Appendix T

Biodiversity impact assessment

WestConnex

WestConnex Delivery Authority

M4 East Project

Biodiversity Impact Assessment

September 2015

Prepared for

WestConnex Delivery Authority

Prepared by

GHD Pty Ltd

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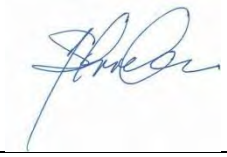
Signed:	
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Glossary of terms and abbreviations

Term	Meaning
CAMBA	China–Australia Migratory Bird Agreement
CBD	Central business district
CCTV	Closed circuit television
CMA	Catchment management area
DEC	Department of Environment and Conservation (now the Office of Environment and Heritage)
DECCW	Department of Environment, Climate Change and Water (now the Office of Environment and Heritage)
DEWHA	Department of Environment, Water, Heritage and the Arts (now the Department of the Environment)
DGRs	Director General's Requirements
DotE	Department of the Environment
DPI	Department of Primary Industries
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
FBA	Framework for Biodiversity Assessment
FM Act	*Fisheries Management Act 1994*
GDEs	Groundwater dependent ecosystems
GHD	GHD Australia Pty Ltd
ITS	Intelligent transport systems
JAMBA	Japan-Australia Migratory Bird Agreement
KTP	Key threatening process
LGA	Local Government Area
Locality	The area within a 10 kilometre radius of the centreline of the project
MNES	Matters of National Environmental Significance
NSW	New South Wales
NW Act	*Noxious Weeds Act 1993*
OEH	Office of Environment and Heritage
PMST	Protected matters search tool
The project	The M4 East project, located between Homebush Bay Drive, Strathfield in the west and Ashfield and Haberfield in the east (as described in **Section 1.1**)
Project footprint	The area where direct impacts would occur
RBGT	Royal Botanic Gardens Trust
Region	The Sydney Basin Bioregion as defined in the Interim Biogeographic Regionalisation for Australia (Thackway & Cresswell, 1995)
Roads and Maritime	NSW Roads and Maritime Services
RoKAMBA	Republic of Korea–Australia Migratory Bird Agreement
SEARs	Secretary's environmental assessment requirements
SOP	Sydney Olympic Park
SSI	State significant infrastructure

Study area	The project footprint and any proximal areas that could potentially be affected by the project, identified as a 150 m corridor along the alignment. Areas of ecological significance outside the 150 m corridor were also inspected where applicable such as wetlands and parklands
TEC	Threatened ecological community
TSC Act	*Threatened Species Conservation Act 1995*
VMS	Variable message sign
WDA	WestConnex Delivery Authority

Executive summary

The NSW Roads and Maritime Services (Roads and Maritime) is seeking approval to upgrade and extend the M4 Motorway from Homebush Bay Drive at Homebush to Parramatta Road and the City West Link (Wattle Street) at Haberfield, in inner western Sydney. Much of the project would be tunnelled under existing roads and residential areas. These proposed works are described as the M4 East project (the project).

The project is located in a highly urbanised environment and much of the project would be tunnelled under existing roads and residential areas. No intact, remnant native vegetation communities are present in the project footprint or immediately adjacent to the study area. Vegetation within the project footprint and adjoining areas has been planted and comprises a combination of private gardens, landscaped parks, reserves or strips of vegetation planted as visual screening as part of rehabilitation/landscaping works following construction of major roads (eg the M4).

This biodiversity impact assessment report has been prepared with reference to the Draft Guidelines for Threatened Species Assessment (NSW Department of Conservation/NSW Department of Primary Industries (DEC/DPI) 2005) as required by the original Director General's Requirements (DGRs) for the project issued on 7 January 2014 and also subsequently by the Secretary's Environmental Assessment Requirements (SEARs) issued on 16 June 2015.

Construction of the project would result in the removal of about 15.7 hectares of vegetation, comprising about 12.9 hectares of planted trees and screening vegetation (mainly from alongside the M4) and about 2.8 hectares of grassland with scattered trees (such as from Cintra Park and Reg Coady Reserve).

This vegetation is not commensurate with any threatened ecological communities listed under the *Threatened Species Conservation Act 1995* (NSW) (TSC Act) or the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) (EPBC Act). No habitat for threatened flora species listed under the TSC Act or EPBC Act is present in the project footprint.

The vegetation to be removed within the project footprint is of limited extent and value for most native fauna other than highly mobile species typical of urban parks and gardens. Only one threatened fauna species was recorded within the project footprint. The Grey-headed Flying-fox (*Pteropus poliocephalus*), a vulnerable fauna species listed under the TSC Act and EPBC Act, is a highly mobile species that would forage in areas of planted vegetation within the project footprint on occasion when suitable food trees are fruiting or flowering. These planted trees do not constitute habitat critical to the survival of the Grey-headed Flying-fox and their removal would have a negligible impact on the available foraging habitat for this species in the locality. The project would not impact any roosting or breeding camps for the Grey-headed Flying-fox or affect the movement of this species between roosts and foraging areas.

Several threatened microbat species, such as the Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*) and the Large-footed Myotis (*Myotis macropus*), may also occur within the project footprint on occasion. These species could potentially roost under bridges and culverts in the study area on occasion, although no evidence of roosting bats was detected during the field surveys. Construction activities near culverts or bridges could temporarily disrupt roosting bats if present during construction. There is no suitable breeding habitat for these species within the construction footprint or adjoining areas. The proposal would remove small areas of potential foraging habitat (planted trees along roads and in parks) for the Eastern Bentwing Bat, but would not affect foraging habitat for the Large-footed Myotis which forages over waterways.

The project is unlikely to have any adverse impact on Mason Park Wetland which is located about one kilometre downstream of the project footprint. This wetland contains high biodiversity values containing Coastal Saltmarsh threatened ecological community and habitat for threatened flora and fauna and migratory species. There is only limited hydrological connection between Powells Creek (which runs under the M4 within the project corridor) and Mason Park Wetland and given the distance downstream and the proposed implementation of mitigation measures to minimise the potential release of sediments or pollutants, the project is unlikely to have a significant impact on the threatened biota that occurs at the wetlands.

Given the above considerations, there is likely to only be minor residual impacts on the natural environment. A formal biodiversity offset is not considered necessary to compensate for these minor and localised residual impacts. The planting of Grey-headed Flying-fox food trees in landscaped areas following construction will compensate for the removal of planted vegetation within the project footprint and assist in maintaining foraging habitat for this species in the study area.

On the basis of the assessments undertaken, the project is not likely to result in a significant impact on any matter of national environmental significance under the EPBC Act, including threatened and migratory species. Accordingly, the project has not been referred to the Australian Government Department of the Environment for further assessment or approval under the EPBC Act.

1 Introduction

1.1 Overview of the project

NSW Roads and Maritime Services (Roads and Maritime) is seeking approval to upgrade and extend the M4 Motorway from Homebush Bay Drive at Homebush to Parramatta Road and City West Link (Wattle Street) at Haberfield. This includes twin tunnels about 5.5 kilometres long and associated surface works to connect to the existing road network. These proposed works are described as the M4 East project (the project). The location of the project is shown in **Figure 1.1**.

Approval is being sought under Part 5.1 of the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act). The project was declared by the Minister for Planning to be State significant infrastructure and critical State significant infrastructure and an environmental impact statement (EIS) is therefore required.

The project is a component of WestConnex, which is a proposal to provide a 33 kilometre motorway linking Sydney's west and south-west with Sydney Airport and the Port Botany precinct. The location of WestConnex is shown in **Figure 1.2**. The individual components of WestConnex are:

- M4 Widening – Pitt Street at Parramatta to Homebush Bay Drive at Homebush (planning approval granted and under construction)
- M4 East (the subject of this report)
- New M5 – King Georges Road at Beverly Hills to St Peters (planning application lodged and subject to planning approval)
- King Georges Road Interchange Upgrade (planning approval granted and work has commenced)
- M4–M5 Link – Haberfield to St Peters, including the Southern Gateway and Southern Extension (undergoing concept development and subject to planning approval).

Separate planning applications will be lodged for each individual component project. Each project will be assessed separately, but the impacts of each project will also be considered in the context of the wider WestConnex.

The NSW Government has established the WestConnex Delivery Authority (WDA) to deliver WestConnex. WDA has been established as an independent public subsidiary corporation of Roads and Maritime. Its role and functions are set out in Part 4A of the *Transport Administration (General) Regulation 20*13 (NSW). WDA is project managing the planning approval process for the project on behalf of Roads and Maritime. However, for the purpose of the planning application for the project, Roads and Maritime is the proponent.

1.2 Project location

The project is generally located in the inner west region of Sydney within the Auburn, Strathfield, Canada Bay, Burwood and Ashfield local government areas (LGAs). The project travels through 10 suburbs: Sydney Olympic Park, Homebush West, Homebush, North Strathfield, Strathfield, Concord, Burwood, Croydon, Ashfield and Haberfield.

The project is generally located within the M4 and Parramatta Road corridor, which links Broadway at the southern end of the Sydney central business district (CBD) and Parramatta in Sydney's west, about 20 kilometres to the west of the Sydney CBD. This corridor also provides the key link between the Sydney CBD and areas further west of Parramatta (such as Penrith and western NSW).

The western end of the project is located at the interchange between Homebush Bay Drive and the M4, about 13 kilometres west of the Sydney CBD. The project at this location would tie in with the M4 Widening project in the vicinity of Homebush Bay Drive.

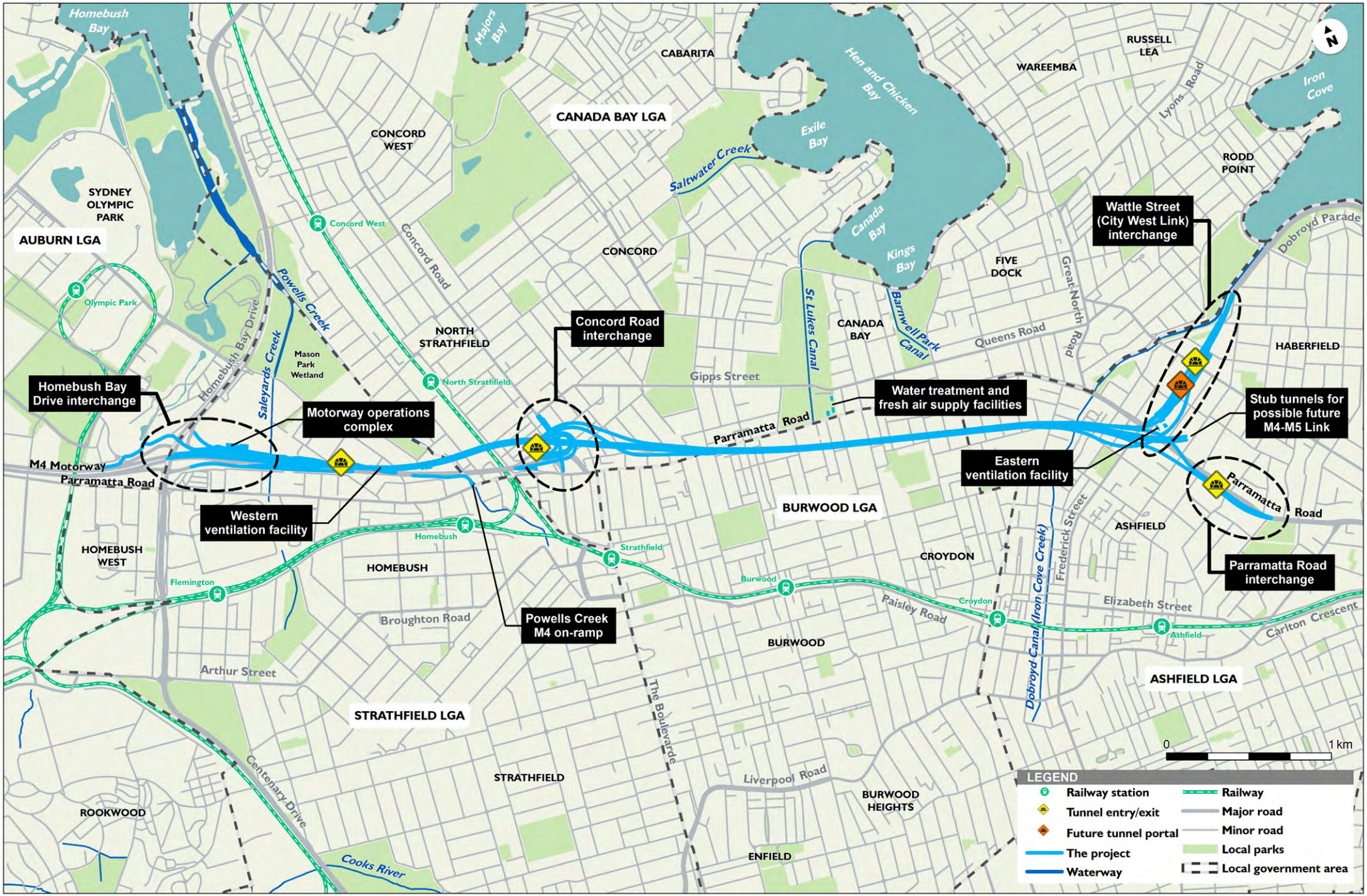

Figure 1.1 Local context of the project

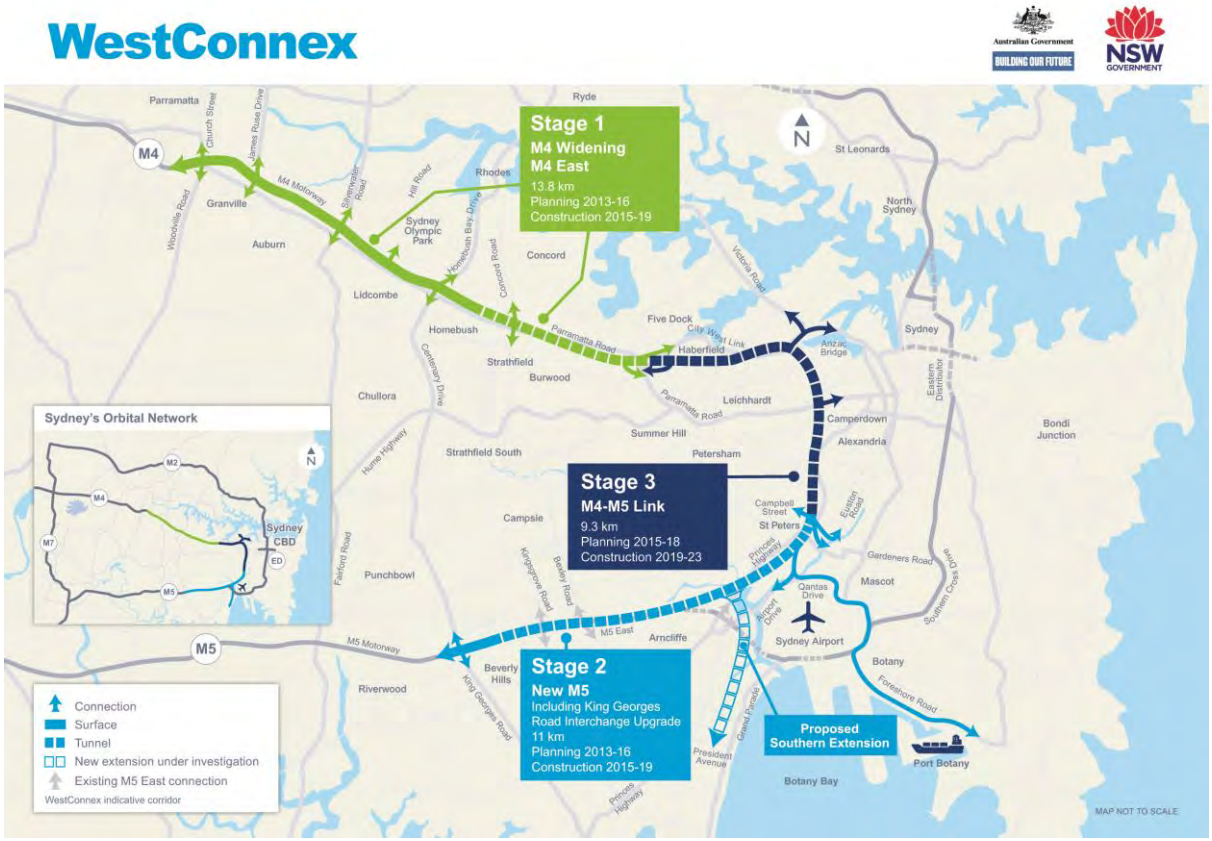

Figure 1.2 WestConnex

The tunnel dive structures would start at the centre of the M4, west of the existing pedestrian footbridge over the M4 at Pomeroy Street, and would continue underground to the north of the existing M4 and Parramatta Road, before crossing beneath Parramatta Road at Broughton Street at Burwood. The tunnels would continue underground to the south of Parramatta Road until the intersection of Parramatta Road and Wattle Street at Haberfield. Ramps would connect the tunnels to Parramatta Road and Wattle Street (City West Link) at the eastern end of the project. The tunnels would end in a stub connection to the possible future M4–M5 Link (M4–M5 Link), near Alt Street at Haberfield.

The project would include interchanges between the tunnels and the above ground road network, along with other surface road works, at the following locations:

- M4 and Homebush Bay Drive interchange at Sydney Olympic Park and Homebush (Homebush Bay Drive interchange)
- Powells Creek, near George Street at North Strathfield (Powells Creek M4 on-ramp)
- Queen Street, near Parramatta Road at North Strathfield (Queen Street cycleway westbound on-ramp)
- M4 and Sydney Street, Concord Road and Parramatta Road interchange at North Strathfield (Concord Road interchange)
- Wattle Street (City West Link), between Parramatta Road and Waratah Street at Haberfield (Wattle Street (City West Link) interchange)
- Parramatta Road, between Bland Street and Orpington Street at Ashfield and Haberfield (Parramatta Road interchange).

1.3 Secretary's environmental assessment requirements

The Secretary of the NSW Department of Planning and Environment (DP&E) has issued a list of Secretary's Environmental Assessment Requirements (SEARs) that inform the environmental impact assessment. **Table 1.1** displays the SEARs that are specific to biodiversity and also provides a cross reference to the relevant section(s) of this report which address these requirements.

In addition agency letters, which accompany the SEARs and are relevant to biodiversity, were also taken into account during the preparation of this report. These are detailed in **Appendix A**.

Table 1.1 How SEARs have been addressed in this report

SEARs	
Requirement	**Section where addressed**
Biodiversity – including, but not limited to: An assessment of the potential ecological impacts of the project, with specific reference to vegetation and habitat clearing, connectivity, edge effects, weed dispersal, riparian and aquatic habitat impacts and soil and water quality impacts. The assessment must:	**Section 6**: Assessment of impacts
Make specific reference to impacts on threatened species and endangered ecological communities,	**Section 6**: Assessment of impacts **Appendix D** **Appendix E**
Have reference to the Draft Guidelines for Threatened Species Assessment (DEC/DPI, 2005), Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (DEC), the Guidelines for Aquatic Habitat Management and Fish Conservation (DPI, 1999) and any relevant draft or final recovery plans.	**Section 4.1**: Assessment approach **Section 6**: Assessment of impacts **Appendix D** **Appendix E**
Include details of any off-set measures that may be required, including demonstration that the measures are consistent with the Principles for the use of biodiversity offsets in NSW (DECCW 2008).	**Section 7**: Management of impacts **Section 7.3**: Offsetting impacts
Note: The Department encourages you to undertake this assessment in accordance with the Framework for Biodiversity Assessment (OEH, 2014) and the NSW Biodiversity Offsets Policy for Major Projects (OEH, 2014).	**Section 4.1.2**

1.4 Purpose and scope of this report

This Biodiversity Impact Assessment considers potential impacts of the project on ecological values, with particular emphasis on:

- Threatened ecological communities (TECs), populations and species listed under the *Threatened Species Conservation Act 1995* (NSW) (TSC Act) and *Fisheries Management Act 1994* (NSW) (FM Act)
- Matters of National Environmental Significance (MNES) listed under the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) (EPBC Act).

This report describes the biodiversity values present in the study area and the impact of the project on these values. It also identifies measures and strategies that can be taken to avoid and minimise impacts on biodiversity and assesses the requirement for a biodiversity offset.

The approach for this assessment is outlined in **section 4.1** and the detailed methodology is provided in **section 4.2** of this report.

The scope of this report is to:

- Outline the methods used for the biodiversity assessment

- Describe the existing environment of the study area, including the results of the desktop assessment and site surveys
- Identify the presence or likely presence of threatened species, populations and ecological communities and their habitats listed under the TSC Act and FM Act
- Assess the potential for any MNES listed under the EPBC Act to occur within the site and/or to be affected by the proposal
- Identify the potential impacts of the proposal on threatened biota and their habitats
- Recommend mitigation and environmental management measures to avoid or minimise adverse impacts on threatened biota and biodiversity values
- Assess the requirement for a biodiversity offset
- Assess the likely significance of impacts on threatened biota listed under the TSC Act and FM Act in accordance with the threatened species assessment requirements (NSW Department of Conservation/NSW Department of Primary Industries – DEC/DPI 2005)
- Assess the likely significance of impacts on MNES in accordance with the significant impact guidelines 1.1 (Australian Government Department of the Environment (DotE) 2013) to determine whether the proposal should be referred to the Commonwealth for assessment under the EPBC Act
- Assess key thresholds and provide an assessment of whether the project improves or maintains biodiversity values as per the threatened species assessment guidelines (DEC/DPI 2005).

1.5 Definitions

For the purposes of this report the following areas are defined:

- The 'project' is the M4 East project, located between Homebush Bay Drive, Homebush in the west and Ashfield and Haberfield in the east (as described in **section 1.1**), as shown in **Figure 1.1**
- The 'project footprint' is the area where direct impacts would occur within the project area (defined above), as shown on **Figure 5.1** – **Figure 5.5.**
- The 'study area' is the project footprint (defined above) and any proximal areas containing vegetation (generally within 150 metres of the alignment) that could potentially be indirectly impacted by the project. Mason Park Wetland (located about one kilometre downstream of the project footprint) was also inspected as part of the assessment
- The 'locality' is the area within a 10 kilometre radius of the centreline of the project
- The 'region' is the Sydney Basin Bioregion as defined in the Interim Biogeographic Regionalisation for Australia (Thackway & Cresswell 1995).

2 Proposed project

2.1 Project features

The project would comprise the construction and operation of the following key features:

- Widening, realignment and resurfacing of the M4 between Homebush Bay Drive and Underwood Road at Homebush
- Upgrade of the existing Homebush Bay Drive interchange to connect the western end of the new tunnels to the existing M4 and Homebush Bay Drive, while maintaining all current surface connections
- Two new three-lane tunnels (the mainline tunnels), one eastbound and one westbound, extending from west of Pomeroy Street at Homebush to near Alt Street at Haberfield, where they would terminate until the completion of the M4–M5 Link. Each tunnel would be about 5.5 kilometres long and would have a minimum internal clearance (height) to in-tunnel services of 5.3 metres
- A new westbound on-ramp from Parramatta Road to the M4 at Powells Creek, west of George Street at North Strathfield
- An interchange at Concord Road, North Strathfield/Concord with on-ramps to the eastbound tunnel and off-ramps from the westbound tunnel. Access from the existing M4 to Concord Road would be maintained via Sydney Street. A new on-ramp would be provided from Concord Road southbound to the existing M4 westbound, and the existing on-ramp from Concord Road northbound to the existing M4 westbound would be removed
- Modification of the intersection of the existing M4 and Parramatta Road, to remove the left turn movement from Parramatta Road eastbound to the existing M4 westbound
- An interchange at Wattle Street (City West Link) at Haberfield with an on-ramp to the westbound tunnel and an off-ramp from the eastbound tunnel. The project also includes on- and off-ramps at this interchange that would provide access to the M4–M5 Link. In addition, the westbound lanes of Wattle Street would be realigned
- An interchange at Parramatta Road at Ashfield/Haberfield, with an on-ramp to the westbound tunnel and an off-ramp from the eastbound tunnel. In addition, the westbound lanes of Parramatta Road would be realigned
- Installation of tunnel ventilation systems, including ventilation facilities within the existing M4 road reserve near Underwood Road at Homebush (western ventilation facility) and at the corner of Parramatta Road and Wattle Street at Haberfield (eastern ventilation facility). The eastern ventilation facility would serve both the project and the M4–M5 Link project. Provision has also been made for a fresh air supply facility at Cintra Park at Concord
- Associated surface road work on the arterial and local road network, including reconfiguration of lanes, changes to traffic signalling and phasing, and permanent road closures at a small number of local roads
- Pedestrian and cycle facilities, including permanently re-routing a portion of the existing eastbound cycleway on the northern side of the M4 from west of Homebush Bay Drive to near Pomeroy Street, and a new westbound cycleway on-ramp connection from Queen Street at North Strathfield to the existing M4
- Tunnel support systems and services such as electricity substations, fire pump rooms and tanks, water treatment facilities, and fire and life safety systems including emergency evacuation infrastructure
- Motorway operations complex on the northern side of the existing M4, east of the Homebush Bay Drive interchange
- Provision of road infrastructure and services to support the future implementation of smart motorway operations (subject to separate planning approval)
- Installation of tolling gantries and traffic control systems along the length of the project

- Provision of new and modified noise walls
- Provision of low noise pavement for new and modified sections of the existing M4
- Temporary construction ancillary facilities and temporary works to facilitate the construction of the project.

An overview of the project at completion is shown in **Figure 2.1**.

The project does not include work required for reconfiguring Parramatta Road as part of the urban transformation program. The project does not include ongoing motorway maintenance activities during operation. These would be subject to separate assessment and approval as appropriate.

2.2 Construction activities

2.2.1 Overview

Construction activities associated with the project would generally include:

- Enabling and temporary works, including construction power, water supply, ancillary site establishment, demolition works, property adjustments and public transport modifications (if required)
- Construction of the road tunnels, interchanges, intersections and roadside infrastructure
- Haulage of spoil generated during tunnelling and excavation activities
- Fitout of the road tunnels and support infrastructure, including ventilation and emergency response systems
- Construction and fitout of the motorway operations complex and other ancillary operations buildings
- Realignment, modification or replacement of surface roads, bridges and underpasses
- Implementation of environmental management and pollution control facilities for the project.

The project assessed in this report does not include surveys, sampling or investigation to inform the design or assessment, such as test drilling, test excavations, geotechnical investigations, or other tests. It also does not include adjustments to, or relocation of, existing utilities infrastructure undertaken prior to commencement of construction. These would be subject to separate assessment and approval as appropriate.

2.2.2 Construction footprint

The total area required for construction of the project, including construction ancillary facilities, is referred to as the ‘construction footprint’. The construction footprint would be about 65 hectares in total, comprising about 48 hectares at the surface and about 17 hectares below ground.

In addition to below ground works, surface works would be required to support tunnelling activities and to construct surface infrastructure such as interchanges, tunnel portals, ventilation facilities, ancillary operations buildings and facilities, and new cycleway facilities near the Homebush Bay Drive interchange and Queen Street at North Strathfield.

The overall surface construction footprint generally aligns with the operational footprint, with the locations of future operational ancillary facilities being used to support construction work. Some additional areas adjacent to the operational footprint (around the portals and on- and off-ramps, and also at the tunnel mid-point) would also be required during the construction stage only to facilitate construction.

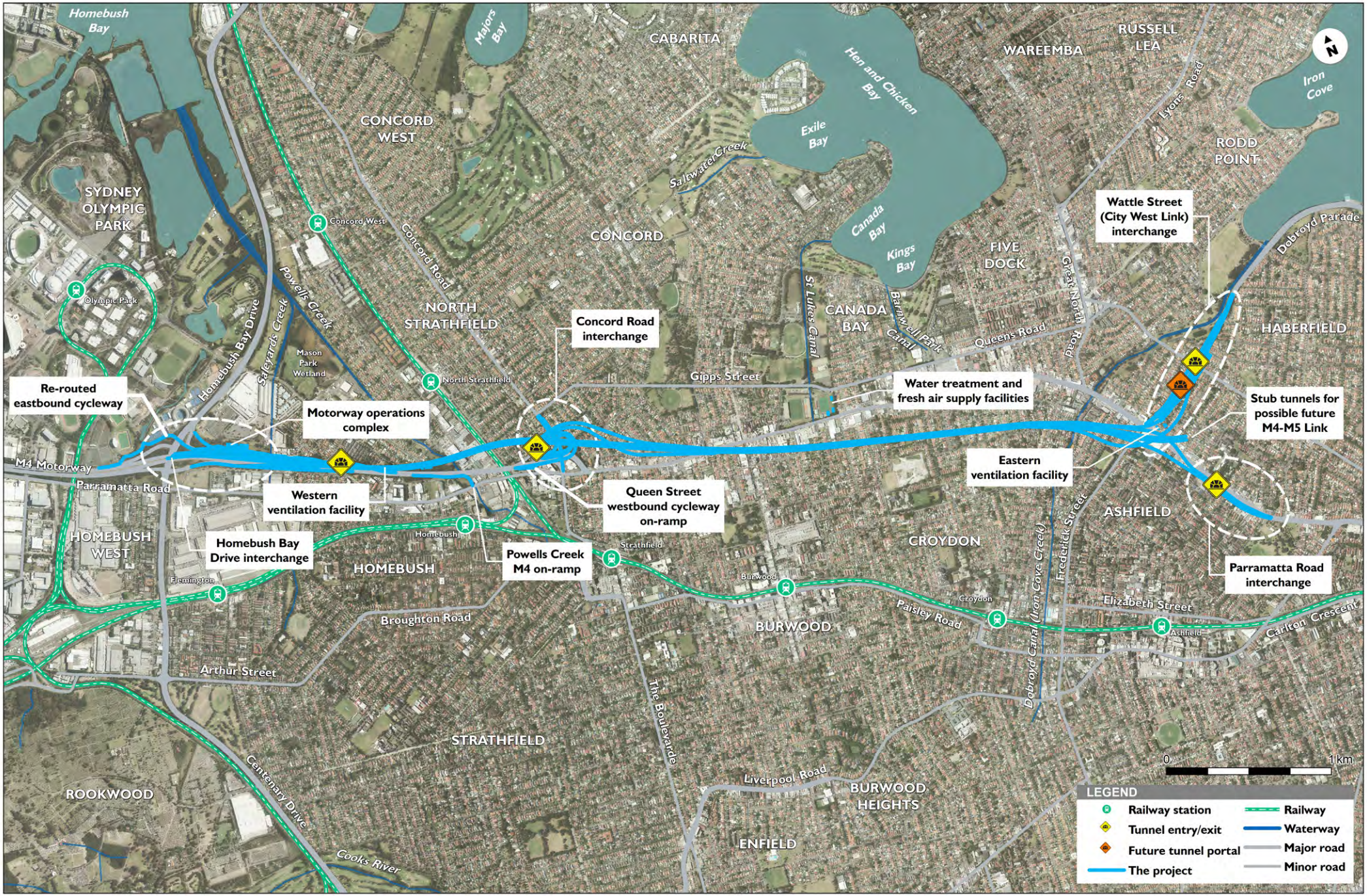

Figure 2.1 Overview of the proejct

Construction ancillary facilities currently proposed would be required at the following 10 locations:

- Homebush Bay Drive civil site (C1)
- Pomeroy Street civil site (C2)
- Underwood Road civil and tunnel site (C3)
- Powells Creek civil site (C4)
- Concord Road civil and tunnel site (C5)
- Cintra Park tunnel site (C6)
- Northcote Street tunnel site (C7)
- Eastern ventilation facility site (C8)
- Wattle Street and Walker Avenue civil site (C9)
- Parramatta Road civil site (C10).

An overview of the construction footprint is shown in **Figure 2.2**.

The final size and configuration of construction ancillary facilities would be further developed during detailed design.

2.2.3 Construction program

Subject to planning approval, construction of the project is planned to start in the second quarter of 2016, with completion planned for the first quarter of 2019. The total period of construction works is expected to be around three years, including nine months of commissioning occurring concurrently with the final stages of construction. The indicative construction program is shown in **Table 2.1**.

Table 2.1 Indicative construction program overview

Construction activity	Indicative construction timeframe															
	2016				2017				2018				2019			
Construction access excavation (all sites)		■	■	■												
Tunnelling (excavation)			■	■	■	■	■	■								
Tunnel drainage and pavement works						■	■	■	■	■						
Tunnel mechanical and electrical fitout works								■	■	■	■					
Tunnel completion works											■	■	■			
Homebush Bay Drive interchange			■	■	■	■	■	■	■	■						
M4 surface works		■	■	■	■	■	■	■	■	■	■	■				
Western ventilation facility							■	■	■	■	■					
Powells Creek on-ramp		■	■	■	■	■										
Concord Road interchange			■	■	■	■	■	■	■	■	■	■				
Wattle Street interchange		■	■	■	■	■	■	■	■	■	■	■	■			
Parramatta Road interchange		■	■	■	■	■	■	■	■	■	■	■	■			
Eastern ventilation facility		■	■	■	■	■	■	■	■	■	■	■				
Cintra Park fresh air supply facility				■	■	■	■	■	■	■	■	■	■			
Cintra Park water treatment facility										■	■	■	■			
Motorway operations complex						■	■	■								
Mechanical and electrical fitout works							■	■	■	■	■	■				
Site rehabilitation and landscaping						■	■	■	■	■	■	■	■			

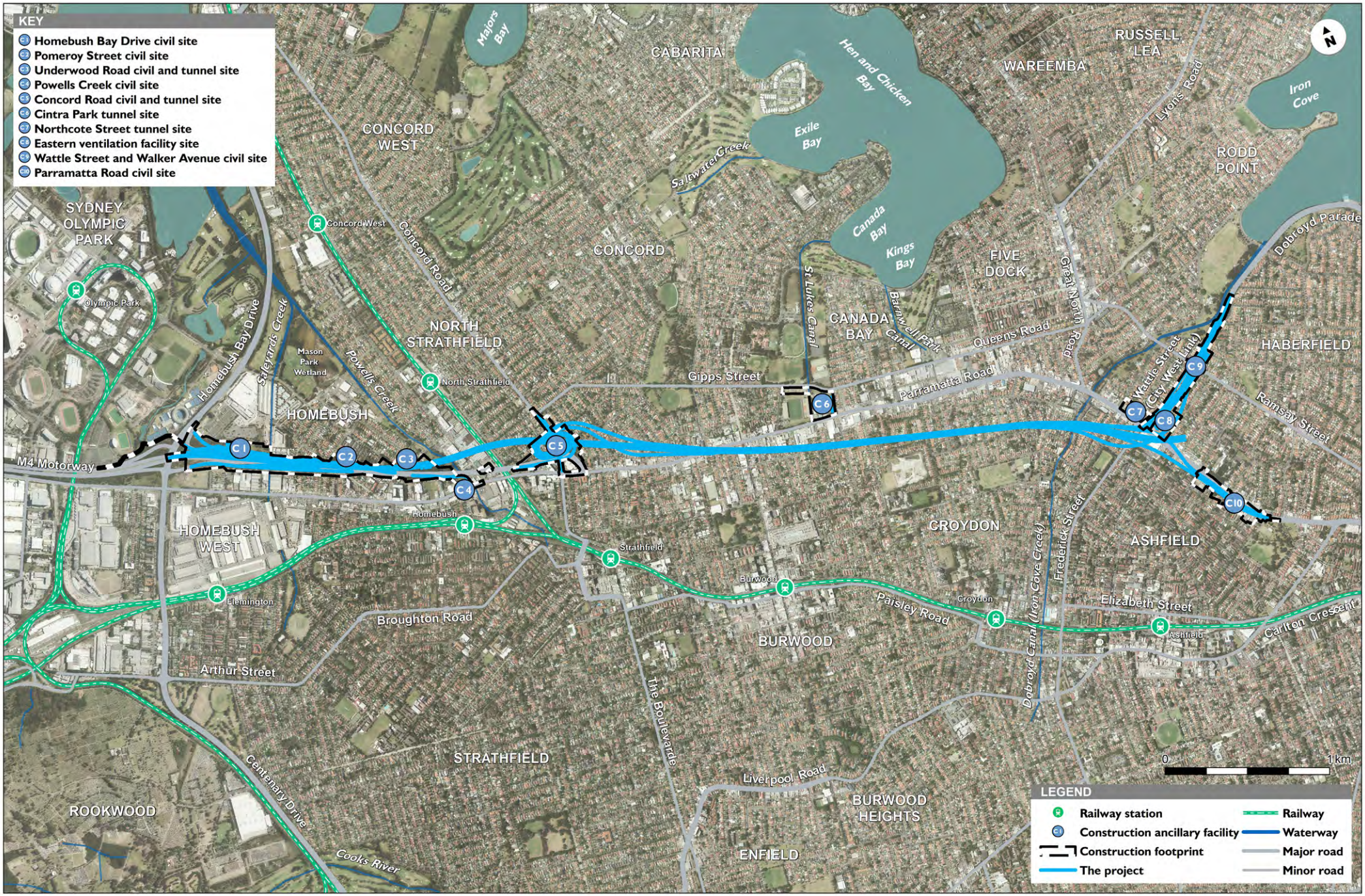

Figure 2.2 Overview of construction footprint and construction ancillary facilities

3 Legislative context

3.1 NSW Legislation

3.1.1 Environmental Planning and Assessment Act 1979

The EP&A Act forms the legal platform for environmental assessment and approval in NSW and aims to 'encourage the proper management, development and conservation of natural and artificial resources' (among other aims).

On 5 December 2014, the project was declared by the then Minister for Planning to be State significant infrastructure and critical State significant infrastructure, under sections 115U(4) and 115V of the EP&A Act and clause 16 of the *State Environmental Planning Policy (State and Regional Development) 2011*. In accordance with section 115Z of the EP&A Act, an environmental impact statement (EIS) EIS is required.

An application under section 115X of the EP&A Act to carry out the project was lodged with the then Director General of NSW Planning and Infrastructure (the Director General) in November 2013. An application report describing the project aimed to assist the formulation of environmental assessment requirements by the then Director General under section 115Y of the EP&A Act.

On 7 January 2014, the A/Executive Director notified Roads and Maritime of the environmental assessment requirements (Director Generals Requirements or DGRs) for preparation of an EIS. In April 2014, NSW Planning and Infrastructure and the position of Director General were replaced with DP&E and the position of Secretary respectively.

On 16 June 2015, modified environmental assessment requirements (now referred to as SEARs) were provided to Roads and Maritime. The modified requirements reflect changes to the project since the application was lodged, in particular the inclusion of work in the Auburn local government area (LGA). The modified requirements were also consistent with the SEARs issued for the New M5 project.

The SEARs include requirements relating to the assessment of potential impacts on biodiversity. This report describes the biodiversity values present in the project footprint and the impact of the project on these values. It also identifies measures and strategies that can be taken to avoid and minimise impacts on biodiversity and assesses the requirement for a biodiversity offset.

3.1.2 Threatened Species Conservation Act 1995

The TSC Act aims to 'conserve biological diversity and promote ecologically sustainable development' (among other things). It provides for:

- The listing of 'threatened species, populations and ecological communities', with endangered species, populations and ecological communities listed under Schedule 1, critically endangered species and ecological communities listed under Schedule 1A, and vulnerable species and ecological communities listed under Schedule 2
- The listing of 'Key Threatening Processes' (under Schedule 3)
- The preparation and implementation of Recovery Plans and Threat Abatement Plans.

The TSC Act has been considered in the current assessment through:

- Desktop review to determine the threatened species, populations or ecological communities listed under the Act that have been previously recorded within the locality of the site or have distributions that encompass the study area and hence could potentially occur subject to the habitats present
- Targeted field surveys for threatened species, populations and ecological communities listed under the Act
- Identification, assessment and mapping of vegetation and threatened species (or their habitat) listed under the Act
- Assessment of potential impacts on threatened species, populations and ecological communities listed under the Act.

3.1.3 Fisheries Management Act 1994

The object of the FM Act is to conserve, develop and share the fishery resources of the State for the benefit of present and future generations. It provides for:

- The listing of threatened species, populations and ecological communities, with endangered species, populations and ecological communities listed under Schedule 4, critically endangered species and communities listed under Schedule 4A, and vulnerable species and communities listed under Schedule 5
- The listing of 'Key Threatening Processes' (under Schedule 6)
- The preparation and implementation of Recovery Plans and Threat Abatement Plans.

The FM Act has been considered in this assessment through:

- Desktop review to determine the threatened species, populations or ecological communities listed under the Act that have been previously recorded within the locality of the site and hence could potentially occur within the site, subject to the habitats present
- Assessment of aquatic habitats during field surveys
- Assessment of impacts on threatened species, populations and ecological communities and their habitat listed under the FM Act.

3.1.4 Noxious Weeds Act 1993

The *Noxious Weeds Act 1993* (NSW) (NW Act) provides for the declaration of noxious weeds by the Minister for Primary Industries. Noxious weeds may be considered noxious on a national, State, regional or local scale. All private landowners, occupiers, public authorities and Councils are required to control noxious weeds on their land under Part 3 Division 1 of the NW Act. This report has identified noxious weeds in the study area and appropriate mitigation measures to minimise the spread of weeds as a result of the proposal.

3.2 Commonwealth legislation

3.2.1 Environment Protection and Biodiversity Conservation Act 1999

Under the EPBC Act, an action includes a project, undertaking, development, activity, and series of activities or alteration. An action that 'has, will have or is likely to have a significant impact on a matter of national environmental significance' is a 'controlled action' and may not be undertaken without approval from the Australian Government Minister for the Environment ('the Minister'). Under the EPBC Act, approval is also required for any action that:

- Is undertaken on Commonwealth land and will have or is likely to have a significant impact on the environment
- Is undertaken outside Commonwealth land and will have or is likely to have a significant impact on the environment on Commonwealth land
- Is undertaken by the Commonwealth and will have or is likely to have a significant impact on the environment.

No land within or immediately adjacent to the project footprint is Commonwealth land and the action is not being undertaken by the Australian Government.

The EPBC Act identifies MNES as:

- World heritage properties
- National heritage places
- Wetlands of international importance
- Threatened species and ecological communities
- Migratory species
- Commonwealth marine areas

- The Great Barrier Reef Marine Park
- Nuclear actions (including uranium mining)
- A water resource, in relation to coal seam gas development and large coal mining development.

The EPBC Act has been considered in this assessment through:

- Desktop review to determine the MNES that have been previously recorded within the locality of the site and hence could potentially occur, subject to the habitats present
- Targeted field surveys for species and ecological communities listed under the EPBC Act
- Identification of suitable impact mitigation and environmental management measures for threatened species, where required
- Assessment of potential impacts on MNES.

If a significant impact on MNES is likely, a referral should be submitted to the Australian Government Department of the Environment for a decision by the Minister on whether assessment and approval is required under the EPBC Act. No significant impacts on MNES are anticipated as a result of the project (refer to **section 6.7**) and consequently the project has not been referred to the Australian Government Department of the Environment.

4 Assessment methodology

4.1 Assessment approach

4.1.1 Threatened species assessment guidelines for major projects

This Biodiversity Impact Assessment report has been prepared with reference to the *Draft Guidelines for Threatened Species Assessment* (DEC/DPI 2005) as required by the original DGRs for the project and subsequently revised to the SEARs (refer to **section 3.1.1** for a discussion of the history of the project application).

The DEC/DPI (2005) guidelines identify important factors and key thresholds to be considered when assessing the potential impacts of major projects on threatened species, populations, ecological communities or their habitats. The evaluation of impacts involves identifying the magnitude and extent of impacts, but also the significance of the impacts as related to the conservation importance of the native biota likely to be affected. A key focus of the assessment methodology is to demonstrate measures to avoid, mitigate and where necessary offset identified impacts, to maintain or improve biodiversity values.

Field surveys were also conducted with reference to the *Threatened Biodiversity Survey and Assessment Guidelines for Developments and Activities* (DEC 2004). Given the highly modified nature of the project footprint and the extent and condition of habitats present, the survey effort focussed on habitat assessment.

A detailed methodology for the assessment is presented in **section 4.2** below.

4.1.2 The Framework for Biodiversity Assessment and NSW Biodiversity Offsets Policy

On 1 October 2014 the *NSW Biodiversity Offsets Policy for Major Projects* (Biodiversity Offsets Policy) was released by the NSW Office of Environment and Heritage (OEH 2014a), well after the release of the original DGRs. This policy is underpinned by the *Framework for Biodiversity Assessment* (FBA) (OEH 2014b). In addition to the DEC/DPI (2005) Assessment Guidelines discussed above, the revised SEARs also encouraged use of the FBA and the Biodiversity Offsets Policy for the preparation of the Biodiversity Impact Assessment. The FBA provides a methodology for quantifying the potential impacts on biodiversity and determining the required offsets for major projects.

This Biodiversity Impact Assessment has not been prepared in accordance with the FBA and Biodiversity Offsets Policy. These policies were released subsequent to the issue of the original DGRs (7 January 2014) for the project and after most of the ecological survey and assessments required by the DEC/DPI (2005) threatened species assessment guidelines had been completed. In addition, as discussed below, no intact native remnant vegetation is present in the project footprint and the project would not remove any habitat for 'species' credit species, and as such the FBA cannot be applied to this project.

A high level consideration of native vegetation species and populations in the study area, and key thresholds for assessing and offsetting impacts outlined in the FBA, is presented below as a guide to how the FBA would apply to the project.

No native vegetation is mapped in the project footprint by NPWS (2002), Tozer (2010) or OEH (2013). Native plants in the study area are contained within patches of planted native species. These areas were confidently identified as planted (rather than regrowth or remnant vegetation). Vegetation in the project footprint cannot be assigned to any intact native remnant vegetation or plant community types (PCTs) identified in the NSW Native vegetation database (OEH 2014c). As such, no vegetation zones and threatened species zones can be entered into the FBA and no calculations can be made for ecosystem or species credits.

The FBA includes a methodology for identifying threatened species that are associated with native vegetation at a site (included as part of the ecosystem credits) as well as other threatened species that cannot be reliably predicted to occur based on the presence of habitat surrogates (species credits) (see section 6 of OEH 2014b). The FBA requires assessment of impacts and calculation of offsets for

species credits based on the availability of habitat components for identified species credit species (see section 6.4 of OEH 2014b).

There are no species credit species or their habitats in the project footprint. The project would remove planted trees, which are not commensurate with naturally occurring PCTs identified in the NSW vegetation type database (OEH 2014c). Much of this planted vegetation provides foraging habitat for the Grey-headed Flying-fox (a threatened species listed under the TSC and EPBC Acts). The Grey-headed Flying-fox is considered a 'species' credit species under the FBA if breeding habitat is present. No breeding or roosting habitat for the Grey-headed Flying-fox is present in the project footprint, and as such this species is not considered a 'species' credit species for the purpose of this project. As all vegetation is planted and there are no PCTs in the project footprint, no ecosystem credits can be calculated for this species. As such, impacts of the project on the Grey-headed Flying-fox do not require specific assessment or offsetting under the FBA. Further discussion of Grey-headed Flying-fox habitat in the project footprint is provided in **section 5.5.3**.

In summary, the project has not been assessed in accordance with the FBA. As the project would not remove any PCTs or species credit habitats, an offset assessment is not required under the FBA. The project therefore does not include any impacts that require further consideration by a consent authority, impacts for which the assessor is required to determine an offset, or impacts that require further assessment in accordance with the key thresholds for assessing and offsetting impacts contained in the FBA (see Table 4, OEH 2014b).

As noted above (**section 4.1.1**), the impacts of the project on biodiversity have been assessed according to the *Draft Guidelines for Threatened Species Assessment* (DEC/DPI 2005) as required by the original DGRs for the project and also subsequently by the SEARs.

4.2 Methodology

The key components of the methodology for the biodiversity assessment were:

- Desktop assessment to describe the existing environment and landscape features of the study area and to identify threatened biota potentially affected by the project
- Field surveys to describe the biodiversity values of the project site and surrounding study area and determine the likelihood of threatened biota and their habitats occurring in the project site or being affected by the project
- Assessment of potential impacts of the project on threatened biota and biodiversity values.

The desktop and field methodology is described below.

4.2.1 Desktop assessment

Database searches

A desktop database review was undertaken to identify threatened flora and fauna species, populations and ecological communities (biota) listed under the TSC Act and FM Act, and MNES listed under the EPBC Act, that could be expected to occur in the locality, based on previous records, known distribution ranges and habitats present. The database review assisted with focusing field survey techniques and effort. Biodiversity resources pertaining to the project site and locality (ie within a 10 kilometre radius of the site) that were reviewed prior to conducting field investigations included:

- The OEH Atlas of NSW Wildlife for records of threatened species listed under the TSC Act and EPBC Act which have been recorded within the locality (as defined in **section 1.5**) (report generated in January 2014, updated 3 June 2015) (OEH 2015a)
- The NSW Department of Primary Industries (DPI) online protected species viewer for records of threatened aquatic species listed under the TSC Act, FM Act and EPBC Act that have been recorded within the locality (DPI 2015a) (database queried in January 2014, updated in June 2015)
- The DotE Protected Matters Search Tool for MNES, as listed under the EPBC Act and which may occur in the locality (report generated in January 2014, updated 3 June 2015) (DotE 2015a)
- OEH threatened species profiles online database (OEH 2015b)
- DotE online species profiles and threats database (DotE 2015b).

Following collation of database records and species and community profiles, a 'likelihood of occurrence' assessment was prepared with reference to the broad habitats in the project footprint. This was further refined following field surveys and assessment of habitat present (see **section 4.2.2**). The results of this assessment are presented in **Appendix B**.

Document review

A document review assisted with identifying biodiversity values in the study area and surrounds and assisted with focussing surveys. Documents reviewed for the preparation of this report included:

- *Mason Park Plan of Management* (Parkland Environmental Planners et al. 2008). Report prepared for Strathfield Council
- *Upper Duck River Wetlands and Riparian Plan of Management* (Applied Ecology 2012). Report prepared for Parramatta Council
- *Native Vegetation of the Cumberland Plain* Map 8 of 16 (NSW National Parks and Wildlife Service 2002a)
- *Interpretation Guidelines for the Native Vegetation of the Cumberland Plain, Western Sydney* (NSW National Parks and Wildlife Service 2002b)
- *The Native Vegetation of the Sydney Metropolitan Area* (OEH 2013)
- *Policy and guidelines for fish habitat conservation and management* (DPI 2013 update)
- *Powells Creek Master Plan* (Clouston Associates 2008)
- Review of aerial photography of the study area.

4.2.2 Assessment of likelihood of occurrence

A likelihood of occurrence ranking was attributed to these MNES based on the framework outlined in **Table 4.1**. The results of this assessment are included in **Appendix B**.

Table 4.1 Description of likelihood of occurrence classes

Likelihood of occurrence	Definition
Known	Biota confirmed as present within the study area either from previous records or field survey results.
Likely	Species previously recorded within the locality and/or; suitable habitat occurs within the study area (as defined in **section 1.5**). These species are likely to occur in the study area and the project may result in direct or indirect impacts on these species, including through the removal of habitat resources that may be relied upon by local populations of these species.
Possible	Species known or predicted to occur within the locality and potentially suitable habitat occurs within the study area. These species may occur in the study area on a transitory, seasonal or opportunistic basis. The project may result in direct or indirect impacts on these species, but would not remove any habitat resources that are relied upon by local populations of these species for their ongoing survival in the locality.
Unlikely	Species not previously recorded within the locality; study area is outside of the biota's known distribution and/or; suitable habitat not present within the study area. The project would not result in any direct or indirect impacts on these species or their habitats.

Likelihood of occurrence	Definition
Absent	Threatened ecological communities confirmed as absent from the study area by site surveys or; threatened species that could not occur in the study area even on an occasional basis (such as species that are geographically isolated or which depend on specific resources such as aquatic habitats that are absent and would never be present in the study area). The project would not result in any direct or indirect impacts on these species or their habitats.

4.2.3 Field survey

A diurnal survey of the study area was conducted by two GHD ecologists on 12 February 2014. Weather during the survey was warm and sunny, with no rain. Nocturnal surveys (anabats and spotlighting) were conducted on 27 February 2014. An anabat unit was also set on the night of 19 May 2014.

A brief field survey was conducted by an ecologist on 12 March 2015 to inspect biodiversity values at the Cintra Park hockey and tennis facilities in Concord. A second brief field survey was conducted on 26 June 2015 to inspect compound sites not previously surveyed. In particular, this included the site at Powells Creek between Parramatta Road and the M4.

Flora surveys

Surveys were undertaken throughout the study area, particularly targeting areas where planted vegetation would be removed for the project, as well as downstream wetland habitat areas. Vegetation present in the project footprint consists of planted vegetation along road sides, in gardens and in parklands. Surveys focused on the identification of dominant flora species, and any potential habitat for threatened flora. Flora species observed were recorded on data sheets.

Fauna surveys and habitat assessment

An assessment was made of the type and quality of habitats present in the study area for native fauna. Habitat quality was based on the level of breeding, nesting, feeding and roosting resources available. The study area was searched for habitat features, such as hollow-bearing trees, feed trees for the Grey-headed Flying-fox and water bodies. Areas of planted trees that may provide habitat for fauna were inspected. This included planted vegetation along the M4 and Mason Park Wetland downstream of the M4, and any other areas of planted vegetation within and adjacent to the project footprint, such as the Yasmar Estate and Ashfield Park. Any fauna observed or heard were recorded.

No natural creek lines are present. Four concrete-sided canals are present in the study area: Saleyards Creek, Powells Creek, St Lukes Park canal and Iron Cove Creek (Dobroyd Canal). These were inspected from adjacent bridges, roads or parklands. Downstream wetland habitat at Mason Park was inspected, and fauna species present recorded. A brief visual inspection of the underside of the bridges over Saleyards Creek and Iron Cove Creek was carried out to see if any bats appeared to be using the bridges for roosting. These inspections were carried out from adjacent roads or road reserves, as access to the canals was not possible.

Two anabat call detectors were placed in the study area on the evening of 27 February 2014. One was placed in planted vegetation adjacent to the M4 near Ismay Avenue, Homebush. The other was placed facing the bridge over Saleyards Creek adjacent to the M4. Anabat units were collected three hours after dusk (rather than deployed all night) to minimise the potential for human interference or theft. One anabat was disturbed by a member of the public but not turned off during the survey period. An additional anabat was placed in Yasmar on the evening of 19 May 2014 and collected the following morning. Weather on this night was unseasonably warm. The anabat at Yasmar was deployed for the entire night given the more secure location (ie less accessible by the public).

Spotlighting for nocturnal fauna, including the Grey-headed Flying-fox, was carried out in the larger patches of vegetation where anabats were placed.

Opportunistic observations of fauna species were recorded at all times during field surveys.

4.2.4 Survey effort considerations

The project site is located within a highly modified, urban landscape and there are no stands of intact native vegetation within the study area. Vegetation is limited to small stands of planted roadside vegetation, and within parks and gardens which provide habitat for mobile, common fauna typical of urban environments. The study area does not contain habitat of relevance to the vast majority of threatened biota previously recorded or predicted to occur in the locality (see **section 5.5**). As such dedicated targeted surveys such as trapping were not warranted. Instead, the fauna surveys focused on habitat assessment to identify specific resources of potential value for more mobile threatened biota species (such as the Grey-headed Flying-fox and microchiropteran bats) capable of accessing and using small, isolated patches of vegetation within urban landscapes.

Given the short duration of the survey, it is likely that some species that utilise the study area (permanently, seasonally or transiently) were not detected. These species may include flora species that flower after rainfall as well as annual, ephemeral or cryptic species; and fauna species that are mobile and transient in their use of resources. The habitat assessment conducted for the site allows for identification of habitat resources for such species. As such, the survey was not designed to detect all species, rather to provide an overall assessment of the ecological values in the study area in order to predict potential impacts of the project, with particular emphasis on threatened biota and their habitats.

5 Existing environment

5.1 Vegetation communities

5.1.1 Native vegetation

Vegetation in the locality has been mapped as part of the mapping of the Cumberland Plain (NSW National Parks and Wildlife Service 2002a) and the Sydney Metropolitan area (OEH 2013). This mapping does not identify any native vegetation communities or TECs in the project footprint.

No intact native vegetation communities are present in the project footprint or immediately adjacent to the study area. Vegetation within the project footprint and immediate study area has been planted and comprises a combination of private gardens, landscaped parks, reserves or strips of vegetation that have been planted as visual screening as part of rehabilitation/landscaping works following construction of major roads (eg the M4). Some of the species that have been used in these landscaping works are locally endemic; however, many species are not characteristic of locally occurring vegetation types, and the provenance of planted vegetation is unknown. Based on these attributes, the areas of planted vegetation in the study area do not comprise naturally occurring PCTs that can be entered into the FBA (see **section 4.1**). No vegetation in the project footprint or immediate vicinity is a groundwater dependent ecosystem.

Coastal Saltmarsh, listed as an endangered ecological community under the TSC Act and a vulnerable ecological community under the EPBC Act, is present at Mason Park, about one kilometre downstream of the study area. Coastal Saltmarsh mainly relies on sea water, however this vegetation type has the potential to have some reliance on groundwater (NSW Office of Water 2012). It is likely that a number of TECs once occurred within the study area; however, historical clearing for development and infrastructure has removed or modified habitats for any TECs that may have occurred. Characteristic species of some TECs occur in isolation or in linear strips along roads or in gardens. These occur over a maintained grass understorey and no characteristic understorey or groundcover vegetation is present. A narrow linear stand of planted Swamp Oak (*Casuarina glauca*) is present along the Iron Cove Creek canal, near the intersection of the canal with the Great Western Highway. While *Casuarina glauca* is a component species of Swamp Oak Floodplain Forest, the context of its occurrence does not qualify it as part of the TSC Act-listed community.

Given the lack of intact native vegetation types within the project footprint, broadly descriptive vegetation types have been identified and mapped as part of this assessment as opposed to native vegetation types. Vegetation types are described below and are shown on **Figure 5.1 – Figure 5.5**.

5.1.2 Planted/landscaped screening vegetation

This vegetation type has been planted alongside portions of the existing M4 motorway, and acts as a visual screen for the roadway to minimise exposure of local residents. It also occurs in the vicinity of Concord Road, and small areas of Cintra Park and Wattle Street. This vegetation type comprises a mixture of local and non-locally endemic species, as well as cultivars used in landscaped plantings. Inside the noise wall, Gymea Lily (*Doryanthes excelsa*), cultivar Grevillea species and Acacia species (*Acacia binervia* and *Acacia floribunda*) have been planted in rows, for aesthetic purposes. Outside of the noise wall, but still within the road reserve, planted canopy species include Spotted Gum (*Corymbia maculata*), Sydney Red Gum (*Angophora costata*), River Oak (*Casuarina cunninghamiana* subsp. *cunninghamiana*), *Eucalyptus beyeriana*, Flooded Gum (*Eucalyptus grandis*), Swamp Mahogany (*Eucalyptus robusta*), Forest Red Gum (*Eucalyptus tereticornis*), Moreton Bay Fig (*Ficus macrophylla*) and Port Jackson Fig (*Ficus rubiginosa*). The understorey in these areas is either absent or dominated by exotic herbaceous annuals or climbers.

Sites proposed for compound sites and the on-ramp near Powells Creek include planted trees, such as eucalypts and figs. Also present are introduced species such as Poplars (*Populus* sp.). No native vegetation types are present. The understory at these sites generally comprises mown lawn or leaf litter.

Planted and landscaped screening vegetation is mapped on **Figure 5.1 – Figure 5.5**.

5.1.3 Grassland with scattered trees

Vegetation within grassland with scattered trees within the project footprint predominantly comprises mown lawn with scattered planted canopy trees designed to facilitate public recreation and be aesthetically pleasing. There are several reserves within the study area, including Ismay Reserve, Reg Coady Reserve, Concord Oval, Cintra Park, Jegorow Reserve, Bill Boyce Reserve and Wentworth Reserve. Several of these reserves are immediately adjacent to and/or encompass some of the planted screening vegetation adjacent to the M4.

Some of the species planted in these reserves are locally endemic; however, the provenance of the species is unknown. Planted trees include a range of eucalypts and figs. One threatened species, the Wallangarra White Gum (*Eucalyptus scoparia*), has been planted in Reg Coady Reserve. This species is a commonly planted street/landscape tree that is well outside of its natural range (the Northern Tablelands of NSW) (RBGT 2015) within the study area.

Grassland with scattered trees is mapped on **Figure 5.1** – **Figure 5.5**.

5.1.4 Private gardens

Private gardens occur throughout much of the study area in residential properties and comprise common native, exotic and cultivar species. These gardens typically have mown and well-maintained lawns, with hedges and scattered small shrubs or trees.

This vegetation type has not been mapped as part of this assessment.

5.2 Flora species

A total of 83 species from 46 families were recorded within the study area (refer to **Appendix C**). This number excludes species within private gardens as well as cultivars which were not identified as part of this assessment. The Myrtaceae (trees and shrubs, 17 species) was the most abundant, followed by the Poaceae (grasses, five species) and Proteaceae (shrubs, three species). Only those species visible from public land were identified. Some species are cryptic and only flower or emerge in response to particular events (such as rainfall) or at certain times of year and may not have been detectable during the survey periods. There was no access to private property and only dominant species visible from public land were identified in residential areas. The full number of species that occur within the study area is therefore likely to be greater than the number presented within this assessment.

5.3 Fauna species

Habitats within the project footprint are of limited extent and value for most native fauna other than highly mobile species typical of urban parks and gardens (see below). A total of 26 fauna species were recorded in the study area during field surveys (see **Appendix C**). These comprise 23 bird species, one mammal species and two reptile species typical of urban parks and gardens. Four introduced bird species were recorded. The small number of common fauna species recorded during the field survey reflects the limited habitat available within the study area.

One threatened fauna species listed under the TSC Act and EPBC Act was recorded: the Grey-headed Flying-fox. A dead individual was observed hanging from a power line adjacent to planted figs within the project footprint (Wentworth Road near Pomeroy Street in Homebush) and individuals were heard calling from planted vegetation adjacent to the M4 during nocturnal surveys.

No microchiropteran bat (microbat) species were identified from anabat analysis, although there were some calls recorded from anabats left in February 2014. Calls could not be identified due to the small number of calls and poor quality, due in part to the low numbers of individuals likely to occur in the area as a result of limited habitat, as well as the limited survey time (see **section 4.2.4**). No calls were recorded on the unit placed at Yasmar in May 2014. A number of microbats are likely to occur on occasion in the area. These are discussed further below.

The study area may provide limited habitat for other threatened fauna known to occur in the locality. More detail on fauna habitats and habitat for threatened fauna in the study area is provided below.

5.4 Fauna habitats

The literature review and field surveys identified a number of areas with the potential to provide habitat for native flora and fauna, including planted vegetation alongside roads and in parks and gardens and canals within the project footprint. There are also habitats of higher biodiversity value that provide known habitat for threatened biota and migratory species in the wider area such as Mason Park and Upper Duck River. These areas are discussed below.

5.4.1 Cleared land

The majority of the project footprint consists of hardstand areas, including roads, pavements and buildings. These areas have negligible habitat value for native fauna. Common species recorded included the introduced Common Myna (*Acridotheres tristis*).

5.4.2 Planted trees and gardens

Screening vegetation, vacant land, urban parks and gardens within the project footprint contain planted trees and shrubs, garden beds and mown lawns that provide some habitat resources for native fauna. Planted trees and shrubs are present as street plantings and screening along the existing M4 and associated on and off ramps. Planted trees include a range of locally endemic, native Australian and exotic trees. Planted and screening vegetation and parks provide limited connectivity for fauna. Mobile species such as birds and bats would use patches of vegetation as 'stepping stones' for movement across the urban landscape.

No trees with hollows suitable for nesting or denning were observed. Trees would provide nesting and shelter habitat for a range of common birds and possums. Foraging habitat includes myrtaceous trees, such as the Spotted Gum (*Corymbia maculata*), Sydney Red Gum (*Angophora costata*), Flooded Gum (*Eucalyptus grandis*), Tallowwood (*Eucalyptus microcorys*), Swamp Mahogany (*Eucalyptus robusta*), Forest Red Gum (*Eucalyptus tereticornis*), Brush Box (*Lophostemon confertus*) and fruiting trees such as Port Jackson and Moreton Bay Figs (*Ficus* spp.) and Date Palms. A number of common bird species were recorded, including the Red Wattlebird (*Anthochaera carunculata*), Noisy Miner (*Manorina melanocephala*) and Rainbow Lorikeet (*Trichoglossus haemotodus*). Common bird species were observed foraging on mown lawns in parks. These included Masked Lapwings (*Vanellus miles*), Magpie-larks (*Grallina cyanoleuca*), Galahs (*Eolophus rosiecapillus*) and the introduced Rock Dove (*Columba livia*).

As noted above, a dead Grey-headed Flying-fox was observed hanging from a power line adjacent to figs planted for screening purposes on the northern side of the M4, and one was heard foraging in trees on the southern side of the M4. This species is likely to forage throughout planted trees in the study area when eucalypts are in flower and figs and palms are in fruit.

The study area provides foraging habitat for microbats. A small number of bat calls were recorded using anabat analysis but could not be identified to species. A number of species are known to occur in urban areas of Sydney including common species such as the White-striped Freetail Bat (*Tadarida australis*), Gould's Wattled Bat (*Chalinolobus gouldii*) and the Forest Bat (*Vespadelus vulturnus*). There is very limited roosting habitat in the study area. The young age of many of the planted trees means there is a lack of hollows and deep fissures for roosting. The threatened Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*) could roost in the area as it is known to roost under bridges and culverts. It is also known to forage over woodland and cleared areas.

The distribution of the Long-nosed Bandicoot (*Perameles nasuta*) endangered population of the inner west covers the study area. The majority of records of this population are associated with the inner west light rail corridor, although there is one record of a dead individual from the Canada Bay area. No other individuals have been recorded away from the inner west light rail corridor and adjacent areas. This species has the potential to occur in reserves within the project footprint, although there are no records suggesting this is the case (OEH 2015a).

Residential gardens in the study area provide limited habitat for fauna species. Common species as detailed above would occur in these areas. Fruiting trees and planted eucalypts may also provide seasonal foraging habitat for the Grey-headed Flying-fox.

5.4.3 Wetlands

Mason Park is located between the M4 and Homebush Bay Drive, alongside Powells Creek and Saleyards Creek, about one kilometre downstream and to the north of the project. Both of these creeks run through concrete canals at this location. Mason Park Wetlands provide a mosaic of tidal pools and remnant saltmarsh vegetation once common along the Homebush Bay foreshore as well as a small freshwater pond, rush swamp, mangrove forests and landscaped recreational areas. In the past, this wetland was one of the most important shorebird feeding and roosting sites in the Sydney area, and until recently had more shorebirds per hectare than any other site in the region (PEP et al. 2008).

Mason Park was listed on the Register of the National Estate due to the importance of the wetlands (PEP et al. 2008). The Register of the National Estate was closed in 2007 and is no longer a statutory list. All reference to the list was removed from the EPBC Act in 2012. Mason Park provides important habitat for migratory wetland birds listed under the EPBC Act and wetland birds listed under the TSC Act (see **section 5.5**). It also contains Coastal Saltmarsh, which is listed as a vulnerable community under the EPBC Act and an endangered ecological community under the TSC Act.

Powells Creek, which runs under the M4 in a concrete canal, forms the eastern boundary of the park. The Mason Park Wetlands are not fully hydrologically connected to Powells Creek. The base water level in the wetland is positioned above the base level of Powells Creek canal, with water from the wetland flowing down into the canal. Limited tidal flushing occurs at high tide via an existing drop-board weir; however, this does not adequately flush the wetland. Most hydrological interaction would occur during very high tides and at times of flood. A new automated inlet is proposed to improve flushing of the wetland.

At the time of the survey, water level at the wetland was very low, and water quality appeared to be poor with orange colouring in some areas. Waterbirds observed included about 30 Masked Lapwings (*Vanellus miles*) and one White-faced Heron (*Egretta novahollandiae*). Monitoring undertaken at Mason Park concurrent with monitoring for the Sydney Olympic Park Authority has recorded very few shorebirds at Mason Park, most likely due to the low water levels and poor water condition (J. Harrington pers. comm.). A number of threatened wetland birds listed under the TSC Act and/or the EPBC Act are known or may occur at the wetland. These include the Black-tailed Godwit (*Limosa limosa*) and Little Tern (*Sterna albifrons*), which have been recorded in the area previously, as well as a range of other migratory wetland species listed under the EPBC Act that may occur on occasion (see **section 5.5.3**).

Freshwater wetlands at Sydney Olympic Park (SOP) and the adjacent Newington Armoury and Bicentennial Park are located over 500 metres to the north of the western end of the project footprint (OEH 2015a). These wetlands provide habitat for one of the largest populations of the endangered Green and Golden Bell Frog (*Litoria aurea*). Substantial construction of additional habitat was undertaken during construction for the 2000 Sydney Olympic Games (Darcovich and O'Meara 2008). There is no connectivity via water bodies between the project footprint and habitat areas for the Green and Golden Bell Frog at SOP or adjacent lands.

5.4.4 Creeks and canals

Four creek lines are located within the study area. These are Saleyards Creek and Powells Creek which flow to Homebush Bay, St Lukes Park Canal which flows to Canada Bay, and Dobroyd Canal (Iron Cove Creek) in Five Dock which flows to Iron Cove. All of these creeks have historically been converted to concrete canals.

Saleyards Creek originates in Rookwood Cemetery and flows into Powells Creek to the north of the project footprint. Some sections of this creek, such as where it runs through Rookwood Cemetery may have limited value as a riparian corridor. However in the vicinity of the project footpint the creek has limited value as a riparian corridor as it is concrete lined and runs under or through industrial/commercial properties and major road infrastructure such as the M4 and Parramatta Road.

Powells Creek is a concrete lined channel which flows north to the Parramatta River. To the north of the M4 the creek flows largely through open space and residential areas. To the south of the M4 and Parramatta Road the creek flows under or through industrial/commercial areas and a railway corridor and there is very limited planted vegetation along this section of the canal. To the north of the M4 Powells Creek has the potential to provide value as a riparian corridor

St Lukes Park Canal does not extend southwards beyond Parramatta Road, and thus the riparian corridor is mainly located north of Cintra Park. Dobroyd Canal (Iron Cove Creek) starts in Ashfield, and runs under Parramatta Road, however very limited planted vegetation is present along this canal.

Planted vegetation (trees and shrubs) is present above the concrete-edged creeks. No trailing vegetation is present along the sides of the concrete canals, and no emergent aquatic vegetation is present in the canals. No natural creek banks are present, and the planted vegetation does not contribute to bank stability or provide any fish habitat as there are no exposed roots or woody debris. Planted vegetation along the canals provides some riparian connectivity for mobile fauna such as common bird species (eg. the Superb Fairy-wren). Riparian connectivity along creek lines that cross the project footprint is minimal due to surrounding residential and industrial areas, with often very little if any vegetation present along the edges of the canals. Within the project footprint, the M4 and Parramatta Road currently result in gaps in the riparian vegetation where these canals pass under these roads.

The water quality of the creeks relevant to the project is largely influenced by stormwater, aquatic weeds and erosion of the catchment upstream. Sewer overflows, particularly during high rainfall events, also influence water quality in these catchments, providing additional sources of nitrogen, phosphorus, suspended solids and faecal coliforms. High pollutant loads including cadmium, copper and zinc have been recorded in Powells Creek. Hawthorne Canal and Dobroyd Canal (Iron Cove Creek) contain high levels of heavy metals, predominantly from cars and runoff from roads. Water and sediment quality within the Parramatta River estuary is also generally poor, largely due to polluted stormwater runoff in these and other canals (GHD 2015a).

These creeks are highly modified artificial environments and have minimal habitat values for aquatic or terrestrial fauna. Water quality is impacted by the presence of aquatic weeds and pollutants andthere is limited habitat for fish present in these canals. Some small common fish may forage in the canals on occasion. No habitat for threatened fish species listed under the FM Act or EPBC Act are present in the canals.

Silver Gulls (*Chroicocephalus novaehollandiae*) and Australian White Ibis (*Threskiornis moluccus*) were observed foraging in the canals during the fauna survey. No bats were observed roosting under bridges over Iron Cove Creek or Saleyards Creeks. Few calls were recorded on the anabats and none were able to be assigned to species. Microbats such as the Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*) and the Large-footed Myotis (*Myotis macropus*) could potentially roost temporarily in culverts or under bridges associated with these canals, but these sites would not be suitable as maternity sites for these species. Accessible culverts in the study area were inspected for signs of roosting microbats during the field survey. There was no evidence of use by microbats detected during these inspections. The Eastern Bentwing Bat only breeds in particular maternity caves, and the Large-footed Myotis is more likely to breed in caves and tree hollows than under bridges in a highly urbanised area. This latter species may forage along the canals on occasion.

It is understood that Sydney Water proposes to naturalise the banks of Powells Creek downstream of Pomeroy Street in the near future. This would involve removing the steep concrete banks and creating a softer landscape feel with rocks and native plants and trees. This would improve the water quality and creek habitat for native fauna. The project is currently in the detailed design stage (Sydney Water 2015).

The Upper Duck River is located about five kilometres south of the M4 where it intersects with James Ruse Drive (about five kilometres south-west of the western end of the project footprint). The Duck River drains to the Parramatta River west of Silverwater Road and is not hydrologically connected to the project footprint.

Six threatened fauna species listed under the TSC Act and/or EPBC Act have been recorded from the Duck River riparian corridor. There are several records of the Green and Golden Bell Frog (*Litoria aurea*), listed under the TSC Act and EPBC Act. A roosting camp of the Grey-headed Flying-fox (*Pteropus poliocephalus*), listed under the TSC Act and EPBC Act, is located on the Duck River immediately upstream from Clyde Weir. There is one record of Spotted-tailed Quoll (*Dasyurus maculatus*), listed under the TSC Act and EPBC Act, in the area from 1993. There is also one record each of the Little Eagle (*Hieraetus morphnoides*) and the Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*), as well as a number of records of the Cumberland Plain Land Snail (*Meridolum corneovirens*), all listed under the TSC Act (Applied Ecology 2012).

The Downy Wattle (*Acacia pubescens*), listed under the TSC Act and EPBC Act, is known from a number of locations in Duck River Bushland Reserve, and there is one historic record of the Glandular Pink-bell (*Tetratheca glandulosa*), which is also listed under the TSC Act and EPBC Act. The Narrow-leaf Wilsonia (*Wilsonia backhousei*), listed under the TSC Act, has been recorded from tidal mudflats in the area (Applied Ecology 2012).

Nine species of birds listed under the JAMBA, CAMBA and RoKAMBA agreements have been recorded within a five kilometre radius from Duck River; however, none had been recorded in the Duck River Wetlands (Applied Ecology 2012).

The project has a negligible risk of impacting this wetland and riparian corridor due to its distance from the project footprint (about five kilometres) and the limited hydrological connection.

5.5 Conservation significance

5.5.1 Threatened ecological communities

A total of 23 TECs listed under the TSC Act have been recorded in the locality (OEH 2015a). Twelve TECs listed under the EPBC Act are known or predicted to occur in the locality (OEH 2015a; DotE 2015a). The presence or absence of these TECs within the study area is indicated in **Appendix B** based on assessment of vegetation in the study area during field surveys.

All vegetation in the study area is planted and no TECs occur within the project footprint. Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (referred to as 'Coastal Saltmarsh') occurs in the Mason Park Wetlands, about one kilometre downstream of the project footprint. This community is listed as an endangered ecological community (EEC) under the TSC Act and as a vulnerable ecological community under the EPBC Act. The Mason Park Wetlands are not directly connected to the creek. The potential for indirect impacts such as sedimentation and introduction of pollutants occurring as a result of the project are unlikely, except potentially during times of flood or very high tides.

A patch of Turpentine-Ironbark Forest (a TEC listed under the TSC Act) is mapped within Queen Elizabeth Park in Concord, 500 metres north of the study area (NSW National Parks and Wildlife Service 2002a). The project would not affect this vegetation community and this community is not considered further in this report.

5.5.2 Threatened flora species

The Atlas of NSW Wildlife database (OEH 2015a) identifies 28 threatened flora species and four threatened flora populations listed under the TSC Act previously recorded in the locality in the last two decades. The protected matters search tool (PMST) (DotE 2015a) identifies 21 threatened flora species listed under the EPBC Act as potentially occurring in the locality. The likelihood of occurrence of threatened plant species and populations within the study area has been assessed in **Appendix B**.

No threatened flora species native to the locality were recorded, or are likely to occur in the project footprint. Two threatened species listed under the TSC Act have been recorded historically in Mason Park and/or in wetlands associated with Olympic Park, downstream of the study area:

- Narrow-leafed Wilsonia (*Wilsonia backhousei*), listed as a vulnerable species
- *Zannichellia palustris*, listed as an endangered species.

One threatened species, the Wallangarra White Gum (*Eucalyptus scoparia*), listed as endangered under the TSC Act and vulnerable under the EPBC Act, has been planted in Reg Coady Reserve. This species is a commonly planted street/landscape tree and is well outside of its natural range (the Northern Tablelands of NSW and Queensland) (RBGT 2015). While this species is threatened in its natural setting in the Northern Tablelands of NSW and southern Queensland, the removal of one planted specimen from a recreation reserve in inner Sydney would not threaten the persistence of the species in the wild. This species is not considered further in this assessment.

One additional threatened species has the potential to occur within the study area as a planted specimen: Magenta Lilli Pilly (*Syzygium paniculatum*), listed as endangered under the TSC Act and vulnerable under the EPBC Act. This species is naturally found in rainforest on sandy soils or stabilised sand dunes at low altitudes in coastal areas. There is no natural habitat for this species within the study area, and it is a commonly planted species in horticultural and landscaping works. As such, it is not considered as a threatened flora species for the purposes of this assessment.

5.5.3 Threatened fauna species

A total of 46 threatened terrestrial fauna species and two threatened fauna populations have been recorded in the locality in the last two decades (OEH 2015a). The PMST identifies 51 threatened fauna species (or their habitats) listed under the EPBC Act as potentially occurring in the locality. A number of these species are pelagic or marine species (eg albatrosses and whales) which have been excluded from further consideration in this assessment as the proposal would not impact marine environments.

NSW Department of Primary Industries (DPI) identifies three threatened aquatic species (one fish and two dragonfly species) listed under the FM Act as having previously been recorded in the Sydney Metropolitan Catchment Management Area (CMA) (DPI 2015). The PMST predicts two threatened fish species to occur within the study locality.

The likelihood of occurrence of threatened fauna species within the study area has been assessed in **Appendix B**.

As discussed in **section 5.3**, one threatened fauna species, the Grey-headed Flying-fox, was recorded in the study area. This species would forage in planted trees in the study area and broader locality when suitable trees are in fruit or flower. Forage trees include Spotted Gum (*Corymbia maculata*), which is a highly productive species in the region, as well other eucalypts and figs. Spotted Gum flowers from winter to spring, providing a foraging resource in winter during food bottlenecks and in spring for breeding. These planted trees are likely to contribute to the available foraging habitat for the Grey-headed Flying-fox but comprise only a very small component of foraging resources in the locality, and would therefore not constitute habitat critical to the survival of a local population of the species. No breeding camps are located within the project footprint. The closest known camps are located at Duck River (about five kilometres south-west of the western end of the project footprint) and Wolli Creek (four kilometres to the south of the project). Neither of these camps would be impacted by the project.

Two threatened microbat species may occur in the study area: the Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*) and the Large-footed Myotis (*Myotis macropus*). These species are known to roost under bridges and in culverts and could roost temporarily under bridges in the study area. The Eastern Bentwing Bat is known to forage in urban areas, and the Large-footed Myotis may forage along canals in the study area.

Three threatened wetland birds have been recorded or are likely to occur in the Mason Park Wetland, located about one kilometre downstream and to the north of the project. These are the Curlew Sandpiper (*Calidris ferruginea),* Black-tailed Godwit (*Limosa limosa*) and Little Tern (*Sterna albifrons*). In addition, an endangered population of the White-fronted Chat (*Epthianura albifrons*) is known to occur in the area. No other threatened wetland species known or predicted to occur in the locality are considered likely to occur at Mason Park Wetland based on the lack of records at the wetland itself.

The study area does not contain suitable habitat for any threatened aquatic species listed under the TSC, FM or EPBC Acts and will not have an adverse impact on any populations of these species. No key fish habitat as defined in DPI (2013 update) is present in the project footprint.

Threatened fauna species considered likely to occur at least on occasion in the study area (including Mason Park Wetlands) are detailed in Appendix B. These species are considered affected threatened species for the purposes of this assessment. The likely significance of impacts on these species is assessed in **section 6**.

5.5.4 Migratory species

The PMST predicts 76 migratory species (or their habitats) listed under the EPBC Act to occur within the study locality (**Appendix B**). These comprise:

- 18 migratory marine birds
- 33 migratory wetland species
- Seven migratory terrestrial species
- 17 migratory marine species (excluding birds).

The OEH Atlas of NSW Wildlife database search identified an additional six migratory species that have been recorded in the locality that were not predicted in the PMST report (OEH 2015a). Of the total 82 species, five migratory marine bird species, 27 migratory wetland bird species and six migratory terrestrial species have been recorded in the locality in the last two decades (OEH 2015a).

The likelihood of occurrence of EPBC Act migratory species within the study area has been assessed in **Appendix B** and the findings are summarised below. The project will not have any direct or indirect impacts on marine environments. On this basis, 15 migratory marine species and the majority of the migratory marine bird species (eg albatrosses) previously recorded or predicted by the PMST to occur in the locality are not considered relevant to the assessment and have not been included in the likelihood of occurrence assessment in **Appendix B**.

Migratory species likely to occur in the project footprint

No migratory terrestrial or wetland species are likely to occur within the project footprint given the lack of native vegetation and natural wetlands, the restricted nature of planted trees and shrubs, and the generally highly modified urban environment in surrounding areas.

Migratory species known or likely to occur at Mason Park Wetland

Mason Park Wetland, located about one kilometre downstream of the project, provides habitat for 20 species listed under the Japan-Australia Migratory Bird Agreement (JAMBA) and 19 species listed under the China-Australia Migratory Bird Agreement (CAMBA) (PEP et al. 2008; DotE 2015c). Important migratory species associated with Mason Park since the 1960s are:

- Curlew Sandpiper, listed as critically endangered and migratory under the EPBC Act and endangered under the TSC Act. Mason Park is one of the most important sites for this species in the Sydney region
- Pacific Golden Plover, listed as migratory under the EPBC Act. Mason Park has long been the most important roost site for this species in the estuary
- Sharp-tailed Sandpiper, listed as migratory under the EPBC Act. This species is most numerous at inland wetlands and has increased in numbers at Mason Park during droughts in inland Australia
- Latham's Snipe, listed as migratory under the EPBC Act. Coastal wetlands provide important drought refuge for this species
- Other migratory species listed under the EPBC Act occurring in small numbers (one or two birds) from time to time include Red-necked Stint, Pectoral Sandpiper, and Marsh Sandpiper (PEP et al. 2008)
- Subtropical and Temperate Coastal Saltmarsh, listed as a vulnerable ecological community under the EPBC Act, occurs throughout Mason Park.

Mason Park Wetland is located about one kilometre downstream of the project along Powells Creek. The wetlands are not directly connected to the creek. The potential for indirect impacts such as sedimentation and introduction of pollutants occurring as a result of the project is unlikely, except potentially during times of flood or very high tides.

Defining important habitat for migratory shorebirds

A critical consideration in assessing the significance of potential impacts on listed migratory shorebird species, according to the Draft significant impact guidelines for 36 migratory shorebird species (DEWHA 2009), is whether or not a proposed action is likely to affect 'important habitat'. Important habitat is defined separately for 35 of the migratory shorebird species and Latham's Snipe (*Gallinago hardwickii)*. Most migratory species considered in Appendix B are included on the list of 35 species, except for Latham's Snipe, the Great Egret (*Ardea alba*), Cattle Egret *(Ardea ibis*) and Little Tern (*Sterna albifrons*) (DEWHA 2009). An area of 'important habitat' for the 35 migratory shorebird species is either:

- A site that is identified as internationally important
- A site that supports either:
    a) at least 0.1 per cent of the flyway population of a single species, or
    b) at least 2000 migratory shorebirds, or
    c) at least 15 shorebird species.

Important habitat for Latham's Snipe occurs at sites that have previously been identified as internationally important for the species, or sites that both:

- Support at least 18 individuals of the species
- Are naturally occurring open freshwater wetlands with vegetation cover nearby (for example, tussock grasslands, sedges, lignum or reeds within 100 metres of the wetland).

As noted above, no important habitat for migratory shorebirds occurs in the project footprint.

Mason Park, located north of the M4 and east of Homebush Bay Drive, is not an identified internationally important site (Bamford et al. 2008) but does support at least 15 shorebird species (DotE 2014). It therefore meets the criteria for an area of important habitat for migratory shorebirds according to DEWHA (2009). The wetland may also be important habitat for Latham's Snipe, which has been recorded at the wetland during periods of drought (PEP et al. 2008).

Defining important habitat for other migratory species

Important habitat for migratory birds is also defined in the significance criteria for listed migratory species (DotE 2013). An area of 'important habitat' for migratory species is defined as satisfying one or more of the following criteria:

- Habitat utilised by a migratory species occasionally or periodically within the 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.

The 'population' of a listed migratory species means the entire population or any geographically separate part of the population of any species of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries, including Australia.

An 'ecologically significant proportion' of the population varies with the species. Some factors that should be considered include the species' population status, genetic distinctiveness and species specific behavioural patterns (for example, site fidelity and dispersal rates).

The likelihood of occurrence of migratory species within the study area is assessed in **Appendix B**. Three migratory species that are not included in the list of 36 migratory shorebirds above are known or likely to occur at the Mason Creek Wetlands: the Great Egret, Cattle Egret and Little Tern. There is no potential habitat for these species in the project footprint. Habitats within the Mason Park Wetland are not likely to contain an ecologically significant proportion of the population of any of these species, be critical to any of these species at particular life stages, or are near the limit of these species' ranges. The habitat within Mason Park is therefore not considered to be 'important habitat' for these species as defined in the significant impact guidelines for migratory species (DEWHA 2009). The Mason Park Wetlands are not directly connected to the creek. The potential for indirect impacts such as sedimentation and introduction of pollutants occurring as a result of the project are unlikely, except potentially during times of flood or very high tides.

5.5.5 Wetlands of international importance

Towra Point Nature Reserve was identified in the PMST as occurring in the locality. This wetland is located on the southern side of Botany Bay, about 12 kilometres to the south of the study area. None of the creeks in the study area drain towards Botany Bay; rather they all drain to the Parramatta River. As Towra Point Nature Reserve is not in the same catchment as the study area, this wetland is not considered to be relevant to this report.

5.5.6 World Heritage properties

The PMST identifies eight World Heritage properties that are present in the locality. None of these properties would be impacted by the project, and they are not considered further in this report.

5.5.7 National Heritage properties

The PMST identifies seven listed, indicative or nominated National Heritage properties in the locality. None of these are of relevance to this biodiversity assessment, and they are not considered further.

5.5.8 Other MNES

The following MNES are not relevant to this report and are not considered further:

- Commonwealth marine areas
- The Great Barrier Reef Marine Park
- Nuclear actions
- A water resource, in relation to coal seam gas development and large coal mining development.

The project is not located on Commonwealth land.

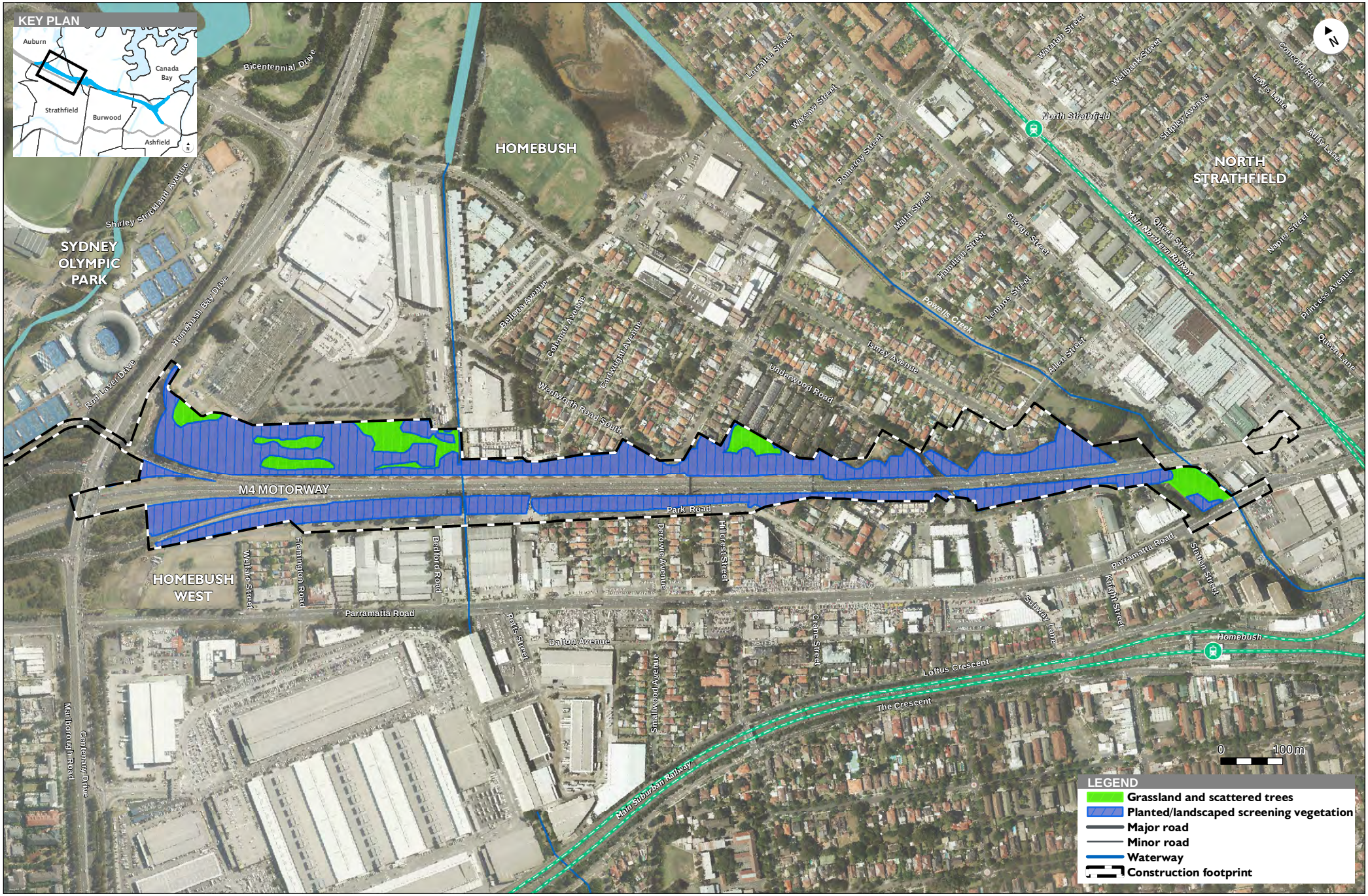

Figure 5.1 Vegetation types to be removed - Map 1 (Homebush)

Figure 5.2 Vegetation types to be removed - Map 2 (North Strathfield)

Figure 5.3 Vegetation types to be removed - Map 3 (Cintra Park)

Figure 5.4 Vegetation types to be removed - Map 4 (Haberfield)

Figure 5.5 Vegetation types to be removed - Map 5 (Ashfield)

6 Assessment of impacts

6.1 Construction impacts

6.1.1 Direct impacts

Loss of native vegetation

The M4 East project is located in a highly urbanised environment. Much of the project would be tunnelled under existing roads and residential areas, and would thus generally avoid direct impacts on biodiversity values. No area of naturally occurring or intact native vegetation communities would be removed for the project. There would be no impact on any TECs or naturally occurring plant community types.

No naturally occurring threatened flora species listed under the TSC Act would be directly impacted by the project. As discussed in **section 5.5.2**, two threatened flora species are known to occur within the Mason Park Wetland and in wetlands associated with Sydney Olympic Park. The project is highly unlikely to impact these species given the distance between the project and the wetland, and the limited hydrological connection between Powells Creek which runs under the M4 and the wetland. Potential indirect impacts on Powells Creek are discussed in **section 1.1.1**.

As discussed in **section 5.5.2**, two threatened species are either known or have the potential to occur within the study area as planted individuals used in landscaping and gardens. The impact of the proposal on planted individuals is not considered as part of this assessment.

Loss of planted vegetation

Construction of the project would result in the removal of about 15.7 hectares on vegetation, comprising about 12.9 hectares of planted trees and screening vegetation (mainly from alongside the M4) and about 2.8 hectares of grassland with scattered trees (such as from Cintra Park and Reg Coady Reserve) (as mapped on **Figure 5.1 – Figure 5.5**). A summary of vegetation clearing by location is provided in **Table 6.1**. In addition to the vegetation identified in the table below, scattered trees located in private gardens and some street tree plantings would also be removed.

The impacts of vegetation clearing would occur along the M4 in particular, as well as near the tunnel interchanges at Concord Road, Wattle Street and Parramatta Road. In addition planted trees would be lost as a result of construction compounds (such as at Bill Boyce Reserve and Cintra Park) and the Powells Creek on-ramp between Parramatta Road and the M4. In some locations, for example the eastern side of Cintra Park, vegetation clearing may be limited to lopping only.

Vegetation to be removed is mapped in **Figure 5.1 – Figure 5.5**. At this stage a conservative approach has been taken to identifying areas of vegetation to be removed. During the detailed design and construction phases it may be possible to retain existing vegetation in some locations such as around the periphery of some construction compound sites. Indirect impacts associated with vegetation removal and construction are discussed in **section 1.1.1**.

Table 6.1 Vegetation clearing

Location	Planted and screening vegetation (ha)	Grassland with scattered trees (ha)
North of M4 (between Homebush Bay Drive and Powells Creek)	6.9	1.2
South of M4 (between Homebush Bay Drive and Powells Creek civil site)	4.0	0.3
Concord Rd interchange including Queen St cycleway on-ramp	1.4	0.1
Cintra Park	0.3	0.6
Wattle Street and Dobroyd Parade	0.3	0.6
Total	12.9	2.8

Impacts on fauna species and habitat

The clearance of planted vegetation for the project would result in the loss of foraging and shelter habitat for common fauna species, including birds, possums and small skinks typical of urban parks and gardens. The project would remove about 12.9 hectares of planted trees and screening vegetation (mainly located along the M4). The project would result in minimal fragmentation of habitat. No stands of intact native vegetation communities would be removed or fragmented. The project would remove planted trees from an already highly fragmented urban landscape.

The majority of the planted trees and screening vegetation would provide foraging resources for the Grey-headed Flying-fox when fruiting or flowering. These planted trees do not constitute habitat critical to the survival of the Grey-headed Flying-fox (see **section 5.5.3**). There would be no removal of roosting habitat of the Grey-headed Flying-fox. No areas of potential foraging habitat for the Grey-headed Flying-fox would become isolated and the project would not affect movements of the Grey-headed Flying-fox in the locality. The project would not indirectly impact any breeding camps in the locality.

Construction activities near culverts could temporarily disrupt the roosting habitat of the Large-footed Myotis and the Eastern Bentwing Bat if these bat species are using these features as temporary roost sites. There is no breeding habitat for these species in the study area. Following construction, these species could continue to roost in culverts in the study area. There would be no impact on foraging habitat for the Large-footed Myotis. The project would remove about 12.9 hectares of planted trees and screening vegetation and 2.8 hectares of grassland with scattered trees that provide foraging resources for the Eastern Bentwing Bat. The project would not affect the movements of these species between foraging areas and breeding sites.

There would be no removal of wetland habitat at Mason Park. As such, there would be no fragmentation of habitat for migratory wetland species. The project would not affect the movements of any wetland birds between foraging areas and breeding sites.

The project may result in the mortality of small, common fauna that are resident in vegetation to be removed, such as skinks in leaf litter and common nesting birds. Mortality of threatened fauna is unlikely given that no threatened species would be resident in habitats to be removed. The project would not remove any hollow-bearing trees or other roost sites for bats, any roosts or camps for the Grey-headed Flying-fox or any habitat for migratory birds or other wetland birds.

Impacts on aquatic habitats

No natural creek lines occur in the study area; all creeks occur as concrete canals, although some vegetation is present where the M4 crosses Saleyards Creek. As noted in **section 5.4**, Sydney Water proposes to naturalise the banks of Powells Creek in the future, although this is unlikely to occur prior to the construction of this project. Any construction works in the vicinity of canals would involve the construction of culverts or bridges similar to what are currently present. No canals would be realigned. There would be no impact on fish passage or large woody debris. Indirect impacts associated with vegetation removal and construction are discussed in.

6.1.2 Indirect impacts

Indirect impacts on flora and fauna resulting from construction of the project are discussed below.

Erosion and sedimentation

Uncontrolled erosion of topsoil from excavated areas and exposed soils and corresponding deposition into native vegetation or freshwater creeks can cause weed problems and stifle plant growth. Sedimentation runoff to waterways from exposed soils due to riparian vegetation clearing or earthworks can alter water quality and adversely affect aquatic life.

Proposed works in riparian areas and removal of vegetation associated with the construction of the project over Saleyards Creek or the on-ramp at Powells Creek, for example, have the potential to reduce soil stability. Combined with the high erosive potential of runoff passing through the waterway crossings, there is the potential for the release of large sediment loads into the downstream receiving environment due to the proposed works, particularly during significant rainfall events (GHD 2015a).

Canals in the project footprint currently have poor water quality as a result of stormwater runoff. High levels of sediments are present. This is reflected in the poor water quality of the Parramatta River

estuary, which receives this polluted water (see **section 5.4.4**).There is a negligible risk of increased levels of sediments in Powells Creek entering the Mason Park Wetland and reducing habitat quality for wetland birds. The Mason Park Wetland is separated from Powells Creek by the concrete sides of the canal. There is only very limited transfer of water between Powells Creek and the wetland, probably only during flood conditions or very high tides. Any sediments that are transferred into Powells Creek as a result of the project would need to travel a long distance (about one kilometre) before they have the potential to enter the wetland. Water transfer between the creek and the wetland is via a pipe with a weir. Given the distance between the project and the wetland, and the limited hydrological relationship between the wetland and the creek, potential indirect impacts of sedimentation would be negligible.

Narrow bands of mangroves and/or seagrasses are mapped on the edges of Powells Creek, Iron Cove and Canada Bay (DPI 2000). Sediments transferred into the canals leading to these areas have the potential to reduce habitat quality for this marine vegetation. As discussed above, the Parramatta River estuary, including these bays, currently has poor water quality asa result of polluted stormwater. Given the distance between the project and these aquatic habitats, and the existing poor water quality, potential indirect impacts of sedimentation would be negligible.

The project is not likely to impact flooding levels downstream of the M4, but could increase the extent of existing flooding between Parramatta Road and the M4 (particularly at Saleyards Creek) during construction. This would not affect the Mason Park Wetland.

The widening of the M4 at the Saleyards Creek crossing would remove planted and screening vegetation that is adjacent to the canal. This could potentially result in an increase in exposed soil surface adjacent to the canal and subsequent erosion. This has the potential to negatively impact water quality and overall health of the creek at this location and downstream of the project footprint (GHD 2015a).

Freshwater wetland habitats occupied by the Green and Golden Bell Frog at Homebush are separated from the project by at least 500 metres. There is no hydrological connectivity between the project footprint and any water bodies that contain habitat for the Green and Golden Bell Frog. No sediment runoff from the project would be able to travel between the project and the wetland occupied by the Green and Golden Bell Frog. The project is highly unlikely to impact this species.

Mitigation measures recommended to maintain water quality would to minimise the risk of indirect impacts on biodiversity values (see **section 7.2** and GHD 2015a).

Impacts on aquatic habitats and riparian corridors

No natural creek lines occur in the study area; all creeks occur as concrete canals. As noted in **section 5.4**, Sydney Water proposes to naturalise the banks of Powells Creek in the future, although this is unlikely to occur prior to the construction of this project. Any construction works in the vicinity of canals would involve the construction of culverts or bridges similar to those currently present. No canals would be realigned. There would be no impact on fish passage or large woody debris.

Some limited planted riparian vegetation is present above the concrete-sided canals. As discussed in **section 5.4.4**, this planted vegetation does not contribute to the health of the canals as it is located above the concrete edges. No trailing or emergent vegetation is present.

The widening of the M4 would further increase the existing gap in the planted riparian vegetation. Some planted vegetation would be removed from adjacent to Saleyards Creek where the M4 crossing is located and from the Powells Creek civil site. There would be very limited clearing of planted trees from the Cintra Park civil site adjacent to St Lukes Park canal and from Reg Coady Reserve adjacent to Iron Cove Creek Canal. No planted vegetation would be removed from Barnwell Park Canal.

The limited removal of planted vegetation at these locations would have a negligible impact on the ecological value of riparian corridors, given that this vegetation is planted above the concrete sides of the canals and does not contribute to the health of water quality of the creeks. The loss of small areas of vegetation at Saleyards Creek and Powells Creek would not impact the movement of mobile fauna along the riparian corridor.

Landscaping of civil sites near creek lines is recommended to improve riparian corridors (see **section 7.2).**

Pollution

The project has the potential to pollute waterways as a result of chemical spills from construction. All creeks in the study area are located in canals, and have no natural aquatic habitat. Canals in the project footprint currently have poor water quality as a result of stormwater runoff. High levels of heavy metals, faecal matter and other nutrients are present. This is reflected in the poor water quality of the Parramatta River estuary, which receives this polluted water (see **section 5.4.4**). Pollution could potentially impact wetland bird habitats downstream at the Mason Park Wetlands. Given the distance between the project and the wetland, and the limited hydrological relationship between the wetland and the creek, and the existing poor water quality, there is limited risk of indirect impacts of pollution at the wetland as a result of the project. Similarly, the distance between the project and any mangroves and seagrasses would limit indirect impacts of pollution on these aquatic habitats. Mitigation measures are recommended to minimise the risk of pollution of water bodies as a result of the project (see **section 7.2**).

Groundwater impacts

No groundwater dependent ecosystems are present in or immediately adjacent to the project footprint.

Coastal Saltmarsh located in the Mason Park Wetland is mainly reliant on seawater, but is also likely to be somewhat reliant on groundwater for ecological processes. Mason Park Wetland is located about 500 metres north of the project footprint. There would be no tunnelling under or in the immediate vicinity the wetland. As such, the project is unlikely to impact any groundwater dependent ecosystems.

Impacts on groundwater dependent ecosystems is discussed in more detail in the *Groundwater Impact Assessment* (GHD 2015c).

Edge effects and weeds

Edge effects are described as an ecological impact at two or more interfacing habitat types. Removal of vegetation causes a number of new environmental conditions to develop along the edges of the cleared environments, including the spread of weeds as a result of disturbance and increased light. Planted and screening vegetation in the project footprint is already subject to edge effects given the narrow width of the vegetation. Most of the vegetation in the project footprint would be removed, and given the lack of connectivity or any other large patches of vegetation in the vicinity, there would be no new edges created.

Without the use of appropriate weed management protocols, the project has the potential to facilitate the spread of weeds into cleared and planted areas. Given the lack of native vegetation communities in the study area, and presence of many environmental weeds in the study area already, the potential impact of this is negligible. Canals could potentially transport weed propagules from the project to downstream areas. Mitigation measures to be implemented during the construction and operational phases of the project include strategies for the management and control of noxious and environmental weeds.

Pathogens

The infectious disease Chytridiomycosis, caused by the chytrid fungus, is known to affect Green and Golden Bell Frog populations in NSW. Chytrid fungus is a water borne pathogen and could be spread through water or mud on vehicles, machinery, footwear and other equipment. There is a risk of this disease being introduced or spread on machinery, clothing and in soil/fill during construction of the project. Given that there is no hydrological link between the project and habitat areas for the Green and Golden Bell Frog, the transfer of chytrid fungus as a result of the project is highly unlikely.

Light and noise

There is likely to be limited, temporary impacts on fauna utilising adjacent areas of habitat during construction associated with noise, light and other disturbances. Existing noise and light associated with roads and urban environments would already affect resident fauna. There are limited fauna habitats present in the study area. The project is unlikely to result in any substantial increase or impact in this regard.

6.2 Operational impacts

The project is located in a highly urbanised area, and threatened and migratory species listed under the TSC Act or EPBC Act that may occur in the study area (refer to **Appendix B**) are unlikely to be affected by the operation of the project. There would be little change in the existing level of risk associated with vehicle strike and/or habitat modification (eg weed spread, light and noise) as a result of the project.

The proposed M4 on-ramp at Powells Creek would encroach on a section of Powells Creek between Parramatta Road and the M4. This area of the creek would be impacted by overshadowing from the M4 and the proposed on-ramp. Powells Creek is a concrete canal at this location. Planted trees at this location currently comprise exotic trees over a groundcover of introduced grasses which have limited biodiversity value. These exotic trees would be removed to allow construction of the proposed on-ramp. Given the lack of native species and the presence of the concrete canal, removal of this vegetation would have negligible impact on the riparian corridor at this location.

Sydney Water is proposing to naturalise Powells Creek in the future which has the potential to improve the riparian habitat along the creek corridor in the longer term. In addition Strathfield Council has a masterplan to develop the land adjacent to Powells Creek between Parramatta Road and the M4 as an open space area. The proponent should liaise with Sydney Water and the Council to ensure that an appropriate landscaping treatment is agreed adjacent to the proposed on-ramp along this section of the creek.

A permanent water quality basin is proposed at the motorway operations complex immediately to the west of Saleyards Creek. The water quality basin is to be setback from the boundary of the creek and should be designed to avoid any impact on the creek corridor. The setback area along this boundary should be appropriately landscaped.

The increase in impervious area from the above ground sections of the project would result in an increase in the quantity of stormwater flows into the canals during operation (GHD 2015a). It is expected that these impacts would be relatively minor as the surface component of the M4 East project would not differ substantially from the current land use and footprint. There may be increases in pollutants entering these waterways as a result of increased traffic use (GHD 2015a), however the proposed drainage design would minimise the risk of this occurring (GHD 20115b)).

Under large storm events or where road drainage may become blocked there is the potential for stormwater to run down the roads and collect in the tunnel. This runoff would carry with it the matter (ie pollutants and sediment) dropped on the road carriageway within the tunnel and any other runoff from within the tunnel. Runoff would be discharged from the tunnel potentially by means of a pumping system. A water treatment plant, basins for the management of groundwater and stormwater, and gross pollutant traps are included in the design of the tunnel. This would minimise the risk of pollutants entering nearby canals and other receiving waters (GHD 2015a, GHD 2015b).

Mitigation measures relating to water quality during operation are provided in *WestConnex M4 East EIS: Surface Water: Water Quality, Soil and Water* (GHD 2015a).

6.3 Cumulative impacts

The major potential ecological impacts of increasing road networks are likely to be the disruption of landscape processes and loss of biodiversity (Forman and Alexander 2014). The study area is located within the centre of Sydney and an extensive and complex road network, residential and industrial areas dominate the area.

The project will only involve the removal of small patches of already highly fragmented planted vegetation. Additional road projects such as the New M5 and possible future M4–M5 Link (both subject to planning approval) would also result in removal of mainly planted vegetation and associated fauna habitats. These losses in biodiversity are also likely to be restricted in area, given their location in a highly modified environment. Together these projects and other developments would result in the further loss of habitat from an already modified environment with only limited natural biodiversity values.

6.4 Key threatening processes

A key threatening process (KTP) is defined in the TSC Act as an action, activity or proposal that:

- Adversely affects two or more threatened species, populations or ecological communities, or
- Could cause species, populations or ecological communities that are not currently threatened to become threatened.

There are currently 38 KTPs listed under the TSC Act and eight listed under the FM Act. A number of KTPs are listed under more than one Act. Those potentially relevant to this proposal are listed in **Table 6.2** below. Mitigation measures to limit the impacts of these KTPs are discussed in **section 7.2**.

Table 6.2 Key Threatening Processes of relevance to the proposal

KTP	Status	Comment
Clearing of native vegetation	TSC Act EPBC Act	No naturally occurring stands of native vegetation are located in the study area. The project would remove planted trees and landscaped gardens only.
Clearing of hollow-bearing trees	TSC Act	No trees with suitable hollows for birds or mammals are likely to be removed by the project. The implementation of fauna management procedures is recommended to limit impacts on fauna and their habitats (see **section 7.2**).
Removal of dead wood and dead trees	TSC Act	Fallen timber and standing dead trees (stags) provide important habitat for a range of native species and are important to ecosystem health. The proposal footprint generally contained very little fallen timber at the time of the field survey, with few occurrences of terrestrial woody debris. The proposal may result in the removal or disturbance to those small amounts that do occur within the proposal footprint, during construction of the proposal. The implementation of fauna management procedures is recommended to limit impacts on fauna and their habitats (see **section 7.2**).
The degradation of native riparian vegetation along NSW water courses	FM Act	Unlikely. There are no natural watercourses located in the project footprint. Construction activities could have indirect impacts on riparian vegetation downstream of the study area. The implementation of a Construction Soil and Water Management Plan is recommended to limit impacts on riparian vegetation.
Human-caused climate change	TSC Act EPBC Act	Combustion of fuels associated with construction and operation of the project would contribute to anthropogenic emissions of greenhouse gases. The project does not pass through any areas mapped as coastal corridors for climate change that provide for the latitudinal movement of species. The increase in greenhouse gases as a result of the project may impact climatic habitat elsewhere in NSW over the long-term.
Invasion of plant communities by perennial exotic grasses	TSC Act	Exotic perennial grasses are already established throughout the study area, including around the Mason Park Wetland. There is negligible risk of weeds being spread to native vegetation as a result of the project. Weed management and control would be undertaken in accordance with the *Roads and Maritime Biodiversity Guidelines* (RTA 2011) to minimise the risk of spread of weeds.

6.5 Identification of affected threatened and migratory biota

The desktop assessment, field surveys and habitat assessments undertaken for this assessment have been used to identify the suite of threatened and migratory biota that may be affected by the proposal, through either direct or indirect impacts.

Affected threatened biota for the purposes of this assessment are:

- One threatened ecological community:
  - Coastal Saltmarsh (EEC, TSC Act; VEC, EPBC Act)
- Two threatened flora species:
  - *Wilsonia backhousei* (Vulnerable, TSC Act)
  - *Zannichellia palustris* (Endangered, TSC Act)
- Three threatened mammals:
  - Grey-headed Flying-fox (*Pteropus poliocephalus*) (Vulnerable, TSC Act; Vulnerable, EPBC Act)
  - Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) (Vulnerable, TSC Act)
  - Large-footed Myotis (*Myotis macropus*) (Vulnerable, TSC Act)
- Four threatened birds:
  - Black-tailed Godwit (*Limosa limosa*) (Vulnerable, TSC Act; Migratory, EPBC Act)
  - Curlew Sandpiper (*Callidris ferruginea*) (Endangered TSC Act; Critically Endangered EPBC Act; Migratory, EPBC Act)
  - Little Tern (*Sterna albifrons*) (Endangered TSC Act; Migratory, EPBC Act)
  - White-fronted Chat (*Epthianura albifrons*) (Vulnerable, TSC Act; Endangered Population, TSC Act).

Based on the targeted surveys and habitat assessments undertaken, many of the threatened biota presented in **Appendix B** are unlikely to occur in the study area or be impacted by the project. Given the limited scale and magnitude of impacts arising from the proposal and impact mitigation and environmental management measures described in **section 7.2**, no additional threatened biota outside of the study area are likely to be affected by off-site impacts of the proposal.

An assessment of the potential effects of the project on identified affected threatened biota has been undertaken in accordance with the threatened species assessment guidelines (DEC/DPI 2005) and the MNES Significant Impact Guidelines (DotE 2013) (see **section 6.6** and **section 6.7**).

6.6 Assessment of significance of impacts on State-listed biota

An assessment of the likely significance of impacts of the project on relevant threatened biota listed under the TSC Act has been undertaken using the assessment criteria contained in the threatened species assessment guidelines (DEC/DPI 2005). The findings of these assessments are discussed below and summarised in **Table 6.3**. No significant impacts on threatened biota listed under the TSC Act are likely to result from the project.

No threatened biota listed under the FM Act are likely to be impacted by the proposal (refer **section 5.5**).

6.6.1 Threatened ecological communities and threatened flora species

No TECs or threatened flora species occur in the project footprint or would be directly impacted by the proposal (refer **section 6.1**).

One TEC, Coastal Saltmarsh, and two threatened flora species (*Wilsonia backhousei* and *Zannichellia palustris*) occur downstream of the study area. There is a negligible risk of indirect impacts on Coastal Saltmarsh and these two species at the Mason Park Wetlands through the transfer of sediments or pollution along Powells Creek if not appropriately mitigated. As discussed in **section 5.4**, there is only limited hydrological connectivity between Powells Creek and the Mason Park Wetland, probably only during times of flood or at very high tides. Given the potential for indirect impacts, an assessment of

the likely significance of impacts on Coastal Saltmarsh and these two species at Mason Park (**Appendix D**) has been prepared on a precautionary basis and is presented in **Appendix D**. Given that no area of this community would be directly impacted and indirect impacts on wetland habitat are unlikely (given the distance of the wetland from the project and the limited hydrological interaction between the wetland and Powells Creek), the project is unlikely to have a significant impact on Coastal Saltmarsh, *Wilsonia backhousei* and *Zannichellia palustris*.

Mitigation measures recommended to maintain water quality would minimise the risk of indirect impacts on downstream vegetation and flora habitats.

6.6.2 Threatened fauna species

The Grey-headed Flying-fox was recorded in the study area. Habitat in the study area would support a small number of individuals that roost within 50 kilometre radius of the study area. Spotted Gum is a dominant planted tree in the study area, particularly along the existing M4. This species flowers from winter to spring, and provides foraging resources in winter during food bottlenecks and in spring for breeding. These planted trees are likely to contribute to the available foraging habitat for the Grey-headed Flying-fox but comprise only a very small component of foraging resources in the locality or that within 50 kilometres of the nearest camp and would therefore not constitute habitat critical to the survival of a local population of the species.

Foraging habitat in the locality (a 10 kilometre buffer of the project) includes planted and screening vegetation in the project footprint as well as native vegetation mapped elsewhere in the locality (Tozer et al. 2010). The project would remove about 0.9 per cent of the total available potential foraging habitat for this species from within the locality). The planted vegetation to be removed would comprise a much smaller component of potential foraging habitat within a 50 kilometre radius of the project. No breeding camps are present in the study area.

An assessment of significance has been prepared for this species (**Appendix D**). Given that removal of foraging habitat would be restricted to the loss of small, linear patches of planted trees located along existing urban roads and in urban parks and gardens; that this habitat loss represents a minor proportion of the potential foraging habitat for the Grey-headed Flying-fox; and that there would be no direct impact on any breeding camps or foraging movements, the project is unlikely to have a significant impact on this species.

Threatened cave-roosting microbats (the Eastern Bentwing Bat and Large-footed Myotis) may roost in culverts in the study area on occasion. There is no breeding habitat present for the Eastern Bentwing Bat, which breeds in specific maternity caves, or the Large-footed Myotis, which is unlikely to breed in culverts in such a highly urbanised area. The proposal would remove small areas of potential foraging habitat (planted trees along roads and in parks) for the Eastern Bentwing Bat, but would not impact any foraging habitat for the Large-footed Myotis which forages over waterways. Assessments of significance have been prepared for these species (Appendix D). Given the limited potential foraging habitat to be disturbed, large areas of foraging habitat available in the locality and lack of impact on potential breeding habitat, the project is unlikely to have a significant impact on these species.

No habitat for wetland birds occurs in the project footprint. Threatened wetland species may occur at Mason Park. There is a negligible risk of indirect impacts on Mason Park Wetlands through the transfer of sediments or pollution along Powells Creek if not appropriately mitigated. As discussed in **section 5.4**, there is only limited hydrological connectivity between Powells Creek and the Mason Park Wetland (probably only during times of flood or very high tides) and the potential for indirect impacts on the wetland as a result of the project is considered negligible.

Given the potential for indirect impacts, an assessment has been prepared on a precautionary basis to assess the likely significance of impacts on the threatened wetland birds that may occur at Mason Park (**Appendix D**). Given that no habitat for wetland birds would be directly impacted, there would be no direct mortality of birds as a result of the project, and indirect impacts on wetland habitat are likely to be minor (given the distance of the wetland from the project, and the limited hydrological interaction between the wetland and Powells Creek), the project is unlikely to have a significant impact on threatened wetland birds. Mitigation measures recommended to maintain water quality would minimise the risk of indirect impacts on downstream fauna habitats.

Table 6.3 Threatened biota that may be affected by the proposal

Species	TSC Act Status	EPBC Act Status	Potential for impact	Likely significant impact?
TECs				
Coastal Saltmarsh	EEC	VEC	Low. Potential for indirect impacts from changes to water quality in Powells Creek and Mason Park Wetland if not mitigated.	No
Flora species				
Wilsonia backhousei	V		Low. Potential for indirect impacts from changes to water quality in Powells Creek and Mason Park Wetland if not mitigated.	No
Zannichellia palustris	E		Low. Potential for indirect impacts from changes to water quality in Powells Creek and Mason Park Wetland if not mitigated.	No
Fauna species				
Grey-headed Flying-fox (*Pteropus poliocephalus*)	V	V	Low. Project would remove a small area of planted trees that may be used for foraging when flowering or fruiting.	No
Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)	V		Low. Project would remove a small area of planted vegetation that may be used for foraging habitat on occasion. The project may temporarily disturb potential artificial roosting sites. No evidence of roosting bats was observed during the survey.	No
Large-footed Myotis (*Myotis macropus*)	V		Low. The project may temporarily disturb potential artificial roosting sites. No evidence of roosting bats was observed during the survey.	No
Black-tailed Godwit (*Limosa limosa*)	V	M	Low. Potential for indirect impacts from changes to water quality in Powells Creek and Mason Park Wetland if not mitigated.	No
Curlew Sandpiper (*Callidris ferruginea*)	E	CE, M	Low. Potential for indirect impacts from changes to water quality in Powells Creek and Mason Park Wetland if not mitigated.	No
Little Tern (*Sterna albifrons*)	E	M	Low. Potential for indirect impacts from changes to water quality in Powells Creek and Mason Park Wetland if not mitigated.	No
White-fronted Chat (*Epthianura albifrons*)	V, EP		Low. Potential for indirect impacts from changes to water quality in Powells Creek and Mason Park Wetland if not mitigated.	No

Key: EEC: endangered ecological community; VEC: vulnerable ecological community; E: endangered; EP: endangered population; M: migratory; V: vulnerable.

6.7 Assessment of significance of impacts on MNES

6.7.1 Threatened ecological communities and threatened flora species

There would be no direct impact on any TECs listed under the EPBC Act. One vulnerable ecological community listed under the EPBC Act, Coastal Saltmarsh, is present downstream of the project footprint within the Mason Park Wetlands. As discussed in **section 5.4**, this wetland has minimal hydrological interaction with the adjacent Powells Creek. Vulnerable ecological communities listed under the EPBC Act are not MNES for the purposes of Part 3 of the EPBC Act (requirements for environmental approvals) (DotE 2013), and thus do not require assessments of significance. As noted above, this community is listed under the TSC Act. The impacts on this community have been assessed in accordance with Section 5A of the EP&A Act, and the project is unlikely to have a significance impact on the community.

No naturally occurring threatened flora species listed under the EPBC Act would be directly or indirectly impacted by the project. As such, no assessments of significance have been prepared for threatened flora species listed under the EPBC Act.

6.7.2 Threatened fauna species

An assessment of the likely significance of impacts on the Grey-headed Flying-fox has been prepared in accordance with the significant impact guidelines (DotE 2013) and is provided in **Appendix E**. The project is unlikely to have a significant impact on this species. As noted above, the area of planted vegetation to be cleared represents a negligible proportion of the total extent of foraging habitat present within a 50 kilometre radius of local camps, and these trees do not constitute habitat critical to the survival of the Grey-headed Flying-fox. The project will not have any impact on breeding behaviour or breeding habitat of the Grey-headed Flying-fox.

No other threatened fauna species listed under the EPBC Act are likely to be impacted by the project.

6.7.3 Migratory species

No migratory species are expected to occur in the proposal footprint given the absence of suitable habitat. A total of 30 migratory species are either known to occur, or have been assessed as likely to occur, within the Mason Park Wetlands.

Mason Park, located north of the M4 and east of Homebush Bay Drive, is not an identified internationally important site (Bamford et al. 2008) but it does support at least 15 shorebird species (DotE 2014). It therefore meets the criteria for an area of important habitat for migratory shorebirds according to DEWHA (2009). The wetland may also be important habitat for the migratory Latham's Snipe, which has been recorded at the wetland during periods of drought (PEP et al. 2008).

There is a negligible risk of the project indirectly impacting the wetlands through the transfer of sediments or pollution along Powells Creek if not appropriately mitigated. As discussed in section 5.4, there is only limited hydrological connectivity between Powells Creek and the Mason Park Wetland at high tide and times of flood. While there is a negligible potential for indirect impacts, an assessment has been prepared on a precautionary basis to assess the likely significance of impacts on the migratory shorebirds included in the Draft significant impact guidelines for 36 migratory shorebird species (DEWHA 2009) that may occur at Mason Park. In addition, a separate assessment of significance has been prepared pursuant to DotE (2013) for the Great Egret, Cattle Egret and Little Tern, migratory species not included in DEWHA (2009). These are provided in **Appendix E**.

The project is unlikely to have a significant impact on migratory wetland birds as:

- No important habitat for migratory birds would be directly impacted
- There would be no direct mortality of birds as a result of the project
- Indirect impacts on wetland habitat are unlikely, given the distance of the wetland from the project, and the limited hydrological interaction between the wetland and Powells Creek
- The project is unlikely to disrupt the breeding cycle of an ecologically significant proportion of the population of any migratory species

- The project is unlikely to lead to degradation or increased disturbance of habitat at Mason Park Wetland such that there would be a substantial reduction in migratory shorebirds using the wetland.

Recommended mitigation measures include the use of sediment and erosion control, appropriate storage of chemicals to prevent spills, no release of dirty water into creeks, and monitoring of water quality throughout construction. Mitigation measures recommended to maintain water quality would minimise the risk of indirect impacts on the Mason Park Wetland.

7 Management of impacts

7.1 Avoiding and minimising impacts during design

The project would not directly impact any intact native vegetation communities. There would be no direct impacts on habitats of importance for threatened or migratory biota given the location of the project in a highly modified urban environment and the lack of suitable habitat. Landscaping at various locations would incorporate planting of Grey-headed Flying-fox feed trees, which would replace some of the foraging habitat that would be lost (see **section 7.3**).

7.2 Mitigating impacts

A Construction Flora and Fauna Management Plan (FFMP) would be prepared as part of the Construction Environmental Management Plan (CEMP) following approval of the project. Mitigation measures to minimise impacts on biodiversity values would be incorporated into the FFMP. Recommended mitigation measures are detailed in **Table 7.1**.

Table 7.1 Mitigation measures

Safeguard	Responsibility	Timing
Mark the limits of clearing and install fencing around all no-go zones prior to the commencement of construction activities to avoid unnecessary vegetation and habitat removal	Construction contractor	Pre-construction
Investigate opportunities to retain perimeter plantings at civil sites where feasible particularly in areas adjacent to existing creeks and canals such as at Homebush Bay Drive (C1), Powells Creek (C4) and Cintra Park (C6)	Construction contractor	Pre-construction
The water quality basin at Saleyards Creek should be designed to minimise any impact on the creek corridor and the setback area along this boundary should be appropriately landscaped	Construction contractor	Pre-construction
Erosion and sediment control measures, appropriate chemical storage, and water quality monitoring would be implemented as detailed in the Soil and Water Report (GHD 2015a)	Construction contractor	Pre-construction
A pre-clearing survey is to be carried out to identify any habitat trees or other features that require the presence of an appropriately qualified fauna handler during clearing	Construction contractor	Pre-construction
An appropriately qualified fauna handler must be present during removal of habitat trees identified during pre-clearing surveys to guide clearing activities and undertake rescue and relocation of fauna	Construction contractor	Pre-construction
Weed management and control would be undertaken in accordance with the Roads and Maritime Biodiversity Guidelines (RTA 2011)	Construction contractor	During construction
At the completion of construction complementary landscaping using locally endemic species should be undertaken in areas of former civil sites abutting creeks, canals and open space areas, where feasible	Landscaper	Post-construction
Landscaping should incorporate planting of Grey-headed Flying-fox feed trees (such as Spotted Gums, other eucalypts and figs) where feasible	Landscaper	Post-construction

7.3 Offsetting impacts

The project would result in some minor unavoidable residual adverse impacts, comprising the removal of planted native trees and the possible mortality of some common native fauna species during clearing and construction. These residual impacts are not expected to impose a significant negative effect on any local populations of native biota, including any threatened fauna species, which may occur in the study area or adjoining areas on an occasional, transient basis. No native vegetation communities, threatened flora species or TECs would be directly impacted. There would be no residual impacts on migratory species or their habitats downstream of the project.

The project would remove about 12.9 hectares of planted vegetation and screening vegetation, some of which comprises foraging habitat for the Grey-headed Flying-fox. Landscaping would include planting of trees and shrubs where possible, including along the M4 on- and off-ramps, the Concord Road interchange, and the Parramatta Road interchange, which would replace some of the planted vegetation that would be lost, thus replacing habitat for fauna, including in particular for the Grey-headed Flying-fox. Species recommended for planting include Spotted Gum, other eucalypts and figs.

The project is located in a highly modified urban landscape, and impacts on biodiversity have generally been avoided as no native vegetation communities would be removed. Mitigation measures, including the preparation of a FFMP, have been recommended to minimise the impacts of the project on biodiversity values. Given the generally low conservation value of the project footprint and the minor nature of impacts on biodiversity arising from the proposal, formal biodiversity offsets are not considered necessary to address any residual adverse impacts.

8 Conclusion

8.1 Assessment of key thresholds

On the basis of the assessments undertaken, the following conclusions have been reached with respect to the key thresholds identified in the threatened species assessment guidelines (DEC/DPI 2005).

Whether or not the proposal, including actions to avoid or mitigate impacts or compensate to prevent unavoidable impacts would maintain or improve biodiversity values.

Measures to avoid and mitigate impacts on biodiversity values associated with the proposal are provided in **section 7.2**. The M4 East project is located in a highly urbanised environment. Much of the project would be tunnelled under existing roads and residential areas, and would this generally avoid direct impacts on biodiversity values. Impacts would occur as a result of removal of vegetation, surface disturbance and changes in water quality for the widening the M4, construction and operation of the tunnels and interchanges, compound sites and ancillary facilities. Biodiversity values in the study area are limited and are associated with planted trees along roadsides and in parks and gardens and the habitat resources provided by these trees. There is only very limited potential for impacts on threatened biota.

Specific mitigation measures are recommended to minimise the potential for any indirect impacts on the natural environment outside the project footprint during construction. Given the highly modified environment in which the project is located, there is likely to only be very minor residual impacts on biodiversity values. Any residual impacts are not expected to impose a significant negative effect on any local populations of native biota, including TECs or threatened species and their habitats which occur in the study area or in adjoining habitats. Use of Grey-headed Flying-fox feed trees is recommended for the landscaping plan following construction to replace lost foraging habitat. A formal biodiversity offset is not considered necessary to compensate for these very minor and localised residual impacts.

Whether or not the proposal is likely to reduce the long-term viability of a local population of any threatened species, population or ecological community.

There are no endangered ecological communities present or threatened flora species listed under the TSC or EPBC Acts that are likely to occur in the project footprint.

Planted trees in the study area provide some foraging habitat for the threatened Grey-headed Flying-fox. The project is unlikely to have a significant impact on this species. The loss of about 12.9 hectares of planted trees and screening vegetation along roads and in parks would have a minor impact of the foraging habitat available to this species in the locality. These planted trees do not constitute habitat critical to the survival of the Grey-headed Flying-fox. There would be no impact on any breeding camps for the Grey-headed Flying-fox or on the movement of this species between roosts and foraging areas.

The Large-footed Myotis and the Eastern Bentwing Bat could roost under bridges and culverts in the study area on occasion. Construction activities near culverts could temporarily disrupt the roosting habitat of these species. Following construction, these species could continue to roost in culverts in the study area. There is no breeding habitat present for these species. The proposal would remove small areas of potential foraging habitat (planted trees along roads and in parks) for the Eastern Bentwing Bat, but would not impact any foraging habitat for the Large-footed Myotis which forages over waterways.

The project is unlikely to have a significant impact on threatened biota that occur at Mason Park located about one kilometre downstream of the project footprint. The project would not directly impact this wetland area. There is limited hydrological connection between Powells Creek and the wetland, and the project is unlikely to indirectly impact habitat in the wetlands such that the breeding cycle of any species is disrupted. There would be no mortality of wetland birds as a result of the project and no impact on the movement of wetland birds in the locality.

Measures have been incorporated into the project to mitigate potential indirect impacts on downstream habitats and will be implemented via a construction environmental management plan.

Given the above points, the project is not likely to reduce the long-term viability of any local populations of threatened species, populations or ecological communities.

Whether or not the proposal is likely to accelerate the extinction of any species, population or ecological community or place it at risk of extinction.

The project is considered highly unlikely to accelerate the extinction of threatened species given:

- There would be no clearing of naturally occurring PCTS as a result of the project
- Direct impacts are limited to the clearing of planted vegetation only
- The project would impact a negligible area of foraging habitat for the Grey-headed Flying-fox and the Eastern Bent-wing Bat
- The project would not impact any roosting habitat for the Grey-headed Flying-fox
- The project may temporarily disturb potential roost sites for the Eastern Bent-wing Bat and Large-footed Myotis, however there would be no impact on breeding habitat for these species
- The project may have a negligible indirect impact on the Mason Park Wetland located about one kilometre downstream of the project footprint. There is limited hydrological connection between Powells Creek (which runs under the M4) and the wetland, and the project is unlikely to indirectly impact habitat in the wetlands such that any threatened community or species is placed at risk of extinction.

Whether or not the proposal will adversely affect critical habitat.

No listed critical habitat will be removed or adversely affected as a result of the proposal.

8.2 Summary of key findings

The project is located in a highly modified urban area and would not result in the clearing of any intact remnant vegetation or native PCTs identified in the NSW vegetation database. Small areas of planted vegetation would be removed. Where impacts are unavoidable, mitigation measures have been proposed to minimise the potential for indirect impacts. No threatened biota is likely to be significantly affected by the proposal.

Given the above considerations, there is likely to only be minor residual impacts on the natural environment. A formal biodiversity offset is not considered necessary to compensate for these minor and localised residual impacts. The planting of Grey-headed Flying-fox food trees in landscaped areas following construction will compensate for the removal of planted vegetation within the project footprint and assist in maintaining foraging habitat for this species in the study area.

On the basis of the assessments undertaken, the project is not likely to result in a significant impact on any matter of national environmental significance under the EPBC Act, including threatened and migratory species. Accordingly, the project has not been referred to the Commonwealth Department of the Environment for further assessment or approval under the EPBC Act.

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Appendix A – Government agency comments relating to biodiversity

Government Agency Requirements	Location where addressed in this report
Office of Environment and Heritage	
Requirement	**Section where addressed in this report**
The NSW Government has developed the NSW offset principles for major projects (state significant development and state significant infrastructure). These were released on 17 July 2013 and are to be used in assessing impacts to biodiversity and determining acceptable offsets for state significant development and state significant infrastructure projects.	**Section 7.3**: Offsetting Impacts
OEH recommends the following be included in the Director-General's Requirements for the preparation of an Environmental Impact Statement (EIS).	
1. The EIS should address impacts on flora and fauna, including threatened species, populations and endangered ecological communities and their habitats, in accordance with OEH's Threatened Species Survey and Assessment Guidelines and any relevant draft or final recovery plans. This should include potential indirect impacts on the Grey-headed Flying Fox camp at Duck River.	**Section 4**: Assessment methodology. **Section 6.** Assessment of impacts **Appendix D** **Appendix E**
2. Any steps taken to mitigate or offset any identified impacts to the environment should also be detailed in the EIS. The NSW offset principles for major projects (state significant development and state significant infrastructure) are to be used in assessing and determining the adequacy of any offsets.	**Section 7.2**: Mitigating measures **Section 7.3**: Offsetting impacts
Office of Water	
Requirement	**Location in this report**
Groundwater dependent ecosystems It is suggested the EIS considers the potential impacts on any Groundwater Dependent Ecosystems (GDEs) at the site and in the vicinity of the site	No naturally occurring PCTS are present in the project footprint. Potential indirect impacts on the Mason Park Wetland are discussed in **section 1.1.1**.
Watercourses and Riparian The EIS should consider the NSW Office of Water Guidelines for Controlled Activities on Waterfront Land (2012). The EIS should address the potential impacts of the project on all watercourses likely to be affected by the project, existing riparian vegetation and the rehabilitation of riparian land. It is recommended the EIS provides details on all watercourses potentially affected by the proposal	**Section 5.4**: Fauna habitats

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Appendix B - Likelihood of occurrence of threatened biota in the study area

Description of likelihood of occurrence classes used in tables below

Likelihood of occurrence	Definition
Known	Biota confirmed as present within the study area either from previous records or field survey results.
Likely	Species previously recorded within the locality and/or; suitable habitat occurs within the study area. These species are likely to occur in the study area and the project may result in direct or indirect impacts on these species, including through the removal of habitat resources that may be relied upon by local populations of these species.
Possible	Species known or predicted to occur within the locality and potentially suitable habitat occurs within the study area. These species may occur in the study area on a transitory, seasonal or opportunistic basis. The project may result in direct or indirect impacts on these species, but would not remove any habitat resources that are relied upon by local populations of these species for their ongoing survival in the locality.
Unlikely	Species not previously recorded within the locality; study area is outside of the biota's known distribution and/or; suitable habitat not present within the study area. The project would not result in any direct or indirect impacts on these species or their habitats.
Absent	Threatened ecological communities confirmed as absent from the study area by site surveys or; threatened species that could not occur in the study area even on an occasional basis (such as species that are geographically isolated or which depend on specific resources such as aquatic habitats that are absent and would never be present in the study area). The project would not result in any direct or indirect impacts on these species or their habitats.

Table B1: Likelihood of occurrence of threatened ecological communities in the study area

Community	TSC Act	EPBC Act	Habitat association	Details of records for locality	Presence in study area	Likelihood of impact
Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (listed under the EPBC Act as Subtropical and Temperate Coastal Saltmarsh)	EEC	VEEC	Occurs on landward side of mangrove stands in intertidal zones along the shores of estuaries and lagoons that are permanently or intermittently open to the sea. Characterised by *Baumea juncea, Juncus kraussii, Sarcocornia quinqueflora, Sporobolus virginicus, Triglochin striata, Isolepis nodosa, Samolus repens, Selliera radicans, Suaeda australis* and *Zoysia macrantha*, with occasional scattered mangroves occurring throughout the saltmarsh. Saltpans and tall reeds may also occur.	Known within 10 km (OEH 2015a)	Absent. Present in Mason Park, about 1 km downstream of the project.	Low. Potential for indirect impacts from changes to water quality in Powells Creek. Specific mitigation measures are recommended to minimise the risk of indirect impact.

Table B2: Likelihood of occurrence of threatened flora and fungi within the study area

Scientific name	Common name	TSC Act	EPBC Act	Habitat association	Details of record in the locality	Likelihood of occurrence in the study area	Likelihood of impact
Flora							
Acacia prominens endangered population (Hurstville and Kogarah*)*	Gosford Wattle	EP		Occurs at a few sites along the railway line at Penshurst, at Carss Bush Park, Carss Park and there is an unconfirmed siting at Oatley Park, Oatley. Grows in open situations on clayey or sandy soils. Habitats are mostly cleared. Species occurs as isolated or small groups of trees.	1 record within 10 km (OEH 2015a)	Unlikely. No suitable habitat present within study area.	Nil.
Acacia pubescens	Downy Wattle	V	V	Occurs mainly in Bankstown-Fairfield-Rookwood and Pitt Town areas, with outliers at Barden Ridge, Oakdale and Mountain Lagoon. Grows on alluviums, shales and shale/sandstone intergrades. Soils characteristically gravely, often with ironstone. Occurs in open woodland and forest, in communities including Cooks River/ Castlereagh Ironbark Forest, Shale/ Gravel Transition Forest and Cumberland Plain Woodland. Flowers August to October.	4324 records within 10 km (OEH 2015a) Species or species habitat likely to occur within 10 km (DotE 2015a)	Unlikely. No suitable habitat present within study area.	Nil.
Acacia terminalis subsp. *terminalis*	Sunshine Wattle	E	E	Occurs in near-coastal areas from northern shores of Sydney Harbour south to the northern and western shores of Botany Bay. Occurs on sandy soil on creek banks, hill slopes of in shallow soil in rock crevices and sandstone platforms on cliffs. Grows in scrub and open eucalypt woodland or forest.	9 records within 10 km (OEH 2015a) Species or species habitat known to occur within 10 km (DotE 2015a)	Unlikely. No suitable habitat present within study area.	Nil.

Scientific name	Common name	TSC Act	EPBC Act	Habitat association	Details of record in the locality	Likelihood of occurrence in the study area	Likelihood of impact
Allocasuarina glareicola		E	E	Primarily restricted to small populations in and around Castlereagh NR (NW Cumberland Plain), but with an outlier population at Voyager Point, Liverpool. Also reported from Holsworthy Military Area. Grows on tertiary alluvial gravels, with yellow clayey subsoil and lateritic soil. Occurs in Castlereagh open woodland.	Species or species habitat may occur within 10 km (DotE 2015a)	Absent. Study area not located within known distribution.	Nil.
Asterolasia elegans		E	E	Occurs north of Sydney, in the Baulkham Hills, Hawkesbury and Hornsby LGAs, may also occur in the western part of Gosford LGA. Seven known populations. Occurs on Hawkesbury sandstone, commonly amongst rocky outcrops and boulders in sheltered forests on mid- to lower slopes and valleys.	Species or species habitat may occur within 10 km (DotE 2015a)	Absent. Study area not located within known distribution.	Nil.
Caladenia tessellata		E	V	Occurs from Central Coast NSW to southern VIC. Mostly coastal but extends inland to Braidwood in southern NSW. In NSW grows in grassy dry sclerophyll woodland on clay loam or sandy soils, and less commonly in heathland on sandy loam soils (Duncan 2010).	Species or species habitat likely to occur within 10 km (DotE 2015a)	Unlikely. No suitable habitat present within study area.	Nil.
Callistemon linearifolius	Netted Bottlebrush	V		Recorded from the Georges to Hawkesbury Rivers in Sydney, and north to Nelson Bay. There is also a recent record from the northern Illawarra. In Sydney, recent records are limited to the Hornsby Plateau area near the Hawkesbury River. Grows in dry sclerophyll forest on the coast and adjacent ranges.	4 records within 10 km (OEH 2015a)	Unlikely. No suitable habitat present within study area.	Nil.

Scientific name	Common name	TSC Act	EPBC Act	Habitat association	Details of record in the locality	Likelihood of occurrence in the study area	Likelihood of impact
Cryptostylis hunteriana	Leafless Tongue Orchid	V	V	Occurs in coastal areas from East Gippsland to southern Queensland. Habitat preferences not well defined. Grows mostly in coastal heathlands, margins of coastal swamps and sedgelands, coastal forest, dry woodland, and lowland forest. Prefers open areas in the understorey and is often found in association with *Cryptostylis subulata* and the *Cryptostylis erecta*. Soils include moist sands, moist to dry clay loam and occasionally in accumulated eucalypt leaves. Flowers November-February.	Species or species habitat likely to occur within 10 km (DotE 2015a)	Unlikely. No suitable habitat present within study area.	Nil.
Darwinia biflora		V	V	Known from north and north-western Sydney, in the Ryde, Baulkham Hills, Hornsby and Ku-Ring-Gai LGAs. Grows on the edges of weathered shale-capped ridges, at the intergrade with Hawkesbury Sandstone. Occurs in woodland, open forest and scrub/heath. Associated overstorey species include *Eucalyptus haemastoma*, *Corymbia gummifera* and/or *E. squamosa*.	126 records within 10 km (OEH 2015a) Species or species habitat likely to occur within 10 km (DotE 2015a)	Absent. Study area not located within known distribution. No suitable habitat present.	Nil.
Deyeuxia appressa		E	E	Known only from two pre-1942 records in Sydney, at Saltpan Creek and Killara. May be extinct in the wild. Thought to occur in moist conditions.	Species or species habitat likely to occur within 10 km (DotE 2015a)	Unlikely. No suitable habitat present within study area.	Nil.

Scientific name	Common name	TSC Act	EPBC Act	Habitat association	Details of record in the locality	Likelihood of occurrence in the study area	Likelihood of impact
Dillwynia tenuifolia		V		Occurs in western Sydney, predominantly the Cumberland Plain as well as the Lower Blue Mountains and north to Yengo. Grows in scrubby/dry heath areas of Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays, and associated transitional communities including Castlereagh Scribbly Gum Woodland.	1 record within 10 km (OEH 2015a)	Unlikely. No suitable habitat present within study area.	Nil.
Epacris purpurascens var. *purpurascens*		V		Primarily found in Richmond district; although outlier populations exist in Voyager Point, Liverpool. Found in open woodland on Castlereagh woodland on lateritic soil; associated with these species: *Eucalyptus parramattensis, Eucalyptus fibrosa, Angophora bakeri, Eucalyptus sclerophylla* and *Melaleuca decora*.	51 records within 10 km (OEH 2015a)	Absent. Study area not located within known distribution. No suitable habitat present.	Nil.
Eucalyptus camfieldii	Camfield's Stringybark	V	V	Occurs from Raymond Terrace to Waterfall, with populations known Elvina Bay Trail (West Head), Terrey Hills, Killara, North Head, Menai and the Royal NP. Occurs in exposed situations on sandstone plateaus, ridges and slopes near the coast, often on the boundary of tall coastal heaths or low open woodland. It grows in shallow sandy soils overlying Hawkesbury sandstone.	Species or species habitat likely to occur within 10 km (DotE 2015a)	Unlikely. No suitable habitat present within study area.	Nil.

Scientific name	Common name	TSC Act	EPBC Act	Habitat association	Details of record in the locality	Likelihood of occurrence in the study area	Likelihood of impact
Eucalyptus nicholii	Narrow-leaved Black Peppermint	V	V	Naturally occurs only in New England Tablelands from Nundle to north of Tenterfield. Widely planted as urban street tree. Grows in dry grassy woodland, on shallow and infertile soils, mainly on granite.	11 records within 10 km (OEH 2015a)	Absent. Study area not located within known distribution. No suitable habitat present.	Nil.
Eucalyptus scoparia		E	V	Occurs mostly in Queensland with only three known occurrences in NSW near Tenterfield. In NSW it is found on well-drained granitic hilltops, slopes and outcrops, often as scattered trees in open forest and woodland.	2 records within 10 km (OEH 2015a)	Present. A planted specimen occurs in Reg Coady Reserve. The study area is outside the species' natural distributional range. The tree is not naturally occurring and is not assessed as a threatened species of relevance.	Low. The project may impact a planted specimen. Specimen is located outside its natural range and is not of conservation significance.
Genoplesium baueri	Bauer's Midge Orchid	E	E	Occurs from Ulladulla to Port Stephens, with only 13 known extant populations. Grows in sparse sclerophyll forest and moss gardens over sandstone	Species or species habitat known to occur within 10 km (DotE 2015a)	Unlikely. No suitable habitat present within study area.	Nil.
Grevillea beadleana	Beadle's Grevillea	E	E	Four disjunct populations in north-east NSW: Torrington west of Tenterfield, Oxley Wild Rivers NP, Guy Fawkes River NP and Shannon Creek southwest of Grafton. Grows in open eucalypt forest with shrubby understorey, usually on steep granite slopes at high altitudes.	1 record within 10 km (OEH 2015a)	Unlikely. No suitable habitat present within study area.	Nil.

Scientific name	Common name	TSC Act	EPBC Act	Habitat association	Details of record in the locality	Likelihood of occurrence in the study area	Likelihood of impact
Grevillea parviflora subsp. *parviflora*	Small-flower Grevillea	V	V	Occurs between Moss Vale/Bargo and lower Hunter Valley, with most occurrences in Appin, Wedderburn, Picton and Bargo. Broad habitat range including heath, shrubby woodland and open forest on light clay or sandy soils, and often in disturbed areas such as on the fringes of tracks.	Species or species habitat likely to occur within 10 km (DotE 2015a)	Absent. Study area not located within known distribution. No suitable habitat present.	Nil.
Marsdenia viridiflora subsp. *viridiflora* Endangered population		EP		Recent records are from Prospect, Bankstown, Smithfield, Cabramatta Creek and St Marys. Previously known north from Razorback Range. A climber that grows in vine thickets and open shale woodland.	336 records within 10 km (OEH 2015a)	Unlikely. No suitable habitat present within study area.	Nil.
Melaleuca deanei	Deane's Paperbark	V	V	Occurs from Nowra to St Albans and west to the Blue Mountains, with most records in Ku-ring-gai / Berowra and Holsworthy/Wedderburn areas. Mostly grows on broad flat ridgetops, dry ridges and slopes and strongly associated with low nutrient sandy loam soils, sometimes with ironstone. Grows in heath- open forest, often in sandstone ridgetop woodland communities.	1 record within 10 km (OEH 2015a) Species or species habitat likely to occur within 10 km (DotE 2015a)	Unlikely. No suitable habitat present within study area.	Nil.
Melaleuca biconvexa	Biconvex Paperbark	V	V	Scattered, disjunct populations in coastal areas from Jervis Bay to Port Macquarie, with most populations in the Gosford-Wyong areas. Grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects.	Species or species habitat may occur within 10 km (DotE 2015a)	Unlikely. No suitable habitat present within study area.	Nil.

Scientific name	Common name	TSC Act	EPBC Act	Habitat association	Details of record in the locality	Likelihood of occurrence in the study area	Likelihood of impact
Pelargonium sp. Striatellum (G.W.Carr 10345)	Omeo Stork's-bill	E	E	Omeo Storksbill is a tufted perennial forb known from only 3 locations in NSW, with two on lake-beds on the basalt plains of the Monaro and one at Lake Bathurst. It has a narrow habitat that is usually just above the high-water level of irregularly inundated or ephemeral lakes, in the transition zone between surrounding grasslands or pasture and the wetland or aquatic communities.	Species or species habitat may occur within 10 km (DotE 2015a)	Absent. Study area not located within known distribution. No suitable habitat present.	Nil.
Persoonia nutans	Nodding Geebung	E	E	Occurs from Richmond to Macquarie Fields on the Cumberland Plain. Grows only on aeolian and alluvial sediments in sclerophyll forest and woodland vegetation communities. Largest populations occur in Agnes Banks Woodland or Castlereagh Scribbly Gum Woodland.	8 records within 10 km (OEH 2015a) Species or species habitat likely to occur within 10 km (DotE 2015a)	Unlikely. No suitable habitat present within study area.	Nil.
Pimelea curviflora var. *curviflora*		V	V	Confined to area between north Sydney in the south and Maroota in the north-west. Former range extended to Parramatta River including Five Dock, Bellevue Hill and Manly. Grows on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands. Often grows amongst dense grasses and sedges. Flowers October to May.	1 record within 10 km (OEH 2015a) Species or species habitat known to occur within 10 km (DotE 2015a)	Unlikely. No suitable habitat present within study area.	Nil.

Scientific name	Common name	TSC Act	EPBC Act	Habitat association	Details of record in the locality	Likelihood of occurrence in the study area	Likelihood of impact
Pimelea spicata	Spiked Rice Flower	E	E	Disjunct populations within the Cumberland Plain (from Mount Annan and Narellan Vale to Freemans Reach and Penrith to Georges Hall). In the Cumberland Plain region, restricted to areas which support or historically supported Cumberland Plain Woodland. Grows on well-structured clay soils derived from Wianamatta Shale. In the Illawarra, grows on variable soils in close proximity to the coast on hills or coastal headlands. Inhabits coastal woodland or grassland with emergent shrubs.	287 records within 10 km (OEH 2015a) Species or species habitat known to occur within 10 km (DotE 2015a)	Unlikely. No suitable habitat present within study area.	Nil.
Pomaderris prunifolia Endangered population (Parramatta, Auburn, Strathfield and Bankstown LGAs)		EP		Known from only 3 sites within population range: at Rydalmere, within Rookwood Cemetery and at The Crest of Bankstown. At Rydalmere occurs along a road reserve near a creek, among grass species on sandstone. At Rookwood Cemetery occurs in small gully of degraded Cooks River / Castlereagh Ironbark Forest on shale soils.	17 records within 10 km (OEH 2015a)	Unlikely. No suitable habitat present within study area.	Nil.
Pterostylis saxicola	Sydney Plains Greenhood	E	E	Occurs in western Sydney between Picton and Freemans Reach. Grows in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines. Associated vegetation above these rock shelves is sclerophyll forest or woodland on shale or shale/sandstone transition soils.	Species or species habitat likely to occur within 10 km (DotE 2015a)	Unlikely. No suitable habitat present within study area.	Nil.

Scientific name	Common name	TSC Act	EPBC Act	Habitat association	Details of record in the locality	Likelihood of occurrence in the study area	Likelihood of impact
Pultenaea parviflora		E	V	Occurs on the Cumberland Plain, with core distribution from Windsor to Penrith and east to Dean Park, and outliers in Kemps Creek and Wilberforce. Grows in dry sclerophyll woodlands, forest or in grasslands on Wianamatta Shale, laterite or Tertiary alluvium, on infertile sandy to clay soils. Associated communities include Castlereagh Ironbark Forest, Shale Gravel transition Forest and intergrade with Castlereagh Scribbly Gum Woodland.	1 record within 10 km (OEH 2015a)	Unlikely. No suitable habitat present within study area.	Nil.
Pultenaea pedunculata	Matted Bush-pea	E		3 disjunct populations in NSW: in the Cumberland Plains in Sydney, the coast between Tathra and Bermagui and the Windellama area south of Goulburn (where it is locally abundant). NSW populations typically among woodland vegetation but also found on road batters and coastal cliffs. In Windellama it is largely confined to loamy soils in dry gullies.	7 records within 10 km (OEH 2015a)	Unlikely. No suitable habitat present within study area.	Nil.
Streblus pendulinus	Siah's Backbone		E	On the Australian mainland, Siah's Backbone is found in warmer rainforests, chiefly along watercourses. The altitudinal range is from near sea level to 800 m above sea level. The species grows in well-developed rainforest, gallery forest and drier, more seasonal rainforest (ATRP 2010).On Norfolk Island, the species is found in a variety of forest types, though it is rare (DNP 2010).	Species or species habitat likely to occur within 10 km (DotE 2015a)	Unlikely. No suitable habitat present within study area.	Nil.

Scientific name	Common name	TSC Act	EPBC Act	Habitat association	Details of record in the locality	Likelihood of occurrence in the study area	Likelihood of impact
Syzygium paniculatum	Magenta Lilly Pilly	V	V	Occurs in narrow coastal strip from Bulahdelah to near Ulladulla. Grows in rainforest on sandy soils or stabilised Quaternary sand dunes at low altitudes in coastal areas, often in remnant littoral or gallery rainforests.	15 records within 10 km (OEH 2015a) Species or species habitat likely to occur within 10 km (DotE 2015a)	Possible. Unlikely to occur naturally, however is a commonly planted species. Not assessed as a threatened species.	Low. The project may impact planted specimens. Specimens are located outside their natural habitat and are not of conservation significance.
Tetratheca glandulosa		V	V	Restricted to The Hills, Gosford, Hawkesbury, Hornsby, Ku-ring-gai, Pittwater, Ryde, Warringah, and Wyong LGAs. Associated with shale-sandstone transition habitat (shale-cappings over sandstone). Occupies ridgetops, upper-slopes and to a lesser extent mid-slope sandstone benches. Soils generally shallow, yellow, clayey/sandy loam, commonly with lateritic fragments. Vegetation varies from heath to open forest and is broadly equivalent to Sydney Sandstone Ridgetop Woodland community.	1 record within 10 km (OEH 2015a)	Unlikely. No suitable habitat present within study area.	Nil.
Thesium australe	Austral Toadflax	V	V	Found in small, scattered populations along the east coast, northern and southern tablelands. Occurs in grassland or grassy woodland, and is often found in association with Kangaroo Grass (*Themeda australis*).	Species or species habitat may occur within 10 km (DotE 2015a)	Unlikely. No suitable habitat present within study area.	Nil.

Scientific name	Common name	TSC Act	EPBC Act	Habitat association	Details of record in the locality	Likelihood of occurrence in the study area	Likelihood of impact
Wahlenbergia multicaulis Endangered population (Auburn, Bankstown, Baulkham Hills, Canterbury, Hornsby, Parramatta and Strathfield LGAs)	Tadgell's Bluebell	EP		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.	68 records within 10 km (OEH 2015a)	Unlikely. No suitable habitat present within study area.	Nil.
Wilsonia backhousei	Narrow-leaved Wilsonia	V		In NSW it is scattered along the coast with a northern limit of Wamberal, north of Sydney. Most extensive stands occur at Jervis Bay. Grows on the margins of saltmarshes and lakes.	91 records within 10 km (OEH 2015a)	Known. Known to occur within Powells Creek and/or Mason Park.	Low. Potential for indirect impacts from changes to water quality in Powells Creek. Specific mitigation measures are recommended to minimise the risk of indirect impact.
Zannichellia palustris		E		Known from the Lower Hunter and Sydney Olympic Park. A submerged aquatic plant that grows in fresh or slightly saline water.	4 records within 10 km (OEH 2015a)	Known. Known to occur within Powells Creek and/or Mason Park.	Low. Potential for indirect impacts from changes to water quality in Powells Creek. Specific mitigation measures are recommended to minimise the risk of indirect impact.

Scientific name	Common name	TSC Act	EPBC Act	Habitat association	Details of record in the locality	Likelihood of occurrence in the study area	Likelihood of impact
Fungi							
Hygrocybe anomala var. ianthinomargin ata		V		Recorded from the Lane Cove LGA and the Royal and Blue Mountains NPs. Inhabits gallery warm temperate forests dominated by *Acmena smithii*, *Backhousia myrtifolia*, *Glochidion ferdinandi* and *Pittosporum undulatum*. Associated with alluvial sandy soils, in soil, humus, moss or rotten wood.	1 record within 10 km (OEH 2015a)	Nil. No suitable habitat present within study area.	Nil.
Hygrocybe aurantipes		E		Recorded from Lane Cove Bushland Park. Inhabits gallery warm temperate forests dominated by *Acmena smithii*, *Backhousia myrtifolia*, *Glochidion ferdinandi* and *Pittosporum undulatum*. Associated with alluvial sandy soils, in soil, humus, moss or rotten wood.	1 record within 10 km (OEH 2015a)	Nil. No suitable habitat present within study area.	Nil.
Hygrocybe austropratensis		E		Recorded from Lane Cove Bushland Park. Inhabits gallery warm temperate forests dominated by *Acmena smithii*, *Backhousia myrtifolia, Glochidion ferdinandi* and *Pittosporum undulatum*. Associated with alluvial sandy soils, in soil, humus, moss or rotten wood.	1 record within 10 km (OEH 2015a)	Nil. No suitable habitat present within study area.	Nil.
Hygrocybe collucera		E		Recorded from Lane Cove Bushland Park. Inhabits gallery warm temperate forests dominated by *Acmena smithii*, *Backhousia myrtifolia, Glochidion ferdinandi* and *Pittosporum undulatum*. Associated with alluvial sandy soils, in soil, humus, moss or rotten wood.	1 record within 10 km (OEH 2015a)	Nil. No suitable habitat present within study area.	Nil.

Scientific name	Common name	TSC Act	EPBC Act	Habitat association	Details of record in the locality	Likelihood of occurrence in the study area	Likelihood of impact
Hygrocybe griseoramosa		E		Recorded from Lane Cove Bushland Park. Inhabits gallery warm temperate forests dominated by *Acmena smithii*, *Backhousia myrtifolia*, *Glochidion ferdinandi* and *Pittosporum undulatum*. Associated with alluvial sandy soils, in soil, humus, moss or rotten wood.	1 record within 10 km (OEH 2015a)	Nil. No suitable habitat present within study area.	Nil.
Hygrocybe lanecovensis		E		Recorded from Lane Cove Bushland Park. Inhabits gallery warm temperate forests dominated by *Acmena smithii*, *Backhousia myrtifolia*, *Glochidion ferdinandi* and *Pittosporum undulatum*. Associated with alluvial sandy soils, in soil, humus, moss or rotten wood.	1 record within 10 km (OEH 2015a)	Nil. No suitable habitat present within study area.	Nil.
Hygrocybe reesiae		V		Recorded from Lane Cove Bushland Park. Inhabits gallery warm temperate forests dominated by *Acmena smithii*, *Backhousia myrtifolia*, *Glochidion ferdinandi* and *Pittosporum undulatum*. Associated with alluvial sandy soils, in soil, humus, moss or rotten wood.	1 record within 10 km (OEH 2015a)	Nil. No suitable habitat present within study area.	Nil.
Hygrocybe rubronivea		E		Recorded from Lane Cove Bushland Park. Inhabits gallery warm temperate forests dominated by *Acmena smithii*, *Backhousia myrtifolia*, *Glochidion ferdinandi* and *Pittosporum undulatum*. Associated with alluvial sandy soils, in soil, humus, moss or rotten wood.	1 record within 10 km (OEH 2015a)	Nil. No suitable habitat present within study area.	Nil.

All information in these tables is taken from NSW OEH and Commonwealth DotE Threatened Species profiles (OEH, 2015a; DotE 2015b) unless otherwise stated.

Key: CE – Critically Endangered; E – Endangered; V – Vulnerable; EP – Endangered Population; CEEC – Critically Endangered Ecological Community; EEC – Endangered Ecological Community; VEC – Vulnerable Ecological Community

Table B3: Likelihood of occurrence of threatened fauna within the study area

Scientific name	Common name	TSC Act	EPBC Act	Habitat association	Details of record	Likelihood of occurrence in the study area	Likelihood of impact
Birds							
Botaurus poiciloptilus	Australasian Bittern	E	E	Favours permanent freshwater wetlands with tall dense reedbeds particularly *Typha* spp.and *Eleocharis* spp., with adjacent shallow, open water for foraging.	10 records within 10 km (OEH 2015a) Species or species habitat known to occur within 10 km (DotE 2015a)	Unlikely. No suitable reedy habitat present in the project footprint or at Mason Park, downstream of the project footprint.	Nil.
Rostratula australis	Australian Painted Snipe	E	V, M	Normally found in permanent or ephemeral shallow inland wetlands, either freshwater or brackish. Nests on the ground amongst tall reed-like vegetation near water. Feeds on mudflats and the water's edge taking insects, worm and seeds. Prefers fringes of swamps, dams and nearby marshy areas with cover of grasses, lignum, low scrub or open timber.	2 records within 10 km (OEH 2015a) Species or species habitat likely to occur within 10 km (DotE 2015a)	Unlikely. No suitable reedy habitat present in the project footprint or at Mason Park, downstream of the project footprint.	Nil.
Ninox connivens	Barking Owl	V		Occurs from coast to inland slopes and plains. Inhabits eucalypt woodlands, open forest, swamp woodlands, and, especially in inland areas, timber along watercourses. Roosts along creek lines in dense, tall understorey foliage (eg in *Acacia* and *Casuarina*), or dense eucalypt canopy. Nests in hollows of large, old eucalypts. Birds and mammals important prey during breeding. Territories range from 30 to 200 hectares.	8 records within 10 km (OEH 2015a)	Unlikely. No suitable native vegetation or timbered watercourses.	Nil.

Scientific name	Common name	TSC Act	EPBC Act	Habitat association	Details of record	Likelihood of occurrence in the study area	Likelihood of impact
Ixobrychus flavicollis	Black Bittern	V		Occurs from southern NSW to Cape York and the Kimberley, and southwest WA. Inhabits terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. May occur in flooded grassland, forest, woodland, rainforest and mangroves as long as there is permanent water. Roosts by day in trees or within reeds on the ground. Nests in branches overhanging water and breeds from December to March.	4 records within 10 km (OEH 2015a)	Unlikely. No suitable reedy habitat present in the project footprint or at Mason Park, downstream of the project footprint.	Nil.
Falco subniger	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 attributed to the Brown Falcon. Occurs in plains, grasslands, foothills, timbered watercourses, wetland environs, crops, and occasionally over towns and cities. Breeding occurs along timbered waterways in in land areas.	1 record within 10 km (OEH 2015a)	Absent. Study area is outside the usual range of the species.	Nil.
Limosa limosa	Black-tailed Godwit	V	M	The Black-tailed Godwit is a migratory wading bird that breeds in Mongolia and Eastern Siberia. It is usually found in sheltered bays, estuaries and lagoons with large intertidal mudflats and/or sandflats. It has also been found around muddy lakes and swamps, wet fields and sewerage treatment works.	18 records within 10 km (OEH 2015a) Foraging, feeding or related behaviour known to occur within 10 km (DotE 2015a)	Likely in study area but no suitable habitat present in the project footprint. Potential habitat may be present downstream of the project footprint at Mason Park. Potential indirect impacts possible if not mitigated appropriately.	Low. Potential for indirect impacts from changes to water quality in Powells Creek. Specific mitigation measures are recommended to minimise the risk of indirect impact.

Scientific name	Common name	TSC Act	EPBC Act	Habitat association	Details of record	Likelihood of occurrence in the study area	Likelihood of impact
Ephippiorhynchus asiaticus	Black-necked Stork	E		In NSW, becomes increasingly uncommon south of the Northern Rivers region, and rarely occurs south of Sydney. Breeding recorded as far south as Buladelah, though most breeding in NSW occurs in the north-east. Primarily inhabits permanent freshwater wetlands and surrounding vegetation including swamps, floodplains, watercourses and billabongs, freshwater meadows, wet heathland, farm dams and shallow floodwaters. Will also forage in inter-tidal shorelines, mangrove margins and estuaries. Feeds in shallow, still water. Breeds during summer, nesting in or near a freshwater swamp.	1 record within 10 km (OEH 2015a)	Unlikely. No suitable habitat present in the project footprint. Few records from the locality. Unlikely to occur at Mason Park, downstream of the project footprint.	Nil.
Burhinus grallarius	Bush Stone-curlew	E		Scattered distribution across NSW. Inhabits lowland grassy woodland and open forest and, in coastal areas, Casuarina and Melaleuca woodlands, saltmarsh and mangroves. Requires a low, sparse groundcover, some fallen timber and leaf litter, and a general lack of a shrubby understory (DEC 2006).	7 records within 10 km (OEH 2015a)	Unlikely. No suitable woodland habitat present in the study area.	Nil.
Nettapus coromandelianus	Cotton Pygmy-goose	E		Small surface-feeding duck with a goose-like bill. Prefers freshwater lakes, lagoons, swamps and dams, particularly those vegetated with waterlilies and other floating and submerged aquatic vegetation. Uses standing dead trees with hollows close to water for roosting and breeding.	4 records within 10 km (OEH 2015a)	Unlikely. No suitable habitat present in the project footprint. Few records from the locality. Unlikely to occur at Mason Park, downstream of the project footprint.	Nil.

Scientific name	Common name	TSC Act	EPBC Act	Habitat association	Details of record	Likelihood of occurrence in the study area	Likelihood of impact
Calidris ferruginea	Curlew Sandpiper	E	CE	Occurs along the entire coast of NSW, particularly in the Hunter Estuary, and sometimes in freshwater wetlands in the Murray-Darling Basin. The Curlew Sandpiper breeds in Siberia and migrates to Australia (as well as Africa and Asia) for the non-breeding period, arriving in Australia between August and November, and departing between March and mid-April. Occurs along the entire coast of NSW, particularly in the Hunter Estuary, and sometimes in freshwater wetlands in the Murray-Darling Basin. Breeds in Siberia and migrates to Australia (as well as Africa and Asia) for the non-breeding period, arriving in Australia between August and November, and departing between March and mid-April.	493 records within 10 km (OEH 2015a) Foraging, feeding or related behaviour known to occur within 10 km (DotE 2015a) Has been recorded at the Mason Park Wetlands (PEP et al. 2008).	Likely in study area but no suitable habitat present in the project footprint. Known to occur 1 km downstream of the project footprint at Mason Park. Potential indirect impacts possible if not mitigated appropriately.	Low. Potential for indirect impacts from changes to water quality in Powells Creek. Specific mitigation measures are recommended to minimise the risk of indirect impact.
Dasyornis brachypterus	Eastern Bristlebird	E	E	Habitat characterised by dense, low vegetation including heath and open woodland with a heathy understorey. The fire history of habitat is important, and the Illawarra and southern populations reach maximum densities in habitat that have not been burnt for over 15 years.	Species or species habitat likely to occur within 10 km (DotE 2015a)	Unlikely. No suitable habitat present.	Nil.
Tyto longimembris	Eastern Grass Owl	V		Most common in N and NE Australia, but recorded in all mainland states. In NSW most likely to be resident in the NE. Inhabit areas of tall grass, including grass tussocks, in swampy areas, grassy plains, swampy heath, and in cane grass or sedges on flood plains. Nests on the ground in trodden grass, and are often accessed by tunnels through vegetation.	1 record within 10 km (OEH 2015a)	Unlikely. No suitable habitat present.	Nil.

Scientific name	Common name	TSC Act	EPBC Act	Habitat association	Details of record	Likelihood of occurrence in the study area	Likelihood of impact
Pandion cristatus	Eastern Osprey	V	M	Favours coastal areas, especially the mouths of large rivers, lagoons and lakes. They feed on fish over clear, open water. Breeding takes place from July to September in NSW, with nests being built high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea	2 records within 10 km (OEH 2015a)	Unlikely. No suitable habitat present.	Nil.
Stictonetta naevosa	Freckled Duck	V	-	Breeds in large, ephemeral swamps in the Murray-Darling, particularly along the Paroo and Lachlan Rivers and other Riverina rivers. In drier times moves to more permanent waters. Disperses during extensive inland droughts and may be found in coastal areas during such times. Prefers freshwater swamps/creeks with dense Cumbungi, Lignum or tea-tree. Nests in dense vegetation at or near water level.	2 records within 10 km (OEH 2015a)	Unlikely. No suitable habitat present in the project footprint. Few records from the locality. Unlikely to occur at Mason Park, downstream of the project footprint.	Nil.
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	Restricted to the south-eastern coast and highlands, from the lower Hunter and northern Blue Mountains to the Southwestern Slopes, south to and contiguous with the Victorian population. Inhabits eucalypt open forests and woodlands with an acacia understorey. In summer it lives in moist highland forest types, and in winter it moves to more open types at lower elevations. Nests in hollows in the trunks, limbs or dead spouts of tall living trees, especially eucalypts, often near water. Feeds on seeds obtained in trees and shrubs, mostly from eucalypts and wattles.	2 records within 10 km (OEH 2015a)	Unlikely. No suitable woodland or forest habitat present.	Nil.

Scientific name	Common name	TSC Act	EPBC Act	Habitat association	Details of record	Likelihood of occurrence in the study area	Likelihood of impact
Calyptorhynchus lathami	Glossy Black-Cockatoo	V		Widespread but uncommon from coast to southern tablelands and central western plains. Feeds almost exclusively on the seeds of *Allocasuarina* species. Prefers woodland and open forests, rarely away from *Allocasuarina*. Roost in leafy canopy trees, preferably eucalypts, usually <1km from feeding site. Nests in large (approx. 20cm) hollows in trees, stumps or limbs, usually in Eucalypts (Higgins 1999).	2 records within 10 km (OEH 2015a)	Unlikely. No suitable woodland or forest habitat present.	Nil.
Charadrius leschenaultii	Greater Sand-plover	V	M	Does not breed in Australia. In NSW, recorded between the northern rivers and the Illawarra, with most records coming from the Clarence and Richmond estuaries. Occurs 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; forage on wet ground at low tide.	4 records within 10 km (OEH 2015a)	Unlikely. No suitable habitat present in the project footprint. Few records from the locality. Unlikely to occur at Mason Park, downstream of the project footprint.	Nil.
Hieraaetus morphnoides	Little Eagle	V		Occurs throughout NSW except most densely forested parts of the Dividing Range escarpment. Occupies habitats rich in prey within open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used. For nest sites it requires a tall living tree within a remnant patch, where pairs build a large stick nest in winter and lay in early spring.	6 records within 10 km (OEH 2015a)	Unlikely. No suitable woodland or forest habitat present.	Nil.

Scientific name	Common name	TSC Act	EPBC Act	Habitat association	Details of record	Likelihood of occurrence in the study area	Likelihood of impact
Glossopsitta pusilla	Little Lorikeet	V		Occurs from coast to western slopes of the Great Dividing Range. Inhabits dry, open eucalypt forests and woodlands. Occurrence is positively associated with patch size, and with components of habitat complexity including canopy cover, shrub cover, ground cover, logs, fallen branches and litter. Feed primarily on profusely-flowering eucalypts and a variety of other species including melaleucas and mistletoes. Mostly nests in small (opening approx. 3cm) hollows in living, smooth-barked eucalypts. Most breeding records are from the western slopes.	11 records within 10 km (OEH 2015a)	Unlikely. No suitable woodland or forest habitat present.	Nil.
Sternula albifrons	Little Tern	E	M	In NSW occurs mainly north of Sydney, with smaller numbers south to VIC. Almost exclusively coastal, preferring sheltered environments; may occur several kilometres from the sea in harbours, inlets and rivers. Nests in low dunes or sandy beaches just above high tide mark near estuary mouths/ adjacent to coastal lakes and islands. Forage in shallow waters of estuaries, coastal lagoons and lakes, also along open coasts, less often at sea, and usually within 50 m of shore.	51 records within 10 km (OEH 2015a) Breeding likely to occur within 10 km (DotE 2015a).	Likely in study area but no suitable habitat present in the project footprint. Potential habitat may be present downstream of the project footprint at Mason Park. Potential indirect impacts possible if not mitigated appropriately.	Low. Potential for indirect impacts from changes to water quality in Powells Creek. Specific mitigation measures are recommended to minimise the risk of indirect impact.
Anseranas semipalmata	Magpie Goose	V		Occurs in the tropics, increasing numbers in central and northern NSW and vagrants to south-east NSW. Inhabits shallow wetlands containing dense rushes or sedges, and nearby dry land used for grazing. It feeds on grasses, bulbs and rhizomes and roosts in tall vegetation within wetland areas. Breeding occurs predominantly in monsoonal areas and is unlikely in SE NSW. Nests are formed in trees over deep water.	9 records within 10 km (OEH 2015a)	Unlikely. No suitable reedy habitat present in the project footprint or at Mason Park, downstream of the project footprint.	Nil.

Scientific name	Common name	TSC Act	EPBC Act	Habitat association	Details of record	Likelihood of occurrence in the study area	Likelihood of impact
Tyto novaehollandiae	Masked Owl	V	-	Occurs across NSW except NW corner. Most common on the coast. Inhabits dry eucalypt woodlands from sea level to 1100 m. Roosts and breeds in large (>40cm) hollows and sometime caves in moist eucalypt forested gullies. Hunts along the edges of forests and roadsides. Home range between 500 ha and 1000 ha. Prey mostly terrestrial mammals but arboreal species may also be taken.	1 record within 10 km (OEH 2015a)	Unlikely. No suitable native woodland or forest habitat present.	Nil.
Neophema chrysogaster	Orange-bellied Parrot	CE	CE	Breeds in Tasmania and migrates in winter to SE South Australia and southern Victoria. There are occasional reports from NSW, including Maroubra. In winter, usually found within 3 km of the coast in saltmarsh and strandline/ foredune vegetation. May also occur on golf-courses and other grassy areas.	Species or species habitat may occur within 10 km (DotE 2015a)	Unlikely. No suitable habitat present. Very rare visitor to Sydney region.	Nil.
Haematopus longirostris	Pied Oyster-catcher	E	-	Scattered along NSW coast. Favours intertidal flats of inlets and bays, open beaches and sandbanks. Forages on exposed sand, mud and rock at low tide. Nests mostly on coastal or estuarine beaches; occasionally saltmarsh or grassy areas.	4 records within 10 km (OEH 2015a)	Unlikely. No suitable intertidal habitat present.	Nil.
Ninox strenua	Powerful Owl	V		Occurs from the coast to the western slopes. Solitary and sedentary species. Inhabits a range of habitats from woodland and open sclerophyll forest to tall open wet forest and rainforest. Prefers large tracts of vegetation. Nests in large tree hollows (> 0.5 m deep), in large eucalypts (dbh 80-240 cm) that are at least 150 years old. Pairs have high fidelity to a small number of hollow-bearing nest trees and defend a large home range of 400 - 1,450 ha. Forages within open and closed woodlands as well as open areas.	244 records within 10 km (OEH 2015a)	Unlikely. No suitable native woodland or forest habitat present.	Nil.

Scientific name	Common name	TSC Act	EPBC Act	Habitat association	Details of record	Likelihood of occurrence in the study area	Likelihood of impact
Xanthomyza phrygia	Regent Honeyeater	E	E	In NSW, confined to two known breeding areas: the Capertee Valley and Bundarra-Barraba region. Non-breeding flocks occasionally seen in coastal areas foraging in flowering Spotted Gum and Swamp Mahogany forests, presumably in response to drought.	5 records within 10 km (OEH 2015a) Species or species habitat known to occur within 10 km (DotE 2015a)	Possible. There are few records of the species in the locality. The species could forage occasionally on planted Spotted Gums but would not rely on habitats present.	Very low. Project would remove a small area of planted forage trees that may be used on occasion only.
Petroica boodang	Scarlet Robin	V		In NSW occurs from coast to inland slopes. Breeds in drier eucalypt forests and temperate woodlands, often on ridges and slopes, within open understorey of shrubs and grasses and sometimes in open areas. In autumn and winter it migrates to more open habitats such as grassy open woodland or paddocks with scattered trees. Abundant logs and coarse woody debris are important habitat components.	2 records within 10 km (OEH 2015a)	Unlikely. No suitable woodland or forest habitat present.	Nil.
Tyto tenebricosa	Sooty Owl	V		Occurs in the coastal, escarpment and tablelands regions of NSW. More common in the north and absent from the western tablelands and further west. Inhabits tall, moist eucalypt forests and rainforests, and are strongly associated with sheltered gullies, particularly those with tall rainforest understorey. Roosts in tree hollows, amongst dense foliage in gullies or in caves, recesses or ledges of cliffs or banks. Nest in large (>40cm wide, 100cm deep) tree hollows in unlogged/unburnt gullies within 100m of streams or in caves.	1 record within 10 km (OEH 2015a)	Unlikely. No suitable woodland or forest habitat present.	Nil.

Scientific name	Common name	TSC Act	EPBC Act	Habitat association	Details of record	Likelihood of occurrence in the study area	Likelihood of impact
Haematopus fuliginosus	Sooty Oyster-catcher	V		Evenly distributed along NSW coast, including offshore islands. Favours rocky headlands, rocky shelves, exposed reefs with rock pools, beaches and muddy estuaries. Forages on exposed rock or coral at low tide. Breeds almost exclusively on offshore islands, and occasionally on isolated promontories.	1 record within 10 km (OEH 2015a)	Unlikely. No suitable intertidal habitat present.	Nil.
Circus assimilis	Spotted Harrier	V		Occurs throughout 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. Inhabits grassy open woodland including acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe (eg chenopods). Most commonly in native grassland, but also in agricultural land, foraging over open habitats including edges of inland wetlands. Builds a stick nest in a tree and lays eggs in spring (or sometimes autumn).	2 records within 10 km (OEH 2015a)	Unlikely. No suitable woodland or grassland habitat present.	Nil.
Ptilinopus superbus	Superb Fruit-dove	V		Occurs mainly north from NE NSW, much less common further south and largely confined to pockets of habitat south to Moruya. Vagrants occur south to VIC and TAS. Inhabits rainforest and closed forests, may also forage in eucalypt or acacia woodland with fruit-bearing trees. Nests 5-30 m above ground in rainforest/rainforest edge tree and shrub species. Part of the population migratory/nomadic.	6 records within 10 km (OEH 2015a)	Unlikely. No suitable rainforest or forest habitat present.	Nil.

Scientific name	Common name	TSC Act	EPBC Act	Habitat association	Details of record	Likelihood of occurrence in the study area	Likelihood of impact
Lathamus discolor	Swift Parrot	E	E	Migratory, travelling to the mainland from March to October. Breeds in Tasmania from September to January. *Eucalyptus robusta*, *Corymbia maculata* and *C. gummifera* dominated coastal forests are important habitat in NSW.	5 records within 10 km (OEH 2015a) Species or species habitat likely to occur within 10 km (DotE 2015a)	Unlikely. No suitable native forest habitat present.	Nil.
Neophema pulchella	Turquoise Parrot	V	-	Occurs from coast to inland slopes. In coastal area, most common between Hunter and Northern Rivers, and further south in S Coast. Inhabits open eucalypt woodlands and forests, typically with a grassy understorey. Favours edges of woodlands adjoining grasslands or timbered creek lines and ridges. Feeds on the seeds of native and introduced grasses and other herbs. Grasslands and open areas provide important foraging habitat for this species while woodlands provide important roosting and breeding habitat. Nests in tree hollows, logs or posts from August to December.	1 record within 10 km (OEH 2015a)	Unlikely. No suitable woodland or grassland habitat present.	Nil.

Scientific name	Common name	TSC Act	EPBC Act	Habitat association	Details of record	Likelihood of occurrence in the study area	Likelihood of impact
Daphoenositta chrysoptera	Varied Sittella	V	-	Sedentary, occurs across NSW from the coast to the far west. Inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Sensitive to habitat isolation and loss of structural complexity, and adversely affected by dominance of Noisy Miners. Cleared agricultural land is potentially a barrier to movement. Builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.	3 records within 10 km (OEH 2015a)	Unlikely. No suitable woodland or forest habitat present.	Nil.
Epthianura albifrons	White-fronted Chat	V	-	This species occurs from southern Queensland to Western Australia and down to Tasmania, mostly in temperate to arid climates and very rarely in sub-tropical areas. It is found in damp open habitats, particularly wetlands containing saltmarsh areas that are bordered by open grasslands. Along the coast they are found in estuarine and marshy habitats with vegetation <1m tall, and in open grasslands and areas bordering wetlands. Inland, they are often observed in grassy plains, salt lakes and saltpans along waterway margins.	210 records within 10 km (OEH 2015a)	Likely in study area but no suitable habitat present in the project footprint. Potential habitat may be present downstream of the project footprint at Mason Park. Potential indirect impacts possible if not mitigated appropriately.	Low. Potential for indirect impacts from changes to water quality in Powells Creek. Specific mitigation measures are recommended to minimise the risk of indirect impact.

Scientific name	Common name	TSC Act	EPBC Act	Habitat association	Details of record	Likelihood of occurrence in the study area	Likelihood of impact
Epthianura albifrons endangered population in the Sydney Metropolitan Catchment Management Authority area	White-fronted Chat	EP	-	There are two isolated sub-populations of White-fronted Chats currently known from the Sydney Metropolitan CMA: at Newington Nature Reserve and at Towra Point NR. This species is unlikely to cross the 25km separating these areas, or the greater distances separating other colonies outside the CMA.	210 records within 10 km (OEH 2015a)	Likely in study area but no suitable habitat present in the project footprint. Potential habitat may be present downstream of the project footprint at Mason Park. Potential indirect impacts possible if not mitigated appropriately.	Low. Potential for indirect impacts from changes to water quality in Powells Creek. Specific mitigation measures are recommended to minimise the risk of indirect impact.
Mammals							
Petrogale pencillata	Brush-tailed Rock-wallaby	E	V	Occurs on rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges facing north. Diet consists of vegetation in adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees.	Species or species habitat may occur within 10 km (DotE 2015a)	Absent. No suitable habitat present. Outside known distribution.	Nil.
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V		Generally occurs east of the Great Dividing Range along NSW coast. Inhabits various habitats from open grasslands to woodlands, wet and dry sclerophyll forests and rainforest. Essentially a cave bat but may also roost in road culverts, stormwater tunnels and other man-made structures. Only 4 known maternity caves in NSW, near Wee Jasper, Bungonia, Kempsey and Texas. Females may travel hundreds of kilometres to the nearest maternal colony.	108 records within 10 km (OEH 2015a)	Likely. Likely to forage throughout the locality. May use culverts under the M4 and Parramatta Road and bridges within the study area as temporary diurnal roosts but not suitable for breeding. No evidence of roosting activity observed during field surveys.	Low. Possible disturbance of temporary roost habitat during construction as a result of noise and vibration (if roosting when construction occurs near these culverts or bridges). Negligible clearing of foraging habitat.

Scientific name	Common name	TSC Act	EPBC Act	Habitat association	Details of record	Likelihood of occurrence in the study area	Likelihood of impact
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V		Occurs on southeast coast and ranges. Prefers tall (>20m) and wet forest with dense understorey. Absent from small remnants, preferring continuous forest but can move through cleared landscapes and may forage in open areas. Roosts in hollow trunks of Eucalypts, underneath bark or in buildings. Forages in gaps and spaces within forest, with large foraging range (12km foraging movements recorded).	1 record within 10 km (OEH 2015a)	Unlikely. No suitable woodland or forest habitat present.	Nil.
Mormopterus norfolkensis	Eastern Freetail-bat	V		Occurs in dry sclerophyll forest and woodland east of the Great Dividing Range. Forages in natural and artificial openings in vegetation, typically within a few kilometres of its roost. Roosts primarily in tree hollows but also recorded from man-made structures or under bark.	13 records within 10 km (OEH 2015a)	Unlikely. No suitable woodland or forest habitat present.	Nil.
Scoteanax rueppellii	Greater Broad-nosed Bat	V		Occurs on the east coast and Great Dividing Range. Inhabits a variety of habitats from woodland to wet and dry sclerophyll forests and rainforest, also remnant paddock trees and timber-lined creeks, typically below 500m asl. Forages in relatively uncluttered areas, using natural or man-made openings in denser habitats. Usually roosts in tree hollows or fissures but also under exfoliating bark or in the roofs of old buildings. Females congregate in maternal roosts in suitable hollow trees.	2 records within 10 km (OEH 2015a)	Unlikely. No suitable woodland or forest habitat present.	Nil.

Scientific name	Common name	TSC Act	EPBC Act	Habitat association	Details of record	Likelihood of occurrence in the study area	Likelihood of impact
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Roosts in camps within 20 km of a regular food source, typically in gullies, close to water and in vegetation with a dense canopy. Forages in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths, swamps and street trees, particularly in eucalypts, melaleucas and banksias. Highly mobile with movements largely determined by food availability (Eby and Law 2008). Will also forage in urban gardens and cultivated fruit crops.	471 records within 10 km (OEH 2015a) Roosting known to occur within 10 km (DotE 2015a)	Present. Would forage in planted vegetation in the area on occasion. Nearest breeding camps are at Duck River and Wolli Creek, 5 km to the west and 4 km to the south-east of the study area respectively.	Low. Low quality foraging habitat would be removed. No impact on breeding habitat.
Phascolarctos cinereus	Koala	V	V	Occurs from coast to inland slopes and plains. Restricted to areas of preferred feed trees in eucalypt woodlands and forests. Home range varies depending on habitat quality, from < 2 to several hundred hectares.	Species or species habitat known to occur within 10 km (DotE 2015a)	Unlikely. No suitable habitat present.	Nil.
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Roosts in caves and mines and most commonly recorded from dry sclerophyll forests and woodlands. In southern Sydney appears to be largely restricted to the interface between sandstone escarpments and fertile valleys.	Species or species habitat likely to occur within 10 km (DotE 2015a)	Unlikely. No suitable habitat present.	Nil.
Myotis macropus	Large-footed Myotis	V		Mainly coastal but may occur inland along large river systems. Usually associated with permanent waterways at low elevations in flat/undulating country, usually in vegetated areas. Forages over streams and watercourses feeding on fish and insects from the water surface. Roosts in a variety of habitats including caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, under bridges and in dense foliage, typically in close proximity to water. Breeds November or December.	475 records within 10 km (OEH 2015a)	Likely. Likely to forage throughout the locality. May use culverts under the M4 and Parramatta Road and bridges within the study area as temporary diurnal roosts but not suitable for breeding. No evidence of roosting activity observed during field surveys.	Low. Possible disturbance of temporary roost habitat during construction as a result of noise and vibration (if roosting when construction occurs near these culverts or bridges). Negligible impact on foraging habitat.

Scientific name	Common name	TSC Act	EPBC Act	Habitat association	Details of record	Likelihood of occurrence in the study area	Likelihood of impact
Miniopterus australis	Little Bentwing-bat	V		Occurs from Cape York to Sydney. Inhabits rainforests, wet and dry sclerophyll forests, paperbark swamps and vine thickets. Only one maternity cave known in NSW, shared with Eastern Bentwing-bats at Willi Willi, near Kempsey. Outside breeding season roosts in caves, tunnels and mines and has been recorded in a tree hollow on one occasion. Forages for insects beneath the canopy of well-timbered habitats (Churchill 2008; Hoye and Hall 2008).	1 record within 10 km (OEH 2015a)	Unlikely. No suitable breeding or foraging habitat present.	Nil.
Perameles nasuta	Long-nosed Bandicoot population in inner western Sydney	EP		Occurs within Marrickville and Canada Bay LGAs, and may also occur in the Canterbury, Ashfield and Leichhardt LGAs. Shelter mostly under older houses and buildings, and forage in parkland and backyards.	24 records within 10 km (OEH 2015a)	Unlikely. No habitat in the study area is connected with the Inner West light rail corridor, where this species is known to occur.	Nil.
Pseudomys novaehollandiae	New Holland Mouse		V	Inhabits a variety of coastal habitats including heathland, woodland, dry sclerophyll forest with a dense shrub layer and vegetated sand dunes. Presence strongly correlated with understorey vegetation density, and high floristic diversity in regenerating heath.	Species or species habitat likely to occur within 10 km (DotE 2015a)	Nil. No suitable habitat present.	Nil.
Isoodon obesulus obesulus	Southern Brown Bandicoot	E	E	Inhabits scrubby vegetation, including heath, shrubland, and heathy forest and woodland. Often associated with well-drained soils and dry heathland communities, and prefers periodically burnt areas as this increases insect abundance.	Species or species habitat likely to occur within 10 km (DotE 2015a)	Nil. No suitable habitat present.	Nil.

Scientific name	Common name	TSC Act	EPBC Act	Habitat association	Details of record	Likelihood of occurrence in the study area	Likelihood of impact
Dasyurus maculatus	Spotted-tailed Quoll	V	E	Inhabits a range of environments including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Den sites are in hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces. Females occupy home ranges of up to 750 ha and males up to 3,500 ha, usually traversed along densely vegetated creek lines.	3 records within 10km (OEH 2015a) Species or species habitat known to occur within 10 km (DotE 2015a)	Unlikely. No suitable habitat present. Has been recorded previously along the Duck River riparian corridor 5 km to the west of the study area. No connectivity of habitat present between Duck River and the study area.	Nil.
Petaurus australis	Yellow-Bellied Glider	V		Occurs along the east coast to the western slopes of the Great Dividing Range. Inhabits a variety of forest types but prefers tall mature eucalypt forest with high rainfall and rich soils. Relies on large hollow-bearing trees for shelter and nesting, with family groups of 2-6 typically denning together. In southern NSW its preferred habitat at low altitudes is moist gullies and creek flats in mature coastal forests. Mostly feeds on sap, nectar and honeydew.	1 record within 10km (OEH 2015a)	Unlikely. No suitable woodland or forest habitat present.	Nil.
Saccolaimus flaviventris	Yellow-bellied Sheathtail Bat	V		Migrates from tropics to south-east Australia in summer. Forages across a range of habitats including those with and without trees, from wet and dry sclerophyll forest, open woodland, Acacia shrubland, mallee, grasslands and desert. Roosts communally in large tree hollows and buildings.	4 records within 10km (OEH 2015a)	Unlikely. No suitable woodland or forest habitat present.	Nil.

Scientific name	Common name	TSC Act	EPBC Act	Habitat association	Details of record	Likelihood of occurrence in the study area	Likelihood of impact
Reptiles							
Hoplocephalus bungaroides	Broad-headed Snake	E	V	Nocturnal, sheltering in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter, and spring, moving to shelters in hollows of large trees within 200m of escarpments in summer. Feeds mostly on geckos and small skinks, and occasionally on frogs and small mammals.	Species or species habitat likely to occur within 10 km (DotE 2015a)	Unlikely. No suitable habitat present.	Nil.
Frogs							
Heleioporus australiacus	Giant Burrowing Frog	V	V	Occurs along the coast and eastern slopes of the Great Dividing Range south from Wollemi National Park. Occurs on sandy soils supporting heath, woodland or open forest. Breeds in ephemeral to intermittent streams with persistent pools.	Species or species habitat likely to occur within 10 km (DotE 2015a)	Unlikely. No suitable habitat present.	Nil.
Litoria aurea	Green and Golden Bell Frog	E	V	Formerly occurred from Brunswick Heads to Victoria, but >80% populations now extinct. Inhabits marshes, natural and artificial freshwater to brackish wetlands, dams and in stream wetlands. Prefers sites containing cumbungi (*Typha* spp.) or spike rushes (*Eleocharis* spp.), which are unshaded and have a grassy area and/or rubble as shelter/refuge habitat nearby.	12005 records within 10km (OEH 2015a) Species or species habitat known to occur within 10 km (DotE 2015a)	Unlikely. No suitable habitat present. Known to occur at Sydney Olympic Park and Bicentennial Park, over 500 m from the project footprint.	Unlikely. No hydrological link between the project footprint and habitat areas.
Litoria raniformis	Growling Grass Frog	E	V	Currently, the species is known to exist only in isolated populations in the Coleambally Irrigation Area, the Lowbidgee floodplain and around Lake Victoria. Usually found in or around permanent or ephemeral Black Box/Lignum/Nitre Goosefoot swamps, Lignum/Typha swamps and River Red Gum swamps or billabongs along floodplains and river valleys. They are also found in irrigated rice crops, particularly where there is no available natural habitat (OEH 2013).	Species or species habitat may occur within 10 km (DotE 2015a)	Absent. Study area is outside known distribution.	Nil.

Scientific name	Common name	TSC Act	EPBC Act	Habitat association	Details of record	Likelihood of occurrence in the study area	Likelihood of impact
Pseudophryne australis	Red-crowned Toadlet	V		Restricted to Sydney Basin, from Nowra to Pokolbin and west to Mt Victoria. Inhabits heathland and open woodland on Hawkesbury and Narrabeen Sandstones, within 100m of ridgelines. Breeds in ephemeral feeder creeks or flooded depressions, requiring unpolluted water between 5.5 and 6.5 pH. Shelters under rocks, amongst masses of dense vegetation or leaf litter. Populations restricted to immediate vicinity of breeding areas.	17 records within 10 km (OEH 2015a)	Unlikely. No suitable habitat present.	Nil.
Mixophyes balbus	Stuttering Frog	E	V	Inhabits rainforest and wet, tall, open forest. Shelter in deep leaf litter and thick understorey vegetation on the forest floor. The species does not occur in areas where the riparian vegetation has been disturbed or where there have been significant upstream human impacts.	Species or species habitat likely to occur within 10 km (DotE 2015a)	Absent. No suitable habitat present. Study area is outside known distribution.	Nil.
Crinia tinnula	Wallum Froglet	V		Inhabits acid paperbark swamps and sedge swamps along the northern and central coast regions of NSW. It is generally not associated with disturbed habitats (Renwick 2006).	1 record within 10 km (OEH 2015a)	Unlikely. No suitable habitat present.	Nil.
Invertebrates		FM Act					
Meridolum corneovirens	Cumberland Plain Land Snail	E		Occurs within a small area of the Cumberland Plain, from Richmond and Windsor to Picton. Found primarily under litter of bark, leaves and logs, or in loose soil around grass clumps within Cumberland Plain Woodland. Has also been found under rubbish. Feeds on fungus. During periods of drought can burrow into the soil to escape the dry conditions.	6 records within 10 km (OEH 2015a)	Unlikely. No suitable woodland or forest habitat present.	Nil.

All information in these tables is taken from NSW OEH and Commonwealth DotE Threatened Species profiles (OEH, 2015a; DotE 2015b) unless otherwise stated.

Key: CE – Critically Endangered; E – Endangered; V – Vulnerable; EP – Endangered Population; CEEC – Critically Endangered Ecological Community; EEC – Endangered Ecological Community.

Table B4: Likelihood of occurrence of threatened aquatic species in the study area

Scientific name	Common name	FM Act	EPBC Act	Habitat association	Details of record	Likelihood of occurrence in the study area	Likelihood of impact
Fish							
Prototroctes mairaena	Australian Grayling		V	Occurs in coastal rivers and streams south from the Shoalhaven River. Inhabits estuarine waters and coastal seas as larvae/juveniles, and freshwater rivers and streams as adults. Most of their lives are spent in freshwater rivers and streams.	Species or species habitat likely to occur within 10 km (DotE 2015a)	Unlikely. No suitable habitat present.	Nil.
Epinephelus daemelii	Black Rockcod	V	V	Occurs from southern Queensland through NSW to northern Victoria. Generally inhabits near-shore rocky and offshore coral reefs at depths down to 50m (DotE 2015b)	Species or species habitat likely to occur within 10 km (DotE 2015a) Found in the Sydney Metro CMA (DPI 2015a)	Unlikely. No suitable habitat present.	Nil.
Invertebrates							
Archaeophya adamsi	Adams Emerald dragonfly	E		The species is only known from a few sites in the greater Sydney region. Larvae have been found in small creeks with gravel or sandy bottoms, in narrow, shaded riffle zones with moss and rich riparian vegetation. Adult dragonflies generally fly away from the water to mature before returning to breed. Males congregate at breeding sites and often guard a territory. Females probably lay their eggs into the water.	Found in the Sydney Metro CMA (DPI 2015a)	Absent. No suitable habitat present.	Nil.

Scientific name	Common name	FM Act	EPBC Act	Habitat association	Details of record	Likelihood of occurrence in the study area	Likelihood of impact
Austrocordulia leonardi	Sydney hawk dragonfly	E		The Sydney Hawk Dragonfly has a very restricted distribution. The known distribution of the species includes three locations in a small area south of Sydney, from Audley to Picton. The species is known from the Hawkesbury-Nepean, Georges River, Port Hacking and Karuah drainages. The Sydney hawk dragonfly has specific habitat requirements, and has only ever been collected from deep and shady riverine pools with cooler water. Larvae are found under rocks where they co-exist with Austrocordulia refracta.	Found in the Sydney Metro CMA (DPI 2015a)	Absent. No suitable habitat present.	Nil.

All information in these tables is taken from NSW OEH and Commonwealth DotE Threatened Species profiles (OEH, 2015a; DotE 2015b) unless otherwise stated.

Key: CE – Critically Endangered; E – Endangered; V – Vulnerable; EP – Endangered Population; CEEC – Critically Endangered Ecological Community; EEC – Endangered Ecological Community.

Table B5: Likelihood of occurrence of migratory species in the study area

Scientific name	Common name	EPBC Act	Habitat association	Records in the locality	Likelihood of occurrence in the study area	Likelihood of impact
Migratory marine birds						
Apus pacificus	Fork-tailed Swift	Migratory Marine	It is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher. Mostly occur over inland plains but sometimes above foothills or in coastal areas, over cliffs and beaches and also over islands and sometimes well out to sea. They probably roost aerially, but are occasionally observed to land.	6 records within 10 km (OEH 2015a) Species or species habitat likely to occur within 10 km (DotE 2015a)	Unlikely. No suitable habitat present.	Nil.
Philomachus pugnax	Ruff (Reeve)	Migratory Marine	In NSW the species has been recorded at Kurnell, Tomki, Casino, Ballina, Kooragang Island, Broadwater Lagoon and Little Cattai Creek (DotE 2015b). Occurs in fresh, brackish of saline wetlands with exposed mudflats at the edges. Also found in terrestrial wetlands including lakes, swamps, pools, lagoons, tidal rivers, swampy fields and floodlands. Occasionally seen on sheltered coasts, in harbours, estuaries, seashores and are known to visit sewage farms and saltworks (DotE 2015b). They are sometimes found on wetlands surrounded by dense vegetation including grass, sedges, saltmarsh and reeds	3 records within 10 km (OEH 2015a)	Likely in study area but no suitable habitat present in the project footprint. Potential habitat may be present 1 km downstream of the project footprint at Mason Park. Potential indirect impacts possible if not mitigated appropriately.	Low. Potential for indirect impacts from changes to water quality in Powells Creek if not mitigated.

Scientific name	Common name	EPBC Act	Habitat association	Records in the locality	Likelihood of occurrence in the study area	Likelihood of impact
Sterna albifrons	Little Tern	M-CAMBA, ROKAMBA, Marine	In NSW occurs mainly north of Sydney, with smaller numbers south to VIC. Almost exclusively coastal, preferring sheltered environments; may occur several kilometres from the sea in harbours, inlets and rivers. Nests in low dunes or sandy beaches just above high tide mark near estuary mouths/ adjacent to coastal lakes and islands. Forage in shallow waters of estuaries, coastal lagoons and lakes, also along open coasts, less often at sea, and usually within 50 m of shore.	51 records within 10 km (OEH 2015a) Breeding likely to occur within 10 km (DotE 2015a). Has been recorded at the Mason Park Wetlands (PEP et al. 2008; DotE, 2015c).	Likely in study area but no suitable habitat present in the project footprint. Known to occur 1 km downstream of the project footprint Mason Park. Potential indirect impacts possible if not mitigated appropriately.	Low. Potential for indirect impacts from changes to water quality in Powells Creek if not mitigated.
Sterna hirundo	Common Tern	M-CAMBA, ROKAMBA, Marine	Non-breeding migrant to Australia. Widespread and common along the east coast from SE Qld to Victoria, though less often recorded south of Port Hacking. Utilise marine, pelagic and coastal habitats, but are commonly observed in near-coastal waters, on ocean beaches, platforms and headlands and in sheltered waters (bays, harbours and estuaries). Forage in marine environments and near-coastal terrestrial wetlands. Roost on beaches, rock platforms, islands and banks of estuaries and lagoons.	42 records within 10 km (OEH 2015a)	Likely in study area but no suitable habitat present in the project footprint. Known to occur 1 km downstream of the project footprint at Mason Park. Potential indirect impacts possible if not mitigated appropriately.	Low. Potential for indirect impacts from changes to water quality in Powells Creek if not mitigated.

Scientific name	Common name	EPBC Act	Habitat association	Records in the locality	Likelihood of occurrence in the study area	Likelihood of impact
Egretta sacra	Eastern Reef Egret	M- CAMBA, Marine	Occurs along most of Australia's coastline except Victoria, Tasmania and the Nullarbor. Usually inhabit rocky shorelines, coral islands and reefs. Also occur in tidal rivers and inlets. Breed throughout the year and nests can be in trees in island woodlands or on the ground under shrubs or rock ledges (Birdlife Australia 2015).	1 record within 10 km (OEH 2015a)	Likely in study area but no suitable habitat present in the project footprint. Potential habitat may be present 1 km downstream of the project footprint at Mason Park. Potential indirect impacts possible if not mitigated appropriately	Low. Potential for indirect impacts from changes to water quality in Powells Creek if not mitigated.
Migratory wetland species						
Actitis hypoleucos	Common Sandpiper	Migratory – CAMBA, JAMBA, ROKAMBA, Marine, Wetland	Widespread in small numbers; predominantly concentrated in northern and western Australia (Higgins & Davies 1996). 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. Has also been recorded in estuaries and deltas of streams, as well as on banks farther upstream; around lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties.	79 records within 10 km (OEH 2015a) Foraging, feeding or related behaviour known to occur within 10 km (DotE 2015a)	Likely in study area but no suitable habitat present in the project footprint. Potential habitat may be present 1 km downstream of the project footprint at Mason Park. Potential indirect impacts possible if not mitigated appropriately.	Low. Potential for indirect impacts from changes to water quality in Powells Creek if not mitigated.

Scientific name	Common name	EPBC Act	Habitat association	Records in the locality	Likelihood of occurrence in the study area	Likelihood of impact
Ardea alba	Great Egret	Migratory Marine, Wetlands	This species of wetland bird occurs in a variety of habitats including marshes, swamps, river margins, lake shorelines, flooded grasslands, sea-grass flats, mangrove swamps, coastal lagoons, and offshore coral reefs.	424 records within 10 km (OEH 2015a) Species or species habitat known to occur within 10 km (DotE 2015a)	Likely in study area but no suitable habitat present in the project footprint. Potential habitat may be present 1 km downstream of the project footprint at Mason Park. Potential indirect impacts possible if not mitigated appropriately.	Low. Potential for indirect impacts from changes to water quality in Powells Creek if not mitigated.
Ardea ibis	Cattle Egret	Migratory Marine, Wetlands	This species occurs in grasslands, woodlands, wetlands and pasture areas often seen with cattle and other animals. It makes shallow platform nests in wetland areas in surrounding trees and shrubs.	124 records within 10 km (DotE 2015a) Species or species habitat may occur within 10 km (DotE 2015a)	Likely in study area but no suitable habitat present in the project footprint. Potential habitat may be present 1 km downstream of the project footprint at Mason Park. Potential indirect impacts possible if not mitigated appropriately.	Low. Potential for indirect impacts from changes to water quality in Powells Creek if not mitigated.

Scientific name	Common name	EPBC Act	Habitat association	Records in the locality	Likelihood of occurrence in the study area	Likelihood of impact
Arenaria interpres	Ruddy Turnstone	Migratory-Bonn, CAMBA, JAMBA, ROKAMBA; Marine Wetland	Widespread throughout Australia during non-breeding periods. Mainly found on coastal regions with exposed rock coast lines or coral reefs. It also lives near platforms and shelves, often with shallow tidal pools and rocky, shingle or gravel beaches. It can, however, be found on sand, coral or shell beaches, shoals, cays and dry ridges of sand or coral. It has occasionally been sighted in estuaries, harbours, bays and coastal lagoons, among low saltmarsh or on exposed beds of seagrass, around sewage ponds and on mudflats (DotE 2015b)	9 records within 10 km (OEH 2015a) Foraging, feeding or related behaviour known to occur within 10 km (DotE 2015a)	Likely in study area but no suitable habitat present in the project footprint. Potential habitat may be present 1 km downstream of the project footprint at Mason Park. Potential indirect impacts possible if not mitigated appropriately.	Low. Potential for indirect impacts from changes to water quality in Powells Creek if not mitigated.

Scientific name	Common name	EPBC Act	Habitat association	Records in the locality	Likelihood of occurrence in the study area	Likelihood of impact
Calidris acuminata	Sharp-tailed Sandpiper	Migratory-Bonn, CAMBA, JAMBA, ROKAMBA; Wetland	Most of the population migrates to Australia, mostly to the south-east and are widespread in both inland and coastal locations and in both freshwater and saline habitats. prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline saltlakes inland. They also occur in saltworks and sewage farms. 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. (DotE 2015b)	623 records within 10 km (OEH 2015a) Foraging, feeding or related behaviour known to occur within 10 km (DotE 2015a) Has been recorded at the Mason Park Wetlands (PEP et al. 2008).	Likely in study area but no suitable habitat present in the project footprint. Known to occur 1 km downstream of the project footprint at Mason Park. Potential indirect impacts possible if not mitigated appropriately.	Low. Potential for indirect impacts from changes to water quality in Powells Creek if not mitigated.
Calidris alba	Sanderling	Migratory-Bonn, CAMBA, JAMBA, ROKAMBA; Wetland	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. Roosts on bare sand, behind clumps of beach-cast kelp or in coastal dunes.	2 records within 10 km (OEH 2015a) Foraging, feeding or related behaviour known to occur within 10 km (DotE 2015a)	Likely in study area but no suitable habitat present in the project footprint. Potential habitat may be present 1 km downstream of the project footprint at Mason Park. Potential indirect impacts possible if not mitigated appropriately.	Low. Potential for indirect impacts from changes to water quality in Powells Creek if not mitigated.

Scientific name	Common name	EPBC Act	Habitat association	Records in the locality	Likelihood of occurrence in the study area	Likelihood of impact
Calidris canutus	Red Knot	Migratory – CAMBA, JAMBA, ROKAMBA; Marine, Wetland	Found along much of the NSW coast. Inhabit intertidal mudflats, sandflats 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. They are occasionally seen on terrestrial saline wetlands near the coast, such as lakes, lagoons, pools and pans, and recorded on sewage ponds and saltworks, but rarely use freshwater swamps. They rarely use inland lakes or swamps (Higgins & Davies 1996) (DotE 2015b)	21 records within 10 km (OEH 2015a) Foraging, feeding or related behaviour known to occur within 10 km (DotE 2015a)	Likely in study area but no suitable habitat present in the project footprint. Potential habitat may be present 1 km downstream of the project footprint at Mason Park. Potential indirect impacts possible if not mitigated appropriately.	Low. Potential for indirect impacts from changes to water quality in Powells Creek if not mitigated.

Scientific name	Common name	EPBC Act	Habitat association	Records in the locality	Likelihood of occurrence in the study area	Likelihood of impact
Calidris ferruginea	Curlew Sandpiper	Critically endangered Migratory – CAMBA, JAMBA, ROKAMBA; Wetland	Occurs along the entire coast of NSW, particularly in the Hunter Estuary, and sometimes in freshwater wetlands in the Murray-Darling Basin. The Curlew Sandpiper breeds in Siberia and migrates to Australia (as well as Africa and Asia) for the non-breeding period, arriving in Australia between August and November, and departing between March and mid-April. Occurs along the entire coast of NSW, particularly in the Hunter Estuary, and sometimes in freshwater wetlands in the Murray-Darling Basin. The Curlew Sandpiper breeds in Siberia and migrates to Australia (as well as Africa and Asia) for the non-breeding period, arriving in Australia between August and November, and departing between March and mid-April.	493 records within 10 km (OEH 2015a) Foraging, feeding or related behaviour known to occur within 10 km (DotE 2015a) Has been recorded at the Mason Park Wetlands (PEP et al. 2008).	Likely in study area but no suitable habitat present in the project footprint. Known to occur 1 km downstream of the project footprint at Mason Park. Potential indirect impacts possible if not mitigated appropriately.	Low. Potential for indirect impacts from changes to water quality in Powells Creek if not mitigated.
Calidris melanotos	Pectoral Sandpiper	M-Bonn, JAMBA, ROKCAMBA; Marine	In NSW, the Pectoral Sandpiper is widespread, but scattered. Records exist east of the Great Divide, from Casino and Ballina, south to Ulladulla (DotE 2015b). 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.	41 records within 10 km (OEH 2015a) Foraging, feeding or related behaviour known to occur within 10 km (DotE 2015a)	Likely in study area but no suitable habitat present in the project footprint. Potential habitat may be present 1 km downstream of the project footprint at Mason Park. Potential indirect impacts possible if not mitigated appropriately.	Low. Potential for indirect impacts from changes to water quality in Powells Creek if not mitigated.

Scientific name	Common name	EPBC Act	Habitat association	Records in the locality	Likelihood of occurrence in the study area	Likelihood of impact
Calidris ruficollis	Red-necked Stint	Migratory-Bonn. CAMBA, JAMBA, ROKAMBA, Marine; Wetland	Found in most coastal areas. Inhabit intertidal mudflats, sandflats 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. They are occasionally seen on terrestrial saline wetlands near the coast, such as lakes, lagoons, pools and pans, and recorded on sewage ponds and saltworks, but rarely use freshwater swamps. They rarely use inland lakes or swamps (Higgins & Davies 1996; DotE 2015b)	168 records within 10 km (OEH 2015a) Foraging, feeding or related behaviour known to occur within 10 km (DotE 2015a) Has been recorded at the Mason Park Wetlands (PEP et al. 2008).	Likely in study area but no suitable habitat present in the project footprint. Potential habitat may be present 1 km downstream of the project footprint at Mason Park. Potential indirect impacts possible if not mitigated appropriately.	Low. Potential for indirect impacts from changes to water quality in Powells Creek if not mitigated.
Calidris subminuta	Long-toed Stint	Migratory-Bonn. CAMBA, JAMBA, ROKAMBA, Marine; Wetland	The Long-toed Stint is a regular summer visitor to Australia, but uncommon in the east. They prefer shallow freshwater or brackish wetlands including lakes, swamps, river floodplains, streams, lagoons and sewage ponds.	Foraging, feeding or related behaviour known to occur within 10 km (DotE 2015a)	Likely in study area but no suitable habitat present in the project footprint. Potential habitat may be present 1 km downstream of the project footprint at Mason Park. Potential indirect impacts possible if not mitigated appropriately.	Low. Potential for indirect impacts from changes to water quality in Powells Creek if not mitigated.

Scientific name	Common name	EPBC Act	Habitat association	Records in the locality	Likelihood of occurrence in the study area	Likelihood of impact
Calidris tenuirostris	Great Knot	Migratory; Wetland	In NSW, the species has been recorded at scattered sites along the coast 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 sandflats, 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 (OEH 2012).	5 records within 10 km (OEH 2015a) Foraging, feeding or related behaviour known to occur within 10 km (DotE 2015a)	Likely in study area but no suitable habitat present in the project footprint. Potential habitat may be present 1 km downstream of the project footprint at Mason Park. Potential indirect impacts possible if not mitigated appropriately.	Low. Potential for indirect impacts from changes to water quality in Powells Creek if not mitigated.
Charadrius bicinctus	Double-banded Plover	Migratory; Wetland	Occurs along the coast and inland areas of NSW. Non-breeding visitor. Important sites in NSW include Lake Bathurst and Botany Bay (Penrhyn Estuary and Sydney Airport). Inhabits littoral, estuarine and fresh/saline terrestrial wetlands as well as saltmarsh, grasslands and pasture.	32 records within 10 km (OEH 2015a) Foraging, feeding or related behaviour known to occur within 10 km (DotE 2015a)	Likely in study area but no suitable habitat present in the project footprint. Potential habitat may be present 1 km downstream of the project footprint at Mason Park. Potential indirect impacts possible if not mitigated appropriately.	Low. Potential for indirect impacts from changes to water quality in Powells Creek if not mitigated.

Scientific name	Common name	EPBC Act	Habitat association	Records in the locality	Likelihood of occurrence in the study area	Likelihood of impact
Charadrius leschenaultii	Greater Sand-plover	Migratory-Bonn, CAMBA, JAMBA, ROKAMBA; Wetland	In NSW, the species has been recorded between the northern rivers and the Illawarra, with most records coming from the Clarence and Richmond estuaries (OEH 2015b). Occurs mainly on sheltered sandy, shelly or muddy beaches or estuaries with large intertidal mudflats or sandbanks (OEH 2015b). 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 (OEH 2015b).	4 records within 10 km (OEH 2015a) Foraging, feeding or related behaviour known to occur within 10 km (DotE 2015a)	Likely in study area but no suitable habitat present in the project footprint. Potential habitat may be present 1 km downstream of the project footprint at Mason Park. Potential indirect impacts possible if not mitigated appropriately.	Low. Potential for indirect impacts from changes to water quality in Powells Creek if not mitigated.
Charadrius mongolus	Lesser Sand-plover	Migratory-Bonn, CAMBA, JAMBA, ROKAMBA; Marine, Wetland	In NSW, occurs along the coastline preferring beaches of sheltered bays, harbours and estuaries with large intertidal sandflats or mudflats; occasionally occurs on sandy beaches, coral reefs and rock platforms (OEH 2015b). 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 (OEH 2015b).	5 records within 10 km (OEH 2015a) Foraging, feeding or related behaviour known to occur within 10 km (DotE 2015a)	Likely in study area but no suitable habitat present in the project footprint. Potential habitat may be present 1 km downstream of the project footprint at Mason Park. Potential indirect impacts possible if not mitigated appropriately.	Low. Potential for indirect impacts from changes to water quality in Powells Creek if not mitigated.

Scientific name	Common name	EPBC Act	Habitat association	Records in the locality	Likelihood of occurrence in the study area	Likelihood of impact
Gallinago hardwickii	Latham's Snipe	Migratory Wetlands	This species of medium sized wading bird occurs in permanent and ephemeral wetlands up to 2000 m above sea-level, usually inhabiting open, freshwater wetlands with nearby low, dense vegetation such as swamps, flooded grasslands or heathlands, around bogs and other water bodies.	502 records within 10 km (OEH 2015a) Foraging, feeding or related behaviour known to occur within 10 km (DotE 2015a) Has been recorded at the Mason Park Wetlands (PEP et al. 2008).	Likely in study area but no suitable habitat present in the project footprint. Known to occur 1 km downstream of the project footprint Mason Park. Potential indirect impacts possible if not mitigated appropriately.	Low. Potential for indirect impacts from changes to water quality in Powells Creek if not mitigated.
Heteroscelus brevipes	Grey-tailed Tattler	Migratory – JAMBA, CAMBA and ROKAMBA; Wetland	Occurs along NSW coast, more common north of Sydney. Non-breeding visitor to Australia. Inhabits sheltered coasts with reefs and rock platforms or with intertidal mudflats. Usually forages in shallow water on hard intertidal substrates, but also recorded foraging on intertidal mudflats with mangroves/seagrass and occasionally on intertidal sandflats.	Foraging, feeding or related behaviour known to occur within 10 km (DotE 2015a)	Likely in study area but no suitable habitat present in the project footprint. Potential habitat may be present 1 km downstream of the project footprint at Mason Park. Potential indirect impacts possible if not mitigated appropriately.	Low. Potential for indirect impacts from changes to water quality in Powells Creek if not mitigated.

Scientific name	Common name	EPBC Act	Habitat association	Records in the locality	Likelihood of occurrence in the study area	Likelihood of impact
Limicola falcinellus	Broad-billed Sandpiper	M-CAMBA, JAMBA, ROKCAMBA; Marine	In NSW, occurs in coastal areas, from Ballina, south to Shoalhaven Heads. In Victoria, they are an annual visitor in small numbers in coastal regions, with rare inland records. Occurs in sheltered parts of the coast, favouring estuarine mudflats but also occasionally occur on saltmarshes, shallow freshwater lagoons, saltworks and sewage farms, and in areas with large soft intertidal mudflats, which may have shell or sandbanks nearby. Occasionally they occur on reefs or rocky platforms. They have also been recorded in creeks, swamps and lakes near the coast, particularly those with bare mudflats or sand exposed by receding water.(OEH 2015b)	2 records within 10 km (OEH 2015a) Foraging, feeding or related behaviour known to occur within 10 km (DotE 2015a)	Likely in study area but no suitable habitat present in the project footprint. Potential habitat may be present 1 km downstream of the project footprint at Mason Park. Potential indirect impacts possible if not mitigated appropriately.	Low. Potential for indirect impacts from changes to water quality in Powells Creek if not mitigated.
Limosa lapponica	Bar-tailed Godwit	Migratory-CAMBA, JAMBA, ROKAMBA; Marine; Wetland	Occurs along NSW coast, with important sites including the Hunter River estuary. Non-breeding visitor to Australia. Mainly inhabits coastal habitats including intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. Often found around seagrass beds and sometimes in nearby saltmarsh. Also recorded from sewage farms, saltworks, saltlakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats.	953 records within 10 km (OEH 2015a) Foraging, feeding or related behaviour known to occur within 10 km (DotE 2015a)	Likely in study area but no suitable habitat present in the project footprint. Potential habitat may be present 1 km downstream of the project footprint at Mason Park. Potential indirect impacts possible if not mitigated appropriately.	Low. Potential for indirect impacts from changes to water quality in Powells Creek if not mitigated.

Scientific name	Common name	EPBC Act	Habitat association	Records in the locality	Likelihood of occurrence in the study area	Likelihood of impact
Limosa limosa	Black-tailed Godwit	Migratory-CAMBA, JAMBA, ROKAMBA; Marine Wetland	The Black-tailed Godwit is a migratory wading bird that breeds in Mongolia and Eastern Siberia and flies to Australia for the southern summer, arriving in August and leaving in March. In NSW, it is most frequently recorded at Kooragang Island (Hunter River estuary), with occasional records elsewhere along the north and south coast, and inland. Records in western NSW indicate that a regular inland passage is used by the species, as it may occur around any of the large lakes in the western areas during summer, when the muddy shores are exposed. It is usually found in sheltered bays, estuaries and lagoons with large intertidal mudflats and/or sandflats. It has also been found around muddy lakes and swamps, wet fields and sewerage treatment works.	18 records within 10 km (OEH 2015a) Foraging, feeding or related behaviour known to occur within 10 km (DotE 2015a) Has been recorded at the Mason Park Wetlands (DotE 2015c).	Likely in study area but no suitable habitat present in the project footprint. Known to occur 1 km downstream of the project footprint at Mason Park. Potential indirect impacts possible if not mitigated appropriately.	Low. Potential for indirect impacts from changes to water quality in Powells Creek if not mitigated.
Numenius madagascariensis	Eastern Curlew	Migratory – CAMBA, JAMBA, ROKAMBA; Marine; Wetland	Primarily coastal. Non-breeding visitor to Australia. Associated with sheltered coasts with large intertidal mudflats or sandflats, often with seagrass and are often recorded among saltmarsh. Occasionally found on open beaches, coral reefs, rock platforms or islets. Also recorded from saltworks and sewage farms.	30 records within 10 km (OEH 2015a) Foraging, feeding or related behaviour known to occur within 10 km (DotE 2015a)	Likely in study area but no suitable habitat present in the project footprint. Potential habitat may be present 1 km downstream of the project footprint at Mason Park. Potential indirect impacts possible if not mitigated appropriately.	Low. Potential for indirect impacts from changes to water quality in Powells Creek if not mitigated.

Scientific name	Common name	EPBC Act	Habitat association	Records in the locality	Likelihood of occurrence in the study area	Likelihood of impact
Numenius minutus	Little Curlew	Migratory-CAMBA, JAMBA, ROKAMBA; Marine, Wetland	In New South Wales (NSW), most records are scattered east of the Great Dividing Range, from Casino, south to Greenwell Point with a few scattered records west of the Great Dividing Range (Higgins & Davies 1996). Congregates around pools, river beds and water-filled tidal channels, and shallow water at edges of billabongs. The species prefers pools with bare dry mud (including mudbanks in shallow water) and they do not use pools if they are totally dry, flooded or heavily vegetated (Higgins & Davies 1996).	Foraging, feeding or related behaviour likely to occur within 10 km (DotE 2015a)	Likely in study area but no suitable habitat present in the project footprint. Potential habitat may be present 1 km downstream of the project footprint at Mason Park. Potential indirect impacts possible if not mitigated appropriately.	Low. Potential for indirect impacts from changes to water quality in Powells Creek if not mitigated.
Numenius phaeopus	Whimbrel	M- Bonn, CAMBA, JAMBA, ROKAMBA; Marine	Occurs along NSW coast. Non-breeding visitor to Australia. Often found on intertidal mudflats (with/without mangroves) of sheltered coasts, also harbours, lagoons, estuaries and river deltas. Also uses saltflats with saltmarsh, saline grasslands and sewage farms/ saltworks.	2 records within 10 km (OEH 2015a) Foraging, feeding or related behaviour known to occur within 10 km (DotE 2015a)	Likely in study area but no suitable habitat present in the project footprint. Potential habitat may be present 1 km downstream of the project footprint at Mason Park. Potential indirect impacts possible if not mitigated appropriately.	Low. Potential for indirect impacts from changes to water quality in Powells Creek if not mitigated.

Scientific name	Common name	EPBC Act	Habitat association	Records in the locality	Likelihood of occurrence in the study area	Likelihood of impact
Plegadis falcinellus	Glossy Ibis	M- Bonn, CAMBA,; Marine	Occurs throughout eastern and northern Australia, east of the Kimberley and Eyre Peninsula. Largest areas of prime habitat are inland and northern floodplains, with largest numbers in the Top End and Channel Country. Preferred habitats 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. Breeds at limited locations, with most records from the Murray Darling Basin (NSW), western Riverina (VIC), south-east (SA), Channel Country (Qld/ SA) and lower Ord/Keep Rivers (WA).	44 records within 10 km (OEH 2015a)	Unlikely. No suitable habitat present in the project footprint or at Mason Park, downstream of the project footprint.	Nil.
Pluvialis fulva	Pacific Golden Plover	Migratory – Bonn, CAMBA, JAMBA, ROKAMBA; Marine Wetland	Widespread along coast, may occur inland along major river systems. Important sites in NSW comprise the Hunter and Shoalhaven estuaries and Richmond and Clarence Rivers. Does not breed in Australia. Usually forages on sandy or muddy shores or margins of sheltered areas such as estuaries and lagoons, though it also feeds on rocky shores, islands or reefs. Occasionally forage among vegetation, such as saltmarsh, mangroves or in pasture or crops.	322 records within 10 km (OEH 2015a) Foraging, feeding or related behaviour known to occur within 10 km (DotE 2015a) Has been recorded at the Mason Park Wetlands (PEP et al. 2008).	Likely in study area but no suitable habitat present in the project footprint. Known to occur 1 km downstream of the project footprint at Mason Park. Potential indirect impacts possible if not mitigated appropriately.	Low. Potential for indirect impacts from changes to water quality in Powells Creek if not mitigated.

Scientific name	Common name	EPBC Act	Habitat association	Records in the locality	Likelihood of occurrence in the study area	Likelihood of impact
Pluvialis squatarola	Grey Plover	M; Bonn, CAMBA, JAMBA, ROKAMBA; Marine, Wetland	Breed north of 65° N in the Northern Hemisphere, in northern Siberia, from the White Sea east to the Gulf of Anadyr, and in Alaska and northern Canada from the shores of the Bering Sea east to Baffin Island. In Australia, occur almost entirely in coastal areas, where they usually inhabit sheltered embayments, estuaries and lagoons with mudflats and sandflats, and occasionally on rocky coasts with wave-cut platforms or reef-flats, or on reefs within muddy lagoons. They also occur around terrestrial wetlands such as near-coastal lakes and swamps, or salt-lakes.	2 records within 10 km (OEH 2015a) Foraging, feeding or related behaviour known to occur within 10 km (DotE 2015a)	Likely in study area but no suitable habitat present in the project footprint. Potential habitat may be present 1 km downstream of the project footprint at Mason Park. Potential indirect impacts possible if not mitigated appropriately.	Low. Potential for indirect impacts from changes to water quality in Powells Creek if not mitigated.
Rostratula benghalensis	Australian Painted Snipe	V; Migratory-CAMBA; Wetland	Normally found in permanent or ephemeral shallow inland wetlands, either freshwater or brackish. Nests on the ground amongst tall reed-like vegetation near water. Feeds on mudflats and the water's edge taking insects, worm and seeds. Prefers fringes of swamps, dams and nearby marshy areas with cover of grasses, lignum, low scrub or open timber.	Species or species habitat likely to occur within 10 km (DotE 2015a)	Unlikely. No suitable habitat present in the project footprint or at Mason Park, downstream of the project footprint.	Nil.

Scientific name	Common name	EPBC Act	Habitat association	Records in the locality	Likelihood of occurrence in the study area	Likelihood of impact
Tringa glareola	Wood Sandpiper	Migratory Bonn, CAMBA, JAMBA, ROKAMBA, Marine	In NSW there are records east of the Great Divide, from Stratheden and Casino, south to Nowra and elsewhere, mostly from the Riverina, but also from the Upper and Lower Western Regions (DotE 2015b). The Wood Sandpiper uses well-vegetated, shallow, freshwater wetlands, such as swamps, billabongs, lakes, pools and waterholes. They are typically associated with emergent, aquatic plants or grass, and dominated by taller fringing vegetation, such as dense stands of rushes or reeds, shrubs, or dead or live trees, especially Melaleuca and River Red Gums *Eucalyptus camaldulensis* and often with fallen timber.	3 records within 10 km (OEH 2015a)	Likely in study area but no suitable habitat present in the project footprint. Potential habitat may be present 1 km downstream of the project footprint at Mason Park. Potential indirect impacts possible if not mitigated appropriately.	Low. Potential for indirect impacts from changes to water quality in Powells Creek if not mitigated.

Scientific name	Common name	EPBC Act	Habitat association	Records in the locality	Likelihood of occurrence in the study area	Likelihood of impact
Tringa nebularia	Common Greenshank	Migratory-CAMBA JAMBA, ROKAMBA; Wetland	The species has been recorded in most coastal regions as well as west of the Great Dividing Range, between the Lachlan and Murray Rivers and the Darling River drainage basin, including the Macquarie Marshes, and north-west regions (Higgins & Davies 1996). Typically is found in a wide variety of inland wetlands and sheltered coastal habitats of varying salinity including sheltered coastal habitats such as embayments, harbours, river estuaries, deltas and lagoons and are recorded less often in round tidal pools, rock-flats and rock platforms. The species uses both permanent and ephemeral terrestrial wetlands, including swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, claypans and saltflats. It will also use artificial wetlands generally of mud or clay, occasionally of sand, and may be bare or with emergent or fringing vegetation, including short sedges and saltmarsh, mangroves, thickets of rushes, and dead or live trees.	171 records within 10 km (OEH 2015a)	Likely in study area but no suitable habitat present in the project footprint. Potential habitat may be present 1 km downstream of the project footprint at Mason Park. Potential indirect impacts possible if not mitigated appropriately.	Low. Potential for indirect impacts from changes to water quality in Powells Creek if not mitigated.

Scientific name	Common name	EPBC Act	Habitat association	Records in the locality	Likelihood of occurrence in the study area	Likelihood of impact
Tringa stagnatilis	Marsh Sandpiper	M- Bonn, CAMBA, JAMBA, ROKAMBA; Marine	It is recorded in all regions of NSW but especially the central and south coasts and (inland) on the western slopes of Great Divide and western plains (OEH 2015b). It lives in permanent or ephemeral wetlands of varying salinity, including swamps, lagoons, billabongs, saltpans, saltmarshes, estuaries, pools on inundated floodplains, and intertidal mudflats and also regularly at sewage farms and saltworks. They are recorded less often at reservoirs, waterholes, soaks, bore-drain swamps and flooded inland lakes (DotE 2015b)	39 records within 10 km (OEH 2015a) Foraging, feeding or related behaviour known to occur within 10 km (DotE 2015a) Has been recorded at the Mason Park Wetlands (PEP et al. 2008).	Likely in study area but no suitable habitat present in the project footprint. Known to occur 1 km downstream of the project footprint at Mason Park. Potential indirect impacts possible if not mitigated appropriately.	Low. Potential for indirect impacts from changes to water quality in Powells Creek if not mitigated.
Xenus cinereus	Terek Sandpiper	M; Marine	The two main sites for this species in NSW are the Richmond River and Hunter River estuaries. Inhabits coastal mudflats, lagoons, creeks and estuaries. Favours mudbanks and sandbanks near mangroves, also observed on rocky pools and reefs and up to 10 km inland around brackish pools. Roost communally in mangroves or dead trees. Forages in open intertidal mudflats.	5 records within 10 km (OEH 2015a) Foraging, feeding or related behaviour known to occur within 10 km (DotE 2015a)	Likely in study area but no suitable habitat present in the project footprint. Potential habitat may be present 1 km downstream of the project footprint at Mason Park. Potential indirect impacts possible if not mitigated appropriately.	Low. Potential for indirect impacts from changes to water quality in Powells Creek if not mitigated.
Migratory terrestrial birds						
Monarcha melanopsis	Black-faced Monarch	Migratory Terrestrial	This species of bird usually inhabits dense gullies of rainforest, sclerophyll forests and eucalypt woodlands along the coastal regions from Victoria to Cape York and is migratory over much of its range.	20 records within 10 km (OEH 2015a) Species or species habitat known to occur within 10 km (DotE 2015a)	Unlikely. No suitable habitat present.	Nil.

Scientific name	Common name	EPBC Act	Habitat association	Records in the locality	Likelihood of occurrence in the study area	Likelihood of impact
Merops ornatus	Rainbow Bee-eater	Migratory Terrestrial	Occurs in a variety of habitat but seems to prefer lightly timbered forests and woodlands, and various cleared or semi-cleared habitats, including farmland and areas of human habitation often located close to permanent water. Nests in enlarged chambers at the end of long burrow or tunnel excavated in flat or sloping ground, in the banks of rivers, creeks or dams, in roadside cuttings, in the walls of gravel pits or quarries, in mounds of gravel, or in cliff-faces.	1 record within 10 km (OEH 2015a) Species or species habitat may occur within 10 km (DotE 2015a)	Unlikely. No suitable habitat present.	Nil.
Rhipidura rufifrons	Rufous Fantail	Migratory Terrestrial	This species is a breeding migrant to southeast Australia during July to December, wintering in Papua New Guinea. It prefers wetter eucalypt forests, gullies, coastal scrub, watercourses, and rainforests where it feeds of insects. Occasional reports have this species utilising parks and gardens during migration.	47 records within 10 km (OEH 2015a) Species or species habitat known to occur within 10 km (DotE 2015a)	Unlikely. No suitable habitat present.	Nil.
Myiagra cyanoleuca	Satin Flycatcher	Migratory Terrestrial	Prefers heavily vegetated gullies in forests, tall woodlands and during migration, coastal forests, woodlands, mangroves, trees in open country, and even gardens.	8 records within 10 km (OEH 2015a) Species or species habitat known to occur within 10 km (DotE 2015a)	Unlikely. No suitable habitat present.	Nil.

Scientific name	Common name	EPBC Act	Habitat association	Records in the locality	Likelihood of occurrence in the study area	Likelihood of impact
Symposiarchus trivirgatus	Spectacled Monarch	M, Marine	The Spectacled Monarch is found in coastal north-eastern and eastern Australia, including coastal islands, from Cape York, Queensland to Port Stephens, New South Wales. It is much less common in the south. Prefers thick understorey in rainforest, wet gullies and waterside vegetation as well as mangroves.	Species or species habitat known to occur within 10 km (DotE 2015a)	Unlikely. No suitable habitat present.	Nil.
Haliaeetus leucogaster	White-bellied Sea-Eagle	Migratory Terrestrial	Occurs along the coastline of Australia and also range inland over large rivers and wetlands, favouring forested coasts and forested margins of inland waterways. Nests are usually near water, in tall live or dead trees or on remote coastal cliffs.	Breeding known to occur within 10 km (DotE 2015a) 225 records within 10 km (OEH 2015a)	Unlikely. No suitable habitat present in the project footprint. Breeding pairs are known to occur at Homebush Bay.	Nil.
Hirundapus caudacutus	White-throated Needletail	Migratory Terrestrial	It is known to inhabit a variety if habitats including forests, woodlands, farmlands, plains, lakes, costs and towns. Feeds on insects during flight, chiefly ahead of weather changes. In Australia, this species is nomadic, responding to local weather changes.	20 records within 10 km (OEH 2015a) Species or species habitat known to occur within 10 km (DotE 2015a)	Unlikely. No suitable habitat present.	Nil.

All information in these tables is taken from NSW OEH and Commonwealth DotE Threatened Species profiles (OEH, 2015a; DotE 2015b) unless otherwise stated.

Key: CE – Critically Endangered; E – Endangered; V – Vulnerable; EP – Endangered Population; CEEC – Critically Endangered Ecological Community; EEC – Endangered Ecological Community.

Appendix C - Species recorded during field survey

Flora species recorded during surveys

Scientific Name	Common Name	Exotic	Noxious Weed class
Acacia binervia	Coast Myall		
Acacia floribunda	White Sally		
Acacia sp.	Wattle		
Agapanthus praecox subsp. orientalis		*	
Aloe sp.		*	
Angophora costata	Sydney Red Gum		
Araucaria cunninghamii	Hoop Pine		
Araujia sericifera	Moth Vine	*	4*
Asparagus aethiopicus	Asparagus Fern	*	4*
Asparagus plumosus	Climbing Asparagus Fern	*	4*
Aspidistra elatior		*	
Bidens pilosa	Cobbler's Pegs	*	Environmental weed
Bromus catharticus	Prairie Grass	*	Environmental weed
Buxus sp.		*	
Callistemon citrinus	Crimson Bottlebrush		
Callistemon sp.			
Callistemon viminalis	Weeping Bottlebrush		
Camellia japonica	Camellia	*	
Camellia sasanqua	Sasanqua Camellia	*	
Canna indica	Tous-les-mois Arrowroot	*	
Cardiospermum grandiflorum	Balloon Vine	*	4*
Casuarina cunninghamiana subsp. cunninghamiana	River Oak		
Celtis sinensis	Japanese Hackberry	*	
Chlorophytum comosum	Spider Plant	*	
Cinnamomum camphora	Camphor Laurel	*	Environmental weed
Clivea miniata			
Commelina cyanea	Native Wandering Jew		
Correa sp.			
Corymbia maculata	Spotted Gum		
Cotoneaster sp.		*	Environmental weed
Cynodon dactylon	Common Couch		
Dietes sp.			
Doryanthes excelsa	Gymea Lily		
Ehrharta erecta	Panic Veldtgrass	*	Environmental weed
Einadia nutans	Climbing Saltbush		

Scientific Name	Common Name	Exotic	Noxious Weed class
Eucalyptus beyeriana			
Eucalyptus citriodora			
Eucalyptus grandis	Flooded Gum		
Eucalyptus microcorys	Tallowwood		
Eucalyptus robusta	Swamp Mahogany		
Eucalyptus scoparia	Wallangarra White Gum		
Eucalyptus sp.			
Eucalyptus tereticornis	Forest Red Gum		
Ficus macrophylla			
Ficus rubiginosa	Port Jackson Fig		
Foeniculum vulgare	Fennel	*	Environmental weed
Grevillea robusta	Silky Oak		
Grevillea sp.			
Grevillea sp.			
Hedychium gardnerianum	Ginger Lily	*	
Ipomoea indica	Morning Glory	*	4*
Jacaranda mimosifolia	Jacaranda	*	
Lagerstroemia indica		*	
Lantana camara	Lantana	*	4*
Lantana sp.		*	4*
Ligustrum lucidum	Large-leaved Privet	*	4*
Ligustrum sinense	Small-leaved Privet	*	4*
Lomandra longifolia	Spiny-headed Mat-rush		
Lophostemon confertus	Brush Box		
Macadamia tetraphylla	Rough-shelled Bush Nut		
Melaleuca quinquenervia	Broad-leaved Paperbark		
Melaleuca styphelioides	Prickly-leaved Tea Tree		
Monstera deliciosa	Fruit Salad Plant	*	
Morus sp.		*	
Nephrolepis cordifolia	Fishbone Fern		
Nerium oleander	Oleander	*	
Ochna serrulata	Mickey Mouse Plant	*	4*
Olea europaea subsp. cuspidata	African Olive	*	Environmental weed
Paspalum dilatatum	Paspalum	*	Environmental weed
Pennisetum clandestinum	Kikuyu Grass	*	Environmental weed
Phoenix canariensis	Canary Island Date Palm	*	
Phoenix dactylifera	Date Palm	*	
Photinia serratifolia	Chinese Photinia	*	
Pittosporum undulatum	Sweet Pittosporum		

Scientific Name	Common Name	Exotic	Noxious Weed class
Populus alba	White Poplar	*	
Rhododendron sp.	Rhododendron, Azalea	*	
Senna pendula var. glabrata		*	Environmental weed
Sida rhombifolia	Paddy's Lucerne	*	Environmental weed
Solanum nigrum	Black-berry Nightshade	*	Environmental weed
Strelitzia sp.		*	
Syncarpia glomulifera	Turpentine		
Tradescantia fluminensis	Wandering Jew	*	
Westringia fruticosa	Coastal Rosemary		
Westringia sp.			

4 - Locally Controlled Weed: the growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed.

Fauna species recorded during surveys

Scientific Name	Common Name	Exotic	TSC Act	EPBC Act	Project Footprint	Mason Park Wetland
Cracticus tibicen	Australian Magpie				O	O
Corvus coronoides	Australian Raven				O	O
Threskiornis molucca	Australian White Ibis				O	O
Chenonetta jubata	Australian Wood Duck					O
Cygnus atratus	Black Swan					O
Himantopus himantopus	Black-winged Stilt					O
Sturnus tristis	Common Myna	*			O	O
Ardea modesta	Eastern Great Egret			M		O
Eolophus roseicapillus	Galah				O	
Dacelo novaeguineae	Laughing Kookaburra				O	
Phalacrocorax sulcirostris	Little Black Cormorant					O
Grallina cyanoleuca	Magpie-lark				O	
Vanellus miles	Masked Lapwing				O	O
Phylidonyris novaehollandiae	New Holland Honeyeater					O
Manorina melanocephala	Noisy Miner				O	
Strepera graculina	Pied Currawong					
Trichoglossus haematodus	Rainbow Lorikeet				O	
Anthochaera carunculata	Red Wattlebird				W	
Neochmia temporalis	Red-browed Finch				O	
Pycnonotus jocosus	Red-whiskered Bulbul	*			W	
Columba livia	Rock Dove	*			O	
Platalea regia	Royal Spoonbill					O
Chroicocephalus novaehollandiae	Silver Gull				O	O
Streptopelia chinensis	Spotted Turtle-Dove	*				O
Malurus cyaneus	Superb Fairy-wren				W	O
Hirundo neoxena	Welcome Swallow				O	
Egretta novaehollandiae	White-faced Heron					O
Rhipidura leucophrys	Willie Wagtail					W
Pteropus poliocephalus	Grey-headed Flying-fox		V	V	WK	
Lampropholis delicata	Dark-flecked Garden Sunskink				O	
Eulamprus quoyii	Water Skink					K

Key: * - introduced, M – Migratory, V – vulnerable, O – observed, W – heard, K – dead.

Appendix D - Likely significance of impacts on TSC Act-listed biota

Legislative requirement

Potential effects of the proposal on threatened species, populations and ecological communities, or their habitat, have been assessed in accordance with the threatened species assessment guidelines (DEC/DPI 2005) for threatened species and communities recorded or likely to occur in the study area. Where possible, threatened fauna have been grouped based on similar habitat requirements.

Impacts on threatened biota are anticipated to be very minor given nature of the footprint. The project would directly impact foraging habitat for the Grey-headed Flying-fox and Eastern Bentwing Bat through the removal of about 12.9 hectares of planted trees. The project may disturb temporary diurnal roost sites of the Eastern Bentwing Bat and Large-footed Myotis if these species are roosting culverts or under bridges when construction is occurring at these locations. Assessments of significance have been prepared for these three species.

Indirect impacts on Mason Park Wetland, located about one kilometre downstream of the project footprint, are possible as a result of transfer of sediment or pollution. Specific mitigation is recommended to minimise the risk of indirect impacts on this wetland. Assessments of significance have been prepared on a precautionary basis to assess the potential indirect impacts on threatened biota associated with Mason Park, including Coastal Saltmarsh EEC, the threatened wetland plants *Wilsonia backhousei* and *Zannichellia palustris* and the threatened wetland birds the Little Tern, Black-tailed Godwit and White-fronted Chat.

The following threatened biota are included in these assessments:

- Direct impacts
  - Grey-headed Flying-fox
  - Eastern Bent-wing Bat
  - Large-footed Myotis
- Indirect impacts
  - Coastal Saltmarsh
  - *Wilsonia backhousei*
  - *Zannichellia palustris*
  - Little Tern
  - Black-tailed Godwit
  - White-fronted Chat.

Grey-headed Flying-fox

Grey-headed Flying-foxes roost and breed in large colonies (camps). All the flying-fox camps in eastern Australia are linked into one population and numbers in any one camp are influenced by food availability and the requirements of mating and raising young. Fluctuations in the size of a camp can vary week by week, month by month or in some cases from one night to the next, and reflect the nomadic nature of Grey-headed Flying-foxes (Ku-ring-gai Bat Conservation Society 2012).

The primary food source for Grey-headed Flying-foxes is blossom from Eucalyptus species and related genera but in some areas it also utilises a wide range of rainforest fruits (Eby 1998). The Grey-headed Flying-fox is a highly mobile species which regularly travels up to 50 kilometres in a night to forage, and has been shown to make migratory movements of almost 1000 kilometres within a year (Churchill 2008; Webb and Tidemann 1996).

The Grey-headed Flying-fox was recorded in the study area. It is known to forage in urban parks and gardens and remnant bushland throughout Sydney metropolitan area.

Grey-headed Flying-fox (Vulnerable)
i) How is the project likely to affect the lifecycle of a threatened species and/or population?
a) displaces or disturbs threatened species and/or populations;
The Grey-headed Flying-fox is a highly mobile species. The proposal would remove about 12.9 hectares of planted trees and screening vegetation from alongside roads and in parks within the linear project footprint that provides foraging habitat (eg eucalypts and figs) for the Grey-headed Flying-fox. The removal of this vegetation would not displace or disturb the Grey-headed Flying-fox. There would be no impact on any known camp sites.
b) disrupts breeding cycle;
The study area does not contain any diurnal roost sites or breeding camps for the Grey-headed Flying-fox and the proposal will not have a direct impact on any such features in the wider locality. Life-cycle characteristics of the population that are considered pertinent to the proposed action relate to the potential loss of critical foraging habitat within a 50 kilometre radius of local camps which takes in the project study area. This is the expected maximum foraging distance of the species from roost sites (Eby 1996). Foraging habitat for the Grey-headed Flying-fox in the study area comprises planted trees such as eucalypts and figs. Spotted Gum, a highly productive foraging species, is planted along the M4 between Homebush Bay Drive and in various parks, roadsides and gardens. More extensive areas of higher quality foraging habitat, including patches of intact native vegetation are present in the wider locality, such as to the north in Lane Cove National Park and to the south in the Georges River National Park. Planted trees throughout the local suburbs also provide foraging habitat for the species. Individuals from various roost camps are likely to forage in the study area on an opportunistic basis when food trees are flowering or fruiting. A dead individual was observed in power lines adjacent to planted figs next to the M4 and another was heard foraging in planted Figs near the M4 during the nocturnal surveys. Foraging habitat in the locality (a 10 kilometre buffer of the project) includes planted and screening vegetation in the project footprint as well as native vegetation mapped elsewhere in the locality (Tozer et al. 2010). The project would remove up to 0.9 per cent of the total available potential foraging habitat for this species from within the locality. The vegetation to be removed would comprise a much smaller component of potential foraging habitat within a 50 kilometre radius of the project. Whilst Grey-headed Flying-foxes are likely to forage in the subject site on occasion, the linear patches of planted vegetation to be removed comprise only a small component of that available in the wider locality, and are not likely to comprise habitat critical to the survival of the local population as discussed below. The vegetation within the study area occurs as isolated patches within an already highly fragmented urban landscape and the project will not create a barrier to the movements of the Grey-headed Flying-foxes between roost camps and foraging grounds. As such, the project would not disrupt the breeding cycle of the Grey-headed Flying-fox.
c) disturbs the dormancy period;
Not applicable to this species.
d) disrupts roosting behaviour;

Grey-headed Flying-fox (Vulnerable)
The Grey-headed Flying-fox roosts in large camps or colonies. Known camps are present at Wolli Creek (about four kilometres to the south of the project), Duck River (about five kilometres to the south-west of the project), Parramatta (about six kilometres to the west of the project), and Centennial Park (about six kilometres to the east of the project). There would be no direct or indirect impacts on these roosts given their distance from the project and the project would therefore not disrupt the roosting behaviour of this species.
e) changes foraging behaviour;
The proposal would remove about 12.9 hectares of planted trees and screening vegetation from alongside roads and in parks and gardens within the linear project footprint that provides foraging habitat for the Grey-headed Flying-fox. Foraging behaviour is unlikely to be altered as there would be no construction noise and disturbance during the night. Individuals that forage in the area are already habituated to noise and light associated with urban environment and thus should continue to use adjoining similar habitat (that will not be directly impacted) for foraging during and following construction.
ii) How is the project likely to affect the habitat of a threatened species, population or ecological community?
a) disturbs any permanent, semi-permanent or ephemeral water bodies;
Not applicable to this species.
b) degrades soil quality;
Not applicable to this species.
c) clears or modifies native vegetation;
There would be no clearing or modification of native vegetation of relevance to this species as a result of the project. The project would remove about 12.9 hectares of planted trees that provide foraging habitat (eg eucalypts and figs) for the Grey-headed Flying-fox.
d) introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;
There is no naturally occurring native vegetation within the study area. No intact native vegetation would be impacted by the proposal. The project is not likely to introduce new feral animals to the area or encourage the spread of feral animals. The proposal will not result in or cause the spread of any weed or invasive species in any areas of native vegetation that may provide habitat critical to the Grey-headed Flying-fox in the locality.
e) removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;
No roost camp has been identified within the project footprint. The proposed action will not directly impact on any local roost camps. The project would remove about 12.9 hectares of planted trees and screening vegetation distributed in linear patches that may be used as a foraging resource by the Grey-headed Flying-fox. Within the locality of the project (a 10 kilometre buffer), about 1500 hectares of native vegetation has been mapped by Tozer et al. (2010) which may also form foraging habitat for this species. Removal of 12.9 hectares of planted vegetation is equivalent to a loss of about 0.9 per cent of the total available foraging habitat for this species in the locality. Based on the above calculations, this represents a very small proportion of the potential foraging habitat for the Grey-headed Flying-fox within a 50 kilometre radius of local roost camps. The loss of this foraging habitat is not likely to disrupt the breeding cycle of the local population of this highly mobile species.
f) affects natural revegetation and recolonisation of existing species following disturbance.
There are no stands of naturally occurring vegetation in the study area. The project would not affect natural revegetation following disturbance. Replanting of trees, including Grey-headed Flying-fox feed trees, would occur in some locations following construction of the project.
iii) Does the project affect any threatened species or populations that are at the limit of its known distribution?
The Grey-headed Flying-fox occurs along the east coast of NSW, as well as in inland areas. It is not at the limit of its distribution within the project study area.
iv) How is the project likely to affect current disturbance regimes?
a) modifies the intensity and frequency of fires;
The proposal is unlikely to affect the intensity and frequency of fires.
b) modifies flooding flows;
Not applicable to this species.
v) How is the project likely to affect habitat connectivity?
a) creates a barrier to fauna movement;

Grey-headed Flying-fox (Vulnerable)

The proposal will not affect a breeding camp of diurnal roost site of any local populations of the Grey-headed Flying-fox, and will not fragment the local population in any way.
The proposal will not form a barrier to the movement of the species between any local camps or roosts and foraging habitat in the locality.
The Grey-headed Flying-fox is a highly mobile species that is capable of accessing isolated patches of foraging habitat within urban areas. Any such habitat within the study area exists as small, isolated patches that are already fragmented from any large extensive patches of high-quality or important foraging habitat.
Patches of planted trees in the study area exist as isolated patches within the urban landscape. The project would result in a minor increase to existing isolation of foraging habitat in a highly urbanised landscape by impacting on patches of planted trees. Highly mobile species such as the Grey-headed Flying-fox are expected to be less impacted by fragmentation and this species is well-adapted to accessing widely spaced habitat resources given its mobility and preference for seasonal fruits and blossom. This species' typically exhibits very large home ranges and Grey-headed Flying-fox are known to travel distances of at least 50 kilometres from roost sites to access seasonal foraging resources (Eby 1996).
The project would therefore not create a barrier to the movement of the Grey-headed Flying-fox.

b) removes remnant vegetation or wildlife corridors; and

The project would not remove any remnant native vegetation or wildlife corridors of relevance to this species.

c) modifies remnant vegetation or wildlife corridors.

The project would not modify any remnant native vegetation or wildlife corridors of relevance to this species.

vi) How is the project likely to affect critical habitat?

Critical habitat for the Grey-headed Flying-fox is identified as:

- Productive during winter and spring, when food bottlenecks have been identified
- Known to support populations of >30,000 individuals, within an area of 50 kilometre radius
- Productive during the final weeks of gestation, and during the weeks of birth, lactation and conception (September to 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.

No breeding camps are present in the study area and there would be no direct impact to any Grey-headed Flying-fox camp sites.
The proposal would result in the removal of patches of planted vegetation in linear patches along the edges of existing roads from within an urban environment. Grey-headed Flying-foxes would forage in the area on an opportunistic basis when trees are flowering or fruiting. Planted trees in the study area include Spotted Gum (*Corymbia maculata*) which is a highly productive species in the region, as well other eucalypts and figs. Spotted Gum flowers from winter to spring, providing a foraging resource in winter during food bottlenecks and in spring for breeding. These planted trees are likely to contribute to the available foraging habitat for the Grey-headed Flying Fox but comprise only a very small component of foraging resources in the locality or that within 50 kilometres of the nearest camp (see above) and would therefore not constitute habitat critical to the survival of a local population of the species.

Conclusion

The project is unlikely to have a significant impact on the Grey-headed Flying-fox as:

- The project is located in a highly urbanised environment
- No breeding camps would be directly impacted
- Removal of foraging habitat would be restricted to the loss of small, linear patches of planted trees located along existing urban roads and in urban parks and gardens
- This habitat loss represents a minor proportion of the potential foraging habitat for the Grey-headed Flying-fox within a 50 kilometre radius of local roost camps
- It would not impact movements between breeding camps and foraging grounds.

Use of Grey-headed Flying-fox feed trees is recommended for the landscaping plan following construction to compensate for the loss of foraging habitat within the project footprint.

Eastern Bentwing Bat

The Eastern Bentwing Bat is essentially a cave bat, but also utilises man-made habitats such as road culverts, storm-water tunnels and other man-made structures as roost sites outside the breeding season. Breeding takes place from October to April in a number of maternity caves that host up 100,000 females (Churchill, 2008). Maternity colonies are known from Wee Jasper, Bungonia, Willi-Willi, and Riverton (OEH 2015b). The Eastern Bentwing Bat is known from a variety of habitats along the east coast, including rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grasslands. It also occurs in urban areas. In forested areas, it flies above the canopy to hunt, while in open grassland areas, flight may be within six metres of the ground. Moths form the major component of their diet (Churchill 2008).

There are many records for the Eastern Bentwing Bat in the locality. This species could use culverts in the study area as temporary roosts, and forage over planted vegetation.

Large-footed Myotis

The Large-footed Myotis breeds November or December, roosting in a variety of habitats including caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, under bridges and in dense foliage. The Large-footed Myotis is primarily a coastal species that forages over streams and watercourses feeding on fish and insects. It is known to occur in urban areas (Churchill, 2008).

There are many records for the Large-footed Myotis in the locality. This species could use culverts in the study area as temporary roosts, and forage over canals. It is unlikely to breed in the study area given the high level of urban disturbance.

Microchiropteran bats (Vulnerable)
i) How is the project likely to affect the lifecycle of a threatened species and/or population?
a) displaces or disturbs threatened species and/or populations;
The Eastern Bentwing Bat and Large-footed Myotis are highly mobile species. The removal of about 12.9 hectares of planted trees and screening vegetation and about 2.8 hectares of grassland and scattered trees would not displace or disturb these species. There is the potential for these species to roost in culverts under the M4 and Parramatta Road outside the breeding season. Construction activities near culverts could temporarily disrupt the roosting habitat of these species (if present at the time of construction) as a result of noise and vibration. The proposal may therefore displace or disturb some individuals of these species, if roosting in the culverts at the time of construction.
b) disrupts breeding cycle;
There is no breeding habitat for the Eastern Bentwing Bat or Large-footed Myotis in the study area. Construction activities near culverts could temporarily disrupt the roosting habitat of these species. The project may disrupt roosting behaviour if they are present in the culverts during construction when proximate (ie construction activities could temporarily make the roost site less attractive given noise and vibration). However, this is not directly linked to breeding cycle. Following construction, these species could continue to roost in culverts in the study area. These species may forage on occasion in the study area. Planted vegetation and artificial creeks in the study area are not likely to be important foraging habitat for the Eastern Bentwing Bat in the locality given the urban context. Limited extent and existing fragmentation. Creeks in the study area run along concrete canals which are unlikely to be as productive as natural creeks in terms of providing foraging resources (eg fish and aquatic macroinvertebrates) for the Large-footed Myotis. Given the mobility of the species, the lack of impact on specific breeding habitat, and the negligible impact on foraging habitat, the project is highly unlikely to cause any disruption in the breeding cycle of these species.
c) disturbs the dormancy period;
Not applicable to these species.
d) disrupts roosting behaviour;
There is the potential for the Eastern Bentwing Bat and Large-footed Myotis to roost in culverts in the study area outside the breeding season. As noted above, construction activities near culverts could temporarily disrupt the roosting habitat of these species if present at the time of construction. Following construction, these species could continue to roost in culverts in the study area.
e) changes foraging behaviour;

Microchiropteran bats (Vulnerable)
The project would remove about 12.9 hectares of planted trees and screening vegetation and about 2.8 hectares of grassland and scattered trees which provides potential foraging habitat for the Eastern Bentwing Bat. This habitat is not considered important for this species, which forages over a wide range of forest types and cleared land. There would be negligible impact on foraging habitat for the Large-footed Myotis. As such, the project is unlikely to change the foraging behaviour of these species.
ii) How is the project likely to affect the habitat of a threatened species, population or ecological community?
a) disturbs any permanent, semi-permanent or ephemeral water bodies;
The project could result in increased sedimentation and introduction of pollutants to creeks in the study area without appropriate mitigation. This could further reduce the already limited foraging habitat of the Large-footed Myotis present in these creeks. The project is not likely to impact flooding levels downstream of the M4, but could increase the extent of existing flooding between Parramatta Road and the M4 (particularly at Saleyards Creek) during construction. This would not impact the Mason Park Wetland. This would not impact the foraging habitat of the Large-footed Myotis.
b) degrades soil quality;
Not applicable to these species.
c) clears or modifies native vegetation;
There would be no clearing or modification of native vegetation of relevance to these species as a result of the project. The project would remove about 12.9 hectares of planted trees and screening vegetation and about 2.8 hectares of grassland with scattered trees which provides potential foraging habitat.
d) introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;
The project is located in a highly urbanised environment with many weeds and no stands of naturally occurring vegetation. The project is highly unlikely to involve the introduction or spread of weeds into areas of habitat for these species that would have an impact on the species. The project is not likely to introduce new feral animals to the area or encourage the spread of feral animals.
e) removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;
There is the potential for the Eastern Bentwing Bat and Large-footed Myotis to roost temporarily in culverts in the study area outside the breeding season. Construction activities near culverts could temporarily disrupt the roosting habitat of these species if present during construction. As noted above, there would be no loss of key foraging habitat.
f) affects natural revegetation and recolonisation of existing species following disturbance.
There is no native vegetation in the study area. The project would not affect natural revegetation following disturbance. Culverts would remain in the study area and could be used for temporary roosts following construction.
iii) Does the project affect any threatened species or populations that are at the limit of its known distribution?
The Eastern Bentwing Bat and Large-footed Myotis both occur along the length of the NSW coast. These species are not at the limit of their distribution within the project study area.
iv) How is the project likely to affect current disturbance regimes?
a) modifies the intensity and frequency of fires;
The proposal is unlikely to affect the intensity and frequency of fires.
b) modifies flooding flows;
The project is not likely to impact flooding levels downstream of the M4, but could increase the extent of existing flooding between Parramatta Road and the M4 (particularly at Saleyards Creek) during construction. This would not impact the Mason Park Wetland. This would not impact the foraging habitat of the Large-footed Myotis.
v) How is the project likely to affect habitat connectivity?
a) creates a barrier to fauna movement;
The project is located in a highly fragmented landscape that bats currently traverse to access foraging resources in the study area and surrounds. The project would not create a new barrier to the movement of the Eastern Bentwing Bat and Large-footed Myotis.
b) removes remnant vegetation or wildlife corridors; and
The project would not remove any remnant native vegetation or wildlife corridors of relevance to this species.

Microchiropteran bats (Vulnerable)
c) modifies remnant vegetation or wildlife corridors.
The project would not modify any remnant native vegetation or wildlife corridors of relevance to this species.
vi) How is the project likely to affect critical habitat?
The project would not impact any maternity roosts of the Eastern Bentwing Bat and Large-footed Myotis. As discussed above, planted vegetation in the study area is not considered important foraging habitat for the Eastern Bentwing Bat and artificial canals would not be important foraging habitat for the Large-footed Myotis. As such, the project is unlikely to affect critical habitat.
Conclusion
The project is unlikely to have a significant impact on the Eastern Bentwing Bat and Large-footed Myotis as: • The project is located in a highly urbanised environment • No maternity roosts of the Eastern Bentwing Bat or Large-footed Myotis would be directly or indirectly impacted • No potential temporary non-breeding roost sites in culverts would be removed • Removal of foraging habitat for the Eastern Bentwing Bat is restricted to loss of small, linear patches of planted trees located along existing urban roads and in urban parks and gardens • The proposal is unlikely to impact foraging habitat for the Large-footed Myotis along artificial creeks • It would not impose a novel barrier in the landscape and would not impact movements between roost sites and foraging grounds.

Coastal Saltmarsh (Threatened ecological community)

Coastal Saltmarsh occurs in the intertidal zone on the shores of estuaries and lagoons that are permanently or intermittently open to the sea. It is frequently found as a zone on the landward side of mangrove stands. Coastal Saltmarsh is a mostly treeless plant community recognised by a low mosaic of succulent herbs, salt tolerant grasses and sedges, found in the tidal flats of estuaries and on edges of intermittently opened coastal lagoons. It is characterised by vegetation interspersed with un-vegetated patches or salt pans.

Coastal Saltmarsh occurs in the Mason Park Wetland, downstream of the project footprint.

Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions (Endangered Ecological Community)
i) How is the project likely to affect the lifecycle of a threatened species and/or population?
a) displaces or disturbs threatened species and/or populations;
Not applicable for threatened ecological community assessment
b) disrupts breeding cycle;
Not applicable for threatened ecological community assessment
c) disturbs the dormancy period;
Not applicable for threatened ecological community assessment
d) disrupts roosting behaviour;
Not applicable for threatened ecological community assessment
e) changes foraging behaviour;
Not applicable for threatened ecological community assessment
f) affects migration and dispersal ability;
The project will not result in any barrier to migration or dispersal ability within the highly modified landscape context of the study area. The project will not alter the abiotic environment or influence the dispersal ability of this community within areas of potential habitat outside the project area.
g) disrupts pollination cycle;
The project will not disrupt the pollination cycle of plants within this community located in the Mason Park Wetlands. This community does not occur within the project footprint and would not be directly impacted by the project. Mason Park Wetland is located one kilometre downstream of the project and has only limited hydrological interaction with Powells Creek. Transfer of sediments or pollution to the wetland could only occur as a result of tidal flushing. Potential indirect impacts from sedimentation or pollution are unlikely due to the distance of the wetland from the project, and the limited hydrological interaction between the wetland and Powells Creek. The project is unlikely to indirectly impact pollination cycles.

Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions (Endangered Ecological Community)
h) disturbs seedbanks;
The project would not disrupt the seed bank of this of this community as it occurs within Mason Park Wetlands and would not be directly impacted by the project. As noted above, indirect impacts are unlikely due to the distance of the wetland from the project, and the limited hydrological interaction between the wetland and Powells Creek. The project is unlikely to indirectly impact the seedbank of the EEC.
i) disrupts recruitment (ie germination and establishment of plants);
The project will not directly impact the abiotic environment in such a way that recruitment of component species of this community would be disrupted. As noted above, indirect impacts are unlikely due to the distance of the wetland from the project, and the limited hydrological interaction between the wetland and Powells Creek. The project is unlikely to indirectly impact species recruitment in the EEC.
j) affects the interaction between threatened species and other species in the community (eg pollinators, host species, mychorrizal associations);
Not applicable for threatened ecological community assessment.
ii) How is the project likely to affect the habitat of a threatened species, population or ecological community?
a) disturbs any permanent, semi-permanent or ephemeral water bodies;
The project will cross Powells Creek, which occurs as a concrete canal in the study area. There is some potential for the creek/canal to experience increased levels of sedimentation or pollution as a result of the project. Coastal Saltmarsh is found within Mason Park, which is located about one kilometre downstream of the project along Powells Creek. Mason Park Wetlands are separated from Powells Creek by the concrete sides of the canal through which Powells Creek runs. There is only very limited transfer of water between Powells Creek and the wetland during high tide events. Transfer of sediments of pollution is unlikely given the distance from the project, the limited hydrological connectivity, and the implementation of mitigation measures. The project is not likely to impact flooding levels downstream of the M4, but could increase the extent of existing flooding between Parramatta Road and the M4 (particularly at Saleyards Creek) during construction. This would not impact the Mason Park Wetland. The project is unlikely to impact the stormwater capacity of Powells Creek. Given the existing condition of creeklines in the study area, all of which occur as concrete canals and highly modified environments, the project is unlikely to disturb any permanent, semi-permanent of ephemeral creeklines. Given the limited transfer of water between Powells Creek and the wetland, the project is unlikely to disturb water bodies associated with the wetlands themselves.
b) degrades soil quality;
Coastal Saltmarsh is found within Mason Park, which is located about one kilometre downstream of the project along Powells Creek. The project would not directly impact soil quality within the wetland. There is some potential, without suitable mitigation measures, for the creek/canal to experience increased levels of sedimentation or pollution as a result of the project. Indirect impacts are unlikely due to the distance of the wetland from the project, and the limited hydrological interaction between the wetland and Powells Creek. The project is therefore unlikely to indirectly degrade soil quality within the EEC.
c) clears or modifies native vegetation;
The project will not result in clearing of this EEC. As noted above, indirect impacts are unlikely due to the distance of the wetland from the project, and the limited hydrological interaction between the wetland and Powells Creek. The project is unlikely to modify vegetation within the EEC.
d) introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;
The study area is highly modified and developed and weed and exotic species are present throughout the study area and project footprint. The majority of exotic species within the study area exist as planted specimens in private gardens as well as landscaped varieties in open space and parklands. Weed species have been recorded throughout the study area and during construction there is potential for weeds to be further spread via earthworks and clearing activities, from seeds and other propagules in the soil and on vegetative material. Standard industry mitigation measures to minimise the spread of weeds are recommended as part of the project. The project is not likely to introduce new feral animals or vermin to the area or encourage the spread of feral animals or vermin.
e) removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;

Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions (Endangered Ecological Community)
Not applicable for threatened ecological community assessment
f) affects natural revegetation and recolonisation of existing species following disturbance.
The project will not result in clearing of this EEC. The project would not affect natural revegetation following disturbance.
iii) Does the project affect any threatened species or populations that are at the limit of its known distribution?
Not applicable for threatened ecological community assessment
iv) How is the project likely to affect current disturbance regimes?
a) modifies the intensity and frequency of fires;
The proposal is unlikely to affect the intensity and frequency of fires.
b) modifies flooding flows;
The project is not likely to impact flooding levels downstream of the M4, but could increase the extent of existing flooding between Parramatta Road and the M4 (particularly at Saleyards Creek) during construction. This would not impact flooding flows at the Mason Park Wetland. The project is unlikely to impact the stormwater capacity of Powells Creek.
v) How is the project likely to affect habitat connectivity?
a) creates a barrier to fauna movement;
Not applicable for threatened ecological community assessment
b) removes remnant vegetation or wildlife corridors; and
The project would not remove any native vegetation or wildlife corridors of relevance to this EEC. Similarly, the project is unlikely to result in the creation of any new barriers to wildlife movement or dispersal given the landscape context of the project, the lack of wildlife corridors in the study area and the highly modified and developed landscape in which the project will be located.
c) modifies remnant vegetation or wildlife corridors.
The project would not modify any native vegetation or wildlife corridors of relevance to this EEC. As discussed above, project is situated in a landscape largely devoid of wildlife corridors and there is no intact native vegetation within the study area.
vi) How is the project likely to affect critical habitat?
a) removes or modifies key habitat features
No critical habitat of relevance to this EEC has been listed or would be affected by the project. The project will not remove or modify any key habitat features of relevance to this EEC.
b) affects natural revegetation or recolonisation of existing species following disturbance
The project would not result in clearing of any of this EEC. The EEC is threatened by changes in hydrology, sedimentation and weed infestation, all of which are associated with disturbance. Indirect impacts are unlikely due to the distance of the wetland from the project, and the limited hydrological interaction between the wetland and Powells Creek. The project is therefore unlikely to indirectly degrade soil quality within the EEC. Mitigation measures are recommended to minimise the potential of all of these processes being influenced by the project.
c) introduces weeds, vermin or feral species
This community is threatened by the presence of weed species and being out-competed by more vigorous exotic species. Mason Park is currently managed for conservation and public use, and regular bushland regeneration and weed control activities are undertaken. The project is located in a highly urbanised environment with many weeds and no stands of naturally occurring vegetation. The project is highly unlikely to involve the introduction or spread of weeds into the Mason Park Wetland. The project is unlikely to result in the introduction of vermin or feral species to this community provided recommended mitigation measures are adopted.
d) generates or disposes of solid, liquid or gaseous waste;
Construction of the project will result in the production of spoil from tunnelling activities and associated construction processes. Standard industry measures to manage the appropriate disposal and storage of any such waste will be adopted for the project.
e) uses pesticides, herbicides, other chemicals
Various chemicals may be used in the construction process and could potentially be transferred via stormwater in Powells Creek to the Mason Park Wetland. Standard industry measures relating to the storage, handling and use of chemicals and pesticides will be adopted for the life of the project. As noted above, there is only very limited hydrological interaction between Powell's Creek and the wetland, further reducing the risk of contamination.
Conclusion

Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions (Endangered Ecological Community)
The project is unlikely to have a significant impact on Coastal Saltmarsh EEC as: The project is located in a highly urbanised environment No Coastal Saltmarsh vegetation would be directly impacted Indirect impacts on wetland habitat are unlikely, given the distance of the wetland from the project, and the limited hydrological interaction between the wetland and Powells Creek.

Wilsonia backhousei (vulnerable plant species)

Wilsonia backhousei is found on the coast between Mimosa Rocks National Park and Wamberal north of Sydney. This species grows on the margins of salt marshes and lakes. *Wilsonia backhousei* has been recorded at Mason Park Wetland, downstream of the project footprint.

Zannichellia palustris (endangered plant species)

Zannichellia palustris is a submerged aquatic plant. It grows in fresh or slightly saline stationary or slowly flowing water. *Zannichellia palustris* has been recorded at Mason Park Wetland, downstream of the project footprint.

Narrow-leafed Wilsonia *Wilsonia backhousei* (Vulnerable) ***Zannichellia palustris* (Endangered)**
i) How is the project likely to affect the lifecycle of a threatened species and/or population?
a) displaces or disturbs threatened species and/or populations;
No populations of *Wilsonia backhousei* or *Zannichellia palustris* occur within the project footprint. Known populations are located within Mason Park Wetlands about one kilometre from the project. The project would remove about 12.9 hectares of planted trees and screening vegetation and about 2.8 hectares of grassland with scattered trees that do not support suitable habitat for these species and therefore would not displace or disturb these species. Mason Park Wetland is located one kilometre downstream of the project and has only limited hydrological interaction with Powells Creek. Transfer of sediments or pollution to the wetland could only occur as a result of tidal flushing. Potential indirect impacts from sedimentation or pollution are unlikely due to the distance of the wetland from the project, and the limited hydrological interaction between the wetland and Powells Creek. The project is unlikely to disturb or displace these species.
b) disrupts breeding cycle;
The project is unlikely to disturb pollinators for these species and all areas of known habitat will remain undisturbed during construction. As noted above, indirect impacts from sedimentation or pollution are unlikely due to the distance of the wetland from the project, and the limited hydrological interaction between the wetland and Powells Creek. Given the above considerations, it is unlikely that the project would disrupt the breeding cycle of the species in the Mason Park Wetlands.
c) disturbs the dormancy period;
These species do not have any known dormancy periods that would be affected by the project.
d) disrupts roosting behaviour;
Not applicable to these species.
e) changes foraging behaviour;
Not applicable to these species.
f) affects migration and dispersal ability;
The project will not result in any barrier to dispersal ability for these species within the highly modified landscape context of the study area. These species or areas of potentially suitable habitat were not identified within the project footprint. As noted above, indirect impacts from sedimentation or pollution are unlikely due to the distance of the wetland from the project, and the limited hydrological interaction between the wetland and Powells Creek. The project will not alter the abiotic environment or influence the dispersal ability of these species within areas of potential habitat outside the project area.
g) disrupts pollination cycle;
These species or suitable habitat do not occur within the project footprint. The project will not disrupt the pollination cycle of these species within Mason Park Wetlands or any other area of suitable habitat outside of the project footprint.
h) disturbs seedbanks;

<table>
<tr><th colspan="2">Narrow-leafed Wilsonia Wilsonia backhousei (Vulnerable)
Zannichellia palustris (Endangered)</th></tr>
<tr><td colspan="2">These species or suitable habitat do not occur within the project footprint. The project would not directly disrupt the seed bank of these species within Mason Park Wetlands. As noted above, indirect impacts from sedimentation or pollution are unlikely due to the distance of the wetland from the project, and the limited hydrological interaction between the wetland and Powells Creek. The project is thus unlikely to indirectly impact the seedbank of these species.</td></tr>
<tr><td colspan="2">i) disrupts recruitment (ie germination and establishment of plants);</td></tr>
<tr><td>Wilsonia backhousei is a perennial mat forming herb, and individual genets are capable of covering large areas up to 225 metres square. The species is believed to be wind pollinated, likely to be out-breeding and may be self-incompatible (Sommerville et al., 2012).
The project will not directly or indirectly impact the abiotic environment in such a way that recruitment of this species would be disrupted. The project is located about one kilometre from the nearest known occurrence of this species. Indirect impacts are unlikely due to the distance of the wetland from the project, and the limited hydrological interaction between the wetland and Powells Creek. The project is therefore unlikely to result in any disruption to recruitment.</td><td>Zannichellia palustris a submerged monoecious weakly rhizomatous aquatic annual or perennial plant. NSW populations behave as annuals and die back each summer. The species reproduces sexually; once seeds are formed and released into the water, the plants typically die back.
The project will not directly or indirectly impact the abiotic environment in such a way that recruitment of this species would be disrupted. The project is located about one kilometre from the nearest known occurrence of this species. Indirect impacts are unlikely due to the distance of the wetland from the project, and the limited hydrological interaction between the wetland and Powells Creek. The project is therefore unlikely to result in any disruption to recruitment.</td></tr>
<tr><td colspan="2">j) affects the interaction between threatened species and other species in the community (eg pollinators, host species, mychorrizal associations);</td></tr>
<tr><td colspan="2">Wilsonia backhousei and Zannichellia pallustris occur within Mason Park, located about one kilometre downstream of the project footprint. There would be no direct impact on these species. Indirect impacts are unlikely due to the distance of the wetland from the project, and the limited hydrological interaction between the wetland and Powells Creek. The project is therefore unlikely to affect the interaction between this species and other species in the wetland.</td></tr>
<tr><td colspan="2">ii) How is the project likely to affect the habitat of a threatened species, population or ecological community?</td></tr>
<tr><td colspan="2">a) disturbs any permanent, semi-permanent or ephemeral water bodies;</td></tr>
<tr><td colspan="2">The project will cross Powells Creek, which comprises a concrete canal within the study area. There is some potential, without suitable mitigation measures, for the creek/canal to experience increased levels of sedimentation and pollution as a result of the project.
Wilsonia backhousei and Zannichellia pallustris are known to occur within Mason Park, which is located between the M4 and Homebush Bay Drive, alongside Powells Creek and Saleyards Creek. Both of these creeks run through concrete canals at this location. Mason Park Wetland is about one kilometre downstream of the project along Powells Creek.
Mason Park Wetlands are separated from Powells Creek by the concrete sides of the canal through which Powells Creek runs. There is only very limited transfer of water between Powells Creek and the wetland during high tide events. Water transfer between the creek and the wetland is via a pipe with a weir.
The project is not likely to impact flooding levels downstream of the M4, but could increase the extent of existing flooding between Parramatta Road and the M4 (particularly at Saleyards Creek) during construction. This would not impact the Mason Park Wetland. The project is unlikely to impact the stormwater capacity of Powells Creek.
Given the existing condition of creeklines in the study area, all of which occur as concrete canals and highly modified environments, the project is unlikely to disturb any permanent, semi-permanent of ephemeral creeklines. Given the limited transfer of water between Powells Creek and the wetland, the project is unlikely to disturb water bodies associated with the wetlands themselves.
The project does not intersect any known habitat of this species and is unlikely to result in any direct or indirect impacts to this species given the recommended mitigation measures.</td></tr>
<tr><td colspan="2">b) degrades soil quality;</td></tr>
</table>

Narrow-leafed Wilsonia *Wilsonia backhousei* (Vulnerable) **_Zannichellia palustris_ (Endangered)**	
These species are known to occur within the Mason Park Wetland, which is located about one kilometre downstream of the project along Powells Creek. The project would not directly impact soil quality within the wetland. There is some potential, without suitable mitigation measures, for the creek/canal to experience increased levels of sedimentation or pollution as a result of the project. Indirect impacts are unlikely due to the distance of the wetland from the project, and the limited hydrological interaction between the wetland and Powells Creek. The project is therefore unlikely to indirectly degrade soil quality where these species occur..	
c) clears or modifies native vegetation;	
There would be no clearing or modification of habitat for this species as a result of the project.	
d) introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;	
The study area is highly modified and developed and weed and exotic species are present throughout the study area and project footprint. The majority of exotic species within the study area exist as planted specimens in private gardens as well as landscaped varieties in open space and parklands. Weed species have been recorded throughout the study area and during construction there is potential for weeds to be further spread via earthworks and clearing activities, from seeds and other propagules in the soil and on vegetative material. Standard industry mitigation measures to minimise the spread of weeds are recommended as part of the project. The project is not likely to introduce feral animals or vermin to the area or encourage the spread of feral animals or vermin.	
e) removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;	
Not applicable for threatened flora assessment.	
f) affects natural revegetation and recolonisation of existing species following disturbance.	
The project is located about one kilometre from the nearest known occurrence of these species. There would be no clearing or modification of habitat for this species as a result of the project. The project would not affect natural revegetation following disturbance.	
iii) Does the project affect any threatened species or populations that are at the limit of its known distribution?	
Wilsonia backhousei is found on the coast from Mimosa Rocks National Park in southern NSW to Wamberal north of Sydney. Known locations include Nelson's Lake, Potato Point, Sussex Inlet, Wowly Gully, Parramatta River at Ermington, Clovelly, Voyager Point, Wollongong and Royal National Park. The species also grows in all southern states. As such, the project will not affect the limit of this species' range or known distribution.	*Zannichellia palustris* has a cosmopolitan distribution, but in Australia is known only from the Murray River estuary in South Australia and the lower Hunter region in NSW (NSW Scientific Committee, 1998). There are records of the species from wetlands associated with Olympic Park (OEH, 2014). As such, the project will not affect the limit of this species' range or known distribution.
iv) How is the project likely to affect current disturbance regimes?	
a) modifies the intensity and frequency of fires;	
The proposal is unlikely to affect the intensity and frequency of fires.	
b) modifies flooding flows;	
Powells Creek and Saleyards Creek are located in artificial canals and at low tide are located well below the water level of the wetland. Powells Creek has only limited hydrological interaction with the wetland. There is no hydrological link between Stockyard Creek and the wetland. Tidal flushing occurs via a small pipe located partway up the concrete canal wall. The project is not likely to impact flooding levels downstream of the M4, but could increase the extent of existing flooding between Parramatta Road and the M4 (particularly at Saleyards Creek) during construction. This would not impact flooding flows at the Mason Park Wetland. The project is unlikely to impact the stormwater capacity of Powells Creek.	
v) How is the project likely to affect habitat connectivity?	
a) creates a barrier to fauna movement;	
Not applicable for threatened flora assessment.	
b) removes remnant vegetation or wildlife corridors; and	
The project would not remove any native vegetation or wildlife corridors of relevance to these species. Similarly, the project is unlikely to result in the creation of any new barriers to wildlife movement or dispersal given the landscape context of the project, the lack of wildlife corridors in the study area and the highly modified and developed landscape in which the project will be located.	

Narrow-leafed Wilsonia *Wilsonia backhousei* (Vulnerable) *Zannichellia palustris* (Endangered)
c) modifies remnant vegetation or wildlife corridors.
The project would not modify any native vegetation or wildlife corridors of relevance to these species. As discussed above, project is situated in a landscape largely devoid of wildlife corridors and there is no intact native vegetation within the study area.
vi) How is the project likely to affect critical habitat?
a) removes or modifies key habitat features
No critical habitat of relevance to these species has been listed or would be affected by the project. The project will not remove or modify any key habitat features of relevance to these species.
b) affects natural revegetation or recolonisation of existing species following disturbance
These species would be threatened by changes in hydrology, sedimentation and weed infestation, all of which are associated with disturbance. Indirect impacts are unlikely due to the distance of the wetland from the project, and the limited hydrological interaction between the wetland and Powells Creek. Mitigation measures are recommended to minimise the potential of all of these processes being influenced by the project.
c) introduces weeds, vermin or feral species
This species can be threatened by the presence of weed species and being out-competed by more vigorous exotic species. Mason Park is currently managed for conservation and public use, and regular bushland regeneration and weed control activities are undertaken. The project is located in a highly urbanised environment with many weeds and no stands of naturally occurring vegetation. The project is highly unlikely to involve the introduction or spread of weeds into areas of habitat for these species. Mitigation measures are proposed to minimise the risk of weeds being transferred as a result of the proposal. The project is unlikely to result in the introduction of feral species of relevance to these species.
d) generates or disposes of solid, liquid or gaseous waste;
Construction of the project will result in the production of spoil from tunnelling activities and associated construction processes. Standard industry measures to manage the appropriate disposal and storage of any such waste will be adopted for the project. No waste would be disposed of at the wetland at which these species occur.
e) uses pesticides, herbicides, other chemicals
Various chemicals may be used in the construction process however none are likely to result in any impact to this species as the project is located about one kilometre from the wetland. Standard industry measures relating to the storage, handling and use of chemicals and pesticides will be adopted for the life of the project.
Conclusion
In summary, the project is unlikely to have a significant impact on *Wilsonia backhousei* and *Zannichellia palustris* as: The project is located in a highly urbanised environment and would not result in any direct impacts to these species or their habitat. Indirect impacts on these species and wetland habitat in Mason Park downstream of the project footprint are highly unlikely, given the distance of the wetland from the project, the limited hydrological interaction between the wetland and Powells Creek and project design and mitigation measures that will be implemented to reduce the potential for adverse indirect impacts on downstream habitats.

Wetland birds

Three threatened birds have been recorded at the Mason Park Wetland, located one kilometre downstream of the project. These include:

- Black-tailed Godwit
- Little Tern
- White-fronted Chat.

The project has the potential to indirectly impact the wetland if not appropriately mitigated. The project could potentially transfer sediment-laden runoff or pollution from the project area along Powells Creek to the wetland. There is, however, only limited hydrological connectivity between Powells Creek and the Mason Park Wetland at high tide.

The project is not likely to impact flooding levels downstream of the M4, but could increase the extent of existing flooding between Parramatta Road and the M4 (particularly at Saleyards Creek) during construction. This would not impact the Mason Park Wetland. The project is unlikely to impact the stormwater capacity of Powells Creek.

Wetland Birds (Vulnerable)
i) How is the project likely to affect the lifecycle of a threatened species and/or population?
a) displaces or disturbs threatened species and/or populations;
The Mason Park Wetland is currently subject to disturbance from the urban environment in which it is located, including disturbance from use of nearby sports fields, and people using the wetland for recreational activities (eg walking and cycling). Neither construction nor operation of the project would increase disturbance of shorebirds utilising Mason Park Wetland. The project is located about one kilometre upstream of the wetland, and is separated from the wetland by the DFO shopping centre, residential areas and industrial areas, including the Homebush substation. Construction noise and operational noise is unlikely to carry from the project site to the wetland. Similarly, vibrations from tunnelling are unlikely to impact the wetland due to the distance between the wetland and the project.
b) disrupts breeding cycle;
The Black-tailed Godwit breeds in Siberia. It does not breed in Australia. The Little Tern breeds along the eastern coast of Australia, on sand dunes and sand spits. It is unlikely to breed at the Mason Park Wetland. The project would not directly impact breeding habitat for these species. The White-fronted Chat breeds in the Homebush area, in low vegetation. The project would not directly impact breeding habitat for this species. The project is located about one kilometre upstream of the Mason Park Wetland. Powells Creek, which flows under the existing M4 passes along the eastern boundary of Mason Park. Saleyards creek, which also flows under the existing M4, passes along the northern boundary of the wetland. Both creeks are located in artificial canals and at low tide are located well below the water level of the wetland. Powells Creek has only limited hydrological interaction with the wetland. There is no hydrological link between Saleyards Creek and the wetland. Powells Creek has the potential to transfer sediments and pollutants generated during construction to the wetland via a weir at high tide. Tidal flushing occurs via a small pipe located partway up the concrete canal wall. At low tide the level of the creek is well below the pipe during low flow periods. The project would have design and mitigation measures to reduce the potential for sediment and pollution to enter canals. Any residual sediments or pollutants would be flushed down the canal to Homebush Bay and are unlikely to enter the wetland. Given that there would be no direct impact on Mason Park, and indirect impacts are unlikely due to the distance of the wetland from the project, and the limited hydrological interaction between the wetland and Powells Creek, the project is unlikely to disrupt the breeding cycle of any wetland species.
c) disturbs the dormancy period;
Not applicable to these species.
d) disrupts roosting behaviour;
Given that there would be no direct impact on Mason Park, and indirect impacts are unlikely due to the distance of the wetland from the project, and the limited hydrological interaction between the wetland and Powells Creek, the project is unlikely to disrupt roosting behaviour of these species.
e) changes foraging behaviour;
Given that there would be no direct impact on Mason Park, and indirect impacts are unlikely due to the distance of the wetland from the project, and the limited hydrological interaction between the wetland and Powells Creek, the project is unlikely to change the foraging behaviour of any of these species.

Wetland Birds (Vulnerable)
ii) How is the project likely to affect the habitat of a threatened species, population or ecological community?
a) disturbs any permanent, semi-permanent or ephemeral water bodies;
The project is located about one kilometre upstream of the Mason Park Wetland. Powells Creek, which flows under the existing M4 passes along the eastern boundary of Mason Park. Saleyards creek, which also flows under the existing M4, passes along the northern boundary of the wetland. Both creeks are located in artificial canals and at low tide are located well below the water level of the wetland. Powells Creek has only limited hydrological interaction with the wetland. There is no hydrological link between Saleyards Creek and the wetland. Powells Creek has the potential to transfer sediments and pollutants generated during construction to the wetland via a weir at high tide. Tidal flushing occurs via a small pipe located partway up the concrete canal wall. At low tide the level of the creek is well below the pipe during low flow periods. Most sediments or pollutants would be flushed down the canal to Homebush Bay. The project is not likely to impact flooding levels downstream of the M4, but could increase the extent of existing flooding between Parramatta Road and the M4 (particularly at Saleyards Creek) during construction. This would not impact the Mason Park Wetland. The project is unlikely to impact the stormwater capacity of Powells Creek. The CEMP will include mitigation measures to minimise the spread of sediments and pollution (see **section 7.2**).
b) degrades soil quality;
Not applicable to these species.
c) clears or modifies native vegetation;
The project would not clear any native vegetation. As noted above, the project has the potential to indirectly impact vegetation within the Mason Park Wetland. Powells Creek has the potential to transfer sediments and pollutants generated during construction to the wetland via a weir at high tide. Tidal flushing occurs via a small pipe located partway up the concrete canal wall. At low tide the level of the creek is well below the pipe during low flow periods. Most sediments or pollutants would be flushed down the canal to Homebush Bay. Indirect impacts are, however, unlikely due to the distance of the wetland from the project, and the limited hydrological interaction between the wetland and Powells Creek.
d) introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;
Weed species have been recorded throughout the study area and during construction there is potential for noxious and invasive weeds to be further spread via earthworks and clearing activities, from seeds and other propagules in the soil and on vegetative material. Mason Park Wetland is located one kilometre downstream of the project and has only limited hydrological interaction with Powells Creek, which could transfer weed propagules to the wetland. The project is unlikely to lead to the establishment of new weed species within Mason Park. The CEMP would include mitigation measures to minimise the spread of weeds (see **section 7.2**). The project is not likely to introduce feral animals to the area or encourage the spread of feral animals.
e) removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;
No key habitat features of relevance to these species would be removed. The project has the potential to indirectly impact foraging habitat within the Mason Park Wetland, however this is unlikely due to the distance of the wetland from the project, and the limited hydrological interaction between the wetland and Powells Creek.
f) affects natural revegetation and recolonisation of existing species following disturbance.
No native vegetation in the study area would be directly impacted. The project would not affect natural revegetation following disturbance.
iii) Does the project affect any threatened species or populations that are at the limit of its known distribution?
The study area is not at the limit of the range of any of these species.
iv) How is the project likely to affect current disturbance regimes?
a) modifies the intensity and frequency of fires;
The proposal is unlikely to affect the intensity and frequency of fires.
b) modifies flooding flows;

Wetland Birds (Vulnerable)
Powells Creek and Saleyards Creek are located in artificial canals and at low tide are located well below the water level of the wetland. Powells Creek has only limited hydrological interaction with the wetland. There is no hydrological link between Saleyards Creek and the wetland. Tidal flushing occurs via a small pipe located partway up the concrete canal wall. At low tide the level of the creek is well below the pipe during low flow periods. The project is not likely to impact flooding levels downstream of the M4, but could increase the extent of existing flooding between Parramatta Road and the M4 (particularly at Saleyards Creek) during construction. This would not impact flooding flows at the Mason Park Wetland. The project is unlikely to impact the stormwater capacity of Powells Creek.
v) How is the project likely to affect habitat connectivity?
a) creates a barrier to fauna movement;
The project would not create a barrier to the movement of wetland birds.
b) removes remnant vegetation or wildlife corridors; and
The project would not remove any native vegetation or wildlife corridors of relevance to these species.
c) modifies remnant vegetation or wildlife corridors.
The project would not modify any native vegetation or wildlife corridors of relevance to these species.
vi) How is the project likely to affect critical habitat?
Mason Park is not an identified internationally important site for migratory birds (Bamford et al. 2008) but does support at least 15 shorebird species (DotE 2014). It therefore meets the criteria for an area of important habitat for migratory shorebirds according to DEWHA (2009). The wetland is also within the distribution of the endangered population of the White-fronted Chat within the Sydney Metropolitan CMA, which occurs in wetlands throughout the Homebush Bay area. No key habitat features of relevance to any of these species would be removed. No breeding habitat would be directly impacted. Indirect impacts are unlikely due to the distance of the wetland from the project, and the limited hydrological interaction between the wetland and Powells Creek. Given these points, the project is unlikely to affect critical habitat for any of these species.
Conclusion
The project is unlikely to have a significant impact on threatened wetland birds as: No habitat for these species would be removed as a result of the project Indirect impacts on wetland habitat are highly unlikely, given the distance of the wetland from the project, and the limited hydrological interaction between the wetland and Powells Creek The project would not result in any barriers to movement of these species The project is unlikely to lead to degradation or increased disturbance of habitat at Mason Park Wetland such that here would be a substantial reduction in these species using the wetland Recommended mitigation measures include the use of sediment and erosion control, appropriate storage of chemicals to prevent spills, no release of dirty water into creeks, and monitoring of water quality throughout construction. These mitigation measures would minimise the risk of indirect impacts on the Mason Park Wetland.

Appendix E - Likely significance of impacts on EPBC Act-listed biota

Under the EPBC Act an action requires approval from the minister if the action has, will have, or is likely to have, a significant impact on a Matter of National Environmental Significance (MNES). Assessments of significance have been prepared using the Matters of National Environmental Significance Significant impact guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999 (DotE 2013) for the following MNES of relevance to the project:

- Grey-headed Flying-fox
- Curlew Sandpiper
- Migratory wetland bird species.

Grey-headed Flying-fox

An assessment of significance for the Grey-headed Flying-fox is provided below.

Grey-Headed Flying-fox (Vulnerable)
According to the DotE (2013) 'significant impact criteria' for vulnerable species, an action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:
Lead to a long-term decrease in the size of an important population of a species
The study area does not contain any diurnal roost sites or breeding camps for the Grey-headed Flying-fox and the proposal will not have a direct impact on any such features in the wider locality. Life-cycle characteristics of the population that are considered pertinent to the proposed action relate to the potential loss of critical foraging habitat within a 50 kilometre radius of local camps which takes in the project study area. This is the expected maximum foraging distance of the species from roost sites (Eby 1996). Foraging habitat for the Grey-headed Flying-fox in the study area comprises planted trees such as eucalypts and figs. Spotted Gum, a highly productive foraging species, is planted along the M4 between Homebush Bay Drive and in various parks, roadsides and gardens. More extensive areas of higher quality foraging habitat, including patches of intact native vegetation are present in the wider locality, such as to the north in Lane Cove National Park and to the south in the Georges River National Park. The project would remove about 12.9 hectares of planted trees and screening vegetation that may be used as a foraging resource by the Grey-headed Flying-fox. Within the locality of the project (a 10 kilometre buffer), about 1500 hectares of native vegetation has been mapped by Tozer et al. (2010) of which much would also form foraging habitat for this species. Removal of about 12.9 hectares of planted trees and screening vegetation is equivalent to a loss of about 0.9 per cent of the total available foraging habitat for this species in the locality (which incorporates the planted and screening vegetation in the project footprint), and a much smaller proportion of available foraging habitat within 50 kilometres of local roost camps. Individuals from various roost camps are likely to forage in the study area on an opportunistic basis when food trees are flowering or fruiting. A dead individual was observed in power lines adjacent to planted figs next to the M4 and another was heard foraging in planted Figs near the M4 during the nocturnal surveys. Whilst Grey-headed Flying-foxes are likely to forage in the subject site on occasion, the relatively small patches of planted vegetation to be removed comprise only a small component of that available in the wider locality, and are not likely to comprise habitat critical to the survival of the local population as discussed below. The vegetation within the study area occurs as isolated patches within an already highly fragmented urban landscape and the project will not create a barrier to the movements of the Grey-headed Flying-foxes between roost camps and foraging grounds. Given the above considerations, the project is highly unlikely to result in a long term decline in an important population of the species.
Reduce the area of occupancy of an important population

Grey-Headed Flying-fox (Vulnerable)

The proposed action will not directly impact on any known roost camps in the locality. The impacts of construction of the proposed action on the Grey-headed Flying-fox population would be primarily confined to loss of feeding habitat caused by clearing or damage to planted trees during the construction phase. No impacts are anticipated during operation.

The project would result in the loss of about 12.9 hectares of planted trees and screening vegetation that contains food trees for the Grey-headed Flying-fox. This vegetation represents a minor proportion of the foraging habitat available in a 50 kilometre radius of local camps sites for the Grey-headed Flying-fox.

Within the locality of the project (a 10 kilometre buffer), about 1500 hectares of native vegetation has been mapped by Tozer et al. (2010) which may also form foraging habitat for this species. Removal of 12.9 hectares of planted trees and screening vegetation is equivalent to a loss of about 0.9 per cent of the total available foraging habitat for this species in the locality, and a much smaller proportion of available foraging habitat within 50 kilometres of local roost camps.

The project will not affect the ability of this highly mobile and wide-ranging species to move between local camps and foraging habitats. Extensive areas of habitat are present in the locality and wider area, including various national parks and reserves throughout Sydney, as well as planted trees in residential areas. Given the widespread nature and abundance of potential foraging habitat within the feeding range of the local population, the project is not expected to substantially reduce the area of occupancy of an important population of the Grey-headed Flying-fox.

Fragment an existing important population into two or more populations

The proposal will not affect a breeding camp of diurnal roost site of any local populations of the Grey-headed Flying-fox, and will not fragment the local population in any way.

The proposal will not form a barrier to the movement of the species between any local camps or roosts and foraging habitat in the locality.

The Grey-headed Flying-fox is a highly mobile species that is capable of accessing isolated patches of foraging habitat within urban areas. Any such habitat within the study area exists as small, isolated patches that are already fragmented from any large extensive patches of high-quality or important foraging habitat.

Patches of planted trees in the study area exist as isolated patches within the urban landscape. The project would result in a minor increase to existing isolation of foraging habitat in a highly urbanised landscape by impacting on patches of planted trees. Highly mobile species such as the Grey-headed Flying-fox are expected to be less impacted by fragmentation and this species is well-adapted to accessing widely spaced habitat resources given its mobility and preference for seasonal fruits and blossom. This species' typically exhibits very large home ranges and Grey-headed Flying-fox are known to travel distances of at least 50 kilometres from roost sites to access seasonal foraging resources (Eby 1996).

The project would therefore not fragment an existing important population of the Grey-headed Flying-fox into two or more populations.

Adversely affect habitat critical to the survival of a species

Habitat in the study area consists of planted food trees and is not considered critical to the survival of the Grey-headed Flying-fox. Critical foraging habitat is identified as:

- Productive during winter and spring, when food bottlenecks have been identified.
- Known to support populations of >30,000 individuals, within an area of 50 kilometre radius.
- 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.

The proposal would result in the removal of patches of planted trees and screening vegetation in linear patches along the edges of existing roads from within an urban environment. No breeding camps are present in the study area. There would be no direct impact to any Grey-headed Flying-fox camp sites. Grey-headed Flying-foxes would forage in the area on an opportunistic basis when trees are flowering or fruiting. Additional foraging habitat is present in planted vegetation throughout the locality, as well as areas of native vegetation in Lane Cove National Park and Georges River National Park. Planted trees in the study area include Spotted Gum (*Corymbia maculata*) which is a highly productive species in the region, as well other eucalypts and figs. Spotted Gum flowers from winter to spring, providing a foraging resource in winter during food bottlenecks and in spring for breeding.

The area of habitat loss caused by the project represents a minor proportion of available habitat present within 50 kilometre radius of local camps. As such, the project is unlikely to adversely affect habitat critical to the survival of the species.

Grey-Headed Flying-fox (Vulnerable)
Disrupt the breeding cycle of an important population
The study area does not contain any Grey-headed Flying-fox camp sites and none will be affected by the proposal. The proposal will not form a barrier to the movement of Grey-headed Flying-foxes between any local camps and foraging habitat throughout the locality. The project would remove about 12.9 hectares of planted trees and screening vegetation. This total is made up of small, isolated patches of planted vegetation, typically distributed in linear patches along the edges of existing roads or from urban parks and gardens, which is not considered habitat critical to the survival of a local population. This represents a minor proportion of the potential foraging habitat for the Grey-headed Flying-fox within a 50 kilometre radius of local roost camps. The loss of this foraging habitat is not likely to disrupt the breeding cycle of the local population of this highly mobile species.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
The area of habitat loss associated with the proposed upgrade represents a minor proportion of the potential foraging habitat for the Grey-headed Flying-fox within a 50 kilometre radius of local roost camps and will not isolate areas of foraging habitat for this highly mobile species though this already highly urbanised landscape. There is limited potential for indirect impacts on foraging habitat that may suffer from edge effects resulting from the proposed action. Planted trees in the study area occur as narrow strips along urban roads and form only a small area of foraging habitat. The loss and/or modification of foraging habitat is not likely to disrupt the breeding cycle of the local population of this highly mobile species given the extent of suitable foraging habitat within a 50 kilometre radius of local camps. The proposed action will not directly impact on any local roost camps. Given the above considerations the proposed action is unlikely to modify, destroy, remove or isolate or decrease the availability or quality of habitat for the Grey-headed Flying-fox to the extent that the species is like to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat
There is no naturally occurring native vegetation within the study area. No intact native vegetation would be impacted by the proposal. The project is not likely to introduce new feral animals to the area or encourage the spread of feral animals. The proposal will not result in or cause the spread of any weed or invasive species in any areas of native vegetation that may provide habitat critical to the Grey-headed Flying-fox in the locality.
Introduce disease that may cause the species to decline
There are no known disease issues affecting this species in relation to the project. The project would be unlikely to increase the potential for significant disease vectors to affect this species.
Interfere substantially with the recovery of the species
The project would not remove habitat critical to the survival of the species. The project would not directly impact on any local roost camps for the local population and no impacts on the breeding success of the local population are anticipated. The draft recovery plan for the Grey-headed Flying-fox (DECCW 2009) identifies the protection of foraging resources as a key recovery objective. The project is located in a highly urbanised environment, and would involve the removal of small, linear patches of planted trees. This habitat does not constitute habitat critical to the survival of the Grey-headed Flying-fox. This habitat loss represents a minor proportion of the potential foraging habitat for the Grey-headed Flying-fox within a 50 kilometre radius of local roost camps. As such, the removal and modification of this foraging habitat is not likely to interfere substantially with the recovery of the species.
Conclusion
The project is unlikely to have a significant impact on the Grey-headed Flying-fox as: • The project is located in a highly urbanised environment • No breeding camps would be directly impacted • Removal of foraging habitat would be restricted to the loss of small, linear patches of planted trees located along existing urban roads and in urban parks and gardens • This habitat loss represents a minor proportion of the potential foraging habitat for the Grey-headed Flying-fox within a 50 kilometre radius of local roost camps • It would not impact movements between breeding camps and foraging grounds.

Curlew Sandpiper

An assessment of significance for the Curlew Sandpiper is provided below.

Curlew Sandpiper (Critically endangered)
According to the DotE (2013) 'significant impact criteria' for a critically endangered species, an action is likely to have a significant impact on a critically endangered species if there is a real chance or possibility that it will:
Lead to a long-term decrease in the size of a population
The Curlew Sandpiper is a summer non-breeding migrant to Australia. In the Sydney area, most records are from the Homebush Bay and Botany Bay areas (OEH 2015a). There would be no direct impact on Mason Park Wetland, and indirect impacts are unlikely due to the distance of the wetland from the project, and the limited hydrological interaction between the wetland and Powells Creek. The Curlew Sandpiper would be an occasional transient visitor to Mason Park Wetland. Given these considerations, the project is highly unlikely to result in a long term decline in a population of the species.
Reduce the area of occupancy of the species
The Curlew Sandpiper breeds in Siberia. About 13 per cent of the global population occurs in the East Asian-Australasian Flyway (Bamford et al. 2008). In Australia, Curlew Sandpipers occur around the coasts and are also quite widespread inland, though in smaller numbers (DotE 2015b). There would be no direct impacts on foraging habitat of the Curlew Sandpiper as a result of the project. As such, the project would not reduce the area of occupancy of the species.
Fragment an existing population into two or more populations
The Curlew Sandpiper is a migratory species, travelling between Australia and Siberia in its annual migration. The proposal will not form a barrier to the movement of the species between foraging habitat in the locality and breeding areas in Siberia. The project would therefore not fragment an existing population of the species into two or more populations.
Adversely affect habitat critical to the survival of a species
Mason Park Wetland is located about one kilometre downstream of the project along Powells Creek. The Mason Park Wetland is not an identified internationally important site for the Curlew Sandpiper (Bamford et al 2008) but is one of the most important sites for this species in the Sydney region (PEP et al 2008). Numbers of Curlew Sandpipers varied with counts between 50 and 100 birds when the area was poorly managed and up to 240 when the tidal flushing was effectively managed by council. Counts, during the 2006/07 season did not exceed 16 birds (PEP et al 2008). While Mason Park is important to the local population that occurs in the Sydney area, it is not an internally important site for the species, and as such is not habitat critical to the survival of the species. The project would not directly impact Mason Park Wetland. Mason Park Wetland is not directly connected to the Powells Creek and Saleyards Creek; however there is some potential for indirect impacts such as sedimentation and introduction of pollutants occurring as a result of the project in the absence of mitigation measures. Transfer of sediments or pollution to the wetland could only occur as a result of tidal flushing. Potential indirect impacts from sedimentation or pollution are unlikely due to the distance of the wetland from the project, and the limited hydrological interaction between the wetland and Powells Creek. Powells Creek and Saleyards Creek are located in artificial canals and at low tide are located well below the water level of the wetland. Powells Creek has only limited hydrological interaction with the wetland. There is no hydrological link between Saleyards Creek and the wetland. Tidal flushing occurs via a small pipe located partway up the concrete canal wall. The project is not likely to impact flooding levels downstream of the M4, but could increase the extent of existing flooding between Parramatta Road and the M4 (particularly at Saleyards Creek) during construction. This would not impact flooding flows at the Mason Park Wetland. Given the distance from the project, and lack of hydryological connectivity as discussed above, the project is unlikely to indirectly impact foraging habitat for the Curlew Sandpiper at Mason Park Wetland, which is an important site for the Sydney population of the species. No habitat critical to the survival of the species would be directly or indirect impacted by the project.
Disrupt the breeding cycle of a population

Curlew Sandpiper (Critically endangered)
The Curlew Sandpiper is a summer non-breeding migrant to Australia. Foraging habitat at Mason Park Wetland would be important to the Sydney population during the non-breeding season when tidal flushing at the wetland is well managed. As noted above, when not well managed, the population that uses the wetland is very low in numbers. The project is located about 1 kilometre upstream of the Mason Park Wetland. Powells Creek, which flows under the existing M4 passes along the eastern boundary of Mason Park. Saleyards creek, which also flows under the existing M4, passes along the northern boundary of the wetland. Both creeks are located in artificial canals and at low tide are located well below the water level of the wetland. Powells Creek has only limited hydrological interaction with the wetland. There is no hydrological link between Saleyards Creek and the wetland. Powells Creek has the potential to transfer sediments and pollutants generated during construction to the wetland via a weir at high tide. Tidal flushing occurs via a small pipe located partway up the concrete canal wall. At low tide the level of the creek is well below the pipe during low flow periods. The project would have design and mitigation measures to reduce the potential for sediment and pollution to enter canals. Any residual sediments or pollutants would be flushed down the canal to Homebush Bay and are unlikely to enter the wetland. Given that there would be no direct impact on Mason Park Wetland, and indirect impacts are unlikely due to the distance of the wetland from the project, and the limited hydrological interaction between the wetland and Powells Creek, the project is unlikely to disrupt the breeding cycle of the Curlew Sandpiper.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
The project would not destroy or remove any foraging habitat for the Curlew Sandpiper and would not isolated any habitat for this highly mobile species. As discussed above, Given the distance from the project, and lack of hydryological connectivity as discussed above, the project is unlikely to indirectly impact foraging habitat for the Curlew Sandpiper at Mason Park Wetland. As such, the project is unlikely to cause the species to decline.
Result in invasive species that are harmful to a critically endangered species becoming established in the critically endangered habitat
There is no naturally occurring native vegetation within the study area. No intact native vegetation would be impacted by the proposal. The project is not likely to introduce new feral animals to the area or encourage the spread of feral animals. The proposal will not result in or cause the spread of any weed or invasive species in any areas of native vegetation that may provide habitat critical to the Curlew Sandpiper in the locality.
Introduce disease that may cause the species to decline
There are no known diseases affecting this species that are of relevance to the project. The project would be unlikely to increase the potential for significant disease vectors to affect this species.
Interfere substantially with the recovery of the species
The Curlew Sandpiper does not breed in Australia. The project would not remove habitat critical to the survival of the species. The project would not directly impact any foraging habitat for the species. Indirect impacts are unlikely given the distance from the project and lack of hydryological connectivity. As such, the project is not likely to interfere substantially with the recovery of the species.
Conclusion
The project is unlikely to have a significant impact on the Curlew Sandpiper as: • No habitat for this species would be removed as a result of the project • Indirect impacts on wetland habitat are highly unlikely, given the distance of the wetland from the project, and the limited hydrological interaction between the wetland and Powells Creek • The project would not result in any barriers to movement of this species • The project is unlikely to lead to degradation or increased disturbance of habitat at Mason Park Wetland such that there would be a substantial reduction in this species using the wetland Recommended mitigation measures include the use of sediment and erosion control, appropriate storage of chemicals to prevent spills, no release of dirty water into creeks, and monitoring of water quality throughout construction. These mitigation measures would minimise the risk of indirect impacts on the Mason Park Wetland.

Migratory shorebirds

The Draft significant impact guidelines for 36 migratory shorebird species (DEWHA 2009) provide guidance on determining the significance of an action on migratory shorebirds.

Mason Park, located north of the M4 and east of Homebush Bay Drive, is not an identified internationally important site (Bamford et al. 2008) but does support at least 15 shorebird species (DotE 2014). It therefore meets the criteria for an area of important habitat for migratory shorebirds according to DEWHA (2009). The wetland may also be important habitat for the migratory Latham's Snipe, which has been recorded at the wetland during periods of drought (PEP et al. 2008).

The assessment of significance provided below assesses the likely significance of impacts of the project on migratory shorebirds that occur or may occur at the Mason Park Wetlands.

Significant Impact Criteria (DotE, 2013) – migratory shorebirds
Impacts are likely to be significant where there is
Loss of important habitat
The project would not remove any important habitat for migratory shorebirds. Mason Park wetland is separated from the project by the DFO shopping centre, residential areas and the Homebush substation.
Degradation of important habitat leading to a substantial reduction in migratory shorebirds using the site
The project is located about one kilometre upstream of the Mason Park Wetland. Powells Creek, which flows under the existing M4 passes along the eastern boundary of Mason Park. Saleyards creek, which also flows under the existing M4, passes along the northern boundary of the wetland. Both creeks are located in artificial canals and at low tide are located well below the water level of the wetland. Powells Creek has only limited hydrological interaction with the wetland. There is no hydrological link between Saleyards Creek and the wetland. Powells Creek has the potential to transfer sediments and pollutants generated during construction to the wetland via a weir at high tide. Tidal flushing occurs via a small pipe located partway up the concrete canal wall. At low tide the level of the creek is well below the pipe during low flow periods. The project would have design and mitigation measures to reduce the potential for sediment and pollution to enter canals. Any residual sediments or pollutants would be flushed down the canal to Homebush Bay and are unlikely to enter the wetland. Given the distance of the wetland from the project site, and only limited exchange of water between Powells Creek and the wetland, the project is unlikely to degrade water quality within the wetland. The project is highly unlikely to lead to a substantial reduction in migratory shorebirds using the site as a result of habitat degradation. The CEMP will include mitigation measures to minimise the spread of sediments and pollution (see **section 7.2**).
Increased disturbance leading to a substantial reduction in migratory shorebirds using important habitat
The Mason Park Wetland is currently subject to disturbance from the urban environment in which it is located, including disturbance from use of nearby sports fields, and people using the wetland for recreational activities (eg walking and cycling). Neither construction nor operation of the project would increase disturbance of shorebirds utilising Mason Park Wetland. The project is located about one kilometre upstream of the wetland, and is separated from the wetland by the DFO shopping centre, residential areas and industrial areas including the Homebush substation. Construction noise and operational noise is unlikely to carry from the project site to the wetland. Similarly, vibrations from tunnelling are unlikely to impact the wetland due to the distance between the wetland and the project.
Direct mortality of birds leading to a substantial reduction in migratory shorebirds using important habitat
The project would not remove any important habitat for migratory shorebirds and would not affect the movements of any migratory shorebirds. Mason Park Wetland is separated from the project by the DFO shopping centre, residential areas and the Homebush substation. The project is therefore unlikely to result in direct mortality of shorebirds at Mason Park wetland, and thus would not lead to a substantial reduction in migratory shorebirds using the habitat.
Conclusion

Significant Impact Criteria (DotE, 2013) – migratory shorebirds
The project is unlikely to have a significant impact on migratory shorebirds as: • No important habitat for migratory birds would be directly impacted and there would be no direct mortality of birds as a result of the project • Indirect impacts on wetland habitat are unlikely, given the distance of the wetland from the project, and the limited hydrological interaction between the wetland and Powells Creek • The project is unlikely to disrupt the breeding cycle of an ecologically significant proportion of the population of any migratory species • The project is unlikely to lead to degradation or increased disturbance of habitat at Mason Park Wetland such that here would be a substantial reduction in migratory shorebirds using the wetland. Recommended mitigation measures include the use of sediment and erosion control, appropriate storage of chemicals to prevent spills, no release of dirty water into creeks, and monitoring of water quality throughout construction. These mitigation measures would minimise the risk of potential indirect impacts on the Mason Park Wetland.

Other migratory species

The criteria for listed migratory species (not including migratory shorebirds assessed above) are addressed below. The assessment of significance provided below assesses the significance of impacts of the project on the migratory species Great Egret, Cattle Egret and Little Tern that are likely to occur or are known to occur at the Mason Park Wetland. There is no potential habitat for these species in the project footprint, however they are known or are likely to occur at the Mason Park Wetland about one kilometre downstream of the project footprint. Habitats within the Mason Park Wetland are not likely to contain an ecologically significant proportion of the population of any of these species, be critical to any of these species at particular life stages, or are near the limit of these species' ranges. The habitat within Mason Park is therefore not considered to be important habitat for these species.

Significant Impact Criteria (DotE 2013) – other migratory birds
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles) destroy or isolate an area of important habitat for a migratory species
The project would not remove any important habitat for migratory shorebirds. Mason Park Wetland is separated from the project by the DFO shopping centre, residential areas and the Homebush substation. The project is located about one kilometre upstream of the Mason Park Wetland. Powells Creek, which flows under the existing M4, passes along the eastern boundary of Mason Park. Saleyards Creek, which also flows under the existing M4, passes along the northern boundary of the wetland. Both creeks are located in artificial canals and at low tide are located well below the water level of the wetland. Powells Creek has the potential to transfer sediments and pollutants generated during construction to the wetland. Exchange of water between Powells Creek and the wetland may occur at high tide. Tidal flushing occurs via a small pipe located partway up the concrete canal wall. The project would have design and mitigation measures to reduce the potential for sediment and pollution to enter canals. Any residual sediments or pollutants would be flushed down the canal to Homebush Bay and are unlikely to enter the wetland. The project is not likely to impact flooding levels downstream of the M4, but could increase the extent of existing flooding between Parramatta Road and the M4 (particularly at Saleyards Creek) during construction. This would not impact the Mason Park Wetland. The project is unlikely to impact the stormwater capacity of Powells Creek. Given the distance of the wetland from the project, and only limited exchange of water between Powells Creek and the wetland, the project is unlikely to degrade water quality within the wetland. The project is therefore unlikely to substantially modify, destroy or isolate habitat within the Mason Park Wetlands. The CEMP will include mitigation measures to minimise the potential for spread of sediments and pollution (see **section 7.2**).
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species

Significant Impact Criteria (DotE 2013) – other migratory birds
Weed species have been recorded throughout the study area and during construction there is potential for noxious and invasive weeds to be further spread via earthworks and clearing activities, from seeds and other propagules in the soil and on vegetative material. Mason Park Wetland is located one kilometre downstream of the project and has only limited hydrological interaction with Powells Creek, which could transfer weed propagules to the wetland. The project is unlikely to lead to the establishment of new weed species within Mason Park. The CEMP will include mitigation measures to minimise the potential for the spread of weeds (see **section 7.2**). The project is not likely to introduce feral animals to the area or encourage the spread of feral animals.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species
Given that there would be no direct impact on Mason Park, and indirect impacts are unlikely due to the distance of the wetland from the project, and the limited hydrological interaction between the wetland and Powells Creek, the project is unlikely to seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.
Conclusion
The project is unlikely to have a significant impact on migratory birds as: • No important habitat for migratory birds would be directly impacted and there would be no direct disturbance or mortality of birds as a result of the project • Indirect impacts on wetland habitat are unlikely, given the distance of the wetland from the project, and the limited hydrological interaction between the wetland and Powells Creek • The project is unlikely to disrupt the breeding cycle of an ecologically significant proportion of the population of any migratory species • The project is unlikely to lead to the degradation of or increased disturbance of habitat at Mason Park Wetland such that here would be a substantial reduction in migratory shorebirds using the wetland. Recommended mitigation measures include the use of sediment and erosion control, appropriate storage of chemicals to prevent spills, no release of dirty water into creeks, and monitoring of water quality throughout construction. These mitigation measures would minimise the risk of indirect impacts on the Mason Park Wetland.