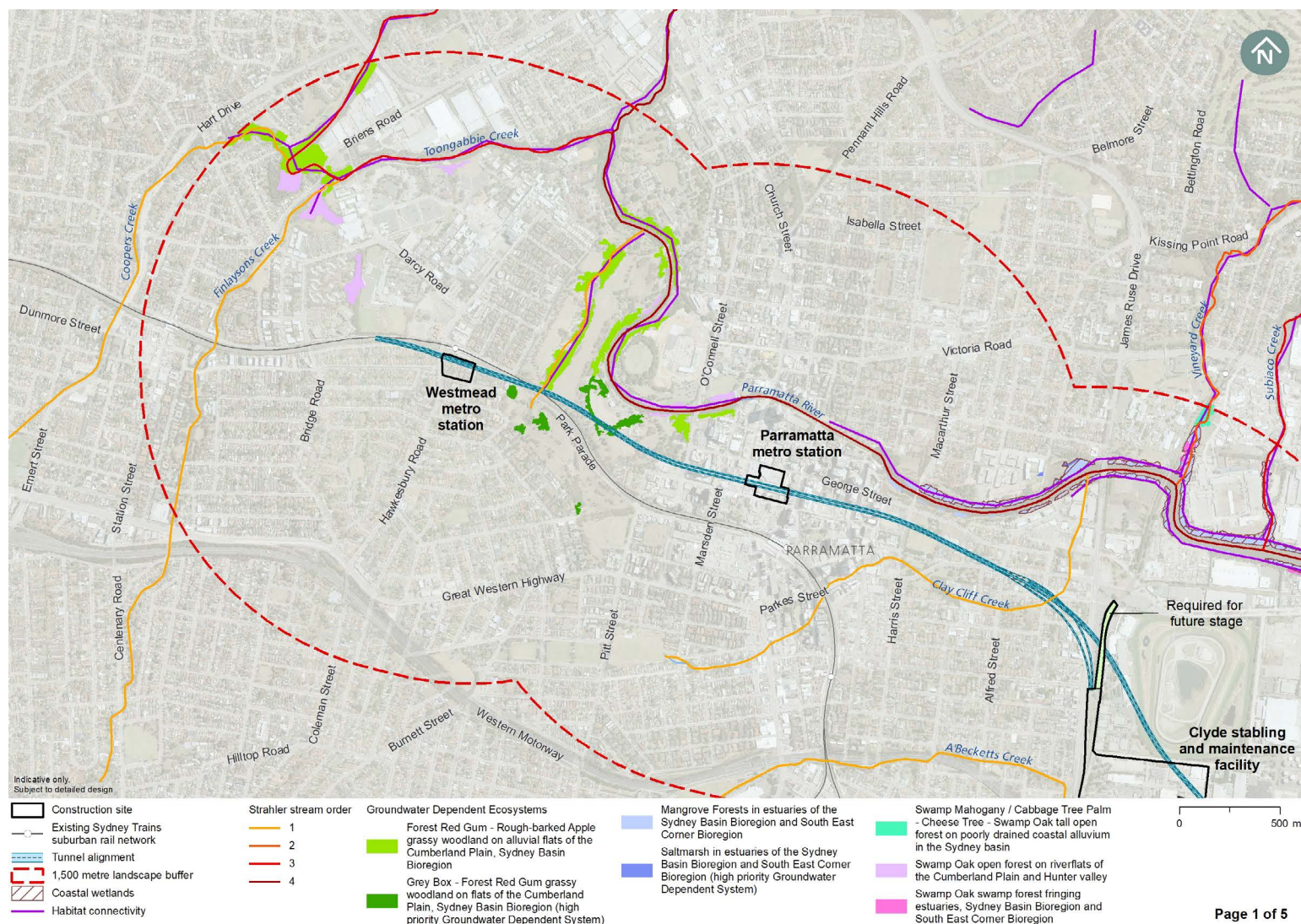


Figure 4-2: Location of potential GDEs within the 1,500 metre landscape buffer – Map 1

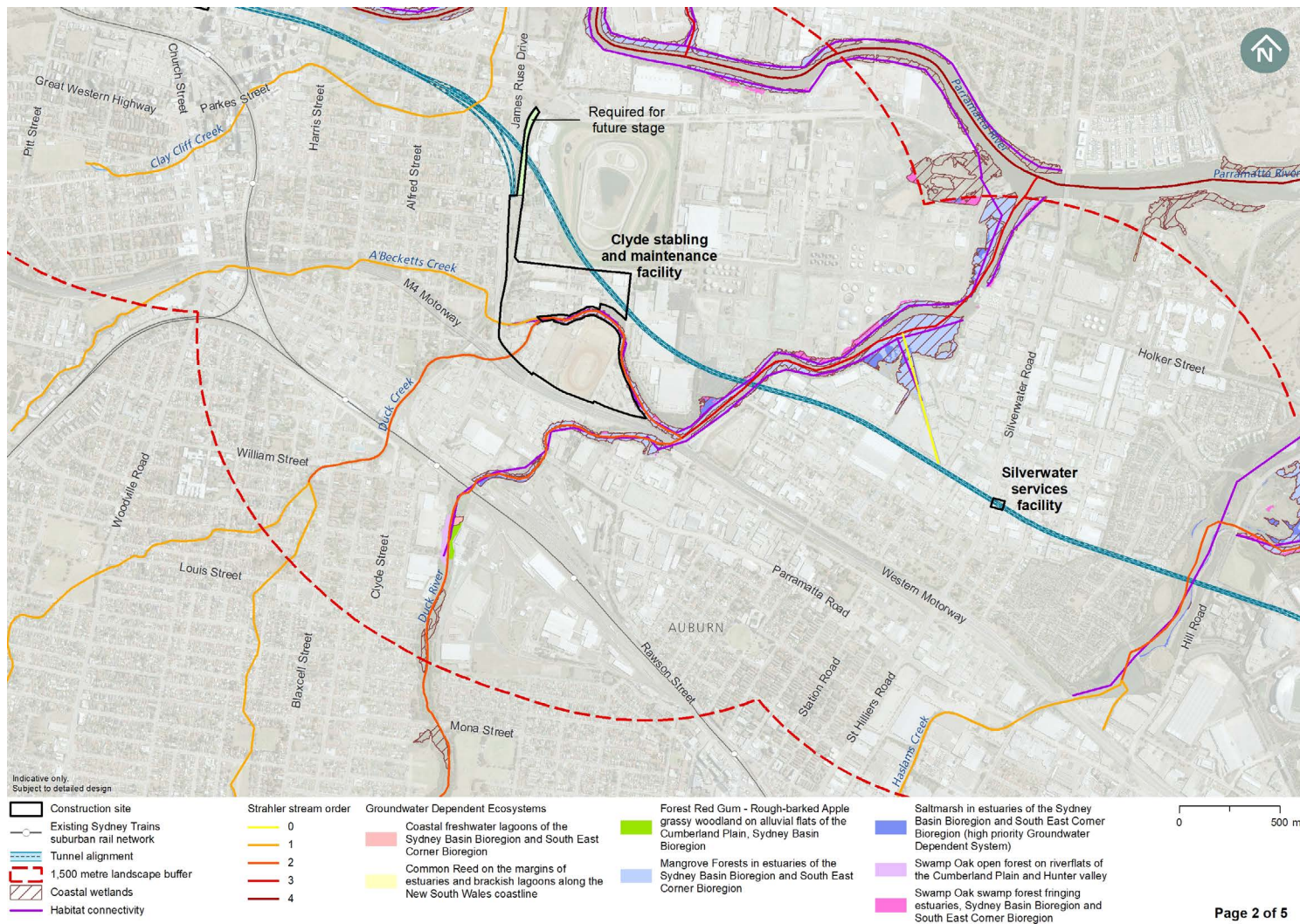
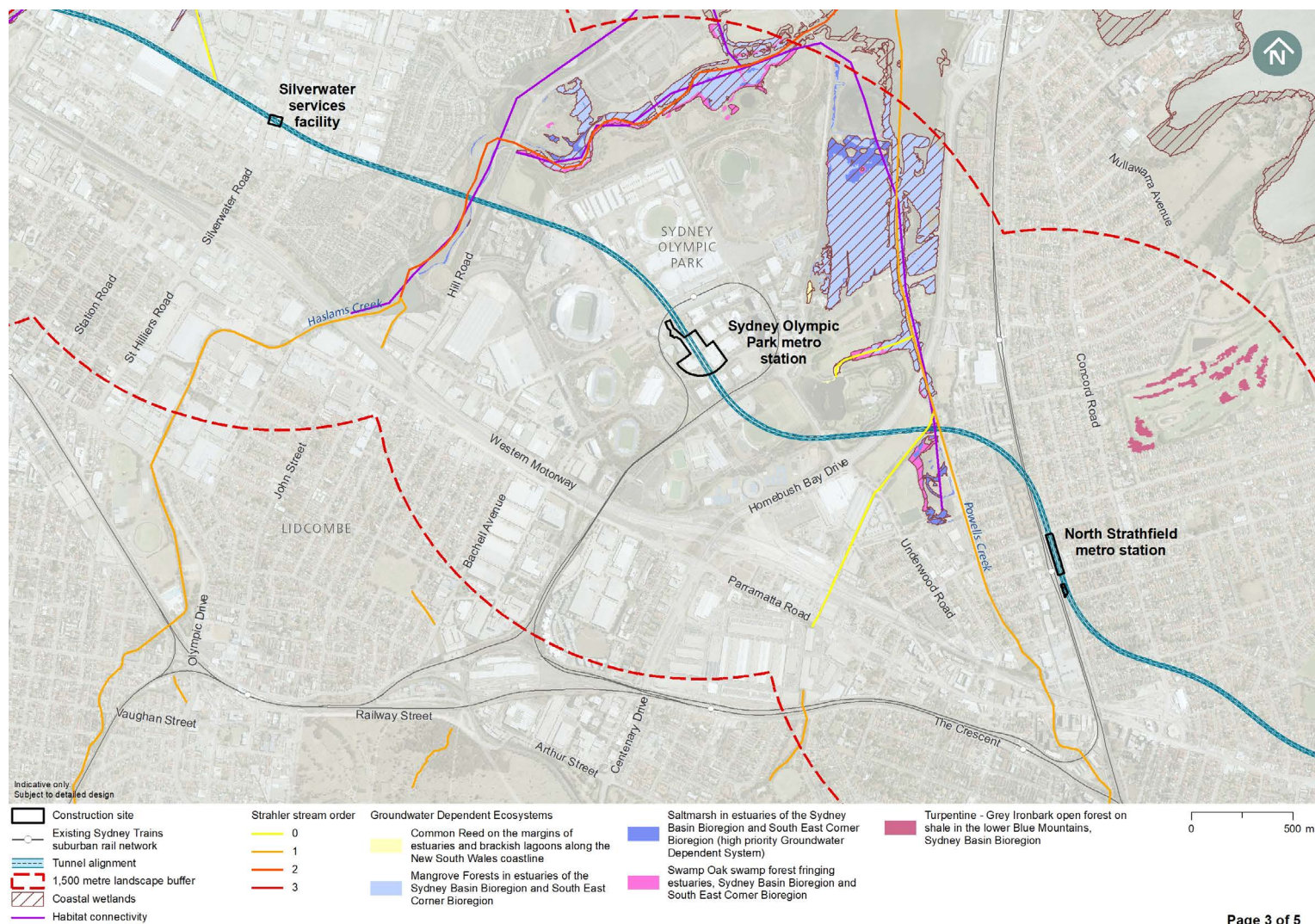
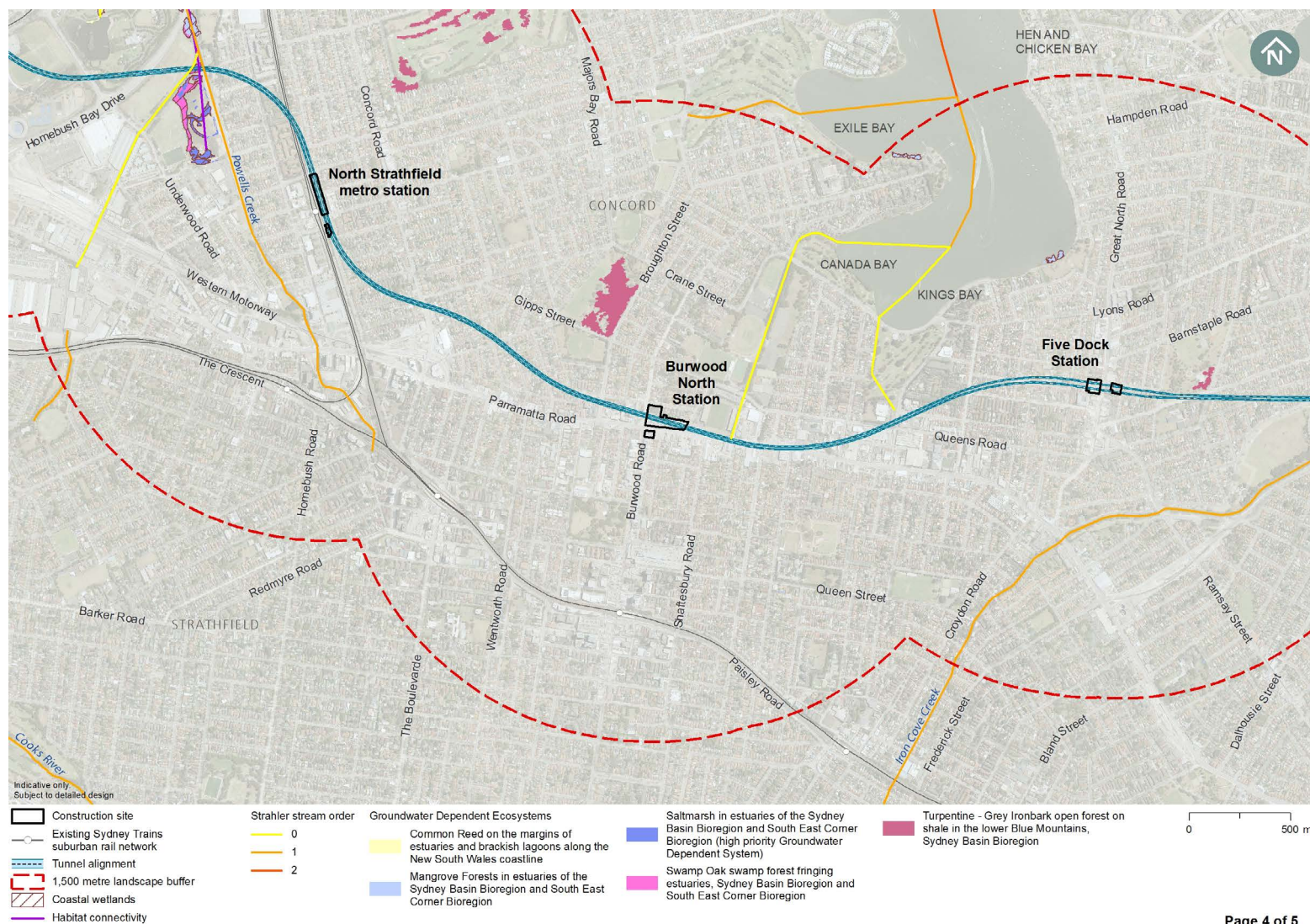


Figure 4-2: Location of potential GDEs within the 1,500 metre landscape buffer – Map 2



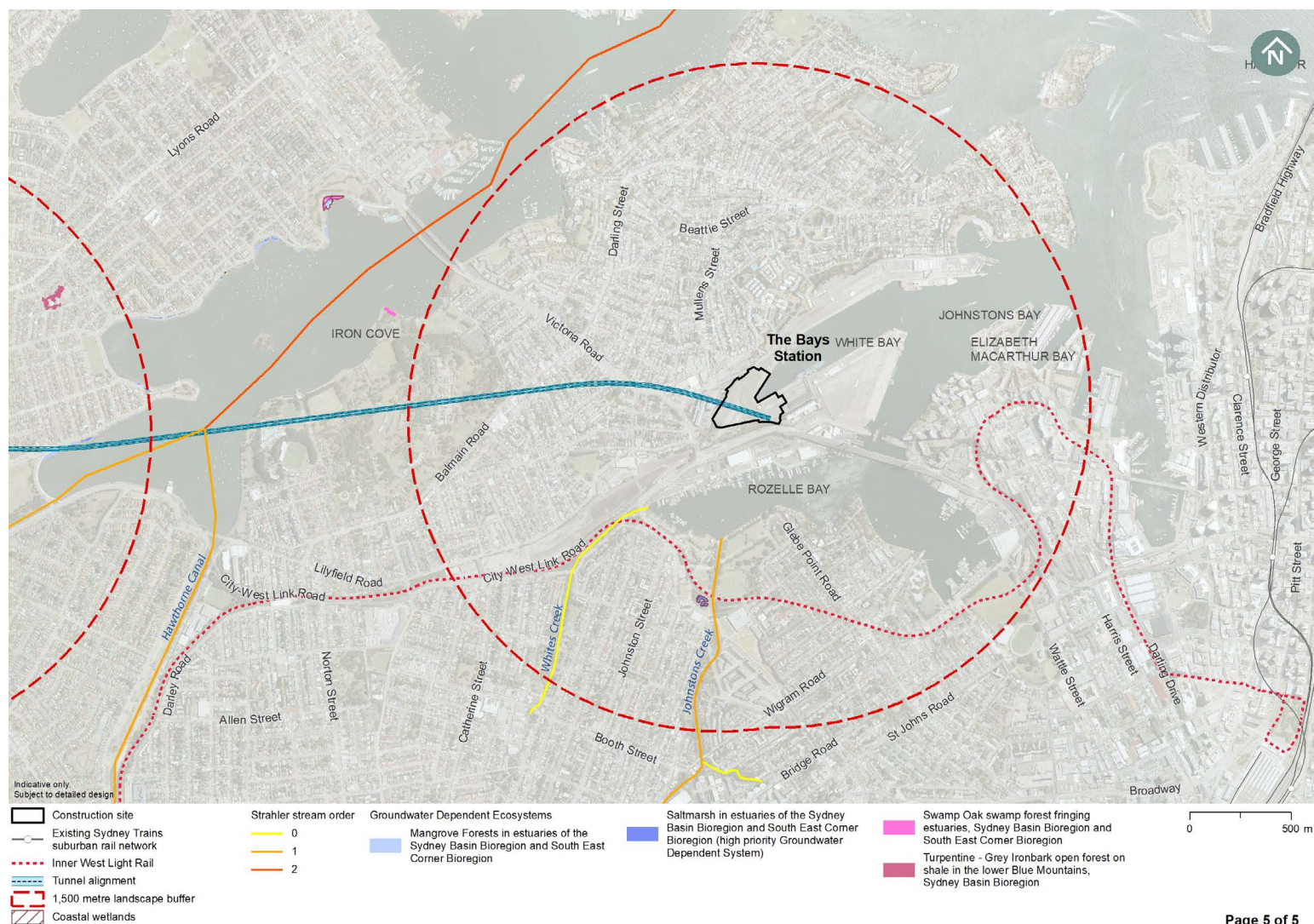
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Figure 4-2: Location of potential GDEs within the 1,500 metre landscape buffer – Map 3



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Figure 4-2: Location of potential GDEs within the 1,500 metre landscape buffer – Map 4



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Figure 4-2: Location of potential GDEs within the 1,500 metre landscape buffer – Map 5

Table 4-6: Groundwater Dependent Ecosystem types, location within the 1,500 metre landscape buffer area and likely impacts from Stage 1

Groundwater Dependent Ecosystem	Location	Groundwater Dependent Ecosystem type	Likely groundwater impact	Potential impacts to the Groundwater Dependent Ecosystem
Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion PCT (PCT 849)	This PCT is located at the Westmead metro station construction site and in Parramatta Park (within the former Parramatta Golf Course) approximately 200 metres east of the Westmead metro station construction site.	This PCT is considered with a high likelihood to be a terrestrial GDE. However, this PCT is not an obligate GDE (not entirely dependent on groundwater). This PCT is likely to be an opportunistic facultative GDE that depends on the subsurface presence of groundwater (often accessed via the capillary fringe – subsurface water just above the water table) in some locations but not in others, particularly where an alternative source of water (i.e. rainfall) cannot be accessed to maintain ecological function.	Drawdown beneath this PCT is predicted in the sandstone at depth. However, given the geology there is a possibility that there is a perched water table in the shale. Plant roots will be in the silty clay soils separated from the zone of drawdown by the lower permeability shale layer.	Plant roots will be within the silty clay soils and given the presence of a shale layer that may have a perched aquifer the potential for impacts is low.
Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion PCT (PCT 835)	<p>This PCT is located along:</p> <ul style="list-style-type: none"> Toongabbie Creek approximately 1.2 kilometres north-west of the Westmead metro station construction site Domain Creek in Parramatta Park approximately 350 metres east of the Westmead metro station construction site Parramatta River approximately 650 metres east of the Westmead metro station construction site and approximately 360 metres north-west of the Parramatta metro station construction site. 	This PCT is considered with a moderate to high likelihood to be terrestrial GDE. However, this PCT is not an obligate GDE (not entirely dependent on groundwater). This PCT is likely to be an opportunistic facultative GDE that depends on the subsurface presence of groundwater (often accessed via the capillary fringe – subsurface water just above the water table) in some locations but not in others, particularly where an alternative source of water (i.e. rainfall) cannot be accessed to maintain ecological function.	<p>Drawdown beneath this PCT is predicted in the sandstone at depth. However, given the geology there is a possibility that there is a perched water table in the shale or alluvium (if present). Plant roots will be in the silty clay soils separated from the zone of drawdown by the lower permeability shale layer.</p> <p>The groundwater baseflow contribution to Parramatta River would likely be negligible relative to the river water flows and volumes. As such, Stage 1 is not likely to reduce baseflow to this river.</p> <p>The groundwater contribution to baseflow at Toongabbie Creek and Domain Creek are likely to be a minor component of streamflow, the significance of this impact is likely to be low.</p>	<p>Plant roots will be within the silty clay soils and given the presence of a shale layer and potentially alluvium that may have a perched aquifer the potential for impacts is low.</p> <p>If reduced groundwater baseflow at Toongabbie Creek and Domain Creek were to occur due to Stage 1, the PCT at this location could be impacted however the risk is considered low. This is further discussed in Technical Paper 7 (Hydrogeology).</p>

Groundwater Dependent Ecosystem	Location	Groundwater Dependent Ecosystem type	Likely groundwater impact	Potential impacts to the Groundwater Dependent Ecosystem
Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley PCT (PCT 1800)	<p>This PCT is located along:</p> <ul style="list-style-type: none"> Toongabbie Creek at two locations approximately 1.2 kilometres north-west and one kilometre north of the Westmead metro station construction site. Finlaysons Creek approximately one kilometre north-west of the Westmead metro station construction site Immediately west of Mother Teresa Primary School at Westmead approximately 500 metres north-west of the Westmead metro station construction site Along Parramatta River approximately 460 metres north-west of the Parramatta metro station construction site Along Duck River approximately 800 metres south of the Clyde stabling and maintenance facility construction site. 	<p>This PCT is considered with a moderate to high likelihood to be terrestrial GDE. However, this PCT is not an obligate GDE (not entirely dependent on groundwater). This PCT is likely to be an opportunistic facultative GDE that depends on the subsurface presence of groundwater (often accessed via the capillary fringe – subsurface water just above the water table) in some locations but not in others, particularly where an alternative source of water (i.e. rainfall) cannot be accessed to maintain ecological function.</p>	<p>Drawdown beneath this PCT is predicted in the sandstone at depth, except for the patch of this PCT located along Duck River where drawdown is not predicted. However, given the geology there is a possibility that there is a perched water table in the shale or alluvium (if present). Plant roots will be in the silty clay soils separated from the zone of drawdown by the lower permeability shale layer. The potential for impacts to patches of this PCT along Toongabbie Creek, Finlaysons Creek and the Parramatta River is low</p>	<p>Plant roots will be within the silty clay soils and given the presence of a shale layer and potentially alluvium that may have a perched aquifer the potential for impacts is low.</p>
			<p>Impacts to the baseflow of Finalysons Creek is unlikely as it is concrete lined.</p> <p>The groundwater contribution to baseflow in the Parramatta River would likely be negligible relative to the river water flows and volumes. As such, Stage 1 is not likely to reduce base flow to this river.</p> <p>The groundwater contribution to baseflow at Toongabbie Creek, Domain Creek and Duck Creek are likely to be a minor component of streamflow, therefore the significance of this impact is likely to be low.</p>	<p>If reduced baseflow to Toongabbie Creek, Domain Creek and Duck Creek were to occur due to Stage 1 groundwater drawdown, the PCT in these locations could be impacted however the risk is considered low. This is further discussed in Technical Paper 7 (Hydrogeology).</p>
Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion PCT (PCT 920)	<p>This PCT is located along Duck Creek and A'Becketts Creek within and adjacent to the Clyde stabling and maintenance facility construction site.</p> <p>This PCT is also present outside of the development site in the following locations:</p> <ul style="list-style-type: none"> Duck River approximately 250 metres east and south of the Clyde stabling and maintenance facility construction 	<p>This PCT is considered with a high likelihood to be terrestrial GDE. The distribution of the mangroves is driven by tidally forced seawater. However, estuarine and near-shore marine systems, such as coastal mangroves are also known to somewhat rely on the submarine discharge of groundwater, but the extent of groundwater dependence is not well known. The growth and productivity of mangrove forests is related to fresh water input from groundwater and rainwater that flows into these intertidal habitats.</p>	<p>This PCT would not be directly impacted by the groundwater drawdown associated with Stage 1. Groundwater drawdown is predicted to occur immediately adjacent to Duck Creek, sourcing water from the rock aquifer at depth.</p>	<p>The PCT would not be directly impacted by drawdown. The PCT is tolerant of saline groundwater.</p>
			<p>Baseflows of Duck Creek, Haslams Creek and Powells Creek are unlikely to be affected by groundwater drawdown from Stage 1, as the predicted drawdown contours do not extend to these creeks or surface water bodies. Therefore the potential impact to baseflow is likely to be low.</p>	<p>The PCT along Duck Creek, Haslams Creek and Powells Creek could be impacted if reduced groundwater baseflow to this waterway was to occur, however, the reliance of this PCT on baseflow and therefore the</p>

Groundwater Dependent Ecosystem	Location	Groundwater Dependent Ecosystem type	Likely groundwater impact	Potential impacts to the Groundwater Dependent Ecosystem
	<p>site to the confluence of the Parramatta River</p> <ul style="list-style-type: none"> Parramatta River approximately 650 metres east of the Parramatta metro station construction site and 1.2 kilometres north of the Clyde stabling and maintenance facility construction site. Haslams Creek located approximately 1.2 kilometres north of the Sydney Olympic Park metro station construction site. Bicentennial Park wetlands approximately 800 metres to the north-east of the Sydney Olympic Park metro station construction site. Mason Park Wetland (not mapped by regional mapping but mangroves are present) approximately 850 metres north-west of the North Strathfield metro station construction site. Exile Bay approximately 1.5 kilometres north-west of the Five Dock Station construction site. Kings Bay approximately 800 metres north-west of the Five Dock Station construction site. Iron Cove approximately 1.2 kilometres east of the Five Dock Station construction site A small area at the edge of Johnstons Bay approximately 700 metres south- 	<p>Groundwater, and rainfall, have been shown to stimulate organic matter accumulation in aboveground biomass suggesting the availability of non saline water sources, such as groundwater and rainfall, are important for the growth and productivity of mangrove forests (see Hayes et al., 2019).</p>	<p>Further the Bicentennial and Mason Park wetlands, rainfall and tidal flows from the Parramatta River are likely to be the dominant source of water for the wetland systems, and as such, the significance of any change in baseflow from groundwater (if it were to occur) is likely to be low.</p> <p>Impacts to baseflow in the vicinity of other patches of mangroves are not predicted (e.g. Exile Bay, Kings Bay, Iron Cove and Johnstons Bay).</p>	<p>extent of potential impact is unknown. More information on the possible groundwater and surface water interaction is provided in Technical Paper 7 (Hydrogeology).</p>

Groundwater Dependent Ecosystem	Location	Groundwater Dependent Ecosystem type	Likely groundwater impact	Potential impacts to the Groundwater Dependent Ecosystem
	east of the Bays Station construction site			
Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion PCT (PCT 781)	This PCT is located along the Duck River at Auburn approximately one kilometre to the south of the Clyde stabling and maintenance facility construction site.	This PCT is considered with a moderate to high likelihood to be terrestrial GDE. However, rainfall is the dominant source of water for nearly all wetland systems. Groundwater does play a role in wetlands, but it is not well understood. These wetlands may be hydrologically and ecologically linked to adjacent groundwater bodies, but the degree of interaction is not known. The wetlands are likely to be rainfall fed and are likely to have very limited dependence on groundwater given their location along Duck River.	This PCT would not be impacted by the groundwater drawdown associated with Stage 1 of Sydney Metro West.	The PCT would not be directly impacted by groundwater drawdown.

Groundwater Dependent Ecosystem	Location	Groundwater Dependent Ecosystem type	Likely groundwater impact	Potential impacts to the Groundwater Dependent Ecosystem
Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion PCT (PCT 1126)	<p>This PCT is located:</p> <ul style="list-style-type: none"> Along Parramatta River approximately 1.3 kilometres north of the Clyde stabling and maintenance facility construction site. Along Duck River, about 1.2 kilometres downstream of the Clyde stabling and maintenance facility construction site and also in other small scattered locations along the length of Duck River. Haslams Creek approximately 1 to 1.3 kilometres north and north-west of the Sydney Olympic Park metro station construction site. Bicentennial Park located approximately 1.2 kilometres north-east of the Sydney Olympic Park metro station construction site with other smaller scattered occurrences throughout the Bicentennial Park area At Mason Park Wetland, located immediately south of the alignment (with the tunnels around 25 to 30 metres underground) and approximately 600 metres north-west of the North Strathfield metro station construction site. Small scattered patches along the edges of Iron Cove approximately 1.4 kilometres east and two kilometres north-east of the Five Dock Station construction site. 	<p>This PCT may potentially be a GDE. The distribution of the saltmarsh is driven by tidally forced seawater. However, estuarine and near-shore marine systems, such as saltmarsh are also known to somewhat rely on the submarine discharge of groundwater. However, the extent of groundwater dependence in these vegetation types is not well known. Saltmarsh ecosystems appear to make limited or opportunistic use of groundwater (Kuginis et al., 2016). However, groundwater levels are known to control ecological zonation of saltmarsh species (Wilson et al., 2015).</p>	<p>This PCT would not be impacted by the groundwater drawdown associated with Stage 1.</p> <p>Baseflows of Haslams Creek and Powells Creek and the surface water bodies (Mason Park wetlands and Bicentennial Park wetlands) are unlikely to be affected by groundwater drawdown from Stage 1, as the predicted drawdown contours do not extend to these creeks or surface water bodies. Therefore the potential for groundwater drawdown impact is likely to be low.</p> <p>Further, the Bicentennial and Mason Park wetlands, rainfall and tidal flows from the Parramatta River are likely to be the dominant source of water for the wetland systems, and as such, the significance of any change in baseflow from groundwater (if it were to occur) is likely to be low.</p> <p>Impacts to baseflow in the vicinity of other patches of saltmarsh are not predicted (e.g. Exile Bay, Kings Bay, Iron Cove and Johnstons Bay).</p>	<p>The PCT would not be directly impacted by drawdown.</p> <p>The PCT could be impacted if reduced groundwater baseflow to Haslams Creek and Powell Creek were to occur, however, the reliance of this PCT on baseflow and therefore the extent of potential impact is unknown. More information on the possible groundwater and surface water interaction is provided in Technical Paper 7 (Hydrogeology).</p>

Groundwater Dependent Ecosystem	Location	Groundwater Dependent Ecosystem type	Likely groundwater impact	Potential impacts to the Groundwater Dependent Ecosystem
	<ul style="list-style-type: none"> A small patch along Johnstons Creek approximately one kilometre south of the Bays Station construction site. 			
Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion PCT (PCT 1234)	Located along: <ul style="list-style-type: none"> Parramatta River approximately one kilometre north of the Clyde stabling and maintenance facility construction site Duck Creek and Duck River directly adjacent to the Clyde stabling and maintenance facility construction site Haslams Creek approximately 1.2 kilometres north of the Sydney Olympic Park metro station construction site Bicentennial Park located approximately 780 metres east of the Sydney Olympic Park metro station construction site Powells Creek approximately 1.2 kilometres south-east of the Sydney Olympic Park metro station construction site. 	This PCT is considered with a moderate to high likelihood to be terrestrial GDE. However, this PCT is not an obligate GDE (not entirely dependent on groundwater). This PCT is likely to be an opportunistic facultative GDE that depends on the subsurface presence of groundwater (often accessed via the capillary fringe – subsurface water just above the water table) in some locations but not in others, particularly where an alternative source of water (i.e. rainfall) cannot be accessed to maintain ecological function.	This PCT would not be directly impacted by the groundwater drawdown associated with Stage 1.	The PCT would not be directly impacted by drawdown.
			Baseflows of Haslams Creek and Powells Creek and the surface water bodies (Mason Park wetlands and Bicentennial Park wetlands) are unlikely to be affected by groundwater drawdown from Stage 1, as the predicted drawdown contours do not extend to these creeks or surface water bodies. Therefore the potential for groundwater drawdown impact is likely to be low. For the Bicentennial and Mason Park wetlands, rainfall and tidal flows from the Parramatta River are likely to be the dominant source of water for the wetland systems, and as such, the significance of any change in baseflow from groundwater (if it were to occur) is likely to be low.	The PCT along Duck Creek, Haslams Creek and Powells Creek could be impacted if reduced baseflow to these waterways were to occur, however the reliance on baseflow and therefore extent of potential impact is unknown. More information on the possible groundwater and surface water interaction is provided in Technical Paper 7 (Hydrogeology).

Groundwater Dependent Ecosystem	Location	Groundwater Dependent Ecosystem type	Likely groundwater impact	Potential impacts to the Groundwater Dependent Ecosystem
Turpentine – Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin Bioregion PCT (PCT 1281)	<p>Located at:</p> <ul style="list-style-type: none"> Concord Golf Club approximately 650 metres north-east of the North Strathfield metro station footprint Queen Elizabeth Park located approximately 450 metres north of the Burwood North Station construction site Five Dock Park located approximately 350 metres east of the Five Dock Station construction site Russel Lea Primary School located approximately 1.4 kilometres north-east of the Five Dock Station construction site. 	<p>This PCT is considered with a moderate to high likelihood to be terrestrial GDE. However, this PCT is not an obligate GDE (not entirely dependent on groundwater). This PCT is likely to be an opportunistic facultative GDE that depends on the subsurface presence of groundwater (often accessed via the capillary fringe – subsurface water just above the water table) in some locations but not in others, particularly where an alternative source of water (i.e. rainfall) cannot be accessed to maintain ecological function.</p>	<p>This PCT may be impacted by the groundwater drawdown associated with Stage 1 from the North Strathfield metro construction site, Burwood North Station construction site and the Five Dock Station construction site. Drawdown beneath all of these PCT's are predicted in the sandstone at depth. However, given the geology there is a possibility that there is a perched water table in the shale. Plant roots will be in the silty clay soils separated from the zone of drawdown by the lower permeability shale layer. Only the western portion of the PCT at Concord Golf Club is predicted to be affected by groundwater drawdown. The patch of the PCT at Russel Lea Primary School is unlikely to be impacted by groundwater drawdown.</p>	<p>Plant roots will be within the silty clay soils and given the presence of a shale layer that may have a perched aquifer the potential for impacts on this PCT is low.</p>
Common Reed on the margins of estuaries and brackish lagoons along the New South Wales coastline PCT (PCT 1808)	<p>Located in Bicentennial Park approximately 800 metres to the east and north-east of the Sydney Olympic Park metro station construction site.</p>	<p>This PCT is considered with a moderate to high likelihood to be terrestrial GDE. However, rainfall is the dominant source of water for nearly all wetland systems. Groundwater does play a role in wetlands, but it is not well understood. These wetlands may be hydrologically and ecologically linked to adjacent groundwater bodies, but the degree of interaction is not known. The wetlands are likely to be rainfall fed and are likely to have very limited dependence on groundwater given their location in Bicentennial Park.</p>	<p>This PCT would not be impacted by the groundwater drawdown associated with Stage 1.</p> <p>Stage 1 may result in a potential reduction in groundwater baseflow to Bicentennial Park wetlands. For the Bicentennial wetlands, rainfall and tidal flows from the Parramatta River are likely to be the dominant source of water for the wetland systems, and as such, the significance of this impact is likely to be low.</p>	<p>The PCT would not be directly impacted by drawdown.</p> <p>Impacts to the PCT is likely to be low. More information on the possible groundwater and surface water interaction is provided in Technical Paper 7 (Hydrogeology).</p>

5. Habitat suitability for threatened species

The Biodiversity Assessment Calculator was used to derive the list of candidate species for this assessment, but the results were also supplemented with database searches, including a review of the Threatened Biodiversity Data Collection, to identify the threatened species that have been recorded by previous surveys or are considered likely to occur in the broader locality and development site. This section provides the results of the habitat suitability assessment for threatened species as outlined in section 6 of the BAM.

5.1 Habitat suitability for species that can be predicted by habitat surrogates (ecosystem credit species)

Ecosystem credit species are those threatened species where the likelihood of occurrence of a species or elements of the species' habitat can be predicted by vegetation surrogates and landscape features, or for which targeted survey has a low probability of detection. Ecosystem credit threatened species have been assessed in conjunction with information about site context (section 4.3 and subsection 5.3.2 of the BAM), PCTs and vegetation integrity attributes (Chapter 5 of the BAM), and data from the Threatened Biodiversity Data Collection (section 6.1 of the BAM).

The Biodiversity Assessment Calculator was used to generate a list of the predicted threatened species that met the criteria outlined in section 6.4.1.3 of the BAM. The results of the BioNet search and the federal Department of the Environment and Energy's PMST search were also used to inform development of the species list.

The initial list of predicted ecosystem credit species is provided in Table 5-1. The full threatened species habitat suitability assessment is provided in Appendix A. Once the initial list of predicted ecosystem credit species was generated, the geographic limitations of each species (where applicable) were examined to see if they were met. Geographic limitations usually relate to altitude or topographic features. Where the development site is not within the geographic limitation described for a species, the species was removed from the predicted list of threatened species and no further assessment was undertaken.

In accordance with paragraphs 6.4.1.9 – 6.4.1.16 (Step 2) of the BAM, an onsite assessment was undertaken to determine the presence of any habitat constraints or microhabitats for the threatened species predicted to occur on the development site. Some species do not have any identified habitat constraints, in which case this step was not undertaken. The justification for including or excluding ecosystem credit species from the assessment is provided in Table 5-1.

Under the BAM, targeted survey is not required for ecosystem credit species. However, in some circumstances, the Threatened Biodiversity Data Collection may identify that a species requires assessment for ecosystem credits and species credits (a dual credit species). This occurs where part of the habitat is assessed as a species credit (e.g. breeding habitat, or mapped locations identified as important area that is used by a species). The remaining part of the habitat is assessed as an ecosystem credit (e.g. foraging habitat, unmapped locations used by a species). Therefore, some species are listed in both Table 5-1 and Table 5-2 as an ecosystem credit species and a species credit species.

Table 5-1: Summary of predicted ecosystem credit species that were assessed

Species name	Common name	EPBC Act *	BC Act *	Justification for inclusion / exclusion	Sensitivity to gain class
Birds					
<i>Anthochaera phrygia</i>	Regent Honeyeater (foraging)	CE	CE	Excluded from all zones. This species very infrequently visits the Sydney urban area. There is a record of this species from Sydney Olympic Park made in 2017. However, the habitats in the development site do not provide any significant resources for this species and this species is unlikely to use the development site on a permanent basis.	High
<i>Artamus cyanopterus cyanopterus</i>	Dusky Woodswallow	-	V	Included. This species is commonly seen near the Parramatta River and may forage in or over the mangroves in and adjacent to the development site.	Moderate
<i>Botaurus poiciloptilus</i>	Australasian Bittern	E	E	Excluded as the mangrove habitat to be cleared is unlikely to be suitable for this species due to its narrow shape and closed structure.	Moderate
<i>Calidris ferruginea</i>	Curlew Sandpiper (foraging)	CE	E	Excluded as the mangrove habitat to be cleared is unlikely to be suitable for this species due to its narrow shape and closed structure. Foraging habitat is not present.	High
<i>Chthonicola sagittata</i>	Speckled Warbler	-	V	Excluded from the assessment as the development site no longer provides habitat for this species. There are no records of this species from the locality.	High
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)	-	V	Excluded from the assessment as the development site no longer provides habitat for this species. There are no records of this species from the locality.	High
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork	-	V	Excluded from the assessment as this species is a vagrant to the Sydney area. There is one record of this species in the locality from Ryde in 2004. The development site is considered unlikely to provide suitable habitat.	Moderate
<i>Epthianura albifrons</i>	White-fronted Chat	-	V	Excluded from the assessment as the species is only known to occur in discreet areas in Sydney and the habitat in the development site is not optimal for the species.	Moderate

Species name	Common name	EPBC Act *	BC Act *	Justification for inclusion / exclusion	Sensitivity to gain class
<i>Glossopsitta pusilla</i>	Little Lorikeet	-	V	Included but the only habitat for this species in the development footprint consists of highly disturbed rail corridor vegetation that does not represent any significant foraging or nesting opportunities for this species. While this species is unlikely to use the development site on a permanent basis, temporary foraging cannot be discounted. Impacts on this species associated with the loss of planted vegetation are discussed in Section 9.2.	High
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle (foraging)	M	V	Excluded as the habitat to be cleared is unlikely to be suitable for this species due to its narrow shape and closed structure.	High
<i>Lathamus discolor</i>	Swift Parrot (foraging)	CE	E	Included but the only habitat for this species in the development footprint consists of highly disturbed rail corridor vegetation that does not represent any significant foraging or nesting opportunities for this species. While this species is unlikely to use the development site on a permanent basis, temporary foraging cannot be discounted. Impacts on this species associated with the loss of planted vegetation are discussed in Section 9.2.	Moderate
<i>Limicola falcinellus</i>	Broad-billed Sandpiper (foraging)	-	V	Excluded as the mangrove habitat to be cleared is unlikely to be suitable for this species due to its narrow shape and closed structure.	High
<i>Limosa limosa</i>	Black-tailed Godwit (foraging)	-	V	Excluded as the mangrove habitat to be cleared is unlikely to be suitable for this species due to its narrow shape and closed structure.	High
<i>Melanodryas cucullata cucullata</i>	Hooded Robin (south-eastern form)	-	V	Excluded from the assessment as the development site no longer provides habitat for this species.	Moderate
<i>Pandion cristatus</i>	Eastern Osprey (foraging)	M	V	Excluded as the mangrove habitat to be cleared is unlikely to be suitable for this species due to its narrow shape and closed structure.	Moderate

Species name	Common name	EPBC Act *	BC Act *	Justification for inclusion / exclusion	Sensitivity to gain class
<i>Petroica boodang</i>	Scarlet Robin	-	V	Excluded from assessment. The development site does not contain any significant source of habitat for this species and it is considered unlikely to occur.	Moderate
<i>Petroica phoenicea</i>	Flame Robin	-	V	Excluded from assessment. There are only five records of this species from the locality, but one is a recent 2017 record from Newington suggesting this species does still use the habitats in the Sydney urban area on occasion. However, the development site does not contain any significant source of habitat for this species and it is considered unlikely to occur	Moderate
<i>Stagonopleura guttata</i>	Diamond Firetail	-	V	Excluded from the assessment as the development site no longer provides habitat for this species.	Moderate
Mammals					
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	E	V	Excluded from the assessment as the development site no longer provides optimal habitat for this species. There are nine records of this species from the locality, but it hasn't been recorded in the locality since 2013 and is unlikely to use the urban areas of the development site.	High
<i>Miniopterus australis</i>	Little Bent-winged Bat (foraging)	-	V	Included. May forage in and around the mangrove vegetation present in the development footprint. Impacts on this species associated with the loss of planted vegetation are discussed in Section 9.2.	High
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat (foraging)	-	V	Included. May forage in and around the mangrove vegetation present in the footprint. Impacts on this species associated with the loss of planted vegetation are discussed in Section 9.2.	High
<i>Micronomus norfolkensis</i>	Eastern Coastal Free-tailed Bat	-	V	Included in all zones. Likely to forage in the vegetation present in the development footprint. Mangrove trees can provide roosting habitat for this species. Impacts on this species associated with the loss of planted vegetation are discussed in Section 9.2.	High

Species name	Common name	EPBC Act *	BC Act *	Justification for inclusion / exclusion	Sensitivity to gain class
<i>Phascolarctos cinereus</i>	Koala (foraging)	V	V	Excluded from the assessment. There are 17 records of the Koala in the locality. However, the PCTs in the development site do not contain significant foraging resources for this species.	High
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox (foraging)	V	V	Included. May forage in the mangrove vegetation present in the development footprint. Impacts on this species associated with the loss of planted vegetation are discussed in Section 9.2.	High

Key: CE = critically endangered, E = endangered, V = vulnerable, M = migratory

5.2 Habitat suitability for species that cannot be predicted by habitat surrogates (species credit species)

Habitat suitability is identified as the degree to which the habitat needs of threatened species are present at a particular site. Species credit species have been assessed in conjunction with information collected about the site context of the development site (section 4.3 of the BAM), on PCTs and vegetation integrity attributes in (section 5 of the BAM), and data obtained from the Threatened Biodiversity Data Collection (section 6.1 of the BAM).

Species credit species are threatened species or components of species habitat that are identified in the Threatened Species Data Collection as requiring assessment for species credits. Species credit species are those species for which the likelihood of occurrence, or elements of suitable habitat, cannot be confidently predicted by vegetation surrogates or landscape features. Species credit species can be reliably detected by survey. Based on the assessment of habitat in the development site, and review of databases and published information, the species credit species as outlined in Table 5-2 are considered 'candidate species' for the assessment. The full threatened species habitat suitability assessment is provided in Appendix A.

Table 5-2: Summary of candidate species credit species returned by the Biodiversity Assessment Calculator

Species name	Common name	EPBC Act*	BC Act*	Sensitivity to gain class
Plants				
<i>Acacia bynoeana</i>	Bynoe's Wattle	V	E	High
<i>Acacia pubescens</i>	Downy Wattle	V	V	High
<i>Caladenia tessellata</i>	Thick Lip Spider Orchid	V	E	Moderate
<i>Cynanchum elegans</i>	White-flowered Wax Plant	E	E	High
<i>Dillwynia tenuifolia</i>	Dillwynia tenuifolia	-	V	High
<i>Dillwynia tenuifolia</i> - endangered population	Dillwynia tenuifolia, Kemps Creek	-	EP	NA
<i>Eucalyptus benthamii</i>	Camden White Gum	V	V	High
<i>Grevillea juniperina</i> subsp. <i>juniperina</i>	Juniper-leaved Grevillea	-	V	High
<i>Haloragis exalata</i> subsp. <i>exalata</i>	Square Raspwort	V	V	Moderate

Species name	Common name	EPBC Act*	BC Act*	Sensitivity to gain class
<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> - endangered population	Marsdenia viridiflora R. Br. subsp. viridiflora population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	-	EP	High
<i>Persoonia bargoensis</i>	Bargo Geebung	V	E	High
<i>Pimelea curviflora</i> var. <i>curviflora</i>	Pimelea curviflora var. curviflora	V	V	High
<i>Pimelea spicata</i>	Spiked Rice-flower	V	E	High
<i>Pterostylis saxicola</i>	Sydney Plains Greenhood	E	E	High
<i>Pultenaea pedunculata</i>	Matted Bush-pea	-	V	NA
<i>Thesium australe</i>	Austral Toadflax	V	V	Moderate
<i>Wilsonia backhousei</i>	Narrow-leafed Wilsonia	-	V	High
Birds				
<i>Anthochaera phrygia</i>	Regent Honeyeater (breeding)	CE	CE	High
<i>Calidris ferruginea</i>	Curlew Sandpiper (breeding)	CE	E	High
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle (breeding)	M	V	High
<i>Lathamus discolor</i>	Swift Parrot (breeding)	CE	E	Moderate
<i>Limicola falcinellus</i>	Broad-billed Sandpiper (breeding)	-	V	High
<i>Limosa limosa</i>	Black-tailed Godwit (breeding)	-	V	High
<i>Pandion cristatus</i>	Eastern Osprey (breeding)	M	V	Moderate
Mammals				
<i>Miniopterus australis</i>	Little Bent-winged Bat (breeding)	-	V	Very High
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat (breeding)	-	V	Very High
<i>Myotis macropus</i>	Southern Myotis	-	V	High
<i>Petaurus norfolcensis</i>	Squirrel Glider	-	V	High
<i>Phascolarctos cinereus</i>	Koala (breeding)	V	V	High
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox (breeding)	V	V	High
Frogs				
<i>Litoria aurea</i>	Green and Golden Bell Frog	V	E	High
Invertebrates				
<i>Meridolum corneovirens</i>	Cumberland Plain Land Snail	-	E	High
<i>Pommerhelix duralensis</i>	Dural Woodland Snail	E	E	High

Key: CE = critically endangered, E = endangered, V = vulnerable, M = migratory

5.2.1 Identifying geographic and habitat constraints

Once the initial list of predicted candidate species credit species was generated, the geographic limitations of each species (where applicable) were examined to see if they were met. Where the development site is not within

the geographic limitation described for a species, the species was removed from the predicted list of threatened species and no further assessment was undertaken. In accordance with paragraphs 6.4.1.9 – 6.4.1.16 (Step 2) of the BAM, an onsite assessment was undertaken to determine the presence of any habitat constraints or microhabitats for the threatened species predicted to occur on the development site. Some species do not have any identified habitat constraints, in which case this step was not undertaken. The species included or excluded based on habitat constraints or geographic limitations are outlined below in Table 5-3.

None of the identified species have geographic limitations.

Table 5-3: Summary of candidate species credit species with geographic or habitat constraints

Species name	Common name	EPBC Act	BC & FM Act	Habitat constraint	Geographic limitation	Justification for inclusion / exclusion
Plants						
<i>Dillwynia tenuifolia</i> - endangered population	Dillwynia tenuifolia, Kemps Creek	-	EP	-	The area bounded by western Road, Elizabeth Drive, Devonshire Road and Cross Street, Kemps Creek in the Liverpool Local Government Area	Excluded as the development site is not in the area bounded by western Road, Elizabeth Drive, Devonshire Road and Cross Street, Kemps Creek in the Liverpool Local Government Area.
<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> - endangered population	Marsdenia viridiflora R. Br. subsp. <i>viridiflora</i> population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	-	EP	-	The Local Government Areas named in the population's listing	Included. The Westmead metro station construction site is in the former Holroyd Local Government Area.

Species name	Common name	EPBC Act	BC & FM Act	Habitat constraint	Geographic limitation	Justification for inclusion / exclusion
<i>Wilsonia backhousei</i>	Narrow-leafed Wilsonia	-	V	Other Margins of salt marshes and lakes, both coastal and inland	-	Included due to the presence of saline wet areas.
Mammals						
<i>Myotis macropus</i>	Southern Myotis	-	V	Hollow bearing trees Within 200 metres of riparian zone Other Bridges, caves or artificial structures within 200 metres of riparian zone	-	Included as the development site is within 200 metres of riparian zones.
Frogs						
<i>Litoria aurea</i>	Green and Golden Bell Frog	V	E	Semi-permanent/ephemeral wet areas Within one kilometre of wet areas swamps	-	Included as the development site is within one kilometre of wet areas.
Invertebrates						
<i>Pommerhelix duralensis</i>	Dural Woodland Snail	E	E	Other Leaf litter and shed bark or within 50 metres of litter or bark Rocky areas Rocks or within 50 metres of rocks Fallen/standing dead timber including logs Including logs and bark or within 50 metres of logs or bark	-	Included. Westmead metro station construction site contains leaf litter.

Key: CE = critically endangered, E = endangered, EP = endangered population, V = vulnerable

5.2.2 Identifying candidate species for further assessment

In accordance with paragraphs 6.4.1.17 – 6.4.1.19 (Step 3) of the BAM, a field assessment was undertaken to determine whether the habitats within the development site were substantially degraded to the point that a candidate species is unlikely to utilise the development site (or specific vegetation zones). There were a number of threatened species returned from the calculator that are species credit species if breeding habitat would be impacted. These species include the Regent Honeyeater, Curlew Sandpiper, White-bellied Sea-Eagle, Swift Parrot, Broad-billed Sandpiper, Black-tailed Godwit, Eastern Osprey, Little Bent-winged Bat, Large Bent-winged

Bat, Koala, and Grey-headed Flying-fox. The development site does not contain breeding habitat for any of these identified species as follows:

- The Regent Honeyeater does not typically breed in the Sydney urban area. There are only three known key breeding regions remaining for the Regent Honeyeater: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region. Therefore, the Regent Honeyeater was removed from the candidate species list
- The Swift Parrot breeds in Tasmania. As such, it was removed from the candidate species list
- The Curlew Sandpiper, Broad-billed Sandpiper, and Black-tailed Godwit are migratory wading birds that breed in Siberia. The Black-tailed Godwit also breeds in Mongolia. As such, these three species were removed from the candidate species list
- White-bellied Sea-Eagle breeding habitat is specified as live large old trees within one kilometre of rivers, lakes, large dams or creeks, wetlands and coastlines AND the presence of a large stick nest within tree canopy; or an adult with nest material; or adults observed duetting within breeding period. There are no live large old trees within the development site that contain large stick nests. The habitats within the development site contain relatively small *Avicennia marina* and planted *Eucalyptus* spp. trees that are not suitable as nesting sites for the White-bellied Sea-Eagle. Consequently, the White-bellied Sea-Eagle was removed from the candidate species list
- Eastern Osprey nests are made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea. As for the White-bellied Sea-Eagle, no nests were found in the development site. The habitats within the development site contain relatively small *Avicennia marina* and planted *Eucalyptus* spp. trees that are not suitable as nesting sites for the Eastern Osprey. Consequently, the Eastern Osprey was removed from the candidate species list
- Breeding habitat for the Little Bent-winged Bat is highly specific and is restricted to cave systems. There are only five nursery sites /maternity colonies known in Australia and a single maternity colony in NSW which is in close association with a large maternity colony of Large Bent-winged bats. The breeding colonies of the Little Bent-winged Bat and Large Bentwinged Bat are not in the Sydney area and would not be affected. As such, these species were removed from the candidate species list
- There are no Koala breeding colonies in or near the development site. Consequently, the Koala was removed from the candidate species list
- There are no Grey-headed Flying-fox camps in the development site. The nearest camps are at Parramatta Park and Clyde, but these camps would not be affected. The Clyde camp is located on Duck River approximately 800 metres to the south-west of the Clyde stabling and maintenance facility construction site and the camp would not be impacted by Stage 1. Consequently, the Grey-headed Flying-fox was removed from the candidate species list.

The Squirrel Glider was returned as a potential candidate species from the Biodiversity Assessment Calculator. This is due to the presence of the Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion PCT (PCT 920). However, the habitats within the development site are not considered to be suitable for the Squirrel Glider. There are only two records of the Squirrel Glider in the locality (Pennant Hills and Taronga Zoo) and this species has not been observed within the habitats in the locality since 2012. The mangrove habitats within the development site do not provide the necessary foraging, sheltering or breeding resources for the Squirrel Glider so it was removed from the candidate species list.

The Green and Golden Bell Frog has been excluded based on habitat degradation. A'Becketts Creek and Duck Creek are unlikely to provide suitable breeding habitat for the Green and Golden Bell Frog. These two waterways are tidal (not still water), have permanent water, are polluted, lack emergent aquatic plant species (i.e. no Typha, Phragmites, etc.), and contain predatory fish including Gambusia and Carp. These factors combine to make the habitats unsuitable as breeding habitat for this species. While the Green and Golden Bell Frog does inhabit many

disturbed sites, including the Viva Energy site to the north-east, A'Becketts Creek and Duck Creek contain a very different environment. For breeding, the Green and Golden Bell Frog needs water bodies that are still, shallow, ephemeral, unpolluted (but the frog can be found in polluted habitats), unshaded, with aquatic plants and free of mosquito fish and other predatory fish. This is not found in A'Becketts Creek or Duck Creek. Green and Golden Bell Frogs are also associated with terrestrial habitats consisting of grassy areas and vegetation no higher than woodlands, and a range of diurnal shelter sites. The riparian vegetation along A'Becketts Creek and Duck Creek is very dense with a closed canopy of Grey Mangrove at the water's edge and planted eucalypts at the landward side. The remainder of the vegetation along each creek is dominated by a dense cover of exotic climbers and herbaceous species. There are no terrestrial grassland habitats or open woodlands adjacent to the waterway that would be suitable as terrestrial habitat for the Green and Golden Bell Frog. Developed areas of the Clyde stabling and maintenance construction site (e.g. industrial properties and the Sydney Speedway (located on NSW Government owned land)) are unlikely to provide suitable habitats as the areas do not contain any ephemeral wetlands and are not directly connected to any breeding habitats. The tunnels would pass underneath Haslam's Creek at depth, which is known to provide habitat for a population of the Green and Golden Bell Frog. However, there would be no direct impacts to the wetland habitat in this area.

Cumberland Plain Land Snail has been excluded from the assessment based on habitat degradation. The area of habitat (PCT 849) at the Westmead metro station construction site is very small and has been subject to a history of disturbance. It is unlikely that the Cumberland Plain Land Snail still exists in the rail corridor. Likewise, the habitat is not considered suitable for the Dural Woodland Snail due to the disturbance that has occurred. The development site is also outside of the known distribution of the Dural Woodland Snail.

The habitats within the development site are highly disturbed. Regrowth of some native species from PCT 849 is present at the Westmead metro station construction site but the habitat quality is poor. The vegetation in this area was comprehensively cleared and is likely regrowth from the 1990s (based on historical aerial photos) and significant soil disturbance has taken place. Due to the disturbance the following plant species are considered unlikely to occur and were excluded from the assessment based on habitat degradation:

- *Caladenia tessellata*
- *Pimelea spicata*
- *Pterostylis saxicola*
- *Thesium australe*.

The following species were excluded from the assessment as they do not occur in the development site based on known distributions:

- *Acacia bynoeana*
- *Dillwynia tenuifolia* – endangered population (*Dillwynia tenuifolia*, Kemps Creek)
- *Eucalyptus benthami*
- *Persoonia bargoensis*
- *Pimelea curviflora* var. *curviflora*.

The list of species retained for further assessment is shown in Table 5-4.

Table 5-4: Summary of candidate species credit species for further assessment

Species name	Common name	EPBC Act	BC & FM Act	Sensitivity to gain class	SAIL*	Relevant construction site
Plants						
<i>Acacia pubescens</i>	Downy Wattle	V	V	High	No	Westmead metro station construction site
<i>Cynanchum elegans</i>	White-flowered Wax Plant	E	E	High	No	Westmead metro station construction site
<i>Dillwynia tenuifolia</i>	Dillwynia tenuifolia	-	V	High	No	Westmead metro station construction site
<i>Grevillea juniperina</i> subsp. <i>juniperina</i>	Juniper-leaved Grevillea	-	V	High	No	Westmead metro station construction site
<i>Haloragis exalata</i> subsp. <i>exalata</i>	Square Raspwort	V	V	Moderate	No	Clyde stabling and maintenance facility construction site
<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> - endangered population	Marsdenia viridiflora R. Br. subsp. viridiflora population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	-	EP	High	No	Westmead metro station construction site
<i>Pultenaea pedunculata</i>	Matted Bush-pea	-	V	NA	No	Westmead metro station construction site
<i>Wilsonia backhousei</i>	Narrow-leaved Wilsonia	-	V	High	No	Clyde stabling and maintenance facility construction site
Mammals						
<i>Myotis macropus</i>	Southern Myotis	-	V	High	No	Clyde stabling and maintenance facility site

Note: SAIL* = Serious and Irreversible Impact Entity.

5.3 Threatened species survey results

5.3.1 Threatened plant species

No threatened plant species were found in the development site during the surveys.

Wilsonia backhousei was not found within the development site during the surveys undertaken for this BDAR. However, a small sub-population of this species was found about 1.2 kilometres downstream of the Clyde stabling and maintenance facility construction site in the saltmarsh habitat along the Duck River in four separate clumps (see photo 15 and 16). The plants are restricted to microhabitats between the expanse of *Sarcocornia quinqueflora* and the ring of *Sporobolus virginicus* that separates the saltmarsh from the adjacent swamp oak forest habitats. *Wilsonia backhousei* does not appear to inhabit most of the main saltmarsh area and is restricted to a limited occurrence at the saltmarsh edge. This sub-population of *Wilsonia backhousei* is part of a larger population that occurs along Duck River with more extensive occurrences present in the patches of saltmarsh on the western side of Duck River. There would be no direct impact to this species but there may be potential for indirect off-site impacts and potential impacts from groundwater drawdown (see discussion in Section 9.2.5).



Photo 15 and 16: *Wilsonia backhousei* and saltmarsh habitat on the Duck River about 1.2 kilometres downstream of the Clyde stabling and maintenance facility construction site

5.3.2 Threatened animal species

Targeted surveys for threatened animals were not undertaken during the surveys undertaken for this BDAR. The assessment of these species was habitat based and also used existing information on species distributions and data from previous surveys undertaken for other Environmental Impact Statements including the Ecological Assessment for the Clyde Terminal Conversion Environmental Impact Statement (AECOM Australia Pty Ltd, 2013) and the more recent BDAR for the Viva Energy Clyde Western Area Remediation Project (Biosis, 2018). The Biodiversity Assessment Report for the Parramatta Light Rail (Stage 1) project (WSP, 2017) was also reviewed and relevant data used to inform this assessment.

The Southern Myotis is assumed to be present within the development site in accordance with paragraph 6.4.1.2.1 of the BAM. The Southern Myotis is considered likely to occur based on the presence of suitable habitat in the form of the Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion PCT (PCT 920). Foraging habitat is present downstream along the Duck River. No potential roosting or breeding habitat is present. The Southern Myotis is known to occur around the Port Jackson estuary and its tributaries. Records of the Southern Myotis exist from the Sydney Olympic Park area (likely due to the level of survey effort concentrated in this area rather than actual distribution of the species). While, the Parramatta River has been

shown to be potentially less suitable for the Southern Myotis than other parts of the Port Jackson estuary (see Gonsalves and Law, 2017), habitat is present and the species is considered likely to occur. Impacts to the habitat for the Southern Myotis are outlined in Section 9.1. The species polygon for the Southern Myotis is estimated at 0.15 hectares (extent of PCT 920) and is shown in Figure 5-1.

5.3.3 Serious and irreversible impact entities

The concept of serious and irreversible impacts (SAIL) is fundamentally about protecting threatened entities that are most at risk of extinction from potential development. The Biodiversity Offsets Scheme recognises that there are some types of serious and irreversible impacts that the community expects will not occur except where the consent authority considers that this type of impact is outweighed by the social and economic benefits that a development will deliver to the State. There are no SAIL entities that would be affected.

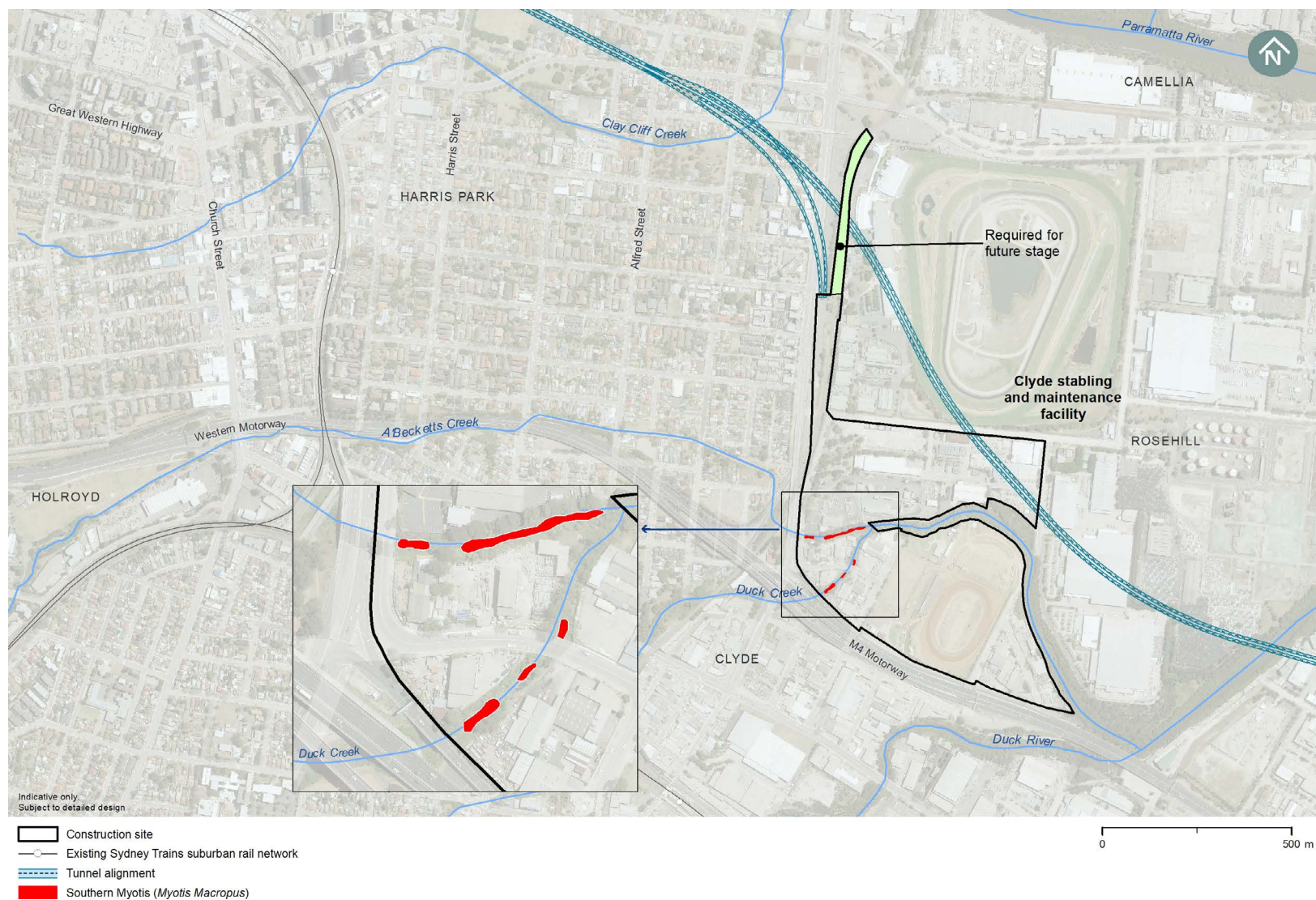


Figure 5-1: Threatened species polygon for Southern Myotis (*Myotis macropus*)

6. Aquatic assessment

Aquatic habitats within the development site and broader locality were assessed against the *Policy and guidelines for fish habitat conservation and management – Update 2013* (NSW Department of Primary Industries, 2013) and *Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull and Witheridge, 2003). The Aquatic Ecology in Environmental Impact Assessment – EIA Guideline (Lincoln Smith, 2003) was used to guide the level of aquatic assessment required for Sydney Metro West. There is sufficient existing information to describe the existing aquatic environment and to assess the quality and importance of the aquatic environments to be impacted by Stage 1. As such, this assessment was based on a review of existing information and a habitat assessment.

Searches of databases, existing mapping and other literature were used to identify the locations of these sensitive receptors. Sources included:

- Fisheries Spatial Data Portal
- Protected Matters Search Tool
- Atlas of GDEs (Bureau of Meteorology, 2017)
- Australian Wetlands Database (Department of the Environment and Energy, 2019).

6.1 Existing environment

The development site is located entirely within the Sydney Metro catchment (Port Jackson) which includes Parramatta River and Sydney Harbour. Parramatta River becomes Sydney Harbour at the confluence with Lane Cove River.

The Stage 1 construction sites (with the exception of The Bays Station construction site) are located within the upper estuary of the Parramatta River catchment, one of the main tributaries of Sydney Harbour. The Bays Station construction site drains to White Bay in the lower estuary of Sydney Harbour. The Parramatta River catchment and Sydney Harbour includes the Sydney CBD and significant commercial districts of North Sydney and Parramatta. The catchment is highly urbanised and altered from its natural state, with pockets of open spaces and parkland. These landuses influence the water quality and quantity and velocity of flows within the catchment. Most of the catchment is estuarine, up to the tidal limit at Charles Street weir in Parramatta with freshwater watercourses in the upper catchments of the tributaries of Parramatta River. The catchment lies over the Cumberland Plain which is relatively flat with elevation ranging from 140 metres Australian Height Datum (AHD) in the north-west of the catchment to sea level in the east.

The tunnel alignment would pass at depth beneath Domain Creek, Clay Cliff Creek, Duck River, Haslams Creek, Saleyards Creek, Powells Creek and Iron Cove. Duck Creek and A'Becketts Creek would be crossed with structures as part of the Clyde stabling and maintenance facility construction site (see Figure 6-1 (Map 1 to Map 5)). These creeks are discussed in more detail below in Section 6.1.1. Other waterways in the 1,500 metre landscape buffer include Coopers Creek, Toongabbie Creek, Finlaysons Creek, Parramatta River, Darling Mills Creek, Vineyard Creek, Subiaco Creek, Saltwater Creek, Iron Cove Creek, Hawthorne Canal, Whites Creek Johnstons Creek and a number of unnamed tributaries and canals (see Figure 3-1 and Figure 3-2).

The 1,500 metre landscape buffer includes the upper reaches of the Parramatta River estuary, Homebush Bay, Exile Bay, Canada Bay, Kings Bay, Hen and Chicken Bay, Iron Cove, Rozelle Bay, Johnstons Bay, White Bay and Elizabeth Macarthur Bay (see Figure 3-1 and Figure 3-2).

6.1.1 Parramatta River

The tunnels would be located to the south of the upper extents of Parramatta River, and pass beneath the upper Parramatta River estuary at Iron Cove (at approximately 35 to 45 metres below ground). The Parramatta metro station construction site is located approximately 300 metres to the south of Parramatta River. Construction water treatment plant discharges would ultimately discharge treated groundwater to Parramatta River via the local stormwater network.

The Parramatta River is the main tributary of Sydney Harbour (a large fourth order waterway). The headwaters of the Parramatta River are formed by the confluence of Toongabbie Creek and Darling Mills Creek in North Parramatta. The river is tidal to Charles Street Weir in Parramatta, approximately 30 kilometres upstream from Sydney Heads. The Parramatta River catchment is approximately 257 square kilometres and consists of numerous land uses, including residential, commercial, environmental protection, education, industrial, open space and recreation services, transport and communications (Cardno Lawson Treloar, 2008). Water quality is dominated by catchment inputs, including stormwater and wastewater overflow resulting in elevated levels of nutrients and pollutants. Flooding of the Parramatta River occurs on a periodic basis as a result of rainfall events in the catchment.

The Parramatta River is mapped as Key Fish Habitat (Type 1 – Highly sensitive Key Fish Habitat) and is classified as Class 1 (major key fish habitat) as it is a permanently flowing river. Coastal wetlands which are listed under the Coastal Management SEPP occur along large sections of the Parramatta River estuary.

Historically, the catchment was heavily impacted by industry, which has resulted in contaminated sediments, with high concentrations of metals and nutrients typically associated with point sources or where creeks and stormwater outlets enter the estuary in the upper reaches of embayments (Cardno Lawson Treloar, 2008). Many parts of the estuary have been subject to land reclamation, and in many cases, these reclaimed lands have been filled with rubbish or other waste materials. In addition, historical industrial activity has left a legacy of contamination and a number of the tributaries have been channelised and altered from their natural state (Cardno, 2012). As such commercial taking of fish (and other species) from the Parramatta River Estuary has been banned due to concerns over the levels of contaminants (including dioxins) in estuarine fauna. In addition to contaminated sediments, there are areas that have a high probability of occurrence for acid sulfate soils which have the potential to impact on water and sediment quality and aquatic ecology. Whilst a large amount of estuarine habitats have been lost due to the development of the foreshores, significant stands of mangroves still exist and nationally significant wetlands remain in Bicentennial Park and Newington Nature Reserve Wetland (Cardno, 2012).

The Parramatta River Catchment Group is currently working to improve the water quality of Parramatta River. Water quality appears to be improving as a result of these catchment management measures, however wastewater overflows and stormwater continue to contribute to poor water quality conditions Parramatta River (Parramatta City Council, 2016).

Coopers Creek

Coopers Creek is located approximately 1.5 kilometres north-west of the Westmead metro station construction site. Coopers Creek is unlikely to be impacted by Stage 1.

Coopers Creek is a first order Strahler stream that originates in Greystanes and flows into Toongabbie Creek at Parramatta. The creek drains a heavily urbanised and industrialised catchment.

Coopers Creek is not mapped as Key Fish Habitat. However, where Coopers Creek joins Toongabbie River the creek is likely to be a Class 2 (Moderate Key Fish Habitat) as it is a non-permanently flowing (intermittent) creek with clearly defined bed and banks with semi-permanent to permanent waters in pools. No threatened species listed under the *Fisheries Management Act 1994* have potential habitat within Coopers Creek.

Toongabbie Creek

The tunnels would be located approximately 970 metres to the south-east of Toongabbie Creek and the Westmead metro station construction site is located approximately 1.2 kilometres to the south-east of Toongabbie Creek. Toongabbie Creek is unlikely to be impacted by Stage 1 however the predicted groundwater drawdown contours from the excavation of Westmead metro station construction site extend in a northerly direction close to the creek.

The Parramatta metro station construction site is located approximately 300 metres to the south of Parramatta River. Construction water treatment plant discharges would ultimately discharge treated groundwater to Parramatta River via the local stormwater network.

Toongabbie Creek is an urban creek in the upper Parramatta River Catchment. It is one of the major tributaries flowing into Parramatta River at Cumberland Hospital. Toongabbie Creek is a third order Strahler stream fed by numerous tributaries including Lalor Creek, Finlaysons Creek, Coopers Creek, Northmead Gully, Burra Creek, Girraween Creek, Quarry Branch Creek, Greystanes Creek and Blacktown Creek. The creek drains a heavily urbanised and industrialised catchment and water quality is influenced by diffuse sources of pollution including stormwater runoff and wastewater overflows in addition to the inflows from its tributaries, particularly Blacktown and Lalor Creeks.

The waterway is mapped as Key Fish Habitat (Type 2 – Moderately Sensitive Key Fish Habitat) and is classified as Class 1 (major key fish habitat) as it is permanently flowing with suitable aquatic habitat features, including overhanging vegetation and aquatic macrophytes present within the stream and along the banks.

Finlaysons Creek

Finlaysons Creek is located approximately 800 metres to the west of the alignment and around one kilometre to the west of the Westmead metro station construction site. Its confluence with Toongabbie Creek is located near Milson Park, located around 800 metres to the north-east of the alignment. Finlaysons Creek is unlikely to be impacted by Stage 1.

Finlaysons Creek is a freshwater, first order watercourse originating in South Wentworthville, flowing through residential areas and several parks. Within the vicinity of Westmead, the majority of the creek is a modified and concrete lined channel. Finlaysons Creek contains no instream aquatic habitat. Finlaysons Creek is not mapped as Key Fish Habitat, and it is not considered to be Key Fish Habitat in accordance with the *Policy and guidelines for fish habitat conservation and management – Update 2013* (NSW Department of Primary Industries, 2013). It is classified as Class 4 (unlikely key fish habitat). No threatened species listed under the *Fisheries Management Act 1994* have potential habitat within Finlaysons Creek.

Darling Mills Creek

Darling Mills Creek is located approximately 1.5 kilometres to the north-east of the Westmead metro station construction site. Darling Mills Creek is unlikely to be impacted by Stage 1.

Darling Mills Creek is a freshwater, fourth order watercourse in the area where it meets the confluence of Toongabbie Creek and the Parramatta River at Northmead, originating in West Pennant Hills. Darling Mills Creek has a natural channel and the catchment of the creek includes bushland and residential, commercial and industrial properties.

The instream habitat includes aquatic macrophytes and riparian vegetation. Darling Mills Creek is mapped as Key Fish Habitat (Type 2 – Moderately Sensitive Key Fish Habitat) and is classified as Class 2 (Moderate Key Fish Habitat) as it is a non-permanently flowing (intermittent) creek with clearly defined bed and banks with semi-

permanent to permanent waters in pools. No threatened species listed under the *Fisheries Management Act 1994* have potential habitat within Darling Mills Creek.

Domain Creek

The tunnels pass under Domain Creek approximately 25 metres below ground and 200 metres from the confluence with the Parramatta River and 450 metres away from Westmead Station. The Westmead metro station construction site is around 300 metres to the west from Domain Creek. Construction water treatment plant discharges would ultimately discharge to Domain Creek via the local stormwater network.

Domain Creek is a freshwater, first order watercourse, originating in Pemulwuy Reserve, flowing through Parramatta Park and into the Parramatta River. Within the vicinity of the rail tunnel, Domain Creek is a modified waterway with sections of naturalised channel, and sections that are concrete-lined. The catchment of the creek includes parkland and residential properties.

The instream habitat includes aquatic macrophytes and limited overhanging riparian vegetation. Domain Creek is not mapped as Key Fish Habitat. However, it is classified as Class 1 (major key fish habitat) as it is permanently flowing. No threatened species listed under the *Fisheries Management Act 1994* have potential habitat within Domain Creek. There are no coastal wetlands as defined in Coastal Management SEPP. Domain Creek is not listed on the Australian Wetlands Database.

Clay Cliff Creek

The tunnels pass approximately 30 metres below Clay Cliff Creek and 820 metres upstream of the confluence with the Parramatta River.

Clay Cliff Creek is a highly modified second order watercourse that discharges into the Parramatta River. Clay Cliff Creek is a concrete lined channel, with underground sections, and contains no instream habitat. It is not mapped as Key Fish Habitat and is classified as Class 4 (unlikely key fish habitat). No threatened species listed under the *Fisheries Management Act 1994* have potential habitat within Clay Cliff Creek. A coastal wetland listed under the Coastal Management SEPP is located downstream along the banks of the Parramatta River at the confluence with Clay Cliff Creek.

Vineyard Creek

Vineyard Creek is located approximately 1.4 kilometres to the north of the Clyde stabling and maintenance facility construction site on the northern side of the Parramatta River and would not be impacted by Stage 1.

Vineyard Creek is a freshwater, second order watercourse that becomes estuarine where it meets the Parramatta River at Parramatta. Vineyard Creek originates in Telopea and has a natural channel. The catchment of the creek includes bushland and residential, commercial and industrial properties.

Vineyard Creek is not mapped as Key Fish Habitat but is likely to be a Class 2 (Moderate Key Fish Habitat) as it is a non-permanently flowing (intermittent) creek with clearly defined bed and banks with semi-permanent to permanent waters in pools. No threatened species listed under the *Fisheries Management Act 1994* have potential habitat within Vineyard Creek.

Subiaco Creek

Subiaco Creek is located approximately 1.4 kilometres to the north of the Clyde stabling and maintenance facility construction site on the northern side of the Parramatta River and would not be impacted by Stage 1.

Subiaco Creek is a freshwater, second order watercourse that becomes estuarine where it meets the Parramatta River at Rydalmere. Subiaco Creek originates in Rydalmere and has a natural channel. The catchment of the creek includes bushland and residential, commercial and industrial properties.

Subiaco Creek is mapped as Key Fish Habitat (Type 2 – Moderately Sensitive Key Fish Habitat) and is likely to be a Class 2 (Moderate Key Fish Habitat) as it is a non-permanently flowing (intermittent) creek with clearly defined bed and banks with semi-permanent to permanent waters in pools. No threatened species listed under the *Fisheries Management Act 1994* have potential habitat within Subiaco Creek.

Duck River

The tunnels pass under Duck River approximately 30 metres below ground and 1.7 kilometres upstream of the confluence with the Parramatta River. The Clyde stabling and maintenance facility construction site is located upstream. The Silverwater services facility construction site is located around 950 metres to the east of Duck River. Construction water treatment plant discharges would ultimately discharge to Duck River from the Silverwater services facility construction site via the stormwater network.

Duck River originates at a drain in Birrong, flowing in a north-east direction for about 11.5 kilometres to the confluence with the Parramatta River at Silverwater. Within the study area, Duck River is a third order estuarine watercourse. The Duck River tidal limit is located at the railway culvert at Memorial Drive. The Duck River catchment is approximately 41 square kilometres, and contains a mix of residential, industrial and commercial developments together with areas of open space (parks, Auburn and Woodville golf courses). The upper extents are generally concrete lined open channels and pipes, becoming a semi-naturalised channel within the lower estuary.

Duck River is mapped as Key Fish Habitat and is classified as Type 1 Key Fish Habitat. It is also classified as Class 1 (major key fish habitat) as it is a permanently flowing river. No threatened species listed under the *Fisheries Management Act 1994* have potential habitat within Duck River. The banks of the channel are densely vegetated by mangroves and are mapped as coastal wetlands as defined by SEPP Coastal Wetlands.

Duck Creek

The creek is located within and adjacent to the Clyde stabling and maintenance facility construction site. Construction water treatment plant discharges would discharge to Duck Creek via the local stormwater network.

Duck Creek is a highly modified second order watercourse which drains into Duck River at Clyde / Rosehill. It receives flows from the urbanised catchments of Guildford, Granville and Clyde. Duck Creek is estuarine within the development site but becomes less saline and eventually freshwater in its upper reaches. In the development site, the channel of the creek contains mangrove vegetation, but the banks are dominated by exotic species with occasional planted native trees. Upstream of the development site, the creek consists of concrete-lined open channel and pipes.

The creek is mapped as Key Fish Habitat and is classified as Type 1 (Key Fish Habitat). It is also classified as Class 1 (major key fish habitat) as it is a permanently flowing estuarine river. No threatened species listed under the *Fisheries Management Act 1994* have potential habitat within Duck Creek. Areas of coastal wetland as defined by the Coastal Management SEPP are mapped along Duck Creek, including an area within the Clyde stabling and maintenance facility construction site at the confluence of Duck Creek and A'Becketts Creek.

A'Becketts Creek

A'Becketts Creek is located upstream and within the Clyde stabling and maintenance facility construction site.

A'Becketts Creek is a highly modified first order watercourse which drains into the Duck Creek at Clyde. It receives flows from the urbanised catchments of Merrylands, Harris Park, Holroyd and Clyde. A'Becketts Creek is estuarine within the development site but becomes less saline and eventually freshwater in its upper reaches. In the development site, the channel of the creek contains mangrove vegetation, but the banks are dominated by exotic species with occasional planted native trees. Upstream of the development site, the creek consists of concrete-lined open channel and pipes.

The creek is not mapped as Key Fish Habitat however, it can be classified as Class 1 (major key fish habitat) as it is a permanently flowing estuarine river. No threatened species listed under the *Fisheries Management Act 1994* have potential habitat within Duck Creek. An area of coastal wetland as defined by the Coastal Management SEPP is mapped at the confluence of Duck Creek and A'Becketts Creek within the footprint of the Clyde stabling and maintenance facility construction site.

Haslams Creek

The tunnels pass under Haslams Creek approximately 30 metres below ground and two kilometres upstream of the confluence with Homebush Bay. The Silverwater services facility construction site is located around 950 metres to the west of Haslams Creek. The Sydney Olympic Park metro station construction site is located over one kilometre to the east of Haslams Creek. Construction water treatment plant discharges would discharge to Haslams Creek from the Sydney Olympic Park metro station construction site via the local stormwater network.

Haslams Creek is a highly modified second order watercourse which drains into the Parramatta River at Homebush Bay. The 17 square kilometre catchment of Haslams Creek is highly urbanised and includes the M4 Motorway and Rockwood Cemetery. The upper extents are generally concrete lined open channels and pipes, becoming a naturalised channel with rock-stabilised banks downstream from Hill Road through to Homebush Bay (Cardno Lawson Treloar, 2008). Where the tunnel crosses under Haslams Creek it is estuarine.

Haslams Creek is mapped as Key Fish Habitat and is classified as Type 1 (Key Fish Habitat). It is also classified as Class 1 (major key fish habitat) as it is a permanently flowing river. No threatened species listed under the *Fisheries Management Act 1994* have potential habitat within Haslams Creek. Coastal wetlands as defined by the Coastal Management SEPP are present along Haslams Creek.

Saleyards Creek

The tunnels pass under Saleyards Creek, approximately 20 metres below ground and 130 metres upstream of the confluence with Powells Creek.

Saleyards Creek is a highly modified first order watercourse which originates in Rockwood Cemetery, flowing in a northerly direction for two kilometres to the confluence with Powells Creek. The creek is a concrete lined channel and contains minimal instream habitat.

It is mapped as Key Fish Habitat up to the Underwood Road crossing. However, given the creek is a first order stream and a concrete lined channel which contains little instream habitat, it is not considered Key Fish Habitat in accordance with the *Policy and guidelines for fish habitat conservation and management – Update 2013* (NSW Department of Primary Industries, 2013) and is classified as Class 3 (minimal key fish habitat). No threatened species listed under the *Fisheries Management Act 1994* have potential habitat within Saleyards Creek. Coastal wetlands as defined by the Coastal Management SEPP including the Mason Park Wetlands are in close proximity to Saleyards Creek.

Powells Creek

The tunnels pass under Powells Creek approximately 20 metres below ground and 1.4 kilometres upstream of the confluence with Homebush Bay. The North Strathfield metro station construction site is located around 320 metres to the east of Powells Creek and the Sydney Olympic Park metro station construction site is located approximately 1.1 kilometres to the west of Powells Creek. Construction water treatment plant discharges would discharge to Powells Creek via the local stormwater network from the North Strathfield metro station construction site.

Powells Creek is a concrete lined first order drainage channel, which becomes semi-naturalised downstream (due to recent naturalisation works), prior to the confluence with the Parramatta River at Homebush Bay. The Powells Creek catchment includes residential and recreational land uses including Bicentennial Park and Sydney Olympic Park. Where the tunnel passes beneath Powells Creek it is estuarine, with the tidal limit located 100 metres upstream of the Allen Street Bridge. Dense mangroves occur in areas along the banks which are mapped as SEPP Coastal wetlands.

Powells Creek is mapped as Key Fish Habitat and is classified as Type 1 (Key Fish Habitat). It is also classified as Class 1 (major key fish habitat) as it is a permanently flowing river. No threatened species listed under the *Fisheries Management Act 1994* have potential habitat within Powells Creek. Coastal wetlands as defined by the Coastal Management SEPP including the Mason Park wetland and Homebush Bay wetlands that are associated with Powells Creek.

6.1.2 Sydney Harbour

The tunnels are located to the south of Sydney Harbour, around 30 metres below ground and the tunnels pass beneath Iron Cove at an approximate depth of 35 to 45 metres. The Bays Station construction site is located on the foreshore of White Bay.

Sydney Harbour (Port Jackson) is a drowned valley estuarine environment which experiences a tidal regime and consists of Sydney Harbour, Middle Harbour, North Harbour and the main tributaries Parramatta River and Lane Cove River. Port Jackson catchment is a sub-catchment of the Sydney Harbour Catchment and includes most of the Sydney Harbour Estuary. The catchment consists of numerous land uses, broadly including residential, commercial, environmental protection, education, industrial, open space and recreation services, and infrastructure.

The entirety of Sydney Harbour, including Iron Cove, and all major tributaries linked to the harbour are mapped as Key Fish Habitat and are classified as Type 1 Key Fish Habitat. It is also classified as Class 1 (major key fish habitat) as it is a permanently flowing estuarine environment.

White Bay has been heavily modified for port purposes and is unlikely to contain significant aquatic habitat and is therefore not considered Key Fish Habitat in accordance with the *Policy and guidelines for fish habitat conservation and management – Update 2013* (NSW Department of Primary Industries, 2013). No threatened species listed under the *Fisheries Management Act 1994* have potential habitat within White Bay. Coastal wetlands as defined by the Coastal Management SEPP are greater than 500 metres away.

6.1.3 Other watercourses

There are a number of watercourses located in proximity to Stage 1, including:

- St Lukes Park Canal, which discharges in Hen and Chicken Bay. The tunnels pass about 20 metres underground immediately to the south of the canal, at about 90 metres to the east of Burwood North Station construction site. Construction water treatment plant discharges would discharge to the canal via the local stormwater network

- Saltwater Creek, a concrete lined canal located approximately 1.7 kilometres north of the Burwood North Station construction site that discharges to Exile Bay at Concord.
- Barnwell Park Canal, which discharges in Hen and Chicken Bay. The tunnels pass under the upstream extents of canal, approximately 30 metres below ground
- Iron Cove Creek (also known as Dobroyd Canal), which discharges into Iron Cove. The tunnels pass around 130 metres to the north of the creek at around 35 metres below ground, and Five Dock Station construction site is located approximately 600 metres to the north. Construction water treatment plant discharges would discharge to the creek via the local stormwater network. The creek is mapped as Key Fish Habitat up to the Ramsay Road crossing
- Hawthorne Canal, which discharges into Iron Cove. The tunnels pass around 180 metres to the north of the creek at around 40 metres below ground. The creek is mapped as Key Fish Habitat up to the Marion Street crossing.
- Whites Creek, a concrete lined canal that discharges to Rozelle Bay at Annandale approximately 600 metres south-west of The Bays Station construction site.
- Johnstons Creek, a concrete lined canal that discharges to Rozelle Bay at Glebe approximately 1.3 kilometres south of The Bays Station construction site.

These waterways are concrete lined and contain no instream aquatic habitat. While some are mapped as Key Fish Habitat, these waterways are not considered to be Key Fish Habitat in accordance with the *Policy and guidelines for fish habitat conservation and management – Update 2013* ((NSW Department of Primary Industries, 2013) and are classified as Class 4 (unlikely key fish habitat). However, seagrasses have been mapped by the Department of Planning, Industry and Environment (Regions, Industry, Agriculture & Resources) within 500 metres of the point of discharge of these canals into Hen and Chicken Bay and Iron Cove (Type 1 Key Fish Habitat) (refer to Section 6.3).

No threatened species listed under the *Fisheries Management Act 1994* have potential habitat within these watercourses. Coastal wetlands as defined by the Coastal Management SEPP are greater than 500 metres downstream.

6.2 Sensitive receiving environments

Table 6-1 summarises the receiving water environments for Stage 1 components and highlights whether these are considered to be sensitive receiving environments.

Sensitive receiving environments were identified based on proximity to the following considerations:

- The presence of Key Fish Habitat (NSW Department of Primary Industries, 2013)
- Waterway classification (Fairfull and Witheridge, 2003)
- Habitat for threatened aquatic species listed under the Fisheries Management Act 1994 and EPBC Act
- Drinking water catchments
- Areas that contribute to aquaculture and commercial fishing
- Groundwater and surface water dependent vegetation
- Proximity to coastal wetlands listed in the State Environment Planning Policy (Coastal Management) 2018 (Coastal Management SEPP).

Parramatta River / Sydney Harbour, Duck River, Duck Creek, Haslams Creek, Powells Creek, Iron Cove Creek / Dobroyd Canal and Hawthorne Canal have been identified as receiving environments of high sensitivity predominantly due to the key fish habitat classifications (including those downstream) and/or proximity to

coastal wetlands as defined by the Coastal Management SEPP. These watercourses have a high conservation or community value or supports ecosystems or human uses of water that are particularly sensitive to pollution or degradation of water quality. Further information regarding sensitive receiving environments is available in Chapter 19 (Soils and surface water quality) of the Environmental Impact Statement.

Table 6-1: Sensitivity of receiving environments

Stage 1 component	Watercourse / Waterbody name	Description of the surface water features	Current condition	Sensitivity
Westmead metro station construction site Parramatta metro station construction site The Bays Station construction site Tunnels	Parramatta River / Sydney Harbour	Numerous SEPP Coastal Wetlands. Potential habitat for threatened aquatic species and protected aquatic vegetation. Type 1 Key Fish Habitat. Fourth order waterway.	Moderately disturbed	High
Westmead metro station construction site Tunnels	Domain Creek	Modified channel, with no SEPP Coastal Wetlands within 0.5 kilometres. First order waterway.	Highly disturbed	Low
Westmead metro station construction site	Toongabbie Creek	Type 2 Key Fish Habitat Third order waterway Some aquatic habitat present	Moderately disturbed	Moderate
Tunnels	Clay Cliff Creek	Highly modified channel with limited aquatic habitat. SEPP Coastal Wetlands within 0.5 kilometres. First order waterway	Highly disturbed	Moderate
Clyde stabling and maintenance facility construction site Tunnels	Duck River	Type 1 Key Fish Habitat SEPP Coastal Wetlands within 0.5 kilometres. Third order waterway.	Moderately disturbed	High
	Duck Creek	Type 1 Key Fish Habitat SEPP Coastal Wetlands within 0.5 kilometres. Second order waterway.	Moderately disturbed	High
	A'Beckett's Creek	Highly modified channel SEPP Coastal Wetlands within 0.5 kilometres. First order waterway.	Highly disturbed	Moderate
Sydney Olympic Park metro station construction site Tunnels	Haslams Creek	Type 1 Key Fish Habitat SEPP Coastal Wetlands within 0.5 kilometres. Third order waterway.	Moderately disturbed	High

Stage 1 component	Watercourse / Waterbody name	Description of the surface water features	Current condition	Sensitivity
North Strathfield metro station construction site Tunnels	Saleyards Creek	Type 1 Key Fish Habitat SEPP Coastal Wetlands within 0.5 kilometres. Second order waterway.	Highly disturbed	Moderate
	Powells Creek Mason Park Wetland	Highly modified channel with limited aquatic habitat. SEPP Coastal wetlands within 0.5 kilometres. First order waterway.	Moderately disturbed	High
Burwood North Station construction site Tunnels	St Lukes Park Canal	Type 1 Key Fish Habitat SEPP Coastal Wetlands within 0.5 kilometres. First order waterway.	Highly disturbed	Moderate
	Barnwell Park Canal	Highly modified channel with limited aquatic habitat. SEPP Coastal Wetlands greater than 0.5 kilometres downstream.	Highly disturbed	Moderate
Five Dock Station construction site	Iron Cove Creek / Dobroyd Canal	Highly modified channel with limited aquatic habitat. SEPP Coastal Wetlands greater than 0.5 kilometres downstream.	Moderately disturbed	High
Tunnels	Iron Cove	Concrete lined, enclosed embayment. SEPP Coastal Wetlands within 0.5 kilometres.	Moderately disturbed	High
The Bays Station construction site	White Bay	Concrete lined, enclosed embayment. SEPP Coastal Wetlands within 0.5 kilometres.	Highly disturbed	Low

6.3 Marine vegetation

Marine vegetation is protected under the *Fisheries Management Act 1994* (e.g. saltmarsh, seagrasses, and mangroves) but a permit under section 205 of the *Fisheries Management Act 1994* (permit to harm marine vegetation) is not required for State significant infrastructure projects as outlined in section 5.23 of the EP&A Act. A description of the marine vegetation applicable to Stage 1 (i.e. mangroves along A'Becketts Creek and Duck Creek), is provided in Section 4.2.1.

Expansive seagrass meadows are not known within any of the areas likely to be affected by Stage 1, however small isolated and fragmented patches of seagrass (*Zostera capricorni* and *Halophila ovalis*) have been identified within Hen and Chicken Bay and Iron Cove. Seagrasses are unlikely to be located away from the

intertidal or shallow subtidal zones in the harbour due to the deep and turbid waters which limit light available for photosynthesis. Stage 1 is considered unlikely to impact seagrasses.

6.4 Aquatic biota

No fish surveys or site inspections for aquatic ecology were conducted for Stage 1. The known aquatic ecology of the Parramatta River is limited to the few publicly available historical fish surveys which have been conducted within the upper Parramatta River estuary (Cardno Lawson Treloar, 2008). Nineteen estuarine species of fish have been recorded from fish surveys conducted within the Parramatta River at Charles Street Weir, Homebush Bay and Kendall Bay (see Cardno Ecology Lab, 2014). No threatened aquatic species have been recorded. Two introduced species the Eastern Gambusia (*Gambusia holbrooki*) and Japanese Goby (*Tridentiger trigonocephalus*) are known to be present.

6.5 Threatened fish

The desktop searches returned two threatened fish, five elasmobranchs (sharks and rays), four marine mammals, and five marine reptiles as having the potential to occur within the study locality. An assessment of the likelihood of occurrence of all threatened species and endangered populations were undertaken to determine the potential for these species to occur within the development site (see Appendix A).

Of the sixteen aquatic species with potential to occur within the locality, thirteen were considered unlikely to occur or have a low likelihood of occurring. The Black Rockcod (*Epinephelus daemeli*) and two elasmobranchs: White Shark (*Carcharodon carcharias*) and Grey Nurse Shark (*Carcharias taurus*) were considered to have a moderate to high likelihood of occurrence (see Appendix A).

The Black Rockcod is a reef dwelling species found along the NSW coastline. They inhabit caves, gutters, beneath bommies in near shore environments to depths of 50 metres (Department of Primary industries, 2015). The species is territorial, occupying caves, recesses, coastal and estuarine rocky or artificial reefs. Stage 1 is not expected to directly impact suitable habitat for the Black Rockcod, and the nearshore environments, particularly within the vicinity of The Bays Station construction sites as these areas are considered unsuitable for this species. The Black Rockcod has a low likelihood of occurrence in any habitats that may be impacted by Stage 1. As such it is unlikely that actions associated with Stage 1 would have a significant impact on the Black Rockcod.

The threatened shark species (White Shark, Grey Nurse Shark) are large and conspicuous. While desktop assessment indicated that the habitat in the lower Parramatta River Estuary is suitable or potentially suitable for these species to occupy, they have not been recorded in the development site. With respect to the White Shark, this species has not been definitively recorded within Sydney Harbour for over 100 years (West, 2013). However, juvenile white sharks (less than three metres in length) are predominately fish eaters and known to congregate at nursery sites along the east coast of New South Wales and may follow fish into large estuaries (Bruce and Bradford, 2008). If in the unlikely event great white sharks were within the bays at Pyrmont and Iron Cove, it is unlikely that any sharks would remain long enough to be vulnerable to any potential impacts. The Parramatta River and Duck River are considered marginal habitat for the White Shark.

The grey nurse shark is known to aggregate at discreet locations across coastal New South Wales (Otway et al., 2003). Given the distance from known aggregation areas, the proposed works within the development site would not directly affect Grey Nurse Shark habitat. The Parramatta River and Duck River are considered marginal habitat for the Grey Nurse Shark.

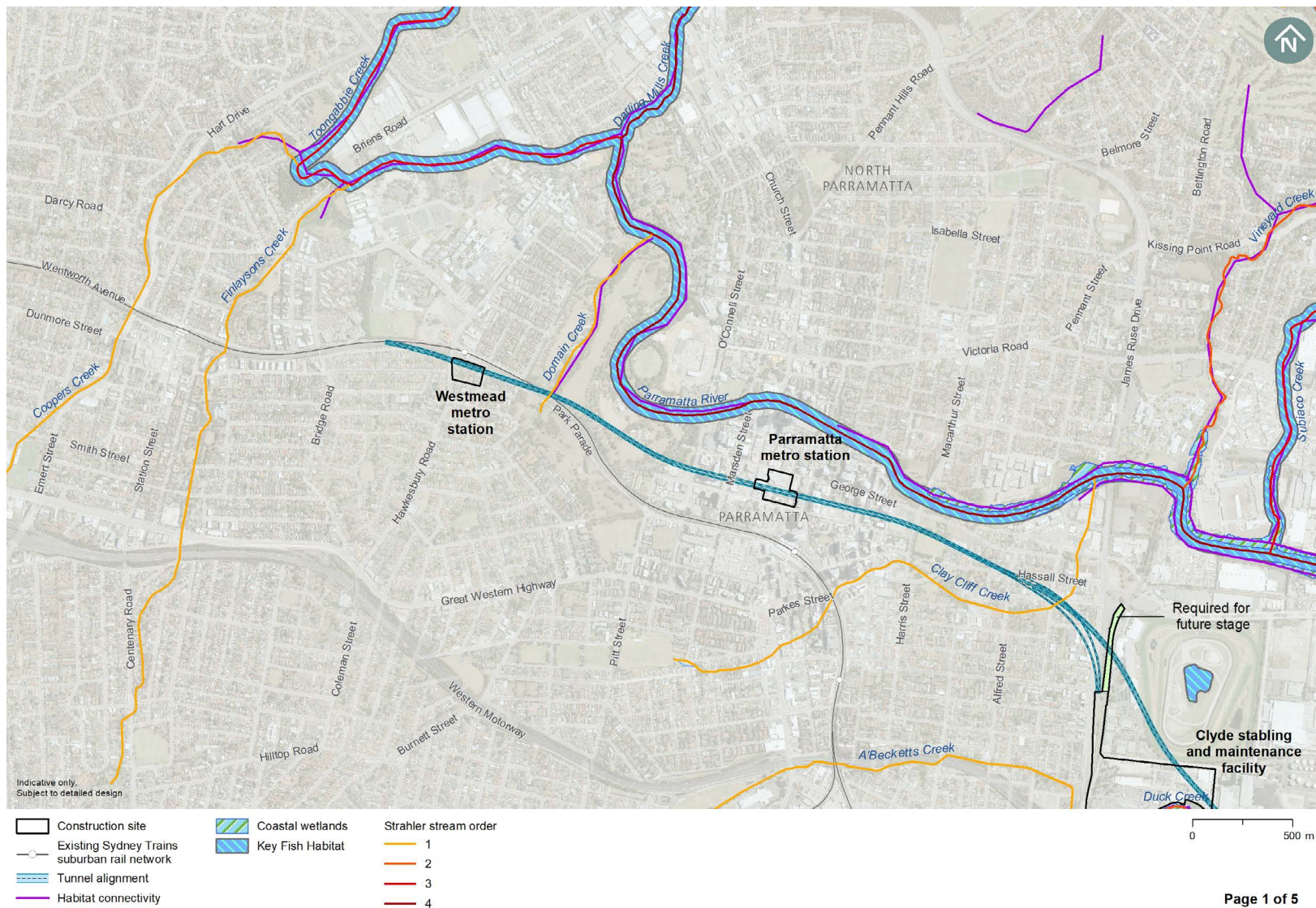


Figure 6-1: Aquatic habitats – Map 1

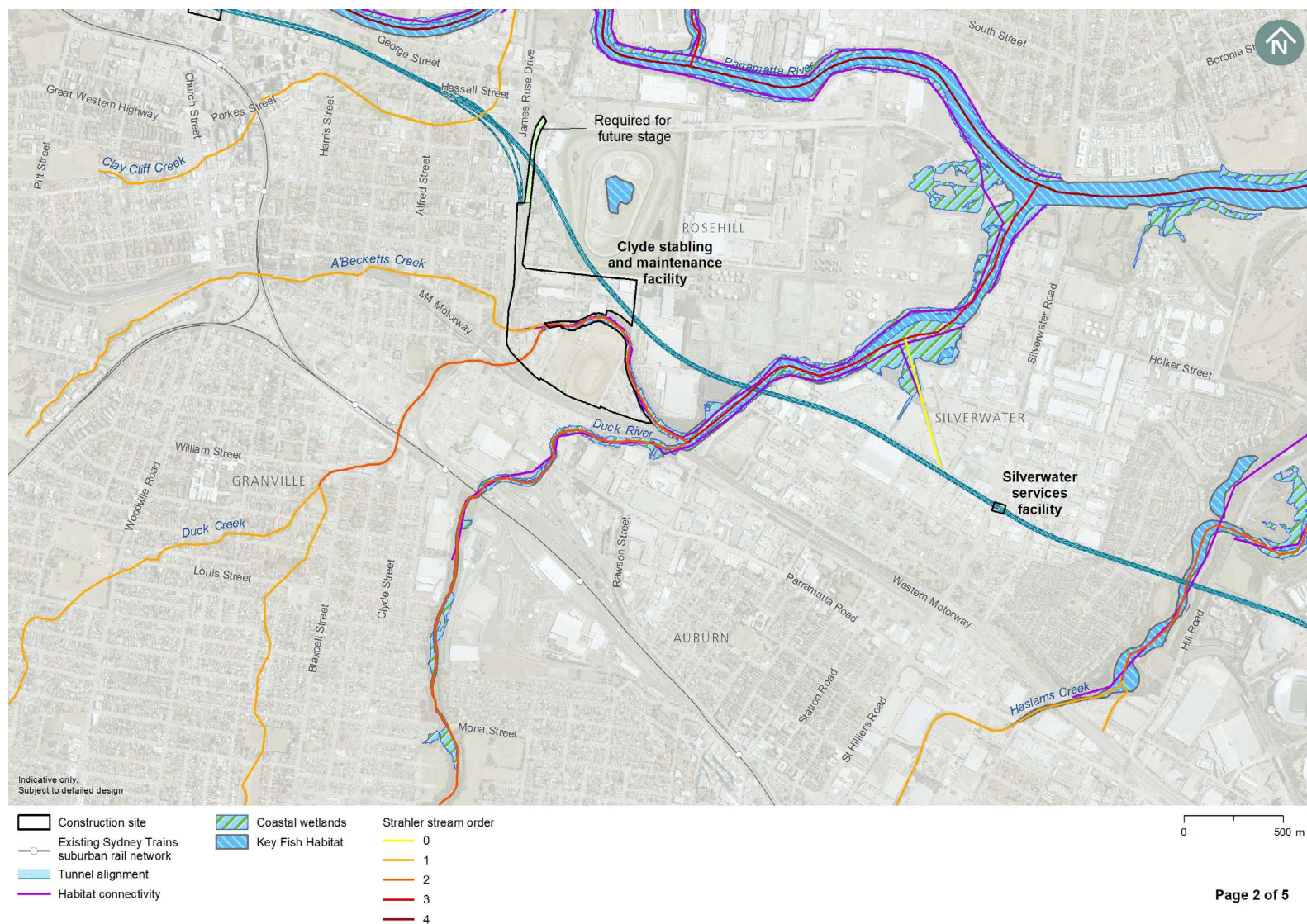


Figure 6-1: Aquatic habitats – Map 2

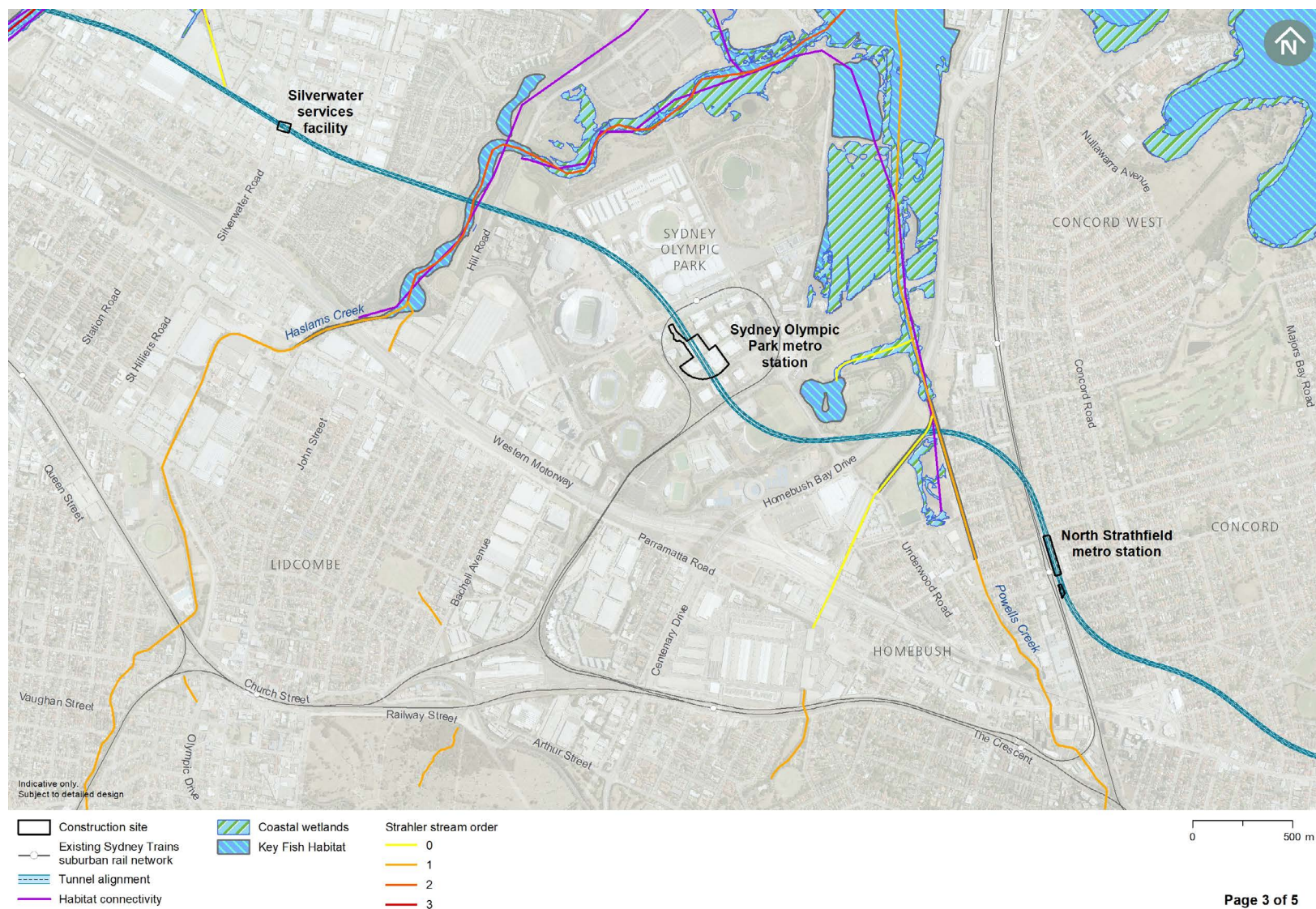
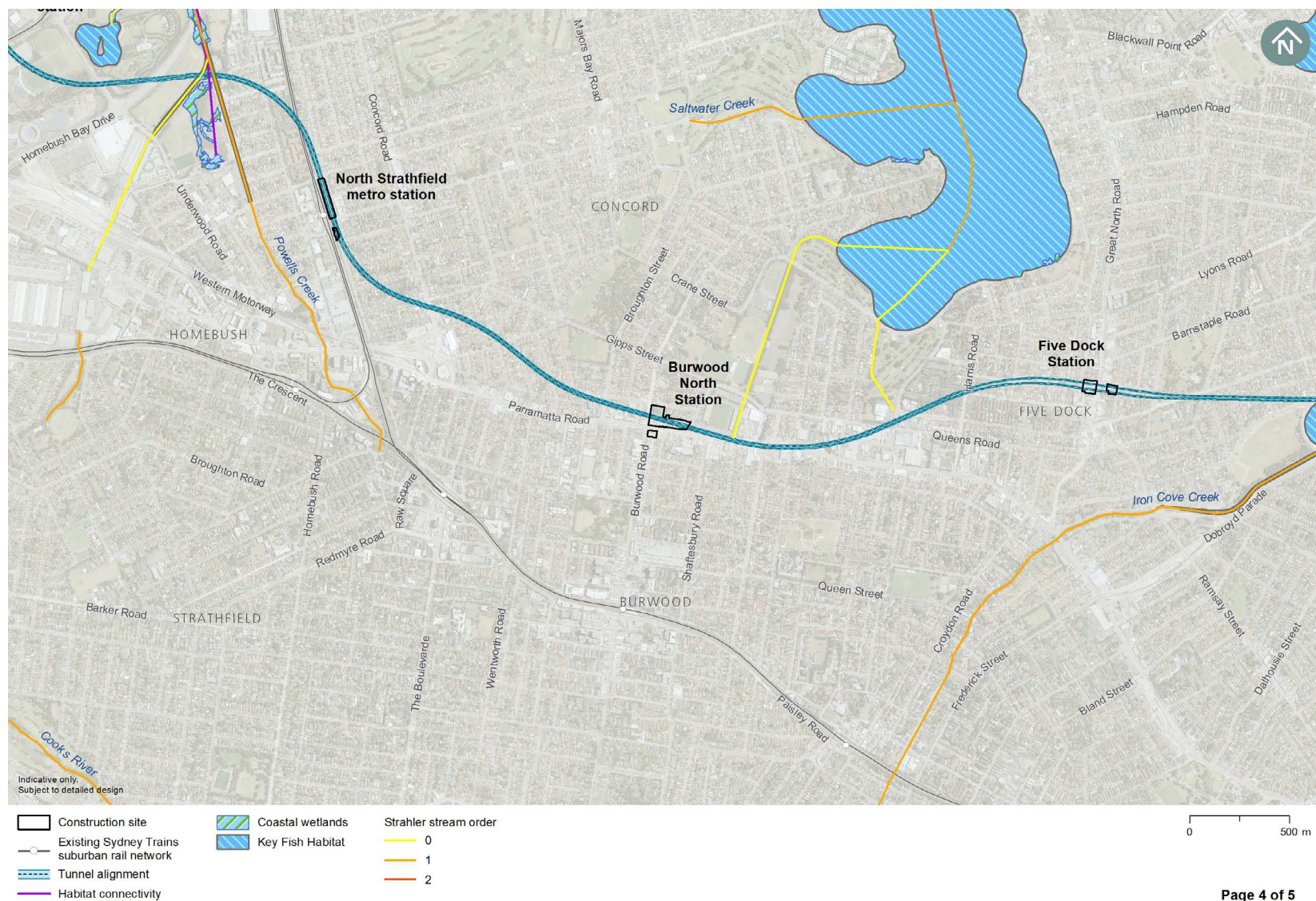


Figure 6-1: Aquatic habitats – Map 3



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Figure 6-1: Aquatic habitats – Map 4

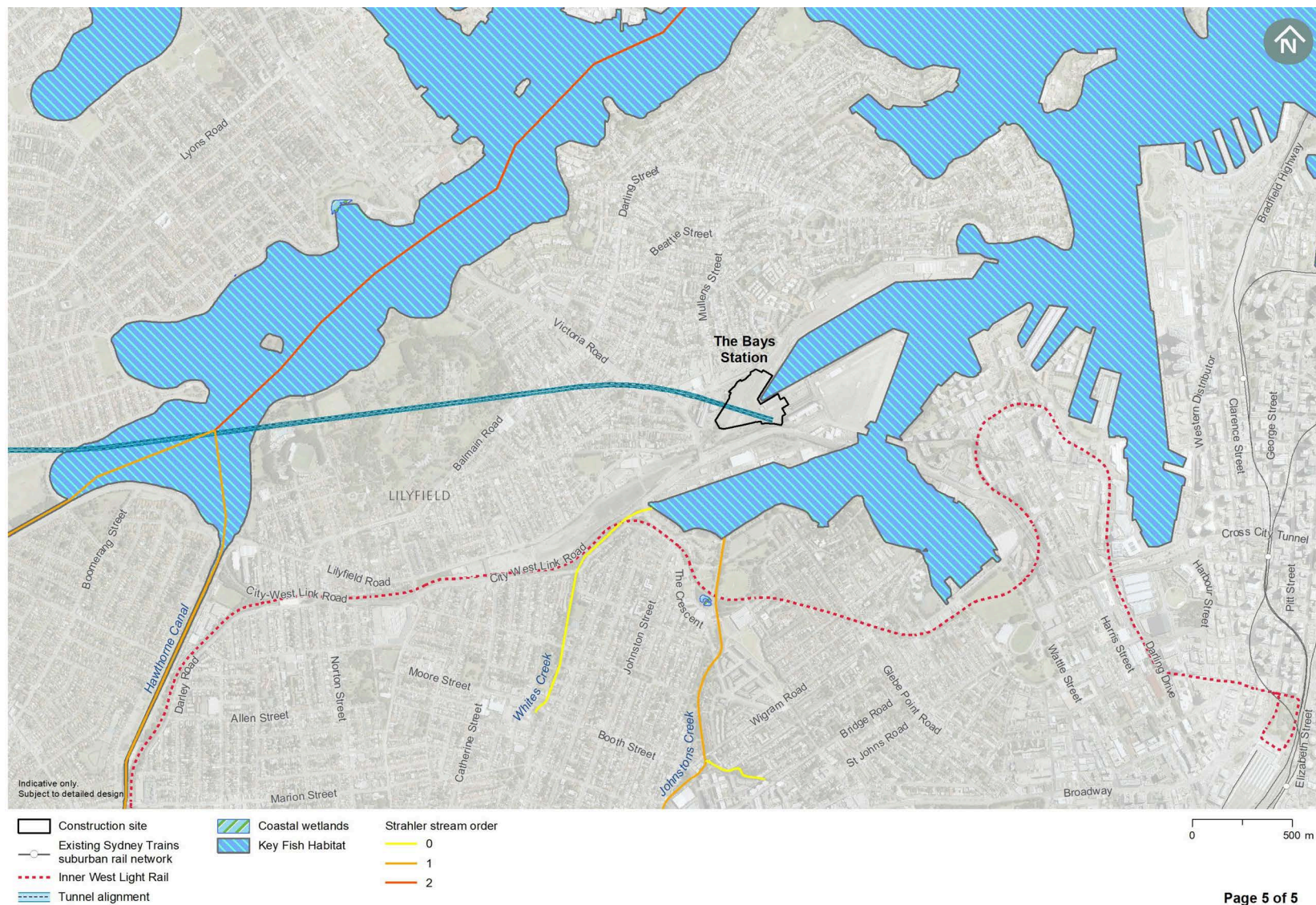


Figure 6-1: Aquatic habitats – Map 5

7. Matters of National Environmental Significance

The EPBC Act provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places – defined as matters of national environmental significance. Matters relevant and applicable to this assessment include:

- 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.

For threatened biodiversity and migratory species listed under the EPBC Act, significance assessments have been completed in accordance with the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines* (Department of Environment, 2013) (see Appendix D). Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment that is affected, and upon the intensity, duration, magnitude and geographic extent of the impacts (Department of Environment, 2013). Importantly, for a 'significant impact' to be 'likely', it is not necessary for a significant impact to have a greater than 50 per cent chance of happening; it is sufficient if a significant impact on the environment is a real or not a remote chance or possibility (Department of Environment, 2013). This advice has been considered while undertaking the assessments.

7.1 Wetlands of international and national importance

The development site does not contain any wetlands of international or national importance.

The nearest wetland of international importance is Towra Point Nature Reserve but due to the distance of this wetland from the development site they are considered unlikely to be affected.

The Bicentennial Park Wetlands and the Newington Wetlands, both at Sydney Olympic Park, are the only Nationally Important Wetlands in the 1,500 metre landscape buffer. However, these wetlands are unlikely to be impacted by Stage 1. The Botany Wetlands and Eve Street Marsh, Arncliffe wetlands were also returned from the Protected Matters Search Tool, but these wetlands are not in the 1,500 metre landscape buffer and would not be affected by Stage 1.

7.2 Nationally listed threatened ecological communities

According to the Protected Matters Search Tool (PMST) 12 EPBC Act listed TECs are known to occur, likely to occur, or may occur in the development site (see Table 7-1).

None of the PCTs within the development site correspond to EPBC Act listed TECs. The patch of PCT 849 at Westmead metro station construction site is too small and degraded to be part of the EPBC Act listed Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest TEC. However, EPBC Act TECs may occur outside of the development site based on regional vegetation mapping in *The Native Vegetation of the Sydney Metropolitan Area – Version 3.1* (State Government of NSW and Office of Environment and Heritage, 2016) (see Table 7-1).

There would be no direct impacts to EPBC Act listed TECs. Indirect impacts to GDEs that are EPBC Act listed TECs outside the development site may occur due to groundwater drawdown or reductions in baseflow to nearby creeks. However, any impacts to these TECs from Stage 1 is likely to be minimal based on the modelling provided in Technical Paper 7 (Hydrogeology). Further, since a conservative approach has been adopted for the groundwater modelling, the magnitude of potential drawdown is considered to be a conservative estimate.

Table 7-1: EPBC Act listed TECs returned from the Protected Matters Search Tool and their predicted occurrence (based on PMST assessment)

Threatened ecological community	Predicted occurrence	Actual occurrence and mapped location
Blue Gum High Forest of the Sydney Basin Bioregion (Critically Endangered Community)	Likely to occur	Not mapped in the 1,500 metre landscape buffer
Castlereagh Scribbly Gum and Agnes Banks Woodlands of the Sydney Basin Bioregion (Endangered Community)	May occur	Not mapped in the 1,500 metre landscape buffer
Coastal Swamp Oak (<i>Casuarina glauca</i>) Forest of New South Wales and South East Queensland ecological community) (Endangered Community)	Likely to occur	Mapped at: <ul style="list-style-type: none"> • Toongabbie Creek at two locations approximately 1.2 kilometres north-west and one kilometre north of the Westmead metro station construction site. • Finlaysons Creek approximately one kilometre north-west of the Westmead metro station construction site • Immediately west of Mother Teresa Primary School at Westmead approximately 500 metres north-west of the Westmead metro station construction site • Along Parramatta River approximately 460 metres north-west of the Parramatta metro station construction site • Along Duck River approximately 960 metres south of the Clyde stabling and maintenance facility construction site.
Coastal Upland Swamps in the Sydney Basin Bioregion (Endangered Community)	Likely to occur	Not mapped in the 1,500 metre landscape buffer
Cooks River/Castlereagh Ironbark Forest of the Sydney Basin Bioregion (Critically Endangered Community)	Likely to occur	Not mapped in the 1,500 metre landscape buffer
Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (Critically Endangered Community)	Likely to occur	Mapped in Parramatta Park (within the former Parramatta Golf Course) approximately 200 metres east of the Westmead metro station construction site.
Eastern Suburbs Banksia Scrub of the Sydney Region (Endangered Community)	Known to occur	Not mapped in the 1,500 metre landscape buffer
<i>Posidonia australis</i> seagrass meadows of the Manning-Hawkesbury ecoregion (Endangered Community)	Likely to occur	Not mapped in the 1,500 metre landscape buffer
Shale Sandstone Transition Forest of the Sydney Basin Bioregion (Critically Endangered Community)	Likely to occur	Not mapped in the 1,500 metre landscape buffer

Threatened ecological community	Predicted occurrence	Actual occurrence and mapped location
Subtropical and Temperate Coastal Saltmarsh (Vulnerable Community)	Likely to occur	<p>Mapped at:</p> <ul style="list-style-type: none"> Parramatta River approximately 1.3 kilometres north of the Clyde stabling and maintenance facility construction site. Duck River, about 1.2 kilometres downstream of the Clyde stabling and maintenance facility construction site and also in other small scattered localities along the length of Duck River. Haslams Creek approximately one to 1.3 kilometres north and north-west of the Sydney Olympic Park metro station construction site. Bicentennial Park located approximately 1.2 kilometres north-east of the Sydney Olympic Park metro station construction site with other smaller scattered occurrences throughout the Bicentennial Park area Mason Park Wetland, located immediately south of the alignment (with the tunnels around 20 metres underground) and approximately 600 metres north-west of the North Strathfield metro station construction site. Small scattered patches along the edges of Iron Cove approximately 1.4 kilometres east and two kilometres north-east of the Five Dock Station construction site. A small patch along Johnstons Creek approximately one kilometre south of the Bays Station construction site.
Turpentine-Ironbark Forest of the Sydney Basin Bioregion (Critically Endangered Community)	Likely to occur	<p>Mapped at:</p> <ul style="list-style-type: none"> Concord Golf Club approximately 650 metres north-east of the North Strathfield metro station footprint Queen Elizabeth Park located approximately 450 metres north-west of the Burwood North Station construction site Five Dock Park located approximately 350 metres east of the Five Dock Station construction site.
Western Sydney Dry Rainforest and Moist Woodland on Shale (Critically Endangered Community)	Likely to occur	Not mapped in the 1,500 metre landscape buffer

7.3 Threatened plants

Three EPBC Act listed threatened plant species were considered potentially likely to occur based on the presence of broadly associated habitat: *Acacia pubescens*, *Cynanchum elegans* and *Haloragis exalata* subsp. *exalata*.

These species were not found within or adjacent to the development site during the surveys undertaken for this BDAR. As such, these species are considered unlikely to be impacted.

7.4 Threatened animals

Targeted surveys for threatened animals were not undertaken during the surveys for this BDAR. The assessment of these species was habitat based and also used existing information on species distributions and data from previous surveys undertaken for other Environmental Impact Statements including the ecological assessment for the *Clyde Terminal Conversion Environmental Impact Statement* (AECOM Australia Pty Ltd, 2013) and the more recent BDAR for the *Viva Energy Clyde Western Area Remediation Project* (Biosis, 2018). The Biodiversity Assessment Report for the Parramatta Light Rail project (WSP, 2017) was also reviewed and relevant data used to inform this assessment.

The development site provides some limited foraging habitat for the EPBC Act listed species; Grey-headed Flying-fox and Swift Parrot. These two species may use the street trees and garden plantings in the area for foraging on occasion but there is no breeding habitat present. The Grey-headed Flying-fox may also utilise the mangrove forest (PCT 920). Impacts to foraging habitat would be of low magnitude, so impacts to these species will be negligible (see Appendix D). Significance assessments have been completed for these species in accordance with the EPBC Act Policy Statement 1.1 Significant Impact Guidelines (Department of Environment, 2013) (see Appendix D). The White-throated Needletail may fly over the site on occasion but would not use the habitats and would not be impacted.

Some EPBC Act listed threatened and migratory wader birds including the Curlew Sandpiper, Great Knot, Red Knot, Eastern Curlew, Greater Sand Plover, Lesser Sand Plover, Bar-tailed Godwit and Black-tailed Godwit may occur in the adjacent saltmarsh and/or mangrove habitats on occasion. Mason Park wetland is a known habitat for threatened and migratory waders and the tunnel would pass beneath in proximity to this wetland (approximately 25 metres below ground). However, Stage 1 would not directly impact these habitats and groundwater drawdown is not considered likely to have indirect impacts on these habitats based on the groundwater modelling as detailed in Technical Paper 7 (Hydrogeology).

The Australasian Bittern is considered moderately likely to occur on occasion in the saltmarsh habitat at Mason Park wetlands and the tunnels would cross beneath (at about 25 metres below ground) in proximity to this wetland. This habitat would not be considered optimal or potential breeding habitat as it is saline and lacks extensive reed beds. However, Stage 1 would not directly impact these habitats and groundwater drawdown is not considered likely to indirectly impact these habitats based on the groundwater modelling as detailed in Technical Paper 7 (Hydrogeology).

Habitats for the Green and Golden Bell Frog along Haslams Creek are unlikely to be impacted by groundwater drawdown based on the groundwater modelling as detailed in Technical Paper 7 (Hydrogeology) or alterations to surface water quality. Haslams Creek would ultimately receive construction water treatment plant discharges from construction sites, via the local stormwater network. As outlined in Chapter 19 (Soils and surface water quality), treatment plants would be designed such that there would be a neutral or beneficial effect to water quality. Provided appropriate treatment is achieved, wastewater discharges during construction would pose a negligible impact on the water quality of the Haslams Creek.

The estimated direct impacts to native vegetation that provides habitat for threatened species is outlined in Table 7-2. There is unlikely to be a significant impact to any threatened species (see Appendix D).

Table 7-2: Summary of direct impact to EPBC Act listed threatened species habitat (native vegetation) within the development site

Species	Plant community type name	Area (ha) in development site
Grey-headed Flying-fox	Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion (PCT 920)	0.15

7.5 Migratory species

Based on the results of the PMST, 50 listed migratory species may occur in the broader locality (see Appendix A). Some additional species were recorded from the BioNet search. The following species are considered moderately likely to occur in, or adjacent to, the development site based on the presence of suitable habitats:

- Migratory marine birds – Fork-tailed Swift
- Migratory terrestrial species – White-throated Needletail
- Migratory wetland species – Common Sandpiper, Ruddy Turnstone, Sharp-tailed Sandpiper, Curlew Sandpiper, Pectoral Sandpiper, Red-necked Stint, Great Knot, Double-banded Plover, Greater Sand Plover, Lesser Sand Plover, Latham's Snipe, Bar-tailed Godwit, Black-tailed Godwit, Eastern Curlew, Whimbrel, Osprey, Ruff, Pacific Golden Plover, Grey-tailed Tattler, Common Greenshank and Marsh Sandpiper.

These birds are also listed as marine species under the EPBC Act. Other listed marine species including the Great Egret, Cattle Egret, Red-capped Plover, White-bellied Sea-Eagle, Black-winged Stilt, Swift Parrot, and Red-necked Avocet may occur in the habitats on occasion.

'Important habitat' for a migratory species is defined as (Department of Environment, 2013):

- Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species
- Habitat that is of critical importance to the species at particular life-cycle stages
- Habitat utilised by a migratory species which is at the limit of the species range
- Habitat within an area where the species is declining.

According to the guidance provided in the EPBC Act Policy Statement 3.21—Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species (Department of the Environment, 2015), important habitats in Australia for migratory shorebirds under the EPBC Act include those recognised as nationally or internationally important. A wetland habitat should be considered internationally important if it regularly supports one per cent of the individuals in a population of one species or subspecies of waterbird, or a total abundance of at least 20,000 waterbirds. Nationally important wetland habitat includes wetlands that regularly support 0.1 per cent of the flyway population of a single species of migratory shorebird, or 2,000 migratory shorebirds, or 15 migratory shorebird species. The habitats in the development site are not important habitats for migratory birds. Bicentennial Park wetlands and Mason Park wetlands provide local wader habitat but are unlikely to be impacted by groundwater drawdown based on the groundwater modelling as detailed in Technical Paper 7 (Hydrogeology).

An assessment of the likely occurrence of these species and the presence of important habitat is included in Appendix A. While some migratory species of bird are likely to use the development site and locality, the development site would not be classed as an 'important habitat'. A nationally significant proportion of a population would not be supported by the habitats in the development site. Stage 1 would not substantially modify, destroy or isolate an area of important habitat for the migratory species and it would not seriously disrupt the lifecycle of an ecologically significant proportion of a population of migratory birds.

8. Impact avoidance and minimisation

This section of the BDAR demonstrates the efforts taken to avoid and minimise impacts on biodiversity values in accordance with section 8 of the BAM. Combined with safeguards during construction (as outlined in Appendix D (Construction Environmental Management Framework) of the Environmental Impact Statement), the siting and planning of Stage 1 is likely to be sufficient to ensure that the requirements to avoid and minimise impacts on biodiversity values as set out in section 8 of the BAM are met.

Chapter 3 (Sydney Metro West development and alternatives) of the Environmental Impact Statement outlines the options considered for Metro West. The Sydney Metro West development process was driven by the identified strategic need to improve connectivity between Greater Parramatta and the Sydney CBD. The process included consideration of alignment options, analysis of options for station locations, analysis of options for a stabling and maintenance facility, and analysis of options for the approach to tunnelling.

Four strategic alignment and service alternatives were evaluated by Sydney Metro Authority. Options investigated were:

- About four to five stations from Parramatta CBD to the Sydney CBD (inclusive) ('Metro Express'). This option would achieve a higher speed but service a small amount of stations. This option was found to be limited in its ability to service a large catchment due to a minimal number of stations
- About nine to ten stations from Parramatta to the Sydney CBD (inclusive) ('Metro Rapid'), with anchor precincts at Parramatta, Sydney Olympic Park, The Bays and Sydney CBD. This option was found to achieve a balance between an efficient travel time between Greater Parramatta and Sydney CBD, and the ability to service a large catchment area and key precincts
- About 11 to 12 stations from Greater Parramatta to the Sydney CBD (inclusive) ('Metro Local South'). This option would service a large catchment due to a higher number of stations yet result in a higher travel time (greater than the optimum time of about 20 minutes) between Greater Parramatta and the Sydney CBD.
- An 11 to 12 station option north of Parramatta River ('Metro Local North'). However this alignment would be unable to service key precincts including Sydney Olympic Park.

8.1 Avoiding and minimising impacts on native vegetation and habitat

Stage 1 is located within a highly urbanised area that does not possess large expanses of intact native vegetation with high biodiversity value. As the majority of Stage 1 would be underground or in pre-existing built-up areas, direct impacts to terrestrial biodiversity have been avoided and/or minimised. Stage 1 would result in minimal disturbance of native vegetation. Where this disturbance cannot be avoided, the vegetation is of poor to moderate quality and/or provides limited habitat for threatened species.

No areas of land declared as an area of outstanding biodiversity value in accordance with section 3.1 of the BC Act would be affected. Importantly, opportunities to further minimise native vegetation clearance would be refined during detailed design and reviewed as part of the pre-clearing process.

Through the design process potential biodiversity impacts have been further avoided so that Stage 1 has minimal direct and indirect biodiversity impacts. This is demonstrated through the selection of the preferred option for the stabling and maintenance facility. Two sites were considered, one being at the former refinery site on the west bank of the Duck River at Rosehill, and the preferred option selected at Clyde. The preferred option:

- Avoids impacts to non-breeding and movement corridor habitats for the threatened Green and Golden Bell Frog Parramatta Key Population. The Rosehill site was directly adjacent to known habitat for the threatened Green and Golden Bell Frog Parramatta Key Population and would have potentially impacted non-breeding and movement habitat for this species

- Avoids impacts to a patch of saltmarsh that is known to contain a population of the threatened plant *Wilsonia backhousei*. The Rosehill option required a bridge crossing of Duck River to access the tunnel drive and portal in Silverwater. This crossing would have had indirect impacts to a patch of saltmarsh located on the eastern bank of Duck River, which is known to contain a population of the threatened plant *Wilsonia backhousei*
- Minimises the total area of mangroves that could be impacted and impacts mangrove habitat that is of lower quality. The bridge across the Duck River for the Rosehill option would have a direct impact on a larger area of higher quality mangroves, when compared to the mangroves that would be impacted by the preferred option.

8.2 Avoiding and minimising prescribed biodiversity impacts

Some types of projects may have impacts on biodiversity values (as defined in the BC Act and Biodiversity Conservation Regulation 2017) in addition to, or instead of, impacts from clearing vegetation and/or loss of habitat. For many of these impacts, the biodiversity values may be difficult to quantify, replace or offset, making avoiding and minimising impacts critical. Clause 6.1 of the Biodiversity Conservation Regulation 2017 identifies actions that are prescribed as impacts to be assessed under the biodiversity offsets scheme as follows:

- a) impacts of development on the habitat of threatened species or ecological communities associated with:
 - i. karst, caves, crevices, cliffs and other geological features of significance, or
 - ii. rocks, or
 - iii. human made structures, or
 - iv. non-native vegetation
- b) impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range
- c) impacts of development on movement of threatened species that maintains their life cycle
- d) impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities (including from subsidence or upsidence resulting from underground mining)
- e) impacts of wind turbine strikes on protected animals
- f) impacts of vehicle strikes on threatened species or on animals that are part of a TEC.

Importantly, Stage 1 would have negligible impact on prescribed biodiversity values as:

- There would be no impacts to Karst, caves, crevices, cliffs and other geological features of significance
- There would be no impacts to Rocks that provide habitat for threatened species
- Stage 1 is not a wind farm development so turbine strike is not an issue
- While there would be some additional construction vehicle movements on existing roads, these are largely along busy roads and vehicle strike due to Stage 1 is unlikely to be a substantially increased from current levels.

There is however potential for impacts on non-native vegetation, connectivity and species movement, and water quality water bodies and hydrological processes (see section 9.2.7).

9. Assessment of impacts

The potential for direct impacts to biodiversity is limited to two areas of the development site; 1) Westmead metro station and 2) the Clyde stabling and maintenance facility construction sites. The other areas of the footprint do not contain native vegetation so there would be no direct impacts. Indirect and other impacts are identified below in Section 9.2. Potential aquatic biodiversity impacts are discussed in Section 9.3.

9.1 Impacts on native vegetation and habitat

Despite avoidance measures and locating Stage 1 in a heavily developed environment, Stage 1 would result in the direct removal of some native vegetation. The estimated clearing is approximately 0.18 hectares (1,800 square metres) consisting of the following PCTs:

- Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849) – 0.03 hectares (300 square metres). The direct impact would be limited to the Westmead metro station construction site
- Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion (PCT 920) – 0.15 hectares (1,500 square metres). The direct impact would be limited to the Clyde stabling and maintenance facility construction site.

Table 9-1 provides a summary of the native vegetation clearing that would occur within the development site including the corresponding TEC where applicable and the vegetation integrity loss. The biodiversity credit requirements for these impacts are outlined in Section 12.

The direct impacts on species credit threatened species habitat associated with the clearing of native vegetation are outlined in Table 9-2. Other impacts to threatened species habitat including impacts to connectivity and species movement, impacts to non-native vegetation and disturbed areas, and impacts to water quality and hydrology are discussed in Section 9.2.

Indirect impacts to vegetation retained directly adjacent to the areas of direct impact are expected to be negligible. Most of the development site does not contain native vegetation and is not adjacent to any native vegetation. The vegetation adjacent to the Clyde stabling and maintenance facility construction site is a thin band of vegetation along the Duck Creek and does not contain any core habitats that are not currently heavily impacted by edge effects. This vegetation is currently surrounded by industrial development and the Sydney Speedway. No further loss of vegetation integrity is expected in these areas as a result of Stage 1 so indirect impacts have not been calculated.

Table 9-1: Summary of native vegetation clearing within the development site

Plant community type ID No.	Plant community type name	Vegetation formation	PCT per cent cleared (historically across range)	Corresponding Threatened Ecological Community (TEC)	Area (ha) in development site	Vegetation integrity loss
920	Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	Saline Wetlands	86%	None	0.15	34.6

Plant community type ID No.	Plant community type name	Vegetation formation	PCT per cent cleared (historically across range)	Corresponding Threatened Ecological Community (TEC)	Area (ha) in development site	Vegetation integrity loss
849	Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Coastal Valley Grassy Woodlands	93%	Cumberland Plain Woodland in the Sydney Basin Bioregion	0.03	11.4

Table 9-2: Summary of direct impacts on threatened species credit species habitat associated with the loss of native vegetation

Species name	Common name	EPBC Act	BC Act	Sensitivity to gain class	SAII	Area (ha) in development site
Mammals						
<i>Myotis macropus</i>	Southern Myotis	-	V	High	No	0.15

9.2 Prescribed biodiversity impacts

This section identifies the potential prescribed biodiversity impacts on threatened species associated with Stage 1 in accordance with section 6.7 of the BAM. These are impacts that are in addition to, or instead of, impacts from clearing vegetation and/or loss of habitat.

9.2.1 Impacts on the habitat of threatened species or ecological communities associated with karst, caves, crevices, cliffs and other features of geological significance

There are no occurrences of karst, caves, crevices and cliffs or other geological features of significance within the development site, or threatened species or ecological communities associated with these features. As such, this prescribed impact has not been considered further.

9.2.2 Impacts on the habitat of threatened species or ecological communities associated with rocks

There are no occurrences of rocks or rocky habitats within the development site or threatened species or ecological communities associated with rocks. As such, this prescribed impact has not been considered further.

9.2.3 Impacts on the habitat of threatened species or ecological communities associated with human made structures

There are four threatened species that can use human made structures as habitat that may be affected by Stage 1 which are:

- Large Bent-winged Bat (*Miniopterus orianae oceanensis*)
- Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*)
- Little Bent-winged Bat (*Miniopterus australis*)
- Southern Myotis (*Myotis macropus*).

The Large Bent-winged Bat, Little Bent-winged Bat and Southern Myotis are known to roost in cave-like human made structures including mine shafts, storm water channels, buildings, and under bridges. There are no human made structures in the development site that would be suitable for these bats to use as roosting habitat. The buildings are subject to a high amount of human use so would be at best marginal as roost sites. The Eastern Coastal Free-tailed Bat roost mainly in tree hollows but will also roost under bark or in man-made structures. There are likely to be minimal, if any, roosting opportunities for this species. It is unlikely that Stage 1 would detrimentally affect the bioregional persistence of these species.

9.2.4 Impacts on the habitat of threatened species or ecological communities associated with non-native vegetation

Eight threatened species may utilise the non-native vegetation, including both native and exotic planted trees and shrubs, that are found within the development sites.

The Grey-headed Flying-fox, Swift Parrot and Little Lorikeet are considered likely to forage on the flowers and/or fruit of both planted and exotic trees within the development site. The Dusky Woodswallow may forage in the air space above the planted trees and non-native vegetation and may use the vegetation for perching. The Eastern Coastal Free-tail Bat, Large Bent-winged Bat and Little Bent-winged Bat may forage in the air spaces around areas of non-native vegetation, feeding on the insects attracted to the vegetation. Potential roosting habitat in the form of small tree hollows may also be present in some of the larger trees for the Eastern Coastal Free-tailed Bat and Southern Myotis. In the case of the Southern Myotis, only tree hollows within 200 metres of water bodies are likely to be utilised.

Due to the marginal, non-natural, structure of the vegetation present, it is unlikely to be used as breeding habitat by any threatened species. It is unlikely that Stage 1 would detrimentally affect the bioregional persistence of these species.

9.2.5 Impacts on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range

Habitat connectivity is identified as the degree to which a particular site connects different areas of habitat of threatened species to facilitate the movement of those species across their range. Threatened species movement is identified as the degree to which a particular site contributes to the movement of threatened species to maintain their lifecycle.

In terms of habitat connectivity, the development site is located within a highly disturbed landscape where the majority of habitats have been cleared. The habitats that do remain are fragmented and highly isolated. The vegetated riparian zones of Duck Creek and A'Becketts Creek provide the most obvious movement corridors that would be impacted by the development site, but these corridors are only likely used by flying species or local common mammals, reptiles and amphibians. There is a low chance that the threatened Green and Golden Bell Frog would utilise the riparian zones of Duck Creek and A'Becketts Creek as discussed in Section 5.2.2. Additionally, the planted urban vegetation within the development site also plays a less obvious role in facilitating the movement of threatened species across the landscape. Functional connectivity still exists for many species, particularly birds and bats and to a more limited extent amphibians, mammals and reptiles.

Flying animals such as birds and bats use the airspace to move between natural habitats and the planted vegetation within the development site is likely to be used as a foraging or perching resource as part of daily movements. For example, a portion of the Grey-headed Flying-fox population leaves the nationally important Parramatta camp of an evening and likely passes over the development site as the animal's head to foraging grounds. The threatened Swift Parrot is likely to pass through the development site during seasonal movements. Threatened species known from the locality including the Grey-headed Flying-fox, Swift Parrot and Southern Myotis (and other threatened bats) are powerful flyers capable of covering large distances between habitat patches. The landscape of the locality in its current form is permeable to these species and habitat connectivity

for these species would not be detrimentally affected and the bioregional persistence of these species would not be detrimentally affected by Stage 1.

9.2.6 Impacts on movement of threatened species that maintains their life cycle

The life cycle of threatened species known from the locality including the Grey-headed Flying-fox, Swift Parrot and Southern Myotis is unlikely to be dependent on the habitats to be affected by the development site. The habitats to be affected are marginal foraging habitat and no breeding habitat is likely to be impacted. The development site is not part of a recognised movement corridor between breeding grounds, foraging grounds, or other habitats important for the lifecycle of these species such as staging points for migration. The movement of these species between foraging and breeding grounds would not be affected, and the bioregional persistence of these species would not be detrimentally affected by Stage 1.

9.2.7 Impacts on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities

The Clyde stabling and maintenance facility construction site would have a direct impact to mangrove habitats and would result in the realignment of short sections of A'Becketts Creek and Duck Creek. These activities, alongside general construction activity adjacent to watercourses, would have a potential impact on water quality (if not mitigated). There is also the potential for additional impacts to downstream environments due to potential changes in water quality and geomorphology associated with the construction of new crossings at A'Becketts Creek and Duck Creek. An area of saltmarsh habitat is located on the Duck River approximately 1.2 kilometres downstream from the Clyde stabling and maintenance facility construction site. The crossings of the creek and realigned section of the creeks would include instream structures but would be designed as to not worsen existing downstream velocities to minimise the potential for downstream impacts. Further, the implementation of standard mitigation measures (i.e. sediment control, spill control) would be implemented to control sediment and pollutants from any significant runoff events.

Elsewhere, the construction sites are typically at sufficient distance from waterways and separated by urban development. Standard mitigation measures to control sediment and runoff impacts would be implemented at each construction site to prevent impacts to the ultimate receiving waterbody.

The construction water treatment plants would also discharge to several sensitive receiving environments (refer to Section 9.4). As outlined in Chapter 19 (Soils and surface water quality) of the Environmental Impact Statement, treatment plants would be designed such that there would be a neutral or beneficial effect to water quality. The final discharge criteria would be determined during detailed design in consultation with the Environment Protection Authority and as set by any environmental protection licence. Provided appropriate treatment is achieved, wastewater discharges during construction would pose a negligible impact on the water quality of downstream environments.

The tunnels would pass beneath Domain Creek, Clay Cliff Creek, Duck River, Haslams Creek, Saleyards Creek, Powells Creek (including near Mason Park wetlands), and Iron Cove at an approximate depth of 25 to 45 metres below ground. The tunnels would be tanked to minimise groundwater inflow into the tunnels. As such, there is a very low risk that any groundwater drawdown could detrimentally impact these areas and associated ecosystems and species (see Technical Paper 7 (Hydrogeology)).

Indirect impacts such as those from groundwater drawdown are not expected to impact the habitat of threatened species based on groundwater modelling as detailed in Technical Paper 7 (Hydrogeology). Some terrestrial GDEs that are EPBC Act listed or BC Act listed TECs may be indirectly impacted by a level of groundwater drawdown but they are not obligate GDEs (meaning they are not entirely dependent on groundwater). These terrestrial GDEs that are TECs are likely to be opportunistic facultative GDEs that depend on the subsurface presence of groundwater (often accessed via the capillary fringe – subsurface water just above the water table) in some locations but not in others, particularly where an alternative source of water (i.e. rainfall)

cannot be accessed to maintain ecological function. The TECs that may be impacted by groundwater drawdown are outlined in Table 9-3.

Table 9-3: Threatened ecological communities that may be impacted by groundwater drawdown

Threatened Ecological Community	Location
Cumberland Plain Woodland in the Sydney Basin Bioregion (BC Act) Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (EPBC Act)	This TEC is located at the Westmead metro station construction site and in Parramatta Park (within the former Parramatta Golf Course) approximately 200 metres east of the Westmead metro station construction site.
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (BC Act)	This TEC is located in the following areas: <ul style="list-style-type: none"> • Toongabbie Creek approximately 1.2 kilometres north-west of the Westmead metro station construction site • Domain Creek in Parramatta Park approximately 470 metres east of the Westmead metro station construction site • Parramatta River approximately 700 metres east of the Westmead metro station construction site and approximately 360 metres north-west of the Parramatta metro station construction site.
Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (BC Act) Coastal Swamp Oak (<i>Casuarina glauca</i>) Forest of New South Wales and South East Queensland ecological community (EPBC Act)	This PCT is located in the following areas: <ul style="list-style-type: none"> • Toongabbie Creek at two locations approximately 1.3 kilometres north-west and one kilometre north of the Westmead metro station construction site. • Finlaysons Creek approximately one kilometre north-west of the Westmead metro station construction site • Immediately west of Mother Teresa Primary School at Westmead approximately 630 metres north-west of the Westmead metro station construction site • Along Parramatta River approximately 460 metres north-west of the Parramatta metro station construction site • Along Duck River approximately 960 metres south of the Clyde stabling and maintenance facility construction site.
Sydney Turpentine-Ironbark Forest (BC Act) Turpentine-Ironbark Forest of the Sydney Basin Bioregion (EPBC Act)	This PCT is located in the following areas: <ul style="list-style-type: none"> • Concord Golf Club approximately 650 metres north-east of the North Strathfield metro station footprint • Queen Elizabeth Park located approximately 470 metres north-west of the Burwood North Station construction site • Five Dock Park located approximately 420 metres east of the Five Dock Station construction site.

Any impacts to these TECs from Stage 1 is likely to be minimal based on the groundwater modelling provided in Technical Paper 7 (Hydrogeology) however there is some uncertainty. While likely to be minimal, the extent of impacts from groundwater drawdown are not known and additional investigations would be completed during detailed design to confirm the potential for impacts and to identify any mitigation response (if required) (refer to Section 10). Further mitigation is identified in Technical Paper 7 (Hydrogeology) to further investigate potential impacts to baseflow impacts, and to mitigate through design as required.

9.2.8 Impacts of wind turbine strikes on protected animals

This prescribed impact is not applicable to Stage 1, or Sydney Metro West generally.

9.2.9 Impacts of vehicle strikes on threatened species of animals or on animals that are part of a TEC

Vehicle collision is a direct impact that reduces local population numbers and is a common occurrence in Australia. Mammals, reptiles, amphibians and birds are all at risk of vehicle strike, particularly those common species (e.g. birds) that are tolerant of disturbance and remain in the development site. The risk of increased vehicle strike due to Stage 1 is low and would generally be limited to vehicle movements to and from construction sites, which would typically be on existing busy roads. Vehicle strike associated with Stage 1 is unlikely to affect any threatened species of animals or animals that are part of a TEC.

9.3 Contribution to Key Threatening Processes

A Key Threatening Process (KTP) is a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or an ecological community. KTPs are listed under the BC Act and EPBC Act. At present, there are currently 39 listed KTPs under the BC Act. There are eight KTPs listed under the *Fisheries Management Act 1994*. There are 21 KTPs listed under the EPBC Act. Of the listed KTPs, Stage 1 may directly or indirectly contribute to the following KTPs as outlined in Table 9-4.

Table 9-4: Summary of Key Threatening Processes that Sydney Metro West may directly or indirectly contribute to

Key Threatening Process	BC Act, FM Act or EPBC Act	Likelihood of Stage 1 directly or indirectly contributing to the KTP
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands	BC Act	High – some sections of Duck Creek and A'Becketts Creek would be modified.
Installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams	FM Act	High – permanent instream structures would be built in A'Becketts Creek and Duck Creek but they would be designed where practicable to allow for fish passage.
Clearing of native vegetation	BC Act	High – clearing of native vegetation would occur. However, the magnitude of clearing is small (0.18 hectares).
Land clearance	EPBC Act	High – clearing of native vegetation would occur. However, the magnitude of clearing is small (0.18 hectares).
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis	BC Act	Low – mitigation measures would be implemented to prevent the spread or introduction of amphibian chytrid fungus.
Infection of amphibians with chytrid fungus resulting in chytridiomycosis	EPBC Act	Low – mitigation measures would be implemented to prevent the spread or introduction of amphibian chytrid fungus.
Infection of native plants by <i>Phytophthora cinnamomi</i>	BC Act	Low – mitigation measures would be implemented to prevent the spread or introduction of <i>Phytophthora cinnamomi</i> .

Key Threatening Process	BC Act, FM Act or EPBC Act	Likelihood of Stage 1 directly or indirectly contributing to the KTP
Dieback caused by the root-rot fungus (<i>Phytophthora cinnamomi</i>)	EPBC Act	Low – mitigation measures would be implemented to prevent the spread or introduction of <i>Phytophthora cinnamomi</i> .
Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae	BC Act	Low – mitigation measures would be implemented to prevent the spread or introduction of Exotic Rust Fungi.
Invasion and establishment of exotic vines and scrambler	BC Act	Low – mitigation measures would be implemented to prevent the spread of weeds.
Invasion of native plant communities by African Olive <i>Olea europaea</i> subsp. <i>cuspidata</i> (Wall. ex G. Don) Cif.	BC Act	Low – mitigation measures would be implemented to prevent the spread of weeds.
Invasion of native plant communities by <i>Chrysanthemoides monilifera</i>	BC Act	Low – mitigation measures would be implemented to prevent the spread of weeds.
Invasion of native plant communities by exotic perennial grasses	BC Act	Low – mitigation measures would be implemented to prevent the spread of weeds.
Invasion, establishment and spread of Lantana (<i>Lantana camara</i> L. sens. Lat)	BC Act	Low – mitigation measures would be implemented to prevent the spread of weeds.
Degradation of native riparian vegetation along New South Wales water courses	FM Act	High – sections of Duck Creek and A'Becketts Creek and associated native riparian vegetation would be modified and cleared.

9.4 Aquatic impacts

Unmitigated impacts to aquatic habitats (specifically A'Becketts Creek and Duck Creek) may arise from construction activities. The key potential aquatic ecology impacts due to Stage 1 are associated with the realignment of a short section of A'Becketts Creek and Duck Creek, and the potential impacts on fish passage, loss of mangroves, and potential for indirect impacts downstream of the Clyde stabling and maintenance facility construction site.

The proposed crossings at A'Becketts Creek and Duck Creek may also modify the hydrology of these waterways in turn impacting aquatic biodiversity. However, any impacts to biodiversity resulting from altered hydrology are expected to be minimal as the aquatic biodiversity of A'Becketts Creek and Duck Creek, and the adjoining Duck River and Parramatta River, are already considerably modified due to habitat degradation. The aquatic species that inhabit these waterways are suffering from altered abiotic conditions and introduction of invasive species and only disturbance tolerant species remain. There would be permanent structures within the creeks and the design of the crossings would directly impact creek bed and banks. A section of creeks would be realigned. The crossings would shade the creeks resulting in changes to the structure and there would be no vegetation or associated habitat for aquatic animals beneath the crossings. However, given the relatively small area affected, and the existing degraded condition of the creeks, this impact is unlikely to be significant. The crossings would be designed to provide for fish passage and where practicable, the open areas of creek would be naturalised to enhance aquatic habitat.

The partial realignment of Duck Creek and A'Becketts Creek and the removal of associated mangroves could result in a temporary change in creek flows and velocities. The direct impacts to this vegetation are discussed in Section 9.1. Staging of these works would ensure creek flows and velocities are not significantly changed and to avoid downstream erosion and bed and bank stability impacts.

The aquatic habitats of A'Becketts Creek and Duck Creek, and downstream, may experience reduced water quality due to increased turbidity, in-stream works and disturbance of potentially contaminated soils during construction activity due to earthworks and associated civil works for the future stabling and maintenance facility. This may have a negative impact on aquatic biodiversity through reduced light availability and degradation to habitat but the implementation of standard mitigation measures (i.e. sediment control) are expected to control sediment from any significant runoff events. Changes in flow velocity would be managed to minimise bank scour with flow dissipation devices installed on any new connections to the creeks. There is also the potential for accidental spillage/leakage of contaminants during construction as plant and equipment move through the development site. However, given the existing level of pollution in A'Becketts Creek and Duck Creek and with the implementation of appropriate sediment control and spill controls, these impacts are unlikely to be significant.

Potential impacts to aquatic environments at Clyde and elsewhere would be associated with:

- Construction water treatment plant discharges (refer to Table 9-5). However, as discussed in Section 9.2.7, treatment plants would be designed such that there would be a neutral or beneficial effect to water quality
- Construction activities immediately adjacent or near to waterbodies or watercourses, such as at the Clyde stabling and maintenance facility and The Bays Station construction sites. These impacts would largely be associated with the disturbance of soils (including potentially contaminated soils). However, these activities are likely to have a low impact on water quality provided management and mitigation measures are implemented. These measures would be focused around sediment control at construction sites. With the implementation of appropriate measures during construction, impacts to water quality (and therefore aquatic environments) would be temporary and manageable with no long-term impacts expected.

Table 9-5: Construction water treatment plants and receiving waterways

Construction site	Discharge location	Receiving waterway
Westmead metro station	Local stormwater	Domain Creek
Parramatta metro station	Local stormwater	Parramatta River
Clyde stabling and maintenance facility	Local stormwater	A'Becketts Creek/Duck Creek
Silverwater services facility	Local stormwater	Duck River
Sydney Olympic Park metro station	Local stormwater	Haslams Creek
North Strathfield metro station	Local stormwater	Powells Creek
Burwood North Station	Local stormwater	St Lukes Park Canal
Five Dock Station	Local stormwater	Iron Cove Creek
The Bays Station	Local stormwater	White Bay (Sydney Harbour)

9.5 Cumulative biodiversity impacts

Potential cumulative impacts were considered for assessment based on the likely interactions of Stage 1 with other projects and plans that met the adopted screening criteria. The approach to assessment and the other projects considered are described further in Appendix G (Cumulative impacts assessment methodology) of the Environmental Impact Statement.

The cumulative impacts of historic vegetation clearing for agriculture, urban development, and development and maintenance of infrastructure will likely include continued loss of biodiversity on the Cumberland Plain. The Cumberland Plain is an over cleared landscape and due to the expansion of western Sydney and creation of housing and associated infrastructure, further impacts to biodiversity are likely to result in this region.

While data from all recent projects in the locality is not freely available, some information on recent projects with biodiversity impacts is available as follows:

- Parramatta Light Rail – Stage 1: Direct impact to 0.62 hectares of native vegetation. Removal of approximately 300 individual trees that are mostly horticultural plantings
- Clyde Terminal Conversion Project: No impacts to native vegetation, but potential impacts to tank farm habitat for the Green and Golden Bell Frog
- Viva Energy Clyde Western Area Remediation Project: No direct impacts to native vegetation. Removal of foraging habitat for the Green and Golden Bell Frog, however this was not considered to have a significant impact on the species. Potential direct and indirect impacts were identified (e.g. fragmentation of movement corridors and water quality impacts) but were considered manageable with mitigation and management measures
- WestConnex program of works: This includes M4 Widening (direct impact on up to 8.86 hectares of planted and remnant vegetation), M4 East (around 15.7 hectares of vegetation, of which 12.9 hectares comprises of planted trees and landscaped areas) and M4-M5 Link (with no direct impacts to native vegetation). Other impacts (direct and indirect) were concluded to not have a significant impact or unlikely (including GDEs), and/or considered to be minimal and manageable.

When the impacts of Stage 1 are considered together with the impacts of the above projects the contribution of Stage 1 to cumulative biodiversity impacts in the Cumberland Plain region is low. While there would be some limited biodiversity impacts from Stage 1, no significant increase to cumulative impacts would occur.

10. Mitigating and managing impacts on biodiversity values

Once all practicable steps to avoid or minimise impacts have been implemented at the detailed design phase, mitigation and management measures would be implemented to further lessen the potential ecological impacts of Stage 1.

Mitigation and management measures to be carried out during the construction would be outlined in a Flora and Fauna Management Plan (refer to Appendix D (Construction Environmental Management Framework of the Environmental Impact Statement). This includes (but is not limited to):

- Procedures for the demarcation and protection of retained vegetation, including all vegetation outside and adjacent to the construction footprint
- Measures to reduce disturbance to sensitive fauna
- Procedures for the clearing of vegetation and the relocation of flora and fauna
- Procedures for dealing with unexpected Endangered Ecological Communities or threatened species identified during construction
- Weed management measures in accordance with the *Biosecurity Act 2015*
- Pathogen management measures to prevent introduction and spread of amphibian chytrid fungus, *Phytophthora cinnamomi* and Exotic Rust Fungi
- Inspection and monitoring requirements.

Additional biodiversity mitigation measures are outlined in Table 10-1. These would be in addition to mitigation measures as detailed elsewhere in the Environmental Impact Statement relating to:

- Groundwater (refer to Chapter 18 (Groundwater and ground movement) and Technical Paper 7 (Hydrogeology))
- Soils and surface water (refer to Chapter 19 (Soils and surface water quality)).

Table 10-1 : Mitigation measures

Refence	Mitigation measure	Applicable location
B1	During construction, sufficient flow and fish passage would be maintained similar to current conditions during in-stream works where feasible and reasonable.	CSMF
B2	<p>The A'Becketts Creek and Duck Creek crossings would be designed to:</p> <ul style="list-style-type: none"> • Provide sufficient fish passage is accordance with <i>Policy and guidelines for fish habitat conservation and management – Update 2013</i> (DPI (Fisheries NSW) 2013) • Incorporate suitable scour protection • Avoid worsening of existing flow velocities downstream from the crossing locations • Incorporate a vegetated riparian zone within the realigned open channel sections, where feasible and reasonable. 	CSMF

Refence	Mitigation measure	Applicable location
B3	Additional investigations and assessment would be completed to confirm the potential for impacts to groundwater dependent ecosystems due to groundwater drawdown, and to identify any required mitigation through design.	WMS, PMS, CMSF, NSMS, BNS, FDS.

¹ WMS: Westmead Metro Station; PMS: Parramatta Metro Station; CSMF: Clyde stabling and maintenance facility; SSF: Silverwater services facility; SOPMS: Sydney Olympic Park Metro Station; NSMS: North Strathfield Metro Station; BNS: Burwood North Station; FDS: Five Dock Station; TBS: The Bays Station; Metro rail tunnels: Metro rail tunnels not related to other sites (eg tunnel boring machine works); PSR: Power supply routes.

11. Thresholds for the assessment and offsetting of impacts of development

This section of the BDAR identifies the impact thresholds that the assessor must apply including:

- a) impacts on a potential entity that are serious and irreversible impacts
- b) impacts for which the assessor is required to determine an offset requirement
- c) impacts that do not require further assessment by the assessor.

11.1 Impacts on a potential entity that are serious and irreversible impacts

There would be no impacts to any SAI entities. As such, the additional impact assessment provision outlined in subsection 10.2.3 of the BAM has not been completed.

11.2 Impacts for which the assessor is required to determine an offset requirement

11.2.1 Impacts on native vegetation (ecosystem credits)

An offset is required for the impacts to PCTs as outlined in Table 11-1. Complete removal of the vegetation within the development site would occur. The location of this PCT is shown in Figure 11-1.

Table 11-1: Impacts to PCTs which require an offset

PCT	TEC	Area (ha)
Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion (PCT 920)	Not a TEC	0.15

11.2.2 Impacts on threatened species

An offset is required for impacts to threatened species as outlined in Table 11-2. The location of this habitat is shown in Figure 11-1 (it is the same area as PCT 920).

Table 11-2: Impacts to threatened species which require an offset

Species name	Common name	EPBC Act	BC & FM Act	Sensitivity to gain class	SAI	Area (ha) in development site
Mammals						
<i>Myotis macropus</i>	Southern Myotis	-	V	High	No	0.15

11.3 Impacts for which the assessor is not required to determine an offset requirement

An offset is not required for impacts on native vegetation where the vegetation integrity score is below those set out in paragraph 10.3.1.1 of the BAM. The vegetation integrity score for the Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion PCT (PCT 849) is 11.4. As the vegetation integrity score for this PCT is below 15 an offset is not required for this impact. The location of this PCT is shown in Figure 11-1.

11.4 Impacts that do not require further assessment by the assessor

Areas of land on the development site without native vegetation do not need to be assessed for credits under chapter 4 or chapter 5 of the BAM. As such, areas of the development site that do not possess PCTs have not been assessed and credits have not been generated.

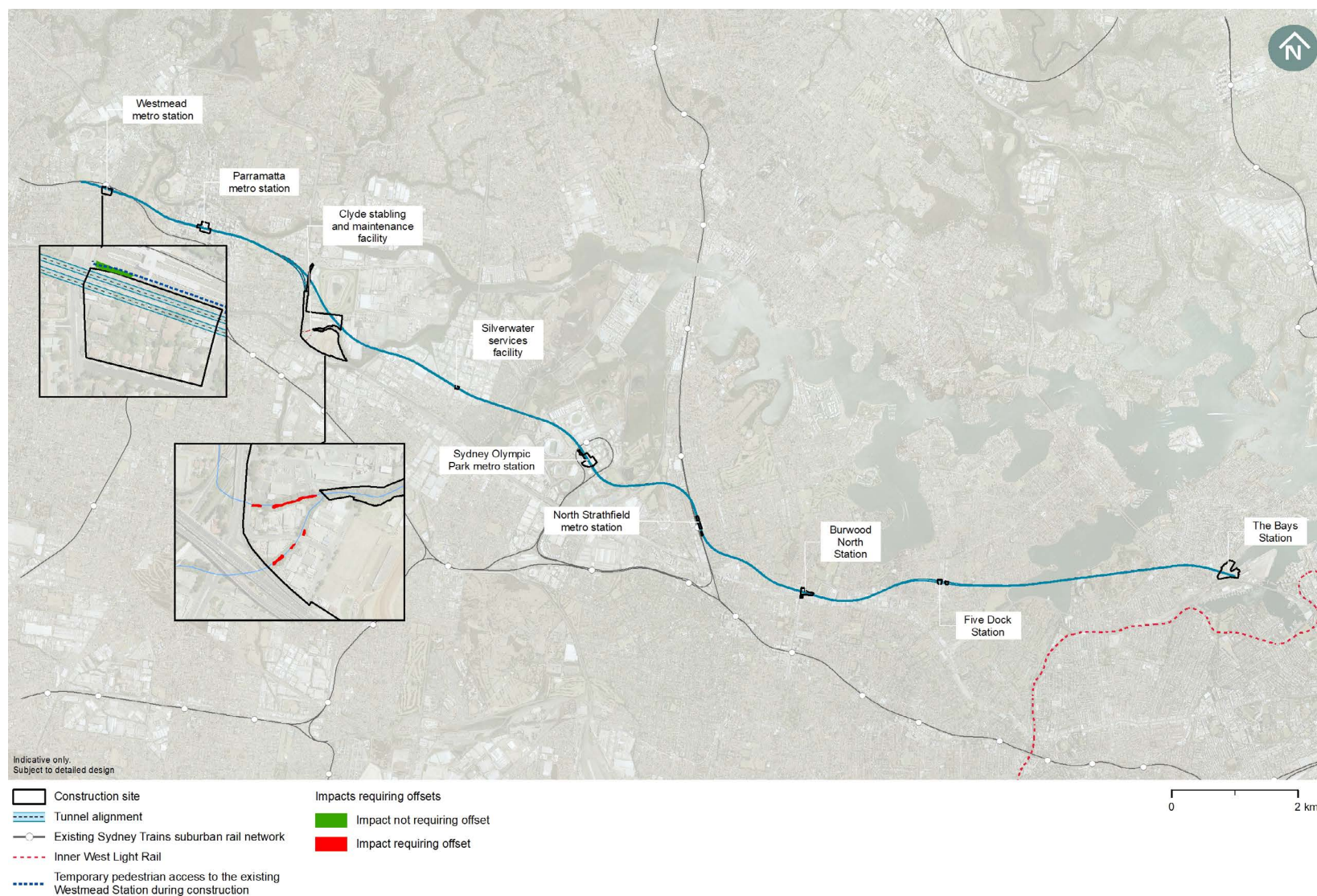


Figure 11-1: Impacts requiring offsets and impacts not requiring offsets

12. Biodiversity credit requirements

A summary of the biodiversity credit requirements for Stage 1 are provided below in Table 12-1 and Table 12-2. The credit report is provided in Appendix E.

Table 12-1: Ecosystem credits required

PCT	TEC	Credits
Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion (PCT 920)	Not a TEC	3

Table 12-2: Species credits required

Species	Credits
<i>Myotis macropus</i> (Southern Myotis)	3

12.1 Offsets for impacts to marine vegetation

For marine vegetation such as mangroves and saltmarsh, the offsetting rules of the *Policy and guidelines for fish habitat conservation and management – Update 2013* (NSW Department of Primary Industries, 2013) are applicable as the guidelines are intended to feed into the assessment of State significant infrastructure projects to ensure the sustainable management, and “no net loss”, of key fish habitats in NSW. The *Policy and guidelines for fish habitat conservation and management – Update 2013* (NSW Department of Primary Industries, 2013) outlines habitat compensation requirements on a minimum 2:1 basis for all key fish habitat (Type 1 to 3). A greater compensation ratio may be considered if opportunities for compensation are not available in the vicinity of, or of the type of, habitat that has been lost. The *Policy and guidelines for fish habitat conservation and management – Update 2013* (NSW Department of Primary Industries, 2013) indicates that compensation for disturbances to SEPP 14 coastal wetlands (which may include Type 1 and 2 habitats) requires approval from the Department of Planning, Infrastructure and Environment and a ratio of 10:1 generally applies (NSW Department of Primary Industries, 2013). As SEPP 14 has been repealed by the Coastal Management SEPP, the mapping from the Coastal Management SEPP has been applied.

The Coastal Management SEPP identifies part of vegetation to be removed at the Clyde stabling and maintenance facility construction site as a coastal wetland. As such, the impact to marine vegetation and likely offset ratio are outlined in Table 12-3.

Table 12-3: Impact to marine vegetation and likely offset ratio

Plant community type name	Vegetation formation	Area in development site	Offset ratio	Likely offset required
Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	Saline Wetlands	0.15 ha	10:1	1.5 ha

13. Conclusions

Stage 1 is located within a highly urbanised area that does not possess large expanses of intact native vegetation with high biodiversity value. As the majority of Stage 1 would be underground or in pre-existing built-up areas, direct impacts to terrestrial biodiversity has been avoided and/or minimised. The limited amount of native vegetation that would be disturbed is of poor to moderate quality and threatened species habitats are limited. No areas of land that the Minister for Energy and Environment has declared as an area of outstanding biodiversity value in accordance with section 3.1 of the BC Act would be affected. Importantly, the areas proposed for clearing would be refined during detailed design and reviewed as part of the pre-clearing process.

The direct impacts to biodiversity values that would potentially occur would be confined to the areas affected by the Westmead metro station and Clyde stabling and maintenance facility construction sites. The direct impacts to biodiversity in these areas includes removal of the following PCTs:

- Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849) – 0.03 hectares. The impact to this PCT would be limited to the Westmead metro station construction site
- Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion (PCT 920) – 0.15 hectares. The impact to this PCT would be limited to the Clyde stabling and maintenance facility construction site. This PCT is also considered to be marine vegetation under the *Fisheries Management Act 1994*.

Stage 1 would also have direct impacts to riparian and aquatic habitats due to the construction of new crossings of A'Becketts Creek and Duck Creek, including the alignment of a section of these creeks.

One species credit species is assumed to be directly impacted: Southern Myotis. The extent of impact to this species is limited to the habitat in the form of PCT 920 (0.15 hectares) at the Clyde stabling and maintenance facility construction site. No significant impacts to threatened species listed under the EPBC Act are likely to occur.

An offset would be required for the impacts to PCT 920 and the Southern Myotis and the credit requirement has been calculated using the Biodiversity Assessment Calculator. Offsets for impacts to marine vegetation would need to be made at a 10:1 ratio due to impacts on a mapped Coastal Wetland area.

Once all practicable steps to avoid or minimise impacts have been implemented at the detailed design phase, mitigation and management measures would be implemented to further lessen the potential ecological impacts of Stage 1. Mitigation and management measures that would be implemented during Stage 1 would be outlined in a Flora and Fauna Management Plan (refer to Appendix D (Construction Environmental Management Framework) of the Environmental Impact Statement).

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Appendix A. Habitat assessment

State and nationally listed threatened species identified from the literature review, database searches and Biodiversity Assessment Calculator, were considered in terms of their likelihood to occur in the habitats present within the survey area based on identified habitat requirements. The habitat suitability assessment for threatened species is provided in Table A-1 and Table A-2.

Table A-1: Habitat suitability assessment for threatened plant species

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Acacia baueri</i> subsp. <i>aspera</i>	V	-	Restricted to the Sydney region, occurring on the Kings Tableland in the central Blue Mountains and with sporadic occurrences on the Woronora Plateau in the Royal National Park, Mt. Keira district and at Wedderburn. May also occur on the escarpment/Woronora Plateau in the Flat Rock Junction and Stanwell Tops area of the Illawarra. Occurs in low, damp heathlands, often on exposed rocky outcrops over a wide range of climatic and topographical conditions. Appears to prefer open conditions; rarely observed where there is any shrub or tree canopy development; and many of the observations of this species have been made following fire, suggesting the species prefers early successional habitats. Peak flowering occurs December to March. Pods have been observed to remain on the plants for several months, maturing October to December.	10 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Acacia bynoeana</i> (Bynoe's Wattles)	E	V	Found in central eastern NSW, from the Hunter District south to the Southern Highlands and west to the Blue Mountains. It has recently been found in the Colymea and Parma Creek areas west of Nowra. Occurs in heath or dry sclerophyll forest on sandy soils. Seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches. Associated overstorey species include Red Bloodwood (<i>Corymbia gummifera</i>), Scribbly Gum (<i>Eucalyptus haemastoma</i>), Drooping Red Gum (<i>E. parramattensis</i>), Old Man Banksia (<i>Banksia serrata</i>) and Small-leaved Apple (<i>Angophora bakeri</i>).	384 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Acacia clunies-rossiae</i>	V	-	Kanangra Wattle grows in the Kowmung and Coxs River areas entirely within Kanangra-Boyd and Blue Mountains National Parks. Grows in dry sclerophyll forest on skeletal soils on rocky slopes, or on alluvium along creeks.	1 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Acacia gordonii</i> (Gordon's Wattle)	E	E	It is chiefly found in the lower eastern slopes of the Blue Mountains but also occurs in the Glenorie-Maroota area on the northern outskirts of Sydney and there is one record from Hornsby. It occurs on rock platforms on ridgetops and spurs at 0-400 m asl in dry sclerophyll open forest, woodland and heath. The substrate is sandy soil derived from Hawkesbury Sandstone with some residual clay and laterite influence, low in nutrients and well drained.	28 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Acacia prominens</i> (Gosford wattle) population, Hurstville and Kogarah local government areas	EP	-	Occurs at a few sites along the railway line at Penshurst, at Carss Bush Park, Carss Park and there is an unconfirmed sighting 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. This population is only endangered in the Hurstville and Kogarah LGAs.	15 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Acacia pubescens</i> (Downy Wattle)	V	V	Concentrated around the Bankstown-Fairfield-Rookwood area and the Pitt Town area, with outliers occurring at Barden Ridge, Oakdale and Mountain Lagoon. 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. Occurs on alluviums, shales and at the intergrade between shales and sandstones. The soils are characteristically gravelly soils, often with ironstone.	5,185 - BioNet	Low in development footprint. Known to occur in the broader locality but unlikely to occur in the footprints due to a lack of habitat.
<i>Acacia terminalis</i> subsp. <i>terminalis</i>	E	E	Very limited distribution between Botany Bay to the northern foreshore of Port Jackson. Recent collections have only been made from the Quarantine Station, Clifton Gardens, Dover Heights, Parsely Bay, Nielson Park, Cooper Park, Chifley and Watsons Bays. Coastal scrub and dry sclerophyll woodland on sandy soils. Habitat is generally sparse and scattered. Most areas of habitat or potential habitat are small and isolated.	406 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Acrophyllum australe</i>	V	V	This species distribution is restricted, from Faulconbridge to Lawson, South of Bilpin and near Kings Tableland, in the Blue Mountains area, all within the Central Coast Botanical Subdivision, currently known from 27 sites. Grows in sheltered gullies beneath waterfalls and drip zones of rock overhangs and cliff faces, usually with a south-east to south-west aspect. Typically found in areas where there is a more or less constant supply of water. Usually grows in shale interbeds at the base of small cliffs, in crevices on the sandstone rock face or on talus slopes. The rock overhangs are of Hawkesbury or Narrabeen Sandstone.	3 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Allocasuarina diminuta</i> subsp. <i>mimica</i> L.A.S. Johnson population in the Sutherland and Liverpool local government areas	EP	-	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). Other occurrences in the Blue Mountains and Southern Highlands (Blackheath to Bundanoon and Taralga), and also in the coastal communities from Kingsford to Little Bay) are not included in the Endangered population listing. Occurs in Heathy woodland, Heathlands and Low open woodlands.	41 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Allocasuarina glareicola</i>	E	E	This species grows on tertiary alluvial gravels, with yellow clayey subsoil and lateritic soil. These soils are low in fertility and are strongly to very strongly acidic. Rainfall in the area is lower than surrounding regions. The median annual rainfall is 803 mm (measured at the University of Western Sydney), with a summer peak. It is found in the Castlereagh open woodland community, with <i>Eucalyptus parramattensis</i> , <i>E. fibrosa</i> , <i>E. sclerophylla</i> , <i>Angophora bakeri</i> and <i>Melaleuca decora</i> . Common associated understorey species include <i>Melaleuca nodosa</i> , <i>Hakea dactyloides</i> , <i>H. sericea</i> , <i>Dillwynia tenuifolia</i> , <i>Micromyrtus minutiflora</i> , <i>Acacia elongata</i> , <i>A. brownei</i> , <i>Themeda australis</i> and <i>Xanthorrhoea minor</i> .	37 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Allocasuarina portuensis</i>	E	E	The original known habitat of the Neilsen Park She-oak is at Nielsen Park, in Woollahra local government area. There are no plants left at the original site where it was discovered. However, propagation material has been planted successfully at a number of locations at Nielsen Park and other locations in the local area, e.g. Gap Bluff, Hermit Point and Vaucluse House. The original habitat occurs above a sandstone shelf approximately 20 m above the harbour. The shallow sandy soils are highly siliceous, coarsely textured and devoid of a soil profile. The plantings have occurred on similar soils.	75 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Amperea xiphioclada</i> var. <i>pedicellata</i>	Ex	PEx	<i>Amperea xiphioclada</i> var. <i>pedicellata</i> is known only from the type specimen collected in 1892 from Sydney, NSW. The species has not been observed since and is presumed to be extinct. <i>Amperea xiphioclada</i> var. <i>pedicellata</i> was previously widespread in heath, woodland and forest in low-fertility, sandy soils.	1 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Ancistrachne maidenii</i>	V	-	Restricted to northern Sydney, around St Albans - Mt White - Maroota - Berowra areas and to the Shannon Creek area south-west of Grafton. Habitat requirements appear to be specific, with populations occurring in distinct bands in areas associated with a transitional geology between Hawkesbury and Watagan soil landscapes. Flowers in summer. Grows in dry sclerophyll forest on sandstone-derived soils.	24 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Asterolasia buxifolia</i>	E	-	Known from a single site at a granite outcrop in the riparian zone of the Lett River. Rediscovered in 2000, little is known about the species. The growth rate appears to be very slow, and the flowering season short. Apparently restricted to dense riparian scrub along rocky watercourses with a granitic substrate.	1 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Asterolasia elegans</i>	E	E	Occurs north of Sydney, in the Baulkham Hills, Hawkesbury and Hornsby local government areas. Also likely to occur in the western part of Gosford local government area. Known from only seven populations, only one of which is wholly within a conservation reserve. Occurs on Hawkesbury sandstone. Found in sheltered forests on mid- to lower slopes and valleys, e.g. in or adjacent to gullies which support sheltered forest. The canopy at known sites includes Turpentine (<i>Syncarpia glomulifera</i> subsp. <i>glomulifera</i>), Smooth-barked Apple (<i>Angophora costata</i>), Sydney Peppermint (<i>Eucalyptus piperita</i>), Forest Oak (<i>Allocasuarina torulosa</i>) and Christmas Bush (<i>Ceratopetalum gummiferum</i>).	2 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Astrotricha crassifolia</i>	V	V	Occurs near Patonga (Gosford LGA), and in Royal NP and on the Woronora Plateau (Sutherland and Campbelltown LGAs). There is also a record from near Glen Davis (Lithgow LGA). Occurs on dry ridgetops to 300 m altitude and is associated with very rich heath, or dry sclerophyll woodland. Vegetation associations include typical sandstone genera such as <i>Hakea</i> , <i>Banksia</i> and <i>Xylomelum</i> .	243 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Boronia umbellata</i>	V	V	Found at only a few locations between Glenreagh and Lower Bucca, north of Coffs Harbour, but it is locally common in the restricted area where it occurs. This <i>Boronia</i> grows as an understorey shrub in and around gullies in wet open forest. It appears to regenerate well after disturbance, but it is not known whether prolonged or repeated disturbance affects long-term persistence.	1 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site. Does not occur in the Sydney area, record is erroneous.
<i>Caesia parviflora</i> var. <i>minor</i>	E	-	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. Found in damp places in open forest on sandstone.	1 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Caladenia tessellata</i> (Thick-lipped Spider-orchid)	E	V	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.	38 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Callistemon linearifolius</i>	V	-	Recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW. Was more widespread across its distribution in the past. Some populations are reserved in Ku-ring-gai Chase National Park, Lion Island Nature Reserve, and Spectacle Island Nature Reserve. Further north it has been recorded from Yengo National Park and Werakata National Park. Grows in open dry sclerophyll forest on a substrate of sandy to clayey soils on sandstone on the coast and ranges e.g. with <i>Corymbia eximia</i> , <i>Eucalyptus punctata</i> , <i>E. umbra</i> , <i>Allocasuarina littoralis</i> , and <i>Angophora costata</i> .	159 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Callitris endlicheri</i> (Black Cypress Pine, Woronora Plateau population)	EP	-	The population of <i>Callitris endlicheri</i> on the Woronora Plateau, in the local government area of Wollongong, represents the coastal limit of the species' range and is disjunct from other known populations of the species. Throughout its range, the species is usually found on stony hills or ridges, common, from the plains to the coastal ranges. The Woronora Plateau population is restricted to a single outcrop of sandstone c. 2 ha in area. The soils at this site are skeletal sandy loams and the heathlands on sandstone outcrops in the area are restricted and highly distinctive.	4 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Chamaesyce psammogeton</i> (Sand Spurge)	E	-	Sand Spurge is found sparsely along the coast from south of Jervis Bay (at Currarong, Culburra and Seven Mile Beach National Park) to Queensland (and Lord Howe Island). Grows on fore-dunes, pebbly strandlines and exposed headlands, often with Spinifex (<i>Spinifex sericeus</i>) and Prickly Couch (<i>Zoysia macrantha</i>). Flowering recorded in spring and summer.	13 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Cryptostylis hunteriana</i> (Leafless Tongue-orchid)	V	V	The Leafless Tongue-orchid has been reported to occur in a wide variety of habitats including heathlands, heathy woodlands, sedgeland, <i>Xanthorrhoea</i> spp. plains, dry sclerophyll forests (shrub/grass sub-formation and shrubby sub-formation), forested wetlands, freshwater wetlands, grasslands, grassy woodlands, rainforests and wet sclerophyll forests (grassy sub-formation). Soils are generally considered to be moist and sandy, however, this species is also known to grow in dry or peaty soils.	5 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Cynanchum elegans</i> (White-flowered Wax Plant)	E	E	Occurs from the Gloucester district to the Wollongong area and inland to Mt Dangar. Typically occurs in rainforest gullies, scrub and scree slopes and at the ecotone between dry rainforest vegetation and dry subtropical forest/woodland communities. Other associated vegetation types include littoral rainforest; Coastal Tea-tree (<i>Leptospermum laevigatum</i>) – Coastal Banksia (<i>Banksia integrifolia</i> subsp. <i>integrifolia</i>) coastal scrub; Forest Red Gum (<i>Eucalyptus tereticornis</i>) aligned open forest and woodland; Spotted Gum (<i>Corymbia maculata</i>) aligned open forest and woodland; and Bracelet Honey myrtle (<i>Melaleuca armillaris</i>) scrub to open scrub.	23 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Daphnandra johnsonii</i>	E	E	Restricted to the Illawarra region (below 150 m alt) where it has been recorded from the local government areas of Shoalhaven, Kiama, Shellharbour and Wollongong. Occupies the rocky hillsides and gullies of the Illawarra lowlands, occasionally extending onto the upper escarpment slopes. Associated vegetation includes rainforest and moist eucalypt forest. It is usually found in subtropical rainforest and sometimes found in disturbed areas and in moist eucalypt forest in association with <i>Eucalyptus tereticornis</i> , <i>E. pilularis</i> , <i>E. quadrangulata</i> or <i>Casuarina cunninghamiana</i> . Associated soils are loams and clay loams derived from volcanic and fertile sedimentary rocks.	1 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site. Does not occur in the Sydney area.
<i>Darwinia biflora</i>	V	V	Occurs at 129 sites in the northern and north-western suburbs of Sydney, in the Ryde, Baulkham Hills, Hornsby and Ku-Ring-Gai Local Government Areas (LGAs). Occurs on the edges of weathered shale-capped ridges, where these intergrade with Hawkesbury Sandstone. Associated overstorey species include <i>Eucalyptus haemastoma</i> , <i>Corymbia gummifera</i> and/or <i>E. squamosa</i> . The vegetation structure is usually woodland, open forest or scrub-heath.	1,396 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Darwinia fascicularis</i> subsp. <i>oligantha</i> population in the Baulkham Hills and Hornsby Local Government Areas	EP	-	This endangered population is restricted to the Maroota area of Baulkham Hills and Hornsby Local Government Areas within the Sydney Basin Bioregion. This population is known from three remnant sites with an estimated total population of 500 in 1999. Occurs around rock platforms and in rocky heath associated with friable sandstone shallow soils. Associated species include <i>Allocasuarina nana</i> , <i>A. distyla</i> , <i>Banksia ericifolia</i> and <i>Caustis flexuosa</i> .	1 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Darwinia glaucophylla</i>	V	-	Occurs between Gosford and the Hawkesbury River around Calga, Kariong and Mt Karing. Known from approximately 15 sites, several within or near to Brisbane Waters NP and one within Popran NP. Occurs entirely within the Gosford LGA. Occurs in sandy heath, scrub and woodlands often associated with sandstone rock platforms or near hanging swamps and friable sandstone shallow soils. Associated species in scrub include: <i>Banksia ericifolia</i> , <i>Acacia terminalis</i> , <i>A. oxycedrus</i> , <i>Angophora hispida</i> , <i>Hakea teretifolia</i> , <i>Bauera rubioides</i> , and in woodland: <i>Corymbia gummifera</i> , <i>C. eximia</i> , <i>Eucalyptus haemastoma</i> and <i>E. punctata</i> .	2 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Darwinia peduncularis</i>	V	-	Occurs as local disjunct populations in coastal NSW with a couple of isolated populations in the Blue Mountains. Usually grows on or near rocky outcrops on sandy, well drained, low nutrient soil over sandstone.	60 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Deyeuxia appressa</i>	E	E	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.	0 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Dichanthium setosum</i> (Bluegrass)	V	V	<i>Dichanthium setosum</i> has been reported from mid-coastal to inland NSW and Queensland. <i>Dichanthium setosum</i> occurs on the New England Tablelands, North West Slopes and Plains and the Central Western Slopes of NSW, extending west to Narrabri. <i>Dichanthium setosum</i> is associated with heavy basaltic black soils and red-brown loams with clay subsoil.	1 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site. Record in Sydney likely to be erroneous.
<i>Dillwynia tenuifolia</i>	V	-	Core distribution is the Cumberland Plain from Windsor to Penrith east to Deans Park. Other populations in Western Sydney are recorded at Voyager Point and Kemps Creek in the Liverpool LGA, Luddenham in the Penrith LGA and South Maroota in the Baulkham Hills Shire. Disjunct localities include the Bulga Mountains at Yengo in the north, and Kurrajong Heights and Woodford in the Lower Blue Mountains. In western Sydney, it 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. At Yengo, is reported to occur in disturbed escarpment woodland on Narrabeen sandstone.	1,863 – BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Dillwynia tenuifolia</i> Sieber ex D.C. in the Baulkham Hills local government area	EP	-	The endangered population includes all locations for the species within the Baulkham Hills local government area. Only two confirmed locations are known, both near the junction of Wisemans Ferry and Sackville Roads.	13 – BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Dillwynia tenuifolia</i> , Kems Creek	EP	-	The endangered population occurs in the area bounded by Western Road, Elizabeth Drive, Devonshire Road and Cross Street, Kems Creek in the Liverpool Local Government Area.	68 – BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Diuris aequalis</i>	E	V	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).	2 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site. The original records of this species from Liverpool and other areas of Sydney are now considered likely to be erroneous.
<i>Diuris arenaria</i>	E	-	Sand Doubletail is known from the Tomaree Peninsula near Newcastle and areas including Heatherbrae. This species occurs in coastal heath and dry grassy eucalypt forest on sandy flats. Grows in gently undulating country in eucalypt forest with a grassy understorey on clay soil or sand.	1 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site. Records in Sydney likely to be erroneous.
<i>Diuris bracteata</i>	E	Ex	The complete absence of records for most of the 20th Century resulted in this species being listed as 'presumed extinct' in NSW. In recent years, however, extant populations from north-west of Gosford have been recorded and this area is now the only known area of occurrence of the species. All known plants fall within the Gosford and Wyong Local Government Areas. Inhabits dry sclerophyll woodland and forest with a predominantly grassy understorey.	1 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site. Records in Sydney likely to be erroneous.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Doryanthes palmeri</i> (Giant Spear Lily)	V	-	Giant Spear Lily occurs in far north-east NSW and south-east Queensland. In NSW, it occurs on the coastal ranges that are part of the Mt Warning Caldera. Its southern distributional limit is Mount Billen. The species is currently known from eleven sites within NSW, five of which are conservation reserves. Most populations consist of only a few hundred individuals.	2 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site. Records in Sydney likely to be erroneous or planted specimens in gardens.
<i>Epacris purpurascens</i> var. <i>purpurascens</i>	V	-	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, particularly sclerophyll forests, heathlands and swamps most of which have a strong shale soil influence.	655 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Epacris sparsa</i>	V	V	Restricted to the lower Grose River, within the Hawkesbury and Blue Mountains LGAs. Grows in Riparian Sandstone Scrub, where it grows on the base of cliffs or rock faces, on rocky ledges or amongst rocks in the riparian zone. Grows in association with rocky sites in scrub vegetation dominated by <i>Tristaniopsis laurina</i> , <i>Leptospermum trinervium</i> , <i>Allocasuarina littoralis</i> , <i>Acacia longifolia</i> , <i>Grevillea sericea</i> and <i>Lomandra fluvialis</i> .	13 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Eucalyptus benthamii</i>	V	V	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. A further 18 trees are scattered along the Nepean River, south to The Oaks. Requires a combination of deep alluvial sands and a flooding regime that permits seedling establishment. Occurs in open forest. Associated species at the Bents Basin site include <i>Eucalyptus elata</i> , <i>E. baueriana</i> , <i>E. amplifolia</i> , <i>E. deanei</i> and <i>Angophora subvelutina</i> . Understorey species include <i>Bursaria spinosa</i> , <i>Pteridium esculentum</i> and a wide variety of agricultural weeds. The Kedumba Valley site lists <i>E. crebra</i> , <i>E. deanei</i> , <i>E. punctata</i> , <i>Leptospermum flavescens</i> , <i>Acacia filicifolia</i> and <i>Pteridium esculentum</i> among its associated species.	506 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Eucalyptus camfieldii</i> (Camfield's Stringybark)	V	V	Restricted distribution in a narrow band with the most northerly records in the Raymond Terrace area south to Waterfall. Poor coastal country in shallow sandy soils overlying Hawkesbury sandstone. Coastal heath mostly on exposed sandy ridges. Occurs mostly in small scattered stands near the boundary of tall coastal heaths and low open woodland of the slightly more fertile inland areas. Associated species frequently include stunted specimens of <i>E. oblonga</i> (Narrow-leaved Stringybark), <i>E. capitellata</i> (Brown Stringybark) and <i>E. haemastoma</i> (Scribbly Gum).	176 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Eucalyptus fracta</i>	V	-	Confined largely to State Forest. Locally common but restricted to the northern Broken Back Range near Cessnock, NSW. The dominant tree in a narrow band along the upper edge of a sandstone escarpment. Occurs in dry eucalypt woodland in shallow soils. Associated species in slightly deeper soils include <i>Eucalyptus sparsifolia</i> , <i>E. punctata</i> , <i>Corymbia maculata</i> and <i>Angophora euryphylla</i> .	1 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site. Record in Sydney likely to be a planted street tree.
<i>Eucalyptus macarthurii</i>	E	E	Paddys River Box has a moderately restricted distribution. It is currently recorded from the Moss Vale District to Kanangra Boyd National Park. In the Southern Highlands it occurs mainly on private land, often as isolated individuals in, or on the edges, of paddocks. Isolated stands occur in the north-west part of the range on the Boyd Plateau. It is not well reserved but does occur within Cecil Hoskins Nature Reserve in the Southern Highlands and Kanangra Boyd National Park. Occurs on grassy woodland on relatively fertile soils on broad cold flats.	1 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site. Record in Sydney likely to be a planted street tree.
<i>Eucalyptus nicholii</i> (Narrow-leaved Black Peppermint)	V	V	This species is sparsely distributed but widespread on the New England Tablelands from Nundle to north of Tenterfield, being most common in central portions of its range. Found largely on private property and roadsides, and occasionally 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.	35 - BioNet	Known to occur in the broader locality. Commonly planted as a street tree in Sydney but not present in development sites.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Eucalyptus pulverulenta</i> (Silver-leafed Gum)	V	V	The Silver-leafed Gum is found in two quite separate areas, the Lithgow to Bathurst area and the Monaro (Bredbo to Bombala). Grows in shallow soils as an understorey plant in open forest, typically dominated by Brittle Gum (<i>Eucalyptus mannifera</i>), Red Stringybark (<i>E. macrorhyncha</i>), Broad-leafed Peppermint (<i>E. dives</i>), Silvertop Ash (<i>E. sieberi</i>) and Apple Box (<i>E. bridgesiana</i>).	1 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site. Record in Sydney likely to be a planted street tree.
<i>Eucalyptus scoparia</i> (Wallangarra White Gum)	E	V	In NSW it is known from only three locations near Tenterfield, including Bald Rock National Park. In Queensland it is equally rare, occurring at three sites of which only one has more than a dozen trees. In NSW it is known from only three locations near Tenterfield, including Bald Rock National Park. In Queensland it is equally rare, occurring at three sites of which only one has more than a dozen trees.	12 - BioNet	Known to occur in the broader locality. Commonly planted as a street tree in Sydney but not present in development sites.
<i>Eucalyptus</i> sp. Cattai	CE	CE	Occurs in The Hills Local Government Area, with known populations occurring within the area bounded by Kellyville - Maraylya - Glenorie. Occurs as a rare emergent tree in scrub, heath and low woodland on sandy soils, usually as isolated individuals or occasionally in small clustered groups. The sites at which it occurs are generally flat and on ridge tops. Associated soils are laterised clays overlying sandstone.	499 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Galium australe</i>	E	-	Tangled Bedstraw has been recorded historically in the Nowra (Colymea) and Narooma areas and is extant in Nadgee Nature Reserve, south of Eden. Records in the Sydney area are yet to be confirmed. Most flowering collections have been made in late spring to early autumn. In NSW (and ACT Territory in Jervis Bay), Tangled Bedstraw has been recorded in Turpentine forest and coastal Acacia shrubland. In other States the species is found in a range of near-coastal habitats, including sand dunes, sand spits, shrubland and woodland.	8 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Genoplesium baueri</i> (Bauer's Midge Orchid)	E	E	Recorded from locations between Nowra and Pittwater and may occur as far north as Port Stephens. About half the records were made before 1960 with most of the older records being from Sydney suburbs including Asquith, Cowan, Gladesville, Longueville and Wahroonga. No collections have been made from those sites in recent years. The species has been recorded at locations now likely to be within the several conservation reserves including Berowra Valley Regional Park, Royal National Park and Lane Cove National Park. May occur in the Woronora, O'Hares, Metropolitan and Warragamba Catchments. Found in sparse sclerophyll forest and moss gardens over sandstone	10 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Genoplesium plumosum</i>	CE	E	The Tallong Midge Orchid was originally collected at Kurnell in 1947; presumably it also occurred south of there, but it is now only known from two areas - the village of Tallong and its immediate environs, and a site in Morton National Park 8.5 km south-east of the town of Wingello. Occurs exclusively in heathland, generally dominated by Violet Kunzea (<i>Kunzea parvifolia</i>), Common Fringe-myrtle (<i>Calytrix tetragona</i>) and parrot-peas (<i>Dillwynia</i> spp.). Grows on very shallow soils, often with lichens and mosses on sandstone conglomerate rock shelves.	2 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Grammitis stenophylla</i>	E	-	Occurs in eastern Queensland and eastern NSW. In NSW it has been found on the south, central and north coasts and as far west as Mount Kaputar National Park near Narrabri. Moist places, usually near streams, on rocks or in trees, in rainforest and moist eucalypt forest.	26 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Grevillea beadleana</i> (Beadle's Grevillea)	E	E	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 Shannon Creek south-west of Grafton. Open eucalypt forest with a shrubby understorey. It is usually found on steep granite slopes at high altitudes, although the population at Shannon Creek is at a lower elevation on sandstone.	1 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site. Record in Sydney likely to be erroneous.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Grevillea caleyi</i> (Caley's Grevillea)	CE	E	Restricted to an 8 km square area around Terrey Hills, approximately 20 km north of Sydney. Occurs in three major areas of suitable habitat, namely Belrose, Ingleside and Terrey Hills/Duffys Forest within the Ku-ring-gai, Pittwater and Warringah Local Government Areas. All sites occur on the ridgetop between elevations of 170 to 240m asl, in association with laterite soils and a vegetation community of open forest, generally dominated by <i>Eucalyptus sieberi</i> and <i>Corymbia gummifera</i> . Commonly found in the endangered Duffys Forest ecological community.	761 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Grevillea juniperina</i> subsp. <i>juniperina</i>	V	-	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.	1,746 – BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	V	V	Sporadically distributed throughout the Sydney Basin with the main occurrence centred around Picton, Appin and Bargo. Separate populations are also known further north from Putty to Wyong and Lake Macquarie on the Central Coast, and Cessnock and Kurri Kurri in the Lower Hunter. Grows in sandy or light clay soils usually over thin shales. Occurs in a range of vegetation types from heath and shrubby woodland to open forest. Found over a range of altitudes from flat, low-lying areas to upper slopes and ridge crests. Often occurs in open, slightly disturbed sites such as along tracks.	1,233 – BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Grevillea parviflora</i> subsp. <i>supplicans</i>	E	-	Has a very restricted known distribution (approximately 8 by 10 km) and is confined to the north-west of Sydney near Arcadia and the Maroota–Marramarra Creek area, in Hornsby and Baulkham Hills local government areas. Occurs in heathy woodland associations on skeletal sandy soils over massive sandstones. This plant may have an affinity with disturbance margins such as trail and road verges where soils are suitable and the availability of light due to clearing has promoted its growth.	326 – BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Grevillea shiressii</i>	V	V	Known from two populations near Gosford, on tributaries of the lower Hawkesbury River north of Sydney (Mooney Mooney Creek and Mullet Creek). Both populations occur within the Gosford Local Government Area. There is also a naturalised population at Newcastle. Grows along creek banks in wet sclerophyll forest with a moist understorey in alluvial sandy or loamy soils. Flowers mainly late winter to Spring (July-December), with seed released at maturity in October. Flowers are bird pollinated and seeds are dispersed by ants. A fire sensitive obligate seeder that is highly susceptible to local extinction due to frequent fire, however, fire is likely to be relatively infrequent in the habitat of <i>G. shiressii</i> . Seed germination does occur in the absence of fire; however, some physical disturbance is likely to promote seed germination.	13 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Gyrostemon thesioides</i>	E	-	Within NSW, has only ever been recorded at three sites, to the west of Sydney, near the Colo, Georges and Nepean Rivers. Grows on hillsides and riverbanks and may be restricted to fine sandy soils.	32 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Haloragis exalata</i> subsp. <i>exalata</i>	V	V	Square Raspwort occurs in 4 widely scattered localities in eastern NSW. It is disjunct 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. Flowering specimens in NSW are recorded from November to January.	1 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Haloragodendron lucasii</i>	E	E	The known locations of this species are confined to a very narrow distribution on the north shore of Sydney. Associated with dry sclerophyll forest. Reported to grow in moist sandy loam soils in sheltered aspects, and on gentle slopes below cliff-lines near creeks in low open woodland. Associated with high soil moisture and relatively high soil-phosphorus levels.	96 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Hibbertia fumana</i>	CE	-	Although originally collected by R. Brown, Caley and Sieber from sites as diverse as 'near South Head' and 'western Sydney', the only known extant population is in the Moorebank area (which could be the 'in occidental Sydney' or 'near Sydney' of either author). Currently only known from a single population at Moorebank but potentially elsewhere in greater Sydney. Generally, found in areas of woodland with a more open understorey, in a long intergrade between Castlereagh Scribbly Gum Woodland and Castlereagh Ironbark Forest at the Moorebank Site. Has the potential to occur in similar intergrade alluvial habitats rich in sands and laterite in other parts of western Sydney.	878 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Hibbertia procumbens</i>	E	-	Within NSW, known from several locations only on the Central Coast in the Gosford and Wyong local government areas. These populations are at Bumble Hill near Yarramalong in Wyong LGA; Kulnura, Strickland State Forest, Mangrove Mountain, Somersby, Calga/Mt White and Peats Ridge in the Gosford LGA; and near Mogo Creek to the west of Mangrove Creek Dam. It has been recorded in four conservation reserves: Yengo, Popran and Brisbane Water National Parks and the non-production Strickland State Forest. Also occurs in Victoria and Tasmania, although investigation is required to verify that the disjunct NSW populations are the same species.	7 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Hibbertia puberula</i>	E	-	Recent work on this species and its relatives have shown it to be widespread, but never common. It extends from Wollemi National Park south to Morton National Park and the south coast near Nowra. Early records of this species are from the Hawkesbury River area and Frenchs Forest in northern Sydney, South Coogee in eastern Sydney, the Hacking River area in southern Sydney, and the Blue Mountains. 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 described subspecies also favours upland swamps.	968 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Hibbertia</i> sp. Bankstown	CE	CE	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. Known only from Tertiary alluvial soil along Airport Creek on Bankstown Airport and not from areas where subsequent fill has been deposited in between. The plant assemblage is attributable to "Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion". 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.	4 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Hibbertia spanantha</i>	CE	CE	Endemic to NSW where it is restricted to three locations. Grows in forest with canopy species including <i>Eucalyptus pilularis</i> , <i>E. resinifera</i> , <i>Corymbia gummifera</i> and <i>Angophora costata</i> . The understorey is open with species of Poaceae, Orchidaceae, Fabaceae and Liliaceae.	3 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Hibbertia stricta</i> subsp. <i>furcatula</i>	E	-	<i>Hibbertia stricta</i> subsp. <i>furcatula</i> (<i>Hibbertia</i> sp. nov. 'Menai') is known to occur in two populations, one in 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.	19 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Hibbertia superans</i>	E	-	Occurs from Baulkham Hills to South Maroota in the northern outskirts of Sydney, where there are currently 16 known sites, and at one locality at Mount Boss, inland from Kempsey. No populations are known from a formal conservation reserve. Occurs in open woodland and heathland, and appears to prefer open disturbed areas, such as tracksides.	254 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Kunzea rupestris</i>	V	V	Restricted, with most locations in the Maroota - Sackville - Glenorie area and one outlier in Ku-ring-gai Chase National Park, all within the Central Coast botanical subdivision of NSW. Currently known to exist in 20 populations, 6 of which are reserved. Grows in shallow depressions on large flat sandstone rock outcrops. Characteristically found in short to tall shrubland or heathland.	97 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Lasiopetalum joyceae</i>	V	V	Has a restricted range occurring on lateritic to shaley ridgetops on the Hornsby Plateau south of the Hawkesbury River. It is currently known from 34 sites between Berrilee and Duffys Forest. Seventeen of these are reserved. Grows in heath on sandstone.	1,935 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Leptospermum deanei</i>	V	V	Known from the Hornsby, Warringah, Ku-ring-gai and Ryde LGAs. Occurs in woodland on lower hill slopes or near creeks, sandy alluvial soil or sand over sandstone, riparian scrub woodland and open forest.	60 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Leucopogon exolasius</i>	V	V	Woronora Beard-heath is found along the upper Georges River area and in Heathcote National Park. It inhabits woodland on sandstone (and sandy alluvium) and prefers rocky hillsides along creek banks. The species occupies areas with low nutrient soils, up to an altitude of 100 m above sea level. It is found in association with Sydney Peppermint (<i>Eucalyptus piperita</i>), Silvertop Ash (<i>E. sieberi</i>) and shrubs including the Graceful Bush Pea (<i>Pultenaea flexilis</i>), Flaky-barked Tea-tree (<i>Leptospermum trinervium</i>) and Eggs and Bacon Pea (<i>Dillwynia retorta</i>) Flowering occurs in August and September.	85 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Leucopogon fletcheri</i> subsp. <i>fletcheri</i>	E	-	Mainly found in north-western Sydney between St Albans in the north and Annangrove in the south, within the local government areas of Hawkesbury, Baulkham Hills and Blue Mountains. Also recorded from the Georges River area near Kentlyn and from the Newnes Plateau near Lithgow. Occurs in dry eucalypt woodland or in shrubland on clayey lateritic soils, generally on flat to gently sloping terrain along ridges and spurs.	1,143 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Marsdenia viridiflora</i> R. Br. subsp. <i>viridiflora</i> population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	EP	-	Endangered population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas. Recent records are from Prospect, Bankstown, Smithfield, Cabramatta Creek and St Marys. Grows in vine thickets and open shale woodland.	855 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Maundia triglochinoides</i>	V	-	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. Flowering occurs during warmer months. Associated with wetland species e.g. <i>Triglochin procerum</i> .	6 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Melaleuca biconvexa</i> (Biconvex Paperbark)	V	V	Found only 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.	38 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Melaleuca deanei</i> (Deane's Paperbark)	V	V	The distribution of the species extends from St. Albans (Hawkesbury LGA) in the north, Nowra (Shoalhaven LGA) in the south, and west to Faulconbridge (Blue Mountains LGA). It mostly occupies broad flat ridgetops, dry ridges and slopes between 20 and 410 metres above sea level. It is strongly associated with sandy loam soils that are low in nutrients, sometimes with ironstone present. In southern Sydney, the species most frequently occurs on deep and well developed lateritic soils, i.e. soils where an indurated iron-rich layer usually overlies a mottled clay and a pallid clay. It occurs in a wide range of vegetation communities, but is most often found in Coastal Sandstone Ridgetop Woodland and to a lesser extent, Hinterland Sandstone Gully Forest, Sydney Hinterland Transition Woodland and Coastal Sandstone Gully Forest and other communities on sandstone and transitional geology.	312 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Micromyrtus blakelyi</i>	V	V	Restricted to areas near the Hawkesbury River, north of Sydney. Distribution extends from north of Maroota in the north, to Cowan in the south. All known populations occur within the Baulkham Hills and Hornsby local government areas. Typically occurs within heathlands in shallow sandy soil in cracks and depressions of sandstone rock platforms. Flowers in Spring from September to November and produces fruit (an indehiscent nut) October to November.	320 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Micromyrtus minutiflora</i>	E	V	Restricted between Richmond and Penrith of western Sydney. Grows in Castlereagh Scribbly Gum Woodland, Ironbark Forest, Shale/Gravel Transition Forest and open forest on sandy clay or gravelly soils tertiary alluvium.	193 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Microtis angusii</i> (Angus's Onion Orchid)	E	E	It is not easy to define the preferred natural habitat of this orchid as the Ingleside location is highly disturbed. The dominant species occurring on the site are introduced weeds <i>Hyparrhenia hirta</i> (Coolatai grass) and <i>Acacia saligna</i> . The Ingleside population occurs on soils that have been modified but were originally those of the restricted ridgetop lateritic soils in the Duffys Forest - Terrey Hills - Ingleside and Belrose areas. These soils support a specific and distinct vegetation type, the Duffys Forest Vegetation Community which is listed as an endangered ecological community under the TSC Act and ranges from open forest to low open forest and rarely woodland.	85 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Olearia cordata</i>	V	V	It generally restricted to the south-western hunter Plateau, eastern Colo Plateau and the far north Hornsby Plateau of which most of the population occurs within conservation reserves. Populations are small and scattered growing in dry open forest and open shrubland, including on sandstone ridges.	7 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Pelargonium</i> sp. <i>Striatellum</i> (G.W.Carr 10345) (Omeo Storksbill)	E	E	<i>Pelargonium</i> sp. <i>Striatellum</i> (G.W.Carr 10345) is known to occur in New South Wales and Victoria. The species is known to occur in habitat usually located just above the high water level of irregularly inundated or ephemeral lakes. During dry periods, the species is known to colonise exposed lake beds. It is not known if the species' rhizomes and/or soil seedbank persist through prolonged inundation or drought. Known from only 4 locations in NSW, with three on lake-beds on the basalt plains of the Monaro and one at Lake Bathurst.	0 - BioNet (not recorded in locality)	Low in development footprint. There is no habitat considered suitable for this species. This species does not occur in the Sydney area.
<i>Persicaria elatior</i> (Tall Knotweed)	V	V	Tall Knotweed has been recorded in south-eastern NSW (Mt Dromedary (an old record), Moruya State Forest 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.	1 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Persoonia bargoensis</i> (Bargo Geebung)	E	V	The Bargo Geebung is restricted to a small area south-west of Sydney on the western edge of the Woronora Plateau and the northern edge of the Southern Highlands. The historical limits are Picton and Douglas Park (northern), Yanderra (southern), Cataract River (eastern) and Thirlmere (western). The Bargo Geebung occurs in woodland or dry sclerophyll forest on sandstone and on heavier, well drained, loamy, gravelly soils of the Wianamatta Shale and Hawkesbury Sandstone. It favours interface soil landscapes such as between the Blacktown Soil Landscape and the complex Mittagong Formation soils (Lucas Heights Soil Landscape) with the underlying sandstone (Hawkesbury Soil Landscape and Gynea Soil Landscape).	174 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Persoonia hirsuta</i> (Hairy Geebung)	E	E	<i>Persoonia hirsuta</i> is patchily distributed on the Central Coast and Tablelands of NSW, in an area bounded by Putty, Glen Davis and Gosford in the north, and Royal National Park (NP) and Hill Top in the south. It occurs in the Sydney coastal area (Gosford, Berowra, Manly and Royal NP), the Blue Mountains area (Springwood, Lithgow and Putty) and the Southern Highlands (Balmoral, Buxton, Yanderra and Hill Top). It is frequently found on ridge tops and the mid slopes of hills and rises in dry sclerophyll forest and woodland with a shrubby understorey, heath, shrubby thickets and sandstone scrubs from near sea level to 600 m altitude. Associated canopy species include <i>Eucalyptus sclerophylla</i> , <i>Corymbia gummifera</i> , <i>Leptospermum trinervium</i> , <i>Eucalyptus sieberi</i> , <i>Eucalyptus punctata</i> , <i>Eucalyptus sparsifolia</i> , <i>Corymbia eximia</i> and <i>Banksia ericifolia</i> . It grows on sandy to stony soils derived from sandstone or very rarely on shale and is often found in disturbed areas, like along track edges.	215 – BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Persoonia mollis</i> subsp. <i>maxima</i>	E	E	Highly restricted, known from the Hornsby Heights-Mt Colah area north of Sydney in the Sydney Basin Bioregion. Occurs in sheltered aspects of deep gullies or on the steep upper hillsides of narrow gullies on Hawkesbury Sandstone. These habitats support relatively moist, tall forest vegetation communities, often with warm temperate rainforest influences. Flowers late December – March.	470 – BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Persoonia nutans</i> (Nodding Geebung)	E	E	Restricted to the Cumberland Plain in western Sydney, between Richmond in the north and Macquarie Fields in the south. Core distribution occurs within the Penrith, and to a lesser extent, Hawkesbury LGAs, with isolated and relatively small populations also occurring in the Liverpool, Campbelltown, Bankstown and Blacktown LGAs. Confined to aeolian and alluvial sediments and occurs 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.	1,665 – BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Pilularia novae-hollandiae</i>	E	-	In NSW, Austral Pilwort has been recorded from suburban Sydney, Khancoban, the Riverina between Albury and Urana (including Henty, Walbundrie, Balldale and Howlong) and at Lake Cowal near West Wyalong. The population at Lake Cowal is the only known extant population in NSW. The species has also been recorded in the Australian Capital Territory, Victoria, Tasmania, South Australia and Western Australia. Austral Pillwort grows in shallow swamps and waterways, often among grasses and sedges. It is most often recorded in drying mud as this is when it is most conspicuous. Most of the records in the Albury-Urana area were from table drains on the sides of roads.	1 – BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Pimelea curviflora</i> var. <i>curviflora</i> (Slender Curved Rice Flowers)	V	V	Confined to the coastal area of Sydney between northern Sydney in the south and Maroota in the north-west. Former range extended south to 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. Has an inconspicuous cryptic habit as it is fine and scraggly and often grows amongst dense grasses and sedges. It may not always be visible at a site as it appears to survive for some time without any foliage after fire or grazing, relying on energy reserves in its tuberous roots.	290 – BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Pimelea spicata</i> (Spiked-rice Flower)	E	E	Broad distribution in western Sydney, occurring on the Cumberland Plain (Narellan, Marayong, Prospect Reservoir areas). Another smaller population is recorded in districts (Landsdowne to Shellharbour to northern Kiama) Illawarra. It grows on well-structured clay soils. On the inland Cumberland Plain sites it is associated with Grey Box and Ironbark. In the coastal Illawarra it occurs commonly in Coastal Banksia open woodland with a more well developed shrub and grass understorey.	1,338 – BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Pomaderris adnata</i> (Sublime Point Pomaderris)	E	-	Known only from one site at Sublime Point, north of Wollongong. Occurs near the edge of the plateau behind the Illawarra escarpment. Associated vegetation is <i>Eucalyptus sieberi</i> (Silver-top Ash) - <i>Corymbia gummifera</i> (Red Bloodwood) forest with occasional <i>Hakea salicifolia</i> (Willow-leaved Hakea). Soil is a sandy loam over sandstone.	2 – BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Pomaderris brunnea</i> (Brown Pomaderris)	E	V	Found in a very limited area around the Nepean and Hawkesbury Rivers, including the Bargo area. It also occurs at Walcha on the New England 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.	61 – BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Pomaderris prunifolia</i> (a shrub) population, Parramatta, Auburn, Strathfield and Bankstown local government areas	EP	-	Endangered population in the Parramatta, Auburn, Strathfield and Bankstown Local Government Areas. 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.	26 – BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Prasophyllum fuscum</i> (Slaty Leek Orchid)	CE	V	Confined to the Blue Mountains area. Grows in moist heath, often along seepage lines. The known population grows in moist sandy soil over sandstone amongst sedges and grasses in an area that appears to be regularly slashed by the local council. Flowering does not necessarily occur every year, often skipping years. Although successful flowering and reproduction is likely to be dependent on favourable weather and habitat conditions, the factors which influence flowering behaviour are poorly understood. The seed is dust-like and is wind dispersed.	1 – BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site. Record in Sydney likely to be erroneous.
<i>Prostanthera askania</i> (Tranquillity Mintbush)	E	E	Tranquillity mintbush occurs in moist sclerophyll forest and warm temperate rainforest communities, as well as the ecotone between them. These communities are generally tall forest with a mesic understorey. Canopy species include <i>Syncarpia glomulifera</i> subsp. <i>glomulifera</i> (turpentine), <i>Allocasuarina torulosa</i> (forest oak), <i>Eucalyptus acmenoides</i> (white mahogany), <i>Eucalyptus saligna</i> (Sydney blue gum), <i>Eucalyptus agglomerata</i> (blue-leaved stringybark) and <i>Eucalyptus pilularis</i> (blackbutt). Understorey species vary considerably at each site	84– BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Prostanthera densa</i> (Villous Mint-bush)	V	V	This species has been recorded from the Currarong area in Jervis Bay, Royal National Park, Cronulla, Garie Beach and Port Stephens (Gan Gan Hill, 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. Villous Mintbush is generally grows in sclerophyll forest and shrubland on coastal headlands and near coastal ranges, chiefly on sandstone, and rocky slopes near the sea.	332 – BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Prostanthera junonis</i> (Somersby Mintbush)	E	E	The Somersby Mintbush is currently known only from the eastern parts of the Somersby Plateau in the Gosford local government area in NSW. The Somersby Mintbush frequently occurs along drainage lines or in seepage areas, usually in shallow, coarse, gravelly, white-grey, sandy soils overlying Hawkesbury Sandstone. This substrate supports an open-woodland community dominated by tree species such as <i>Corymbia gummifera</i> , <i>Angophora costata</i> , <i>A. hispidula</i> , <i>Eucalyptus haemastoma</i> , <i>E. piperita</i> , <i>E. punctata</i> and <i>E. sieberi</i> .	3 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Prostanthera marifolia</i> (Seaforth Mintbush)	E	E	<i>Prostanthera marifolia</i> is currently only known from the northern Sydney suburb of Seaforth and has a very highly restricted distribution within the Sydney Basin Bioregion. The single population is fragmented by urbanisation into three small sites. All known sites are within an area of 2x2 km. Two of the sites are within the local government area of Manly and one site is in the LGA of Warringah. Occurs in localised patches in or in close proximity to the endangered Duffys Forest ecological community. Located on deeply weathered clay-loam soils associated with ironstone and scattered shale lenses, a soil type which only occurs on ridge tops and has been extensively urbanised.	177 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Prostanthera saxicola</i> population in Sutherland and Liverpool local government areas	EP	-	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 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. However, the population may extend beyond this into the adjacent parts of the relevant LGAs within the region (including the military reserve lands and the Royal and Heathcote National Parks). Eucalypt forest and heath in association with <i>Hakea dactyloides</i> , <i>Brachyloma daphnoides</i> , <i>Banksia spinulosa</i> , <i>Baeckea brevifolia</i> , <i>Epacris pulchella</i> , <i>Acacia myrtifolia</i> and <i>Acacia ulicifolia</i> . Closed heath in association with <i>Allocasuarina nana</i> and <i>Lepidosperma viscidum</i> . Heathy woodland of <i>Angophora hispida</i> , <i>Eucalyptus squamosa</i> and <i>Corymbia gummifera</i> , as a 'major component of the ground flora'. Rocky ridges and areas of outcrop.	5 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Pterostylis chaetophora</i>	V	-	Recorded in Queensland and NSW. In NSW it is currently known from 18 scattered locations in a relatively small area between Taree and Kurri Kurri, extending to the south-east towards Tea Gardens and west into the Upper Hunter, with additional records near Denman and Wingen. There are also isolated records from the 1940s and 1980s from the Sydney region but identification of two of these Sydney records has not been verified from voucher specimens and it is unclear if any of these possible populations still exist. The preferred habitat is seasonally moist, dry sclerophyll forest with a grass and shrub understorey. Plants are deciduous and die back to underground tubers after seeding. New rosettes are produced following soaking autumn and winter rains and flowering occurs from September to November. Fails to flower in dry seasons.	1 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site. Record in Sydney likely to be erroneous.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Pterostylis gibbosa</i> (Illawarra Greenhood)	E	E	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).	1 – BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Pterostylis nigricans</i> (Dark Greenhood)	V	-	The Dark Greenhood occurs in north-east NSW north from Evans Head, and in Queensland. Coastal heathland with Heath Banksia (<i>Banksia ericifolia</i>), and lower-growing heath with lichen-encrusted and relatively undisturbed soil surfaces, on sandy soils.	2 – BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site. Record in Sydney likely to be erroneous.
<i>Pterostylis saxicola</i> (Sydney Plains Greenhood)	E	E	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. Only one population occurs within a conservation reserve at Georges River National Park. Most commonly found growing in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines. The vegetation communities above the shelves where it occurs are sclerophyll forest or woodland on shale/sandstone transition soils or shale soils.	61 – BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Pterostylis</i> sp. Botany Bay (Botany Bay Bearded Orchid)	E	E	Restricted to the Sydney region where it is known from a small number of sites within Botany Bay National Park on the Kurnell Peninsula. Occupies moist level sites on skeletal sandy soils derived from sandstone. Associated vegetation is coastal heath dominated by <i>Melaleuca nodosa</i> and <i>Baeckea imbricata</i> . Occurs in small localised populations, usually in areas within the heath where the canopy allows filtered light to reach the ground.	12 – BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Pultenaea aristata</i> (Prickly Bush Pea)	V	V	Prickly Bush-pea is restricted to the Woronora Plateau, a small area between Helensburgh, south of Sydney, and Mt Kiera above Wollongong. The species occurs on low nutrient sandstone soils in both moist and dry areas. It is often associated with the Upland Swamp vegetation complex and has been recorded from several locations within the sub-communities of Banksia Thicket and Restioid Heath. The species is also known to occur in association with areas of impeded drainage and creek lines within sandstone woodland and gully forest plant communities. Flowering has been recorded in winter and spring	5,033 – BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Pultenaea parviflora</i> (Sydney-bush Pea)	E	V	Endemic to the Cumberland Plain the 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 of 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. <i>Eucalyptus fibrosa</i> is usually the dominant canopy species. <i>Eucalyptus globoidea</i> , <i>E. longifolia</i> , <i>E. parramattensis</i> , <i>E. sclerophylla</i> and <i>E. sideroxylon</i> may also be present or co-dominant, with <i>Melaleuca decora</i> frequently forming a secondary canopy layer. Associated species may include <i>Allocasuarina littoralis</i> , <i>Angophora bakeri</i> , <i>Aristida</i> spp., <i>Banksia spinulosa</i> , <i>Cryptandra</i> spp., <i>Daviesia ulicifolia</i> , <i>Entolasia stricta</i> , <i>Hakea sericea</i> , <i>Lissanthe strigosa</i> , <i>Melaleuca nodosa</i> , <i>Ozothamnus diosmifolius</i> and <i>Themeda australis</i> .	1,331 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Pultenaea pedunculata</i>	V	-	Widespread in Victoria, Tasmania, and south-eastern South Australia, However in NSW it is represented by just three disjunct populations on the Cumberland Plains in Sydney, the coast between Tathra and Bermagui and the Windellama area south of Goulburn. NSW populations are generally among woodland vegetation but plants have also been found on road batters and coastal cliffs. It is largely confined to loamy soils in dry gullies in populations in the Windellama area.	37 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Pultenaea villifera</i> population in the Blue Mountains Local Government Area	EP	-	An endangered population in Blue Mountains LGA. Has a patchy distribution within NSW, occurring within the South and Central Coasts and Southern Tablelands. The population of <i>P. villifera</i> in the Blue Mountains Local Government Area is disjunct from other known populations and occurs only at a few small sites in the Springwood-Woodford Area. One of these populations occurs within Blue Mountains National Park. Grows in dry sclerophyll forest and woodlands on sandy soil and appears to favour sheltered locations.	22 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Rhodamnia rubescens</i> (Scrub Turpentine)	CE	-	Occurs in coastal districts north from Batemans Bay in New South Wales, approximately 280 km south of Sydney, to areas inland of Bundaberg in Queensland. Populations of <i>R. rubescens</i> typically occur in coastal regions and occasionally extend inland onto escarpments up to 600 m a.s.l. in areas with rainfall of 1,000-1,600 mm. Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils. This species is characterised as highly to extremely susceptible to infection by Myrtle Rust.	113 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Rhodomyrtus psidioides</i> (Native Guava)	CE	-	Occurs from Broken Bay, approximately 90 km 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. 120 km 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. This species is characterised being extremely susceptible to infection by Myrtle Rust. Myrtle Rust affects all plant parts.	8 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Sarcophilus hartmannii</i>	V	V	Distributed from the Richmond River in northern NSW to Gympie in south-east Queensland. Favours cliff faces on steep narrow ridges supporting eucalypt forest and clefts in volcanic rock from 500 to 1,000 m in altitude. Also found occasionally at the bases of fibrous trunks of trees, including cycads and grass-trees.	1 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site. Record in Sydney likely to be erroneous.
<i>Senecio spathulatus</i>	E	-	Coast Groundsel occurs in Nadgee Nature Reserve (Cape Howe) and between Kurnell in Sydney and Myall Lakes National Park (with a possible occurrence at Cudmirrah). Coast Groundsel grows on frontal dunes.	17 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Syzygium paniculatum</i> (Magenta Lilly Pilly)	E	V	The Magenta Lilly Pilly is found only in NSW, in a narrow, linear coastal strip from Upper Lansdowne to Conjola State Forest. On the south coast it occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. On the central coast it occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities.	264 - BioNet	Known to occur in the broader locality. Commonly planted as a street tree in Sydney but not present in development sites.
<i>Tetradlea glandulosa</i> (Glandular-pink Bell)	V	V	Endemic to NSW, with around about 150 populations from Yengo National Park to Lane Cove National Park. Associates in areas with shale cappings over sandstone. Occurs in heath, scrublands to woodlands and open forest. Common woodland tree species include: <i>Corymbia gummifera</i> , <i>C. eximia</i> , <i>Eucalyptus haemastoma</i> , <i>E. punctata</i> , <i>E. racemosa</i> , and/or <i>E. sparsifolia</i> , with an understorey dominated by species from the families Proteaceae, Fabaceae, and Ericaceae.	1,116 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Tetradlea juncea</i> (Black-eyed Susan)	V	V	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. The majority of populations occur on low nutrient soils associated with the Awaba Soil Landscape. While the species has a preference for cooler southerly aspects, it has been found on slopes with a variety of aspects. It generally prefers well-drained sites and occurs on ridges, although it has also been found on upper slopes, mid-slopes and occasionally in gullies.	27 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Thelymitra atronitida</i>	CE	-	In New South Wales, The Black-hooded Sun Orchid is known from two localities, Cape Solander in Botany Bay National Park in southern Sydney, and Bago State Forest south of Tumut. The known occurrences in this state fall in parts of the Sutherland and either or both of the Tumut and Tumbarumba Local Government Areas. At Cape Solander this species is recorded from shallow black peaty soil in coastal heath on sandstone. In the Bago area it is recorded as occurring in open forest with a heathy understorey on well-drained sand or clay-loam soils. Currently undergoing detailed review and occurrences in NSW may be allocated to a different species.	2 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site. Record in Sydney may be erroneous.
<i>Thesium australe</i> (Austral Toadflax)	V	V	Found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. It is also found in Tasmania and Queensland and in eastern Asia. Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Often found in association with Kangaroo Grass (<i>Themeda australis</i>).	2 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Triplarina imbricata</i> (Creek Triplarina)	E	E	Found only in a few locations in the ranges south-west of Glenreagh and near Tabulam in north-east NSW. Along watercourses in low open forest with Water Gum (<i>Tristania laurina</i>).	5 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Wahlenbergia multicaulis</i> (Tadgell's Bluebell) population, Auburn, Bankstown, Strathfield and Canterbury local government areas	EP	-	Endangered population in the in the local government areas of Auburn, Bankstown, Baulkham Hills, Canterbury, Hornsby, Parramatta and Strathfield LGAs. There are 13 known sites, two of which are in northern Sydney (i.e. Thornleigh and Mt Ku-Ring-Gai) with the remainder in western Sydney (e.g. at Rookwood, Chullora, Bass Hill, Bankstown, Georges Hall, Campsie, South Granville and Greenacre). In Western Sydney most sites are closely aligned with the Villawood Soil Series, which is a poorly drained, yellow podsolic extensively permeated with fine, concretionary ironstone (laterite). However, the sites in Hornsby LGA are on the 'Hawkesbury' soil landscape. Found in disturbed sites and grows in a variety of habitats including forest, woodland, scrub, grassland and the edges of watercourses and wetlands. Typically occurs in damp, disturbed sites (with natural or human disturbance of various forms), typically amongst other herbs rather than in the open. In Hornsby LGA it occurs in or adjacent to sandstone gully forest. In Western Sydney it is found in remnants of Cooks River/Castlereagh Ironbark Forest.	87 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Wilsonia backhousei</i>	V	-	Found on the coast between Mimosa Rocks National Park and Wamberal north of Sydney. It grows in all southern states. This is a species of the margins of salt marshes and lakes, both coastal and inland.	104 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site. This species is however present downstream along the Duck River.
<i>Wilsonia rotundifolia</i>	E	-	Round-leafed <i>Wilsonia</i> is known from several sites in the Jervis Bay area, Royal National Park, near Deniliquin and on the lakebeds of Lake George and Lake Bathurst when these are exposed during droughts. The Lake George and Lake Bathurst populations appear to be locally extensive. Also found Western Australia, South Australia and Victoria. Grows in mud in coastal saltmarsh and inland saline or brackish lake beds.	1 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.
<i>Zannichellia palustris</i>	E	-	A submerged aquatic plant. In NSW, known from the lower Hunter and in Sydney Olympic Park. Grows in fresh or slightly saline stationary or slowly flowing water. Flowers during warmer months. NSW populations behave as annuals, dying back completely every summer.	5 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Zieria involucreta</i>	E	V	It has a disjunct distribution north and west of Sydney, in the Baulkham Hills, Hawkesbury, Hornsby and Blue Mountains local government areas. It occurs primarily on Hawkesbury sandstone and Narrabeen Group sandstone and on Quaternary alluvium. Found primarily in sheltered forests on mid- to lower slopes and valleys, e.g. in or adjacent to gullies which support sheltered forest, although some populations extend upslope into drier vegetation. Also known from at least two atypical ridgetop locations. The canopy typically includes <i>Syncarpia glomulifera</i> subsp. <i>glomulifera</i> (Turpentine), <i>Angophora costata</i> (Smooth-barked Apple), <i>Eucalyptus agglomerata</i> (Blue-leaved Stringybark) and <i>Allocasuarina torulosa</i> (Forest Oak).	474 - BioNet	Low in development footprint. There is no habitat considered suitable for this species in the development site.

* Distribution and habitat requirement information adapted from: Australian Government Department of the Environment <http://www.environment.gov.au/biodiversity/threatened/index.html>, NSW Office of Environment and Heritage <http://www.environment.nsw.gov.au/threatenedspecies/>

Key:

CE = critically endangered

E = endangered

EP = endangered population

Ex = extinct

V = vulnerable

Table A-2: Habitat assessment for threatened animal species

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
Birds					
<i>Actitis hypoleucos</i> (Common Sandpiper)	-	M	Found along all coastlines of Australia and in many areas inland, the Common Sandpiper is widespread in small numbers. The species utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins or rocky shores and rarely on mudflats.	89 – BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands. Potentially suitable habitat in saltmarsh along Duck River.
<i>Anous stolidus</i> (Common Noddy)	-	M	In Australia, the Common Noddy occurs mainly in ocean off the Queensland coast, but the species also occurs off the north-west and central Western Australia coast. The species is also rarely encountered off the coast of the Northern Territory, where only one breeding location with about 100-130 birds is known. During the non-breeding period, the species occurs in groups throughout the pelagic zone (open ocean).	5 – BioNet	Low in development footprint. This is a marine bird and there is no habitat considered suitable for this species.
<i>Anseranas semipalmata</i> (Magpie Goose)	V	-	Mainly found in shallow wetlands (less than 1 m deep) with dense growth of rushes or sedges. Equally at home in aquatic or terrestrial habitats; often seen walking and grazing on land; feeds on grasses, bulbs and rhizomes. Activities are centred on wetlands, mainly those on floodplains of rivers and large shallow wetlands formed by run-off; breeding can occur in both summer and winter dominated rainfall areas and is strongly influenced by water level; most breeding now occurs in monsoonal areas; nests are formed in trees over deep water; breeding is unlikely in south-eastern NSW.	10 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Anthochaera Phrygia</i> (Regent Honeyeater)	CE	CE	The Regent Honeyeater that has a patchy distribution between south-east Queensland and central Victoria. It mostly inhabits inland slopes of the Great Dividing Range, in areas of low to moderate relief with moist, fertile soils. It is most commonly associated with box-ironbark eucalypt woodland and dry sclerophyll forest, but also inhabits riparian vegetation such as sheoak (<i>Casuarina</i> spp) where it feeds on needle-leaved mistletoe and sometimes breeds. It sometimes utilises lowland coastal forest, which may act as a refuge when its usual habitat is affected by drought. It also uses a range of disturbed habitats within these landscapes including remnant patches in farmland and urban areas and roadside vegetation. It feeds primarily on the nectar of eucalypts and mistletoes and, to a lesser extent, lerps and honeydew; it prefers taller and larger diameter trees for foraging. It is nomadic and partly migratory with its movement through the landscape being governed by the flowering of select eucalypt species. There are four known key breeding areas: three in NSW and one in Victoria. Breeding varies between regions, and corresponds with flowering of key eucalypt and mistletoe species. It usually nests in horizontal branches or forks in tall mature eucalypts and Sheoaks.	137 – BioNet	Low in development footprint. There is no habitat considered suitable for this species. Vagrant birds (birds found outside the region that is known for that particular species) may occasionally visit the street trees around the Sydney urban area, but the likelihood is low.
<i>Apus pacificus</i> (Fork-tailed Swift)	-	M	Recorded in all regions of NSW. The Fork-tailed Swift is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher.	60 – BioNet	Moderate. Likely to use airspaces during migratory movements.
<i>Ardea ibis</i> (Cattle Egret)	-	M	Widespread and common according to migration movements and breeding localities surveys. Occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands.	496 – BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands. Potentially suitable habitat in saltmarsh along Duck River.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Ardenna carneipes</i> (Flesh-footed Shearwater)	V	M	Ranges throughout the Pacific and Indian Oceans. There are two main breeding areas in the world: one in the South West Pacific includes Lord Howe Island and New Zealand; the other along the coast of Western Australia. Nest on LHI on sandy soils from Ned's Beach to Clear Place, with smaller colonies below Transit Hill and at Old Settlement Beach. Eggs are laid at the end of a burrow 1 - 2 metres in length.	12 – BioNet	Low in development footprint. This is a marine bird and there is no habitat considered suitable for this species.
<i>Ardenna grisea</i> (Sooty Shearwater)	-	M	In Australia, the Sooty Shearwater breeds on islands off New South Wales (NSW) and Tasmania. The Sooty Shearwater forages in pelagic (open ocean) sub-tropical, sub-Antarctic and Antarctic waters. The Sooty Shearwater breeds mainly on subtropical and sub-Antarctic islands, as well as on the mainland of New Zealand.	63 – BioNet	Low in development footprint. This is a marine bird and there is no habitat considered suitable for this species.
<i>Ardenna pacificus</i> (Wedge-tailed Shearwater)	-	M	The Wedge-tailed Shearwater breeds on the east and west coasts of Australia and on off-shore islands. The Wedge-tailed Shearwater is a pelagic, marine bird known from tropical and subtropical waters.	392 – BioNet	Low in development footprint. This is a marine bird and there is no habitat considered suitable for this species.
<i>Ardenna tenuirostris</i> (Short-tailed Shearwater)	-	M	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.	191 – BioNet	Low in development footprint. This is a marine bird and there is no habitat considered suitable for this species.
<i>Arenaria interpres</i> (Ruddy Turnstone)	-	M	Coastline and only occasionally inland. They are mainly found on exposed rocks or reefs, often with shallow pools, and on beaches.	302 – BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Artamus cyanopterus</i> <i>cyanopterus</i> (Dusky Woodswallow)	V	-	The Dusky Woodswallow has two separate populations. The eastern population is found from Atherton Tableland, Queensland south to Tasmania and west to Eyre Peninsula, South Australia. The other population is found in south-west Western Australia. The Dusky Woodswallow is found in open forests and woodlands, and may be seen along roadsides and on golf courses.	567 - BioNet	Moderate. May forage over the development site and perch on trees.
<i>Botaurus poiciloptilus</i> (Australasian Bittern)	E	E	Occurs from south-east Queensland to south-east South Australia, Tasmania and the south-west of Western Australia. The Australasian Bittern's preferred habitat is comprised of wetlands with tall dense vegetation, where it forages in still, shallow water up to 0.3 m deep, often at the edges of pools or waterways, or from platforms or mats of vegetation over deep water. It favours permanent and seasonal freshwater habitats, particularly those dominated by sedges, rushes and reeds (e.g. <i>Phragmites</i> , <i>Cyperus</i> , <i>Eleocharis</i> , <i>Juncus</i> , <i>Typha</i> , <i>Baumea</i> , <i>Bolboschoenus</i>) or cutting grass (<i>Gahnia</i>) growing over a muddy or peaty substrate.	42 - BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands.
<i>Burhinus grallarius</i> (Bush Stone-curlew)	E	-	Open forests and woodlands with a sparse grassy ground layer and fallen timber. Largely nocturnal, being especially active on moonlit nights. Feed on insects and small vertebrates, such as frogs, lizards and snakes. Nest on the ground in a scrape or small bare patch.	416 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Calamanthus fuliginosus</i> (Striated Fieldwren)	E	-	The Striated Fieldwren is found in coastal swamp heaths and tussock fields of south-eastern NSW, into southern Victoria and the south-east of South Australia. It is also found in Tasmania. There are four recognised subspecies, but only one (<i>albiloris</i>) occurs in NSW. Most records are from two main regions - the far south coast (Nadgee NR and Ben Boyd NP) and in Morton NP (Little Forest, Tianjara Falls) though there are scattered records in between these two areas (particularly in coastal habitats). Is occasionally recorded further north with records at Bilpin (1979), Kurnell (1979) and Mittagong (1992), though there do not appear to be resident populations at any of these sites.	1 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species. Record is likely to be a vagrant bird.
<i>Calidris acuminata</i> (Sharp-tailed Sandpiper)	-	M	The Sharp-tailed Sandpiper 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. Many inland records are of birds on passage. 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, salt pans and hypersaline salt lakes inland. They also occur in saltworks and sewage farms. They use flooded paddocks, sedgelands and other ephemeral wetlands, but leave when they dry. They use intertidal mudflats in sheltered bays, inlets, estuaries or seashores, and also swamps and creeks lined with mangroves. They tend to occupy coastal mudflats mainly after ephemeral terrestrial wetlands have dried out, moving back during the wet season. Sometimes they occur on rocky shores and rarely on exposed reefs.	1,572 - BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Calidris alba</i> (Sanderling)	V	M	A regular summer migrant from Siberia and other Arctic breeding grounds to most of the Australian coastline. It is uncommon to locally common, arriving from September and leaving by May (some may overwinter in Australia). Sanderlings occur along the NSW coast, with occasional inland sightings. Often found in coastal areas on low beaches of firm sand, near reefs and inlets, along tidal mudflats and bare open coastal lagoons; individuals are rarely recorded in near-coastal wetlands.	33 - BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands.
<i>Calidris bairdii</i> (Baird's Sandpiper)	-	M	During the non-breeding period the species mainly inhabits areas of bare mud or sand around high-altitude lakes, low vegetation in dry terrestrial habitats, including grasslands or farmland (crops, pasture), or desert coasts. They also sometimes occur in moister habitats such as irrigated paddocks, grassy marshes or saltponds, but are seldom recorded at coastal mudflats, estuaries or beaches, where they occur in the upper littoral zone. In Australia it has been recorded on sandy beaches and mudflats, at saltponds, sewage ponds and shores of lakes and lagoons.	1 - BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands.
<i>Calidris canutus</i> (Red Knot)	-	E, M	Common in all the main suitable habitats around the coast of Australia. Mainly inhabit intertidal mudflats, sand flats and sandy beaches of sheltered coasts, in estuaries, bays, inlets, lagoons and harbours; sometimes on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms or coral reefs.	115 - BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Calidris ferruginea</i> (Curlew Sandpiper)	E	CE	In Australia, Curlew Sandpipers occur around the coasts of all states and are also quite widespread inland, though in smaller numbers. They occur in Australia mainly during the non-breeding period but also during the breeding season when many non-breeding one year old birds remain. Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They generally roost on bare dry shingle, shell or sand beaches, sandspits and islets in or around coastal or near-coastal lagoons and other wetlands, occasionally roosting in dunes during very high tides and sometimes in saltmarsh and in mangroves.	663 – BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and high in Mason Park wetlands.
<i>Calidris mauri</i> (Western Snadpiper)	-	M	When on migration or in non-breeding areas the Western Sandpiper inhabits tidal mudflats and sandflats in sheltered lagoons, river deltas and estuarie and also occurs at artificial salt-evaporation ponds. They also occur at terrestrial wetlands, such as the margins of lakes and ponds. The Western Sandpiper specialises in foraging on intertidal mudflats, mainly in shallow water as the tide recedes.	1 – BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Calidris melanotos</i> (Pectoral Sandpiper)	-	M	In New South Wales (NSW), the Pectoral Sandpiper is widespread, but scattered. Records exist east of 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.	87 – BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands.
<i>Calidris ruficollis</i> (Red-necked Stint)	-	M	It is distributed along most of the Australian coastline with large densities on the Victorian and Tasmanian coasts. The Red-necked Stint breeds in Siberia and sporadically in north and west Alaska, probably from Taymyr region to Anadyr Territory and Koryakland. The Red-necked Stint mostly forages on bare wet mud on intertidal mudflats or sand flats, or in very shallow water; mostly in areas with a film of surface water and mostly close to edge of water. Roosts on sheltered beaches, spits, banks or islets, of sand, mud, coral or shingle, sometimes in saltmarsh or other vegetation.	574 – BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Calidris subminuta</i> (Long-toed Stint)	-	M	The Long-toed Stint is a regular summer visitor to Australia, but uncommon in the east. The species was first recorded in 1886 near Lukins Crossing on the lower Fitzroy River. The Long-toed Stint is irregular with widely scattered records in NSW. The species has been recorded at the estuary of the Richmond River, Kooragang Island, Pitts Town Lagoon, McGrath's Hill, Bushell's Lagoon, the Hawkesbury River, Shell Point, Botany Bay, Parkes, Fivebough Swamp, Tullakool Saltworks, Dareton, Mortanally Billabong, Wentworth and Cobar	4 – BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands.
<i>Calidris tenuirostris</i> (Great Knot)	V	CE, M	In NSW, the species has been recorded at scattered sites along the coast down to about Narooma. It has also been observed inland at Tullakool, Armidale, Gilgandra and Griffith. Occurs within sheltered, coastal habitats containing large, intertidal mudflats or sand flats, including inlets, bays, harbours, estuaries and lagoons. Often recorded on sandy beaches with mudflats nearby, sandy spits and islets and sometimes on exposed reefs or rock platforms. Migrates to Australia from late August to early September, although juveniles may not arrive until October–November.	41 – BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands.
<i>Callocephalon fimbriatum</i> (Gang-gang Cockatoo)	V	-	In summer, occupies tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests with an acacia understorey. Also occur in subalpine Snow Gum woodland and occasionally in temperate or regenerating forest. In winter, occurs at lower altitudes in drier, more open eucalypt forests and woodlands, particularly in box ironbark assemblages, or in dry forest in coastal areas, occasionally feeding on exotic plant species on urban fringe areas. Favours old growth forest and woodland attributes for nesting and roosting. Nesting occurs in Spring and Summer with nests located in hollows that are 10 cm in diameter or larger and at least 9 m above the ground in eucalypts.	329 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
Gang-gang Cockatoo population in the Hornsby and Ku-ring-gai Local Government Areas	EP	-	This endangered population is found in the Ku-ring-gai and Hornsby local government areas. The population is believed to be largely confined to an area bounded by Thornleigh and Wahroonga in the north, Epping and North Epping in the south, Beecroft and Cheltenham in the west and Turramurra/South Turramurra to the east. It is known to inhabit areas of Lane Cove National Park, Pennant Hills Park and other forested gullies in the area.	67 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Calonectris leucomelas</i> (Streaked Shearwater)	-	M	Found in the western Pacific, breeding on the coast and on offshore islands of Japan, Russia, and on islands off the coasts of China, North Korea and South Korea. This marine species can be found over both pelagic and inshore waters.	1 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species. Record is likely of a vagrant bird.
<i>Calyptorhynchus lathamii</i> (Glossy-black Cockatoo)	V	-	The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina. An isolated population exists on Kangaroo Island, South Australia. Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of Sheoak occur. Black Sheoak (<i>Allocasuarina littoralis</i>) and Forest Sheoak (<i>A. torulosa</i>) are important foods. Inland populations feed on a wide range of Sheoaks, including Drooping Sheoak, <i>Allocasuarina diminuta</i> , and <i>A. gymnanthera</i> . Belah is also utilised and may be a critical food source for some populations. In the Riverina, birds are associated with hills and rocky rises supporting Drooping Sheoak, but also recorded in open woodlands dominated by Belah (<i>Casuarina cristata</i>).	602 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Charadrius leschenaultii</i> (Greater Sand plover)	V	-	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. Roosts during high tide on sandy beaches and rocky shores; begin foraging activity on wet ground at low tide, usually away from the edge of the water; individuals may forage and roost with other waders.	17 – BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands.
<i>Charadrius mongolus</i> (Lesser Sand-plover)	V	E, M	Almost entirely coastal in NSW, favouring the beaches of sheltered bays, harbours and estuaries with large intertidal sandflats or mudflats; occasionally occurs on sandy beaches, coral reefs and rock platforms. Highly gregarious, frequently seen in flocks exceeding 100 individuals; also often seen foraging and roosting with other wader species. Roosts during high tide on sandy beaches, spits and rocky shores; forage individually or in scattered flocks on wet ground at low tide, usually away from the water's edge.	55 – BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Charadrius veredus</i> (Oriental Plover)	-	M	The Oriental Plover is a non-breeding visitor to Australia, where the species occurs in both coastal and inland areas, mostly in northern Australia. Most records are along the north-western coast, between Exmouth Gulf and Derby in Western Australia, and there are records at a few scattered sites elsewhere, mainly along the northern coast, such as in the Top End, the Gulf of Carpentaria and on Cape York Peninsula. Forage among short grass or on hard stony bare ground, but also on mudflats or among beach-cast seaweed on beaches. Sometimes roost on soft wet mud or in shallow water of beaches and tidal mudflats, and also occasionally in dry, open habitats, such as saltmarsh or paddocks.	7 – BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands.
<i>Chlidonias leucopterus</i> (White-winged Tern)	-	M	The species is a non-breeding migrant to Australia, where it is widespread and common along south-western, northern and central-eastern coasts, with only scattered records of small numbers along the coasts elsewhere in southern Australia. The White-winged Black Tern mainly forages aerially, over water or over muddy or sandy edges of wetlands; and also forages over land adjacent to wetlands, especially if inundated, including rice paddies and dry paddocks and grassland.	12 – BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands.
<i>Chlidonias niger</i> (Black Tern)	-	M	The species is a rare vagrant to Australia, with all reports of single birds. Only three records have been accepted by the Birds Australia Rarities Committee.	1 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species. This is a vagrant species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Chthonicola sagittata</i> (Speckled Warbler)	V	-	The Speckled Warbler lives in a wide 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 re-growth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area. Pairs are sedentary and occupy a breeding territory of about ten hectares, with a slightly larger home-range when not breeding. The rounded, domed, roughly built nest of dry grass and strips of bark is located in a slight hollow in the ground or the base of a low dense plant, often among fallen branches and other litter. A side entrance allows the bird to walk directly inside.	404 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Circus assimilis</i> (Spotted Harrier)	V	-	The Spotted Harrier occurs throughout the Australian mainland, except in densely 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.	37 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Climacteris picumnus victoriae</i> (Brown Treecreeper (eastern subspecies))	V	-	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 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 (<i>Eucalyptus camaldulensis</i>) Forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses; usually not found in woodlands with a dense shrub layer; fallen timber is an important habitat component for foraging; also recorded, though less commonly, in similar woodland habitats on the coastal ranges and plains. Hollows in standing dead or live trees and tree stumps are essential for nesting.	35 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Daphoenositta chrysoptera</i> (Varied Sittella)	V	-	The Varied Sittella is sedentary and 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. Feeds on arthropods gleaned from crevices in rough or decorticated bark, dead branches, standing dead trees and small branches and twigs in the tree canopy. Nests in an upright tree fork high in the living tree canopy.	430 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Dasyornis brachypterus</i> (Eastern Bristlebird)	E	E	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, 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.	5 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Diomedea antipodensis</i> (Antipodean Albatross)	V	V, M	The Antipodean Albatross is endemic to New Zealand, however forages widely in open water in the south-west Pacific Ocean, Southern Ocean and the Tasman Sea, notably off the coast of NSW. It breeds on the New Zealand islands of Antipodes Island, Campbell Island, Pitt Island and the Auckland Islands. This subspecies nests in open patchy vegetation, such as among tussock grassland or shrubs on ridges, slopes and plateaus. On Antipodes Island, they nest in relatively uniform densities, but avoid areas of tall vegetation on steep coastal slopes, or amongst the tall ferns on poorly drained parts of the peaks near the island's centre	1 - BioNet	Low in development footprint. This is a vagrant marine bird and there is no habitat considered suitable for this species.
<i>Diomedea antipodensis</i> (Antipodean Albatross)	V	V, M	The Antipodean Albatross is endemic to New Zealand, however forages widely in open water in the south-west Pacific Ocean, Southern Ocean and the Tasman Sea, notably off the coast of NSW. It breeds on the New Zealand islands of Antipodes Island, Campbell Island, Pitt Island and the Auckland Islands. This subspecies nests in open patchy vegetation, such as among tussock grassland or shrubs on ridges, slopes and plateaus. On Antipodes Island, they nest in relatively uniform densities, but avoid areas of tall vegetation on steep coastal slopes, or amongst the tall ferns on poorly drained parts of the peaks near the island's centre	1 - BioNet	Low in development footprint. This is a vagrant marine bird and there is no habitat considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Diomedea exulans</i> (Wandering Albatross)	E	V,M	The Wandering Albatross breeds on Macquarie Island. Macquarie Island lies in the southwest Pacific Ocean, about half-way between New Zealand and Antarctica. A single breeding pair has also been recorded on Heard Island. The Territory of Heard Island and McDonald Islands are an Australian external territory and volcanic group of barren Antarctic islands, about two-thirds of the way from Madagascar to Antarctica. It feeds in Australian portions of the Southern Ocean. On breeding islands, the Wandering Albatross nests on coastal or inland ridges, slopes, plateaux and plains, often on marshy ground. Nests of the Wandering Albatross are sited on moss terraces, in dense tussocks, and often in loose aggregations on the west (windward) side of islands. It prefers open or patchy vegetation (tussocks, ferns or shrubs), and it requires nesting areas that are near exposed ridges or hillocks so that it can take off.	5 – BioNet	Low in development footprint. This is a marine bird and there is no habitat considered suitable for this species.
<i>Diomedea gibsoni</i> , <i>Diomedea antipodensis</i> <i>gibsoni</i> (Gibson's Albatross)	V	V, M	In Australian territory, Gibson's Albatross has been recorded foraging between Coffs Harbour, NSW, and Wilson's Promontory, Victoria. Gibson's Albatrosses are rarely observed in the Pacific Ocean or Indian Ocean. The only Australian record of this species is from a recapture off Wollongong, NSW, in September 1997. Gibson's Albatross breeds on Adams Island and Auckland Island, New Zealand. There are no breeding colonies of Gibson's Albatross in Australian territory. This albatross visits Australian waters while foraging and during the non-breeding season.	2 – BioNet	Low in development footprint. This is a marine bird and there is no habitat considered suitable for this species.
<i>Diomedea sanfordi</i> (Northern Royal Albatross)	-	E, M	Significant taxonomic confusion exists within the albatross group. The Northern Royal Albatross is now recognised as the subspecies <i>Diomedea epomophora sanfordi</i> on morphological, biogeographical and molecular grounds. As such, it is one of two subspecies within the species <i>Diomedea epomophora</i> , Royal Albatross.	0 – BioNet	Low in development footprint. This is a marine bird and there is no habitat considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Egretta sacra</i> (Eastern Reef Egret)	-	M	The Eastern Reef Egret is found on the coast and islands of most of Australia but is more common on the Queensland coast and Great Barrier Reef than elsewhere. The Eastern Reef Egret lives on beaches, rocky shores, tidal rivers and inlets, mangroves, and exposed coral reefs.	117 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Ephippiorhynchus asiaticus</i> (Black-necked Stork)	E	-	In Australia, Black-necked Storks are 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. Since 1995, breeding has been recorded as far south as Bulahdelah. 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. Storks usually forage in water 5-30cm deep for vertebrate and invertebrate prey. Eels regularly contribute the greatest biomass to their diet, but they feed on a wide variety of animals, including other fish, frogs and invertebrates (such as beetles, grasshoppers, crickets and crayfish). Black-necked Storks build large nests high in tall trees close to water. Trees usually provide clear observation of the surroundings and are at low elevation (reflecting the floodplain habitat).	18 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<p><i>Epthianura albifrons</i> (White-fronted Chat)</p> <p>and</p> <p>White-fronted Chat <i>Epthianura albifrons</i> in the Sydney Metropolitan Catchment Management Authority area</p>	V, EP	-	<p>The White-fronted Chat is found across the southern half of Australia, from southernmost Queensland to southern Tasmania, and across to Western Australia as far north as Carnarvon. Found mostly in temperate to arid climates and very rarely sub-tropical areas, it occupies foothills and lowlands up to 1,000 m above sea level. 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. Two isolated sub-populations of White-fronted Chats are currently known from the Sydney Metropolitan Catchment 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 25 km of urbanised land, across which the Chats are unlikely to fly. The nearest extant populations outside Sydney Metropolitan CMA are at Ash Island north of Newcastle and Lake Illawarra, south of Wollongong. White-fronted Chats were previously recorded at Penrith Lakes (2001), Hawkesbury Swamps (2002), Tuggerah Lake (1997) and Lake Macquarie (1998). Regularly observed in the saltmarsh of Newington Nature Reserve (with occasional sightings from other parts of Sydney Olympic Park and in grassland on the northern bank of the Parramatta River). Current estimates suggest this population consists of 8 individuals. Regularly observed in the saltmarsh and on the sandy shoreline of a small island of Towra Point Nature Reserve. This population is estimated to comprise 19-50 individuals.</p>	650 - BioNet	<p>Low in development footprint.</p> <p>There is some saltmarsh habitat in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands, but this species is considered unlikely to use this habitat considering the current known distribution of the population and surrounding habitat quality.</p>

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Erythrorhynchus radiatus</i> (Red Goshawk)	CE	V	This unique Australian endemic raptor is distributed sparsely through northern and eastern Australia, from the western Kimberley Division of northern Western Australia to north-eastern Queensland and south to far north-eastern NSW, and with scattered records in central Australia. 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. Red Goshawks inhabit open woodland and forest, preferring a mosaic of vegetation types, a large population of birds as a source of food, and permanent water, and are often found in riparian habitats along or near watercourses or wetlands. In NSW, preferred habitats include mixed subtropical rainforest, Melaleuca swamp forest and riparian Eucalyptus forest of coastal rivers.	1 - BioNet	Low in development footprint. There is no habitat considered suitable for this species. Any records in the Sydney area are likely to be erroneous.
<i>Esacus magnirostris</i> (Beach Stone-Curlew)	E	-	In NSW, the species occurs regularly to about the Manning River, and the small population of north-eastern NSW is at the limit of the normal range of the species in Australia. Found exclusively along the coast, on a wide range of beaches, islands, reefs and in estuaries. They forage in the intertidal zone of beaches and estuaries, on islands, flats, banks and spits of sand, mud, gravel or rock, and among mangroves. Beach Stone-curlews breed above the littoral zone, at the backs of beaches, or on sandbanks and islands, among low vegetation of grass, scattered shrubs or low trees; also among open mangroves.	6 - BioNet	Low in development footprint. The habitat in the development site is not suitable for this species and it is not commonly found in the locality. Likely restricted to relatively undisturbed areas of beach and estuaries.
<i>Eudyptula minor</i> (Little Penguin in the Manly Point Area)	EP	-	Occurs in Australia and NZ. They generally breed from south of Port Stephens in NSW along the coast through Victoria, South Australia, Tasmania and as far as Fremantle in Western Australia. This endangered population occurs from just north of Smedley's Point to Cannae Point, North Sydney Harbour, Manly.	14 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species. Unlikely to use Duck River.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Falco hypoleucos</i> (Grey Falcon)	E	-	Sparsely distributed in NSW, chiefly throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing 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.	1 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species. Record is likely to be of a vagrant bird or erroneous.
<i>Falco subniger</i> (Black Falcon)	V	-	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. In New South Wales there is assumed to be a single population that is continuous with a broader continental population, given that falcons are highly mobile, commonly travelling hundreds of kilometres. The Black Falcon occurs as solitary individuals, in pairs, or in family groups of parents and offspring.	21 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Fregata ariel</i> (Lesser Frigatebird)	-	M	Major breeding populations of the Lesser Frigatebird are found in tropical waters of the Indian and Pacific Ocean (excluding the east Pacific), as well as one population in the South Atlantic (Trinidad and Tobago, Brazil). Outside the breeding season it is sedentary, with immature and non-breeding individuals dispersing throughout tropical seas, especially of the Indian and Pacific Oceans.	4 - BioNet	Low in development footprint. This is a marine bird and there is no habitat considered suitable for this species.
<i>Fregetta grallaria</i> <i>grallaria</i> (White-bellied Storm-Petrel)	V	V	A wide oceanic distribution in the south Pacific and Atlantic Oceans, ranging into tropical waters from various breeding grounds. Known to breed at various island groups including Lord Howe Island.	0 - BioNet	Low in development footprint. This is a marine bird and there is no habitat considered suitable for this species.
<i>Gallinago hardwickii</i> (Latham's Snipe)	-	M	Recorded along the east coast of Australia from Cape York Peninsula through to south-eastern South Australia. Occurs in permanent and ephemeral wetlands up to 2000 m above sea-level.	1,131 - BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Gelochelidon nilotica</i> (Gull-billed Tern)	-	M	Gull-billed Terns are found in freshwater swamps, brackish and salt lakes, beaches and estuarine mudflats, floodwaters, sewage farms, irrigated croplands and grasslands. They are only rarely found over the ocean.	22 - BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands.
<i>Glareola maldivarum</i> (Oriental Pratincole)	-	M	Within Australia the Oriental Pratincole is widespread in northern areas, especially along the coasts of the Pilbara Region and the Kimberley Division in Western Australia, the Top End of the Northern Territory, and parts of the Gulf of Carpentaria. It is also widespread but scattered inland, mostly north of 20° S. There are occasional records in southern Australia, at sparsely scattered sites, with records in all states, including an unconfirmed report in Tasmania. The species has also been recorded on various outlying islands, including Lord Howe Island, and, in the Indian Ocean, Christmas Island and Cocos-Keeling Islands.	2 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species. Records are likely to be of vagrant birds.
<i>Glossopsitta porphyrocephala</i> (Purple-crowned Lorikeet)	V	-	The Purple-crowned Lorikeet occurs across the southern parts of the continent from Victoria to south-west Western Australia. It is uncommon in NSW, with records scattered across the box-ironbark woodlands of the Riverina and south-west slopes, the River Red Gum forests and mallee of the Murray Valley as far west as the South Australian border, and, more rarely, the forests of the South Coast. The species is nomadic and most, if not all, records from NSW are associated with flowering events. Found in open forests and woodlands, particularly where there are large flowering eucalypts. Also recorded from mallee habitats.	1 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species. Record is likely to be a vagrant or aviary escapee.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Glossopsitta pusilla</i> (Little Lorikeet)	V	-	In NSW it is found from the coast to the western slopes of the Great Dividing Range, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. The species forages primarily in the canopy of dry open eucalypt forest and woodland but also utilises paperbark (<i>Melaleuca</i> sp.) dominated forests. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Isolated flowering trees in open country (e.g. paddocks, roadside remnants) and urban trees also help sustain viable populations of the species. Nests in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of smooth-barked eucalypts. Entrance is small (3 cm) and usually high above the ground (2–15 m). These nest sites are often used repeatedly for decades, suggesting that preferred sites are limited; riparian trees are often chosen, including non-eucalypt species such as she-oaks.	330 - BioNet	Moderate. This species may forage in street trees within the development site on occasion.
<i>Grantiella picta</i> (Painted Honeyeater)	V	V	The Painted Honeyeater is nomadic and occurs at low densities throughout its range. The greatest concentrations of birds, and almost all breeding, occur on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland. During the winter it is more likely to be found in the north of its distribution. Inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus <i>Amyema</i> .	4 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Gygis alba</i> (White Tern)	V	-	Occurs widely in tropical and subtropical seas and islands. The subspecies on Lord Howe Island is rarely seen on the mainland but occurs on Norfolk and Kermadec Islands. Most breeding sites on Lord Howe Island are close to the lagoon in the settlement area. This species nests in the high branches of trees. On Lord Howe Island it nests in the introduced Norfolk Island Pine as well as native Sallywood, Blackbutt, Greybark, Banyan and Pandanus.	3 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species. Records are likely of vagrant birds.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Haematopus fuliginosus</i> (Sooty Oystercatcher)	V	-	Sooty Oystercatchers are found around the entire Australian coast, including offshore islands, being most common in Bass Strait. Favours rocky headlands, rocky shelves, exposed reefs with rock pools, beaches and muddy estuaries. Forages on exposed rock or coral at low tide for foods such as limpets and mussels.	260 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Haematopus longirostris</i> (Pied Oystercatcher)	E	-	The species is distributed around the entire Australian coastline, although it is most common in coastal Tasmania and parts of Victoria, such as Corner Inlet. 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. Forages on exposed sand, mud and rock at low tide, for molluscs, worms, crabs and small fish. The chisel-like bill is used to pry open or break into shells of oysters and other shellfish. Nests mostly on coastal or estuarine beaches although occasionally they use saltmarsh or grassy areas. Nests are shallow scrapes in sand above the high tide mark, often amongst seaweed, shells and small stones.	1,061 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Haliaeetus leucogaster</i> (White-bellied Sea-Eagle)	V	M	Distributed along the coastline (including offshore islands) of mainland Australia and Tasmania. Found in coastal habitats (especially those close to the sea-shore) and around terrestrial wetlands in tropical and temperate regions of mainland Australia and its offshore islands. Habitats occupied by the sea-eagle are characterised by the presence of large areas of open water (larger rivers, swamps, lakes, and the sea). It feeds opportunistically on a variety of fish, birds, reptiles, mammals and crustaceans, and on carrion. It generally forages over large expanses of open water; this is particularly true of birds that occur in coastal environments close to the sea-shore. However, it will also forage over open terrestrial habitats (such as grasslands). Nests may be built in a variety of sites including tall trees (especially Eucalyptus species), bushes, mangroves, cliffs, rocky outcrops, crevices, on the ground or even on artificial structures.	777 - BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Halobaena caerulea</i> (Blue Petrel)	-	V, M	The blue petrel has a wingspan of 65 cm and is the only small petrel with a tail with a square white tip. It is gregarious, occurring in small loose flocks of up to 100, with larger flocks close to breeding islands. It is circumpolar, ranging from pack ice to 30° S. It breeds on offshore stacks near Macquarie Island where 500-600 breeding pairs occur. The species was previously more common on the Island, but predation severely impacted the species. An eradication program may now have eliminated cats and rats from the Island. It is also known to breed on a number of other islands in the southern Atlantic and Indian Oceans with a total population of 80 000. On mainland Australia, the species is mainly seen between July and September.	4 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species. This species is a vagrant to the area.
<i>Hieraaetus morphnoides</i> (Little Eagle)	V	-	The Little Eagle is found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. It occurs as a single population throughout NSW. Occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used.	170 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Hirundapus caudacutus</i> (White-throated Needletail)	-	V, M	Widespread in eastern and south-eastern Australia. Almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground. They also commonly occur over heathland but less often over treeless areas, such as grassland or swamps.	252 – BioNet	Moderate. Likely to use airspace above the development site. Unlikely to utilise the affected vegetation or be impacted.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Hirundo rustica</i> (barn Swallow)	-	M	The Barn Swallow is a non-breeding visitor and usually occurs in northern Australia, on Cocos-Keeling Island, Christmas Island, Ashmore Reef, and patchily along the north coast of the mainland from the Pilbara region, Western Australia, to Fraser Island in Queensland. In Australia, the Barn Swallow is recorded in open country in coastal lowlands, often near water, towns and cities. Birds are often sighted perched on overhead wires, and also in or over freshwater wetlands, paperbark Melaleuca woodland, mesophyll shrub thickets and tussock grassland.	8 - BioNet	Low in development footprint. Records are likely of vagrant birds.
<i>Hydroprogne caspia</i> (Caspian Tern)	-	M	Within Australia, the Caspian Tern has a widespread occurrence and can be found in both coastal and inland habitat. The Caspian Tern breeds on variable types of sites including low islands, cays, spits, banks, ridges, beaches of sand or shell, terrestrial wetlands and stony or rocky islets or banks. This species usually forages in open wetlands, including lakes and rivers.	182 - BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands.
<i>Irediparra gallinacea</i> (Comb-crested Jacana)	V	-	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 (possibly in response to unfavourable conditions further north). 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.	10 - BioNet	Low in development footprint. Records are likely of vagrant birds.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Ixobrychus flavicollis</i> (Black Bittern)	V	-	The Black Bittern is found along the coastal plains within NSW, although individuals have rarely being recorded south of Sydney or inland. It inhabits terrestrial and estuarine wetlands such as flooded grasslands, forests, woodlands, rainforests and mangroves with permanent water and dense waterside vegetation. The Black Bittern typically roosts on the ground or in trees during the day and forages at night on frogs, reptiles, fish and invertebrates. The breeding season extends from December to March. Nests are constructed of reeds and sticks in branches overhanging the water.	65 - BioNet	Low in development footprint. Moderate in mangrove habitats downstream along the Duck River.
<i>Lathamus discolor</i> (Swift Parrot)	E	CE	The swift parrot breeds in Tasmania during the summer and the entire population migrates north to mainland Australia for the winter. Whilst on the mainland the swift parrot disperses widely to forage on flowers and psyllid lerps in eucalypt species, with the majority being found in Victoria and NSW. In NSW they forage in forests and woodlands throughout the coastal and western slopes regions each year. Coastal regions tend to support larger numbers of birds when inland habitats are subjected to drought. Non-breeding birds preferentially feed in inland box-ironbark and grassy woodlands, and coastal swamp mahogany (<i>E. robusta</i>) and spotted gum (<i>Corymbia maculata</i>) woodland when in flower; otherwise often in coastal forests. 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 <i>Eucalyptus robusta</i> , <i>Corymbia maculata</i> , <i>C. gummifera</i> , <i>E. sideroxylon</i> , and <i>E. albens</i> . Commonly used lerp infested trees include <i>E. microcarpa</i> , <i>E. moluccana</i> and <i>E. pilularis</i> .	311 - BioNet	Moderate. Vagrant birds are known to occasionally visit the street trees around the Sydney urban area but the street trees in the footprint are not important habitat and the likelihood of birds using the trees within the development footprint as a continual source of habitat is low.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Limicola falcinellus</i> (Broad-billed Sandpiper)	V	-	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. Broad-billed Sandpipers favour sheltered parts of the coast such as estuarine sand flats 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.	17 - BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands.
<i>Limosa lapponica</i> (Bar-tailed Godwit)	-	M	The Bar-tailed Godwit has been recorded in the coastal areas of all Australian states. The Bar-tailed Godwit is found mainly in coastal habitats such as large intertidal sand flats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays.	1,659 - BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and high in Mason Park wetlands.
<i>Limosa lapponica baueri</i> and <i>Limosa lapponica menzbieri</i> (Bar-tailed Godwit)	-	V, CE	The Bar-tailed Godwit has been recorded in the coastal areas of all Australian states. The Bar-tailed Godwit is found mainly in coastal habitats such as large intertidal sand flats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays.	1,659 - BioNet	Moderate. Potentially suitable habitat in saltmarsh along Duck River, approximately 1.2 km downstream of the Clyde stabling and maintenance facility.
<i>Limosa limosa</i> (Black-tailed Godwit)	V	M	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 found at Kooragang Island (Hunter River estuary). Occurs in sheltered bays, estuaries and lagoons with large intertidal mudflats and sand flats. Also found at inland mudflats, swamps.	34 - BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Lophochroa leadbeateri</i> (Major Mitchell's Cockatoo)	V	-	Found across the arid and semi-arid inland, from south-western Queensland south to north-west Victoria, through most of South Australia, north into the south-west Northern Territory and across to the west coast between Shark Bay and about Jurien. In NSW it is found regularly as far east as about Bourke and Griffith, and sporadically further east than that. Inhabits a wide range of treed and treeless inland habitats, always within easy reach of water. Nesting, in tree hollows, occurs throughout the second half of the year; nests are at least 1 km apart, with no more than one pair every 30 square kilometres.	6 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species. Records are likely of vagrant birds of aviary escapees.
<i>Lophoictinia isura</i> (Square-tailed Kite)	V	-	Typically inhabits coastal forested and wooded lands of tropical and temperate Australia. In NSW it is often associated with ridge and gully forests dominated by <i>Eucalyptus longifolia</i> , <i>Corymbia maculata</i> , <i>E. elata</i> , or <i>E. smithii</i> . Individuals appear to occupy large hunting ranges of more than 100 km ² . They require large living trees for breeding, particularly near water with surrounding woodland /forest close by for foraging habitat. Nest sites are generally located along or near watercourses, in a tree fork or on large horizontal limbs.	120– BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Macronectes giganteus</i> (Southern Giant-petrel)	E	E, M	The Southern Giant Petrel has a circumpolar pelagic range from Antarctica to approximately 20° S and is a common visitor off the coast of NSW. Over summer, the species nests in small colonies amongst open vegetation on Antarctic and subantarctic islands, including Macquarie and Heard Islands and in Australian Antarctic territory.	359 – BioNet	Low in development footprint. There is no habitat considered suitable for this marine species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Macronectes halli</i> (Northern Giant-petrel)	V	V, M	The Northern Giant-Petrel has a circumpolar pelagic distribution, usually between 40-64°S in open oceans. Their range extends into subtropical waters (to 28°S) in winter and early spring, and they are a common visitor in NSW waters, predominantly along the south-east coast during winter and autumn. Breeding in Australian territory is limited to Macquarie Island and occurs during spring and summer. Adults usually remain near the breeding colonies throughout the year (though some do travel widely) while immature birds make long and poorly known circumpolar and trans-oceanic movements. Hence most birds recorded in NSW coastal waters are immature birds. Northern Giant-Petrels seldom breed in colonies but rather as dispersed pairs, often amidst tussocks in dense vegetation and areas of broken terrain.	8 – BioNet	Low in development footprint. There is no habitat considered suitable for this marine species.
<i>Melanodryas cucullata</i> <i>cucullata</i> (Hooded Robin (south-eastern form))	V	-	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. 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. The nest is a small, neat cup of bark and grasses bound with webs, in a tree fork or crevice, from less than 1 m to 5 m above the ground.	8 – BioNet	Low in development footprint. There is no habitat considered suitable for this species. Vagrant birds may appear on occasion.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Melithreptus gularis</i> <i>gularis</i> (Black-chinned Honeyeater (eastern subsp.))	V	-	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. Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (<i>Eucalyptus sideroxylon</i>), White Box (<i>E. albens</i>), Inland Grey Box (<i>E. microcarpa</i>), Yellow Box (<i>E. melliodora</i>), Blakely's Red Gum (<i>E. blakelyi</i>) and Forest Red Gum (<i>E. tereticornis</i>). Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks, river sheoaks (nesting habitat) and tea-trees.	38 – BioNet	Low in development footprint. There is no habitat considered suitable for this species. Vagrant birds may appear on occasion.
<i>Merops ornatus</i> (Rainbow Bee-eater)	-	M	Distributed across much of mainland Australia, and occurs on several near-shore islands. Occurs mainly in open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation.	92 – BioNet	Low in development footprint. There is no habitat considered suitable for this species. Vagrant birds may appear on occasion.
<i>Motacilla citreola</i> (Citrine Wagtail)	-	M	This species breeds in north central Asia and migrates in winter to South Asia.	2 – BioNet	Low in development footprint. There is no habitat considered suitable for this species. Vagrant birds may appear on occasion.
<i>Motacilla flava</i> (Yellow Wagtail)	-	M	Rare but regular visitor around Australian coast, especially in the NW coast Broome to Darwin. Found in open country near swamps, salt marshes, sewage ponds, grassed surrounds to airfields, bare ground; occasionally on drier inland plains.	1 – BioNet	Low in development footprint. There is no habitat considered suitable for this species. Vagrant birds may appear on occasion.
<i>Neochmia ruficauda</i> (Star Finch)	E	PE	The Star Finch has been presumed extinct in NSW. This species is thought to exist as two subspecies (i.e. eastern and southern). It is accepted that both subspecies occur from central Queensland to (formerly) NSW. When observed in 1865 at Namoi River in NSW it occurred on the sloping river bank covered with grass and herbs, amongst beds of rushes alongside of the river.	2 – BioNet	Low in development footprint. There is no habitat considered suitable for this species. The records in the Sydney area are likely to be erroneous or an aviary escapee.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Neophema chrysogaster</i> (Orange-bellied Parrot)	CE	CE	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. On the mainland, the Orange-bellied Parrot spends winter mostly within 3 km 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 salt works and golf courses. Birds forage in low samphire herbland or taller coastal shrubland.	1 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species. Records would be of vagrant birds.
<i>Neophema pulchella</i> (Turquoise Parrot)	V	-	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, timbered ridges and creeks in farmland.	46 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Nettapus coromandelianus</i> (Cotton Pygmy-goose)	E	-	Although once found from north Queensland to the Hunter River in NSW, the Cotton Pygmy-Goose is now only a rare visitor to NSW. Uncommon in Queensland. Occupies freshwater lakes, lagoons, swamps and dams, particularly those vegetated with waterlilies and other floating and submerged aquatic vegetation. The Cotton Pygmy-goose uses standing dead trees with hollows close to water for roosting and breeding.	4 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species. Records would be of vagrant birds.
<i>Ninox connivens</i> (Barking Owl)	V	-	Found throughout continental Australia except for the central arid regions. 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.	120 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Ninox strenua</i> (Powerful Owl)	V	-	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. Now at low densities throughout most of its eastern range, rare along the Murray River and former inland populations may never recover. The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The Powerful Owl 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.	3,346 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Numenius madagascariensis</i> (Eastern Curlew)	-	CE, M	Within Australia, the Eastern Curlew has a primarily coastal distribution. The species is found in all states, particularly the north, east, and south-east regions including Tasmania. The Eastern Curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sand flats, often with beds of seagrass.	687 – BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands.
<i>Numenius minutus</i> (Little Curlew)	-	M	Little Curlews generally spend the non-breeding season in northern Australia from Port Hedland in Western Australia to the Queensland coast. The Little Curlew is most often found feeding in short, dry grassland and sedgeland, including dry floodplains and blacksoil plains, which have scattered, shallow freshwater pools or areas seasonally inundated.	15 – BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands.
<i>Numenius phaeopus</i> (Whimbrel)	-	M	The Whimbrel is a regular migrant to Australia and New Zealand, with a primarily coastal distribution. 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.	293 – BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Oceanites oceanicus</i> (Wilson's Storm-Petrel)	-	M	In Australia, most reports of the Wilson's Storm-Petrel are from the edge of the continental shelf and during autumn. The species is known to breed on Heard Island, where it is described as abundant	3 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species. This species is a vagrant marine bird.
<i>Onychoprion fuscata</i> (Sooty Tern)	V	-	The Sooty Tern is found over tropical and sub-tropical seas and on associated islands and cays around Northern Australia. In NSW only known to breed at Lord Howe Island. Occasionally seen along coastal NSW, especially after cyclones. Large flocks can be seen soaring, skimming and dipping but seldom plunging in off shore waters. Breeds in large colonies in sand or coral scrapes on offshore islands and cays including Lord Howe and Norfolk Islands.	16 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Oxyura australis</i> (Blue-billed Duck)	V	-	Endemic to south-eastern and south-western Australia. It is widespread in NSW, but most common in the southern Murray-Darling Basin area. Birds disperse during the breeding season to deep swamps up to 300 km away. It is generally only during summer or in drier years that they are seen in coastal areas. Prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. The species is completely aquatic, swimming low in the water along the edge of dense cover. It will fly if disturbed, but prefers to dive if approached. Partly migratory, with short-distance movements between breeding swamps and overwintering lakes with some long-distance dispersal to breed during spring and early summer. Usually nest solitarily in Cumbungi over deep water between September and February. They will also nest in trampled vegetation in Lignum, sedges or Spike-rushes, where a bowl-shaped nest is constructed. The most common clutch size is five or six. Males take no part in nest-building or incubation.	4 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Pachycephala olivacea</i> (Olive Whistler)	V	-	The Olive Whistler inhabits the wet forests on the ranges of the east coast. It has a disjunct distribution in NSW chiefly occupying the beech forests around Barrington Tops and the MacPherson Ranges in the north and wet forests from Illawarra south to Victoria. In the south it is found inland to the Snowy Mountains and the Brindabella Range. Mostly inhabit wet forests above about 500m. During the winter months they may move to lower altitudes.	3 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Pandion cristatus</i> (Eastern Osprey)	V	M	The Osprey has a global distribution with four subspecies previously recognised throughout its range. Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water.	127 – BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands.
<i>Petroica boodang</i> (Scarlet Robin)	V	-	The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and re-growth vegetation. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps. This species' nest is built in the fork of tree usually more than 2 metres above the ground; nests are often found in a dead branch in a live tree, or in a dead tree or shrub.	119 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Petroica phoenicea</i> (Flame Robin)	V	-	The Flame Robin ranges from near the Queensland border to south-east South Australia and also in Tasmania. In NSW, it breeds in upland areas and in winter, many birds move to the inland slopes and plains. It is likely that there are two separate populations in NSW, one in the Northern Tablelands, and another ranging from the Central to Southern Tablelands. Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes. Prefers clearings or areas with open understoreys. 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 sedgeland at high altitudes.	58 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Petroica rodinogaster</i> (Pink Robin)	V	-	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.	5 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Pezoporus wallicus</i> <i>wallicus</i> (Ground Parrot (eastern subsp.))	V	-	In NSW populations have declined and contracted to islands of coastal or subcoastal heathland and sedgeland habitats. The species is found in small numbers on the north coast (Broadwater, Bundjalung, Yuraygir NPs) and Myall Lakes on the central coast. The largest populations occur on the NSW south coast, particularly Barren Grounds NR, Budderoo NP, the Jervis Bay area and Nadgee NR. The Ground Parrot occurs in high rainfall coastal and near coastal low heathlands and sedgelands, generally below one metre in height and very dense (up to 90% projected foliage cover). These habitats provide a high abundance and diversity of food, adequate cover and suitable roosting and nesting opportunities for the Ground Parrot, which spends most of its time on or near the ground. When flushed, birds fly strongly and rapidly for up to several hundred metres, at a metre or less above the ground. The coastal and subcoastal heathland and sedgeland habitats of the Ground Parrot are particularly fire-prone. Ground Parrots can re-colonise burnt habitat after 1-2 years and reach maximum densities after 15-20 years without fire.	9 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Phaethon lepturus</i> (White-tailed Tropicbird)	-	M	The white-tailed Tropicbird can be found over pelagic waters and the coast of tropical and subtropical seas. It feeds on small fish, especially flying-fish, squid and some crustaceans (especially crabs). Its diet varies locally, for example taking mostly fish in the Seychelles. Most prey is caught by plunge-diving but flying-fish can be taken on the wing. Breeding is seasonal in places but elsewhere can be more or less continuous. It is loosely colonial, nesting in rocky crevices or sheltered scrape on the ground on small-remote islands preferring inaccessible spots on cliffs where take-off is relatively easy.	6 - BioNet	Low in development footprint. There is no habitat considered suitable for this marine species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Philomachus pugnax</i> (Ruff)	-	M	The Ruff is a rare but regular non-breeding visitor to Australia, being recorded in all States and Territories. In NSW the species has been recorded at Kurnell, Tomki, Casino, Ballina, Kooragang Island, Broadwater Lagoon and Little Cattai Creek. The Ruff is found on generally fresh, brackish or saline wetlands with exposed mudflats at the edges.	15 – BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands.
<i>Phoebastria fusca</i> (Sooty Albatross)	V	V, M	The Sooty Albatross has sometimes been observed foraging in inshore waters in southern Australia. The Sooty Albatross is a rare, but probably regular migrant to Australia, mostly in the autumn-winter months, occurring north to south-east Queensland, NSW, Victoria, Tasmania and South Australia. The Sooty Albatross breeds on islands in the southern Indian and Atlantic Oceans, and forages south of 30° S, between southern NSW and Argentina.	2 – BioNet	Low in development footprint. There is no habitat considered suitable for this marine species.
<i>Plegadis falcinellus</i> (Glossy Ibis)	-	M	Preferred habitat for foraging and breeding are fresh water marshes at the edges of lakes and rivers, lagoons, flood-plains, wet meadows, swamps, reservoirs, sewage ponds, rice-fields and cultivated areas under irrigation.	108 – BioNet	Moderate in development site. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands..
<i>Pluvialis fulva</i> (Pacific Golden Plover)	-	M	Most Pacific Golden Plovers occur along the east coast, and are especially widespread along the Queensland and NSW coastlines. In non-breeding grounds in Australia this species usually inhabits coastal habitats, though it occasionally occurs around inland wetlands. Pacific Golden Plovers usually occur on beaches, mudflats and sand flats (sometimes in vegetation such as mangroves, low saltmarsh such as <i>Sarcocornia</i> , or beds of seagrass) in sheltered areas including harbours, estuaries and lagoons, and also in evaporation ponds in salt works.	573 – BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and high in Mason Park wetlands.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Pluvialis squatarola</i> (Grey Plover)	-	M	Non-breeding visitor to Australia, Grey Plovers usually forage on large areas of exposed mudflats and beaches of sheltered coastal shores such as inlets, estuaries and lagoons. They usually roost in sandy areas, such as on unvegetated sandbanks or sand-spits on sheltered beaches or other sheltered environments such as estuaries or lagoons	57 – BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands.
<i>Polytelis swainsonii</i> (Superb Parrot)	V	V	Found throughout eastern inland NSW. On the South-western Slopes their core breeding area is roughly bounded by Cowra and Yass in the east, and Grenfell, Cootamundra and Coolac in the west. Inhabit Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest. In the Riverina the birds nest in the hollows of large trees (dead or alive) mainly in tall riparian River Red Gum Forest or Woodland. On the South West Slopes nest trees can be in open Box-Gum Woodland or isolated paddock trees. Species known to be used are Blakely's Red Gum, Yellow Box, Apple Box and Red Box. Nest in small colonies, often with more than one nest in a single tree.	2 - BioNet	Low in development footprint. There is no habitat considered suitable for this species. Records from the Sydney area are likely to be erroneous or aviary escapees.
<i>Pomatostomus temporalis temporalis</i> (Grey-crowned Babbler)	V	-	In NSW, the eastern sub-species occurs on the western slopes of the Great Dividing Range, and on the western plains reaching as far as Louth and Balranald. It also occurs in woodlands in the Hunter Valley and in several locations on the north coast of NSW. It may be extinct in the southern, central and New England tablelands. Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. Build and maintain several conspicuous, dome-shaped stick nests about the size of a football. A nest is used as a dormitory for roosting each night. Nests are usually located in shrubs or sapling eucalypts, although they may be built in the outermost leaves of low branches of large eucalypts. Nests are maintained year-round, and old nests are often dismantled to build new ones.	2 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Procelsterna cerulea</i> (Grey Ternlet)	V	-	Widely distributed in the southern Pacific Ocean, breeding on oceanic islands including Lord Howe Island. Breeds on Lord Howe Island on sea cliffs of northern hills and southern mountains, and also on offshore islands including Admiralty Islets, Muttonbird Island and Ball's Pyramid.	1 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Pterodroma leucoptera leucoptera</i> (Gould's Petrel)	V	E, M	Breeds on both Cabbage Tree Island, 1.2 km offshore from Port Stephens and on nearby Boondelbah island. The range and feeding areas of non-breeding petrels are unknown. The first arrival of Gould's petrel on cabbage tree Island occurs from mid to late September. Principal nesting habitat is located within two gullies which are characterised by steeply, sloping rock scree with a canopy of Cabbage Tree Palms. They nest predominantly in natural rock crevices among the rock scree and also in hollow fallen palm trunks, under mats of fallen palm fronds and in cavities among the buttresses of fig trees.	6 - BioNet	Low in development footprint. There is no habitat considered suitable for this marine species.
<i>Pterodroma neglecta neglecta</i> (Kermadec Petrel)	V	V	Ranges over subtropical and tropical waters of the South Pacific. Balls Pyramid (near Lord Howe Island) and Phillip Island (near Norfolk Island) are the only known breeding sites in Australian waters. Breeds on islands across the South Pacific. In Australia it breeds on Ball's Pyramid and Phillip Island (near Norfolk Island). Nests in a crevice amongst rocks.	0 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species. This species is a vagrant marine bird.
<i>Pterodroma nigripennis</i> (Black-winged Petrel)	V	-	Nests at numerous sites on Lord Howe Island: North Head, New Gulch, Dawson's Ridge, Malabar, Ned's Beach, Jim's Point, Transit Hill, adjacent to Muttonbird Point, Red Point and Ball's Pyramid. Nest in a burrow, up to a metre long in sandy soil but shorter in stony volcanic soil. The burrow is located on higher ground, and the entrance is usually hidden amongst bushes.	3 - BioNet	Low in development footprint. There is no habitat considered suitable for this marine species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Pterodroma solandri</i> (Providence Petrel)	V	M	Ranges across eastern Pacific. Only known breeding sites are at Lord Howe Island and Philip Island, offshore from Norfolk Island. Previously also bred on main Norfolk Island but extinct there by 1800. Nest on the tops of Mount Gower and Mount Lidgbird and to a less extent, on the lower slopes of the mountains. The nest is a grass lined chamber at the end of a burrow, 1 - 2 metres in length.	3 – BioNet	Low in development footprint. There is no habitat considered suitable for this marine species.
<i>Ptilinopus magnificus</i> (Wompoo Fruit-dove)	V	-	Occurs along the coast and coastal ranges from the Hunter River in NSW to Cape York Peninsula. It is rare south of Coffs Harbour. Occurs in, or near rainforest, low elevation moist eucalypt forest and brush box forests. Feeds on a diverse range of tree and vine fruits and is locally nomadic - following ripening fruit. Thought to be an effective medium to long-distance vector for seed dispersal.	2 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species. This species is vagrant to the Sydney area.
<i>Ptilinopus regina</i> (Rose-crowned Fruit Dove)	V	-	Coast and ranges of eastern NSW and Queensland, from Newcastle to Cape York. Vagrants are occasionally found further south to Victoria. Rose-crowned Fruit-doves occur mainly in sub-tropical and dry rainforest and occasionally in moist eucalypt forest and swamp forest, where fruit is plentiful.	3 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species. This species is vagrant to the Sydney area.
<i>Ptilinopus superbus</i> (Superb Fruit-dove)	V	-	The Superb Fruit-dove occurs principally from north-eastern in Queensland to north-eastern NSW. Inhabits rainforest and similar closed forests where it forages high in the canopy, eating the fruits of many tree species such as figs and palms. It may also forage in eucalypt or acacia woodland where there are fruit-bearing trees.	55 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species. This species is vagrant to the Sydney area.
<i>Puffinus assimilis</i> (Little Shearwater)	V	-	A widespread species in the subtropical Atlantic, Pacific and Indian Oceans. Lord Howe Island has one of the larger breeding colonies in the Australian region. Breeding sites at Lord Howe Island include Roach Island, Muttonbird Island, Blackburn Island and on the main Island at Muttonbird Point and Transit Hill.	5 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Rhipidura rufifrons</i> (Rufous Fantail)	-	M	Occurs in coastal and near coastal districts of northern and eastern Australia. In east and south-east Australia, the Rufous Fantail mainly inhabits wet sclerophyll forests, often in gullies usually with a dense shrubby understorey often including ferns.	0 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Rostratula australis</i> (Australian Painted Snipe)	E	E, M	Most records are from south-east Australia, particularly the Murray Darling Basin, with scattered records across northern Australia. They generally inhabit shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. They also use inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains. Typical sites include those with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire; often with scattered clumps of lignum Muehlenbeckia or canegrass. Breeding habitat requirements may be quite specific; shallow wetlands with areas of bare wet mud and both low cover and canopy cover nearby; nest records nearly all from or near small islands in freshwater wetlands. Has also been recorded nesting in and near swamps, canegrass swamps, flooded areas including samphire, grazing land, among cumbungi, sedges and grasses; one nest has been found in the centre of a cow-pat in a clump of long grass.	23 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Stagonopleura guttata</i> (Diamond Firetail)	V	-	Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum (<i>Eucalyptus pauciflora</i>) Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland. Nests are globular structures built either in the shrubby understorey, or higher up, especially under hawk's or raven's nests. Birds roost in dense shrubs or in smaller nests built especially for roosting.	26 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Stercorarius longicaudus</i> (Long-tailed Jaeger)	-	M	A regular migrant in eastern Australian waters. They are pelagic after breeding and spend little time near the land.	2 – BioNet	Low in development footprint. There is no habitat considered suitable for this marine species.
<i>Stercorarius maccormicki</i> (South Polar Skua)	-	M	The South Polar Skua breeds on relatively snow-free areas in Antarctica. It is usually reliant on fish, with predation on penguins being of variable importance. It can, however, subsist exclusively on penguins where a breeding colony is associated to a penguin rookery. It is a trans-equatorial migrant, wintering in the North Pacific and North Atlantic.	1 – BioNet	Low in development footprint. There is no habitat considered suitable for this marine species.
<i>Stercorarius parasiticus</i> (Parasitic Jaeger)	-	M	The Parasitic Jaeger breeds on the northernmost coasts of Eurasia and North America. This marine species is predominately coastal but will migrate over land.	12 – BioNet	Low in development footprint. There is no habitat considered suitable for this marine species.
<i>Stercorarius pomarinus</i> (Pomarine Jaeger)	-	M	The Pomarine Jaeger breeds in the far north of Eurasia and North America. This species is marine outside the breeding season, remaining somewhat coastal, especially in upwelling regions of the tropics and subtropics.	6 – BioNet	Low in development footprint. There is no habitat considered suitable for this marine species.
<i>Sterna hirundo</i> (Common Tern)	-	M	The species is a non-breeding migrant to Australia, where it is widespread and common on the eastern coast south to eastern Victoria, and common on parts of the northern coast, mainly east of Darwin. Common Terns are marine, pelagic and coastal. In Australia, they are recorded in all marine zones, but are commonly observed in near-coastal waters, both on ocean beaches, platforms and headlands and in sheltered waters, such as bays, harbours and estuaries with muddy, sandy or rocky shores. However, off Wollongong, NSW, Common Terns were recorded in all marine zones but generally recorded in offshore and pelagic waters, 11–55 km from shore.	150 – BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Sternula albifrons</i> (Little Tern)	E	M	Migrating from eastern Asia, the Little Tern is found on the north, east and south-east Australian coasts, from Shark Bay in Western Australia to the Gulf of St Vincent in South Australia. In NSW, it arrives from September to November, occurring mainly north of Sydney. Almost exclusively coastal, preferring sheltered environments; however may occur several kilometres from the sea in harbours, inlets and rivers (with occasional offshore islands or coral cay records). Nests in small, scattered colonies in low dunes or on sandy beaches just above high tide mark near estuary mouths or adjacent to coastal lakes and islands.	1,812 – BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands.
<i>Sternula nereis nereis</i> (Australian Fairy Tern)	-	V	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. The Fairy Tern (Australian) nests on sheltered sandy beaches, spits and banks above the high tide line and below vegetation. The subspecies has been found in embayments of a variety of habitats including offshore, estuarine or lacustrine (lake) islands, wetlands and mainland coastline. The bird roosts on beaches at night.	0 – BioNet	Low in development footprint. There is no habitat considered suitable for this marine species.
<i>Stictonetta naevosa</i> (Freckled Duck)	V	-	Prefer permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds.	21 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Sula leucogaster</i> (Brown Booby)	-	M	In Australia, the Brown Booby is found from Bedout Island in Western Australia, around the coast of the Northern Territory to the Bunker Group of islands in Queensland with occasional reports further south in New South Wales (NSW) and Victoria. The species is reported further south to Tweed Heads, NSW, and to near Onslow, Western Australia and may be becoming more common in these areas.	5 – BioNet	Low in development footprint. There is no habitat considered suitable for this marine species.
<i>Thalassarche bulleri</i> (Buller's Albatross)	-	V, M	Buller's Albatross breed in New Zealand (Snares, Solander and Chatham Islands), but are regular visitors to Australian waters. They are frequently seen off the coast from Coffs Harbour, south to Tasmania and west to Eyre Peninsula. In Australia, Buller's Albatross are seen over inshore, offshore and pelagic waters. They appear to congregate over currents where water temperature exceeds 16 °C.	0 – BioNet	Low in development footprint. There is no habitat considered suitable for this marine species.
<i>Thalassarche buller platei</i> (Buller's Albatross)	-	V, M	The Pacific Albatross is a non-breeding visitor to Australian waters. Foraging birds are mostly limited to the Pacific Ocean and the Tasman Sea, although birds do reach the east coast of the Australian mainland.	0 – BioNet	Low in development footprint. There is no habitat considered suitable for this marine species.
<i>Thalassarche cauta</i> (syn. <i>Diomedea cauta</i>) (Shy Albatross)	V	V, M	This species is circumpolar in distribution, occurring widely in the southern oceans. Islands off Australia and New Zealand provide breeding habitat. In Australian waters, the Shy Albatross occurs along the east coast from Stradbroke Island in Queensland along the entire south coast of the continent to Carnarvon in Western Australia. Although uncommon north of Sydney, the species is commonly recorded off southeast NSW, particularly between July and November, and has been recorded in Ben Boyd National Park.	13 – BioNet	Low in development footprint. There is no habitat considered suitable for this marine species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Thalassarche cauta steadii</i> (White-capped Albatross)	-	V, M	Breeding colonies occur on islands south of New Zealand. The White-capped Albatross is a marine species and occurs in subantarctic and subtropical waters. The White-capped Albatross is probably common off the coast of south-east Australia throughout the year.	0 – BioNet	Low in development footprint. There is no habitat considered suitable for this marine species.
<i>Thalassarche chrysostoma</i> (Grey-headed Albatross)	-	M	In Australian territory, Grey-headed Albatross breed on the southern and western flanks of Petrel Peak, Macquarie Island. The Grey-headed Albatross has bred in this same restricted area on Macquarie Island for at least the past 30 years. This nesting area has been included on the EPBC Act register of Critical Habitat. Macquarie Island is classified as a World Heritage Area, a Biosphere reserve and a National Estate property. The entire island is also classified as a Tasmanian Nature Reserve and is managed by the Tasmanian Parks and Wildlife Service. Breeding and non-breeding birds disperse widely across the Southern Ocean, at more southerly latitudes in summer than in winter, when they frequent the waters off southern Australia and New Zealand. Most Australian records come from south and west of Tasmania, occasionally in Victorian waters, rarely in South Australia and Western Australia, and only as a vagrant in NSW. It has only been recorded once in southern Queensland.	2 – BioNet	Low in development footprint. There is no habitat considered suitable for this marine species.
<i>Thalassarche eremita</i> (Chatham Albatross)	-	E, M	Breeding for the Chatham Albatross is restricted to Pyramid Rock, Chatham Islands, off the coast of New Zealand. The principal foraging range for this species is in coastal waters off eastern and southern New Zealand, and Tasmania.	0 – BioNet	Low in development footprint. There is no habitat considered suitable for this marine species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Thalassarche impavida</i> (Campbell Albatross)	-	V, M	The Campbell Albatross is a non-breeding visitor to Australian waters. Non-breeding birds are most commonly seen foraging over the oceanic continental slopes off Tasmania, Victoria and New South Wales. They breed only on sub-Antarctic Campbell Island (New Zealand), south of New Zealand. After breeding, birds move north and may enter Australia's temperate shelf waters.	0 – BioNet	Low in development footprint. There is no habitat considered suitable for this marine species.
<i>Thalassarche melanophrys</i> (Black-browed Albatross)	V	M, V	The Black-browed Albatross has a circumpolar range over the southern oceans and are seen off the southern Australian coast mainly during winter. This species migrates to waters off the continental shelf from approximately May to November and is regularly recorded off the NSW coast during this period. The species has also been recorded in Botany Bay National Park. Inhabits Antarctic, subantarctic, subtropical marine and coastal waters over upwellings and boundaries of currents. Can tolerate water temperatures between 0°C and 24°C. Spends most of its time at sea, breeding on small isolated islands.	25 – BioNet	Low in development footprint. There is no habitat considered suitable for this marine species.
<i>Thalassarche salvini</i> (Salvin's Albatross)	-	V, M	Salvin's Albatross breeds on Bounty, Snares and Chatham Islands, south of New Zealand, as well as on Crozet Island in the Indian Ocean. The species forages over most of the southern Pacific Ocean, where it is particularly common in the Humboldt Current, off South America. There are small numbers in the Indian Ocean and sometimes in the South Atlantic Ocean. During the non-breeding season, the species occurs over continental shelves around continents. It occurs both inshore and offshore and enters harbours and bays (Jehl 1973). Salvin's Albatross is scarce in pelagic waters.	0 – BioNet	Low in development footprint. There is no habitat considered suitable for this marine species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Tringa brevipes</i> (Grey-tailed Tattler)	-	M	In NSW the Grey-tailed Tattler is distributed along most of the coast from the Queensland border, south to Tilba Lake. The Grey-tailed Tattler is often found on sheltered coasts with reefs and rock platforms or with intertidal mudflats. It can also be found at intertidal rocky, coral or stony reefs as well as platforms and islets that are exposed at low tide.	208 – BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands.
<i>Tringa glareola</i> (Wood Sandpiper)	-	M	The Wood Sandpiper has its largest numbers recorded in north-west Australia, with all areas of national importance located in Western-Australia. Uses well-vegetated, shallow, freshwater wetlands, such as swamps, billabongs, lakes, pools and waterholes.	26 – BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands.
<i>Tringa incana</i> (Wandering Tattler)	-	M	The Wandering Tattler is a vagrant in the East Asian-Australasian Flyway and is uncommon in Australia, although it may sometimes be overlooked. The Wandering Tattler does not breed in Australia. The Wandering Tattler is generally found on rocky coasts with reefs and platforms, points, spits, piers, offshore islands and shingle beaches or beds	24 – BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands.
<i>Tringa nebularia</i> (Common Greenshank)	-	M	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.	320 – BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands.
<i>Tringa stagnatilis</i> (Marsh Sandpiper)	-	M	Fresh or brackish (slightly salty) wetlands such as rivers, water meadows, sewage farms, drains, lagoons and swamps.	68 – BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Tryngites subruficollis</i> (Buff-breasted Sandpiper)	-	M	This species has been sighted in South Asia on at least three occasions. It usually migrates to Argentina. The buff-breasted sandpiper has also been recorded from Australia on at least eight occasions. In 1978, Phillips recorded the species from Sri Lanka, and after that very few sightings were recorded. In 2001 a single bird was also recorded in, South Africa. This species is likely Vagrant to Australia.	6 – BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands.
<i>Tyto longimembris</i> (Eastern Grass Owl)	V	-	Eastern Grass Owls have been recorded occasionally in all mainland states of Australia but are most common in northern and north-eastern Australia. In NSW they are more likely to be resident in the north-east. Eastern Grass Owl numbers can fluctuate greatly, increasing especially during rodent plagues. Eastern Grass Owls are found in areas of tall grass, including grass tussocks, in swampy areas, grassy plains, swampy heath, and in cane grass or sedges on flood plains. They are also found in agricultural land (mainly sugar cane and sorghum, and rice fields in fallow) (Birdlife Australia).	19 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Tyto novaehollandiae</i> (Masked Owl)	V	-	Extends from the coast where it is most abundant to the western plains. Overall records for this species fall within approximately 90% of NSW, excluding the most arid north-western corner. There is no seasonal variation in its distribution. Dry eucalypt forests and woodland, typically prefers open forest with low shrub density. Requires old trees for roosting and nesting.	126 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Tyto tenebricosa</i> (Sooty Owl)	V	-	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.	171 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Xenus cinereus</i> (Terek Sandpiper)	V	M	A rare migrant to the eastern and southern Australian coasts, being most common in northern Australia, and extending its distribution south to the NSW coast in the east. The two main sites for the species in NSW are the Richmond River estuary and the Hunter River estuary. The latter has been identified as nationally and internationally important for the species. In Australia, has been recorded on coastal mudflats, lagoons, creeks and estuaries. Favours mud banks and sandbanks located near mangroves but may also be observed on rocky pools and reefs, and occasionally up to 10 km inland around brackish pools.	56 – BioNet	Low in development footprint. Moderate in saltmarsh around 1.2 km downstream of the Clyde stabling and maintenance facility and in Mason Park wetlands.
Frogs					
<i>Crinia tinnula</i> (Wallum Froglet)	V	-	Wallum Froglets are found along the coastal margin from Litabella National Park in south-east Queensland to Kurnell in Sydney. Wallum Froglets are found in a wide range of habitats, usually associated with acidic swamps on coastal sand plains. They typically occur in sedgeland and wet heathlands. They can also be found along drainage lines within other vegetation communities and disturbed areas, and occasionally in swamp sclerophyll forests. The species breeds in swamps with permanent water as well as shallow ephemeral pools and drainage ditches. Breeding is thought to peak in the colder months, but can occur throughout the year following rain. Eggs of 1.1-1.2mm are deposited in water with a pH of <6 and tadpoles take 2-6 months to develop into frogs. Wallum Froglets shelter under leaf litter, vegetation, other debris or in burrows of other species. Shelter sites are wet or very damp and often located near the water's edge. Males may call throughout the year and at any time of day, peaking following rain.	37 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Heleioporus australiacus</i> (Giant Burrowing Frog)	V	V	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. Spends more than 95% of its time in non-breeding habitat in areas up to 300 m from breeding sites. Whilst in non-breeding habitat it burrows below the soil surface or in the leaf litter. Individual frogs occupy a series of burrow sites, some of which are used repeatedly. The home ranges of both sexes appear to be non-overlapping suggesting exclusivity of non-breeding habitat. Home ranges are approximately 0.04 ha in size.	345 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Litoria aurea</i> (Green and Golden Bell Frog)	E	V	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. Ephemeral and permanent freshwater wetlands, ponds, dams with an open aspect and fringed by Typha and other aquatics, free from predatory fish.	13,982 - BioNet	Low in development footprint. High in wetlands of Haslam's Creek saltmarsh that are located over the tunnel.
<i>Litoria littlejohni</i> (Littlejohn's Tree Frog)	V	V	Distribution includes the plateaus and eastern slopes of the Great Dividing Range from Watagan State Forest (90 km north of Sydney) south to Buchan in Victoria. 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.	60 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Litoria raniformis</i> (Southern Bell Frog)	E	V	The species is currently widespread throughout the Murray River valley and has been recorded from six Catchment Management Areas in NSW: Lower Murray Darling, Murrumbidgee, Murray, Lachlan, Central West and South East. Found mostly amongst emergent vegetation, including Typha sp. (bullrush), Phragmites sp. (reeds) and Eleocharis sp.(sedges), in or at the edges of still or slow-flowing water bodies such as lagoons, swamps, lakes, ponds and farm dams.	0 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species. This species is not known from the Sydney area.
<i>Mixophyes balbus</i> (Stuttering Frog)	E	V	Stuttering Frogs occur along the east coast of Australia from southern Queensland to north-eastern Victoria. Considered to have disappeared from Victoria and to have undergone considerable range contraction in NSW, particularly in south-east NSW. It is the only <i>Mixophyes</i> 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.	0 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Mixophyes iteratus</i> (Giant Barred Frog)	E	E	Forages and lives amongst deep, damp leaf litter in rainforests, moist eucalypt forest and nearby dry eucalypt forest, at elevations below 1000 m. They breed around shallow, flowing rocky streams from late spring to summer.	1 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Pseudophryne australis</i>	V	-	It has restricted distribution from Pokolbin to Nowra and west to Mt Victoria. Occurs in open forests and wet drainage lines below sandstone ridges that often have shale lenses or cappings in the Hawkesbury and Narrabeen Sandstones.	1,100 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
Invertebrates					
<i>Menippus darcyi</i> population in the Sutherland Shire	EP	-	A small, light green, chrysomelid beetle. Confined to Grays Point Reserves, Grays Point, Sutherland Shire. This species has been recorded from only three locations in Australia: Lord Howe Island, coastal North Queensland and Grays Point Reserve (0.8 h in size), adjacent to Port Hacking in southern Sydney.	1 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Meridolum corneovirens</i> (Cumberland Plain Land Snail)	E	-	Primarily inhabits Cumberland Plain Woodland (an endangered ecological community). This community is grassy, open woodland with occasional dense patches of shrubs. Lives under litter of bark, leaves and logs, or shelters in loose soil around grass clumps. Occasionally shelters under rubbish.	1,170 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Petalura gigantea</i> (Giant Dragonfly)	E	-	The Giant Dragonfly is found along the east coast of NSW from the Victorian border to northern NSW. It is not found west of the Great Dividing Range. Live in permanent swamps and bogs with some free water and open vegetation. Adults spend most of their time settled on low vegetation on or adjacent to the swamp. They hunt for flying insects over the swamp and along its margins.	12 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Pommerhelix duralensis</i> (Dural Land Snail)	E	E	The Dural land snail is endemic to New South Wales. The species is a shale-influenced habitat specialist, which occurs in low densities along the northwest fringe of the Cumberland Plain on shale-sandstone transitional landscapes. The species has been observed resting in exposed areas, such as on exposed rock or leaf litter, however it will also shelter beneath logs, rocks and light woody debris.	84 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Synemon plana</i> (Golden Sun Moth)	E	CE	The Golden Sun Moth's NSW populations are found in the area between Queanbeyan, Gunning, Young and Tumut. The species' historical distribution extended from Bathurst (central NSW) through the NSW Southern Tablelands, through to central and western Victoria, to Bordertown in eastern South Australia. Occurs in Natural Temperate Grasslands and grassy Box-Gum Woodlands in which groundlayer is dominated by wallaby grasses <i>Austrodanthonia</i> spp. Grasslands dominated by wallaby grasses are typically low and open - the bare ground between the tussocks is thought to be an important microhabitat feature for the Golden Sun Moth, as it is typically these areas on which the females are observed displaying to attract males. Habitat may contain several wallaby grass species, which are typically associated with other grasses particularly spear-grasses <i>Austrostipa</i> spp. or Kangaroo Grass <i>Themeda australis</i> .	0 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
Mammals					
<i>Aepyprymnus rufescens</i> (Rufous Bettong)	V	-	In NSW it has largely vanished from inland areas but there are sporadic, unconfirmed records from the Pilliga and Torrington districts. Rufous Bettongs inhabit a variety of forests from tall, moist eucalypt forest to open woodland, with a tussock grass understorey. A dense cover of tall native grasses is the preferred shelter.	1 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Arctocephalus forsteri</i> (New Zealand Fur-seal)	V	-	Occurs in Australia and New Zealand. Reports of non-breeding animals along southern NSW coast particularly on Montague Island, but also at other isolated locations to north of Sydney. Prefers rocky parts of islands with jumbled terrain and boulders.	28 - BioNet	Low in development footprint. There is no habitat considered suitable for this species. Unlikely to use the Duck River.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Arctocephalus pusillus doriferus</i> (Australian Fur-seal)	V	-	Reported to have bred at Seal Rocks, near Port Stephens and Montague Island in southern NSW. Haul outs are observed at isolated places along the NSW coast. Prefers rocky parts of islands with flat, open terrain. They occupy flatter areas than do New Zealand Fur-seals where they occur together.	30 - BioNet	Low in development footprint. There is no habitat considered suitable for this species. Unlikely to use the Duck River.
<i>Balaenoptera musculus</i> (Blue Whale)	E	E	Oceanic within Southern Hemisphere between 20 degrees to 70 degrees South including NSW waters. Breeds in warm water at low latitudes, preferring open seas rather than coastal waters.	0 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Cercartetus nanus</i> (Eastern Pygmy-possum)	V	-	Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest. Feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes; soft fruits are eaten when flowers are unavailable. Shelters in tree hollows, rotten stumps, holes in the ground, abandoned bird-nests, Ringtail Possum dreys or thickets of vegetation, (e.g. grass-tree skirts); nest-building appears to be restricted to breeding females; tree hollows are favoured but spherical nests have been found under the bark of eucalypts and in shredded bark in tree forks. Important habitat requirements include trees with hollows >2cm, loose bark of eucalypts or accumulations of shredded bark in tree forks for nesting; and associated vegetation types and with an understorey containing heath, banksias or myrtaceous shrubs and soft-fruited plants in rainforests.	115 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Chalinolobus dwyeri</i> (Large-eared Pied Bat)	V	V	Forages over a broad range of open forest and woodland habitats, this species is a cave roosting bat which favours sandstone escarpment habitats for roosting, in the form of shallow overhangs, crevices and caves.	1,149 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Dasyurus maculatus</i> (Spotted-tailed Quoll)	V	E	Wet and dry sclerophyll forests and rainforests, and adjacent open agricultural areas. Generally associated with large expansive areas of habitat to sustain territory size. Requires hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites.	190 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Dugong dugon</i> (Dugong)	E	-	Extends south from warmer coastal and island waters of the Indo-West Pacific to northern NSW, where its known from incidental records only. Major concentrations of Dugongs occur in wide shallow protected bays, wide shallow mangrove channels and in the lee of large inshore islands.	22 – BioNet	Low in development footprint. There is no habitat considered suitable for this species. Unlikely to use the Duck River.
<i>Eubalaena australis</i> (Southern Right Whale)	E	E	Temperate and sub polar waters of the Southern Hemisphere, with a circumpolar distribution between about 20°S and 55°S with some records further south to 63°S. Migrate between summer feeding grounds in Antarctica and winter breeding grounds around the coasts of southern Australia, New Zealand, South Africa and South America.	28 – BioNet	Low in development footprint. There is no habitat considered suitable for this species. Unlikely to use the Duck River.
<i>Falsistrellus tasmaniensis</i> (Eastern False Pipistrelle)	V	-	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.	179 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Isodon obesulus obesulus</i> (Southern Brown Bandicoot)	E	E	This species prefers sandy soils with scrubby vegetation and/or areas with low ground cover that are burn from time to time. A mosaic of post fire vegetation is important for this species.	447 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Kerivoula papuensis</i> (Golden-tipped Bat)	V	-	The Golden-tipped Bat is distributed along the east coast of Australia in scattered locations from Cape York Peninsula in Queensland to south of Eden in southern NSW. It also occurs in New Guinea. Found in rainforest and adjacent wet and dry sclerophyll forest up to 1000m. Also recorded in tall open forest, Casuarina-dominated riparian forest and coastal Melaleuca forests. Roost mainly in rainforest gullies on small first- and second-order streams in usually abandoned hanging Yellow-throated Scrubwren and Brown Gerygone nests modified with an access hole on the underside. Bats may also roost under thick moss on tree trunks, in tree hollows, dense foliage and epiphytes.	3 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Macropus parma</i> (Parma Wallaby)	V	-	Once occurred from north-eastern NSW 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 the Queensland border. Preferred habitat is moist eucalypt forest with thick, shrubby understorey, often with nearby grassy areas, rainforest margins and occasionally drier eucalypt forest. Typically feed at night on grasses and herbs in more open eucalypt forest and the edges of nearby grassy areas.	1 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Megaptera novaeangliae</i> (Humpback Whale)	V	V	Oceanic and coastal waters worldwide. The population of Australia's east coast migrates from summer cold-water feeding grounds in Subantarctic waters to warm-water winter breeding grounds in the central Great Barrier Reef. They are regularly observed in NSW waters in June and July, on northward migration and October and November, on southward migration.	205 – BioNet	Low in development footprint. There is no habitat considered suitable for this species. Unlikely to use the Duck River.
<i>Miniopterus australis</i> (Little Bentwing-bat)	V	-	East coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW. Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.	231 – BioNet	High. This species is assumed to occur in the development site due to the presence of suitable habitats.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Miniopterus schreibersii</i> <i>oceanensis</i> (Eastern Bentwing-bat)	V	-	Occurs on east and north-west coasts of Australia. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other manmade structures.	1,107 – BioNet	High. This species is assumed to occur in the development site due to the presence of suitable habitats.
<i>Mormopterus</i> <i>norfolkensis</i> (Eastern Freetail-bat)	V	-	Occur in dry sclerophyll forest and woodland east of the Great Dividing Range. Roosts mainly in tree hollows but will also roost under bark or in human-made structures.	495 – BioNet	Moderate. Foraging habitat is present and potential roosting habitat is present in the Mangrove forest along Duck Creek.
<i>Myotis macropus</i> (Southern Myotis)	V	-	Roost in groups close to water in caves, mine shafts, hollow-bearing trees, and storm water channels, buildings, under bridges and in dense foliage. Forages over streams and pools catching insects and small fish.	1,101 – BioNet	High. This species is assumed to occur in the development site due to the presence of suitable habitats.
<i>Perameles nasuta</i> (Long-nosed Bandicoot population in inner western Sydney)	EP	-	An endangered population in inner western Sydney. The exact area occupied by the population is not clearly defined, and includes the local government areas (LGA) of Marrickville and Canada Bay, with the likelihood that it also includes Canterbury, Ashfield and Leichhardt LGAs. Future research may better define the population and possibly indicate a wider distribution. This population is disjunct from the nearest records of the Long-nosed Bandicoot, which occur north of the Parramatta River or much further south at Holsworthy Military Reserve. Shelter mostly under older houses and buildings. Forage in parkland and back-yards. There are apparently no large blocks of suitable habitat, likely to support a large source population, on the Cooks River to the south, or along the southern foreshore of Parramatta River and Sydney Harbour to the north.	25 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Perameles nasuta</i> (Long-nosed Bandicoot, North Head)	EP	-	An endangered population restricted to North Head in the Manly Local Government Area.	2,115 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Petauroides volans</i> (Greater Glider)	-	V	The Greater Glider occurs in eucalypt forests and woodlands along the east coast of Australia from north-east Queensland to the Central Highlands of Victoria from sea level to 1200 m altitude. It feeds exclusively on eucalypt buds, flowers and mistletoe and favours forests with a diversity of eucalypt species, due to seasonal variation in its preferred tree species. It roosts in tree hollows, with a particular selection for large hollows in large, old trees. Individuals use multiple hollows and a relatively high abundance of tree hollows (at least 4-8 suitable hollows per hectare) seems to be needed for the species to persist. Individuals occupy relatively small home ranges with an average size of 1 to 3 ha but the species has relatively low persistence in small forest fragments, and disperses poorly across vegetation that is not native forest. Forest patches of at least 160 km ² may be required to maintain viable populations.	114 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Petaurus australis</i> (Yellow-bellied Glider)	V	-	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. Forest type preferences vary with latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south. Feed primarily on plant and insect exudates, including nectar, sap, honeydew and manna with pollen and insects providing protein. Extract sap by incising (or biting into) the trunks and branches of favoured food trees, often leaving a distinctive 'V'-shaped scar.	60 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Petaurus norfolcensis</i> (Squirrel Glider)	V	-	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. Prefers mixed species stands with a shrub or Acacia midstorey.	266 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
Squirrel Glider on Barrenjoey Peninsula, north of Bushrangers Hill	EP	-	Occurs in eastern Australia extending from north-eastern Queensland through eastern NSW and down through northern and central Victoria. The endangered population is within the Pittwater Local Government Area on the Barrenjoey Peninsula, north of Bushrangers Hill.	1 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Petrogale penicillata</i> (Bruch-tailed Rock-wallaby)	E	V	This species prefers rocky habitats, including loose boulder-piles, rocky outcrops, steep rocky slopes, cliffs, gorges and isolated rock stacks. It also utilises tree limbs. While it appears that most Brush-tailed Rock-wallaby colonies are on north-facing slopes and cliff lines, colonies have been found on south-facing cliffs in Kangaroo Valley, in the Macleay River Gorge, in the Warrumbungles and at Mt Kaputar, although usually in lower densities. Rocky outcrops appear crucial to current habitat selection by rock-wallabies, however, vegetation structure and composition is also considered to be an important factor. In many parts of their range, including at the Warrumbungles, rock-wallabies are closely associated with dense arboreal cover, especially fig trees. The vegetation on and below the cliff appear to be important to this species as a source of food and shelter and in some cases may provide some protection from predation. A range of vegetation types are associated with Brush-tailed Rock-wallaby habitat, including dense rainforest, wet sclerophyll forest, vine thicket, dry sclerophyll forest, and open forest.	4 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Phascogale tapoatafa</i> (Brush-tailed Phascogale)	V	-	Patchy distribution around the coast of Australia. Prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Also inhabit heath, swamps, rainforest and wet sclerophyll forest.	1 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Phascolarctos cinereus</i> (Koala) combined populations of Queensland, New South Wales and the Australian Capital Territory	V	V	In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species.	3,773 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
Koala in the Pittwater Local Government Area	EP	-	Endangered population in the Pittwater LGA. Key likely habitats within Pittwater Council are: Swamp Mahogany Forest, ecotone between Spotted Gum Forest & Hawkesbury Sandstone Open-Forest, Northern form of Coastal Sandstone Woodland at Whale Beach, Red Bloodwood - Scribbly Gum Woodland, Bilgola Plateau Forest and the Grey Ironbark - Grey Gum form of the Newport Bangalay Woodland.	89 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Physeter macrocephalus</i> (Sperm Whale)	V	-	Wide, but patchy distribution from the tropics to the edge of the polar pack-ice in both hemispheres. Concentrations of Sperm Whales tend to occur where the seabed rises steeply from a greater depth, beyond the continental shelf.	6 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species. Duck River is not suitable habitat.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Pseudomys gracilicaudatus</i> (Eastern Chestnut Mouse)	V	-	In NSW the Eastern Chestnut Mouse mainly occurs north from the Hawkesbury River area as scattered records along to coast and eastern fall of the Great Dividing Range extending north into Queensland. There are however isolated records in the Jervis bay area. Mostly found, in low numbers, in heathland and is most common in dense, wet heath and swamps. In the tropics it is more an animal of grassy woodlands. Optimal habitat appears to be in vigorously regenerating heathland burnt from 18 months to four years previously. By the time the heath is mature, the larger Swamp Rat becomes dominant, and Eastern Chestnut Mouse numbers drop again.	7 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Pseudomys novaehollandiae</i> (New Holland mouse)	V	-	Distribution is fragmented across all eastern states of Australia, where it inhabits open heath lands, open woodlands with heath understorey and vegetated sand dunes.	105 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Pteropus poliocephalus</i> (Grey-headed Flying-fox)	V	V	Generally found within 200 km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. In times of natural resource shortages, they may be found in unusual locations. Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young.	852 – BioNet	Known to occur. The Grey-headed Flying-fox is known to occur in the Sydney urban area. No camps would be impacted but some foraging habitat is present in the form of street trees and garden plantings notably <i>Corymbia citriodora</i> and species of fruit tree and palm tree.
<i>Saccolaimus flaviventris</i> (Yellow-bellied Sheath-tail-bat)	V	-	Wide-ranging species found across northern and eastern Australia. Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows.	119 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Scoteanax rueppellii</i> (Greater Broad-nosed Bat)	V	-	Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings.	275 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Vespadelus troungtoni</i> (Eastern Cave Bat)	V	-	Found in a broad band on both sides of the Great Dividing Range from Cape York to Kempsey, with records from the New England Tablelands and the upper north coast of NSW. A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals.	7 – BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
Reptiles					
<i>Caretta caretta</i> (Loggerhead Turtle)	E	E, M	In Australia, the Loggerhead Turtle occurs in the waters of coral and rocky reefs, seagrass beds and muddy bays throughout eastern, northern and western Australia. In Australia, Loggerhead Turtles nest on open, sandy beaches. Hatchlings enter the open ocean and begin feeding on small animals. Small Loggerhead Turtles live at or near the surface of the ocean and move with the ocean currents. In eastern Australia, there is evidence that they spend around 15 years or more in the open ocean, with much of their feeding in the top 5 m of water, before recruiting to their chosen inshore or neritic feeding area. Loggerhead Turtles choose a wide variety of tidal and sub-tidal habitat as feeding areas. Loggerhead Turtles show fidelity to both their foraging and breeding areas. When ready for breeding, mature turtles migrate to their chosen breeding area. Nesting females stay within an "internesting area" during their nesting period. Once breeding and nesting is complete, turtles return to their favoured foraging areas.	20 – BioNet	Low in development footprint. There is no habitat considered suitable for this species. Unlikely to use the Duck River.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Chelonia mydas</i> (Green Turtle)	V	V, M	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. Carnivorous when young but as adults they feed only on marine plant material.	44 – BioNet	Low in development footprint. There is no habitat considered suitable for this species. Unlikely to use the Duck River.
<i>Dermochelys coriacea</i> (Leatherback Turtle)	E	E, M	Throughout the world's tropical and temperate seas and in all coastal waters of Australia. Most sightings are in temperate waters. 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.	8 - BioNet	Low in development footprint. There is no habitat considered suitable for this species. Unlikely to use the Duck River.
<i>Eretmochelys imbricata</i> (Hawksbill Turtle)	-	V	Hawksbill Turtles spend their first five to ten years drifting on ocean currents. During this pelagic (ocean-going) phase, they are often found in association with rafts of Sargassum (a floating marine plant that is also carried by currents). Once Hawksbill Turtles reach 30 to 40 cm curved carapace length, they settle and forage in tropical tidal and sub-tidal coral and rocky reef habitat. They primarily feed on sponges and algae. They have also been found, though less frequently, within seagrass habitats of coastal waters, as well as the deeper habitats of trawl fisheries. Hawksbill Turtles have been seen in temperate regions as far south as northern NSW.	9 - BioNet	Low in development footprint. There is no habitat considered suitable for this species. Unlikely to use the Duck River.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Eulamprus leuraensis</i> (Blue Mountains Water skink)	E	E	Restricted to the middle and upper Blue Mountains west of Sydney, the Blue Mountains Water Skink is known from less than 40 locations extending from Newnes Plateau in the north-west to just south of Hazelbrook in the south-east. Each local population is also genetically distinct, even from populations less than 0.5 km away. Dispersal between populations appears to be very rare and appears to involve mostly males. The Blue Mountains Water Skink occurs at high elevations between 560 m and 1060 m. It is restricted to an isolated and naturally fragmented habitat of sedge and shrub swamps that have boggy soils and appear to be permanently wet. The vegetation in these swamps typically takes the form of a sedgeland interspersed with shrubs, but may occur as a dense shrub thicket.	1 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.
<i>Hoplocephalus bungaroides</i> (Broad-headed Snake)	V	V	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 hollows in large trees within 200 m of escarpments in summer.	126 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Natator depressus</i> (Flatback Turtle)	-	V	Post-hatchling and juvenile Flatback Turtles do not have the wide dispersal phase in the oceanic environment like other sea turtles. Adults inhabit soft bottom habitat over the continental shelf of northern Australia, extending into Papua New Guinea and Irian Jaya although the extent of their range is not fully known. Capture locations from trawlers indicate that Flatback Turtles feed in turbid, shallow inshore waters north of latitude 25° S in depths from less than 10 m to depths of over 40 m. Nesting habitat includes sandy beaches in the tropics and subtropics with sand temperatures between 25 °C and 33 °C at nest depth. Hatchling to subadult Flatback Turtles lack a pelagic life stage and reside in the Australian continental shelf. Flatback Turtles require sandy beaches to nest. Sand temperatures between 25 °C and 33 °C are needed for successful incubation. Beaches free from light pollution are required to prevent disorientation, disturbance, and to allow nesting females to come ashore.	0 - BioNet	Low in development footprint. There is no habitat considered suitable for this species. Unlikely to use the Duck River.
<i>Varanus rosenbergi</i> (Heath Monitor, Rosenberg's Goanna)	V	-	Rosenberg's Goanna occurs on the Sydney Sandstone in Wollemi National Park to the north-west of Sydney, in the Goulburn and ACT regions and near Cooma in the south. There are records from the South West Slopes near Khancoban and Tooma River. Also occurs in South Australia and Western Australia. Found in heath, open forest and woodland. Associated with termites, the mounds of which this species nests in; termite mounds are a critical habitat component. Shelters in hollow logs, rock crevices and in burrows, which they may dig for themselves, or they may use other species' burrows, such as rabbit warrens.	299 - BioNet	Low in development footprint. There is no habitat in the development site considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
Fish					
<i>Epinephelus daemeli</i> (Black Rockcod)	V	V	In Australia, the distribution of black cod ranges from southern Queensland through NSW to northern Victoria. However, records from Queensland and Victoria are rare, and the single specimen recorded from South Australian waters is considered a vagrant. The NSW coastline forms the species' main range, both in Australia and internationally. Black cod are known to occur to some degree in all six NSW Marine Parks – Lord Howe, Cape Byron, Solitary Island, Port Stephens, Jervis Bay and Batemans Bay. Preliminary research based on small sample sizes suggests these populations may be genetically connected to one another and to the NSW coastline populations, presumably through the very small larvae drifting in ocean currents. Black cod generally inhabit near-shore rocky and offshore coral reefs at depths down to 50 m. In coastal waters adult black cod are found in rock caves, rock gutters and on rock reefs. Black cod are an aggressive, territorial species and individuals may occupy one particular cave for most of their adult life. Recently settled juvenile black cod (i.e. individuals that have recently completed the pelagic, drifting larval stage) are often found in coastal rock pools while slightly older juvenile black cod are often found in estuary systems. The use of estuaries may be an important part of the ecology of juvenile black cod, at least in NSW waters.	0	Low in development footprint Moderate chance of this species using the harbour areas to be tunnelled under however no direct or indirect impacts to this species are predicted.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Macquaria australasica</i> (Macquarie Perch)	E	E	Macquarie Perch have declined considerably from their historical distribution within NSW and they are now considered isolated to the upper reaches of the Lachlan and Murrumbidgee Rivers in southern NSW. It is also found in low numbers in the Mongarlowe River, where the population is considered likely to be the result of a translocation from the Murray-Darling Basin. Other populations exist in Cataract Dam in the Nepean River catchment, as well as a 2008 record from Georges River near Campbelltown, the first record from the river since 1894. It persists in the Burrinjuck, Cotter (Murrumbidgee) and Wyangala impoundments. A breeding population in the Queanbeyan River upstream of the Googong Reservoir exists solely due to a translocation of individuals from the reservoir past a natural barrier. The Googong reservoir population is believed to be effectively extinct. Macquarie perch may occasionally become displaced downstream from the Queanbeyan River into Googong, but they do not form a population in the reservoir. The New South Wales Rivers Survey (1994–1996) demonstrated that the Macquarie Perch was present only in low numbers at three sites in streams above Lake Wyangala and Burrinjuck Dam. Hawkesbury and Shoalhaven River populations, including in large impoundments, seem abundant and generally occur upstream of Australian Bass (<i>Macquaria novemaculata</i>) populations. The Macquarie Perch is a riverine, schooling species. It prefers clear water and deep, rocky holes with lots of cover. As well as aquatic vegetation, additional cover may comprise of large boulders, debris and overhanging banks. Spawning occurs just above riffles (shallow running water). Populations may survive in impoundments if able to access suitable spawning sites.	0	Low in development footprint. There is no habitat considered suitable for this species. Unlikely to use the Duck River.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Prototroctes maraena</i> (Australian Grayling)	E	V	The Australian Grayling is diadromous, spending part of its lifecycle in freshwater and at least part of the larval and/or juvenile stages in coastal seas. Adults (including pre spawning and spawning adults) inhabit cool, clear, freshwater streams with gravel substrate and areas alternating between pools and riffle zones such as the Tambo River, which is also known to have granite outcrops. The species has also been associated with clear, gravel-bottomed habitats in the Mitchell and Wonnangatta Rivers (Victoria) and in a muddy-bottomed, heavily silted habitat in the Tarwin River (Victoria). The species has been found over 100 km upstream from the sea	0	Low in development footprint. There is no habitat considered suitable for this species. Unlikely to use the Duck River or harbour areas to be tunnelled under.
Elasmobranchs					
<i>Carcharias taurus</i> (Grey Nurse Shark)	CE	CE	In NSW, aggregations of Grey Nurse Sharks (east coast population) can be found at reefs off the following locations: Byron Bay, Brooms Head, Solitary Islands, South West Rocks, Laurieton, Forster, Seal Rocks, Port Stephens, Sydney, Bateman's Bay, Narooma and Montague Island. These sites may play an important role in pupping and/or mating activities, as Grey Nurse Sharks (east coast population) form regular aggregations at these sites. Grey nurse sharks are found primarily in warm temperate (from subtropical to cool temperate) inshore waters around rocky reefs and islands, in or near deep sandy-bottomed gutters or rocky caves, and occasionally in the surf zone and shallow bays. They are often observed hovering motionless just above the seabed. They have been recorded at varying depths down to 230 m on the continental shelf but are most commonly found between 15–40 m. They generally occur either alone or in small to medium sized groups, usually of fewer than 20 sharks. When observed alone they are thought to be moving between aggregation sites.	0	Low in development footprint Moderate chance of this species using the harbour areas to be tunnelled under but no impact is expected.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Carcharodon carcharias</i> (White Shark, Great White Shark)	V	V, M	Great White Sharks can be found from close inshore around rocky reefs, surf beaches and shallow coastal bays to outer continental shelf and slope areas. They also make open ocean excursions and can cross ocean basins (for instance from South Africa to the western coast of Australia and from the eastern coast of Australia to New Zealand). Great White Sharks are often found in regions with high prey density, such as pinniped colonies.	0	Low in development footprint Moderate chance of this species using the harbour areas to be tunnelled under but no impact is expected.
<i>Lamna nasus</i> (Porbeagle Shark)	-	M	The Porbeagle primarily inhabits oceanic waters and areas around the edge of the continental shelf. They occasionally move into coastal waters, but these movements are temporary. The Porbeagle utilises a broad vertical range of the water column and is known to dive to depths exceeding 1,300 m. The Porbeagle is thought to be reasonably flexible in the types of habitat used for foraging. The surface temperatures of waters inhabited by the Porbeagle typically range from 8-20° C; however, the species has been captured in water temperatures between 2-23° C. It is noted that the Lamna genus is the most cold-adapted of the Lamnidae family and that they are able to access and exploit foraging habitats that are unsuitable for ectothermic predators.	0	Low in development footprint. There is no habitat considered suitable for this species. Unlikely to use the Duck River.
<i>Mobula alfredi</i> (Reef Manta Ray)	-	M	Commonly sighted inshore, but also found around offshore coral reefs, rocky reefs and seamounts. Long-term sighting records of the Reef Manta Ray at established aggregation sites suggest that this species is more resident to tropical waters and may exhibit smaller home ranges, philopatric movement patterns and shorter seasonal migrations than the Giant Manta Ray. Residency is thought to be related to areas of high primary productivity (e.g., upwelling events), which may vary in time and space. Site fidelity to specific areas may also vary by sex and age-class. Seasonal migrations in this species likely correspond with cycles in productivity.	0	Low in development footprint. There is no habitat considered suitable for this species. Unlikely to use the Duck River.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Mobula birostris</i> (Giant Manta Ray)	-	M	The Giant Manta Ray occurs in tropical, sub-tropical and temperate waters of the Atlantic, Pacific and Indian Oceans. Commonly sighted along productive coastlines with regular upwelling, oceanic island groups and particularly offshore pinnacles and seamounts. The Giant Manta Ray is commonly encountered on shallow reefs while being cleaned or is sighted feeding at the surface inshore and offshore. It is also occasionally observed in sandy bottom areas and seagrass beds.	0	Low in development footprint. There is no habitat considered suitable for this species. Unlikely to use the Duck River.

Distribution and habitat requirement information adapted from: Australian Government Department of the Environment <http://www.environment.gov.au/biodiversity/threatened/index.html> NSW Office of Environment and Heritage <http://www.environment.nsw.gov.au/threatenedspecies/> and IUCN red list <https://www.iucnredlist.org/>.

Key:

CE = critically endangered

E = endangered

V = vulnerable

M = migratory

Appendix B. Floristic survey composition and structure data

A'Becketts Creek				Covers	Native	Trees	Shrubs	Grass	Forb	Fern	Other	Exotic	HighThreat
Species	Cover	Abundance		# spp	Count	Count	Count	Count	Count	Count	Count	Count	Count
				16	3	1	0	0	1	1	0	13	7
				Sum cover	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Sum
				73.8	25.2	25	0	0	0.1	0.1	0	48.6	46
<i>Ricinus communis</i>	0.2	10	HT										0.2
<i>Tropaeolum majus</i>	2	100	EX									2	
<i>Avicennia marina</i>	25	20	TG			25							
<i>Malva parviflora</i>	0.1	10	EX									0.1	
<i>Galinsoga parviflora</i>	0.1	1	EX									0.1	
<i>Cardiospermum grandiflorum</i>	40	100	HT										40
<i>Parietaria judaica</i>	0.1	10	EX									0.1	
<i>Lantana camara</i>	0.1	1	HT										0.1
<i>Cestrum parqui</i>	0.4	10	HT										0.4
<i>Morus alba</i>	0.2	2	EX									0.2	
<i>Ageratina adenophora</i>	0.2	10	HT										0.2
<i>Ludwigia peploides</i>	0.1	20	FG						0.1				
<i>Rumex crispus</i>	0.1	10	EX									0.1	
<i>Asparagus scandens</i>	0.1	1	HT										0.1
<i>Cinnamomum camphora</i>	5	1	HT										5
<i>Nephrolepis cordifolia</i>	0.1	100	EG							0.1			

Duck Creek

Species	Cover	Abundance	Covers	Native	Trees	Shrubs	Grass	Forb	Fern	Other	Exotic	HighThreat
			# spp	Count	Count	Count	Count	Count	Count	Count	Count	Count
			20	6	4	1	0	1	0	0	14	10
			Sum cover	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Sum
			152.7	27.9	27.2	0.2	0	0.5	0	0	124.8	112.7
<i>Ricinus communis</i>	5	20	HT									5
<i>Ipomoea indica</i>	40	100	HT									40
<i>Cardiospermum grandiflorum</i>	40	100	HT									40
<i>Acetosa sagittata</i>	10	100	HT									10
<i>Erythrina crista-galli</i>	0.5	3	HT									0.5
<i>Anredera cordifolia</i>	5	10	HT									5
<i>Sonchus oleraceus</i>	1	10	EX								1	
<i>Lactuca serriola</i>	1	10	EX								1	
<i>Ageratina adenophora</i>	2	100	HT									2
<i>Commelina cyanea</i>	0.5	100	FG					0.5				
<i>Avicennia marina</i>	2	10	TG		2							
<i>Phyllostachys spp.</i>	5	100	HT									5
<i>Eucalyptus robusta</i>	20	3	TG		20							
<i>Populus alba</i>	5	3	HT									5
<i>Eucalyptus saligna</i>	5	2	TG		5							
<i>Morus alba</i>	10	10	EX								10	
<i>Casuarina glauca</i>	0.2	1	TG		0.2							
<i>Callistemon salignus</i>	0.2	2	SG			0.2						
<i>Parietaria judaica</i>	0.1	1	EX								0.1	
<i>Arundo donax</i>	0.2	1	HT									0.2

Westmead Station

Species	Cover	Abundance	Covers	Native	Trees	Shrubs	Grass	Forb	Fern	Other	Exotic	HighThreat
			# spp	Count	Count	Count	Count	Count	Count	Count	Count	Count
			25	20	6	10	3	1	0	0	5	2
			Sum cover	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Sum
			22.2	16.5	6.7	2.6	6.2	1	0	0	5.7	2.5
<i>Angophora floribunda</i>	1	1	TG		1							
<i>Acacia falcata</i>	0.1	2	SG			0.1						
<i>Acacia parramattensis</i>	0.1	1	TG		0.1							
<i>Bursaria spinosa</i>	0.5	10	SG			0.5						
<i>Cenchrus purpurascens</i>	0.2	10	GG				0.2					
<i>Lomandra longifolia</i>	5	50	GG				5					
<i>Eucalyptus tereticornis</i>	5	1	TG		5							
<i>Callistemon salignus</i>	0.2	1	SG			0.2						
<i>Themeda triandra</i>	1	20	GG				1					
<i>Senna pendula</i>	2	10	HT									2
<i>Tristanopsis laurina</i>	0.2	1	TG		0.2							
<i>Bidens pilosa</i>	0.2	100	EX								0.2	
<i>Westringia fruticosa</i>	0.5	5	SG			0.5						
<i>Dodonaea triquetra</i>	0.5	10	SG			0.5						
<i>Callistemon spp.</i>	0.2	1	SG			0.2						
<i>Indigofera australis</i>	0.1	2	SG			0.1						
<i>Cinnamomum camphora</i>	0.5	1	HT									0.5
<i>Grevillea spp.</i>	0.2	1	SG			0.2						
<i>Banksia marginata</i>	0.1	1	SG			0.1						
<i>Jacaranda mimosifolia</i>	2	2	EX								2	
<i>Murraya paniculata</i>	1	10	EX								1	
<i>Dianella caerulea</i>	1	10	FG					1				

Appendix C. Vegetation integrity assessment plot data

Table C-1: Vegetation integrity assessment plot data for vegetation zones in the South East Highlands bioregion

funHighThreat	funTreeRegen	funTreeStem5	funTreeStem3	funTreeStem2	funTreeStem1	funTreeStem5	funLenFallenL	funLitterCover	funHollowtree	funLargeTrees	strucOther	strucFerns	strucForbs	strucGrass	strucShrub	strucTree	compOther	compFerns	compForbs	compGrass	compShrub	compTree	bearing	northing	easting	zone	Condition	Patch size	Area	PCT	plot
45	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0.1	0.1	0	0	25	0	1	1	0	0	1	90	6254947	316858	56	Poor	62	0.15	920	PCT 920 – Plot A'Beckett's Creek
100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0	0.5	0	0.2	27.2	0	0	1	0	1	4	10	6254874	316984	56	Poor	62	0.15	920	PCT 920 – Plot Duck Creek
2.5	0	0	0	1	1	0	0	21	0	0	0	0	1	6.2	2.6	6.7	0	0	1	3	10	6	102	6257255	313694	56	Poor	0	0.03	849	PCT 849 – Plot Westmead Station

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Appendix D. EPBC Act significance assessments

Assessment of significance have been conducted for threatened species, populations and communities that were recorded in the development site during field surveys or were identified as having a moderate or higher potential to occur in the development site based on the presence of habitat. For threatened biodiversity listed under the EPBC Act, significance assessments have been completed in accordance with the EPBC Act Policy Statement 1.1 Significant Impact Guidelines (Department of Environment, 2013). Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment that is affected, and upon the intensity, duration, magnitude and geographic extent of the impacts (Department of Environment, 2013). Importantly, for a 'significant impact' to be 'likely', it is not necessary for a significant impact to have a greater than 50 per cent chance of happening; it is sufficient if a significant impact on the environment is a real or not a remote chance or possibility (Department of Environment, 2013). This advice has been considered while undertaking the assessments.

The EPBC Act listed species subject to this assessment include:

- Grey-headed Flying-fox
- Swift Parrot.

When assessing Vulnerable species, the assessment centres around whether the population that would be impacted is an 'important population' or not. An 'important population' is a population that is necessary for a species' long-term survival and recovery (Department of Environment, 2013). 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.

This definition of what constitutes an 'important population' has guided the assessments for Vulnerable species.

The direct impact of Stage 1 is summarised below in Table D-1. The PCT that would be impacted provides potential habitat for the Grey-headed Flying-fox.

Table D-1: Summary of direct impact to EPBC Act listed threatened species habitat (native vegetation) within the development site

Species	Plant community type name	Area (ha) in development site
Grey-headed Flying-fox	Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	0.15

Planted vegetation would also be impacted and these trees may provide foraging habitat for the Grey-headed Flying-fox and Swift Parrot but the impact is not considered to be of a magnitude that is likely to result in a significant impact to these species.

D.1.1 Grey-headed Flying-fox

The Grey-headed Flying-fox (*Pteropus poliocephalus*) is known to forage widely throughout the Sydney urban area and a camp is located along the Parramatta River in Parramatta Park within proximity to the Stage 1 alignment. This species is considered likely to occur throughout the development site based on the presence of suitable foraging habitat. The Grey-headed Flying-fox exists as a single interconnected population in Australia. As such, it is considered an important population.

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

1) lead to a long-term decrease in the size of an important population of a species

There would be no direct impact to the Parramatta Park roost camp so no direct impacts to a known permanent roosting, breeding / maternity site would occur. The tunnels underneath Parramatta Park are unlikely to affect the Parramatta Park camp. Therefore, it is likely that the impacts of Stage 1 would be confined to loss of feeding habitat caused by direct clearing or damage to PCTs and planted trees during the construction. However, this loss of foraging habitat would be negligible and unlikely to affect breeding success given the extent of similar habitat in the Sydney area and the wide-ranging nature of Grey-headed Flying-fox foraging movements. Stage 1 is considered unlikely to lead to a long-term decrease in the size of an important population of the Grey-headed Flying-fox.

2) reduce the area of occupancy of an important population

The area of occupancy of the Grey-headed Flying-fox is not known but the species exists as one interconnected population along the eastern Australian coastal belt from Rockhampton in central Queensland to Melbourne in Victoria. The area occupied by this species would remain the same after construction. No impact to area of occupancy is expected.

3) fragment an existing important population into two or more populations

The Grey-headed Flying-fox is particularly well adapted to accessing widely spaced habitat resources given its mobility and preference for seasonal fruits and blossom in differing parts of the landscape. Stage 1 would not fragment an important population of the Grey-headed Flying-fox. Individuals would still be able to disperse between roosts along the east Australian coast.

4) adversely affect habitat critical to the survival of a species

The draft recovery plan for the Grey-headed Flying-fox identifies critical habitat for this species as:

- Productive during winter and spring, when food bottlenecks have been identified
- Known to support populations of greater than 30,000 individuals, within an area of 50 kilometre radius of a camp site
- Productive during the final weeks of gestation, and during the weeks of birth, lactation and conception (Sept-May)
- Productive during the final stages of fruit development and ripening in commercial crops affected by Grey-headed Flying-foxes
- Known to be continuously occupied as a camp site.

Critical roosting habitat is present in the Parramatta Park camp. However, there would be no direct impacts to the camp as the tunnels would be about 40 metres below Parramatta Park. The foraging habitat to be impacted by Stage 1 is a small area of mangrove dominated PCTs and planted vegetation and does not constitute critical foraging habitat given the relative widespread nature of similar, and higher quality, vegetation in the locality and abundance of higher quality foraging habitat within the feeding range of regional populations. As such, Stage 1 is not expected to adversely affect foraging habitat critical to the survival of this species.

5) disrupt the breeding cycle of an important population

Critical roosting and breeding habitat is present in the Parramatta Park camp. However, there would be no direct impacts to the camp as the tunnels would be below Parramatta Park. There would be a negligible impact on foraging habitat that may be used during the breeding cycle of the species but a disruption to the breeding cycle of the Grey-headed Flying-fox is not likely.

6) modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The Grey-headed Flying-fox can cover large areas of its range seeking suitable flowering eucalypts and fruits for foraging. The species is likely to utilise trees in the area impacted by Stage 1 for foraging intermittently when no other suitable resources are available. The impact to foraging habitat from Stage 1 would be negligible and Stage 1 is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of foraging habitat to the extent that the species is likely to decline.

Critical roosting and breeding habitat is present in the Parramatta Park camp. However, there would be no direct impacts to the camp as the tunnels would be at depth below Parramatta Park, so the availability and quality of the habitat would remain.

7) result in invasive species that are harmful to a vulnerable species becoming established in the Vulnerable species' habitat

Stage 1 is unlikely to result in an invasive species harmful to the Grey-headed Flying-fox becoming established in the habitat. Weeds are already well established in the habitat. The management of invasive species would be managed under the construction environmental management plan using best practice methods.

8) introduce disease that may cause the species to decline, or

There are no known disease issues affecting this species in relation to the project. Stage 1 would be unlikely to increase the potential for significant disease vectors to affect local populations.

9) interfere substantially with the recovery of the species.

The Draft National Recovery Plan for the Grey-headed Flying-fox (*Pteropus poliocephalus*) outlines the following actions:

- Identify and protect foraging habitat critical to the survival of Grey-headed Flying-foxes across their range
- Enhance winter and spring foraging habitat for Grey-headed Flying-foxes
- Identify, protect and enhance roosting habitat critical to the survival of Grey-headed Flying-foxes
- Significantly reduce levels of deliberate Grey-headed Flying-fox destruction associated with commercial horticulture
- Provide information and advice to managers, community groups and members of the public that are involved with controversial flying-fox camps
- Produce and circulate educational resources to improve public attitudes toward Grey-headed Flying-foxes, promote the recovery program to the wider community and encourage participation in recovery actions
- Monitor population trends for the Grey-headed Flying-fox
- Assess the impacts on Grey-headed Flying-foxes of electrocution on powerlines and entanglement in netting and barbed wire, and implement strategies to reduce these impacts
- Oversee a program of research to improve knowledge of the demographics and population structure of the Grey-headed Flying-fox
- Maintain a National Recovery Team to oversee the implementation of the Grey-headed Flying-fox National Recovery Plan.

The recovery actions listed above are largely not applicable to Stage 1. Stage 1 is not expected to interfere substantially with the recovery of the species.

Conclusion

The Grey-headed Flying-fox would suffer a negligible reduction in extent of suitable foraging habitat from Stage 1. No breeding camps or other important habitat would be directly impacted. Stage 1 is unlikely to reduce the population size of the Grey-headed Flying-fox or decrease the reproductive success of this species. Stage 1 would not interfere with the recovery of the Grey-headed Flying-fox.

After consideration of the factors above, an overall conclusion has been made that Stage 1 is unlikely to result in a significant impact to the Grey-headed Flying-fox and a referral for biodiversity matters is not necessary.

D.1.2 Swift Parrot

The Swift Parrot (*Lathamus discolor*) is considered moderately likely to occur based on the presence of suitable winter foraging habitat. This species is known to sporadically occur within and move through the Sydney urban area while on mainland Australia during winter. It is known to forage in street trees and park and garden plantings.

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

1) lead to a long-term decrease in the size of a population

The area impacted by Stage 1 contains some potential foraging habitat for the Swift Parrot in the form of planted trees. While the habitat in the area impacted by Stage 1 is not optimal, the loss of potential feed trees would directly affect the species opportunity to feed in the area. However, the area impacted by Stage 1 is not considered a critical area for the Swift Parrot.

The Swift Parrot may utilise trees in the area impacted by Stage 1 for foraging intermittently when no other suitable inland (i.e. box ironbark woodlands) or coastal resources (i.e. Spotted Gum and Swamp Mahogany forests) are available or opportunistically while moving through the Sydney urban area. Stage 1 would remove a small amount of potential foraging habitat for this species, but the impact will be negligible considering that no high-quality natural foraging habitat for the Swift Parrot will be impacted and the extent of resources in the urban environment that will remain.

The Swift Parrot does not breed in the area impacted by Stage 1 and the extent of habitat remaining in the area impacted by the Project would provide sufficient resources to sustain future visitation, such that Stage 1 is unlikely to lead to a long-term decrease in the size of the Australian population.

2) reduce the area of occupancy of the species

As a specialist nectarivore dependent on flowering eucalypts, Swift Parrots are vulnerable to the loss of quantity and quality of key forage tree species. As a large-scale migrant, it has the ability to cover vast areas of its winter range, seeking suitable flowering eucalypt habitat. The species is an occasional visitor to the Sydney urban area and may utilise trees in the area impacted by Stage 1 for foraging intermittently when no other suitable resources are available.

Stage 1 would contribute to the loss of a small amount of marginal potential foraging habitat which would result in a negligible reduction in foraging habitat available. However, Stage 1 would not reduce the area of occupancy of this species which is estimated at 4,000 square kilometres.

3) fragment an existing population into two or more populations

Importantly, Stage 1 would not result in fragmentation of habitat for the Swift Parrot. This species is highly mobile and as a regular behaviour flies long distances over open areas to move between suitable foraging

habitats. Stage 1 would not affect the movement of the Swift Parrot between habitat patches or fragment the population.

4) adversely affect habitat critical to the survival of a species

Key habitats for this species on the coast and coastal plains of New South Wales include large stands of Spotted Gum (*Corymbia maculata*), Swamp Mahogany (*Eucalyptus robusta*), Red Bloodwood (*Corymbia gummifera*) and Forest Red Gum (*Eucalyptus tereticornis*) forests. The area impacted by the Project contains planted eucalypts including *Corymbia maculata* and *Eucalyptus robusta* constituting suitable albeit marginal foraging habitat for this species. The habitat within the area impacted by Stage 1 is not a primary habitat or of critical importance to the survival of this species as it consists of a small number of planted trees that are likely to only be visited on rare occasion by birds passing through on route to larger higher quality habitats on the coast. There would be no impact to habitat critical to the survival of the Swift Parrot.

5) disrupt the breeding cycle of a population

The Swift Parrot is endemic to south-eastern Australia and breeds only in Tasmania. This species migrates to mainland Australia in autumn. As such, Stage 1 would not impact on breeding habitat for this species. Important winter foraging grounds will not be impacted so there would be negligible impact on the life cycle of this species.

6) modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

As a large-scale migrant, the species can cover vast areas of its winter range, seeking suitable flowering eucalypt habitat. The species is an occasional visitor to the region and may utilise trees in the area impacted by Stage 1 for foraging intermittently when no other suitable resources are available. The impact to foraging habitat from Stage 1 would be negligible and Stage 1 is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

7) result in invasive species that are harmful to a Critically Endangered or Endangered species becoming established in the Endangered or Critically Endangered species' habitat

The main invasive species harmful to the habitat for the swift parrot in NSW are weeds. Additionally, Noisy Miners and Bell Miners may make the habitat less suitable for the Swift Parrot due to competitive exclusion. Stage 1 may result in weed invasion and the removal of habitat may increase competition for food resources, but this impact is considered to be negligible given the context of the habitat in the Sydney urban area. Consequently, Stage 1 is unlikely to result in any further invasive species becoming established in the habitat.

8) introduce disease that may cause the species to decline, or

Infection of native plants by *Phytophthora cinnamomi* has been identified as being spread by construction machinery. This water-borne mould infects the roots of plants and has the potential to cause dieback. It is the intention to use current best practice hygiene protocols as part of a construction environmental management plan to prevent the introduction or spread of pathogens. Mitigation and environmental management procedures for Stage 1 would include guidance for preventing the introduction and/or spread of disease-causing agents such as bacteria and fungi.

9) interfere with the recovery of the species.

The *National Recovery Plan for the Swift Parrot* identifies the following actions for recovery of this species:

- Identify the extent and quality of habitat
- Manage and protect Swift Parrot habitat at the landscape scale
- Monitor and manage the impact of collisions, competition and disease
- Monitor population and habitat.

The recovery actions listed above to help recover the Swift Parrot are largely not applicable to Stage 1. Stage 1 would not interfere with the recovery of the Swift Parrot.

Conclusion

There would be a small reduction in extent of planted foraging habitat for the Swift Parrot from Stage 1. Stage 1 is unlikely to reduce the population size of the Swift Parrot or decrease the reproductive success of this species. Stage 1 would not interfere with the recovery of the Swift Parrot. After consideration of the factors above, an overall conclusion has been made that Stage 1 is unlikely to result in a significant impact to the Swift Parrot and a referral is not required.

Appendix E. Biodiversity credit report

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BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00015222/BAAS17060/19/00015225	Sydney Metro West	26/11/2019
Assessor Name	Report Created	BAM Data version *
Lukas Clews	04/12/2019	22
Assessor Number	BAM Case Status	Date Finalised
BAAS17060	Open	To be finalised
Assessment Revision	Assessment Type	
0	Major Projects	

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

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

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAIL	Ecosystem credits
Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion								
2	849_Poor	11.4	0.0	0.25	High Sensitivity to Potential Gain	2.50	TRUE	0
							Subtotal	0



BAM Credit Summary Report

Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion						
1	920_Poor	34.6	0.2	0.25	High Sensitivity to Potential Gain	2.00
						3
						Subtotal
						3
						Total
						3

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Potential SAIL	Species credits
<i>Myotis macropus / Southern Myotis (Fauna)</i>						
920_Poor	34.6	0.15	0.25	2	False	3
						Subtotal
						3

Appendix F. Protected Matters Search Tool Report

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EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 05/12/19 07:15:20

[Summary](#)

[Details](#)

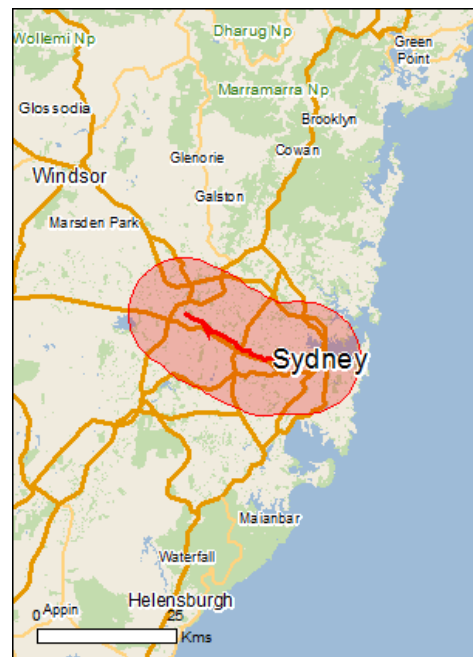
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

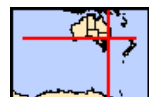
[Acknowledgements](#)



This map may contain data which are
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[Coordinates](#)

Buffer: 10.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties:	8
National Heritage Places:	9
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	12
Listed Threatened Species:	96
Listed Migratory Species:	78

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	69
Commonwealth Heritage Places:	68
Listed Marine Species:	105
Whales and Other Cetaceans:	11
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	7
Regional Forest Agreements:	None
Invasive Species:	53
Nationally Important Wetlands:	4
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

World Heritage Properties		[Resource Information]
Name	State	Status
Australian Convict Sites (Cockatoo Island Convict Site Buffer Zone)	NSW	Buffer zone
Australian Convict Sites (Hyde Park Barracks Buffer Zone)	NSW	Buffer zone
Australian Convict Sites (Old Government House and Domain Buffer Zone)	NSW	Buffer zone
Sydney Opera House - Buffer Zone	NSW	Buffer zone
Australian Convict Sites (Cockatoo Island Convict Site)	NSW	Declared property
Australian Convict Sites (Hyde Park Barracks)	NSW	Declared property
Australian Convict Sites (Old Government House and Domain)	NSW	Declared property
Sydney Opera House	NSW	Declared property

National Heritage Properties		[Resource Information]
Name	State	Status
Indigenous		
Cyprus Hellene Club - Australian Hall	NSW	Listed place
Historic		
Centennial Park	NSW	Listed place
Cockatoo Island	NSW	Listed place
First Government House Site	NSW	Listed place
Hyde Park Barracks	NSW	Listed place
Old Government House and the Government Domain	NSW	Listed place
Parramatta Female Factory and Institutions Precinct	NSW	Listed place
Sydney Harbour Bridge	NSW	Listed place
Sydney Opera House	NSW	Listed place

Wetlands of International Importance (Ramsar)		[Resource Information]
Name	Proximity	
Towra point nature reserve	Within 10km of Ramsar	

Listed Threatened Ecological Communities	[Resource Information]
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For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Blue Gum High Forest of the Sydney Basin Bioregion	Critically Endangered	Community likely to occur within area
Castlereagh Scribbly Gum and Agnes Banks Woodlands of the Sydney Basin Bioregion	Endangered	Community likely to occur within area
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	Endangered	Community likely to occur within area
Coastal Upland Swamps in the Sydney Basin Bioregion	Endangered	Community likely to occur within area
Cooks River/Castlereagh Ironbark Forest of the Sydney Basin Bioregion	Critically Endangered	Community likely to occur within area
Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest	Critically Endangered	Community likely to occur within area
Eastern Suburbs Banksia Scrub of the Sydney Region	Endangered	Community likely to occur within area
Posidonia australis seagrass meadows of the Manning-Hawkesbury ecoregion	Endangered	Community likely to occur within area
Shale Sandstone Transition Forest of the Sydney Basin Bioregion	Critically Endangered	Community likely to occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area
Turpentine-Ironbark Forest of the Sydney Basin	Critically Endangered	Community likely to occur

Name	Status	Type of Presence
Bioregion Western Sydney Dry Rainforest and Moist Woodland on Shale	Critically Endangered	within area Community likely to occur within area
Listed Threatened Species	[Resource Information]	
Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Foraging, feeding or related behaviour known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Foraging, feeding or related behaviour known to occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat known to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Diomedea antipodensis gibsoni Gibson's Albatross [82270]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour known to occur within area
Fregetta grallaria grallaria White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area

Name	Status	Type of Presence
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area
Pterodroma leucoptera leucoptera Gould's Petrel, Australian Gould's Petrel [26033]	Endangered	Species or species habitat may occur within area
Pterodroma neglecta neglecta Kermadec Petrel (western) [64450]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat known to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta cauta Shy Albatross [82345]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis rubricollis Hooded Plover (eastern) [66726]	Vulnerable	Species or species habitat known to occur within area
Fish		
Epinephelus daemeli Black Rockcod, Black Cod, Saddled Rockcod [68449]	Vulnerable	Species or species habitat likely to occur within area
Macquaria australasica Macquarie Perch [66632]	Endangered	Species or species habitat may occur within area
Prototroctes maraena Australian Grayling [26179]	Vulnerable	Species or species habitat likely to occur within area
Frogs		
Heleioporus australiacus Giant Burrowing Frog [1973]	Vulnerable	Species or species habitat likely to occur within area
Litoria aurea Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat known to occur within area
Litoria raniformis Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog [1828]	Vulnerable	Species or species habitat may occur within area
Mixophyes balbus Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat likely to occur within area
Insects		
Synemon plana Golden Sun Moth [25234]	Critically Endangered	Species or species habitat known to occur within area
Mammals		
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat known to occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Isoodon obesulus obesulus Southern Brown Bandicoot (eastern), Southern Brown Bandicoot (south-eastern) [68050]	Endangered	Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat known to occur within area

Name	Status	Type of Presence
Petrogale penicillata Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat likely to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Pseudomys novaehollandiae New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat likely to occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area
Other		
Pommerhelix duralensis Dural Land Snail [85268]	Endangered	Species or species habitat known to occur within area
Plants		
Acacia bynoeana Bynoe's Wattle, Tiny Wattle [8575]	Vulnerable	Species or species habitat known to occur within area
Acacia pubescens Downy Wattle, Hairy Stemmed Wattle [18800]	Vulnerable	Species or species habitat known to occur within area
Acacia terminalis subsp. terminalis MS Sunshine Wattle (Sydney region) [88882]	Endangered	Species or species habitat known to occur within area
Allocasuarina glareicola [21932]	Endangered	Species or species habitat may occur within area
Allocasuarina portuensis Nielsen Park She-oak [21937]	Endangered	Species or species habitat known to occur within area
Asterolasia elegans [56780]	Endangered	Species or species habitat may occur within area
Caladenia tessellata Thick-lipped Spider-orchid, Daddy Long-legs [2119]	Vulnerable	Species or species habitat known to occur within area
Cryptostylis hunteriana Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat likely to occur within area
Cynanchum elegans White-flowered Wax Plant [12533]	Endangered	Species or species habitat likely to occur within area
Darwinia biflora [14619]	Vulnerable	Species or species habitat known to occur within area
Deyeuxia appressa [7438]	Endangered	Species or species habitat likely to occur within area
Eucalyptus camfieldii Camfield's Stringybark [15460]	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus sp. Cattai (Gregson s.n., 28 Aug 1954) [89499]	Critically Endangered	Species or species habitat known to occur within area

Name	Status	Type of Presence
Genoplesium baueri Yellow Gnat-orchid [7528]	Endangered	Species or species habitat known to occur within area
Grevillea parviflora subsp. parviflora Small-flower Grevillea [64910]	Vulnerable	Species or species habitat likely to occur within area
Hibbertia puberula subsp. glabrescens [86645]	Critically Endangered	Species or species habitat known to occur within area
Leptospermum deanei Deane's Tea-tree [21777]	Vulnerable	Species or species habitat known to occur within area
Melaleuca biconvexa Biconvex Paperbark [5583]	Vulnerable	Species or species habitat likely to occur within area
Melaleuca deanei Deane's Melaleuca [5818]	Vulnerable	Species or species habitat likely to occur within area
Persicaria elatior Knotweed, Tall Knotweed [5831]	Vulnerable	Species or species habitat likely to occur within area
Persoonia hirsuta Hairy Geebung, Hairy Persoonia [19006]	Endangered	Species or species habitat known to occur within area
Persoonia nutans Nodding Geebung [18119]	Endangered	Species or species habitat likely to occur within area
Pimelea curviflora var. curviflora [4182]	Vulnerable	Species or species habitat known to occur within area
Pimelea spicata Spiked Rice-flower [20834]	Endangered	Species or species habitat known to occur within area
Prostanthera junonis Somersby Mintbush [64960]	Endangered	Species or species habitat may occur within area
Pterostylis gibbosa Illawarra Greenhood, Rufa Greenhood, Pouched Greenhood [4562]	Endangered	Species or species habitat may occur within area
Pterostylis saxicola Sydney Plains Greenhood [64537]	Endangered	Species or species habitat likely to occur within area
Pultenaea parviflora [19380]	Vulnerable	Species or species habitat may occur within area
Syzygium paniculatum Magenta Lilly Pilly, Magenta Cherry, Daguba, Scrub Cherry, Creek Lilly Pilly, Brush Cherry [20307]	Vulnerable	Species or species habitat known to occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area

Name	Status	Type of Presence
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Hoplocephalus bungaroides		
Broad-headed Snake [1182]	Vulnerable	Species or species habitat likely to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sharks		
Carcharias taurus (east coast population)		
Grey Nurse Shark (east coast population) [68751]	Critically Endangered	Species or species habitat likely to occur within area
Carcharodon carcharias		
White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus		
Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes		
Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area
Ardenna grisea		
Sooty Shearwater [82651]		Species or species habitat likely to occur within area
Calonectris leucomelas		
Streaked Shearwater [1077]		Species or species habitat known to occur within area
Diomedea antipodensis		
Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora		
Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans		
Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi		
Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur

Name	Threatened	Type of Presence within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Sternula albifrons Little Tern [82849]		Breeding likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta Shy Albatross [89224]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Species or species habitat known to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour may occur within area
Dugong dugon Dugong [28]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat known to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Terrestrial Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Foraging, feeding or related behaviour known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Foraging, feeding or related behaviour known to occur within area
Calidris alba Sanderling [875]		Foraging, feeding or related behaviour known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Foraging, feeding or related behaviour known to occur within area
Calidris subminuta Long-toed Stint [861]		Foraging, feeding or related behaviour known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Foraging, feeding or related behaviour known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Foraging, feeding or related behaviour known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Foraging, feeding or related behaviour known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Foraging, feeding or related behaviour known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Foraging, feeding or related behaviour known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Foraging, feeding or related behaviour known to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Foraging, feeding or related behaviour known to occur within area

Name	Threatened	Type of Presence
Limicola falcinellus Broad-billed Sandpiper [842]		Foraging, feeding or related behaviour known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Foraging, feeding or related behaviour known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Foraging, feeding or related behaviour known to occur within area
Numenius phaeopus Whimbrel [849]		Foraging, feeding or related behaviour known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Foraging, feeding or related behaviour known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Foraging, feeding or related behaviour known to occur within area
Pluvialis squatarola Grey Plover [865]		Foraging, feeding or related behaviour known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Foraging, feeding or related behaviour known to occur within area
Tringa incana Wandering Tattler [831]		Foraging, feeding or related behaviour known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Foraging, feeding or related behaviour known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Foraging, feeding or related behaviour known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land

[Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name

Commonwealth Land -
Commonwealth Land - Airservices Australia
Commonwealth Land - Australia Post
Commonwealth Land - Australian & Overseas Telecommunications Corporation
Commonwealth Land - Australian Broadcasting Commission
Commonwealth Land - Australian Broadcasting Corporation
Commonwealth Land - Australian National University
Commonwealth Land - Australian Postal Commission
Commonwealth Land - Australian Postal Corporation
Commonwealth Land - Australian Telecommunications Commission
Commonwealth Land - Australian Telecommunications Corporation
Commonwealth Land - Australian Wool Testing Authority Limited
Commonwealth Land - Commonwealth Bank of Australia
Commonwealth Land - Commonwealth Scientific & Industrial Research Organisation
Commonwealth Land - Commonwealth Trading Bank of Australia
Commonwealth Land - Defence Housing Authority
Commonwealth Land - Defence Service Homes Corporation
Commonwealth Land - Director of Defence Service Homes
Commonwealth Land - Director of War Service Homes
Commonwealth Land - Reserve Bank of Australia
Commonwealth Land - Telstra Corporation Limited
Commonwealth Land - War Service Homes Commissioner
Defence - 1/15 RNSWL - LANCER BARRACKS - PARRAMATTA
Defence - 21 CONST REGT - HABERFIELD DEPOT
Defence - ADFRU PARRAMATTA
Defence - BLACKTOWN TRAINING DEPOT
Defence - CHESTER HILL (NO 2 STORE DPT)
Defence - COCKATOO ISLAND DOCKYARD
Defence - CONCORD OFFICE ACCN
Defence - DEFENCE PLAZA SYDNEY
Defence - DEGAUSSING RANGE
Defence - DSTO PYRMONT - (SEE SITE 1177)
Defence - FLEET BASE WHARVES
Defence - FOREST LODGE (SYDNEY) TRG DEP
Defence - GARDEN ISLAND
Defence - GLADESVILLE TRAINING DEPOT
Defence - HMAS KUTTABUL (AC 30/5 Lot4 DP218946)
Defence - HMAS PENGUIN
Defence - HMAS PLATYPUS - SPDU FOR DISPOSAL
Defence - HMAS WATERHEN
Defence - JENNER BUILDING
Defence - KENSINGTON DEPOT
Defence - KISMET/HMAS KUTTABUL-POTTS PT
Defence - LADY GOWRIE HOUSE
Defence - LEICHHARDT STORES DEPOT
Defence - LIDCOMBE MULTI-USER DEPOT
Defence - MARITIME COMD CTRE-POTTS POINT ; BOMERAH/TARANA
Defence - MARITIME HEADQUARTERS
Defence - MATERIAL RESEARCH LAB
Defence - MERRYLANDS
Defence - MILLER'S POINT TRAINING DEPOT
Defence - NEWINGTON
Defence - NFI CHOWDER BAY (fuel depot)
Defence - NORTH SYDNEY - HYDRO OFFICE
Defence - OXFORD ST SYDNEY
Defence - PARKVIEW BUILDING - SYDNEY
Defence - RAAF STORES DEPOT REGENTS PARK
Defence - RANDWICK (CARRINGTON RD)
Defence - RANDWICK BARRACKS

Name
Defence - RANDWICK FRENCHMANS TRG
Defence - SPECTACLE ISLAND
Defence - SYDNEY UNIVERSITY REGIMENT - DARLINGTON
Defence - TIMOR BARRACKS - DUNDAS
Defence - TRESCO
Defence - VICTORIA BARRACKS - PADDINGTON
Defence - VILLAWOOD - MOTOR REPAIR W/SHP (VILLAWOOD GEMS BASE)
Defence - WILLOUGHBY TRG DEP
Defence - WOOLLOOMOOLOO CARPARK
Defence - ZETLAND NAVY SUPPLY CENTRE

Commonwealth Heritage Places		[Resource Information]
Name	State	Status
Historic		
Admiralty House Garden and Fortifications	NSW	Listed place
Admiralty House and Lodge	NSW	Listed place
Barracks Block	NSW	Listed place
Batteries A83 and C9A	NSW	Listed place
Battery B42	NSW	Listed place
Battery for Five Guns	NSW	Listed place
Biloela Group	NSW	Listed place
Botany Post Office	NSW	Listed place
Building VB1 and Parade Ground	NSW	Listed place
Building VB2 Guard House	NSW	Listed place
Buildings 31 and 32	NSW	Listed place
Buildings MQVB16 and VB56	NSW	Listed place
Buildings VB13, 15, 16 & 17	NSW	Listed place
Buildings VB41, 45 & 53	NSW	Listed place
Buildings VB60 and VB62	NSW	Listed place
Buildings VB69, 75 & 76 including Garden	NSW	Listed place
Buildings VB83, 84, 85, 87 & 89	NSW	Listed place
Buildings VB90, 91, 91A & 92	NSW	Listed place
Chain and Anchor Store (former)	NSW	Listed place
Chowder Bay Barracks Group	NSW	Listed place
Cockatoo Island Industrial Conservation Area	NSW	Listed place
Commonwealth Avenue Defence Housing	NSW	Listed place
Customs Marine Centre	NSW	Listed place
Defence site - Georges Heights and Middle Head	NSW	Listed place
Factory	NSW	Listed place
Fitzroy Dock	NSW	Listed place
Garden Island Precinct	NSW	Listed place
Gazebo	NSW	Listed place
General Post Office	NSW	Listed place
Golf Clubhouse (former)	NSW	Listed place
HMAS Penguin	NSW	Listed place
Headquarters 8th Brigade Precinct	NSW	Listed place
Headquarters Training Command Precinct	NSW	Listed place
Kirribilli House	NSW	Listed place
Kirribilli House Garden & Grounds	NSW	Listed place
Lancer Barracks	NSW	Listed place
Lancer Barracks Precinct	NSW	Listed place
Marrickville Post Office	NSW	Listed place
Mess Hall (former)	NSW	Listed place
Military Guard Room	NSW	Listed place
Military Road Framework - Defence Land	NSW	Listed place
Naval Store	NSW	Listed place
Navy Refuelling Depot and Caretakers House	NSW	Listed place
North Sydney Post Office	NSW	Listed place
Office Building	NSW	Listed place
Officers Mess, HQ Training Command	NSW	Listed place
Paddington Post Office	NSW	Listed place
Power House / Pump House	NSW	Listed place
Prison Barracks Precinct	NSW	Listed place
Pyrmont Post Office	NSW	Listed place

Name	State	Status
Reserve Bank	NSW	Listed place
Residences Group	NSW	Listed place
Rigging Shed and Chapel	NSW	Listed place
School of Musketry and Officers Mess, Randwick Army Barracks	NSW	Listed place
Shark Point Battery	NSW	Listed place
Snapper Island	NSW	Listed place
Spectacle Island Explosives Complex	NSW	Listed place
Sutherland Dock	NSW	Listed place
Sydney Airport Air Traffic Control Tower	NSW	Listed place
Sydney Customs House (former)	NSW	Listed place
Ten Terminal Regiment Headquarters and AusAid Training Centre	NSW	Listed place
Thirty Terminal Squadron Precinct	NSW	Listed place
Underground Grain Silos	NSW	Listed place
Victoria Barracks Perimeter Wall and Gates	NSW	Listed place
Victoria Barracks Precinct	NSW	Listed place
Victoria Barracks Squash Courts	NSW	Listed place
Villawood Immigration Centre	NSW	Listed place
Woolwich Dock	NSW	Listed place

Listed Marine Species

[Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres Ruddy Turnstone [872]		Foraging, feeding or related behaviour known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Foraging, feeding or related behaviour known to occur within area
Calidris alba Sanderling [875]		Foraging, feeding or related behaviour known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Foraging, feeding or related behaviour known to occur within area

Name	Threatened	Type of Presence
Calidris subminuta Long-toed Stint [861]		Foraging, feeding or related behaviour known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Foraging, feeding or related behaviour known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Foraging, feeding or related behaviour known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Foraging, feeding or related behaviour known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Foraging, feeding or related behaviour known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Foraging, feeding or related behaviour known to occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea gibsoni Gibson's Albatross [64466]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Foraging, feeding or related behaviour known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
Gallinago stenura Pin-tailed Snipe [841]		Foraging, feeding or related behaviour likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Breeding known to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Foraging, feeding or related behaviour known to occur within area
Heteroscelus incanus Wandering Tattler [59547]		Foraging, feeding or related behaviour known to occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Foraging, feeding or related behaviour known to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Foraging, feeding or related behaviour known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Foraging, feeding or related behaviour known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat

Name	Threatened	Type of Presence
Numenius minutus Little Curlew, Little Whimbrel [848]		known to occur within area Foraging, feeding or related behaviour likely to occur within area
Numenius phaeopus Whimbrel [849]		Foraging, feeding or related behaviour likely to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Foraging, feeding or related behaviour known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Foraging, feeding or related behaviour known to occur within area
Pluvialis squatarola Grey Plover [865]		Foraging, feeding or related behaviour known to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour known to occur within area
Puffinus griseus Sooty Shearwater [1024]		Species or species habitat likely to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Foraging, feeding or related behaviour known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat known to occur within area
Sterna albifrons Little Tern [813]		Breeding likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour known to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour known to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche sp. nov. Pacific Albatross [66511]	Vulnerable*	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat known to occur within area
Thinornis rubricollis rubricollis Hooded Plover (eastern) [66726]	Vulnerable	Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Foraging, feeding or related behaviour known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Foraging, feeding or related behaviour known to occur within area
Fish		
Acentronura tentaculata Shortpouch Pygmy Pipehorse [66187]		Species or species habitat may occur within area
Festucalex cinctus Girdled Pipefish [66214]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus abdominalis Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233]		Species or species habitat may occur within area
Hippocampus whitei White's Seahorse, Crowned Seahorse, Sydney Seahorse [66240]		Species or species habitat known to occur within area
Histiogamphelus briggsii Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Notiocampus ruber Red Pipefish [66265]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Solegnathus spinosissimus Spiny Pipehorse, Australian Spiny Pipehorse [66275]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Solenostomus paradoxus Ornate Ghostpipefish, Harlequin Ghost Pipefish, Ornate Ghost Pipefish [66184]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Arctocephalus pusillus Australian Fur-seal, Australo-African Fur-seal [21]		Species or species habitat may occur within area
Dugong dugon Dugong [28]		Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans

[Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves

[Resource Information]

Name	State
Lane Cove	NSW
Newington	NSW
Parramatta River	NSW
Prospect	NSW
Sydney Harbour	NSW
Wallumatta	NSW
Wolli Creek	NSW

Invasive Species**[Resource Information]**

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Alauda arvensis Skylark [656]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Carduelis chloris European Greenfinch [404]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Pycnonotus jocosus Red-whiskered Bulbul [631]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat known to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Asparagus scandens Asparagus Fern, Climbing Asparagus Fern [23255]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. rotundata Bitou Bush [16332]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Cytisus scoparius Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large- leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Nassella neesiana Chilean Needle grass [67699]		Species or species habitat likely to occur within area
Nassella trichotoma Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Ulex europaeus Gorse, Furze [7693]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Reptiles		
Hemidactylus frenatus		
Asian House Gecko [1708]		Species or species habitat likely to occur within area

Nationally Important Wetlands		<u>[Resource Information]</u>
Name		State
Bicentennial Park		NSW
Botany Wetlands		NSW
Eve St. Marsh, Arncliffe		NSW
Newington Wetlands		NSW

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-33.808051 150.986882,-33.809905 150.992032,-33.81397 150.998813,-33.817607 151.014262,-33.819675 151.019069,-33.8216 151.0213,-33.825735 151.022073,-33.82873 151.02173,-33.832865 151.025506,-33.828801 151.02173,-33.825236 151.022159,-33.821671 151.021386,-33.826734 151.025849,-33.832295 151.032973,-33.833436 151.036922,-33.835004 151.041728,-33.839211 151.050998,-33.841991 151.058122,-33.843987 151.064731,-33.846268 151.067992,-33.8514 151.071769,-33.853325 151.074,-33.855606 151.078292,-33.856675 151.08224,-33.856533 151.090737,-33.857887 151.092025,-33.861878 151.094428,-33.862733 151.098891,-33.866439 151.109105,-33.869433 151.116744,-33.867936 151.122323,-33.866725 151.16541,-33.866154 151.172706,-33.868079 151.18146

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- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
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- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- [-Other groups and individuals](#)

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.