

Roads and Maritime Services/Sydney Airport Corporation Limited

Sydney Gateway Road Project

Environmental Impact Statement/ Preliminary Draft Major Development Plan

Technical Working Paper 14 Biodiversity Development Assessment Report



November 2019

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Sydney Gateway Road Project

Technical Working Paper 14 – Biodiversity Development Assessment Report



Distribution

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G2S JV Gateway to Sydney Joint Venture

WSP Australia Pty Limited and GHD Pty Ltd

ABN: 55 836 411 311 Project Office Level 27 Ernst & Young Centre 680 George Street Sydney NSW 2000 GPO Box 5394 Sydney NSW 2001 Australia Tel: +61 2 9272 5100 Fax: +61 2 9272 5101



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Contents

|--|

1.	Intro	ductio	n	1
	1.1	Overview		
		1.1.1 1.1.2	Sydney Gateway and the project Overview of approval requirements	1 1
	1.2 1.3	Purpo The pi	se and scope of this report roject	3 6
		1.3.1 1.3.2 1.3.3	Location Key design features Construction overview	6 6 7
	1.4 1.5	Struct Perso	ure of this report nnel	10 10
2.	Stat	utory c	ontext	11
	2.1	Comm	nonwealth legislation	11
		2.1.1 2.1.2 2.1.3 2.1.4 2.1.5	Airports Act and associated regulations Airports (Environment Protection) Regulations 1997 Sydney Airport Master Plan 2039 Sydney Airport Environment Strategy 2019–2024 Environment Protection and Biodiversity Conservation Act 1999	11 11 12 12 12
	2.2	NSW	legislation	13
		2.2.1 2.2.2 2.2.3 2.2.4	Environmental Planning and Assessment Act 1979 Biodiversity Conservation Act 2016 and Biodiversity Conservation Regulation 2017 Fisheries Management Act 1994 Biosecurity Act 2015	13 14 15 15
	2.3	Asses	sment guidelines and information used in this report	16
3.	Met	hodolc	bâà	17
	3.1 3.2	Backg Terres	round research strial flora surveys	17 18
		3.2.1 3.2.3 3.2.4 3.2.5 3.2.8	Nomenclature Mapping of vegetation zones Vegetation integrity plots Random meander survey Candidate terrestrial threatened flora species and survey effort	18 19 20 22 23
	3.3	Terres	strial fauna surveys	24
		3.3.1 3.3.2 3.3.3 3.3.4	Habitat assessment Fauna surveys Threatened fauna likelihood of occurrence assessment Candidate terrestrial threatened fauna species and survey effort	24 24 29 31
	3.4	Aquati	ic habitat surveys	32
		3.4.1 3.4.2	Habitat assessment Threatened fauna likelihood of occurrence assessment	32 32
	3.5	Limita	tions	32

vii



Contents (continued)

4.	Landscape context			35
	4.1 4.2	Landscape features Determining site context		35 36
		4.2.1 4.2.2	Native vegetation cover Patch size	36 36
5.	Nativ	/e veg	etation	39
	5.1	Overvi	ew	39
	5.2	Native	Vegetation types	44
		5.2.2	Corner Bioregion PCT 1232 Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion	44 47
	5.3	Non-na	ative vegetation types	51
		5.3.1 5.3.2	Miscellaneous ecosystem – highly disturbed areas with no or limited native vegetation Miscellaneous ecosystem – urban exotic/native landscape plantings	51 52
	5.4 5.5	Weeds Ground	; dwater Dependent Ecosystems	54 55
6.	NSW	Threat	ened biota	57
	6.1 6.2	Threat Threat	ened ecological communities ened flora	57 59
		6.2.1 6.2.2 6.2.3	Potential habitat for threatened flora Threatened flora candidate species Affected threatened flora	59 59 60
	6.3	Threat	ened fauna	60
		6.3.1 6.3.2 6.3.3	Fauna species Fauna habitats Identification of threatened species under the BAM	60 60 67
	6.4	Aquati	c habitat	73
		6.4.1 6.4.2 6.4.3	Aquatic habitat Threatened aquatic species and key fish habitat identified in the project site Coastal Management SEPP 2018 – Coastal Wetland	73 74 74
7.	Matt	ers of I	National Environmental Significance	75
	7.1	Threat	ened ecological communities	75
		7.1.1	Coastal Swamp Oak (<i>Casuarina glauca</i>) Forest of New South Wales and South East Queensland ecological community	75
	7.2 7.3	Threat Threat	ened flora species ened fauna species	76 77
		7.3.1 7.3.2	Green and Golden Bell Frog Grey-headed Flying-fox	77 77
	7.4 7.5 7.6	Migrate Wetlar Enviro	ory species ids of International Importance (Ramsar wetlands) nment of Commonwealth land	77 77 78
		7.6.1 7.6.2 7.6.3 7.6.4	Existing environment Vegetation and flora within the project site on Sydney Airport land Fauna habitats within the project site on Sydney Airport land Threatened and migratory biota on Commonwealth land	78 78 78 79





8.	Asse	ssment	t of construction impacts	81
	8.1	Summ	arv of kev findings (impact summarv)	81
		8.1.1 8.1.2 8.1.3	Impacts on native vegetation and state-listed entities Impacts on the environment of Commonwealth land Impacts on MNES	81 81 81
	8.2 8.3	8.2 Measures to avoid impacts8.3 Direct impacts on native vegetation and habitat		82 82
		8.3.1	Removal of vegetation	82
	8.4 8.5	Indirec Impact	t impacts on native vegetation and habitat ts on threatened species listed under the BC Act	88 89
		8.5.1 8.5.2	Threatened flora species Threatened fauna species	89 89
	8.6 8.7 8.8	Impact Ground Prescr	ts on aquatic fauna and habitats dwater dependent ecosystems ibed biodiversity impacts	90 91 91
		8.8.1 8.8.2 8.8.3 8.8.4 8.8.5	Areas of geological significance Human made structures and non-native vegetation Connectivity and movement Hydrology Vehicle strike	91 91 91 92 92
	8.9 Key threatening processes8.10 Serious and irreversible impacts		93 93	
		8.10.1 8.10.2	Threatened ecological communities Threatened species	94 94
	8.11	Impact	s on Matters of National Environmental Significance	94
		8.11.1 8.11.2 8.11.3 8.11.4 8.11.5	Threatened ecological communities Threatened flora species Threatened fauna species Migratory species Wetlands of international significance	94 94 94 95 95
	8.12 8.13	Constr Consis	uction impacts on Sydney Airport (Commonwealth) land stency with the Sydney Airport Master Plan 2039 and Environment Strategy 2019–	95 96
		8.13.1 8.13.2 8.13.3	Overview Biodiversity and conservation management Project consistency	96 96 97
9.	Asse	ssment	t of operation impacts	99
	9.1 9.2 9.3	 9.1 Summary of key findings 9.2 Operation impacts 9.3 Summary of operational impacts on Commonwealth land 		
	9.4 Consistency with the Sydney Airport Master Plan 2039 and Environment Strategy 2019 2024		100	
10.	Cum	ulative	e impacts	101
	10.1 10.2	Botany Botany	/ Rail Duplication / Rail Duplication and other proposed major developments	101 102



Contents (continued)

11.	Recommended mitigation measures		
	11.1 Construction and operation phases11.2 Mitigation measures	103 103	
12.	Offsetting		
	12.1 Introduction12.2 BC Act – Offset for affected threatened biota	107 107	
	12.2.1 Ecosystem credits12.2.2 Species credits	107 107	
	 12.3 FM Act – Offsetting of impacts on protected marine vegetation and key fish habitat 12.4 EPBC Act – Offset for significant impacts on MNES 12.5 Airports Act – Offset for land clearing 	108 108 108	
13.	Conclusion	109	
14.	. References		



List of tables

Table 1-1	SEARs relevant to this assessment	4
Table 1-2	MDP requirements relevant to this assessment	5
Table 1-3	Construction work phases	7
Table 1-4	Staff and qualifications	10
Table 2-1	Requirements for a BDAR	14
Table 3-1	Threatened and migratory species database searches	18
Table 3-2	Vegetation broad condition states	19
Table 3-3	Comparison of number of plots required under the BAM and completed per vegetation zone	21
Table 3-4	Location and orientation of vegetation integrity plots completed within the project site	21
Table 3-5	Likelihood of occurrence criteria for terrestrial threatened flora species and populations	23
Table 3-6	Candidate terrestrial threatened flora species survey effort	23
Table 3-7	Targeted Green and Golden Bell Frog surveys	26
Table 3-8	Confidence ratings applied to bat calls	29
Table 3-9	Likelihood of occurrence criteria for threatened fauna species and populations	30
Table 3-10	Candidate terrestrial threatened fauna species survey effort	31
Table 4-1	Landscape features	35
Table 4-2	Native vegetation cover	36
Table 5-1	Overview of native and non-native vegetation types and zones identified within the project site	40
l able 5-2	Summary of PCT 920 Mangrove Forests in estuaries of the Sydney Basin Bioregion and South	
T 11 E 0	East Corner Bioregion	44
Table 5-3	Comparison of PCT 920 Mangrove Forests in estuaries of the Sydney Basin Bioregion and	
	South East Corner Bioregion vegetation integrity plot data against PCT condition benchmark	
T 11 C 4		46
I able 5-4	Summary of PCT 1232 Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and	47
	South East Corner Bioregion	47
I able 5-5	Comparison of PCT 1232 Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and	
	South East Corner Bioregion vegetation integrity plot data against PCT condition benchmark	F 0
	uala Driarita una da and una da afinational aignificant recorded	50
Table 5-0	Comparison of PC Act listed Swomp Oak Electrolein Ferent of the New South Wales North	54
	Comparison of BC Act-listed Swamp Oak Floodplain Folest of the New South Wales North	
	coast, Sydney Dasin and South East Comer Dioregions final determination chiena and	59
Table 6.2	Threatened flora candidate species assessment results	50
Table 6-2	Fauna habitats – Mandrove Forest	61
Table 6-4	Fauna habitats – Mangrover orest Fauna habitats – Swamn Oak Floodnlain Forest	62
Table 6-5	Fauna habitats – Gwallip Oak Hoodplain Forest	63
Table 6-6	Fauna habitats – Lirban exotic and planted native species	64
Table 6-7	Fauna habitats – of bar exercise and planed harve species	65
Table 6-8	Fauna habitats – Alexandra Canal	66
Table 6-9	Fauna habitats – bridges and culverts	67
Table 6-10	Predicted threatened fauna that may occur in the site	67
Table 6-11	Candidate species credit species for which surveys were conducted	69
Table 6-12	Potential candidate species credit species not on site	72
Table 7-1	Comparison of Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South	. –
	East Queensland ecological community key diagnostics against candidate PCT 1232	76
Table 8-1	Direct impact of native and miscellaneous vegetation	83
Table 8-2	Direct impacts on fauna and fauna habitat resources	87
Table 8-3	Indirect effects on biodiversity values	88
Table 8-4	Key threatening processes	93
Table 9-1	Potential operational effects on biodiversity values	100
Table 10-1	Cumulative impacts of the Sydney Gateway Road and Botany Rail Duplication projects	101
Table 11-1	Mitigation measures	103
Table 12-1	Ecosystem credit obligation for PCTs on land under state jurisdiction	107



List of figures

Figure 1-1	The Project	2
Figure 1-2	Construction footprint and facilities	9
Figure 3-1	Schematic diagram illustrating the layout of the nested 20 metre x 20 metre and 20 metre x 50	
-	metre plot used for the assessment of vegetation integrity at each plot location	20
Figure 3-2	Survey methods	33
Figure 4-1	Landscape features	37
Figure 4-2	Determining site context	38
Figure 5-1	Vegetation types and zones (Page 1 of 3)	41
Figure 5-1	Vegetation types and zones (Page 2 of 3)	42
Figure 5-1	Vegetation types and zones (Page 3 of 3)	43
Figure 8-1	Project impacts (Page 1 of 3)	84
Figure 8-1	Project impacts (Page 2 of 3)	85
Figure 8-1	Project impacts (Page 3 of 3)	86

List of appendices

- Appendix A Likelihood of occurrence of threatened and migratory biota
- Appendix B Survey results
- Appendix C Field data sheets
- Appendix D Biodiversity Assessment Method (BAM) requirements
- Appendix E EPBC Act assessments of significance





Glossary

BAM	Biodiversity Assessment Method: The rules for biodiversity assessment established under the BC Act that determine biodiversity credits created, credits required and the circumstances that improve or maintain biodiversity values.
BC Act	Biodiversity Conservation Act 2016
BCTF	Biodiversity Conservation Trust Fund: A fund established under the BC Act that receives monies from the purchase of biodiversity credits and that provides for payments to landowners to carry out the management actions required each year on a biodiversity stewardship site.
BDAR	Biodiversity Development Assessment Report
Biodiversity credit	A unit of biodiversity value to measure specific development impacts or conservation gains in accordance with the BAM. Includes ecosystem credits and species credits.
Biodiversity offsets	Biodiversity offsets are measures that benefit biodiversity by compensating for the adverse impacts elsewhere of an action, such as clearing for development. Biodiversity offsets work by protecting and managing biodiversity values in one area in exchange for impacts on biodiversity values in another.
Biodiversity credit report	Specifies the number and type of biodiversity credits required to offset the impacts of a development to obtain a Biodiversity Certification Agreement or that would be generated through conservation and management of a Stewardship site under a Biodiversity Stewardship site agreement.
Biodiversity values	The composition, structure and function of ecosystems, including threatened species, populations and ecological communities and their habitats.
BOS	Biodiversity Offset Scheme
CEMP	Construction environment management plan
DBH	Diameter at breast height
DoEE	(Australian) Department of the Environment and Energy
DPI	(NSW) Department of Primary Industries, now part of the Department of Planning, Industry and Environment
Ecosystem credit	A credit that relates to a vegetation type and the threatened species that are reliably predicted by that vegetation type (as a habitat surrogate).
EEC	Endangered ecological community
EIS	Environmental impact statement
EPA Act	Environmental Planning and Assessment Act 1979
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
FM Act	Fisheries Management Act 1994
GDE	Groundwater dependent ecosystems
GIS	Geographic information system
IBRA	Interim Biogeographic Regionalisation for Australia
КТР	Key threatening processes



LGA	Local Government Area
Locality	The area within a 10 km radius of the project site
MDP	Major Development Plan
Migratory species	Species listed under international agreements (ie Ramsar, JAMBA and CAMBA conventions) to which Australia is a party.
MNES	Matters of National Environmental Significance
OEH	Office of Environment and Heritage, now part of the Department of Planning, Industry and Environment
РСТ	Plant community type
Prescribed biodiversity impacts	Impacts on biodiversity values prescribed by the Biodiversity Conservation Regulation 2017.
Project site	The area that would be directly impacted by construction and operation of the project.
Ramsar wetland	Wetlands of International Significance, especially as waterfowl habitat, identified by the Ramsar Convention.
Roads and Maritime	Roads and Maritime Services, now part of Transport for New South Wales
RTA	Roads and Traffic Authority, became Roads and Maritime Services and is now part of Transport for New South Wales
SAII	Serious and irreversible impacts
SAII entity	Species and ecological communities that are likely to be the subject of serious and irreversible impacts (SAIIs).
SEAR	Secretary's Environmental Assessment Requirement
SEPP	State Environmental Planning Policy
Species credit	A credit that relates to an individual threatened species that cannot be reliably predicted based on habitat surrogates. Threatened species that require species credits are identified in the Threatened Biodiversity Data Collection.
Species credit species	Species for which species credits are calculated
Study area	The area that was subject to a detailed site survey and assessed for direct or indirect impacts arising from construction and operation of the project.
Threatened biota	Threatened species, populations or ecological communities listed under the BC Act, FM Act and/or the EPBC Act.
TEC	Threatened ecological community listed under the BC Act, FM Act or EPBC Act.





1. Introduction

1.1 Overview

1.1.1 Sydney Gateway and the project

Sydney Kingsford Smith Airport (Sydney Airport) and Port Botany are two of Australia's most important infrastructure assets, providing essential domestic and international connectivity for people and goods. Together they form a strategic centre, which is set to grow significantly over the next 20 years. To support this growth, employees, residents, visitors and businesses need reliable access to the airport and port, and efficient connections to Sydney's other strategic centres.

The NSW and Australian governments are making major investments in the transport network to achieve this vision. New road and freight rail options are being investigated to cater for the forecast growth in passengers and freight through Sydney Airport and Port Botany. Part of this solution is Sydney Gateway, which comprises the following road and rail projects:

- Sydney Gateway road project (the subject of this assessment)
- Botany Rail Duplication.

Sydney Gateway will expand and improve the road and freight rail networks to Sydney Airport and Port Botany to keep Sydney moving and growing. The Sydney Gateway road project forms part of the NSW Government's long-term strategy to invest in an integrated transport network and make journeys easier, safer and faster.

Roads and Maritime and Sydney Airport Corporation propose the Sydney Gateway road project (the project). The project comprises new direct high capacity road connections linking the Sydney motorway network at St Peters interchange with Sydney Airport's terminals and beyond. It involves constructing and operating new and upgraded sections of road connecting to the airport terminals, four new bridges over Alexandra Canal, and other operational infrastructure and road connections. The project and its location is shown on Figure 1-1.

1.1.2 Overview of approval requirements

The project is subject to approval under NSW and Commonwealth legislation. Parts of the project located on Commonwealth-owned land leased to Sydney Airport (Sydney Airport land) are subject to the Commonwealth *Airports Act 1996* (the Airports Act). In accordance with the Airports Act, these parts of the project are major airport development. A major development plan (MDP), approved by the Australian Minister for Infrastructure, Transport and Regional Development, is required before a major airport development can be undertaken at a leased airport.

Parts of the project located on other land are State significant infrastructure in accordance with the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). As State significant infrastructure, these parts of the project require approval from the NSW Minister for Planning and Public Spaces. An environmental impact statement (EIS) is required to support the application for approval for State significant infrastructure under the EP&A Act.

A combined EIS and preliminary draft MDP is being prepared to:

- Support the application for approval of the project in accordance with NSW and Commonwealth legislative requirements
- Address the environmental assessment requirements of the Secretary of the Department of Planning and Environment (the SEARs), issued on 15 February 2019
- Address the MDP requirements defined by section 91 of the Airports Act.

This report was prepared on behalf of Roads and Maritime and Sydney Airport Corporation to support the combined EIS/preliminary draft MDP.



Figure 1-1 The Project



1.2 Purpose and scope of this report

This Biodiversity Development Assessment Report (BDAR) has been prepared to assess the impacts of the construction and operation of the project on threatened biota and their habitats in accordance with the biodiversity assessment method (BAM) and the requirements of the *Biodiversity Conservation Act 2016* and the *Biodiversity Conservation Regulation 2017*. This report also incorporates an assessment of impacts on biodiversity values covered by the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), Airports Act and *Fisheries Management Act 1994* (FM Act).

The objectives of this BDAR are to:

- Outline the methods used in the biodiversity assessment
- Describe the landscape features that relate to the assessment, including the physical environment and regional context of the project site
- Describe the biophysical environment of the project site, including extent of native vegetation, type and condition of Plant Community Types (PCTs), flora and fauna species as well as terrestrial and aquatic habitats
- Describe the conservation significance of the project site in terms of threatened biota and their habitats that are known or predicted to occur
- Provide a description of the project, including potential effects on biodiversity values, including threatened biota listed under the *Biodiversity Conservation Act 2016* (BC Act) and FM Act, matters of national environmental significance (MNES) and the environment of Commonwealth land
- Identify measures undertaken to avoid and minimise effects on biodiversity values
- Present the data used to perform the BAM assessment and credit calculations for the project
- Identify the need or otherwise to provide biodiversity offsets for residual impacts of the project under the BC Act and FM Act
- Determine if the project is likely to have a significant impact on MNES (including Commonwealth land) and the need or otherwise to provide biodiversity offsets under the EPBC Act
- Briefly discuss options to deliver the required quantum of biodiversity offset for the project.

The main components of the methodology for this BDAR include:

- Desktop assessment to describe the existing environment and landscape features of the project site and to identify the suite of threatened and migratory biota potentially affected by the project
- Field survey in accordance with the BAM 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 study area or being affected by the project
- Determination of reasonable actions to avoid and minimise impacts to biodiversity values and assessment of residual biodiversity impacts of the project
- Completion of offset calculations using the BAM credit calculator, to determine the ecosystem and species credits that would be required to offset impacts under the BC Act
- Assessment of the likely significance of impacts on MNES (including Commonwealth land) and identification
 of the requirement for offset under the EPBC Act
- Assessment of aquatic impacts and the requirement for offset under the FM Act.

The report addresses the relevant SEARs for the EIS, as outlined in Table 1-1.

MDP requirements (under section 91 of the Airports Act) relevant to biodiversity and addressed in this report are outlined in Table 1-2.



Table 1-1SEARs relevant to this assessment

Requirement	Where addressed in this report
8. Biodiversity	
8.1 The Proponent must assess biodiversity impacts in accordance with the <i>Biodiversity Conservation Act 2016</i> (BC Act), the Biodiversity Assessment Method (BAM) and be documented in a Biodiversity Assessment Report (BDAR) unless a BDAR waiver had been sought, where applicable.	This report is the BDAR prepared in accordance with the BC Act and the BAM
8.2 The BDAR must include information in the form detailed in section 6.12 of the BC Act, clause 6.8 of the Biodiversity Conservation Regulation 2017, and the BAM.	This BDAR has been prepared in accordance with section 6.12 of the BC Act, clause 6.8 of the Biodiversity Conservation Regulation 2017, and the BAM
	Refer to section 2.2
8.3 The BDAR must be submitted with all digital spatial data associated with the survey and assessment as per Appendix 10 of the BAM.	Digital spatial data has been provided to the Department of Planning, Industry and Environment
8.4 The BDAR must be prepared by a person accredited in accordance with the Accreditation Scheme for the Application of the <i>Biodiversity Assessment Method Order 2017</i> under section 6.10 of the BC Act.	Section 1.5, Table 1-4
8.5 The BDAR must include details of the measures proposed to address offset obligations.	Section 12, Table 12-1
8.6 The Proponent must assess any impacts on biodiversity values not covered by the BAM. This includes a threatened aquatic species assessment (Part 7A <i>Fisheries Management Act 1994</i> – FM Act) to address whether there are likely to be any significant effects on listed threatened species, populations or ecological communities listed under the FM Act.	Section 6.4, section 8.6
8.7 The Proponent must identify whether the proposal, or any component of the proposal, would be classified as a Key Threatening Process (KTP) in accordance with the listings in the BC Act, FM Act and <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act).	Section 8.9, Table 8-4





Requirement	Where addressed in this report
10. Water – Hydrology	

10.1	The Proponent must describe (and map) the existing hydrological regime for any surface and groundwater resource (including reliance by users and for ecological purposes) likely to be impacted by the proposal, including rivers, streams, estuaries and wetlands as described in the BAM.	These SEARS are also addressed in: Technical Working Paper 6 – Flooding Technical Working Paper 7 – Groundwater
10.2	The Proponent must prepare a detailed water balance for ground and surface water including the proposed intake from all water supply options and discharge locations (including figures showing these locations), volume, frequency, duration and proposed water conservation measures for both the construction and operation of the project.	Technical Working Paper 8 – Surface Water Quality
10.3	The Proponent must assess (and model if appropriate) the impact of the construction and operation of the proposal and any ancillary facilities (both built elements and discharges) on surface and groundwater hydrology in accordance with the current guidelines, including:	
а	 natural processes within rivers, wetlands, estuaries, marine waters and floodplains that affect the health of the fluvial, riparian, estuarine or marine system and landscape health (such as modified discharge volumes, durations and velocities), aquatic connectivity and access to habitat for spawning and refuge; 	Section 8.6
b	 impacts from any permanent and temporary interruption of groundwater flow, including the extent of drawdown, barriers to flows, implications for groundwater dependent surface flows, ecosystems and species, groundwater users and the potential for settlement; 	Section 8.7
d	 direct or indirect increases in erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses 	Section 8.6

Table 1-2 MDP requirements relevant to this assessment

In accordance with Section 91(1), a major development plan, or a draft of such a plan, must set out:	Where addressed in this report	
91(1)(d) if a final master plan for the airport is in force—whether or not the development is consistent with the final master plan	Section 8.13 and section 9.4	
91(1)(h) the airport-lessee company's assessment of the environmental impacts that might reasonably be expected to be associated with the development; and	Section 8 and section 9: General discussion of construction and operational impacts	
	Section 8.12 and section 9.3: Summary of effects on Commonwealth land	
91(1)(j) the airport-lessee company's plans for dealing with the environmental impacts mentioned in paragraph (h) (including plans for ameliorating or preventing environmental impacts)	Section 11 and section 12	



1.3 The project

1.3.1 Location

The project is located about eight kilometres south of Sydney's central business district and to the north of Sydney Airport on both sides of Alexandra Canal. The northern extent of the project is located at St Peters interchange, which is currently being constructed to the north of Canal Road in St Peters. The western extent of the project is located near the entrance to Sydney Airport Terminal 1 on Airport Drive, to the north of the Giovanni Brunetti Bridge and south-west of Link Road. The eastern extent of the project is located near the intersection of Joyce Drive, Qantas Drive, O'Riordan Street and Sir Reginald Ansett Drive.

The project is located mainly on government owned land in the suburbs of Tempe, St Peters and Mascot, in the Inner West, City of Sydney and Bayside local government areas.

1.3.2 Key design features

The project provides a number of linked road connections to facilitate the movement of traffic between the Sydney motorway network, Sydney Airport Terminal 1 (Terminal 1) and Sydney Airport Terminals 2 and 3 (Terminals 2/3). The project would connect Terminal 1 and Terminals 2/3 with each other and with the Sydney motorway network. The project would also facilitate the movement of traffic towards Port Botany via General Holmes Drive. It would provide three main routes for traffic:

- Between the Sydney motorway network and Terminal 1, and towards M5 motorway and Princes Highway
- Between the Sydney motorway network and Terminals 2/3, and towards General Holmes Drive, Port Botany and Southern Cross Drive
- Between Terminal 1 and Terminals 2/3.

The key features of the project include:

- Road links to provide access between the Sydney motorway network and Sydney Airport's terminals, consisting of the following components:
 - St Peters interchange connection a new elevated section of road extending from St Peters interchange to the Botany Rail Line, including an overpass over Canal Road
 - Terminal 1 connection a new section of road connecting Terminal 1 with the St Peters interchange connection, including a bridge over Alexandra Canal and an overpass over the Botany Rail Line
 - Qantas Drive upgrade and extension widening and upgrading Qantas Drive to connect Terminals 2/3 with the St Peters interchange connection, including a high-level bridge over Alexandra Canal
 - Terminal links two new sections of road connecting Terminal 1 and Terminals 2/3, including a bridge over Alexandra Canal
 - Terminals 2/3 access a new elevated viaduct and overpass connecting Terminals 2/3 with the upgraded Qantas Drive
- Road links to provide access to Sydney Airport land:
 - A new section of road and an overpass connecting Sydney Airport's northern lands either side of the Botany Rail line (the northern lands access)
 - A new section of road, including a signalised intersection with the Terminal 1 connection and a bridge connecting Sydney Airport's existing and proposed freight facility either side of Alexandra Canal (the freight terminal access)
- An active transport link approximately 1.3 kilometres in length along the western side of Alexandra Canal to maintain connections between Sydney Airport, Mascot and the Sydney central business district
- Intersection upgrades or modifications
- Provision of operational ancillary infrastructure including maintenance bays, new and upgraded drainage infrastructure, signage and lighting, retaining walls, noise barriers, flood mitigation basin, utility works and landscaping.





1.3.3 Construction overview

A conceptual construction methodology has been developed based on the preliminary project design to be used as a basis for the environmental assessment process. Detailed construction planning, including programming, work methodologies, staging and work sequencing would be undertaken once construction contractor(s) have been engaged.

1.3.3.1 Timing and work phases

Construction of the project would involve four main phases of work. The indicative construction activities within each phase are outlined below.

Phase	Indicative construction activities
Enabling works	 Construction of the temporary active transport link Modification of various road intersections to facilitate main construction works.
Site establishment	 Installing site fencing, hoarding and signage Establishing construction compounds, work areas and site access routes.
Main construction works	 Clearing/ trimming of vegetation Removal (or partial removal) of a number of buildings and other existing infrastructure eg concrete hardstand areas, drainage infrastructure, sheds, advertising structures, containers, etc Roadworks, including bridge and viaduct construction and drainage works Utility works.
Finishing works	 Erecting lighting, signage and street furniture, landscaping works and site demobilisation and rehabilitation in all areas.

Table 1-3Construction work phases

Specific construction issues which will require careful planning and management and close co-ordination with relevant stakeholders include:

- Works within the prescribed airspace of Sydney Airport
- Works interfacing with the Botany rail line
- Piling in the vicinity of the T8 Airport and South Line underground rail tunnels
- Works within the former Tempe landfill and Alexandra Canal which are subject to remediation orders and specific management plans
- Excavation, storage and handling of contaminated soils generally within the project site and contaminated groundwater from the Botany Sands aquifer.

Construction is planned to start in mid 2020, subject to approval of the project, and is expected to take about three and a half years to complete. Further information on construction is provided in Chapter 8 (Construction) of the EIS.

The project would include work undertaken during recommended standard hours as defined by the *Interim Construction Noise Guideline* (DECC, 2009):

- Monday to Friday: 7am to 6pm
- Saturday: 8am to 1pm
- Sundays and public holidays: no work.

It would also include work outside these hours (out-of-hours work) to minimise the potential for aviation and rail safety hazards.



1.3.3.2 Construction footprint

The land required to construct the project (the construction footprint) is shown on Figure 1-2. The construction footprint includes the land needed to construct the proposed roadways, bridges and ancillary infrastructure and land required for the proposed construction compounds. Utility works to support the project would generally occur within the construction footprint; however, some works (such as connections to existing infrastructure) may be required outside the footprint.

1.3.3.3 Compounds, access and resources

Construction would be supported by five construction compounds located to support the main construction works (shown on Figure 1-2). Construction compounds would include site offices, staff amenities, storage and laydown areas, workshops and workforce parking areas.

Materials would be transported to and from work areas via construction haul routes, which have been selected to convey vehicles directly to the nearest arterial road.

The construction workforce requirements would vary over the construction period based the activities underway and the number of active work areas. The workforce is expected to peak at about 1,000 workers for a period of about 13 months, indicatively from the fourth quarter of 2021. Either side of this peak, workforce numbers are expected to reduce to about two thirds.





Figure 1-2 Construction footprint and facilities





1.4 Structure of this report

The structure of the report is outlined below:

- Section 1 Introduction Provides an introduction to the report
- Section 2 Statutory context Provides the statutory and policy context for the assessment and relevant guidelines
- Section 3 Methodology Describes the methodology for the assessment
- Section 4 Landscape context Describes the landscape context of the project site
- Section 5 Native vegetation Describes vegetation within the project site
- Section 6 NSW Threatened biota Describes threatened species listed under the BC Act and habitat in the project site
- Section 7 Matters of National Environmental Significance Describes relevant Matters of Environmental Significance
- Section 8 Assessment of construction impacts Describes the construction impacts of the project, including a summary of effects on Commonwealth land
- Section 9 Assessment of operation impacts Describes the operational impacts of the project, including a summary of effects on Commonwealth land
- Section 10 Cumulative impacts Discusses the cumulative impacts
- Section 11 Recommended mitigation measures Outlines mitigation measures to minimise impacts
- Section 12 Offsetting Describes the project offset requirements
- Section 13 Conclusion Presents the conclusions of the assessment
- Section 14 References Presents the list of reference documents used in the assessment.

1.5 Personnel

This BDAR was prepared by Mark Stables (accredited assessor number BAAS18097) and Kirsten Crosby (accredited assessor number BAAS17011) in accordance with the BAM. A technical review of the credit calculations was undertaken by Alex Cockerill (accredited assessor number BAAS17020). Staff qualifications are presented in Table 1-4.

Name	Position/Role on project	Qualifications	Relevant experience
Mark Stables	Principal Ecologist (flora) Desktop assessment, site surveys, reporting	BSc (Hons) Accredited BAM Assessor (number BAAS18097)	17+ years
Kirsten Crosby	Senior Ecologist (fauna) Desktop assessment, site surveys, reporting	BSc (Zoology), PhD Accredited BAM Assessor (number BAAS17011)	13+ years
Julia Wylie	Ecologist Desktop assessment, site surveys	BEnv Accredited BAM Assessor (number BAAS18034)	5 years
Malith Weerakoon	Ecologist Desktop assessment, site surveys, reporting	BSc, MPhil (Zoology)	5 years
Josh Cox	Aquatic ecologist Desktop assessment, site surveys, reporting	BEnvSc (Hons)	8 years
Alex Cockerill	Principal Ecologist BAM Calculator review	BSc (Hons) Accredited BAM Assessor (number BAAS17020)	18+ years
Jayne Tipping	Technical Director Biodiversity Technical Review	BSc (Ecology), MEnvLaw	25+ years

Table 1-4 Staff and qualifications





2. Statutory context

2.1 Commonwealth legislation

2.1.1 Airports Act and associated regulations

The project site includes areas of Commonwealth-owned land leased by Sydney Airport Corporation. The Airports Act and associated regulations provide the assessment and approval process for development on Commonwealth-owned land for the operation of Sydney Airport.

Section 89 of the Airports Act specifies types of development that constitute 'major airport development'. A major development plan (MDP) approved by the Australian Minister for Infrastructure, Transport and Regional Development is required before major airport development can be undertaken at a leased airport.

The Airports Act and regulations are the statutory controls for ongoing regulation of development activities on Commonwealth-owned land leased from the Australian Government for the operation of Sydney Airport.

Section 70 of the Airports Act requires there to be a final master plan for the airport that has been approved by the Australian Minister for Infrastructure, Transport and Regional Development.

Part 5 of the Act also requires that each airport develops an environment strategy which is included in its master plan. Once approved, Sydney Airport and all persons who carry out activities at the airport are obliged to take all reasonable steps to ensure compliance with the environment strategy.

The consistency of the project with the Airports Act and associated master plan and environment strategy is provided in section 9.4.

2.1.2 Airports (Environment Protection) Regulations 1997

The objective of the Airports (Environment Protection) Regulations 1997 (the regulations) is to establish a system of regulation for activities at airports that generate or have potential to generate pollution or excessive noise. The regulations impose a general duty to prevent or minimise environmental pollution and have as one of their objects the promotion of improved environmental management practices at Commonwealth-leased airports. The regulations contain detailed provisions setting out:

- Definitions, acceptable limits and objectives for air, water and soil pollution, and offensive noise
- General duties to prevent or minimise pollution, preserve significant habitat and cultural areas, and to prevent
 offensive noise
- Monitoring and reporting requirements for existing pollution.

Part 4, Division 2 of the regulations outlines the general duty to preserve habitat by taking all reasonable and practicable measures to:

- Prevent adverse consequences for the local biota, the ecosystems and habitats of native species
- Prevent adverse consequences for a species or ecological community listed as threatened and migratory under the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act)
- Ensure where there are listed threatened species or ecological communities, operations or other works are not inconsistent with an action intended to lessen the threat to the species or ecological community
- Ensure operations or other works are not inconsistent with an international convention, treaty or other agreement to which Australia is a party and which is applicable to these Regulations.

The consistency of the project with the regulations and associated Master Plan and Environment Strategy is provided in section 9.4.



2.1.3 Sydney Airport Master Plan 2039

As part of the planning framework established by the Airports Act, airport operators are required to prepare a master plan for the coordinated development of their airport. Sydney Airport Master Plan 2039 (Master Plan 2039) outlines the strategic direction for Sydney Airport's operations and development over the next 20 years. It acknowledges that the continued growth of Sydney Airport is vital to achieving local, state and national employment, tourism and development objectives. In accordance with the requirements of the Airports Act, Master Plan 2039:

- Establishes the strategic direction for efficient and economic development at Sydney Airport over the planning period
- Provides for the development of additional uses of the Sydney Airport site
- Indicates to the public the intended uses of the Sydney Airport site
- Reduces potential conflicts between uses of the Sydney Airport site, to ensure that uses of the site are compatible with the areas surrounding the airport
- Ensures that operations at Sydney Airport are undertaken in accordance with relevant environmental legislation and standards
- Establishes a framework for assessing compliance with relevant environmental legislation and standards
- Promotes continual improvement of environmental management at Sydney Airport.

The consistency of the project with the Master Plan 2039 is provided in section 9.4.

2.1.4 Sydney Airport Environment Strategy 2019–2024

The Airports Act requires that airport operators provide an assessment of the environmental issues associated with implementing the airport master plan and the plan for dealing with those issues. This is documented in an environment strategy that forms part of the airport's master plan. The Sydney Airport Environment Strategy 2019–2024 (the Environment Strategy), which forms part of Master Plan 2039, provides strategic direction for the environmental performance and management of Sydney Airport for the five year period between 2019 and 2024. The purpose of the Environment Strategy is to:

- Establish a framework for assessing compliance and ensuring that all operations at Sydney Airport are undertaken in accordance with relevant environmental legislation and standards
- Promote the continual improvement of environmental management and performance at Sydney Airport and build on the achievements and goals of previous strategies
- Realise improvements in environmental sustainability, by minimising Sydney Airport's environmental footprint and working towards a more efficient and resilient airport.

The consistency of the project with the environment strategy is provided in section 9.4.

2.1.5 Environment Protection and Biodiversity Conservation Act 1999

2.1.5.1 Matters of National Environmental Significance

The EPBC Act is administered by the Australian Department of the Environment and Energy (DoEE) and provides a legal framework to protect and manage nationally important flora, fauna, ecological communities and heritage places defined as 'matters of national environmental significance' (MNES).

Under the EPBC Act, proposed actions (ie activities or projects) with the potential to significantly impact matters protected by the EPBC Act must be referred to the Australian Minister for the Environment to determine whether they are controlled actions, requiring approval from the Minister. The following matters are defined as protected matters by Part 3 of the EPBC Act:

- Matters of national environmental significance
- The environment of Commonwealth land
- The environment in general if they are being carried out by an Australian Government agency.





The following MNES are of relevance to this BDAR:

- Threatened species and ecological communities
- Migratory species
- Ramsar wetlands
- The environment of Commonwealth land.

The EPBC Act has been considered in this assessment through:

- Desktop review to determine the listed biodiversity matters that are predicted to occur within the locality of the project and hence could occur, subject to the habitats present
- Targeted field surveys for listed threatened biota and migratory species
- Assessment of potential effects on MNES, plants and animals as a component of the environment of Commonwealth land, including assessments of significance in accordance with the EPBC Act significant impact guidelines (Department of the Environment 2013) where relevant
- Identification of suitable impact mitigation and environmental management measures for threatened and migratory biota, where relevant
- Identification of the need or otherwise for biodiversity offsets for effects on listed biodiversity matters.

2.1.5.2 Authorisation of a Major Development Plan

Section 160(1) of the EPBC Act requires that 'before a Commonwealth agency or employee of the Commonwealth gives an authorisation (however described) of an action described in subsection (2), the agency or employee must obtain and consider advice from the Minister in accordance with this Subdivision.' Section 160(2) includes '(c) the adoption or implementation of a major development plan (as defined in the Airports Act 1996)'.

In accordance with Section 161(1), actions where advice from the Minister is required must be referred to the Australian Minister for the Environment. Section 162 provides the requirements for assessment of an action referred under Section 161(1).

Section 163(1) requires the Minister to give the following advice:

- (a) whether the agency or employee should give the authorisation;
- (b) what conditions (if any) should be attached to the authorisation (if possible) to protect the environment;
- (c) any other matter relating to protection of the environment from the action.

As part of the assessment of the draft MDP, the Department of Infrastructure, Transport, Cities and Regional Development will, on behalf of the Minister for Infrastructure, Transport and Regional Development, seek advice from the Australian Minister for the Environment under Section 160 of the EPBC Act.

2.2 NSW legislation

2.2.1 Environmental Planning and Assessment Act 1979

Parts of the project in State jurisdiction are declared State significant infrastructure. This is regulated under the EPA Act, which requires proponents to apply to the NSW Minister of Planning and Public Spaces for infrastructure approval, supported by an EIS.

The SEARs for the project define the matters to be addressed in the EIS, including biodiversity assessment requirements under the BC Act, FM Act and the EPBC Act.



2.2.2 Biodiversity Conservation Act 2016 and Biodiversity Conservation Regulation 2017

State significant infrastructure applications are subject to biodiversity assessment requirements under the BC Act. The BC Act, together with the Biodiversity Conservation Regulation 2017, provides a mechanism to address effects on biodiversity values associated with development impacts. Under this legislation, there are provisions for a Biodiversity Offsets Scheme (BOS), which includes a framework to avoid, minimise and offset impacts of development on biodiversity. Section 6.12 of the BC Act details the requirements for a Biodiversity Development Assessment Report (BDAR) (see Table 2-1). The regulation provides further guidance on what needs to be incorporated in a BDAR, including Clause 6.8 which outlines the details needed regarding credit requirements and offsetting, as well as accreditation and qualifications of the person preparing the report.

Where addressed in this report Requirement 6.12 Biodiversity development assessment report This report 1. For the purposes of the biodiversity offsets scheme, a biodiversity development assessment report is a report prepared by an accredited person in relation to proposed development or activity that would be authorised by a planning approval, or proposed clearing that would be authorised by a vegetation clearing approval, that: assesses in accordance with the biodiversity assessment method the a) Section 4, 5 and 6 biodiversity values of the land subject to the proposed development, activity or clearing, and assesses in accordance with that method the impact of proposed Section 8 and 9 b) development, activity or clearing on the biodiversity values of that land, and Section 8.2 and 11 sets out the measures that the proponent of the proposed c) development, activity or clearing proposes to take to avoid or minimise the impact of the proposed development, activity or clearing, and Section 12.2 d) specifies in accordance with that method the number and class of biodiversity credits that are required to be retired to offset the residual impacts on biodiversity values of the actions to which the biodiversity offsets scheme applies.

Table 2-1Requirements for a BDAR

2.2.2.1 Biodiversity Offset Scheme and Biodiversity Assessment Method

The aim of the BOS is to provide a transparent, consistent and scientifically based approach to biodiversity assessment and offsetting. It also allows for the establishment of biodiversity stewardship agreements, which are in-perpetuity agreements entered into by landholders, to secure offset sites and generate biodiversity credits, which can be used to offset impacts of development. The aim of the BOS is to ensure that the impacts of development, clearing or biodiversity certification will result in no net loss of biodiversity.

The BAM was established by Office of Environment and Heritage (OEH, now part of the Department of Planning, Industry and Environment) as a standard method to implement the aims of the BOS and to address the loss of biodiversity and threatened species. The scheme creates a market framework for the conservation of biodiversity values and the offsetting of development impacts. It also provides the mechanisms to offset impacts of development, clearing or biodiversity certification such that there is no loss of biodiversity values.





The BAM sets out how biodiversity values will be assessed, prescribes requirements to avoid and minimise impacts, establishes rules for calculating the number and class of credits required for unavoidable impacts, and determines the trading rules that will apply. The method includes a software package known as the Biodiversity Assessment Method Calculator (the credit calculator) which processes site survey and assessment data. The credit calculator specifies the type and extent of surveys required for a biodiversity assessment and then processes survey data to calculate the number and type of biodiversity credits that are either required at a development site or will be generated at a stewardship site. The BAM must be applied by a person accredited under the BC Act.

The Biodiversity Conservation Trust Fund (BCTF) ensures that landowners have the funds needed to carry out the management actions required each year and provides a financial incentive to landowners to carry out those actions. The scheme is administered by OEH and ensures accountability and compliance through legislation, regular reporting requirements and financial measures. Under certain circumstances a developer may make a payment directly into the BCTF to offset the impacts of a proposed development in lieu of purchasing and retiring biodiversity credits. The Biodiversity Conservation Trust must then use funds in the BCTF to purchase and retire appropriate biodiversity credits.

The BOS and BAM have been addressed in accordance with the project SEARs through the preparation of this BDAR by accredited assessors.

2.2.3 Fisheries Management Act 1994

The objects of the *Fisheries Management Act 1994* (FM Act) are 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, listing of 'Key Threatening Processes' and the requirements or otherwise for the preparation of a Species Impact Statement.

One of the objectives of the FM Act is to 'conserve key fish habitats', which includes aquatic habitats that are important to the maintenance of fish populations generally and the survival and recovery of threatened aquatic species. The NSW Department of Primary Industries (DPI, now part of the Department of Planning, Industry and Environment) has a 'no net loss' habitat policy which may require proponents to conduct habitat rehabilitation and/or provide environmental compensation. To assist in the protection of key fish habitats, the *Policy and guidelines for fish habitat conservation and management* (DPI 2013) was produced. This policy applies to the following developments, works or activities, each of which can impact key fish habitat:

- Dredging or reclamation
- Impeding fish passage
- Damaging marine vegetation (which includes mangroves and seagrass)
- De-snagging.

This report assessed the potential effects on key fish habitat associated with Alexandra Canal and potential effects on threatened species (section 6.4).

2.2.4 Biosecurity Act 2015

The *Biosecurity Act 2015* provides for risk-based management of biosecurity in NSW. It provides a statutory framework to protect the NSW economy, environment and community from the negative impact of pests, diseases and weeds.

The primary object of the Act is to provide a framework for the prevention, elimination and minimisation of biosecurity risks posed by biosecurity matter, dealing with biosecurity matter, carriers, potential carriers and other activities that involve biosecurity matter.

In NSW, all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, and knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

Priority weeds recorded in the project site and their control measures are detailed in section 5.4.



2.3 Assessment guidelines and information used in this report

This report has been prepared in accordance with the BAM and with reference to the following guidelines:

- NSW Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Working Draft) (DEC 2004).
- NSW Guide to Surveying Threatened Plants (OEH 2016).
- Survey guidelines for Australia's threatened frogs: Guidelines for detecting frogs listed as threatened under the EPBC Act (DEWHA 2010).
- Significant impact guidelines for the vulnerable green and golden bell frog (Litoria aurea) (DEWHA 2009).
- Policy and Guidelines for Fish Habitat Conservation and Management (DPI 2013).
- Significant impact guidelines 1.1 Matters of National Environmental Significance (DotE 2013).
- Significant impact guidelines 1.2 Actions on, or impacting upon, Commonwealth land and Actions by Commonwealth Agencies (DSEWPC 2013).
- EPBC Act Policy Statement 3.21: Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species (DoEE 2017b).

Additional references are provided in sections 3.1 and 14.





3. Methodology

3.1 Background research

Background research was undertaken to identify:

- Landscape-scale features of the project site in accordance with Section 4.2 of the BAM (OEH 2017a)
- Site context of the project site that includes assessing vegetation cover and patch size as required under Subsections 4.3.2 and 5.3.2 of the BAM (OEH 2017)
- The likely distribution of native vegetation and threatened ecological communities, based on previous mapping and aerial photograph interpretation, for targeted field verification as required under Section 5 of the BAM (OEH 2017)
- A list of predicted and candidate threatened and migratory species as well as populations of flora and fauna to assess the habitat suitability and threatened biodiversity data collection as required under Section 6 of the BAM (OEH 2017), the FM Act and the EPBC Act
- Evaluate baseline information to determine whether additional surveys, mapping and reporting is required to support project approval.

The background research included analysis of the following information sources:

- Threatened species database searches outlined in Table 3-1 and compiled in Appendix A
- Aerial photographic imagery (LPI 2018a)
- NSW Mitchell Landscapes (LPI 2018b)
- Interim Biogeographic Regionalisation of Australia (IBRA version 7.0) (DoEE 2016)
- Atlas of Groundwater Dependent Ecosystems (GDE) (Australian Bureau of Meteorology 2018)
- Directory of Important Wetlands of Australia (DIWA DoEE 2019a)
- State Environmental Planning Policy (Coastal Management) 2018 Coastal Wetlands (DPE 2018)
- Priority weed listings for the Greater Sydney region (DPI 2018)
- The Native Vegetation of the Sydney Metropolitan Area (OEH 2016b)
- Native vegetation of Southeast NSW: A Revised Classification and Map for the Coast and Eastern Tablelands (Tozer et al. 2010)
- Sydney Gateway Green and Golden Bell Frog Surveys 2017/2018. Report prepared for Roads and Maritime Services (SMEC 2018)
- Sydney Gateway Program Preliminary environmental investigation. December 2017. Report prepared for Roads and Maritime Services (SMEC 2017)
- WestConnex Enabling Works Airport East Precinct: Biodiversity Assessment. Report prepared for Roads and Maritime Services (SMEC 2014)
- Sydney Airport Master Plan 2033 and 2039 (Sydney Airport Corporation 2013a, 2018a), and the Sydney Airport Environment Strategy 2014–2018 and 2019–2024 (Sydney Airport Corporation 2013b, 2018b)
- Local government biodiversity strategies (Rockdale Council 2014; AMBS 2011)
- Citizen science databases/apps used for recording species and that may not be included in the BioNet database (eg eBird by The Cornell Lab, which includes data from the 'Tempe Birdos')
- Review of other technical working papers prepared for the EIS (eg. groundwater, flooding and surface water quality).



Database	Search date	Area searches	Reference
PlantNET spatial search	July 2019	5 km radius centred on the suburb of Mascot	RBGT (2019)
BioNet Atlas species sighting search	July 2019	10 km x 10 km centred on the project site	OEH (2019b)
EPBC Protected Matters Search Tool	July 2019	10 km x 10 km centred on the project site	DoEE (2019d)
NSW Department of Primary Industries (Fishing and Aquaculture) spatial data search	July 2019	Local waterways	DPI (2019a)

Table 3-1 Threatened and migratory species database searches

3.2 Terrestrial flora surveys

Threatened terrestrial flora surveys were undertaken over a four-day period on the 14 September, 15 November, 5 and 17 December 2018 in the study area (the project site and adjoining areas potentially subject to indirect impacts). Surveys focused on the mapping of native and non-native vegetation types and targeting the possible presence of threatened flora species using a combination of vegetation integrity plots, random meanders and parallel field traverses generally in accordance with the NSW Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Working Draft) (DEC 2004), NSW Guide to Surveying Threatened Plants (OEH 2016a) and the BAM (OEH 2017). A detailed overview of terrestrial flora survey methods is presented below.

3.2.1 Nomenclature

Names of vegetation communities used in this report are based on the Plant Community Type (PCT) used in the NSW BioNet Vegetation Classification Database (OEH 2019a).

PCTs are cross-referenced with those used for threatened ecological communities listed under the BC Act and/or the EPBC Act.

Names of plants used in this document follow PlantNET (RBGT 2019). Scientific names are used in this report for the identification of plant species. Scientific and common names (where available) are provided in the species results provided in Appendix C. The names of introduced species are denoted with an asterisk (*).

The names of threatened plant species used in the Threatened Species Profile Database (OEH 2019e) are also provided in Appendix A where these differ from the names used in the PlantNET database.

3.2.2 Stratification and verification of existing vegetation mapping

Preliminary mapping of vegetation community boundaries was undertaken through analysis of existing vegetation mapping and aerial photograph interpretation.

Vegetation within the project site and locality has been mapped at the regional scale in:

- Native vegetation of the Southeast NSW: Revised Classification and Map for the Coast and Eastern Tablelands (Tozer et al. 2010)
- The Native Vegetation of the Sydney Metropolitan Area (OEH 2016b).

Refined vegetation mapping within the project site was also undertaken as part of the Preliminary Environmental Investigation (SMEC 2017).

Analysis of aerial photographs was used to identify areas of disturbance (eg buildings, vehicle tracks, dams and power lines), vegetation structure and likely native versus exotic species composition throughout the project site. This provided an initial definition of vegetation communities into simple structural and disturbance classifications for verification during field surveys.





Data on geology, dominant canopy species, native species richness, vegetation structure and condition was collected across the project site during field surveys to validate and refine this existing vegetation classification to determine their associated PCT in accordance with the BioNet Vegetation Classification System (OEH, 2019a).

3.2.3 Mapping of vegetation zones

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

The vegetation broad condition states which were applied to determine vegetation zones within the project site are summarised in Table 3-2. These factors were defined by using features such as levels of disturbance, weed invasion and resilience.

Condition category	Description
Good	Vegetation still retains the species complement and structural characteristics. The vegetation displays resilience to weed invasion due to intact groundcover, shrub and canopy layers. Native species diversity is relatively high. Weeds may exist in this vegetation type but exhibit <10% foliage cover.
Moderate	Vegetation has retained a native canopy but the understorey and groundcover layers are generally co-dominated by exotic species that exhibit between 10–40% foliage cover. The mid and low stratums may have been structurally modified because of previous clearing.
Poor	Vegetation has retained a native canopy or the canopy cover is showing signs of regeneration. The understorey and groundcover layers are generally dominated or co-dominated by exotic species that exhibit >40% foliage cover or exhibit low native species richness. Native species diversity is generally relatively low and the mid and low stratums have been structurally modified due to weed incursions or clearing. Small linear isolated patches of vegetation that is subject to high edge area ratio are also assigned to this vegetation class.
Low	Native vegetation generally lacking a native over-storey and where either less than 50% of ground cover vegetation is indigenous species, or greater than 90% of ground cover vegetation is cleared.
	For native grassland, wetland or herbfield where either less than 50% of ground cover vegetation is indigenous species, or more than 90% of ground cover vegetation is cleared.

Table 3-2Vegetation broad condition states



3.2.4 Vegetation integrity plots

A total of six vegetation integrity plots were completed as outlined in the BAM and as described below. A schematic diagram illustrating the layout of each vegetation integrity plot is provided in Figure 3-1.



Figure 3-1 Schematic diagram illustrating the layout of the nested 20 metre x 20 metre and 20 metre x 50 metre plot used for the assessment of vegetation integrity at each plot location

The following site attributes were recorded at each vegetation integrity plot location:

- Location (easting northing grid type MGA 94, Zone 56).
- Vegetation structure, dominant species and vegetation condition. Vegetation structure was recorded through estimates of percentage foliage cover, average height and height range for each vegetation layer.
- Native and exotic species richness (within a 400 metre squared quadrat): This consisted of recording all species by systematically walking through each 20 metre x 20 metre quadrat. The cover and abundance (percentage of area of quadrat covered) of each species was estimated. The growth form, stratum/layer and whether each species was native/exotic/high threat weed was also recorded.
- Number of trees with hollows (1,000 metre squared quadrat): This was the frequency of hollows within living and dead trees within each 50 metre x 20 metre quadrat. A hollow was only recorded if (a) the entrance could be seen; (b) the estimated entrance width was at least 5 cm across; (c) the hollow appeared to have depth; (d) the hollow was at least 1 metre above the ground and the (e) the centre of the tree was located within the sampled quadrat.
- Number of large trees and stem size diversity (1,000 metre squared quadrat): tree stem size diversity was calculated by measuring the diameter at breast height (DBH) (ie 1.3 metres from the ground) of all living trees (>5 centimetre DBH) within each 50 metre x 20 metre quadrat. For multi-stemmed living trees, only the largest stem was included in the count. Number of large trees was determined by comparing living tree stem DBH against the PCTs' benchmarks.
- Total length of fallen logs (1,000 metre squared quadrat): This was the cumulative total of logs within each 50 metre x 20 metre quadrat with a diameter of at least 10 centimetres and a length of at least 0.5 metres.
- Litter cover: This comprised estimating the average percentage groundcover of litter (ie leaves, seeds, twigs, branchlets and branches with a diameter <10 centimetres which are detached from a living plant) from within five 1 metre x 1 metre sub-plots spaced evenly either side of the 50 metre central transect.
- Evaluation of regeneration: This was estimated as the presence/absence of overstorey species present at the site that was regenerating (ie saplings with a diameter at breast height ≤5 centimetres).

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





A comparison of the number of BAM survey plots that were completed and the required BAM plots per vegetation zones is provided in Table 3-3.

Vegetation integrity plot locations and orientations are provided in Table 3-4 and illustrated in Figure 3-2.

Table 3-3Comparison of number of plots required under the BAM and completed per vegetation
zone

Vegetation type and zone	Vegetation zone area (ha)	BAM plot required	Number of plots completed
VZ1 – PCT 920 Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion – Poor condition	0.04	1	1 (Q6)
VZ2 – PCT 1232 Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion – Low condition	0.87	1	2 (Q2, Q5)
VZ3 – Miscellaneous ecosystem – highly disturbed areas with no or limited native vegetation	18.29	0	1 (Q1)
VZ4 – Miscellaneous ecosystem – urban exotic / native landscape plantings	4.85	0	2 (Q3, Q4)

Table 3-4 Location and orientation of vegetation integrity plots completed within the project site

Plot ID	Vegetation type and zone	Easting	Northing	Orientation (°)	
Q1	VZ3 – Miscellaneous ecosystem – highly disturbed areas with no or limited native vegetation	330684	6244542	120°	
Q2	VZ2 – PCT 1232 Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion – Low condition	330676	6244627	190°	
Q3	VZ4 – Miscellaneous ecosystem – urban exotic / native landscape plantings	330370	6244217	230°	
Q4	VZ4 – Miscellaneous ecosystem – urban exotic / native landscape plantings	330518	6244333	230°	
Q5	VZ2 – PCT 1232 Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion – Low condition	331441	6245384	165°	
Q6	VZ1 – PCT 920 Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion – Poor condition	331061	6244871	138°	

At each vegetation integrity plot, a 30-minute targeted threatened flora search was also undertaken for each candidate species (refer section 3.2.8) that were considered to have potential habitat in the sampled vegetation type.



3.2.5 Random meander survey

Random meander surveys are a variation of the transect type survey and were completed in accordance with the technique described by Cropper (1993), whereby the recorder walks in a random meander throughout the project site recording dominant and key plant species (eg threatened species, priority weeds), boundaries between various vegetation communities and condition of vegetation. The time spent in each vegetation community was generally proportional to the size of the community and its species richness. These were undertaken in areas of highly disturbed vegetation and urban exotic vegetation.

Random meander surveys were undertaken to locate candidate threatened species and populations (see section 3.2.8) within area of suitable habitat (all patches of PCT 920, PCT 1232).

3.2.6 Parallel field traverses

Parallel field traverses followed methods outlined in the NSW Guide to Surveying Threatened Plants (OEH 2016a). These involved two people walking a fixed bearing transect at five metre intervals over known or high likelihood potential habitat for candidate threatened flora species (see section 3.2.8). These were restricted to areas of native vegetation associated with PCT 1232.

3.2.7 Threatened flora likelihood of occurrence assessment

Threatened flora species and populations subject to likelihood of occurrence assessments were those identified during the background research, BAM calculator candidate and predicted species lists and any additional species considered to have the potential to occur in the professional opinion of contributors to this assessment.

The likelihood of occurrence assessment was utilised to produce a candidate species list to inform appropriate targeted surveys. The assessment was based on the habitat profile for the species and other habitat information in the Threatened Species Profile Database (OEH 2019a) and the Species Profile and Threats Database (DoEE 2019c).

The assessment also included consideration of the dates and locations of nearby records and information about species distribution and populations in the locality along with key habitat requirements such as:

- Associated native plant community types and taxa
- Topographic, soil or geological preferences
- Microhabitats (eg preference for rocky outcrops, ground soaks or tree canopies)
- Disturbance, such as fire history, and the level and type of disturbance (eg slashing, canopy removal).

For this study, the likelihood of occurrence of threatened flora species and populations was determined based on the criteria outlined in Table 3-5.





Likelihood	Criteria
Known	The species was observed in the project site either during the current survey or during another survey less than five years prior; assuming no significant change in conditions on site (eg vegetation clearing, fire).
High	A species has a high likelihood of occurrence if:
	 The project site contains or forms part of a large area (> 1 ha) of high quality suitable habitat that has not been subject to recent disturbance (eg fire), the species is known to form a persistent soil seedbank and the species has been recorded recently (within 10 years) in the locality
	 The species is a cryptic flowering species that has been recorded recently (within 10 years) in the locality and has a large area (> 1 ha) of high quality potential habitat on site that was not seasonally targeted by surveys.
Moderate	A species has a moderate likelihood of occurrence if:
	 It has a small area (< 1 ha) of high quality suitable habitat or a large area (> 1 ha) of marginal habitat in the project site that has not been subject to recent disturbance (eg fire)
	 It is known to form a persistent soil seedbank
	 It has been recorded recently (within 10 years) in the locality.
	The species is a cryptic flowering species, with a small area of high quality potential habitat (< 1 ha) or a large area of marginal habitat on site (> 1 ha), that was not seasonally targeted by surveys.
Low	A species has a low likelihood of occurrence if:
	 the species' potential habitat is of high quality but is small in area (< 1 ha) and it is not a cryptic species nor a species known to have a persistent soil seedbank or
	the species' potential habitat is marginal and the species has not been recorded in the locality.
None	Potentially suitable habitat is absent from the project site.

Table 3-5 Likelihood of occurrence criteria for terrestrial threatened flora species and populations

3.2.8 Candidate terrestrial threatened flora species and survey effort

Two threatened flora species were identified as either having a moderate or higher likelihood of occurrence or were identified by the BAM calculator and hence were identified as candidate species that were the focus of detailed targeted surveys (Appendix B and Appendix E). A summary of survey effort for each candidate threatened flora species is outlined in Table 3-6.

Table 3-6	Candidate	terrestrial	threatened	flora	species si	urvey effort
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Scientific name	Common name	Status ¹	Potential habitat ²	Seasonal survey requirements	Recommended survey effort / species notes	Survey effort expended
Melaleuca biconvexa	Biconvex Paperbark	V	PCT 1232	All year	An easily identifiable species that does not have any seasonal survey restrictions	Targeted surveys were completed in PCT 1232 during September, November and December 2018
Wilsonia backhousei	Narrow-leafed Wilsonia	V	PCT 1232	All year	Plants cannot be observed unless water level is 'low'	Targeted surveys were completed in PCT 1232 during September, November and December 2018

(1) V = Vulnerable, E = Endangered as listed under the BC Act

(2) BioNet ecological data (accessed 19/12/2018)

3.3 Terrestrial fauna surveys

Threatened terrestrial fauna surveys were undertaken over nine days or evenings in the study area on the 26 June, 12 and 14 September, 3, 10, 11, 18 and 30 October and 29 November 2018. A summary of methods is provided below.

3.3.1 Habitat assessment

Fauna habitat assessments were undertaken throughout the project site, including active searches for potential shelter, basking, roosting, nesting or foraging sites. Specific habitat features and resources such as water bodies, food trees, the density of understorey vegetation, the composition of ground cover, the soil type, presence of hollow-bearing trees, leaf litter and ground debris were noted.

Habitat assessments included searches for resources of potential value to threatened fauna, including:

- Wetlands, ponds and drains that could provide habitat for frogs, particularly the Green and Golden Bell Frog (*Litoria aurea*)
- Mudflats suitable for foraging by threatened and migratory waders
- Trees with bird nests or other potential fauna roosts (with a particular focus on searching for raptor nests or hollows suitable for owls and large cockatoos)
- Specific food trees
- Rocky outcrops and ground debris.

Evidence of fauna species included searches for:

- Distinctive scats or latrine sites, owl white wash and regurgitated pellets under roost sites
- Tracks or animal remains
- Evidence of activity such as feeding scars, scratches and diggings
- Evidence of foraging.

3.3.2 Fauna surveys

Fauna surveys were undertaken over various months for the project. Fauna surveys undertaken through the project site included:

- General diurnal surveys undertaken by two ecologists along the rail corridor adjacent to Qantas Drive on 26 June 2018
- General diurnal surveys undertaken by two ecologists at the Tempe Lands on 12 and 14 September 2018
- Inspection of the footbridge for guano and dusk observation of the footbridge over Alexandra Canal for emerging microbats on 12 September 2018
- An early morning bird survey undertaken by two ecologists at the Tempe Lands on 14 September 2018
- Microbat ultrasonic echolocation call recordings (Anabat surveys) undertaken at Alexandra Canal and Tempe Wetland on 12 and 13 September 2018. The anabats were left to record overnight and collected on the morning of the 14 September 2018. In addition, an anabat was also placed in the rail corridor on the night of June 26 2018 adjacent to Qantas Drive
- Spotlighting and call playback for the Green and Golden Bell Frog at Tempe Reserve and Alexandra Canal on 12 September 2018, and three additional nights of spotlighting and call playback at Tempe Reserve and the Botany Wetlands on 10, 11 and 18 October 2018 (see section 1.3.3.2.1)
- Fauna surveys by one ecologist at various locations in Alexandria and Mascot on 29 November 2018.





Opportunistic and incidental observations of fauna species were recorded at all times during field surveys. Casual fauna observations were made in suitable areas of habitat throughout the course of the survey and while incidentally traversing the project site. This included visual inspection of trees and woody debris, active searches for small fauna and opportunistic observation of scats, tracks, burrows or other traces.

3.3.2.1 Targeted Green and Golden Bell Frog surveys

Targeted surveys for the Green and Golden Bell Frog were undertaken to build on earlier surveys for this species undertaken in the project site by SMEC (2014, 2018). Surveys are summarised in Table 3-7 and discussed below.

Targeted surveys for the Green and Golden Bell Frog were undertaken by SMEC (2018) in summer 2017 and summer/autumn 2018 to inform planning for the Sydney Gateway project. Surveys were undertaken at Mill Pond (about 500 metres south-east of the project site) and a reference site at Barton Park/Eve Street in Arncliffe (about 800 metres south-west of the project site) where the species is known to occur in February 2017. Surveys were also undertaken at Tempe Wetland (adjacent to the project site), Alexandra Canal (within the project site) and Mill Pond as well as the reference site in Barton Park in late summer and autumn 2018. Due to access constraints in 2018, no additional nocturnal surveys were undertaken at Mill Pond. Rather, SMEC surveyed for tadpoles and basking frogs during the day at this location. Surveys by SMEC were undertaken where possible in accordance with the EPBC Act survey guidelines (DECCW 2010a), however, survey conditions were not ideal given the lack of ongoing rainfall. SMEC (2018) concluded that the Green and Golden Bell Frog was unlikely to be present, due to the lack of evidence of the species, presence of Mosquitofish and high levels of disturbance and pollution (SMEC 2018).

Surveys for the Green and Golden Bell Frog were also undertaken by SMEC at a small wetland between the rail corridor, Botany Road, Mill Pond Road and General Holmes Drive for the WestConnex Enabling Works (SMEC 2013), which is located south of the Sydney Gateway road project extent. This small wetland has only a tenuous connection to the larger Botany Wetlands. Surveys were undertaken over two nights in December 2013. Little rain had fallen in the week prior, however there had been wet conditions in mid-November 2013. Given the small area of the wetland, the lack of suitable fringing habitat and its relative isolation from proximate habitat, SMEC (2013) considered it reasonably unlikely that the Green and Golden Bell Frog would be present at this location. Given the small size of the pond, its isolation from nearby wetland areas and lack of any evidence of the Green and Golden Bell Frog at the more extensive Botany Wetland, no additional surveys were considered necessary at this small pond.

Further surveys were undertaken in September and October 2018 by GHD ecologists to further confirm the absence of the species in the project site and surrounds. These included diurnal and nocturnal surveys at Tempe Wetland, Botany Wetland (Eastlake golf course) and Mill Pond. No surveys of the Marsh Street or Eve Street wetland reference populations were undertaken in spring 2018 due to the low numbers of individuals persisting at these sites (A. Robinson, A. White pers. com.). Rather, calling by Green and Golden Bell Frogs during September and October at Kooragang Island was confirmed with Michael Mahony of the University of Newcastle, although he noted there was little calling on the night of 10 October 2018. Weather had continued to be dry over winter, however heavy rainfalls occurred in early September and early October.

Where possible surveys have been undertaken in accordance with the EPBC Act survey guidelines (DEWHA 2009), which recommend surveys are conducted:

- Between September and March
- Within one week of heavy rainfall (>50 millimetres in seven days)
- On warm and windless nights
- Over four nights in ideal conditions.

Survey timing, locations, effort and weather conditions (Sydney Airport) during and prior to the SMEC and GHD surveys are detailed in Table 3-7 and Figure 3-2. Given the generally dry conditions experienced in Sydney in the last few years, not all surveys met all the recommended conditions. Most of the recent surveys have, however, occurred after very heavy rainfall events and included surveys on warm and windless nights, and have generally met the DEWHA (2009) survey requirements. Given the large number of separate surveys over many months and years, this survey effort is considered reasonable to ascertain species presence/absence.


Date	Min. temp. (°C)	Max. temp. (°C)	Rainfall (mm)	Rainfall over 7 days prior to survey (mm)	Survey locations	Survey effort expended	Frog species recorded
27 February	17.4	24.8	2.2	58.4	Barton Park (reference site)	~1.5 person hours (spotlighting, call playback)	Striped Marsh Frogs (calling)
2018					Tempe Wetland Alexandra Canal	~2.5 person hours (spotlighting, call playback)	Peron's Tree Frog Dwarf Eastern Tree Frog Striped Marsh Frog Common Eastern Froglet (all calling)
7 March 2018	18.7	25.6	3.4	8.4	Barton Park (reference site)	~1.5 person hours (spotlighting, call playback)	Peron's Tree Frog Striped Marsh Frogs (calling)
					Tempe Wetland Alexandra Canal	~3 person hours (spotlighting, call playback)	Peron's Tree Frog Dwarf Eastern Tree Frog Striped Marsh Frog Common Eastern Froglet (all calling)
20 March	20.1	26.3	0	61.8	Barton Park (reference site)	~1.5 person hours (spotlighting, call playback)	Striped Marsh Frog
2018					Tempe Wetland Alexandra Canal	~3 person hours (spotlighting, call playback)	Peron's Tree Frog Dwarf Eastern Tree Frog (calling) Striped Marsh Frog (calling)
28 March	16.9	28.4	0	36.2	Barton Park (reference site)	~1.5 person hours (spotlighting, call playback)	No frogs detected
2018					Tempe Wetland Alexandra Canal	~3 person hours (spotlighting, call playback)	Peron's Tree Frog (not calling) Dwarf Eastern Tree Frog (calling) Striped Marsh Frog (calling)
5 April 2018	18.8	28.8	0	3.6	Mill Pond	2 person hours (dip-netting, diurnal searches)	No frogs detected

Table 3-7Targeted Green and Golden Bell Frog surveys

Sydney Gateway Road Project Technical Working Paper 14 – Biodiversity Development Assessment Report

Date	Min. temp. (°C)	Max. temp. (°C)	Rainfall (mm)	Rainfall over 7 days prior to survey (mm)	Survey locations	Survey effort expended	Frog species recorded	
8 April 2018	13.1	25.0	0	0.0	Mill Pond	2 person hours (dip-netting, diurnal searches)	No frogs detected	
12 September 2018	12.8	26.9	0	36.2	Tempe Wetland	2 person hours (spotlighting, call playback)	Peron's Tree Frog Dwarf Eastern Tree Frog Striped Marsh Frog Common Eastern Froglet (all calling)	
10 October 2018	15.9	17.4	0	64.4	Botany Wetland, Mill Stream	3 person hours (spotlighting, call playback)	Common Eastern Froglet (calling)	
					Tempe Wetland	1 person hour (spotlighting, call playback)	Peron's Tree Frog Dwarf Eastern Tree Frog Striped Marsh Frog Common Eastern Froglet (all calling)	
11 October 2018	12.1	17.7	8.4	64.4	Botany Wetland, Mill Stream	3 person hours (spotlighting, call playback)	Common Eastern Froglet Dwarf Eastern Tree Frog (all calling)	
					Tempe Wetland	1 person hour (spotlighting, call playback)	Peron's Tree Frog Dwarf Eastern Tree Frog Striped Marsh Frog Common Eastern Froglet (all calling)	

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Date	Min. temp. (°C)	Max. temp. (°C)	Rainfall (mm)	Rainfall over 7 days prior to survey (mm)	Survey locations	Survey effort expended	Frog species recorded
18 October 17.4 25.5 8.6 2018 1		38.6	Botany Wetland, Mill Stream	3 person hours (spotlighting, call playback)	Common Eastern Froglet Peron's Tree Frog Dwarf Eastern Tree Frog (all calling)		
		Tempe Wetland	1 person hour (spotlighting, call playback)	Peron's Tree Frog Dwarf Eastern Tree Frog Striped Marsh Frog Common Eastern Froglet (all calling)			
30 October 2018	15.4	26.7	0	2.8	Botany Wetland, Mill Stream	3 person hours (spotlighting, call playback)	Common Eastern Froglet Peron's Tree Frog Dwarf Eastern Tree Frog (all calling)
					Tempe Wetland	1 person hour (spotlighting, call playback)	Peron's Tree Frog Dwarf Eastern Tree Frog Striped Marsh Frog Common Eastern Froglet (all calling)



3.3.2.2 Bat call analysis

Microbat surveys comprised a combination of Anabat detectors, inspection of the footbridge over Alexandra Canal for guano and dusk observation of the footbridge for emerging microbats. Anabat surveys were undertaken at one location in the rail corridor on the night of June 26, Tempe Wetland and Alexandra Canal on 12 and 13 September and Botany Wetland (outside the project site) on 26 June, and 18 and 30 October 2018.

The recorded calls of microchiropteran bats were identified using zero-crossing analysis and AnalookW software (version 4.2n, Chris Corben 2017) by visually comparing the time-frequency graph and call characteristics (eg characteristic frequency and call shape) with reference calls and/or species call descriptions from available reference material.

The 'Bat calls of NSW: Region based guide to the echolocation calls of microchiropteran bats' (Pennay et al. 2004) was used to assist call analysis. Call identification was also assisted by consulting distribution information for possible species (Churchill 2008). No reference calls were collected during the survey.

A call (pass) was defined as a sequence of three or more consecutive pulses of similar frequency and shape. Calls with less than three defined consecutive pulses of similar frequency and shape were not unambiguously identified to a species but were used as part of the activity count for the survey area. Due to variability in the quality of calls and the difficulty in distinguishing some species the identification of each call was assigned a confidence rating (see Mills et al. 1996 & Duffy et al. 2000) as summarised in Table 3-8. Due to the absence of reference calls from the project site, high level of variability within a bat call and overlap in call characteristics between some species, a conservative approach was taken when analysing calls.

Species nomenclature follows Van Dyck et al. (2013) and Reardon et al. (2014).

Identification	Description
D – Definite	Species identification not in doubt.
PR – Probable	Call most likely to represent a particular species, but there exists a low probability of confusion with species of similar call type or call lacks sufficient detail to allow definite species identification.
SG – Species Group	Call made by one of two or more species. Call characteristics overlap making it too difficult to distinguish between species eg.
	Chalinolobus gouldii /Mormopterus ozimops sp.
	<i>Nyctophilus</i> sp. The calls of <i>Nyctophilus geoffroyi / gouldi</i> cannot be distinguished during the analysis process and are therefore lumped together.
	<i>Nyctophilus sp/Myotis Macropus.</i> The calls of these species can be easily confused during the analysis process and are therefore often lumped together.

Table 3-8 Confidence ratings applied to bat calls

3.3.3 Threatened fauna likelihood of occurrence assessment

Threatened fauna species and populations subject to likelihood of occurrence assessments were those identified during the background research, BAM calculator candidate and predicted species lists for the associated Botany Rail Duplication project, and any additional species considered to have the potential to occur in the professional opinion of contributors to this assessment.

The likelihood of occurrence assessment was utilised to produce a potential candidate species list to inform appropriate targeted surveys. The assessment was based on the habitat profile for the species and other habitat information in the Threatened Species Profile Database (OEH 2019b) and the Species Profile and Threats Database (DoEE 2019c).

The assessment also included consideration of the dates and locations of nearby records and information about species distribution and populations in the locality along with key habitat requirements.



For this study, the likelihood of occurrence of threatened flora species and populations was determined based on the criteria outlined in Table 3-9. The likelihood of occurrence assessment is provided in Appendix B.

Table 3-9	Likelihood of	occurrence	criteria for	threatened	fauna species	and populations
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Likelihood	Criteria
Known	The species was observed in the project site either during the current survey or during another survey less than five years prior; assuming no significant change in conditions on site (eg vegetation clearing, fire).
High	A species has a high likelihood of occurrence if:
	 The project site contains or forms part of a large area (> 1 ha) of high quality suitable habitat
	 And the species has been recorded recently (within 10 years) in the locality.
Moderate	A species has a moderate likelihood of occurrence if:
	The species:
	 Has a small area (< 1 ha) of high quality suitable habitat or a large area (> 1 ha) of marginal habitat in the project site, and
	 The species has been recorded recently (within 10 years) in the locality.
Low	A species has a low likelihood of occurrence if:
	 The species' potential habitat is marginal and the species has not been recorded in the locality.
None	Potentially suitable habitat is absent from the project site.





3.3.4 Candidate terrestrial threatened fauna species and survey effort

Four threatened fauna species were assessed as either having a moderate or higher likelihood of occurrence or were identified by the BAM calculator and hence were identified as candidate species that were the focus of detailed targeted surveys (Appendix B and Appendix E). A summary of survey effort for each candidate threatened fauna species is outlined in Table 3-10.

Scientific name	Common name	Status ¹	Potential habitat ²	Seasonal survey requirements	Recommended survey effort / species notes	Survey effort expended
Litoria aurea	Green and Golden Bell Frog	E	PCT 1232	Nov-Mar	See section 3.3.2.1	Five nights of survey in generally appropriate weather conditions in September and October. This builds on the previous surveys in the wider area by SMEC (2013, 2018)
Myotis macropus	Southern Myotis	V	PCT 1232	Nov-Mar	Roost search – 30 minutes per structure	Inspection of the bridge for guano and dusk observation of the footbridge over Alexandra Canal on 12 September 2018 for emerging microbats
					Anabat – five nights	Anabat surveys were undertaken at:
						 one location in the rail corridor on the night of June 26 2018
						 Tempe Wetland and Alexandra Canal on 12 and 13 September 2018
						 Botany Wetland on 18 and 30 October 2018 (evening only)
Haematopus fuliginosus	Sooty Oystercatcher	V	PCT920	All year	Bird surveys	Bird surveys were undertaken at Alexandra Canal on 12 and 14 September 2018, and on 29 November 2018
Haematopus longirostris	Pied Oystercatcher	E	PCT920	All year	Bird surveys	Bird surveys were undertaken at Alexandra Canal on 12 and 14 September 2018, and on 29 November 2018

Table 3-10 Candidate terrestrial threatened fauna species survey effort

(1) V = Vulnerable, E = Endangered as listed under the BC Act

(2) BioNet ecological data (accessed 19/12/2018)



3.4 Aquatic habitat surveys

3.4.1 Habitat assessment

An aquatic habitat assessment was undertaken on 3 October 2018 at Tempe Wetlands, Alexandra Canal and downstream areas of the Cooks River. An assessment of the in-stream physical habitat was undertaken based on the NSW AUSRIVAS habitat assessment sheet (Turak et al. 2004). This entailed qualitative assessments of the substrata and water channel and an on-site assessment of hydraulic habitat features and suitability for threatened taxa identified from the database and literature searches. The sensitivity of key fish was classified according to the *Policy and guidelines for fish habitat conservation and management* (DPI 2013).

3.4.2 Threatened fauna likelihood of occurrence assessment

Threatened aquatic species subject to likelihood of occurrence assessments were those identified during the background research. The likelihood of occurrence assessment was utilised to produce a candidate species list to inform appropriate targeted surveys. The assessment was based on the habitat profile for the species and other habitat information in the Threatened Species Profile Database (OEH 2019b) and the Species Profile and Threats Database (DoEE 2019b).

The assessment also included consideration of the dates and locations of nearby records and information about species distribution and populations in the locality along with key habitat requirements.

For this study, the likelihood of occurrence of threatened aquatic species was determined based on the criteria outlined in Table 3-9. No targeted surveys for threatened fish were conducted as none are likely to occur in the project site. The likelihood of occurrence assessment is provided in Appendix B.

3.5 Limitations

The project site is located in a highly modified industrial area with only limited biodiversity values. The desktop assessment provided a list of the threatened biota previously recorded or that could potentially occur in the project site or be affected by the project (including seasonal, transient or cryptic species). The habitat assessment undertaken allows for identification of habitat resources for those species known or predicted to occur in the locality, to assist in determining their likelihood of occurrence in the project site.

Surveys have been undertaken over various months, and in various weather conditions. Given project program constraints, as well as access constraints, not all surveys were necessarily conducted when conditions were ideal for detecting all species, and not all survey methods were carried out at all locations. Where possible, surveys were conducted in the appropriate season and weather conditions to detect target species. In particular, this included targeted seasonal surveys for the Green and Golden Bell Frog. In addition, surveys undertaken for the Botany Rail Duplication project have informed the assessment of threatened species habitat and occurrence in the wider area, in particular for the Green and Golden Bell Frog and the Southern Myotis. The level of survey undertaken, together with the survey timing and weather conditions, is considered sufficient to inform the preparation of this BDAR.

This BDAR has been prepared based on the project description and engineering drawings provided by the proponent and design team. It is assumed that the description and spatial data accurately represent the extent of direct impacts arising from the project and so these data have been used to calculate the extent of removal of vegetation and habitat arising from the project using GIS. These calculations have in turn been relied upon in the BAM calculations and the determination of key thresholds such as whether a particular impact is likely to be significant. The assessment conclusions may change as a result of the provision of an updated project design and/or spatial data.





Author: David Naken Date: 9/07/2019 Map no: PS109315_GIS_174_A5

Scale 1:15,000

Figure 3-2 Survey methods







4. Landscape context

4.1 Landscape features

The project site is in the Sydney Basin Interim Biogeographic Regionalisation for Australia (IBRA) bioregion and occurs within the SYB07 Pittwater IBRA subregion (IBRA version 7.0). Landscape features within the project site as prescribed in Section 4 of the BAM are summarised in Table 4-1 and shown in Figure 4-1.

Table 4-1	Landscape	features
	Lanascape	iculoics

Landscape feature	Project site
IBRA bioregions and subregions	Sydney Basin Bioregion / SYB07 Pittwater subregion
NSW landscape regions (Mitchell landscapes)	Sydney – Newcastle Barriers and Beaches
Local Government Area (LGA)	Bayside, Inner West, City of Sydney
Rivers and streams	Alexandra Canal – due to the surrounding modified stormwater and drainage pattern the Strahler stream order is unknown
Important and local wetlands	Important wetland – Towra Point Wetland (~5 km to the south)
	Local wetlands – Botany wetland and Tempe wetland
	Coastal Wetlands – small areas along the Cooks River and Alexandra Canal
Connectivity features	The main habitat corridor within the project site is associated with Alexandra Canal. Vegetated connectivity occurs between Tempe Wetland and Alexandra Canal.
Areas of geological significance and soil hazard features	There are no mapped areas of geological significance. Soil hazards include areas of high probability acid sulfate soil risk associated with Alexandra Canal and low probability areas over the majority of the project site occurring as disturbed terrain with elevations of 2–4 metres.
Areas of outstanding biodiversity value	No declared areas of outstanding biodiversity value occur in or near the project site
Landscape features listed in the SEARs	No additional landscape features are listed in the SEARs



4.2 Determining site context

To determine site context as required under Section 4.3 of the BAM, assessments of native vegetation cover and patch size in accordance with Subsections 4.3.2 and 5.3.2 of the BAM have been undertaken and are outlined below.

4.2.1 Native vegetation cover

Native vegetation cover within the project site and a 500 metre buffer area along each side of the centre line of the project site was determined in accordance with Subsection 4.2.2 of the BAM and is summarised in Table 4-2 and shown in Figure 4-2.

Table 4-2 Native vegetation cover

Assessment area	Total	Area of native	Native vegetation
	assessment	vegetation	percentage
	area (ha)	cover (ha)	cover
500 m along each side of the centre line of the project site	440.84	15.99	0-10% (3.63%)

4.2.2 Patch size

Patch size is defined under the BAM (OEH, 2017) as an area of native vegetation that:

- 1. Occurs on the development site or stewardship site, and
- 2. Includes native vegetation that has a gap of less than 100 metres from the next area of moderate to good native vegetation (or ≤ 30 metres for non-woody ecosystems).

Patch size may extend onto adjoining land that is not part of a development site or a stewardship site.

Patch size area is assigned to each vegetation zone as a class, being <5 hectares, 5–24 hectares, 25–100 hectares or ≥100 hectares. Due to the highly disturbed and fragmented landscape, patch size for each native vegetation zone has been determined to be <5 hectares.





Scale 1:16,000

Author: David Naken Date: 9/07/2019 Map no: PS109315_GIS_170_A3 Figure 4-1

Landscape features





Author: D*a*vid Naken Date: 9/07/2019 Map.no: PS109315_GIS_171_A3 Determining site context

Figure 4-2



5. Native vegetation

The section has been prepared to address Section 5 of the BAM. Specifically, this section maps and identifies all native and non-native vegetation types within the development site and provides an assessment of vegetation integrity and whether any recorded vegetation types correspond to threatened ecological communities listed under the BC Act.

5.1 Overview

Two PCTs were recorded in the project site. These are:

- PCT 920 Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion
- PCT 1232 Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion.

In addition, two non-native vegetation types were assigned to a miscellaneous ecosystem class, being:

- Miscellaneous ecosystem highly disturbed areas with no or limited native vegetation
- Miscellaneous ecosystem urban exotic/native landscape plantings.

The two native vegetation types (listed above) were assigned to two discrete vegetation zones based on broad vegetation condition class criteria as outlined in section 3.2.3. A summary of PCTs and associated vegetation zones along with non-native vegetation types is presented in Table 5-1. The extent and distribution of each vegetation type and zone is shown in Figure 5-1.

Detailed descriptions and selection justification for each PCT and vegetation zone is provided in section 5.2 below. A summary and description of non-native vegetation types is presented in section 5.3.



Table 5-1 Overview of native and non-native vegetation types and zones identified within the project site

Vegetation type	Vegetation zone (VZ)	Threatened ecological community (BC Act)	Vegetation formation	Vegetation class	IBRA region / subregion	PCT % cleared	Patch size (ha)	Vegetation integrity score	Extent in project site (ha)
Native vegetation									
PCT 920 Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	VZ1 – Poor	Not listed	KF_CH10 Saline Wetlands	Mangrove Swamps	Sydney	86	<5	87.1	0.04
PCT 1232 Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion	VZ2 – Low	Does not meet TEC listing criteria (refer section 5.5)	KF_CH9 Forested Wetlands	Coastal Swamp Forests	Basin/ Pittwater	95	<5	10.2	0.87
							Total na	ative vegetation	0.91
Non-native vegetation									
Miscellaneous ecosystem – highly disturbed areas with no or limited native vegetation	VZ3	-	_	_	_	_	_	-	18.32
Miscellaneous ecosystem – urban exotic/native landscape plantings	VZ4	_	-	_	_	_	_	_	4.85
						т	otal non-na	ative vegetation	23.28
							Total all v	egetation types	24.05





Figure 5-1

Author: David Naiken Date: 9/07/2019 Map no: PS109315_GIS_172_A6 Vegetation types and zones Page 1 of 3





Figure 5-1

Author: David Naiken Date: 9/07/2019 Map no: PS109315_GIS_172_A6 Vegetation types and zones Page 2 of 3



50 100 Scale 1:5,000

Author: David Naiken Date: 9/07/2019 Map no: PS109315_GIS_172_A6 Vegetation types and zones Page 3 of 3

Figure 5-1



5.2 Native vegetation types

A description of recorded attributes for each native vegetation PCT are provided below.

5.2.1 PCT 920 Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion

The occurrence of this vegetation type within the project site is illustrated in Figure 5-1 with photographic representation provided in Photo 5-1 to Photo 5-3. A profile of PCT 920 Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion is provided in Table 5-2 and a comparison of recorded vegetation integrity data against community condition benchmark data is presented in Table 5-3.

Table 5-2Summary of PCT 920 Mangrove Forests in estuaries of the Sydney Basin Bioregion and South
East Corner Bioregion

1 Cl /20 Maligiove lole	sis in estoanes of the syancy basin bioregion and soom Last corner bioregion
PCT Justification	Vegetation type is dominated by <i>Avicennia marina</i> subsp. <i>australasica</i> (Grey Mangrove) and occurs on tidal mud channels associated with Alexandra Canal.
Vegetation formation	KF_CH10 Saline Wetlands
Vegetation class	Mangrove Swamps
Vegetation zone	VZ1
Conservation status	BC Act: Not listed; EPBC Act: Not listed; FM Act: Protected
Per cent cleared	86% Sydney Basin
Patch size class	<5 ha
Impact area	0.04
Vegetation integrity plots	Q6
Current vegetation integrity score	87.1
Landscape position	Low lying saline tidal influenced drainage channels associated with Alexandra Canal. This vegetation type occurs in two discrete patches (Figure 5-1), being:
	 a narrow liner strip associated with a tidal section of stormwater channel 1 adjacent to the Botany rail line in Tempe
	 a small patch at Tempe Lands to the east of the footbridge on the northern side of Alexandra Canal.
Species upper stratum	Absent
Species middle stratum	Avicennia marina subsp. australasica (Grey Mangrove)
Species ground stratum	Native ground stratum species are limited to fringe edges and have relatively low cover abundance, including <i>Juncus kraussii</i> subsp. <i>australiensis</i> (Sea Rush), <i>Persicaria</i> <i>lapathifolium</i> (knotweed), <i>Sporobolus virginicus</i> var. <i>minor</i> (Saltwater Couch), <i>Suaeda</i> <i>australis</i> (Seablite), <i>Triglochin striata</i> (Streaked Arrowgrass)
Vegetation condition	This vegetation type occurs in a poor condition class and is considered opportunistic regrowth. While the vegetation integrity score for this vegetation zone is considered high (87.1) due to native species richness in the ground stratum and a relatively dense canopy cover, all patches are very small in area, isolated from any large patches of remnant native vegetation and subject to high edge area ratio. Based on these attributes, a poor condition class has been applied. Exotic species were common in this vegetation type and include <i>Cestrum parqui</i> (Green Cestrum), <i>Lantana camara</i> (Lantana), <i>Olea europea</i> (African Olive), <i>Hydrocotyle bonariensis</i> (Largeleaf Pennywort), <i>Foeniculum vulgare</i> (Fennel), <i>Paspalum dilatatum</i> (Paspalum) and other common annual and perennial exotic species.

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







Photo 5-1 PCT 920 dominated by Avicennia marina subsp. australasica (Grey Mangrove) in a tidal section of a stormwater channel 1 adjacent to the Botany rail line in Tempe



Photo 5-2 Mangrove pneumatophores lining stormwater channel 1 adjacent to Boral's St Peters facility



Photo 5-3 Avicennia marina subsp. australasica (Grey Mangrove) fringing Alexandra Canal



Table 5-3Comparison of PCT 920 Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion vegetation integrity plot
data against PCT condition benchmark data

Plot	Tree richness	Shrub richness	Grass richness	Forb richness	Fern richness	Other richness	Tree cover	Shrub cover	Grass cover	Forb cover	Fern cover	Other cover	Length timber	Leaf litter	Large tree	Vegetation integrity score
BM ¹	2	3	2	2	0	1	67	4	0	0	0	0	-	-	-	100
Q6	1	3	3	3	0	0	55	1.6	3.9	1.6	0	0	-	-	-	87.1

(1) Benchmark data for equivalent community in NSW Sydney Basin IBRA Bioregion; Vegetation Type – PCT 920 Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion; Keith Formation: KF_CH10 Saline Wetlands; Keith Class: Mangrove Swamps; source (NSW BioNet Vegetation Classification database accessed December 2018 and cross referenced with Biodiversity Assessment Method Calculator)



5.2.2 PCT 1232 Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion

The occurrence of this vegetation type within the project site is illustrated in Figure 5-1 with photographic representation provided in Photo 5-4 to Photo 5-9. A profile of PCT 1232 Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion is provided in Table 5-4 and a comparison of recorded vegetation integrity data against community condition benchmark data is presented in Table 5-5.

Table 5-4Summary of PCT 1232 Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and
South East Corner Bioregion

PCT 1232 Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion						
PCT Justification	All patches were dominated by <i>Casuarina glauca</i> (Swamp Oak) that generally occurs as young even age class regrowth arising from mostly fill material within disturbed / modified areas. This vegetation type was assigned to PCT 1232 as it is assumed that a persistent soil seed bank occurs within discrete areas of fill material.					
Vegetation formation	KF_CH9 Forested Wetlands					
Vegetation class	Coastal Swamp Forests					
Vegetation zone	VZ2					
Conservation status	Does not meet the criteria for the TEC listing under either the BC Act (refer section 6.1) or EPBC Act (refer section 7.1.1)					
Per cent cleared	95%					
Patch size class	<5%					
Impact area	0.87					
Vegetation integrity plots	Q2, Q5					
Current vegetation integrity score	10.2					
Landscape position	This vegetation type occurs as opportunistic regrowth generally from areas subject to historic filling. It is unclear where the fill material was sourced from but is assumed it contains a soil seed bank of <i>Casuarina glauca</i> (Swamp Oak). This vegetation type occurred in small discrete patches throughout the project site. Most patches of this vegetation type recorded do not appear to have any current association with active coastal floodplain processes or periodic influence of saline groundwater. Small linear patches fringing Alexandra Canal appear as regrowth on fill material associated with the rock / concrete lined channel. These patches are not considered to occur on natural soils of an active floodplain system.					
Species upper stratum	Casuarina glauca (Swamp Oak)					
Species middle stratum	Native species are absent					
Species ground stratum	Native species are absent					
Vegetation condition	This vegetation type was recorded in low condition and generally occurs as regrowth even age class stands of <i>Casuarina glauca</i> (Swamp Oak). The middle and ground stratum is mostly absent of native species and is dominated by exotic annual and perennials such as <i>Acacia saligna</i> (Golden Wreath Wattle), <i>Bidens pilosa</i> (Cobbler's Pegs), <i>Chloris gayana</i> (Rhodes Grass), <i>Conyza sumatrensis</i> (Tall Fleabane), <i>Cortaderia selloana</i> (Pampas Grass), <i>Ipomoea indica</i> (Blue Morning Glory), <i>Lantana camara</i> (Lantana), <i>Melilotus indicus</i> (Hexham Scent), <i>Panicum maximum</i> var. <i>maximum</i> (Guinea Grass), <i>Plantago lanceolata</i> (Lambs Tongue), <i>Verbena bonariensis</i> (Purple Tops).					





Photo 5-4 PCT 1232 dominated by Casuarina glauca (Swamp Oak) regrowth growing from fill material on Sydney Airport land leased by the Cooks River Intermodal Terminal that fronts Canal Road



Photo 5-5 An even age class stand of Casuarina glauca (Swamp Oak) regrowth on Sydney Airport land leased by Cooks River Intermodal Terminal



Photo 5-6 Swamp Oak regrowth on Sydney Airport freehold land to the west of the landing lights



Photo 5-7 PCT 1232 Swamp Oak regrowth on land adjacent to Boral's St Peters facility



Photo 5-8 PCT 1232 Swamp Oak regrowth in fill material fringing Alexandra Canal



Photo 5-9 PCT 1232 Swamp Oak regrowth in fill material fringing Alexandra Canal



Table 5-5	Comparison of PCT 1232 Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion vegetation integrity
	plot data against PCT condition benchmark data

Plot	Tree richness	Shrub richness	Grass richness	Forb richness	Fern richness	Other richness	Tree cover	Shrub cover	Grass cover	Forb cover	Fern cover	Other cover	Length timber	Leaf litter	Large tree	Vegetation integrity score
BM ¹	5	10	7	6	2	5	24	19	57	3	2	2	44	44	5	100
Q2	1	1	1	0	0	0	40	3	3	0	0	0	3	52	0	40.0
Q5	1	0	0	0	0	0	30	0	0	0	0	0	0	46	0	10.2

(1) Benchmark data for equivalent community in NSW Sydney Basin IBRA Bioregion; Vegetation Type - PCT 1232 Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion; Keith Formation: KF_CH9 Forested Wetlands; Keith Class: Coastal Swamp Forests; source (NSW BioNet Vegetation Classification database accessed December 2018 and cross referenced with Biodiversity Assessment Method Calculator)



5.3 Non-native vegetation types

5.3.1 Miscellaneous ecosystem – highly disturbed areas with no or limited native vegetation

This non-native vegetation type occurs over parts of the project site (about 18.29 hectares) and is the result of previous clearing and ongoing maintenance of road, rail and industrial infrastructure. The distribution of this vegetation type is shown in Figure 5-1 and represented in Photo 5-10 to Photo 5-12. The structure varies from scattered or clumped areas of trees to exotic scrub, grassland and weeds. This vegetation type was sampled by plot Q1 and random meander surveys.

Dominant tree species include: Acacia saligna (Golden Wreath Wattle), Celtis sinensis (Chinese Nettle Tree), Erythrina crista-galli (Cockspur Coral Tree), Harpephyllum caffrum (Kaffir Plum), Morus alba (Mulberry) and Olea europaea (African Olive).

Exotic shrub species include: *Acacia saligna* (Golden Wreath Wattle), *Cestrum parqui* (Green Cestrum), *Lantana camara* (Lantana), *Ligustrum lucidum* (Large-leaved Privet), *Ricinus communis* (Castor Oil Plant), *Rubus fruticosus* agg. (Blackberry), *Salpichroa origanifolia* (Pampas Lily-of-the-valley).

Exotic grassland species include: *Axonopus fissifolius* (Narrow-leaved Carpet Grass), *Bromus catharticus* (Prairie Grass), *Cenchrus clandestinus* (Kikuyu Grass), *Chloris gayana* (Rhodes Grass), *Cortaderia selloana* (Pampas Grass), *Cynodon dactylon* (Common Couch), *Echinochloa crus-galli* (Barnyard Grass), *Ehrharta erecta* (Panic Veldgrass), *Eragrostis curvula* (African Love Grass), *Melinis repens* (Red Natal Grass) and *Panicum maximum* var. *maximum* (Guinea Grass). A large range of annual and perennial exotic forb species also occur.

Exotic vine species include: *Anredera cordifolia* (Madeira Vine), *Araujia sericifera* (Moth Vine), *Ipomoea cairica* (Coastal Morning Glory), *Ipomoea indica* (Blue Morning Glory), *Thunbergia alata* (Black-eyed Susan).



Photo 5-10 Miscellaneous ecosystem – highly disturbed areas with no or limited native vegetation dominated by Acacia saligna* (Golden Wreath Wattle) and Cortaderia selloana* (Pampas Grass) on Sydney Airport Corporation freehold land north of Airport Drive





Photo 5-11 Miscellaneous ecosystem – highly disturbed areas with no or limited native vegetation dominated by Acacia saligna (Golden Wreath Wattle), Cortaderia selloana (Pampas Grass) and Lantana camara (Lantana) on Sydney Airport land leased by the Cooks River Intermodal Terminal off Canal Road



Photo 5-12 Miscellaneous ecosystem – highly disturbed areas with no or limited native vegetation in the form of exotic grassland and scrub on Sydney Airport Corporation freehold land north of Airport Drive (left) and Sydney Airport land located near the Botany rail line (right).

5.3.2 Miscellaneous ecosystem – urban exotic/native landscape plantings

This non-native vegetation type is the result of landscape plantings that have occurred throughout the project site (about 4.85 hectares). The distribution of this vegetation type is shown in Figure 5-1 and was sampled by plot Q3, Q4 and random meander surveys.

Extensive landscape plantings have occurred on Tempe Lands particularly on capped batter slopes of the former Tempe landfill (Photo 5-13). These plantings generally comprise native species, including *Acacia decurrens* (Green Wattle), *Acacia parramattensis* (Parramatta Wattle), *Bursaria spinosa* subsp. *spinosa* (Native Blackthorn), *Dodonaea triquetra* (Large-leaf Hop-bush), *Casuarina glauca* (Swamp Oak), *Eucalyptus* sp. (Eucalyptus), *Lomandra longifolia* (Spiny-headed Mat-rush) and *Melaleuca styphelioides* (Prickly-leaved Tea Tree).

Exotic weed species generally dominate the mid and lower stratum and include *Acacia saligna* (Golden Wreath Wattle), *Chloris gayana* (Rhodes Grass), *Cynodon dactylon* (Common Couch), *Ehrharta erecta* (Panic Veldgrass), *Lantana camara* (Lantana) and *Panicum maximum* var. *maximum* (Guinea Grass).







Photo 5-13 Native landscape planting with exotic ground cover at Tempe Lands growing on capped batter slopes of the former Tempe Tip site

Landscape plantings also fringe much of Airport Drive, Qantas Drive and surrounds and include a number of semi mature to mature *Ficus microcarpa* var. *hillii* (Small-fruited Fig). Other commonly planted species include *Callistemon* sp. (Bottlebrush), *Casuarina glauca* (Swamp Oak), *Corymbia citriodora* (Lemon-scented Gum), *Corymbia maculata* (Spotted Gum), *Eucalyptus* sp. (Eucalyptus), *Livistona australis* (Cabbage Palm) and *Lophostemon confertus* (Brush Box) (Photo 5-14 to Photo 5-16).



Photo 5-14 Planted Callistemon sp. (Bottlebrush) and Ficus microcarpa var. hillii (Small-fruited Fig), along with Casuarina glauca (Swamp Oak) and Eucalyptus sp. (Eucalyptus) Qantas Drive





Photo 5-15 Planted Lophostemon confertus (Brush Photo 5-16 Landscape ornamental plantings at the Box) adjacent to Boral's St Peters facility entrance to Sydney Airport

5.4 Weeds

During field surveys, 163 species of plant were recorded. Of these 33 were native and 130 were introduced species (refer to Appendix C).

Of the 130 introduced species recorded within the project site, 12 species were listed under the NSW *Biosecurity Act 2015* as priority weeds for the Greater Sydney region (DPI 2018) while eight are also listed as Weeds of National Significance (Australian Weeds Committee, 2018). All priority weeds identified and species listed as Weeds of National Significance are outlined below in Table 5-6.

Table 5-6 Priority weeds and weeds of national significant recorded

Scientific name	Common name	Duty under the Biosecurity Act	Weed of national significance?
Anredera cordifolia	Madeira Vine	Prohibition on dealings: Must not be imported into the State or sold	Yes
Arundo donax	Giant Reed	Regional Recommended Measure: Land managers should mitigate the risk of new weeds being introduced to their land. The plant should not be bought, sold, grown, carried or released into the environment.	No
Asparagus aethiopicus	Ground Asparagus	Prohibition on dealings: Must not be imported into the State or sold	Yes
Asparagus plumosus	Climbing Asparagus Fern	Prohibition on dealings: Must not be imported into the State or sold	Yes
Cestrum parqui	Green Cestrum	Regional Recommended Measure: Land managers should mitigate the risk of new weeds being introduced to their land. The plant should not be bought, sold, grown, carried or released into the environment.	No





Scientific name	Common name	Duty under the Biosecurity Act	Weed of national significance?
Chrysanthemoides monilifera subsp. rotundata	Bitou Bush	Prohibition on dealings: Must not be imported into the State or sold Biosecurity Zone: The Bitou Bush Biosecurity Zone is established for all land within the State except land within 10 kilometres of the mean high water mark of the Pacific Ocean between Cape Byron in the north and Point Perpendicular in the south (includes the project site).	Yes
Cortaderia selloana	Pampas Grass	Regional Recommended Measure: Land managers should mitigate the risk of new weeds being introduced to their land. The plant should not be bought, sold, grown, carried or released into the environment. This Regional Recommended Measure applies to <i>Cortaderia jubata</i> (pink pampas grass)	No
Lantana camara	Lantana	Prohibition on dealings: Must not be imported into the State or sold	Yes
<i>Olea europaea</i> subsp. <i>cuspidata</i>	African Olive	Regional Recommended Measure: The Greater Sydney region is classified as the core infestation area. Whole region: The plant or parts of the plant are not traded, carried, grown or released into the environment. Core infestation area: Land managers prevent spread from their land where feasible. Land managers reduce impacts from the plant on priority assets.	No
<i>Opuntia</i> sp.	Prickly Pear	Prohibition on dealings: Must not be imported into the State or sold	Yes
Rubus fruticosus agg.	Blackberry	Prohibition on dealings: Must not be imported into the State or sold	Yes
Senecio madagascariensis	Fireweed	Prohibition on dealings: Must not be imported into the State or sold	Yes

5.5 Groundwater Dependent Ecosystems

Communities of potential groundwater dependent ecosystems (GDEs) are identified based on a review of the Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources (NSW Government 2017) and the BOM (2019) Groundwater Dependent Ecosystems Atlas. There are no GDEs near the site. The closest GDEs to the project site are the Botany Wetlands and Lachlan Swamps, located about two kilometres east of the southern end of the project, and vegetation along Wolli Creek, located one kilometre to the west of the project (BOM 2019). No GDEs are mapped at Tempe Wetlands. The wetlands are artificial and rely on stormwater.







6. **NSW Threatened biota**

6.1 Threatened ecological communities

One candidate threatened ecological community listed under the BC Act was considered based on the occurrence of PCT 1232, being Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions. A comparison of BC Act-listed Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions final determination criteria and associated PCT 1232 is provided in Table 6-1. Based on landform, altitudinal range, soils, geology and vegetation structure the recorded patches of PCT 1232 are not considered to meet the BC Act listing for this threatened ecological community.



TEC & PCT	Bioregion	Landform and altitudinal range	Soil/geology	Structure	Species assemblage
Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions Threatened Ecological Community	North Coast, Sydney Basin and South East Corner bioregions	It generally occupies low- lying parts of floodplains, alluvial flats, drainage lines, lake margins and fringes of estuaries; habitats where flooding is periodic and soils show some influence of saline ground water.	Alluvium: silts, clay- loams and sandy loams.	The structure of the community may vary from open forests to low woodlands, scrubs or reedlands with scattered trees.	Dominated by a tree canopy of either <i>Casuarina glauca</i> or, more rarely, <i>Melaleuca ericifolia</i> with or without subordinate tree species, the relatively low abundance of Eucalyptus species and the prominent groundcover of forbs and graminoids. There are 45 characteristic species listed for this community. The total species list of the community is larger with many species present at a small number of sites or in low abundance.
PCT 1232 Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion	Sydney Basin	Occurs as regrowth from fill material that is not subject to floodplain processes or periodic influence of saline groundwater.	This vegetation type was recorded from areas subject to historic filling and disturbance and does not occur on naturally occurring soil profiles.	This vegetation type was recorded as regrowth <i>Casuarina glauca</i> (Swamp Oak) only and lacked structure in the middle and ground stratum.	Tree canopy dominated by <i>Casuarina glauca</i> (Swamp Oak) but no other diagnostic species were recorded.
Comparison	Meets criterion	Does not meet criterion	Does not meet criterion	Does not meet criterion	Partially meets criterion
Outcome				·	Does not meet BC Act listing

Table 6-1Comparison of BC Act-listed Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregionsfinal determination criteria and associated PCT 1232



6.2 Threatened flora

6.2.1 Potential habitat for threatened flora

In general, the study area has been identified to provide limited potential habitat for threatened flora species. The overall likelihood of occurrence for the 37 threatened flora species that are known or predicted to occur within the locality have been assessed as low (Appendix B).

Given remnant native vegetation patches of PCT 920 and PCT 1232 are mostly disturbed and provide limited habitat for threatened flora species, the likelihood of future threatened flora recruitment is also considered low.

6.2.2 Threatened flora candidate species

Overall, two threatened flora species were considered as candidate species as part of this BDAR. These species were identified based on the BAM candidate species report for the project (Appendix E). A brief overview of survey and likelihood assessment results for each threatened flora candidate species is presented in Table 6-2.

Scientific Name	Common Name	Survey month	Presence	Justification
Melaleuca biconvexa	Biconvex Paperbark	All year	No – (surveyed)	This species has not been recorded within the project locality. Within the project site, documented potential habitat identified by the BAM calculator occurs in the form of PCT 1232. <i>Melaleuca</i> <i>biconvexa</i> is readily identifiable based on leaf morphology. No individuals of this species were recorded during targeted surveys. Given this, <i>Melaleuca biconvexa</i> is not considered affected by the project and as such no further consideration or assessment of this species is deemed warranted.
Wilsonia backhousei	Narrow- leafed Wilsonia	All year	No – (surveyed)	This species has not been recorded within the project locality. The occurrence of this species within the broader Sydney region is mostly restricted to discrete populations in the localities of the Parramatta River at Ermington, Clovelly, Voyager Point and the Royal National Park (OEH 2019a).
				Habitat associated with this species is generally restricted to the margins of salt marshes and lakes with potential habitat including PCT 920. Within the project site, this vegetation type has been recorded in two small discrete patches.
				There are no seasonality issues associated with surveying for <i>Wilsonia backhousei</i> as the species is readily identifiable all year (OEH 2019a). Targeted surveys failed to identify any individuals of this species and given the lack of any records in the locality and the generally unfavourable understorey habitat conditions, the occurrence of this species within the project site is considered low. Given this, <i>Wilsonia backhousei</i> is not considered affected by the project and as such, no further consideration or assessment of this species is deemed warranted.

 Table 6-2
 Threatened flora candidate species assessment results

In addition, two threatened flora species were recorded as landscape plantings within the project site, being *Eucalyptus nicholii* (Narrow-leaved Black Peppermint) and *Eucalyptus scoparia* (Wallangarra White Gum). The natural distribution of these species does not occur within the Sydney Basin Bioregion although they have been widely distributed by the horticultural industry as ornamental landscape plantings. The occurrence of these species within the project site do not meet the final determination listing attributes (NSW Scientific Committee 2002) or species profile descriptions (OEH 2019c) for geographical distribution, geology or vegetation formation and as such they are not assigned the conservation significance of a threatened species.



6.2.3 Affected threatened flora

The project is considered unlikely to impact on threatened flora species or their habitats and as such no species are considered affected in terms of project impacts and BAM calculations.

6.3 Threatened fauna

6.3.1 Fauna species

A total of 60 species were recorded during surveys for the project. All species are those typical of urban environments and wetlands in urban areas. This comprised 45 bird species, seven mammal species, four reptile species and four frog species. Two threatened species were recorded, the Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) and Grey-headed Flying-fox (*Pteropus poliocephalus*). Four introduced species were recorded (Appendix B2).

6.3.2 Fauna habitats

A generally low diversity of species was recorded during field surveys, with better quality habitats at Tempe Wetland outside of the project site contributing heavily to the range of species recorded within the study area. Much of the land within the project site has been previously cleared of native vegetation for industrial areas, roads, and Sydney Airport. Planted trees also occur in these areas, as do thickets of weeds such as Lantana. Better quality fauna habitats are located in the Tempe Wetland, which is located adjacent to the project site (with a small portion occurring within the project site). This area contains planted eucalypts, swamp oak, native understorey species, and contains ponds with emergent reeds.

Tempe Reserve/Alexandra Canal and the Cooks River Corridor are identified as high priority biodiversity areas for the Inner West LGA (Australian Museum Business Services 2011). The majority of native vegetation in the previous Marrickville LGA occurs along the Cooks River, which is patchily linked to good quality native communities in Wolli Creek Regional Park and vegetation within Tempe Reserve and Alexandra Canal. These plant communities provide foraging resources, structural sheltering habitat and potential breeding habitat for a range of Marrickville's fauna (Australian Museum Business Services 2011). Sydney Metro Catchment Management Authority (SMCMA 2010) also identified the patch of predominantly exotic vegetation between the Botany rail line and Alexandra Canal as part of a biodiversity corridor together with the Cooks River corridor.

A summary of the various habitat types in the study area is provided in Table 6-3 to Table 6-4 below.





Table 6-3 Fauna habitats – Mangrove Forest

Mangrove Forest	
Description	A small patch of mangroves were recorded in the project site at a narrow liner strip connected with a stormwater channel draining to Alexandra Canal adjacent to Boral's St Peters facility, and another in a small patch at Tempe Lands to the east of the footbridge on the northern side of Alexandra Canal.
Typical fauna species recorded or likely to occur	Common bird species such as the Magpie-lark (<i>Grallina cyanoleuca</i>), Willie Wagtail (<i>Rhipidura leucophrys</i>) and Grey Fantail (<i>Rhipidura albiscapa</i>) would forage in these areas. Common reptile species typical of urban wetlands such as the Australian Water Dragon (<i>Intellagama lesueurii</i>) and Eastern Water Skink (<i>Eulamprus quoyii</i>) are likely to occur. Similarly, the common Striped Marsh Frog (<i>Lymnodynastes peroni</i>) is likely to occur in this habitat type.
Threatened fauna species recorded or likely to occur	No threatened species recorded. The Eastern Bentwing-bat is likely to forage in the area on occasion.
Migratory species recorded or likely to occur	No migratory species were recorded. Given the very narrow and localised patches present, migratory waders are unlikely to occur except on rare occasions.
Introduced species recorded or likely to occur	None recorded.
Photograph	Wangroves near Boral's St Peters facility


Swamp Oak Floodplain Forest				
Description	A number of patches of low condition Swamp Oak Floodplain Forest occur in the project site. These are dominated by Swamp Oak, which often occurs in single age-class stands. No large hollow-bearing trees were observed.			
Typical fauna species recorded or likely to occur	Common bird species would forage and roost in this habitat type. These would include species such as the Noisy Miner (<i>Manorina melanocephala</i>), Red-browed Finches (<i>Neochmia temporalis</i>), Superb Fairy-wrens (<i>Malurus superbus</i>) and Australian Magpies (<i>Cracticus tibicen</i>).			
	The Ringtail Possum (<i>Pseudochierus peregrinus</i>) may also occur in this habitat.			
	Common lizards and frogs are likely to occur in this habitat type, particularly in areas where leaf litter and shrub cover is present, or damp areas.			
Threatened fauna species recorded or likely to occur	Limited low quality habitat for threatened fauna species recorded. No threatened species recorded. The Eastern Bentwing-bat is likely to forage in the area on occasion.			
Migratory species recorded or likely to occur	No migratory fauna species were recorded during surveys. Migratory woodland species such as the Rufous Fantail (<i>Rhipidura rufifrons</i>) could occur on occasion, but would not depend on the habitats present other than as stepping stones across the urban landscape.			
Introduced species recorded or likely to occur	The Red-whiskered Bulbul (<i>Pycnonotus jocosus</i>) was recorded in this habitat type. A range of other introduced species are likely to occur.			
Photograph	Regrowth Swamp Oak Forest on Sydney Airport land leased by Cooks River Intermodal Terminal			

Table 6-4Fauna habitats – Swamp Oak Floodplain Forest





Table 6-5 Fauna habitats – Highly disturbed areas (exotic grassland and weeds)

Exotic grassland and	d weeds					
Description	Exotic grassland and weed-infested areas are located along road reserves and land adjacent to Alexandra Canal. Some planted trees and shrubs are present.					
	These areas would have historically supported native woodland vegetation but have been extensively modified by previous clearing.					
	Exotic grassland contains few habitat resources of relevance to most native species due to its low structural and floristic diversity. Exotic grasses and herbs would provide foraging resources for relatively mobile and opportunistic native fauna species.					
	Areas vegetated with exotic shrubs provide habitat for small birds and reptiles.					
Typical fauna species recorded or likely to occur	Bird species commonly recorded in this habitat type included the Crested Pigeon (<i>Ocyphaps lophotes</i>), Welcome Swallow (<i>Hirundo neoxena</i>), Magpie-lark (<i>Grallina cyanoleuca</i>), Superb Fairy-wren (<i>Malurus cyaneus</i>), Willie Wagtail (<i>Rhipidura leucophrys</i>) and Grey Fantail (<i>Rhipidura albiscapa</i>). These species are insectivorous and were observed foraging within mown portions of the grassland.					
	Small, common lizards such as the Dark-flecked Garden Sunskink <i>(Lampropholis delicata)</i> are likely to occur in this habitat type, particularly in areas where leaf litter and shrubs cover is present.					
	The Common Eastern Froglet (<i>Crinia signifera</i>) may occur in damp areas within weedy shrubland.					
Threatened fauna species recorded or likely to occur	None recorded. Microchiropteran bats such as the Eastern Bentwing-bat (<i>Miniopterus schreibersii oceanensis</i>) may forage over this habitat type on occasion.					
Migratory species recorded or likely to occur	No migratory species were observed and none are likely to occur in this habitat type.					
Introduced species recorded or likely to occur	Introduced species recorded included the Red-whiskered Bulbul (<i>Pycnonotus jocosus</i>), Rock Dove (<i>Columba livia</i>) and Feral/domestic Cat (<i>Felis catus</i>).					
Photograph	Weedy shrubland					



Table 6-6	Fauna habitats – Urban	exotic and planted native species	
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Urban exotic and pl	anted native species
Description	Exotic forest and scrub and planted native species are present in the project site and adjacent areas in Tempe Lands on the former Tempe landfill and in the adjacent Tempe Recreation Reserve. Exotic forest and scrub is dominated by dense midstorey vegetation of variable structural complexity and includes species such as <i>Acacia decurrens</i> (Green Wattle), <i>Acacia parramattensis</i> (Parramatta Wattle), <i>Bursaria spinosa</i> subsp. <i>spinosa</i> (Native Blackthorn), <i>Dodonaea triquetra</i> (Large-leaf Hop-bush), <i>Casuarina glauca</i> (Swamp Oak), <i>Eucalyptus</i> sp. (Eucalyptus), <i>Lomandra longifolia</i> (Spiny-headed Mat-rush) and <i>Melaleuca styphelioides</i> (Prickly-leaved Tea Tree). Planted trees including eucalypts and figs occur along roadsides and car parks. Patches of weeds and planted native or exotic trees and shrubs provide foraging and breeding habitat for a range of common fauna species typical of urban parks and gardens.
Typical fauna species recorded or likely to occur	The Red Wattlebird (<i>Anthochaera carunculata</i>) and New Holland Honeyeater (<i>Phylidonyris novaehollandiae</i>) were observed foraging within this habitat type. The dense shrubby areas provide good cover for small birds such as the Superb Fairy-wren (<i>Malurus superbus</i>) and Horsfield's Bronze-cuckoo (<i>Chalcites basalis</i>). A Tawny Frogmouth (<i>Podargus strigoides</i>) was observed during spotlighting.
	A variety of waterbirds typical of urban ponds and wetlands occur. These include the Purple Swamphen (<i>Porphyrio porphyrio</i>), Dusky Moorhen (<i>Gallinula tenebrosa</i>), Eurasian Coot (<i>Fullica atra</i>) and Pacific Black Duck (<i>Anas pacifica</i>).
	Native mammals, including the Common Ring-tailed Possum (<i>Pseudocheirus peregrinus</i>) and small introduced mammals, such as Black Rats (<i>Rattus rattus</i>) may shelter and forage in the dense midstorey of exotic scrub, although none were recorded.
Threatened fauna species recorded or	The Grey-headed Flying-fox was recorded flying over the site, and may forage in planted eucalypts when specimens are flowering or fruiting. No breeding camps are present.
likely to occur	Microchiropteran bats such as the Eastern Bentwing-bat (<i>Miniopterus schreibersii oceanensis</i>) and Eastern Freetail Bat (<i>Mormopterus norfolkensis</i>) may forage in these habitats on occasion. No hollow-bearing trees were observed that would be suitable for bats to roost in.
Migratory species recorded or likely to occur	No migratory fauna species were recorded during surveys. Migratory terrestrial woodland species such as the Rufous Fantail (<i>Rhipidura rufifrons</i>) could occur on occasion, but are unlikely to depend on the habitats present.
Introduced species recorded or likely to occur	Common Myna (<i>Sturnus tristis</i>) Red-whiskered Bulbul (<i>Pycnonotus jocosus</i>) Feral cat (<i>Felis catus</i>) Black rat (<i>Rattus rattus</i>)
Photograph	

Urban native and exotic scrub above Alexandra Canal





Planted vegetation					
Description	The Tempe Wetland is located predominantly adjacent to the project site, except for a small area in the east which falls into the project site. A range of planted native species occur around the three ponds. These include Swamp Oak (<i>Casuarina glauca</i>), eucalypts and acacias. Understorey species include <i>Lomandra longifolia</i> and various shrubs.				
	A variety of emergent aquatic plants are present in the ponds. These include Cumbunji (<i>Typha orientalis</i>). Tempe Wetland and surrounding plantings are important urban habitats for common and threatened fauna of the area.				
Typical fauna species recorded or likely to occur	The Red Wattlebird (<i>Anthochaera carunculata</i>), White-plumed Honeyeater (<i>Ptilotula penicillata</i>), New Holland Honeyeater (<i>Phylidonyris novaehollandiae</i>) and Grey Shrike-thrush (<i>Coluricincla harmonica</i>) were observed foraging within this habitat type.				
	The dense shrubby areas provide good cover for small birds such as the Superb Fairy-wren (<i>Malurus superbus</i>) and White-browed Scrubwren (<i>Sericornis frontalis</i>).				
	A Common Ring-tailed Possum (<i>Pseudocheirus peregrinus</i>) was observed and small introduced mammals, such as Black Rats (<i>Rattus rattus</i>) may shelter and forage in the dense midstorey of exotic scrub, although none were recorded. Microchiropteran bats, including the White-striped Freetail Bat (<i>Austronomus australis</i>), Gould's Wattled Bat (<i>Chalinolobus gouldii</i>) and Eastern Freetail Bat (<i>Mormopterus ridei</i>) were recorded foraging at the wetland.				
	A variety of common reptile species typical of urban wetlands were recorded, including the Australian Water Dragon (<i>Intellagama lesueurii</i>), Eastern Water Skink (<i>Eulamprus quoyii</i>) and Eastern Blue-tongue (<i>Tiliqua scincoides</i>).				
	Four species of common frogs were recorded: the Emerald-spotted Tree Frog (<i>Litoria peroni</i>), Eastern Dwarf Tree Frog (<i>Litoria fallax</i>), Striped Marsh Frog (<i>Lymnodynastes peroni</i>) and Common Eastern Froglet (<i>Crinia signifera</i>). Large numbers of these species were recorded calling during targeted nocturnal surveys.				
Threatened fauna species recorded or	The Grey-headed Flying-fox was recorded foraging in planted eucalypts. No breeding camps are present.				
likely to occur	The Eastern Bentwing-bat (<i>Miniopterus schreibersii oceanensis</i>) was recorded and the Eastern Freetail Bat (<i>Mormopterus norfolkensis</i>) may also forage in these habitats on occasion. No hollow-bearing trees were observed that would be suitable for bats to roost in.				
	There was no evidence of the Green and Golden Bell Frog (<i>Litoria aurea</i>) at this wetland during the various targeted surveys.				
Migratory species recorded or likely to occur	No migratory fauna species were recorded during surveys. Migratory terrestrial woodland species such as the Rufous Fantail (<i>Rhipidura rufifrons</i>) could occur on occasion, but are unlikely to depend on the habitats present.				
Introduced species recorded or likely to occur	Common Myna (<i>Sturnus tristis</i>)				
Photograph					

Table 6-7 Fauna habitats – planted vegetation at Tempe Wetland adjoining the project site

Planted vegetation at Tempe Wetland



Table 6-8 Fauna habitats – Alexandra Canal

Alexandra Canal	
Description	Alexandra Canal runs alongside Airport Drive. It is an adapted artificial waterway (formally known as Sheas Creek) which stretches 4.5 km from near Huntley Street, Alexandria, and drains into the Cooks River to the south-west of the project site. Its banks are formed by sloping dry sandstone blocks and concrete panels. It provides stormwater drainage for large industrial and residential areas.
	Narrow bands of mudflats occur along the edges of the canal in the project site and downstream along the Cooks River. These areas provide foraging habitat for wading birds and other common bird species.
Typical fauna species recorded or likely to occur	Wading birds observed along the canal included the White-necked Heron (<i>Ardea pacifica</i>), Intermediate Egret (<i>Ardea intermedia</i>), Little Egret (<i>Egretta garzetta</i>), and Striated Heron (<i>Butorides striatus</i>), with the Australian White Ibis (Threskiornis molucca) the most commonly observed species.
	Other water birds included the Pied Cormorant (<i>Phalacrocorax varius</i>), Little Black Cormorant (Phalacrocorax sulcirostris), and Silver Gull (<i>Chroicocephalus novaehollandiae</i>). A Willy Wagtail (<i>Rhinidura leucophrys</i>) was also observed foraging in the mudflats
	Gould's Wattled Bat (<i>Chalinolobus gouldii</i>) was recorded using Anabat analysis.
Threatened fauna species recorded or likely to occur	No threatened fauna species recorded.
Migratory species recorded or likely to occur	No migratory fauna species were recorded during surveys. Migratory waders could occur on rare occasions. The small areas of mudflat present in the project site would not comprise important habitat for migratory waders as defined in the guidelines for assessing effects on migratory species (DotE 2015).
Introduced species recorded or likely to occur	None recorded.
Photograph	Narrow mudflats at Alexandra Canal
Threatened fauna species recorded or likely to occur Migratory species recorded or likely to occur Introduced species recorded or likely to occur Photograph	Gould's Wattled Bat (<i>Chalinolobus gouldii</i>) was recorded using Anabat analysis. No threatened fauna species recorded. No migratory fauna species were recorded during surveys. Migratory waders could occur on ranoccasions. The small areas of mudflat present in the project site would not comprise important habitat for migratory waders as defined in the guidelines for assessing effects on migratory species (DotE 2015). None recorded.





Table 6-9 Fauna habitats – bridges and culverts

Bridges and culverts				
Description	The project site contains a pedestrian footbridge, rail bridge and culverts that open to Alexandra Canal.			
Typical fauna species recorded or likely to occur	Swallows and martins may construct nests under bridges.			
Threatened fauna species recorded or likely to occur	Crevices and pipes in the underside of the bridge or in culverts are potential roost habitat for microchiropteran bats such as the Eastern Bentwing-bat (<i>Miniopterus schreibersii oceanensis</i>) and Large-footed Myotis (<i>Myotis schreibersii</i>). No evidence of roosting bats was observed at the footbridge over Alexandra Canal.			
Photograph				

Underside of the footbridge over Alexandra Canal

6.3.3 Identification of threatened species under the BAM

6.3.3.1 Predicted threatened species

Based on the vegetation types and habitat resources present within the project site, the BAM calculator generates a list of threatened fauna species that are predicted to utilise the project site. Habitat assessments during field surveys and review of existing information were used to refine the list of predicted species (see Appendix A). The suite of threatened species associated with ecosystem credits required for the project site are listed in Table 6-10. For each predicted threatened species, a sensitivity class rating and vegetation zones they are predicted to be associated with are also provided. The BAM does not require targeted surveys for these species.

Common Name	Scientific Name	PCT Association
Australasian Bittern	Botaurus poiciloptilus	1232 – Swamp Oak Floodplain Forest 920 – Mangrove Forests
Australian Painted Snipe	Rostratula australis	1232 – Swamp Oak Floodplain Forest
Beach Stone-curlew	Esacus madnirostris	920 – Mangrove Forests
Black Bittern	Ixobrychus flavicollis	1232 – Swamp Oak Floodplain Forest 920 – Mangrove Forests
Black-tailed Godwit	Limosa limosa	920 – Mangrove Forests

Table 6-10	Predicted	threatened	fauna	that may	occur in	the sit	е
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Common Name	Scientific Name	PCT Association
Broad-billed Sandpiper	Limicola falcinellus	920 – Mangrove Forests
Curlew Sandpiper	Calidris ferruginea	920 – Mangrove Forests
Eastern Bentwing-bat	Miniopterus schreibersii oceanensis	1232 – Swamp Oak Floodplain Forest
		920 – Mangrove Forests
Eastern Freetail-bat	Mormopterus norfolkensis	1232 – Swamp Oak Floodplain Forest
		920 – Mangrove Forests
Eastern Osprey	Pandion cristatus	1232 – Swamp Oak Floodplain Forest
		920 – Mangrove Forests
Gang-gang Cockatoo	Callocephalon fimbriatum	1232 – Swamp Oak Floodplain Forest
Great Knot	Calidris tenuirostris	920 – Mangrove Forests
Greater Sand-plover	Charadrius leschenaulti	920 – Mangrove Forests
Grey-headed Flying-fox	Pteropus poliocephalus	1232 – Swamp Oak Floodplain Forest
		920 – Mangrove Forests
Lesser Sand-plover	Charadrius mongolus	920 – Mangrove Forests
Little Bentwing-bat	Miniopterus australis	1232 – Swamp Oak Floodplain Forest
		920 – Mangrove Forests
Little Eagle	Hieraaetus morphnoides	1232 – Swamp Oak Floodplain Forest
		1020 – Mangrove Polesis
		1232 – Swamp Oak Floodplain Forest
Little I ern	Sternula albifrons	920 – Mangrove Forests
Masked Owl	Tyto novaehollandiae	1232 – Swamp Oak Floodplain Forest
Powerful Owl	Ninox strenua	1232 – Swamp Oak Floodplain Forest
Regent Honeyeater	Anthochaera phrygia	1232 – Swamp Oak Floodplain Forest
Spotted Harrier	Circus assimilis	1232 – Swamp Oak Floodplain Forest
Spotted-tailed Quoll	Dasyurus maculatus	1232 – Swamp Oak Floodplain Forest
		920 – Mangrove Forests
Square-tailed Kite	Lophoictinia isura	1232 – Swamp Oak Floodplain Forest
Swift Parrot	Lathamus discolor	1232 – Swamp Oak Floodplain Forest
Terek Sandpiper	Xenus cinereus	920 – Mangrove Forests
Varied Sittella	Daphoenositta chrysoptera	1232 – Swamp Oak Floodplain Forest
White-bellied Sea-Eagle	Haliaeetus leucogaster	1232 – Swamp Oak Floodplain Forest
		920 – Mangrove Forests
Yellow-bellied Sheathtail-bat	Saccolaimus flaviventris	1232 – Swamp Oak Floodplain Forest
		920 – Mangrove Forests





6.3.3.2 Candidate species credit species

Threatened species that cannot reliably be predicted to occur on a development site based on PCT, distribution and habitat criteria are identified by the Threatened Biodiversity Data Collection as 'species credit species'. In some circumstances, the particular habitat components of species assessed for ecosystem credit species, such as the breeding habitat of a cave roosting bat or forest owls, are also assessed for species credits. The credit calculator references geographic, vegetation and habitat data for the project site to generate a list of the species credit-type threatened species predicted to occur and requiring targeted survey. Searches of threatened species databases were also completed to determine any additional species to those generated by the credit calculator that are known or predicted to occur in the locality (refer to likelihood of occurrence table in Appendix A). These results were reviewed giving consideration to the relevant habitats available on site, to determine the candidate species credit species that may potentially occur onsite.

Following the desktop assessment and habitat assessments undertaken in the field, four threatened fauna species were considered to be candidate species for assessment: the Green and Golden Bell Frog, Southern Myotis, Pied Oystercatcher (*Haematopus longirostris*) and Sooty Oystercatcher (*Haematopus fuliginosus*). These are detailed in Table 6-11 and discussed below. The results of the habitat assessment and surveys were then used to justify whether these species were to be included in the credit calculations for the project.

Scientific Name	Common Name	Survey month	Presence	Justification
Litoria aurea	Green and Golden Bell Frog	Nov-Mar	No – surveyed	No Green and Golden Bell Frogs were recorded during surveys for the project. As detailed in section 3.3.3, dedicated targeted surveys for the Green and Golden Bell Frog have been undertaken in suitable weather conditions over a number of months. Most surveys were undertaken in months identified as suitable in the survey guidelines for the species (DEWHA 2010a). Green and Golden Bell Frogs were active at other reference sites during the survey period. No evidence of the species has been recorded at Botany Wetlands since 1993, and it is generally accepted to be extinct in this area. Given this, the Green and Golden Bell Frog is not considered affected by the project and as such no
<i>Myotis</i> <i>macropus</i>	Southern Myotis	Nov-Mar	No – surveyed. Anabat surveys were undertaken in appropriate weather conditions in September and October	The Southern Myotis was not recorded during surveys. There are no records of the species in the last 30 years associated with Alexandria and the lower Cooks River area (OEH 2019a). The species is not known from the nearby Wolli Creek (Little et al 2010). No evidence of roosting bats was observed at the bridge over Mill Stream at the Botany Wetlands and there are no hollow- bearing trees in the vicinity of the wetland that could be used for roosting by this species. No calls attributable to this species were recorded during anabat surveys undertaken at Alexandra Canal within the project site, in adjoining habitat at Tempe Wetland, or at Botany Wetland to the south-east of the project site. Other bat species were active, showing that surveys were undertaken in appropriate conditions. Given the above, the Southern Myotis is not considered affected by the project and as such no credit calculations are deemed warranted.

Table 6-11 Candidate species credit species for which surveys were conducted





Scientific Name	Common Name	Survey month	Presence	Justification
Haematopus Sooty Oystercatch fuliginosus	Sooty Oystercatcher	All year	No – surveyed	The Sooty Oystercatcher was not recorded at Alexandra Canal, and there are no recent records of the species at this location. There are many records of the species on the southern side of Botany Bay, generally associated with rocky shores. Potential habitat in the project site is very small in area and of low quality.
				Given the above, the Sooty Oystercatcher is not considered affected by the project and as such no credit calculations are deemed warranted.
Haematopus longirostris	Pied Oystercatcher	All year	No – surveyed	The Pied Oystercatcher was not recorded at Alexandra Canal, and there are no recent records of the species at this location, although there are two records along the Cooks River near Muddy Creek, to the south of the project site. There are many records of the species on the southern side of Botany Bay, generally associated with rocky shores. Potential habitat in the project site is very small in area and of low quality.
				Given the above, the Pied Oystercatcher is not considered affected by the project and as such no credit calculations are deemed warranted.

Green and Golden Bell Frog

The mapped distribution of the Green and Golden Bell Frog Lower Cooks River key population includes Marsh Street wetlands, Barton Park and Eve Street wetland at Arncliffe about 1 kilometre south-west of the project site, as well as the Botany Wetlands 600 metres to the south-east and Rosebery about 2 kilometres to the north-east. The species still occurs at the Marsh Street wetlands, and is being monitored as part of the New M5 project, with only low numbers of individuals having been recorded in recent years (Ecological 2017). White and Pyke (2008a) considered the species to be extinct from Botany Wetlands, with the last record being 1993. Ponds and other frog habitats were created at Sir Joseph Banks Park at Botany (about 1 kilometre to the south of the project site) and individuals were translocated into these habitats in 1996, 1997, 1999 and 2000. Translocations were unsuccessful due to the presence of Mosquitofish (*Gambusia holbrooki*), lack of shelter sites and competition from other frogs (White and Pyke 2008b). Despite this, there are records of the Green and Golden Bell Frog from Sir Joseph Banks Park from 2007 (OEH 2019b), suggesting that the population had persisted longer than thought. OEH (2007) identified Alexandra Canal as a potential movement corridor if rehabilitated.

The project does not intersect with any known habitat areas for the Green and Golden Bell Frog. The Marsh Street Wetland is located about one kilometre from the project site and is separated from it by the Cooks River. Botany Wetlands and Rosebery are separated from the project by large areas of industrial and residential land, as well as roads and the rail line.

Tempe Wetland (outside the project site) contains potential habitat for the Green and Golden Bell Frog. Alexandra Canal (within the project site) is not considered to comprise habitat for the species. There are no historical or recent records of the Green and Golden Bell Frog from Tempe Wetland as it was only constructed in the mid-2000s during remediation of the former Tempe landfill. The most recent record in the Alexandria area is from 1964 (OEH 2019a).





Many surveys have been undertaken at Tempe Wetland, Alexandra Canal and the Botany Wetlands in recent years. Where possible, these have been undertaken in accordance with the survey guidelines (DECCW 2010a), however this has been difficult given the generally dry conditions experienced in Sydney in recent years. Recent surveys have been undertaken following substantial spring rainfall events (October 2018). There has been no evidence of the Green and Golden Bell Frog in Tempe or Botany during any of these surveys. Tempe Wetland is not considered to be optimum habitat given its small size, isolation from other potential habitat areas, and presence of the Common Eastern Froglet which is thought to be a carrier of Chytrid fungus (Brannelly et al. 2018).

SMEC (2018) concluded that the Green and Golden Bell Frog was unlikely to be present in the Tempe and Botany areas due to the presence of Mosquitofish and high levels of disturbance and pollution. This is supported by the surveys undertaken in recent months, which found high activity of common frog species, but no evidence of the Green and Golden Bell Frog. The species is unlikely to disperse between the Marsh Street Wetlands and Tempe given the presence of the saline Cooks River and the busy Princes Highway, both of which are hostile barriers to movement.

Based on the historic extinction of the species in the Botany area, lack of suitable habitat in the project site, and lack of any evidence of the species during targeted surveys over 2017 and 2018, the Green and Golden Bell Frog is highly unlikely to be present in the project site.

Southern Myotis

No evidence of roosting bats was observed at the foot-bridge over Alexandra Canal, despite the presence of crevices between the concrete slabs. Other bridges in the area (such as the bridges over Alexandra Canal and the Cooks River) have the potential to provide roost habitat for microchiropteran bats. No hollow-bearing trees were observed in the vicinity of the wetland that could be used for roosting by this species.

No calls attributable to this species were recorded on anabats at Alexandra Canal or Tempe Wetland, nor were they recorded at Botany Wetlands during surveys for the associated Botany Rail Duplication Project. While the species is known to occur around Sydney Harbour (Gonsalves and Law 2017) and has been recorded elsewhere in the locality, there are no records in the last 30 years associated with Botany Wetlands, Alexandria and the lower Cooks River area (OEH 2019a). The species is not known from the nearby Wolli Creek (Little et al. 2010).

The Southern Myotis breeds from October to January, and is active in most months. While surveys were not undertaken between November and March (the period identified in the credit calculator), suitable survey effort was undertaken in a period when the species was likely to be active in the area (September–October), as the species is known to breed in October in NSW (Churchill 2008). Other bat species were active at this time and recorded during the Anabat surveys.

Given the lack of evidence of the species in the project site, and lack of recent records in the area, the Southern Myotis is not considered present and unlikely to be impacted by the project.

Sooty and Pied Oystercatcher

Neither the Sooty Oystercatcher nor the Pied Oystercatcher were recorded during surveys along Alexandra Canal. No breeding habitat is present as the Sooty Oystercatcher breeds almost exclusively on offshore islands and the Pied Oystercatcher breeds on beaches (OEH 2019b). The small areas of low quality foraging habitat present along Alexandra Canal are unlikely to be used by these species except possibly on rare occasions given the large areas of better quality habitat elsewhere around Botany Bay. Most records of these species in the area are around the southern portions of Botany Bay and La Perouse (OEH 2019a). Given the lack of evidence of the species in the project site, the oystercatcher species are not considered present and unlikely to be impacted by the project.



6.3.3.3 Potential candidate species not considered to occur on site

Given the highly disturbed and modified nature of the project site, no suitable habitat for most potential candidate species credit species occurs within the project site. A list of the remaining potential candidate species considered, and justification for their omission from further consideration under this assessment (where relevant) is provided in Table 6-12. Note that some of these species are also ecosystem/species credit species (such as the Grey-headed Flying-fox and Eastern Bentwing-bat). Only breeding habitat is considered for species credits for these species.

Scientific Name	Common Name	Presence	Justification	
Miniopterus australis	Little Bentwing-bat (breeding habitat only)	No	No cave habitat present for breeding	
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat (breeding habitat only)	No	No cave habitat present for breeding	
Chalinolobus dwyeri	Large-eared Pied Bat	No	No cave habitat present for breeding	
Phascolarctos cinereus	Koala	No	No suitable forest habitat present. No connected areas of habitat. No local records.	
lsoodon obesulus obesulus	Southern Brown Bandicoot (eastern)	No	No suitable forest habitat present. No connected areas of habitat. No local records.	
Pteropus poliocephalus	Grey-headed Flying-fox (breeding habitat only)	No	No breeding camp present.	
Hieraaetus morphnoides	tus Little Eagle No No raptor nests present oides (breeding habitat only)		No raptor nests present	
Pandion cristatus	Eastern Osprey (breeding habitat only)	No	No raptor nests present	
Lophoictinia isura	Square-tailed Kite (breeding habitat only)	No	No raptor nests present	
Haliaeetus leucogaster	White-bellied Sea-Eagle (breeding habitat only)	No	No raptor nests present	
Burhinus grallarius	Bush Stone-curlew	No	No suitable woodland habitat present.	
Esacus magnirostris	Beach Stone Curlew	No	Only occurs as a vagrant in the Sydney area. No suitable breeding habitat present.	
Tyto novaehollandiae	Masked Owl (breeding habitat only)	No	No large hollow-bearing trees present	
Ninox strenua	Powerful Owl (breeding habitat only)	No	No large hollow-bearing trees present	
Anthochaera phrygia	Regent Honeyeater	No	No important area of foraging habitat present	
Lathamus discolor	Swift Parrot	No	No important area of foraging habitat present	
Limosa limosa	Black-tailed Godwit	No	No important area of foraging habitat present	
Limicola falcinellus	Broad-billed Sandpiper	No	No important area of foraging habitat present	
Calidris ferruginea	ferruginea Curlew Sandpiper No No important area of foraging habitat		No important area of foraging habitat present	

Table 6-12 Potential candidate species credit species not on site



Scientific Name	Common Name	Presence	Justification
Calidris tenuirostris	Great Knot	No	No important area of foraging habitat present
Charadrius Ieschenaultii	Greater Sand-plover	No	No important area of foraging habitat present
Charadrius mongolus	Lesser Sand Plover	No	No important area of foraging habitat present
Xenus cinereus	Terek Sandpiper	No	No important area of foraging habitat present
Sternula albifrons	Little Tern	No	No dune habitat present
Neophema chrysogaster	Orange-bellied Parrot	No	No saltmarsh habitat present
Callocephalon fimbriatum	Gang-gang Cockatoo (breeding habitat only)	No	No large hollow-bearing trees present
Callocephalon fimbriatum	Gang-gang Cockatoo population in the Hornsby and Ku-ring-gai Local Government Areas (breeding habitat only)	No	Outside distribution of the population
Litoria brevipalmata	Green-thighed Frog	No	Outside known distribution. No suitable habitat present

6.4 Aquatic habitat

6.4.1 Aquatic habitat

The main aquatic habitat located in the project site is Alexandra Canal, and most surface water in the project site drains into the canal and then into the Cooks River before entering Botany Bay. Tempe Wetland is an artificial wetland located to the north-west of the project site. It also drains to the Cooks River. Stormwater from the project area south of Joyce Drive is collected by a drainage system that discharges into Mill Stream, which then drains to Botany Bay. Aquatic habitat values are discussed further below.

Alexandra Canal runs alongside Airport Drive and is crossed by the project. It is an adapted artificial waterway (formally known as Sheas Creek) that drains into the Cooks River to the south-west of the project site. The canal is tidally dominated through its connection to the Cooks River. It is around 3.9 kilometres long and 60 metres at its widest. The tidal influence from the Cooks River extends to the head of the canal.

Alexandra Canal provides stormwater drainage for large industrial and residential areas, with many culverts discharging into the canal. The canal has been subject to historical contamination as a result of direct discharge and runoff from the numerous industries and other land uses located along the canal from the late 1800s (OEH 2001). Older sediments in the canal are known to be highly contaminated, and these are overlain by more recent, less contaminated sediments. Alexandra Canal was declared a remediation site by the EPA due to the bed sediments contaminated with chlorinated hydrocarbons, including organochlorine pesticides, polychlorinated biphenyls and metals. The remediation order notes that the contamination presents a significant risk of harm to human health and the environment (EPA 2000).

The canal banks are generally sandstone, with some areas of concrete. Planted *Juncus* sp. occur within the sandstone walls adjacent to Tempe Reserve. Some small Mangroves (*Avicenna* sp.) occur along the narrow mudflats, and Swamp Oaks (*Casuarina glauca*) are present in some locations along the banks. Sparse woody debris and submerged habitat structures are present, providing little refuge for fish. Large amounts of rubbish are present along the banks.



Oysters are present in the mudflats and on the sandstone and concrete edges of the canal. Bream (*Acanthopagrus* sp.), juvenile fingerlings (species unknown) and jellyfish were observed in the canal during surveys. A range of other common fish species are likely to occur.

Tempe Wetland is an artificial wetland with no flow from a natural system. Water enters from a stormwater drain and the wetland drains to Alexandra Canal. A number of emergent aquatic plants are present, including *Typha* and *Phragmites*. Floating algae covered about 60 per cent of the middle pond surface at the time of the survey. Water was turbid with discolouration on the surface from urban runoff. No native fish would occur in the wetland given the lack of connectivity with Alexandra Canal and the Cooks River.

The Cooks River near its confluence with Alexandra Canal is a highly modified habitat. River banks are typically concrete or stone blocks, with small areas of mudflats adjacent to these at low tide. Present levels of pollutants make it unsafe for swimming, unsuitable for many aquatic species and a health risk for commercial fishing. Riparian vegetation is limited to occasional mangroves and planted trees. Some areas of saltmarsh are also present. Occasional stormwater channels flow into the river in this area.

A relatively small portion of the project footprint which lies within Sydney Airport is located within the Mill Stream catchment. The area of project footprint is drained by a piped drainage line that discharges into Mill Stream, upstream (east) of Foreshore Road. Mill Stream within the project catchment is characterised by high levels of nutrients, dissolved oxygen and heavy metals.

6.4.2 Threatened aquatic species and key fish habitat identified in the project site

Tempe Wetland, Alexandra Canal and Mill Stream do not provide habitat for any threatened fish species known from the locality. Freshwater habitats crossed by the project are outside the natural range of the Australian Grayling (*Prototroctes maraena*). The Black Rock Cod (*Epinephelus daemelii*) occurs around rocky shores and reefs, and no suitable habitat is present in the project site (see Appendix B).

Alexandra Canal is mapped as key fish habitat by DPI (2007) despite its highly disturbed and artificial form. All downstream habitats (the Cooks River, Mill Stream and Botany Bay) are also mapped as key fish habitat.

6.4.3 Coastal Management SEPP 2018 – Coastal Wetland

Parts of the southern end of Tempe Reserve alongside the Cooks River and Alexandra Canal (but outside the project site) are mapped as Coastal Wetlands under the Coastal Management SEPP 2018. The proximity area for the wetland extends north along Alexandra Canal towards the footbridge, and adjoins the project site at this location. These wetlands are separated from the Cooks River by footpaths and at a higher elevation to the river so are likely to be inundated only during very high tides (such as spring tides) or during flood events. The project will not have any direct impact on mapped Coastal Wetlands or the associated proximity area for the wetland. The project has been designed to avoid disturbance of contaminated sediment in the project site and mitigation measures to prevent adverse water quality effects within and downstream of the project site during construction and operation will be implemented.





7. Matters of National Environmental Significance

7.1 Threatened ecological communities

The protected matters search undertaken for this project identified eleven predicted threatened ecological communities as potentially occurring within the locality. These communities are:

- Castlereagh Scribbly Gum and Agnes Banks Woodlands of the Sydney Basin Bioregion
- Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community
- Coastal Upland Swamps in the Sydney Basin Bioregion
- Cooks River/Castlereagh Ironbark Forest of the Sydney Basin Bioregion
- Eastern Suburbs Banksia Scrub of the Sydney Region
- Littoral Rainforest and Coastal Vine Thickets of Eastern Australia
- Posidonia australis seagrass meadows of the Manning-Hawkesbury ecoregion
- Shale Sandstone Transition Forest of the Sydney Basin Bioregion
- Subtropical and Temperate Coastal Saltmarsh
- Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion
- Western Sydney Dry Rainforest and Moist Woodland on Shale.

Of these, one threatened ecological community listed under the EPBC Act, being Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community, was considered as a candidate to occur within the project site. An overview and analysis of this ecological community against recorded field data and the conservation listing advice is provided in section 7.1.1 below.

7.1.1 Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community

Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community is listed as endangered under the EPBC Act.

Within the project site, the following PCT was considered a candidate to form part of this EPBC Act threatened ecological community listing:

PCT 1232 Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion.

To be considered a Matter of National Environmental Significance (MNES), areas or patches of PCT 1232 must meet both:

- The key diagnostic characteristics AND
- At least the minimum condition thresholds for Category C.

An overview of key diagnostics of the EPBC Act-listed community against candidate PCT 1232 is presented in Table 7-1.



Table 7-1Comparison of Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and
South East Queensland ecological community key diagnostics against candidate PCT 1232

Key diagnostic	PCT 1232 – Low
Occurs from south-east Queensland to southern NSW within the South-Eastern Queensland, NSW North Coast, Sydney Basin, or South East Corner bioregions	Yes, project site occurs within the Sydney Basin Bioregion
Occurs in coastal catchments at elevations up to 50 m ASL, typically less than 20 m ASL, on coastal flats, floodplains, drainage lines, lake margins, wetlands and estuarine fringes where soils are at least occasionally saturated, water-logged or inundated. There are also minor occurrences on coastal dune swales or flats, particularly deflated dunes and dune soaks.	No, all patches were recorded as regrowth growing from fill material of generally unknown origin. These areas of fill are not considered to form part of a natural floodplain system.
Occurs on soils derived from unconsolidated sediments (including alluvium), typically hydrosols (grey-black clay-loam and/or sandy loam soils) and sometimes organosols (peaty soils). It may occur in transitional soils (or catenas) where shallow unconsolidated sediments border lithic substrates.	No, all patches were recorded as regrowth growing from fill material of generally unknown origin. No intact undisturbed soil profiles are considered to be associated with patches of PCT1232 recorded within the project site.
Has an open woodland, woodland, forest, or closed forest structure, with a tree canopy that has a total crown cover of at least 10 per cent.	Yes – does contain a total crown cover of >10%.
Has a canopy of trees dominated by <i>Casuarina glauca</i> (swamp-oak, swamp she-oak).	Yes – <i>Casuarina glauca</i> forms a dominant canopy
Does this condition type meet the EPBC Act listed of Coastal Swamp Oak (Casuarina glauca) Forest key characteristics?	No, based on the lack of suitable geomorphology and natural soil profile, no patches of PCT 1232 are considered to meet EPBC Act key diagnostic and, as such, no patches meet the EPBC Act listed form of Coastal Swamp Oak (<i>Casuarina glauca</i>) Forest

Based on a comparison of candidate PCT 1232 against key diagnostic data in Table 7-1, none of the areas mapped as PCT 1232 within the project site meet the EPBC Act listing of Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community.

7.2 Threatened flora species

The protected matters search undertaken for this project identified 28 predicted threatened flora species as potentially occurring within the locality. The results of the field surveys and likelihood of occurrence assessments have determined these species to have a low likelihood of occurrence and are not considered to be affected by the project (Appendix B).

In addition, it is noted that two threatened flora species were recorded as landscape plantings within the project site, being *Eucalyptus nicholii* (Narrow-leaved Black Peppermint) and *Eucalyptus scoparia* (Wallangarra White Gum). The natural distribution of these species does not occur within the Sydney Basin Bioregion although they have been widely distributed by the horticultural industry as ornamental landscape plantings. The occurrences of these species within the project site do not meet the approved conservation advice (DoEE 2019c) for distribution and habitat attributes and as such they are not assigned the conservation significance of a threatened species.



7.3 Threatened fauna species

Fauna habitats are limited in the project site given the predominantly cleared and disturbed nature of the site. Planted trees and cleared land provide foraging and nesting habitat for a range of common fauna, including more mobile species typical of urban parks and gardens. Tempe Wetland, adjoining the project site, provides habitat for a range of common waterbirds, frog and reptile species. Limited habitat is present along Alexandra Canal. Small areas of mudflats are present, which provide foraging habitat for wading birds such as ibis, herons and egrets.

The potential habitat for MNES of relevance to the project is discussed in further detail below.

7.3.1 Green and Golden Bell Frog

The project does not intersect with any known habitat areas for the Green and Golden Bell Frog. Based on the historic extinction of the species in the Botany area, and lack of any evidence of the species during targeted surveys over 2017 and 2018, the Green and Golden Bell Frog is highly unlikely to be present in the project site.

7.3.2 Grey-headed Flying-fox

Occasional fig trees, eucalypts and exotic forage trees occur as planted trees within the project site, such as along Qantas Drive. Grey-headed Flying-foxes would forage in these trees on occasion when fruiting or flowering. There is no breeding camp in the project site. Nearby breeding camps include those at Wolli Creek (3 kilometres to the west) and Centennial Park (5.5 kilometres to the north-east). Foraging habitat in the project site would be a negligible proportion of available foraging habitat used by individuals from these camps and thus would not be habitat critical to the survival of the species.

7.4 Migratory species

There are no records of migratory waders in the project site, however Botany Bay nearby is known to provide habitat for a range of migratory species listed under the EPBC Act. Occasional very narrow bands of mudflats occur along Alexandra Canal. These are highly disturbed and polluted. While an individual migratory wader may occur on occasion, these are unlikely to provide important foraging habitat for any migratory waders.

The primary shorebird habitat areas in the Rockdale area are Eve Street Wetlands, Landing Lights Wetland, Lady Robinsons Beach at Sandringham Bay and Riverside Drive, Sans Souci (Rockdale Council 2014). No important shorebird habitat was identified by Rockdale Council (now Bayside Council) along the lower Cooks River near the project site, nor elsewhere on the lower Cooks River in the Inner West Council area (AMBS 2011).

Towra Point Nature Reserve Ramsar Site is located on the southern side of Botany Bay, about 6.5 kilometres from the project site. Towra Point Nature Reserve and adjacent areas regularly support around 34 of the 80 species of migratory birds listed under the various migratory agreements and provide large areas of much better quality foraging habitat for these species (OEH 2013).

7.5 Wetlands of International Importance (Ramsar wetlands)

Towra Point Nature Reserve Ramsar Site is located on the southern side of Botany Bay, about 6.5 kilometres downstream of the project site. The reserve contains a gradation of environments from subtidal areas to extensive intertidal mudflats and mangrove forest to occasionally tidal-flooded saltmarsh to freshwater wetlands to shallow and deep sand dunes supporting littoral forest. As discussed above, this Ramsar Site provides important habitat for a number of migratory waders. It also hosts one of the most important nesting sites in NSW for the Little Tern (*Sternula albifrons*) and a significant proportion of the statewide nesting population of the Pied Oystercatcher which are listed as endangered under the NSW BC Act (OEH 2013).





7.6 Environment of Commonwealth land

7.6.1 Existing environment

The majority of the project site is located on Commonwealth-owned land leased to Sydney Airport Corporation. This area has been cleared historically and is highly modified. It predominantly comprises industrial areas dominated by roads and hardstand, as well as industrial areas and vacant land.

Due to the long history of industrial use of the area there is significant contamination of soil and groundwater in Commonwealth land in the project site. This includes bonded asbestos containing material and asbestos fines/fibrous asbestos within fill materials; contaminants in the soil and groundwater, including hydrocarbons, polycyclic aromatic hydrocarbons (PAH), per- and poly-fluoroalkyl substances (PFAS) and heavy metals as well as high levels of noise and vibration from aircraft and traffic.

The main areas of natural biodiversity value remaining at Sydney Airport are the Sydney Airport wetlands. Sydney Airport manages the downstream sections of the Botany Wetlands, including Mill Pond, Engine Pond East and West and Mill Stream. These downstream ponds of the Botany Wetlands are referred to as the Sydney Airport Wetlands. The Botany Wetlands are listed in the Directory of Important Wetlands in Australia and are known to provide occasional habitat for threatened and migratory waders (SACL 2013b). The wetlands are considered an environmentally significant area under the Sydney Airport Master Plan 2039. The marine environment of Botany Bay is also identified as an area of environmental sensitivity under the Master Plan 2039. The Sydney Airport Wetlands and the wider aquatic environment of Botany Bay are zoned EC1 Environmental Conservation areas under the Master Plan 2039.

The Botany Wetlands, which include the Sydney Airport Wetlands, are located well outside the project site and the project will not have an adverse impact on the aquatic environment of Botany Bay.

7.6.2 Vegetation and flora within the project site on Sydney Airport land

There are only small areas of native vegetation on Commonwealth land within the project site. This comprises 0.69 hectares of small, isolated and highly modified patches of PCT 1232 Swamp Oak Floodplain Forest and 0.04 hectares of PCT 920 Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion. Based on the lack of suitable geomorphology and natural soil profile, the patches of PCT 1232 do not meet the key diagnostic criteria for the Coastal Swamp Oak (*Casuarina glauca*) Forest endangered ecological community (EEC) listed under the EPBC Act and are therefore not considered commensurate with the listed form of the community.

Small pockets of planted trees (predominantly eucalypts and figs) and shrubs also occur along roadsides and in carparks within Commonwealth land in the project site. Remaining vegetation on Commonwealth land comprises 2.83 hectares of planted native and exotic trees (predominantly eucalypts and figs) and shrubs, which occur in small pockets along roadsides and in carparks and 10.27 hectares of highly disturbed areas with no or limited native vegetation (generally grassed verges and weed infestations).

No threatened flora species listed under the EPBC Act or the BC Act were recorded on areas of Commonwealth land in the project site.

7.6.3 Fauna habitats within the project site on Sydney Airport land

The small patches of native vegetation, planted trees and exotic vegetation located on Commonwealth land provide habitat predominantly for common and widespread native fauna species typical of highly modified urban environments, such as the Australian Magpie, Noisy Miner and Willie Wagtail. Common frogs and lizards also occur in these areas.

The threatened Grey-headed Flying-fox would forage in planted eucalypts and fig trees when trees are flowering or fruiting but there is no roosting habitat for this species within the project site or immediately adjoining areas. Microchiropteran bats are also likely to forage over patches of vegetation on occasion.





An artificial holding pond is located at the northern end of Sydney Airport adjacent to Qantas Drive. This is covered by mesh to prevent birds from using it. It would not provide any habitat for threatened or migratory waders. Despite its disturbed and modified nature, it is mapped as key fish habitat by DPI (2007). The pond is unlikely to provide important habitat for native fish and does not contain suitable habitat for any threatened aquatic species listed under the FM Act or EPBC Act.

7.6.4 Threatened and migratory biota on Commonwealth land

Commonwealth land in the project site contains limited habitat of relevance for threatened biota or migratory species listed under the EPBC Act. A detailed discussion of MNES in the project site as a whole is provided in section 7. A discussion of MNES with specific reference to Commonwealth land in the project site is provided below.

No threatened ecological communities listed under the EPBC Act occur in the project site. None of the areas mapped as PCT 1232 meet the EPBC Act-listed Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community based on the lack of suitable geomorphology and natural soil profile. No threatened flora species listed under the EPBC Act occur in the project site or would be impacted by the project.

The threatened Grey-headed Flying-fox would likely forage in pockets of planted eucalypts and fig trees on Commonwealth land when trees are flowering or fruiting but there is no roosting habitat for this species within the project site. Commonwealth land in the project site does not contain known or historical habitat for the Green and Golden Bell Frog and evidence for this species was detected during targeted surveys undertaken for this assessment. This species has been historically associated with the Botany Wetlands which are located on Commonwealth land outside of the project area. The Botany Wetlands will not be affected by the project.

There are no records of migratory waders on areas of Commonwealth land in the project site. Occasional very narrow bands of mudflats occur along Alexandra Canal which borders areas of Commonwealth land in the project site. These are highly disturbed and polluted. While an individual migratory wader may occur on occasion, these are unlikely to provide important foraging habitat for any migratory waders. The project will not affect habitat for threatened and migratory waders associated with the Botany Wetlands which are located on Commonwealth land outside of the project area.







8. Assessment of construction impacts

8.1 Summary of key findings (impact summary)

8.1.1 Impacts on native vegetation and state-listed entities

The project would predominantly impact already cleared hardstand areas with no biodiversity value. The majority of the vegetation to be removed for the project is not native vegetation and comprises exotic plants or planted, often non-indigenous, native species on fill material. In total, the project would remove about 0.91 hectares of native vegetation, comprising 0.87 hectares of PCT 1232 Swamp Oak floodplain swamp forest and 0.04 hectares of PCT 920 Mangrove Forests in estuaries. No vegetation to be removed is commensurate with a threatened ecological community.

No threatened flora species or their habitat, listed under BC Act, will be affected by the project.

The vegetation that would be removed or modified provides limited habitat resources for native fauna species due to its existing highly modified nature and the surrounding urban environment. Fauna habitat resources that would be removed include foraging and shelter resources for mainly common native fauna typical of urban environments. The project would remove a small number of food trees of the Grey-headed Flying-fox and foraging habitat for microbats. This would not be significant in the context of available foraging habitat in the locality.

Alexandra Canal is not important habitat for any migratory waders that may occur in the Botany Bay area. The project is unlikely to significantly impact threatened or migratory waders as a negligible area of very poor quality mudflats would be impacted by the project. No habitat for threatened fish is present in Alexandra Canal. Construction water runoff and sedimentation in Alexandra Canal, as well as downstream waterbodies including Cooks River and ultimately Botany Bay, could affect habitat for fish, wading birds and other species that utilise these waterways. These waterways are already subject to substantial disturbance and pollution.

The project would not affect entities subject to serious and irreversible impacts. There would be limited prescribed impacts under the BAM. There would be no effects on GDEs.

8.1.2 Impacts on the environment of Commonwealth land

The majority of the vegetation to be removed on Commonwealth land for the project is not native vegetation and comprises exotic plants or planted, often non-indigenous, native species on fill material. The removal of native, planted and exotic vegetation would affect habitat for a range of predominantly common flora and fauna species typical of urban and industrial areas. There would be no direct impact on the Sydney Airport Wetlands.

The project is consistent with the Airport Master Plan 2039 and Environment Strategy 2019-2024. In particular, the project has been designed to avoid adverse consequences on biodiversity values of Commonwealth land and has undertaken a rigorous assessment process through the preparation of this BDAR to ensure biodiversity impacts have been appropriately assessed and minimised where practicable. There would be no direct impact on the Sydney Airport Wetlands or the Botany Bay marine environment, which are identified as sensitive receivers in the Airport Master Plan. There is a potential for indirect impacts due to project discharges (stormwater runoff and discharge construction water). The project is not in conflict with any of the identified biodiversity actions identified in the Environment Strategy 2019-2024. The project would not have a significant impact on plants and animals within Commonwealth land.

8.1.3 Impacts on MNES

Limited habitat for MNES would be impacted by the project. No habitat for migratory waders would be impacted. The loss of 4.85 hectares of planted native and exotic trees would remove a small area of foraging habitat for the Grey-headed Flying-fox. There would not be a significant impact on this species as a result of the project.





The project has adopted the 'avoid, minimise and offset' approach to mitigate impacts to biodiversity values in accordance with the BAM, the BC Act, the EPBC Act, the FM Act and associated policies. In line with this approach, a project should in order of consideration, endeavour to:

- Avoid effects on habitat, through the project planning and design process
- Minimise effects on habitat, through the use of a range of environmental management and impact mitigation measures
- Offset any residual impact that could not be avoided or mitigated.

The project site is located within an industrial area of Sydney, which has been substantially cleared and modified through previous earthworks and construction. The project's impacts are therefore substantially less than would be associated with an undisturbed 'green field' site. The project has been purposefully designed to avoid or further reduce effects on biodiversity values as far as is practicable, through the use of cleared and disturbed lands for compound sites where possible.

The project has also been designed to avoid effects on water quality and aquatic environments, including Alexandra Canal which is mapped as Key Fish Habitat (DPI 2007) despite its highly modified nature and downstream areas. Energy dissipaters have been included in the design of stormwater outlets where necessary to reduce water velocity and minimise the potential for scour and sediment mobilisation. No piers would be constructed within the canal bed itself, and there would be no disruption of fish passage. By adopting these design features, effects on aquatic values of the canal and downstream areas have been minimised (Roads and Maritime 2018). Further to this, excavated material from construction areas would be appropriately stockpiled and managed to prevent contaminants or sediment from entering waterways.

Despite these design features, there are small patches of disturbed native vegetation and planted vegetation that provides habitat for mostly common and widespread fauna species that cannot be avoided. There is also the potential for indirect effects on some areas of native vegetation adjacent to the project site, both during construction and from the resulting operation of the project. The impacts of the construction and operation phases of the project that cannot be avoided through design are discussed in section 8 and section 9 below. Mitigation measures to minimise those impacts that cannot be avoided through design are detailed in section 11.

8.3 Direct impacts on native vegetation and habitat

8.3.1 Removal of vegetation

The project site is characterised in general by cleared land as a result of previous clearing and ongoing maintenance of road, rail and industrial infrastructure with minimal value for native biodiversity. The majority of the vegetation to be removed for the project is not native vegetation and comprises exotic plants or planted, often non-indigenous, native species on fill material. Construction within these areas would remove a small number of individuals of non-threatened native plants, including planted trees, and priority and environmental weeds within highly modified habitat that does not support a native vegetation community.

The project site contains small areas of remnant and regrowth native vegetation, including two small patches of mangroves, several small patches of Swamp Oak regrowth and marginal habitat for a small number of highly mobile threatened fauna species. Native vegetation and habitat within the project site is in moderate to low condition and is already subject to impacts from existing road, rail and industrial infrastructure maintenance, edge effects, weed infestation, and exotic pests.

In total, the project would remove about 0.91 hectares of native vegetation as summarised in Table 8-1 and shown in Figure 8-1, of which most is located in Sydney Airport land (0.72 hectares).





Table 8-1 Direct impact of native and miscellaneous vegetation

Plant community type (PCT)	Status	Commonwealth land impacted (ha)	State land impacted (ha)	Total area impacted (ha)
PCT 920 Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	Not listed under the BC Act or EPBC Act Marine vegetation under the FM Act	0.04	0	0.04
PCT 1232 Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion	Does not meet TEC listing (refer section 5.5)	0.68	0.19	0.87
Total native vegetation		0.72	0.19	0.91
Miscellaneous Ecosystems (Highly disturbed areas with no or limited native vegetation)	Not native vegetation	9.69	8.60	18.29
Miscellaneous Ecosystems (urban exotic/native landscape plantings)	Not native vegetation	2.44	2.41	4.85
Total vegetation		12.85	11.20	24.05





Author: David Naken Date: 10/07/2019 Map.no: PS109315_GIS_175_A4

Scale 1:5,000

Project impacts Page 1 of 3





Figure 8-1

Author: David Naiken Date: 10/07/2019 Map.no: PS109315_GIS_175_A4 Project impacts Page 2 of 3



Figure 8**-**1

Author: David Naiken Date: 10/07/2019 Map.no: PS109315_GIS_175_A4

Scale 1:5,000

Project impacts Page 3 of 3



8.3.1.1 Impacts on fauna and habitat

Potential direct effects on fauna habitats are detailed in Table 8-2 below.

Table 8-2Direct impacts on fauna and fauna habitat resources

Impact	Description
Removal of habitat resources	Construction of the project would remove a very small area of fauna habitat, as most of the project site is already cleared land. The vegetation that would be removed or modified provides limited habitat resources for native fauna species due to its existing highly modified nature and the surrounding urban environment. Fauna habitat resources that would be removed include foraging and shelter resources for mainly common native fauna typical of urban environments. The project would remove a small number of forage trees of the Grey-headed Flying-fox and foraging habitat for microbats.
Removal of hollow- bearing trees	No large hollow-bearing trees suitable for nesting by threatened owls were recorded in the project site.
Injury and mortality	Construction has a potential to result in the injury or mortality of some individuals of less mobile fauna species and other small terrestrial fauna that may be sheltering in vegetation within the project site during clearing activities and unable to move out of the area. This could include nestlings, small lizards and frogs. More mobile native fauna such as native birds, bats, terrestrial and arboreal mammals that may be sheltering in vegetation in the project site are likely to evade injury during construction activities as they are likely to move away from construction activities.
Fragmentation and isolation of habitat.	The project would require the removal of vegetation and habitat and would create or increase small gaps in habitat. The vegetation within the project site is currently fragmented by the existing rail corridor, roads and urban development. It is unlikely that the project would create an additional barrier to the movement of pollinator and seed dispersal vectors, such as insects and birds.
Impacts on key fish habitat and marine vegetation	There would be no loss of key fish habitat. A very small area of mangroves and highly disturbed mudflats would be removed.
	There would be no effect on aquatic connectivity or fish passage along Alexandra Canal. Limited riparian and emergent vegetation is present. The gaps in riparian vegetation would be increased, but would be unlikely to prevent the movement of any fauna along this corridor.
Impact on wetland habitat	There would be no direct effects on wetland habitat at Tempe Wetland or the Sydney Airport Wetlands. Vegetation along the Cooks River corridor (other than small, degraded patches along Alexandra Canal) would not be directly impacted by the project.



8.4 Indirect impacts on native vegetation and habitat

Indirect effects on biodiversity values that may result from construction of the project are detailed in Table 8-3.

Table 8-3 Indirect effects on biodiversity vo	alues
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Impact	Description		
Weed invasion and edge effects	'Edge effects' include increased noise and light, erosion and sedimentation, and introduction of weeds, and the associated degradation of vegetation at the interface of intact vegetation and cleared areas. Edge effects may result in impacts such as changes to vegetation type and structure, increased growth of exotic plants, increased predation of native fauna or avoidance of habitat by native fauna. Altered environmental conditions along new edges can allow invasion by pest animals specialising in edge habitats or change the behaviour of resident animals. Edge effects would result from construction activities and then continue to affect vegetation and habitats adjoining the project site.		
	The project site and adjoining land has been extensively cleared. Small patches of vegetation occur at scattered locations. Due to the small size of native vegetation patches in the project site, they are already severely affected by edge effects and associated negative impacts such as weed infestation. The project would create few novel edge effects and is unlikely to result in a significant increase in the impact of existing edge effects.		
Pests and pathogens	Construction activities, in general, have the potential to introduce or spread pathogens such as Phytophthora (<i>Phytophthora cinnamomi</i>), Myrtle Rust (<i>Uredo rangelii</i>) and Chytrid fungus (<i>Batrachochytrium dendrobatidis</i>) into native vegetation and habitats. There is little available information about the distribution of these pathogens within the locality, and no evidence of these pathogens was observed during surveys, however Chytrid fungus is likely to have contributed to the extinction of the Green and Golden Bell Frog from the area (DECC 2008b). The potential for impacts associated with these pathogens is low, given the existing disturbed nature and high visitation rates to the project site, and lack of intact native vegetation in the vicinity of the project site.		
Noise, light and vibration	Construction of the project would require the use of additional vehicles and plant in the site. Fauna that occupy habitats within the project site and adjacent areas are likely to be accustomed to existing high noise and vibration levels originating from aircraft, road traffic, trains and the urban environment. Similarly, fauna and fauna habitats are already exposed to existing light from trains, cars, street lights and residential and industrial areas. While there would be localised increases in noise, vibration and light that would temporarily create substantial disturbance, increases above existing background levels during construction are unlikely to result in a significant impact on fauna that occur in the project site.		
Sedimentation, erosion and pollution	Construction of the project has the potential to result in sedimentation, erosion and mobilisation of contaminants within the project site and into adjoining native vegetation and aquatic habitats, through soil disturbance and construction activities. Sediment laden runoff to waterways can alter water quality and adversely affect aquatic life. This is a particular risk during construction near Alexandra Canal. The project has been carefully designed at this location to avoid instream bridge piers. Construction of stormwater channels and culverts at Alexandra Canal is likely to result in the mobilisation of sediments, however sediment containment measures will be implemented to minimise impacts.		





Impact	Description
Aquatic disturbance and pollution	Construction of the project has the potential to result in the mobilisation of contaminated sediments into waterways or chemical spills from vehicles or plant. The introduction of pollutants from the project into the surrounding environment, if uncontrolled, could potentially impact on water quality further downstream. The existing environment is already highly contaminated due to the long history of industrial activities in the area. Bonded asbestos containing material and asbestos fines/fibrous asbestos are present within fill materials. Contaminants in the soil or groundwater include hydrocarbons, polycyclic aromatic hydrocarbons (PAH), per- and poly-fluoroalkyl substances (PFAS) and heavy metals.
	Material excavated during construction would be stored appropriately prior to its re-use or removal to an appropriately licenced facility. Contaminated material from the former Tempe Tip landfill would be retained on site and encapsulated in a number of earth mounds. There would be no piers constructed within Alexandra Canal. Mobilisation of sediments during construction of stormwater outlets has the potential to disturb contaminated soils within the canal, which may impact aquatic habitats further downstream. Sediment containment measures will be implemented to minimise impacts.

The potential for indirect impacts would be managed through the construction environmental management plan (CEMP) (see section 11).

8.5 Impacts on threatened species listed under the BC Act

8.5.1 Threatened flora species

No threatened flora species or their habitat, listed under the BC Act, have been determined to be affected by the project.

8.5.2 Threatened fauna species

The project would have minimal effects on threatened fauna species listed under the BC Act. Only two species, the Grey-headed Flying-fox and the Eastern Bentwing-bat, were recorded during surveys. Some other highly mobile species (eg the Eastern Freetail Bat *Mormopterus norfolkensis*) may also occur on occasion within the project site. The Green and Golden Bell Frog was not recorded at Tempe Wetland or Alexandra Canal and is unlikely to be present (see section 6.3.3). It is highly unlikely that any threatened species or any fauna populations would rely on the habitat resources within the project site for their survival.

Effects on threatened fauna would comprise:

- The removal of 4.85 ha of potential foraging habitat for the Grey-headed Flying-fox
- The removal of 5.72 hectares of potential canopied foraging habitat for the Eastern Bentwing-bat and other threatened fauna species with potential habitat in the project site (consisting of 4.85 hectares of planted trees and 0.87 hectares of Swamp Oak forest)
- The removal of 18.32 hectares of highly disturbed areas dominated by weeds, that may provide foraging habitat for the Eastern Bentwing-bat
- The removal of 0.04 hectares of mangroves, that provide limited habitat for common fauna given the small area and location in a predominantly cleared industrial site.

There would be no effects on habitat for candidate species credit species. Targeted surveys did not find any evidence of the Green and Golden Bell Frog, Southern Myotis or oystercatcher species. No other candidate species credit species were surveyed for given the lack of suitable potential habitat in the project site.



8.6 Impacts on aquatic fauna and habitats

There is potential for impacts on the aquatic habitats within and downstream of the project area during construction if not mitigated. Potential aquatic impacts during construction include:

- Modification of flow volumes and velocities in waterways and resulting changes in water quality and aquatic habitat conditions
- Sedimentation of local and downstream watercourses and waterbodies, including Alexandra Canal, Tempe Wetlands, and the Cooks River, as a result of vegetation removal, soil disturbance, destabilisation of watercourse banks and erosion and sediment-laden runoff
- Exposure of actual or potential acid sulfate soils, which may generate acidic runoff and affect water quality
- Effects on surface and groundwater quality as a result of disturbance of contaminated soils
- Disruption of aquatic habitat connectivity.

The project includes new bridges across Alexandra Canal, which is mapped as key fish habitat, despite its artificial nature and highly modified condition. The bridges have been designed so that there are no in-stream piers, and thus there would be no changes to flows, disruption of habitat connectivity or blockage of fish passage. Through this process, effects on existing aquatic values of the canal have been minimised (Roads and Maritime Services 2018).

The water balance analysis undertaken as part of the surface water quality assessment has concluded that the project would have a negligible impact on the volume of stormwater discharged to Alexandra Canal and Mill Stream catchments. The construction of stormwater outlets along the canal has the potential to locally mobilise contaminated sediments, however this would be managed during construction to minimise impacts. Mitigation measures, such as energy dissipaters, will be installed where required to prevent scour and minimise the potential for erosion and sediment mobilisation during operation. The operation of the project is not expected to have geomorphic impacts on Alexandra Canal or downstream watercourses.

Construction involving excavation would interact with contaminated soils and groundwater. This includes works within the Botany Sand Beds Aquifer, which is known to be shallow and contaminated. Construction water runoff and sedimentation in Alexandra Canal, as well as downstream waterbodies, including the Cooks River and ultimately Botany Bay, could affect habitat for fish, wading birds and other species that use these waterways. These waterways are already subject to substantial disturbance and pollution, and natural processes in Alexandra Canal are already highly compromised. Design and mitigation measures would be implemented to minimise further impacts.

Material excavated from Sydney Airport land would be removed from site and stockpiled at appropriately licensed facilities to await classification prior to disposal or treatment. For land that is not Commonwealth-owned, the material would be either reused on site for appropriate purposes or removed to an appropriately licensed facility. It is proposed that contaminated soil from the former Tempe landfill would be retained on site and encapsulated in a number of earth mounds to the west of the project site area. These measures would minimise the risk of contaminants entering Alexandra Canal and impacting aquatic habitats further downstream (the Cooks River, Botany Bay and Towra Point wetland).

The project would not directly impact any habitat for threatened biota listed under the FM Act. Potential habitat for the Black Rock Cod is located over five kilometres downstream of the project (rock headlands of Botany Bay), and indirect effects on habitat are highly unlikely. There would be no blockage of fish passage and no removal of snags as a result of the project. There would be no impacts on fish spawning or refuge habitat.

The proposal would remove 0.04 hectares of mangroves from a stormwater drain and planted and regenerating vegetation, including scattered mangroves, adjacent to the Alexandra Canal. There would be limited impacts on natural riparian vegetation. All creek or river banks in the project site and immediately downstream are artificial. Construction activities will be managed to maintain the stability of Alexandra Canal, and there is unlikely to be any sedimentation or erosion of natural riparian areas.





Mitigation measures including sediment and erosion control, and bunding of contaminated material, would minimise the potential for the impacts discussed above (see section 11). A more detailed discussion of the potential impacts of the project on hydrology and surface water quality and proposed impact mitigation measures is provided in the EIS/draft MDP Technical Working Paper 8 – Surface Water Quality and Technical Working Paper 6 –Flooding.

8.7 Groundwater dependent ecosystems

As noted in section 5.5, no groundwater dependent ecosystems occur in or adjacent to the project site. Any drawdown or changes to groundwater flows would have minimal impacts on ecosystems or species. Aquatic habitats in the study area and in downstream areas are already highly disturbed and subject to contamination and pollution. A more detailed discussion of the potential impacts of the project on groundwater and proposed impact mitigation measures is provided in the combined EIS/preliminary draft MDP Technical Working Paper 7 – Groundwater.

8.8 Prescribed biodiversity impacts

The BAM requires the assessment of prescribed impacts, which are impacts that cannot be offset by the retirement of credits as they do not relate to the removal of native vegetation. A discussion of relevant prescribed impacts is provided below.

8.8.1 Areas of geological significance

No areas of geological significance are present. No caves for breeding of bats are present.

8.8.2 Human made structures and non-native vegetation

Human-made structures present in the construction area and relevant to this study comprise bridges over Alexandra Canal. Bridges provide potential roosting habitat for threatened microchiropteran bats, such as the Eastern Bentwing-bat (recorded during surveys). The bridge over Alexandra Canal was inspected from underneath for signs of roosting bats (eg guano) and was observed at dusk for emerging microbats on one evening. No bats were observed to leave the bridge and no other evidence of roosting bats (eg guano) was observed. Construction noise and vibration has the potential to impact microchiropteran bats if any happen to be roosting at the bridge during construction in adjacent areas. Given the mobility of these species, individuals if present would likely relocate to alternate roosting habitat for this period.

Non-native vegetation provides minimal habitat for most threatened species. Grey-headed Flying-foxes were observed foraging in planted Mulberry trees and Fig trees within the construction area near Mill Stream. These resources would be a very small proportion of foraging habitat for the local roost camps. Similarly, microchiropteran bats such as the Eastern Bentwing-bat may forage above non-native vegetation on occasion.

8.8.3 Connectivity and movement

Habitat fragmentation through the clearing of vegetation can increase the isolation of remnant vegetation and create barriers to the movements of small and sedentary fauna such as ground dwelling mammals, reptiles and amphibians. Furthermore, habitat fragmentation can create barriers to the movement of pollinator vectors, such as insects, or seed vectors, such as birds, and consequently affect the life cycle of both common and threatened flora.

The project would require the removal of vegetation and habitat and would create or increase small gaps in habitat that are the width of the project site. There would be minimal impact on connectivity and movement corridors as a result of the project. It is unlikely that the project would create an additional barrier to the movement of pollinator and seed dispersal vectors, such as insects and birds.



Vegetation in the project site comprises scattered fragments that together with trees in adjacent urban areas provide 'stepping stones' of habitat between larger areas of vegetation for mobile species such as bats and birds. Removal of these patches would reduce the availability of these stepping stones to a small degree. Species that require larger tracts of connected vegetation would not occur in these small, fragmented patches.

8.8.4 Hydrology

Alexandra Canal is one of the main tributaries of the Cooks River and the main watercourse in the vicinity of the project site. A constructed pond is located on Sydney Airport land adjacent to the project site. The pond provides a flood detention/mitigation and spill control function. The project site crosses the channel that connects the pond to the canal. The Tempe Wetlands, located in Tempe Lands, also provide temporary detention for flood waters.

Potential issues that could occur during construction if no mitigation measures are in place include:

- Sedimentation of local and downstream watercourses and waterbodies, including Alexandra Canal, Tempe Wetlands, and the Cooks River, as a result of soil disturbance, erosion and sediment-laden runoff
- Exposure of actual or potential acid sulfate soils, which may generate acidic runoff and affect water quality
- Effects on surface and groundwater quality as a result of disturbance of contaminated soils.

The project includes new bridges across Alexandra Canal and stormwater outlets along the edges of the canal. Works adjacent to the canal would have the potential to disturb contaminated sediments and impact water quality. The project would also involve construction of drainage structures/outlets within the canal banks, which may affect water quality in the canal if inadequately managed.

8.8.5 Vehicle strike

The project is located in a busy industrial area within Sydney, subject to high levels of vehicular traffic. The project would increase road traffic within the project site and would increase the risk of fauna mortality or injury as a result of vehicle-strike. Few terrestrial fauna species occur in the project site that are at risk of vehicle strike, and those that occur are already subject to the risk of vehicle strike given the location of the project. As such, the project is unlikely to have a substantial impact on any local populations of fauna species.





8.9 Key threatening processes

A key threatening process (KTP) is as an action, activity or project that:

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

KTPs listed under the BC Act, FM Act and EPBC Act relevant to this project are listed in Table 8-4 below. Construction of the project would involve KTPs, including clearing of native vegetation, removal of dead wood and dead trees, and human-induced climate change. The latter KTP would continue to occur under operation of the project. The project is not a KTP in its entirety. Mitigation measures to limit the impacts of these KTPs (where possible) are discussed in section 11.

КТР	Status	Comment
Clearing of native vegetation	BC Act EPBC Act	The project includes the clearing of less than one hectare of native vegetation. This minor reduction in extent is highly unlikely to affect the viability of remnant vegetation in the project site or locality or reduce the extent of habitat below a minimum size required for any fauna species.
Removal of hollows	BC Act	No mature trees with obvious large hollows would be removed.
Removal of dead wood and dead trees	BC Act	The project site contains very little fallen timber and dead trees. The project may result in the removal or disturbance to those small amounts that do occur within the project site, during construction of the project.
The degradation of native riparian vegetation along NSW water courses	FM Act	The project would remove small areas of highly modified native vegetation and planted trees from the edges of Alexandra Canal.
Human-caused climate change	BC Act EPBC Act	Combustion of fuels associated with construction 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. Due to the short-term timeframes of construction the potential climate change impacts are considered to be minimal. Due to improved road network efficiency associated with the proposed project and other future road projects, a net annual saving in greenhouse gas emissions would be realised across the overall Sydney network. Anticipated future improvements in fuel efficiency of vehicles would further reduce greenhouse gas emissions more broadly throughout the transport system in NSW.

Table 8-4 Key threatening processes

8.10 Serious and irreversible impacts

Under the BC Act, a determination of whether an impact is serious and irreversible must be made in accordance with the principles set up in Section 6.7 of the BC Regulation. The principles are aimed at capturing impacts which are likely to contribute significantly to the risk of extinction of a threatened species or ecological community in New South Wales. Threatened biota that have been identified as SAII entities are listed in the SAII Guidelines (OEH 2019c). Some SAII entities have an impact threshold identified which can be used to help determine if a development will result in SAII. All SAII entities that may be affected by a project require a detailed assessment of potential impacts, and a discussion of avoidance and mitigation measures put in place to minimise these impacts.



8.10.1 Threatened ecological communities

No threatened ecological communities recorded within the project site have been determined to be SAII entities under the BC Act. Given this, the project is considered unlikely to lead to a serious and irreversible impact on any threatened ecological community.

8.10.2 Threatened species

No threatened species recorded within the project site have been determined to be SAII entities under the BC Act. There is no habitat present for any SAII entities. Given this, the project is considered unlikely to lead to a serious and irreversible effects on any threatened species.

8.11 Impacts on Matters of National Environmental Significance

Given the general lack of habitat present and the small area of vegetation to be removed, the project is unlikely to result in a significant impact on any MNES.

8.11.1 Threatened ecological communities

No threatened ecological communities listed under the EPBC Act have been determined to be affected by the project.

8.11.2 Threatened flora species

No threatened flora species listed under the EPBC Act have been determined to be affected by the project.

8.11.3 Threatened fauna species

8.11.3.1 Green and Golden Bell Frog

The significant impact guidelines for the Green and Golden Bell Frog suggest there is a possibility of a significant impact on the Green and Golden Bell Frog and a referral under the EPBC Act should be considered if the action results in:

- The removal or degradation of aquatic or ephemeral habitat either where the Green and Golden Bell Frog has been recorded since 1995 or habitat that has been assessed as being suitable according to these guidelines. This can include impacts from chytrid or Gambusia originating off-site
- The removal or degradation of terrestrial habitat within 200 metres of habitat identified in threshold 1
- Breaking the continuity of vegetation fringing ephemeral or permanent waterways or other vegetated corridors linking habitats meeting the criteria in threshold 1.

Tempe Wetlands and Alexandra Canal are unlikely to provide suitable habitat for the Green and Golden Bell Frog. There are no recent records of the species in these areas due to the high levels of disturbance and pollution. Targeted surveys in suitable conditions over 2017 and 2018 did not find any evidence of the species at these locations. Tempe Wetlands was constructed only recently and Alexandra Canal is unlikely to provide a movement corridor for the species given its highly polluted state and the lack of other habitat areas in the vicinity. It is highly unlikely that any individuals from the Marsh St wetlands could cross the Cooks River or the Princes Highway to disperse to Tempe. There is similarly no evidence of the species at Botany and it is considered extinct in this area (White and Pyke 2008a). The project would not break the continuity of any vegetation connecting areas of habitat. There would be no effects on the Marsh St wetlands population as a result of this project.



Given the lack of evidence of the species at Tempe and along Alexandra Canal, high levels of pollution and disturbance in the area, lack of direct effects on Tempe Wetland, lack of connecting habitat and likely extinction of the species in the Botany area, the project is unlikely to result in a significant impact on the species. No assessment of significance is considered necessary.

8.11.3.2 Grey-headed Flying-fox

The project is unlikely to significantly impact the Grey-headed Flying-fox. Loss of 4.85 hectares of scattered foraging trees of the Grey-headed Flying-fox that are not likely to be habitat critical to the survival of the species would have limited impact on foraging habitat within the locality. There would be no impact on any nearby roost camps. An assessment of significance has been prepared for the Grey-headed Flying-fox and has concluded that the project would not have a significant impact on this species (Appendix E).

8.11.4 Migratory species

Alexandra Canal is not important habitat for any migratory waders that may occur in the Botany Bay area. The project is unlikely to significantly impact migratory waders as a negligible area of very poor quality mudflats would be impacted by the project. There is unlikely to be any impact on important habitat for migratory waders associated with the Towra Point Wetland Ramsar site given its location well away from the project and on the other side of Botany Bay. An assessment of significance for migratory waders is not considered necessary.

8.11.5 Wetlands of international significance

The project would not impact Towra Point Nature Reserve given its location 6.5 kilometres from the project site. No assessment of significance is considered necessary.

8.12 Construction impacts on Sydney Airport (Commonwealth) land

The majority of the vegetation to be removed in Sydney Airport land for the project is not native vegetation and comprises exotic plants or planted, often non-indigenous, native species on fill material. The project would remove the following vegetation from Sydney Airport land:

- 0.68 hectares of PCT 1232 Swamp Oak Floodplain Forest which does not meet the EPBC Act condition criteria for Coastal Swamp Oak (*Casuarina glauca*) Forest threatened ecological community or the Swamp Oak Floodplain Forest EEC listed under the BC Act)
- 0.04 hectares of PCT 920 Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion
- 9.69 hectares of highly disturbed areas with no or limited native vegetation (generally grassed verges and weed infestations)
- 2.44 hectares of planted native and exotic trees and shrubs.

The removal of native, planted and exotic vegetation would remove habitat for a range of predominantly common flora and fauna species typical of urban and industrial areas.

There would be no direct impact on the Sydney Airport Wetlands.

An assessment of the likely significance of effects on plants and animals (as a component of the environment of Commonwealth land) pursuant to the *Significant impact guidelines 1.2 for actions on Commonwealth land* (DSEWPC 2013) has been prepared and is attached at Appendix G. The conclusion of this assessment is that the project would not have a significant impact on plants and animals within Commonwealth land given the highly modified nature of the existing environment and the small magnitude and extent of effects on plants and animals. Significant Impact Guideline 1.2 also requires an assessment of effects on other matters (eg heritage, water, soil, people etc) that are not covered in this report.



Construction effects on Commonwealth land would not result in a significant impact on any MNES. The areas of Sydney Airport land within the project site do not contain any threatened ecological communities or threatened flora listed under the EPBC Act or important habitat for threatened or migratory shorebirds. The Grey-headed Flying Fox may forage in planted trees on Sydney Airport land on occasion but these do not represent critical habitat and the project would not have a significant impact on the species (see Appendix E).

8.13 Consistency with the Sydney Airport Master Plan 2039 and Environment Strategy 2019–2024

8.13.1 Overview

Minimising environmental impacts is essential for Sydney Airport to operate sustainably. The Sydney Airport Master Plan 2039 (Sydney Airport Corporation 2018) outlines the planning objectives for Sydney Airport and identifies Development Standards, including the requirement for Environmentally Sustainable Development, against which the performance of developments at the airport are assessed. Development proponents must demonstrate compliance with the MDP requirements and consistency with the Master Plan 2039 and associated Environment Strategy 2019–2024 (Sydney Airport Corporation 2018).

8.13.2 Biodiversity and conservation management

Biodiversity and conservation management is identified as a key environmental matter for Sydney Airport in the Airport Master Plan 2039. The main area of natural biodiversity value remaining is the Sydney Airport Wetlands comprising Engine Pond East, Engine Pond West, the Mill Pond and Mill Stream, which are part of the Botany Wetlands. The Botany Wetlands is listed in the Directory of Important Wetlands in Australia and is considered an environmentally significant area under the Airports Act. The marine environment of Botany Bay has also been identified as an area of environmental sensitivity where impacts of developed need to be carefully managed.

The Master Plan 2039 identifies environmentally sensitive areas via EC1 – Environmental Conservation Zoning. The Sydney Airport Wetlands and the wider aquatic environment of Botany Bay are zoned EC1 lands under the Master Plan 2039.

Through implementation of the Master Plan 2039 and corresponding Environment Strategy, Sydney Airport Corporation intends to manage and reduce potential impacts to the ecology and biodiversity of the airport and its surrounds by implementing among other things:

- Ecological impact assessments for all major developments, in particular where potential impacts may occur to the Sydney Airport Wetlands, Botany Bay, listed flora and fauna species, and communities
- Identification and implementation of appropriate management measures and mitigation for both the construction and operational phase of developments to limit the ecological and biodiversity impacts.

The Environment Strategy 2019–2024 provides environmental action plans for biodiversity and conservation management. The environment strategies also identify environmentally significant areas based on their biodiversity significance, including the Sydney Airport Wetlands.

The five year plan for biodiversity in the Environment Strategy (2019-2024) includes a range of actions, of which the following are most relevant to the project:

- Ensure that, where appropriate, potential biodiversity impacts are assessed as part of the assessment of development proposals and, if necessary, managed
- Develop an airport wide vegetation strategy which incorporates biodiversity offsets.

The remaining actions relate to gaining a greater understanding of the biodiversity values of the airport, through undertaking ecological surveys and monitoring and improving the management of biodiversity through the development of management tools, the implementation of management plans for the Botany Wetlands and fig trees located in the South East Sector and feral animal control.





8.13.3 Project consistency

The project is consistent with the development standard relating to Environmentally Sustainable Development detailed in the Airport Master Plan 2039 and Environment Strategy 2019–2024 and actions, being an environmentally responsible development based on sound environmental sustainability principals. In particular, the project has been designed to avoid adverse consequences on biodiversity values of Commonwealth land and has undertaken a rigorous assessment process through the preparation of this BDAR to ensure biodiversity impacts have been appropriately assessed and minimised where practicable. Detailed mitigation and management measures provided in section 11 will be implemented to minimise those impacts that cannot be avoided and offset will be provided for any residual impacts (section 12).

The project will not impact on EC1 zoned lands at Sydney Airport, including Sydney Wetlands or the Botany Bay marine environment, and is not in conflict with any of the identified biodiversity actions identified in the environment strategy. Current biodiversity management practices at Sydney Airport predominantly relate to the management of the Sydney Airport Wetlands, and are not directly applicable to the project, as they are located well outside the project site. The project may impact fig trees that are located on Sydney Airport Land (eg along Qantas Drive), however these are not located in the South East Sector where fig trees are being managed. Nevertheless, to ensure consistency with this management action within the project site, amenity trees (including fig trees) removed as a result of the project would be replaced as part of the urban design in order to achieve a net increase in tree canopy within and adjacent to the project site. It is recommended in section 11.2 that this includes fig trees and other food trees that provide foraging resources for the threatened Grey-headed Flying-fox (where feasible with consideration of airport operations).






9. Assessment of operation impacts

9.1 Summary of key findings

Effects on biodiversity values would be largely restricted to the construction phase of the project. Some potential impacts that would occur as a result of the operation of the project include:

- Generation of additional light, noise and vibration
- Pollution as a result of runoff from hard stand areas
- Fauna mortality as a result of collision with vehicles.

Each of the potential operational impacts listed above would already be occurring in the project site and affecting the surrounding study area. The project is unlikely to increase the extent, duration or magnitude of any of these impacts to the extent that would result in a significant negative effect on biodiversity values.

The potential for these operational impacts will be further minimised through the implementation of appropriate mitigation measures as outlined in section 11 below.

9.2 Operation impacts

Effects on biodiversity values would be largely restricted to the construction phase of the project. Effects on biodiversity values that may result from operation of the project are detailed in Table 9-1.

The project site is located within or immediately adjoining existing urban infrastructure and highly modified environments. Each of the potential operational impacts identified below would already be occurring in the project site and affecting the surrounding study area. Fauna that occupy habitats within the project area and adjacent areas are likely to be accustomed to existing noise originating from road traffic, trains, planes and the urban environment. The project when operational is unlikely to significantly increase the risk of fauna collisions above current levels, given the highly modified habitats present. In this context, the project is likely to comprise only a minor increase in any of these potential negative effects. The project is unlikely to increase the extent, duration or magnitude of any of these impacts to the extent that would result in a significant negative effect on biodiversity values.



The potential for these operational impacts will be further minimised through the implementation of appropriate mitigation measures as outlined in section 11 below.

Operation of the new roads would introduce additional noise, light and vibration from the novement of vehicles. The project is located in a highly industrial urban environment already ubject to substantial noise, light and vibration levels and with limited habitat value for
iodiversity. Fauna species present would be accustomed to existing noise, light and vibration. The project is likely to involve only a minor increase in noise, light and vibration given the levels f existing disturbance and is not likely to result in a significant impact on fauna and flora that ccur adjacent to the project site.
ew terrestrial fauna species occur in the project site that are at high risk of vehicle strike. hose that do occur are already subject to the risk of vehicle strike given the location of the roject. The project is unlikely to significantly increase the risk of vehicle collisions with fauna bove current levels.
Operation of the project has the potential to introduce pollutants to the environment as a result f chemical spills from vehicles and result in erosion and sedimentation from runoff from ardstand areas. The project is located in a highly industrial area subject to substantial existing ontamination and risk of chemical spills, and operation of the project would not substantially ncrease this risk. Discharge of stormwater into Alexandra Canal as a result of new or upgraded utlets also has the potential to mobilise sediments, including contaminated sediments. Energy issipaters have been included in the design where necessary to reduce water velocity and ninimise the potential for scour and sediment mobilisation.
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Table 9-1 Potential operational effects on biodiversity values

9.3 Summary of operational impacts on Commonwealth land

The potential operational impacts discussed in section 9 above are all potentially relevant to areas of Commonwealth land. The project is unlikely to increase the extent, duration or magnitude of any of these impacts to the extent that would result in a significant negative effect on biodiversity values, including MNES, on areas of Commonwealth land. The potential adverse effects on water quality in the project site and aquatic environments downstream during once the project is operational will be minimised through the implementation of appropriate mitigation measures as outlined in Technical Working Paper 8 – Surface Water Quality and summarised in section 11.

9.4 Consistency with the Sydney Airport Master Plan 2039 and Environment Strategy 2019–2024

Consistent with the requirements of the Airport Master Plan and Environment Strategy, mitigation and management measures would be implemented to minimise effects on local biodiversity values (section 11). In particular, drainage and water quality management structures that form part of the project design would be regularly inspected and maintained once the project is operational to minimise potential adverse effects on sensitive areas located downstream of the project site, such as the Botany Bay marine environment.



10. Cumulative impacts

10.1 Botany Rail Duplication

The Botany Rail Duplication project area is characterised in general by cleared land in a rail corridor with minimal value for native biodiversity. The majority of the vegetation to be removed for the project is not native vegetation and comprises exotic plants or planted, often non-indigenous, native species on fill material. The project area contains small areas of remnant and regrowth native vegetation, including small patches of two EECs (Swamp Oak Floodplain Forest and Sydney Coastal Freshwater Wetlands).

Fauna habitat resources that would be removed include foraging and shelter resources for mainly common native fauna typical of urban environments. The project would remove a small number of forage trees of the Grey-headed Flying-fox and forage habitat for microbats.

There would be limited direct effects on wetland habitat at the Botany Wetlands. Clearing would be limited in area, and would comprise mainly the removal of weed-infested planted vegetation. Effects on native vegetation would be restricted to the removal of 0.62 ha of Swamp Oak Forest and 0.1 ha of Coastal Freshwater Wetland from immediately adjacent to the rail bridge at Mill Stream. There would be no instream structures and thus no direct effects on the waterbody itself.

The cumulative effects of the Sydney Gateway road project (SGR) and Botany Rail Duplication (BRD) projects are shown in Table 10-1. The projects would remove a combined 32.12 hectares of vegetation, of which 1.63 hectares is native vegetation. A total of 0.72 hectares of native vegetation and 12.14 hectares of miscellaneous vegetation would be removed from Sydney Airport land.

Plant community type (PCT)	Status	Area impacted by SGR (ha)	Area impacted by BRD (ha)	Total area impacted (ha)	Total area on Commonwealth land (ha)
PCT 920 Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	Not listed under the BC Act or EPBC Act Marine vegetation under the FM Act	0.04		0.04	0.04
PCT 1232 Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion	Does not meet TEC listing (refer section 5.5)	0.87		0.87	0.68
PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion (moderate condition)	Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (BC Act)		0.10	0.10	

Table 10-1 Cumulative impacts of the Sydney Gateway Road and Botany Rail Duplication projects



Plant community type (PCT)	Status	Area impacted by SGR (ha)	Area impacted by BRD (ha)	Total area impacted (ha)	Total area on Commonwealth land (ha)
PCT 1234 Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion (poor condition)	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South		0.46	0.46	
PCT 1234 Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion (low condition)	East Corner Bioregions (BC Act) Does not meet TEC listing criteria under EPBC Act		0.16	0.16	
Total native vegetation		0.91	0.72	1.63	0.72
Miscellaneous Ecosystems (Highly disturbed areas with no or limited native vegetation)	Not native vegetation	18.29	5.34	23.66	9.70
Miscellaneous Ecosystems (urban exotic/native landscape plantings)	Not native vegetation	4.85	1.92	6.88	2.44
Total vegetation		24.05	7.98	32.17	12.86

10.2 Botany Rail Duplication and other proposed major developments

The project site is located within central Sydney in an extensive and complex road and rail network. Residential and industrial/commercial areas dominate the area.

The Sydney Gateway road project and Botany Rail Duplication project would involve the removal of small patches of already highly fragmented, predominantly planted vegetation with only limited effects on native vegetation. Road projects such as the New M5 and future M4–M5 Link would also result in the removal of mainly planted vegetation and associated fauna habitats. Other local rail projects such as the Chatswood to Sydenham metro project and Sydenham to Bankstown metro project would similarly affect small patches of fragmented habitat in highly modified urban areas in the local area (GHD 2017, Arcadis 2016). Losses in biodiversity from these projects and developments 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.





11. Recommended mitigation measures

11.1 Construction and operation phases

In order to address the potential impacts of the project on biodiversity values as discussed in sections 8 and 9, the recommended mitigation measures outlined in section 11.2 will be implemented. In accordance with 3.2(e) of the Secretary's Environmental Assessment Requirements and the MDP requirements, these sections detail how likely impacts that have not been avoided through design will be minimised, and the predicted effectiveness of these measures.

A construction environmental management plan (CEMP) would be required for the construction phase of the project. The CEMP would include, as a minimum, industry-standard measures for the management of soil, surface water, weeds and pollutants, as well as project-specific measures. The proposed mitigation measures would include environmental safeguards for protection of neighbouring properties and waterways in accordance with relevant policy documentation and Government guidelines. The project would have a minor increase in existing effects on native biodiversity values during operation. Little mitigation of the project is therefore likely to be required for biodiversity during this phase.

11.2 Mitigation measures

Mitigation measures that are recommended for implementation as part of the CEMP are provided in Table 11-1.

Impact	Mitigation	Predicted effectiveness	Jurisdiction
Impacts on fauna habitat and tree canopy	Amenity trees (including fig trees) removed as a result of the project would be replaced as part of the project's urban design and landscape plan to achieve a net increase in tree canopy within and adjacent to the project site	High – measures would meet best practice management of fauna resources on construction projects.	State land/ Sydney Airport land
Loss of mangroves	Limit disturbance of mangroves to the minimum necessary to construct works.	High – exclusion areas would be established and maintained around native vegetation adjoining the project site. The need to avoid impacts would be communicated to all construction staff. Measures would meet best practice management of flora and fauna on construction projects.	State land/ Sydney Airport land

Table 11-1 Mitigation measures



Impact	Mitigation	Predicted effectiveness	Jurisdiction
Effects on Tempe Wetland	Limit disturbance of planted vegetation at Tempe Wetland to the minimum necessary to enable construction. Erosion and sediment control plans would be established prior to the commencement of construction and be updated and managed throughout as relevant to the activities during the construction phase. Any revegetation following construction should complement existing rehabilitation works.	High – only a small area along the edge of planted vegetation would be affected in the Tempe Wetland. Exclusion areas would be established and maintained around native vegetation adjoining the project site. The need to avoid impacts would be communicated to all construction staff. Measures would meet best practice management of flora and fauna on construction projects. High – measures would meet best practice management of water quality on construction projects. Sensitive receptors for impacts are limited in extent and quality.	State land
Effects on planted vegetation	Limit disturbance of planted vegetation to the minimum necessary to construct works. Any revegetation following construction should complement existing rehabilitation works.	High – exclusion areas would be established and maintained around planted vegetation adjoining the project site. The need to avoid impacts would be communicated to all construction staff. Measures would meet best practice management of flora and fauna on construction projects.	State land/ Sydney Airport land
General	Ensure all workers are given an environmental induction prior to starting work in the project site. This would include information on the ecological values of the project site, protection measures to be implemented to protect biodiversity and penalties for breaches. A Flora and Fauna Management Plan would be prepared in accordance with the RTA (2011) <i>Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects</i> and to meet the requirements of the Airport Environment Strategy (Sydney Airport Corporation 2018b), incorporating recommendations below and expanding where necessary.	High – communication of environmental values and responsibilities to construction staff is likely to ensure that mitigation measures are implemented. Measures would meet best practice for management of construction projects. High – the Flora and Fauna Management Plan would be prepared by a qualified and experienced professional.	State land/ Sydney Airport land
Vegetation clearing	Limit disturbance of vegetation to the minimum necessary to construct works. Micro-siting of infrastructure would be undertaken during detailed design where practicable to minimise or avoid effects on native vegetation. Where the project site adjoins native vegetation, mark the limits of clearing and install site delineation around the vegetated area prior to the commencement of construction activities to avoid unnecessary vegetation and habitat removal. Restrict equipment storage and stockpiling of resources to designated areas in cleared land.	High – exclusion areas would be established and maintained around vegetation adjoining the project site. The need to avoid impacts would be communicated to all construction staff. Measures would meet best practice management of flora and fauna on construction projects.	State land/ Airport land



Impact	Mitigation	Predicted effectiveness	Jurisdiction
Weeds	Protocols for preventing or minimising the spread of priority and environmental weeds would be developed and implemented in accordance with the RTA (2011) <i>Biodiversity Guidelines (Guide 6:</i> <i>Weed Management</i> and the Airport Environment Strategy (Sydney Airport Corporation 2018b). This would include:	High – measures would meet best practice management of weeds on construction projects.	State land/ Sydney Airport land
	 Develop weed management actions to manage weeds during the construction phase of the project, such as management and disposal of the weeds that were recorded within the project site, including the priority weeds listed in section 5.4 in accordance with the Biosecurity Act and any weeds of national environmental significance. 		
	Vehicles and other equipment to be used should be cleaned to minimise seeds and plant material entering the project site to prevent the introduction of further exotic plant species or disease.		
Fauna habitat	Protocols to prevent introduction or spread of chytrid fungus should be implemented following <i>Hygiene protocol for the control of disease in frogs</i> (DECC 2008b).	High – measures would meet best practice management of fauna on construction projects.	State land/ Sydney Airport land
	A pre-clearance procedure would be developed and implemented in accordance with the RTA (2011) <i>Biodiversity Guidelines (Guide 1: Pre- clearing process)</i> and should incorporate the following:		
	 A trained ecologist should be present during the clearing of native vegetation or removal of potential fauna habitat to avoid effects on resident fauna as far as is practicable. 		
	 Clearing surveys should include inspections of native vegetation for resident fauna, nests or other signs of fauna occupancy. 		
	 Fauna handling would be undertaken in accordance with the RTA (2011) <i>Biodiversity</i> <i>Guidelines (Guide 9: Fauna handling)</i>. 		
	 Any unexpected threatened species finds would be managed in accordance with the RTA (2011) <i>Biodiversity Guidelines</i>. 		
	It is recommended that a similar pre-clearing procedure be developed and implemented on Airport land.		



Impact	Mitigation	Predicted effectiveness	Jurisdiction
Water quality and aquatic habitats	Erosion and sediment control plans would be established prior to the commencement of construction and be updated and managed throughout as relevant to the activities during the construction phase.	High – measures would meet best practice management of water quality on construction projects.	State land/ Sydney Airport land
	Temporary scour protection and energy dissipation measures should be designed to protect receiving environments from erosion.		
	Suitable controls would be developed and implemented to minimise dust generation.		
	All stockpiled material should be adequately protected from erosion and kept away from waterways to avoid sediment entering the waterway.		
	Drainage and water quality management structures that form part of the project design would be regularly inspected and maintained once the project is operational.		



12. Offsetting

12.1 Introduction

The following sections discuss biodiversity offset requirements for residual impacts of the project on land under State jurisdiction in accordance with the BC Act, FM Act, and EPBC Act and offset requirements for impacts on Commonwealth land under the Airports Act and EPBC Act.

12.2 BC Act – Offset for affected threatened biota

Biodiversity offset obligations in the form of ecosystem credits and species credits for impacts of the project on land under State jurisdiction have been determined using the BAM calculator and are discussed below.

12.2.1 Ecosystem credits

The project would remove 0.19 hectares of Swamp Oak floodplain swamp forest (PCT 1232) on land under state jurisdiction in the project site (refer section 8.3.1). This vegetation has a vegetation integrity score of 10.2. A biodiversity offset is not required under the thresholds for the assessment and offsetting of impacts of development on native vegetation or threatened species habitat if the vegetation integrity score of the impacted PCT is < 17 (Sections 10.3.1.1 and 10.3.2.1 of the BAM). In this regard, PCT 1232 has been determined under the credit calculator for the project to have an ecosystem credit obligation of zero (Table 12-1).

 Table 12-1
 Ecosystem credit obligation for PCTs on land under state jurisdiction

Plant community type (PCT)	Threatened ecological community	Vegetation integrity score	Area impacted (ha)	Ecosystem credit obligation
PCT 1232 Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion	Does not meet TEC listing criteria	10.2	0.19	0

Offsets are not required for impacts on non-native vegetation. No credits were therefore calculated for miscellaneous ecosystems that will be impacted by the project, including highly disturbed areas with no or limited vegetation and urban exotic/landscape plantings described in section 5.3.

12.2.2 Species credits

No species credit species or breeding habitat for dual ecosystem/species credit species were recorded in the project area and none are considered likely to be affected by the project (refer section 6.3.3.2). No offset for species credit species is therefore required.



12.3 FM Act – Offsetting of impacts on protected marine vegetation and key fish habitat

The *Policy and guidelines for fish habitat conservation and management* (DPI 2013) details the NSW government policies and guidelines for mitigating and offsetting effects on fish habitat. This policy enforces a 'no net loss' habitat policy as a permit condition or condition of consent.

The project will not remove any fish habitat, including protected marine vegetation (eg mangroves) on state land within the project site. As such, there are no impacts arising as a result of the project on State land that require offset under the FM Act.

12.4 EPBC Act – Offset for significant impacts on MNES

Under the *Environment Protection and Biodiversity Conservation Act 1999* Environmental Offsets Policy (DSEWPaC, 2012) (the EPBC Act Environmental Offsets Policy), biodiversity offsets are required to compensate for significant residual effects on MNES. This BDAR includes the identification and assessment of potentially affected MNES, including an assessment of the likely significance of effects on the Grey-headed Flying-fox pursuant to the EPBC Act significant impact guidelines 1.1 (DotE, 2013). The outcome of these assessments of significance is that the project would not be likely to result in a significant impact on the Grey-headed Flying-fox or on any other MNES. The project is unlikely to impact Towra Point Ramsar site as it is located about 6.5 kilometres away on the southern side of Botany Bay.

No biodiversity offsets for effects on MNES in the project site, including lands under State and Commonwealth jurisdiction, are therefore required in accordance with the EPBC Act Environmental Offsets Policy.

An assessment of the likely significance of effects on plants and animals (as a component of the environment of Commonwealth land) undertaken in accordance with the significant impact guidelines 1.2 for actions on Commonwealth land (DSEWPC 2013) has been undertaken. This assessment has concluded that the project will not have a significant impact on plants and animals that are a component of the environment of Commonwealth land offsets are therefore not required in accordance with the EPBC Act Environmental Offsets Policy for impacts on Sydney Airport land.

12.5 Airports Act – Offset for land clearing

Under the Airports Act, a building application is required for land clearing on leased Federal airports. The Airport Building Controller, in consultation with the Airport Environment Officer, can impose conditions on building activity approvals, including a requirement to provide offset for the removal of trees and vegetation.

Roads and Maritime will consult with the Sydney Airport Environment Officer to identify any offset requirement for vegetation removal on Sydney Airport land and this would be captured in the conditions of approval for land clearing activities at the site.





13. Conclusion

Roads and Maritime and Sydney Airport Corporation propose to build the Sydney Gateway road project. The project comprises new direct high capacity road connections linking the Sydney motorway network at St Peters interchange with Sydney Airport's terminals and beyond. The project site includes freehold land and Commonwealth-owned land leased by Sydney Airport Corporation.

This BDAR has been prepared to address the project SEARs and the requirements for a MDP under the Airports Act. The BDAR has been prepared by accredited BAM assessors in accordance with the BAM to describe the biodiversity values present at the project site, outline the approach to avoiding or minimising impacts, assess residual impacts of the project and determine the need or otherwise for biodiversity offsets.

The project site has been cleared historically and is highly modified. It predominantly comprises industrial areas dominated by roads and hardstand. There is limited native vegetation within the project site given the long history of urban development and disturbance. Two native vegetation PCTs occur in the project site:

- PCT 920 Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion
- PCT 1232 Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion.

PCT 920 is protected marine vegetation under the FM Act. PCT 1232 occurs as opportunistic regrowth generally from areas subject to historic filling. Based on landform, altitudinal range, soils, geology and vegetation structure the recorded patches of PCT 1232 are not considered to meet BC Act or EPBC Act listings for the threatened Swamp Oak ecological community.

Part of the southern end of Tempe Reserve alongside the Cooks River and Alexandra Canal is mapped as a Coastal Wetland under the Coastal Management SEPP 2018. The project will not have any direct impact on mapped Coastal Wetlands or the associated proximity area for the wetland. The project has been designed to avoid disturbance of contaminated sediment in the project site and mitigation measures to prevent adverse effects on water quality within and downstream of the project site during construction and operation will be implemented. No Groundwater Dependent Ecosystems are present in the project site or would be affected by the project.

No threatened flora species occur in the project site or would be impacted by the project. No candidate species credit fauna species were recorded during surveys and none are considered likely to be affected by the project. Two threatened fauna species were recorded, the Eastern Bentwing-bat and Grey-headed Flying-fox. No species credits are required to be calculated for these species as no breeding habitat would be impacted. No SAII entities would be affected by the project.

Alexandra Canal is artificial in form and a highly disturbed environment and does not provide suitable habitat for threatened aquatic species listed under the FM Act. Small mudflat areas along the canal do not comprise important habitat for threatened or migratory shorebirds.

The project has adopted the 'avoid, minimise and offset' approach to mitigate impacts to biodiversity values in accordance with the BAM, the BC Act and associated policy. The project has been purposefully designed to avoid or minimise effects on biodiversity values as far as is practicable, including through the location of compound sites in already disturbed areas and bridge design to avoid effects on water quality within Alexandra Canal and downstream of the project site. Mitigation measures will be implemented to further minimise effects on biodiversity values of the project site.

Despite measures taken to avoid and mitigate impacts, the project would result in some unavoidable residual adverse impacts imposed upon some elements of the natural environment. In total, the project would remove about 0.91 hectares of native vegetation, comprising 0.87 hectares of PCT 1232 Swamp Oak floodplain swamp forest and 0.04 hectares of PCT 920 Mangrove Forests in estuaries. Of this, 0.68 hectares of PCT 1232 Swamp Oak floodplain swamp forest and 0.04 hectares of PCT 920 Mangrove Forests in estuaries in estuaries occurs on Commonwealth land.



The project would remove a very small proportion of available habitat resources for local populations of native fauna. Impacts would include the removal of up to 5.8 hectares of patchily distributed potential foraging habitat for mobile threatened fauna species, including the Grey-headed Flying-fox, birds and microbats. The site is unlikely to contain any important breeding, roosting or nesting habitat for native fauna.

The desktop assessment, field surveys and habitat assessments undertaken for this biodiversity assessment report have been used to identify MNES listed under the EPBC Act that may be affected by the project, through either direct or indirect impacts. The project will not affect any important habitat for migratory birds and hence will not have a significant impact on these species. Similarly, there will not be any adverse effects on Towra Point Ramsar site which is located over 6 kilometres from the project site. The project would result in the removal of a small area of foraging habitat (4.85 hectares of patchily distributed vegetation) for the Grey-headed Flying-fox. An assessment of significance of effects on the Grey-headed Flying-fox has been prepared based on the consideration of the criteria contained in the EPBC Act assessment of significance guidelines 1.1 (DoE, 2013). The outcome of this assessment is that the project is unlikely to have a significant impact on the Grey-headed Flying-fox. Given the minor magnitude of impacts, further assessment or approval under the EPBC Act is highly unlikely to be required and a referral is not recommended.

An assessment of the likely significance of effects on plants and animals (as a component of the environment of Commonwealth land) pursuant to the Significant impact guidelines 1.2 for actions on Commonwealth land (DSEWPC 2013) has concluded that the project would not have a significant impact on plants and animals within Commonwealth land given the highly modified nature of the existing environment and the small magnitude and extent of effects on plants and animals. As noted above, the project, including components located on Commonwealth land, would not have a significant impact on any MNES.

No formal biodiversity offsets are required for the project under the BC Act, FM Act or EPBC Act:

- Biodiversity offset obligations for impacts on land under state jurisdiction under the BC Act have been determined using the BAM calculator as follows:
 - No ecosystem credits are required for PCT 1232 as the vegetation integrity score is less than 17
 - No ecosystem credits are required for PCT 920 as none of this vegetation zone occurs on land under state jurisdiction
 - No species credits are required
- The project will not remove any fish habitat, including protected marine vegetation (eg mangroves) on state land within the project site. As such, there are no impacts arising as a result of the project on land under state jurisdiction that require offset under the FM Act
- The project would not result in any significant effects on any MNES listed under the EPBC Act and so there is no requirement for biodiversity offsets under the EPBC Act and associated policy (DSEWPC, 2012).

This BDAR is compliant with the MDP requirements under Section 91 of the Airports Act and Airports (Environment Protection) Regulations 1997 and has demonstrated consistency with the Sydney Airport Master Plan 2039 and associated Environment Strategy 2019–2024. In this regard, the BDAR provides a rigorous assessment process to ensure biodiversity effects on Commonwealth land have been appropriately assessed and avoided where possible, details mitigation and management measures that will be implemented to minimise those impacts that cannot be avoided, and provides offsets for residual effects on biodiversity values. Furthermore, the project will have no direct impact on EC1 zoned lands at Sydney Airport, including Sydney Wetlands or the Botany Bay marine environment, and is not in conflict with any of the identified biodiversity actions identified in the environment strategy.

Roads and Maritime will consult with the Sydney Airport Environment Officer to identify any offset requirement for vegetation removal on Sydney Airport land.





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Appendix A

Likelihood of occurrence of threatened and migratory biota

A1. Likelihood of occurrence of threatened flora

Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
Acacia bynoeana	Bynoe's Wattle	E	V	This species occurs in heath or dry sclerophyll forest on sandy soils and is generally associated with overstorey species such as Red Bloodwood, Scribbly Gum, Parramatta Red Gum, Saw Banksias and Narrow-leaved Apple.	EPBC Act Protected matters search	Low This species has not been recorded within the locality. The project site does not contain associated habitat attributes such as vegetation formation, floristic assemblage or geological substrate. The occurrence of <i>Acacia bynoeana</i> within the project site is considered unlikely.
Acacia pubescens	Downy Wattle	V	V	Restricted to the Sydney Region from Bilpin to the Georges River and also at Woodford where it usually grows in open sclerophyll forest and woodland on clay soils. Typically it occurs at the intergrade between shales and sandstones in gravely soils often with ironstones.	EPBC Act Protected matters search	Low This species has not been recorded within the locality. The project site does not contain associated habitat attributes such as vegetation formation, floristic assemblage or geological substrate. The occurrence of <i>Acacia pubescens</i> within the project site is considered unlikely.
Acacia terminalis subsp. terminalis	Sunshine Wattle	E	E	This species is associated with coastal scrub and dry sclerophyll woodland on sandy soils.	BioNet, PlantNET, Atlas of living Australia	Low There are 46 known records of this species within the locality (OEH 2018). The recorded vegetation types within the project site (PCT 920 & PCT 1232) are not known to be associated with this species. The occurrence of <i>Acacia terminalis</i> subsp. <i>terminalis</i> within the project site is considered unlikely.

Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
Allocasuarina glareicola	Allocasuarina glareicola	E	E	Primarily restricted to the Richmond (NW Cumberland Plain) district, but with an outlier population found at Voyager Point, Liverpool. Grows on lateritic soil in open forest.	EPBC Act Protected matters search	Low This species has not been recorded within the locality. The project site does not contain associated habitat attributes such as vegetation formation, floristic assemblage or geological substrate. The occurrence of <i>Allocasuarina glareicola</i> within the project site is considered unlikely.
Allocasuarina portuensis	Nielsen Park Sheoak	E	E	The original known habitat of the Neilsen Park She-oak is at Nielsen Park, in Woollahra local government area. There are no plants left at the original site where it was discovered. However, propagation material has been planted successfully at a number of locations at Nielsen Park and other locations in the local area, e.g. Gap Bluff, Hermit Point and Vaucluse House. The original habitat occurs above a sandstone shelf approximately 20 m above the harbour. The shallow sandy soils are highly siliceous, coarsely textured and devoid of a soil profile. The plantings have occurred on similar soils.	EPBC Act Protected matters search	Low This species has not been recorded within the locality. The project site does not contain associated habitat attributes such as vegetation formation, floristic assemblage or geological substrate. The occurrence of <i>Allocasuarina portuensis</i> within the project site is considered unlikely.

Sydney Gateway Road Project Technical Working Paper 14 – Biodiversity Development Assessment Report

Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
Ancistrachne maidenii	Ancistrachne maidenii	V	-	Grows on sandstone derived soils. Thought to have specific habitat requirements, with populations occurring in distinct bands in areas associated with a transitional geology between Hawkesbury and Watagan soil landscapes.	BAM Calculator	Low There are no known records of this species in the locality. The project site does not contain specific geological habitat and no individuals were observed within native vegetation patches (PCT 1232) during targeted surveys. Based on the lack of recent records and absence of suitable habitat, the occurrence of <i>Ancistrachne</i> <i>maidenii</i> within the project site is considered highly unlikely.
Asterolasia elegans	Asterolasia elegans	E	E	Occurs north of Sydney, in the Baulkham Hills, Hawkesbury and Hornsby local government areas. Also likely to occur in the western part of Gosford local government area. Known from only seven populations, only one of which is wholly within a conservation reserve. Occurs on Hawkesbury sandstone.	EPBC Act Protected matters search	Low This species has not been recorded within the locality. The project site does not contain associated habitat attributes such as vegetation formation, floristic assemblage or geological substrate. The occurrence of <i>Asterolasia elegans</i> within the project site is considered unlikely.
Caladenia tessellata	Thick Lip Spider Orchid	E	V	Occurs south of Swansea where it grows on clay loam or sandy soils. Prefers low open forest with a heathy or sometimes grassy understorey. Within NSW, currently known from two disjunct areas; one population near Braidwood on the Southern Tablelands and three populations in the Wyong area on the Central Coast. Previously known also from Sydney and South Coast areas.	BioNet	Low Two historic records of this species occur within the locality. These records exceed 100 years in date and are located within highly urbanised areas of Marrickville South and Tempe. The local occurrence of this species is considered to be extinct. In addition, the recorded vegetation types within the project site (PCT 920 & PCT 1232) are not known to be associated with this species. Based on the lack of recent records and absence of suitable habitat, the occurrence of <i>Caladenia tessellata</i> within the project site is considered highly unlikely.



Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
Callistemon linearifolius	Netted Bottle Brush	V	-	This species is associated with dry sclerophyll forest on the coast and adjacent ranges.	BioNet, PlantNET, Atlas of living Australia	Low There are three known records of this species within the locality (OEH 2018). These records occur to the east of the project site at Phillip Bay and La Perouse. The recorded vegetation types within the project site (PCT 920 & PCT 1232) are not known to be associated with this species. The occurrence of <i>Callistemon linearifolius</i> within the project site is considered unlikely.
Cryptostylis hunteriana	Leafless Tongue- orchid	V	V	Occurs south from the Gibraltar Range, chiefly in coastal districts but also extends on to tablelands. Grows in swamp-heath and drier forest on sandy soils on granite and sandstone. Occurs in small, localised colonies most often on the flat plains close to the coast but also known from some mountainous areas growing in moist depressions and swampy habitats.	EPBC Act Protected matters search, BAM candidate species report	Low This species has not been recorded within the locality. The recorded vegetation types within the project site (PCT 920 & PCT 1232) are not known to be associated with this species. Based on the lack of any records in the locality and the generally unfavourable understorey habitat conditions, the occurrence of <i>Cryptostylis</i> <i>hunteriana</i> within the project site is considered unlikely.
Dichanthium setosum	Bluegrass	V	V	This species is associated with heavy basaltic black soils and red-brown loams with clay in the New England Tablelands, North West Slopes and the Central West Slopes of NSW.	PlantNET, Atlas of living Australia	Low Three historic records (1913) of this species occur in the central Sydney area, in the vicinity of Darlinghurst. The accuracy of these records is unclear however the project site is well outside the known distribution for this species and lacks the associated soils for this species. The occurrence of <i>Dichanthium setosum</i> within the project site is considered highly unlikely.

Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
Darwinia biflora	Darwinia biflora	V	V	Recorded in Ku-ring-gai, Hornsby, Baulkham Hills and Ryde local government areas. The northern, southern, eastern and western limits of the range are at Maroota, North Ryde, Cowan and Kellyville, respectively. Occurs on the edges of weathered shale-capped ridges, where these intergrade with Hawkesbury Sandstone.	EPBC Act Protected matters search	Low This species has not been recorded within the locality. The project site does not contain associated habitat attributes such as vegetation formation, floristic assemblage or geological substrate. The occurrence of <i>Darwinia biflora</i> within the project site is considered unlikely.
Dillwynia tenuifolia	Dillwynia tenuifolia	V	-	Occurs on the Cumberland Plain from the Blue Mountains to Howes Valley area where it grows in dry sclerophyll woodland on sandstone, shale or laterite. Specifically, occurs within Castlereagh woodlands, particularly in shale gravel transition forest. Associated species include <i>Eucalyptus</i> <i>fibrosa</i> , <i>E. sclerophylla</i> , Melaleuca decora, <i>Daviesia ulicifolia</i> , <i>Dillwynia</i> <i>juniperina</i> and <i>Allocasuarina littoralis</i> .	PlantNET	Low This species has not been recorded within the locality. The project site does not contain associated habitat attributes such as vegetation formation, floristic assemblage or geological substrate. The occurrence of <i>Dillwynia tenuifolia</i> within the project site is considered unlikely.
Eucalyptus camfieldii	Camfield's Stringybark	V	V	Restricted distribution in a narrow band with the most northerly records in the the Raymond Terrace area south to Waterfall. Localised and scattered distribution includes sites at Norah Head (Tuggerah Lakes), Peats Ridge, Mt Colah, Elvina Bay Trail (West Head), Terrey Hills, Killara, North Head, Menai, Wattamolla and a few other sites in Royal National Park. Occurs on poor coastal country in shallow sandy soils overlying Hawkesbury sandstone. Coastal heath mostly on exposed sandy ridges.	EPBC Act Protected matters search	Low This species has not been recorded within the locality. The project site does not contain associated habitat attributes such as vegetation formation, floristic assemblage or geological substrate. The occurrence of <i>Eucalyptus camfieldii</i> within the project site is considered unlikely.

Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
Eucalyptus fracta	Broken Back Ironbark	V	-	The dominant tree in a narrow band along the upper edge of a sandstone escarpment. Occurs in dry eucalypt woodland in shallow soils. Confined largely to State Forest. Locally common but restricted to the northern Broken Back Range near Cessnock, NSW.	PlantNET	Low This species has not been recorded within the locality. The project site does not contain associated habitat attributes such as vegetation formation, floristic assemblage or geological substrate. The occurrence of <i>Eucalyptus fracta</i> within the project site is considered unlikely.
Eucalyptus nicholii	Narrow-leaved Black Peppermint	V	V	Occurs from Niangala to Glenn Innes where it grows in grassy sclerophyll woodland on shallow relatively infertile soils on shales and slates, mainly on granite. Endemic on the NSW Northern Tablelands, of limited occurrence, particularly in the area from Walcha to Glen Innes; often on porphyry or granite (OEH 2018).	BioNet	Low This species is non-endemic within the Sydney Basin Bioregion. A small number of planted specimens were recorded within the project site. The species is widely cultivated in the horticultural industry and has been commonly planted for landscape purpose. The natural occurrence of <i>Eucalyptus nicholii</i> within the project site is considered highly unlikely with planted specimens not meeting final determination or scientific listing criteria for threatened species status under the BC Act or EPBC Act.

Sydney Gateway Road Project Technical Working Paper 14 - Biodiversity Development Assessment Report

Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
Eucalyptus scoparia	Wallangarra White Gum	E	V	Occurs in Queensland and reaches its southern limit in NSW. In NSW, it is known from three locations all near Tenterfield in the far northern New England Tableland Bioregion where it grows on well drained granitic hilltops, slopes and outcrops, often as scattered trees in open forest and woodland (OEH 2018).	BioNet	Low This species is non-endemic within the Sydney Basin Bioregion. Individual planted specimens were recorded within the project site. The species is widely cultivated in the horticultural industry and has been commonly planted for landscape purpose. The natural occurrence of <i>Eucalyptus</i> <i>scoparia</i> within the project site is considered highly unlikely with planted specimens not meeting final determination or scientific listing criteria for threatened species status under the BC Act or EPBC Act.
Genoplesium baueri	Yellow Gnat-orchid Bauer's Midge- orchid	E	E	Grows in dry sclerophyll forest and moss gardens over sandstone. The species has been recorded from locations between Ulladulla and Port Stephens (OEH 2018).	EPBC Act Protected matters search	Low This species has not been recorded within the locality. The project site does not contain associated habitat attributes such as vegetation formation, floristic assemblage or geological substrate. The occurrence of <i>Genoplesium baueri</i> within the project site is considered unlikely.

Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
Hibbertia puberula	Hibbertia puberula	E	-	Recent work on this species and its relatives have shown it to be widespread, but never common. It extends from Wollemi National Park south to Morton National Park and the south coast near Nowra. Early records of this species are from the Hawkesbury River area and Frenchs Forest in northern Sydney, South Coogee in eastern Sydney, the Hacking River area in southern Sydney, and the Blue Mountains. It favours low heath on sandy soils or rarely in clay, with or without rocks.	BioNet	Low The project site does not contain associated habitat attributes such as vegetation formation, floristic assemblage or geological substrate. Further, the recorded vegetation types within the project site (PCT 920 & PCT 1232) are not known to be associated with this species. No wiry sub-shrub Hibbertia specimens were recorded during targeted surveys. The occurrence of <i>Hibbertia puberula</i> within the project site is considered unlikely.
Maundia triglochinoides	Maundia triglochinoides	V	-	Maundia triglochiniodes is currently known to occur north from the Wyong region on the Central Coast with most populations occurring within the North Coast Bioregion. Historic records occur from the Sydney region although the species is generally considered extinct within this area. The Sydney records were all from the early 1900s with the localities recorded as Kogarah Swamp, Rockdale and Sans Souci (Atlas of Living Australia 2018). Maundia triglochiniodes is known to grow in swamps, lagoons, dams, channels, creeks or shallow freshwater <60 cm deep on heavy clays with low nutrients.	Atlas of Living Australia	Low Based on the lack of any records of this species in the last 100 years within the locality and given the highly disturbed nature of the project site, it is considered the likelihood of occurrence of this species is low.

Sydney Gateway Road Project Technical Working Paper 14 – Biodiversity Development Assessment Report

Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
Melaleuca biconvexa	Biconvex Paperbark	V	V	Occurs as disjunct populations in coastal New South Wales from Jervis Bay to Port Macquarie, with the main concentration of records in the Gosford/Wyong area. Grows in damp places, often near streams, or low-lying areas on alluvial soils of low slopes or sheltered aspects.	EPBC Act Protected matters search	Low This species has not been recorded within the locality. The project site provides marginal habitat in the form of PCT 1232. <i>Melaleuca biconvexa</i> is readily identifiable based on leaf morphology. No individuals of this species were recorded during targeted surveys. The occurrence <i>Melaleuca biconvexa</i> within the project site is considered unlikely.
Melaleuca deanei	Deane's Paperbark	V	V	Occurs in two distinct areas, in the Ku- ring-gai/Berowra and Holsworthy/Wedderburn areas respectively. There are also more isolated occurrences at Springwood (in the Blue Mountains), Wollemi National Park, Yalwal (west of Nowra) and Central Coast (Hawkesbury River) areas. The species occurs mostly in ridgetop woodland, with only 5% of sites in heath on sandstone.	BioNet, PlantNET	Low There are only historic records of this species within the locality. The project site does not contain associated habitat attributes such as vegetation formation, floristic assemblage or geological substrate. Further, the recorded vegetation types within the project site (PCT 920 & PCT 1232) are not known to be associated with this species. The occurrence of <i>Melaleuca deanei</i> within the project site is considered unlikely.
<i>Pelargonium</i> sp. Striatellum	Omeo Stork's-bill	E	E	Known from only four locations in NSW, with three on lake-beds on the basalt plains of the Monaro and one at Lake Bathurst. The only other known population is at Lake Omeo, Victoria. It has a narrow habitat that is usually just above the high-water level of irregularly inundated or ephemeral lakes, in the transition zone between surrounding grasslands or pasture and the wetland or aquatic communities. It occurs on sandy soils or gravelly soils or among rocks.	EPBC Act Protected matters search	Low This species has not been recorded within the locality. The project site does not contain associated habitat attributes such as vegetation formation, floristic assemblage or geological substrate. Further, the recorded vegetation types within the project site (PCT 920 & PCT 1232) are not known to be associated with this species. The occurrence of <i>Pelargonium</i> sp. Striatellum within the project site is considered unlikely.

Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
Persicaria elatior	Tall Knotweed	V	V	Tall Knotweed has been recorded in south-eastern NSW (Mt Dromedary (an old record), Moruya State Forest near Turlinjah, the Upper Avon River catchment north of Robertson, Bermagui, and Picton Lakes. In northern NSW it is known from Raymond Terrace (near Newcastle) and the Grafton area (Cherry Tree and Gibberagee State Forests). The species also occurs in Queensland. This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.	EPBC Act Protected matters search	Low This species has not been recorded within the locality. The project site does not contain associated habitat attributes such as vegetation formation, floristic assemblage or geological substrate. The occurrence of <i>Persicaria elatior</i> within the project site is considered unlikely.
Persoonia hirsuta	Hairy Geebung	E	E	The species is distributed from Singleton in the north, along the east coast to Bargo in the south and the Blue Mountains to the west. It has a large area of occurrence, but occurs in small populations. Found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone or very rarely on shale. Often occurs in areas with clay influence, in the ecotone between shale and sandstone.	BioNet, EPBC Act Protected matters search	Low There are only historic records of this species within the locality. The project site does not contain associated habitat attributes such as vegetation formation, floristic assemblage or geological substrate. Further, the recorded vegetation types within the project site (PCT 920 & PCT 1232) are not known to be associated with this species. The occurrence of <i>Persoonia hirsuta</i> within the project site is considered unlikely.

Sydney Gateway Road Project Technical Working Paper 14 – Biodiversity Development Assessment Report

Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
Pimelea curviflora var. curviflora	Pimelea curviflora var. curviflora	V	V	Confined to coastal areas around Sydney where it grows on sandstone and laterite soils. It is found between South Maroota, Cowan, Narrabeen, Allambie Heights, Northmead and Kellyville, but its former range extended south to the Parramatta River and Port Jackson region including Five Dock, Bellevue Hill and Manly. Usually occurs in woodland in the transition between shale and sandstone, often on Lucas Heights soil landscape.	EPBC Act Protected matters search	Low This species has not been recorded within the locality. The project site does not contain associated habitat attributes such as vegetation formation, floristic assemblage or geological substrate. Further, the recorded vegetation types within the project site (PCT 920 & PCT 1232) are not known to be associated with this species. The occurrence of <i>Pimelea</i> <i>curviflora</i> var. <i>curviflora</i> within the project site is considered unlikely.
Pimelea spicata	Spiked Rice-flower	E	E	This species occurs in two disjunct areas: in coastal districts from Lansdowne to Shellharbour and in Cumberland Plain Woodland inland to Penrith. In Western Sydney, it grows on Wianamatta Shales in Greybox– Ironbark Woodland with Bursaria spinosa and <i>Themeda australis</i> . In the Illawarra, it occurs on well structured clay soils in grassland or open woodland.	EPBC Act Protected matters search	Low This species has not been recorded within the locality. The project site does not contain associated habitat attributes such as vegetation formation, floristic assemblage or geological substrate. Further, the recorded vegetation types within the project site (PCT 920 & PCT 1232) are not known to be associated with this species. The occurrence of <i>Pimelea</i> <i>spicata</i> within the project site is considered unlikely.

Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
Prostanthera marifolia	Seaforth Mintbush	CE	CE	Prostanthera marifolia is currently only known from the northern Sydney suburb of Seaforth and has a very highly restricted distribution within the Sydney Basin Bioregion. Occurs in localised patches in or in close proximity to the endangered Duffys Forest ecological community. Located on deeply weathered clay-loam soils associated with ironstone and scattered shale lenses, a soil type which only occurs on ridge tops and has been extensively urbanised.	PlantNET	Low The project site does not contain associated habitat attributes such as vegetation formation, floristic assemblage or geological substrate. Further, the recorded vegetation types within the project site (PCT 920 & PCT 1232) are not known to be associated with this species. The occurrence <i>Prostanthera marifolia</i> within the project site is considered unlikely.
Pterostylis saxicola	Sydney Plains Greenhood	E	E	Known now only from Freemans Reach to Picton district. Grows in Sydney Sandstone Gully Forest in shallow or skeletal soils over sandstone shelves, often near streams.	EPBC Act Protected matters search	Low This species has not been recorded within the locality. The project site does not contain associated habitat attributes such as vegetation formation, floristic assemblage or geological substrate. Further, the recorded vegetation types within the project site (PCT 920 & PCT 1232) are not known to be associated with this species. The occurrence of <i>Pterostylis</i> <i>saxicola</i> within the project site is considered unlikely.

Sydney Gateway Road Project Technical Working Paper 14 – Biodiversity Development Assessment Report

Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
<i>Pterostylis</i> sp. Botany Bay	Botany Bay Bearded Greenhood	E	E	This species favours moist level sites on skeletal sandy soils derived from sandstone. It is associated with coastal heath vegetation dominated by <i>Melaleuca nodosa</i> and <i>Baeckea</i> <i>imbricata</i> (OEH 2018).	EPBC Act Protected matters search	Low This species has not been recorded within the locality. The project site does not contain associated habitat attributes such as vegetation formation, floristic assemblage or geological substrate. Further, the recorded vegetation types within the project site (PCT 920 & PCT 1232) are not known to be associated with this species. The occurrence of <i>Pterostylis</i> sp. Botany Bay within the project site is considered unlikely.
Pultenaea glabra	Smooth Bush-Pea	V	V	This species is primarily associated with riparian or swamp habitat areas in the mid to upper altitudes of the central Blue Mountains on sandstone derived soils. Grows in swamp margins, hillslopes, gullies and creekbanks and occurs within dry sclerophyll forest and tall damp heath on sandstone. Restricted to the higher Blue Mountains and has been recorded from the Katoomba-Hazelbrook and Mount Victoria areas, with unconfirmed sightings in the Mount Wilson and Mount Irvine areas. All known populations occur within the Blue Mountains Local Government Area.	PlantNET	Low The project site does not contain associated habitat attributes such as vegetation formation, floristic assemblage or geological substrate. Further, the recorded vegetation types within the project site (PCT 920 & PCT 1232) are not known to be associated with this species. An historic record of this species occurs from the Botany Swamps from 1956 although currently this spcies is only known from the Blue Mountains area. The occurrence <i>Pultenaea glabra</i> within the project site is considered unlikely.

Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
Senecio spathulatus	Coast Groundsel	E	-	Grows on frontal dunes and recorded from Nadgee Nature Reserve (Cape Howe) and between Kurnell in Sydney and Myall Lakes National Park (with a possible occurrence at Cudmirrah). In Victoria there are scattered populations from Wilsons Promontory to the NSW border.	BioNet	Low The project site does not contain associated habitat attributes such as vegetation formation, floristic assemblage or geological substrate. Further, the recorded vegetation types within the project site (PCT920 & PCT 1232) are not known to be associated with this species. The occurrence of <i>Senecio spathulatus</i> within the project site is considered unlikely.
Syzygium paniculatum	Magenta Lilly Pilly	E	E	Occurs between Bulahdelah and St Georges Basin where it grows in subtropical and littoral rainforest on sandy soils or stabilised dunes near the sea. On the south coast the Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. On the central coast Magenta Lilly Pilly occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities.	BioNet, EPBC Act Protected matters search	Low The project site does not contain associated habitat attributes such as vegetation formation, floristic assemblage or geological substrate. Further, the recorded vegetation types within the project site (PCT920 & PCT 1232) are not known to be associated with this species. The occurrence of <i>Syzygium paniculatum</i> within the project site is considered unlikely.
Tetratheca juncea	Black-eyed Susan	V	V	Historically recorded in the Sydney area although now confined to the local government areas of Wyong, Lake Macquarie, Newcastle, Port Stephens, Great Lakes and Cessnock.	BioNet	Low Based on the lack of any records of this species in the last 100 years within the locality and given the highly disturbed nature of the project site, it is considered the likelihood of occurrence of this species is low.

Sydney Gateway Road Project Technical Working Paper 14 – Biodiversity Development Assessment Report

Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
Thesium australe	Austral Toadflax	V	V	Grows in grassland or woodland often in damp sites. It is a semi-parasitic herb and hosts are likely to be <i>Themeda</i> <i>triandra</i> (Syn. <i>Themeda australis</i> and <i>Poa</i> spp.	EPBC Act Protected matters search	Low This species has not been recorded within the locality. The project site does not contain associated habitat attributes such as vegetation formation, floristic assemblage or geological substrate. Further, the recorded vegetation types within the project site (PCT 920 & PCT 1232) are not known to be associated with this species. The occurrence of <i>Thesium</i> <i>australe</i> within the project site is considered unlikely.
Wilsonia backhousei	Narrow-leafed Wilsonia	V	-	The occurrence of this species within the broader Sydney region is mostly restricted discrete populations in the localities of Parramatta River at Ermington, Clovelly, Voyager Point and the Royal National Park. Habitat associated with this species is generally restricted to the margins of salt marshes and lakes.	BAM candidate species report	Low This species has not been recorded within the project locality. Potential habitat occurs in the form of PCT 920. Within the project site, this vegetation type has been recorded in poor condition exhibiting an understorey that has been highly disturbed, having low native species richness/cover and are mostly dominated by transformer exotic weed cover. There are no seasonality issues associated with surveying for <i>Wilsonia backhousei</i> as the species is readily identifiable all year. Targeted surveys failed to identify any
						Individuals of this species and given the lack of any records in the locality and the generally unfavourable understorey habitat conditions, the occurrence of this species within the project site is considered unlikely.



Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
Zannichellia palustris	Zannichellia palustris	Ш	-	Zannichellia palustris is a submerged aquatic plant that is only known from the lower Hunter and Sydney Olympic Park in NSW. The plant grows in fresh or slightly saline stationary or slowly flowing water. Zannichellia palustris flowers during the warmer months and completely dies back every summer.	BAM candidate species report	Low Based on the lack of any records of this species within the locality and given the highly disturbed nature of the project site, it is considered the likelihood of occurrence of this species is low.

(1) CE – critically endangered; E – endangered; V - vulnerable

A2. Likelihood of occurrence of threatened fauna

Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
Botaurus poiciloptilus	Australasian Bittern	E	E	Widespread but uncommon over most of NSW except the northwest. Favours permanent freshwater wetlands with tall dense reedbeds particularly <i>Typha</i> spp. and <i>Eleocharis</i> spp., with adjacent shallow, open water for foraging. Roosts during the day among dense reeds or rushes and feeds mainly at night on frogs, fish, yabbies, spiders, insects and snails.	BioNet, EPBC Act Protected matters search	Nil. No suitable habitat present.
Sternula nereis nereis	Australian Fairy Tern		V	Occurs along NSW coast. Inhabits offshore, estuarine or lake islands, wetlands, beaches and spits. Nests on coral shingle on continental islands or coral cays, on sandy islands and beaches inside estuaries and on open sandy beaches.	Protected matters search	Nil. No suitable sandy beach habitat present.
Rostratula australis	Australian Painted Snipe	E	E	Normally found in permanent or ephemeral shallow inland wetlands, either freshwater or brackish. Nests on the ground among 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.	BioNet, EPBC Act Protected matters search	Nil. No suitable habitat present.
Ninox connivens	Barking Owl	V		Occurs from coast to inland slopes and plains, though is rare in dense, wet forests east of the Great Dividing Range and sparse in higher parts of the tablelands and in the arid zone. 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.	BioNet	Low. Few local records. Could forage on site on occasion. No breeding habitat present.

Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
Esacus magnirostris	Beach Stone- curlew	CE		In NSW occurs regularly from the Manning River north, with occasional vagrants to south-east NSW and VIC. Inhabits a range of beaches, islands, reefs and in estuaries. Often seen near mangroves. Forages in the intertidal zone of beaches and estuaries, on islands, flats, banks and spits of sand, mud, gravel or rock, and among mangroves. Nests in shallow scrapes above the littoral zone, among low vegetation of grass, scattered shrubs or low trees; also among open mangroves or on sandbanks.	BAM calculator	Unlikely. No resident population known from the Sydney area.
lxobrychus flavicollis	Black Bittern	V		Occurs from southern NSW to Cape York, 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.	BioNet	Low. Negligible area of poor-quality habitat within the project site itself.
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 Bulahdelah, 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.	BAM calculator	Unlikely. No resident population known from the Sydney area.
Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
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Limosa limosa	Black-tailed Godwit	V		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.	BioNet, EPBC Act Protected matters search	Low. Negligible area of poor-quality habitat within the project site itself. Known to occur at Towra Point Wetland.
Limicola falcinellus	Broad-billed Sandpiper	V		Breeds in the northern hemisphere. In the non-breeding season most common in north and north-west of Australia, but is a regular visitor in small numbers to the NSW coast from Ballina to Shoalhaven Heads. Occurs on sheltered parts of the coast, favouring estuarine mudflats but also occasionally in saltmarshes, freshwater lagoons, saltworks and sewerage farms. Forages on exposed mudflats or wet sand.	BioNet, EPBC Act Protected matters search	Low. Negligible area of poor-quality habitat within the project site itself. Known to occur at Towra Point Wetland.
Climacteris picumnus victoriae	Brown Treecreeper	V		Occurs from Corowa, Wagga Wagga, Temora, Forbes, Dubbo and Inverell to the east coast, in areas such as the Snowy River Valley, Cumberland Plain, Hunter Valley and parts of the Richmond and Clarence Valleys. Most common on the inland slopes and plains. Inhabits eucalypt woodlands and dry open forest, usually dominated by stringybarks or rough-barked species with open grassy understorey. Fallen timber is important foraging habitat. Nests in hollows in standing trees or stumps.	BAM calculator	Nil. No suitable habitat present. No local records.

Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
Burhinus grallarius	Bush Stone-curlew	Ε		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 understorey. Bush Stone-curlews were formerly found in the fertile, shale-soiled areas of Sydney - the Cumberland Plain but are now absent. There are occasional sightings in the inner Sydney area, including Timbrell Park at Five Dock (2008) and a banded individual in Ultimo (2011) that was transferred to Taronga Zoo. No resident populations are known from the project site or surrounds.	BioNet	Unlikely. No suitable potential habitat present. Only small areas of Swamp Oak Woodland present, with high incidence of weeds. No connected areas of woodland with sparse groundcover present. Project located in a highly industrial area. High incidence of feral predators present. No resident populations known. No evidence during spotlighting at Botany Wetland or call playback at Tempe.
Nettapus coromandelianus	Cotton Pygmy- goose		E	Although once found from north Queensland to the Hunter River in NSW, the Cotton Pygmy-Goose is now only a rare visitor to NSW and is uncommon in Queensland. 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.	BAM calculator	Unlikely. Rare visitor to NSW. Highly unlikely to rely on habitats within Botany Wetlands.
Calidris ferruginea	Curlew Sandpiper	Е	CE	Breeds in northern hemisphere. In Australia, generally occupies littoral and estuarine habitats. In NSW, mainly found in intertidal mudflats on sheltered coasts. Roosts on beaches, spits or islands on the coast, in wetlands or in saltmarsh on rocky shores. No mapped important areas in the project site or surrounds (ie not a candidate species for assessment).	BioNet, EPBC Act Protected matters search	Low. Negligible area of poor-quality habitat within the project site itself. Known to occur at Towra Point Wetland.

Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
Stagonopleura guttata	Diamond Firetail	V		Typically found west of the Great Dividing Range, but populations also occur in drier coastal areas including western Sydney abnd the Hunter, Clarence and Snowy River valleys. Occurs in grassy eucalypt woodlands, including Box Gum and Snow Gum communities, as well as open forest, mallee and natural and derived grasslands. Often found in riparian areas and occasionally in lightly wooded farmland. Nests in shrubby understorey or higher up under nests of other species.	BioNet	Unlikely. Outside usual range. Few local records. Preferred woodland habitat not present.
Artamus cyanopterus	Dusky Woodswallow	V		The Dusky Woodswallow is widespread from the coast to inland. It is often recorded in woodlands and dry open sclerophyll forests, and has also been recorded in shrublands, heathlands regenerating forests and very occasionally in moist forests or rainforests. The understorey is typically open with sparse eucalypt saplings, acacias and other shrubs, often with coarse woody debris. Individuals spend most of their time in about a 2 ha range and defend an area about 50 m around the nest. Dusky Woodswallows prefer larger remnants over smaller remnants. Competitive exclusion by Noisy Miners (<i>Manorina melanocephala</i>) is a significant threat to this species.	BioNet	Unlikely. Preferred woodland habitat not present.
Dasyornis brachypterus	Eastern Bristlebird	E	E	Occurs in three disjunct areas of south-eastern Australia: southern Queensland/northern NSW, the Illawarra Region and in the vicinity of the NSW/Victorian border. 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.	EPBC Act Protected matters search only	Nil. No suitable habitat present.



Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
Numenius madagascariensis	Eastern Curlew		CE	Within Australia, the species has a primarily coastal distribution. The species is found in all states, particularly the north, east, and south-east regions including Tasmania. Breeds in Russia and north-eastern China. Most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass. Occasionally, the species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets. The birds are often recorded among saltmarsh and on mudflats fringed by mangroves, and sometimes use the mangroves. The birds are also found in saltworks and sewage farms.	BioNet, EPBC Act Protected matters search	Low. Negligible area of poor-quality habitat within the project site itself. Known to occur at Towra Point Wetland.
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. Inhabits 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.	BioNet	Nil. No suitable habitat. Local records are from Kurnell Peninsula.
Pezoporus wallicus wallicus	Eastern Ground Parrot	V		Occurs in high rainfall coastal and near coastal low heathlands and sedgelands, generally below one metre in height and very dense (up to 90% projected foliage cover). Ground Parrots can re-colonise burnt habitat after 1–2 years and reach maximum densities after 15–20 years without fire. Home ranges of adult birds is typically 10 ha and overlapping with other birds, while juveniles have a significantly larger home range. Ground Parrots feed mostly on seeds from a large range of plant species, which varies seasonally. Eggs are laid in a shallow bowl of fine sticks and grass, well hidden under overhanging tall, coarse grass, sedge or low, heathy shrubs.	BioNet	Nil. No suitable heath habitat present. Outside usual range.

Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
Pandion cristatus	Eastern Osprey	V		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, though there are a handful of records from inland areas.	BioNet	Low. Would forage within Botany Bay. No raptor nests observed.
Pachyptila turtur subantarctica	Fairy Prion		V	The fairy prion (southern) breeds on Macquarie Island and a number of other subantarctic islands outside of Australia. The subspecies digs burrows among rocks or low vegetation in which to nest. Burrows may be dug below mat forming herbs. The Fairy Prion feeds by plucking food from the ocean surface. Some individuals may migrate towards New Zealand and southern Australia in winter.	EPBC Act Protected matters search only	Nil. No suitable habitat present.
Petroica phoenicea	Flame Robin	V		Breeds in upland moist eucalypt forests and woodlands, often on ridges and slopes, in areas of open understorey. Migrates in winter to more open lowland habitats such as grassland with scattered trees and open woodland on the inland slopes and plains. Forages from low perches, feeding on invertebrates taken from the ground, tree trunks, logs and other coarse woody debris. Fallen logs and coarse woody debris are important habitat components. Open cup nest of plant fibres and cobweb is often built near the ground in a sheltered niche, ledge or shallow cavity in a tree, stump or bank.	BioNet	Unlikely. Preferred woodland habitat not present.
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.	BioNet	Low. Outside usual range. Few local records.

Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
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. The Gang-Gang Cockatoo nests in hollows in the trunks, limbs or dead spouts of tall living trees, especially eucalypts, often near water. The Gang-gang Cockatoo feeds on seeds obtained in trees and shrubs, mostly from eucalypts and wattles.	BAM calculator	Low. No records in the locality. No breeding populations known from the inner Sydney area.
Callocephalon fimbriatum	Gang-gang Cockatoo population in the Hornsby and Ku- ring-gai Local Government Areas	V		Largely confined to area bounded by Thornleigh and Wahroonga in the north, Epping and North Epping in the south, Beecroft and Cheltenham in the west and Turramurra/ South Turramurra to the east.	BAM calculator	Nil. Not within distribution of the population
Calyptorhynchus Iathami	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. Roosts in leafy canopy trees, preferably eucalypts, usually <1 km from feeding site. Nests in large (approx. 20 cm) hollows in trees, stumps or limbs, usually in Eucalypts (Higgins 1999).	BioNet	Low. Minimal suitable habitat present. No breeding habitat present.
Calidris tenuirostris	Great Knot	V	CE	Breeds in northern hemisphere. In Australia, prefers sheltered coastal habitats with large intertidal mud or sandflats, including inlets, bays, harbours, estuaries and lagoons. Occasionally found on exposed reefs or rock platforms, mangroves, saltwork ponds, near-coastal swamps, saltlakes and non-tidal lagoons. Rarely occurs on inland lakes and swamps. Roosts in large groups in open areas, often at the water's edge or in shallow water close to feeding areas.	BioNet, EPBC Act Protected matters search	Low. Negligible area of poor-quality habitat within the project site itself. Known to occur at Towra Point Wetland.

Sydney Gateway Road Project Technical Working Paper 14 – Biodiversity Development Assessment Report

Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
Charadrius Ieschenaultii	Greater Sand- plover	V	V	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.	BioNet, EPBC Act Protected matters search	Low. Negligible area of poor-quality habitat within the project site itself. Known to occur at Towra Point Wetland.
Thinornis rubricollis	Hooded Plover	CE	V	The Hooded Plover is endemic to southern Australia and is nowadays found mainly along the coast from south of Jervis Bay. In the late 1920s and early 1930s the species was recorded from Port Stephens but is now considered locally extinct. It has not been seen in the Sydney area since the 1940s. Occasionally, individual birds are sighted slightly further north to the Shoalhaven River and Comerong Beach and one bird was sighted at Lake Illawarra in March 2001. Hooded Plovers prefer sandy ocean beaches backed by sparsely vegetated sand- dunes for shelter and nesting. Hooded Plovers display high nest site fidelity and nest solitarily. Occasionally Hooded Plovers are found on tidal bays and estuaries, rock platforms and rocky or sand-covered reefs near sandy beaches, and small beaches in lines of cliffs. They regularly use near-coastal saline and freshwater lakes and lagoons, often with saltmarsh.	BioNet	Low. Negligible area of poor-quality habitat within the project site itself. Known to occur at Towra Point Wetland.
Charadrius mongolus	Lesser Sand- plover	V	E	Does not breed in Australia. Found along the entire coast of Australia, most common in northern NSW, QLD and the Gulf of Carpentaria. Rarely recorded south of the Shoalhaven. In NSW almost entirely coastal, on beaches of sheltered bays, harbours and estuaries with large intertidal sand or mudflats, occasionally on sandy beaches, coral reefs and rock platforms.	BioNet, EPBC Act Protected matters search	Low. Negligible area of poor-quality habitat within the project site itself. Known to occur at Towra Point Wetland.

Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
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.	BioNet	Unlikely. No breeding sites observed during appropriate survey months. May forage on occasion over the project site.
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. Feeds primarily on profusely- flowering eucalypts and a variety of other species including melaleucas and mistletoes. Mostly nests in small hollows in living, smooth-barked eucalypts. Most breeding records are from the western slopes.	BioNet	Unlikely. Suitable foraging or breeding habitat not present. May occur on occasion as transient individuals.
Sternula albifrons	Little Tern	E		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. Forages in shallow waters of estuaries, coastal lagoons and lakes, also along open coasts, less often at sea, and usually within 50 m of shore.	BioNet	Low. Minimal habitat within the project site. Known to occur at Towra Point Wetland.

Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
Lophochroa leadbeateri	Major Mitchell's Cockatoo	V		Occupies habitat in arid semi-desert scrublands, savannahs and sparse woodlands where there is fresh surface water and large hollow trees for nesting. These birds have been recorded in forest, woodland and shrub land, including mulga, mallee, acacia, eucalyptus and callitris associations. It has also been recorded in cropping areas throughout its range. Large areas of suitable habitat are required for a viable population to exist.	BioNet	Unlikely. Outside usual distribution.
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 (>40 cm) 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.	BioNet	Possible. May forage in the project site on occasion. No breeding habitat present.
Limosa lapponica menzbieri	Northern Siberian Godwit		CE	Has been recorded in the coastal areas of all Australian states. It is widespread in the Torres Strait and along the east and south-east coasts of Queensland, NSW and Victoria, including the offshore islands. Breeds in the north of Scandinavia, Russia and north-west Alaska. Found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays.	EPBC Act Protected matters search only	Low. Negligible area of poor-quality habitat within the project site. Does not breed in Australia.
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 Shellharbour, Maroubra and the Shoalhaven. 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, including improved pasture.	BioNet	Low. No saltmarsh in the project site.



Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
Grantiella picta	Painted Honeyeater	V	V	Nomadic, occurring in low densities across most of NSW. Highest concentrations and almost all breeding occurs on inland slopes of the Great Dividing Range. Inhabits Boree, Brigalow and Box Gum woodlands as well as Box- Ironbark forests. Specialist forager on the fruits of mistletoes, preferably of the Amyema genus. Nests in outer tree canopy.	EPBC Act Protected matters search only	Nil. No suitable habitat present.
Haematopus Iongirostris	Pied Oystercatcher	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.	BioNet	Low. Would occur around beaches and rock platforms of Botany Bay. Large breeding colony known to occur at Towra Point Wetland. Negligible area of poor quality mud flats present.
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.	BioNet	Possible. May forage in the project site on occasion. No breeding habitat present.
Calidris canutus	Red Knot		E	Breeds in northern hemisphere. Occurs in coastal areas around Australia, with important sites in VIC, SA, WA, NT and Qld. Mainly inhabits intertidal mudflats, sandflats and sandy beaches. Occasionally seen in terrestrial saline wetlands but rarely in freshwater wetlands. Forages in soft substrates in intertidal areas.	BioNet, EPBC Act Protected matters search	Low. Negligible area of poor-quality habitat within the project site. Does not breed in Australia.

Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
Turnix maculosus	Red-backed Button-quail			Recorded infrequently in coastal and subcoastal regions of central and northern NSW. The population around Sydney was last recorded in 1912. Inhabits grasslands, open and savannah woodlands with grassy ground layer, pastures and crops of warm temperate areas.	BAM calculator	Nil. Highly unlikely to occur given lack of records in Sydney and few recent records in NSW. No suitable habitat present.
Anthochaera phrygia	Regent Honeyeater	CE	CE	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. Inhabits dry open forest and woodlands, particularly Box- Ironbark woodland and riparian forests of River Sheoak with an abundance of mature trees, high canopy cover and abundance of mistletoes.	BioNet, EPBC Act Protected matters search	Unlikely. No suitable foraging habitat present. Would not breed in the area.
Ptilinopus regina	Rose-crowned Fruit-Dove	V		Occurs from Newcastle north to Cape York, with vagrants occasionally as far south as Victoria. Occurs mainly in sub-tropical and dry rainforest and occasionally in moist eucalypt forest and swamp forest, where fruit is plentiful. Thought to be locally nomadic in response to fruit availability.	BioNet	Nil. No suitable rainforest or moist eucalypt forest present.
Calidris alba	Sanderling	V		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.	BioNet, EPBC Act Protected matters search	Low. Negligible area of poor-quality habitat within the project site. Does not breed in Australia.



Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
Petroica boodang	Scarlet Robin	V		In NSW, it 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.	BioNet	Unlikely. Preferred woodland habitat not present.
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 is strongly associated with sheltered gullies, particularly those with tall rainforest understorey. Roosts in tree hollows, among dense foliage in gullies or in caves, recesses or ledges of cliffs or banks. Nests in large (>40 cm wide, 100 cm deep) tree hollows in unlogged/unburnt gullies within 100 m of streams or in caves.	BioNet	Unlikely. Suitable forested habitat not present.
Haematopus fuliginosus	Sooty Oystercatcher	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.	BioNet	Low. No suitable rocky shore or beach habitat present. No breeding habitat present. Negligible area of poor quality mud flats present.
Onychoprion fuscata	Sooty Tern	V		Occurs over tropical and subtropical seas and islands around northern NSW. Occasionally seen along coastal NSW, especially after cyclones. Breeds in sand or coral scrapes on offshore islands and cays including Lord Howe and Norfolk Islands.	BioNet	Nil. No suitable beach habitat present.

Sydney Gateway Road Project Technical Working Paper 14 – Biodiversity Development Assessment Report

Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
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).	BioNet	Unlikely. No breeding sites observed during appropriate survey months. May forage on occasion over the project site.
Lophoictinia isura	Square-tailed Kite	V		Occurs across NSW, resident in north, north-east and along west-flowing rivers. Summer breeding migrant to south-east of state. Inhabits a variety of habitats including woodlands and open forests, with preference for timbered watercourses. Favours productive forests on the coastal plain, box-ironbark-gum woodlands on the inland slopes and Coolibah/River Red Gum on the inland plains. In Sydney area, nests in mature living trees within 100 m of ephemeral/permanent watercourse. Large home range > 100 km ² .	BioNet	Unlikely. No breeding sites observed during appropriate survey months. May forage on occasion over the project site.
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.	BioNet	Unlikely. No suitable closed forest present. May occur on a transient basis on rare occasions.

Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
Lathamus discolor	Swift Parrot	E	CE	Migratory, travelling to the mainland from March to October. Breeds in Tasmania from September to January. On the mainland, it mostly occurs in the south- east, foraging on winter-flowering eucalypts and lerps, with records of the species between Adelaide and Brisbane. Principal over-winter habitat is box-ironbark communities on the inland slopes and plains. <i>Eucalyptus</i> <i>robusta, Corymbia maculata</i> and <i>C. gummifera</i> dominated coastal forests are also important habitat.	BioNet, EPBC Act Protected matters search	Nil. No suitable habitat present.
Xenus cinereus	Terek Sandpiper	V		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. Roosts communally in mangroves or dead trees. Forages in open intertidal mudflats.	BioNet	Low. Negligible area of poor-quality habitat within the project site. Does not breed in Australia.
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 South 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.	BioNet	Unlikely. No suitable woodland habitat present.

Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
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 reuses the same fork or tree in successive years.	BAM calculator	Unlikely. No suitable woodland habitat present. No local records.
Haliaeetus leucogaster	White-bellied Sea- Eagle	V		Primarily coastal but may extend inland over major river systems. Breeds close to water, mainly in tall open forest/woodland but also in dense forest, rainforest, closed scrub or remnant trees. Usually forages over large expanses of open water, but also over open terrestrial habitats (eg grasslands).	323 records within 10 km (OEH 2018a)	Possible. Would forage within Botany Bay. Less likely to forage within Alexandra Canal. No raptor nests observed. Known to nest at Towra Point Reserve.
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 <1 m tall, and in open grasslands and areas bordering wetlands. Inland, they are often observed in grassy plains, saltlakes and saltpans along waterway margins.	245 records within 10 km (OEH 2018a)	Low. Could occur on rare occasions at Tempe Lands. No saltmarsh in the project site. Known to occur at Towra Point Wetland.
Epthianura albifrons	White-fronted Chat population in the Sydney Metropolitan Catchment Management Area	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 Nature Reserve. This species is unlikely to cross the 25 km separating these areas, or the greater distances separating other colonies outside the CMA.	BioNet	Low. Could occur on rare occasions at Tempe Lands. No saltmarsh in the project site. Known to occur at Towra Point Wetland.

Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
Hirundapus caudacutus	White-throated Needletail		V	Recorded along NSW coast to the western slopes and occasionally from the inland plains. Breeds in northern hemisphere. Almost exclusively aerial while in Australia. Occurs above most habitat types but is more frequently recorded above more densely vegetated habitats (rainforest, open forest and heathland) than over woodland or treeless areas.	EPBC Act Protected matters search	Low. May forage high above the project site on occasion.
Mammals						
Petrogale penicillata	Brush-tailed Rock- wallaby	E	V	Occurs from the Shoalhaven north to the Queensland border. Now mostly extinct west of the Great Dividing Range, except in the Warrumbungles and Mt Kaputar. Occurs on rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges facing north. Diet consists of vegetation adjacent to rocky areas, eating grasses and forbs as well as the foliage and fruits of shrubs and trees.	EPBC Act Protected matters search only	Nil. No suitable habitat present.
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 four known maternity caves in NSW, near Wee Jasper, Bungonia, Kempsey and Texas. Females may travel hundreds of kilometres to the nearest maternal colony.	BioNet	Known. Definite record at Alexandra Canal and Tempe Wetland. Would forage throughout the project site. No breeding habitat present.
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V		Occurs on south-east coast and ranges. Prefers tall (>20 m) 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 (12 km foraging movements recorded).	BioNet	Unlikely. Suitable foraging or breeding habitat not present.

Sydney Gateway Road Project Technical Working Paper 14 – Biodiversity Development Assessment Report

Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
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.	BioNet	Likely. Would forage throughout the project site. No breeding habitat present.
Cercartetus nanus	Eastern Pygmy- possum	V		Inhabits range of habitats from coastal heath and woodland though open and closed forests, subalpine heath and rainforest. Banksia spp. and myrtaceous shrubs and trees are favoured food sources and nesting subject sites in drier habitats. Diet mostly pollen and nectar from banksia spp, eucalyptus spp, callistemon spp and insects. Nests in hollows in trees, under the bark of eucalypts, forks of tea-trees, abandoned bird nests and xanthorrhoea bases.	BAM calculator	Nil. No suitable habitat present. No local records.
Kerivoula papuensis	Golden-tipped Bat	V		Inhabits moist, closed forest with high summer rainfall. Wide range of possible roosts but 95% in the bottom of Yellow-throated Scrubwren or Brown Gerygone nests within rainforest, usually along creek lines. However, individuals frequently forage in dry sclerophyll forests on upper slopes, generally within 2 km of the roost. Thought to have limited dispersal ability through cleared landscape (Woodside et al 2008).	BAM Calculator	Nil. No suitable habitat present.
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 500 m 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 (Hoye and Richards 2008, Churchill 2008).	BioNet	Likely. Would forage throughout the project site. No breeding habitat present.

Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
Petauroides volans	Greater Glider		V	The greater glider is restricted to eastern Australia, occurring from the Windsor Tableland in north Queensland through to central Victoria (Wombat State Forest), with an elevational range from sea level to 1200 m above sea level. It prefers taller montane, moist eucalypt forest with relatively old trees and abundant hollows.	EPBC Act Protected matters search	Nil. No suitable habitat present. No Local records.
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.	BioNet, EPBC Act Protected matters search	Known. Would forage in fig trees, flowering gums and other trees in the project site. No breeding camp present.
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)	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 less than two to several hundred hectares. Only known populations in Sydney are in outer areas such as the Holsworthy/Campbelltown area and Pittwater area. No known populations in inner Sydney.	EPBC Act Protected matters search	Nil. No suitable habitat present. No local records.
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Occurs from the coast to the western slopes of the divide. Largest numbers of records from sandstone escarpment country in the Sydney Basin and Hunter Valley (Hoye and Schulz 2008). Roosts in caves and mines and most commonly recorded from dry sclerophyll forests and woodlands. An insectivorous species that flies over the canopy or along creek beds (Churchill 2008). In southern Sydney appears to be largely restricted to the interface between sandstone escarpments and fertile valleys.	EPBC Act Protected matters search	Nil. No suitable habitat present. No local records.

Sydney Gateway Road Project Technical Working Paper 14 – Biodiversity Development Assessment Report

Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
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).	BioNet	Likely. Would forage throughout the project site. No breeding habitat present.
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. Shelters mostly under older houses and buildings, and forages in parkland and backyards.	BioNet	Unlikely. Outside known distribution of the population.
Pseudomys novaehollandiae	New Holland Mouse		V	Occurs in disjunct coastal populations from Tasmania to Queensland. In NSW inhabits a variety of coastal habitats including heathland, woodland, dry sclerophyll forest with a dense shrub layer and vegetated sand dunes. Populations may recolonise/increase in size in regenerating native vegetation after wildfire, clearing and sandmining. Presence strongly correlated with understorey vegetation density, and high floristic diversity in regenerating heath (Lock and Wilson 1999).	EPBC Act Protected matters search	Nil. No suitable heath habitat present.
lsoodon obesulus obesulus	Southern Brown Bandicoot	E	E	Occurs mainly in two areas: Ku-ring-gai Chase and Garigal National Parks north of Sydney, and far SE NSW, but also occurs between these areas. Inhabits scrubby vegetation, including heath, shrubland, and heathy forest and woodland. Often associated with well-drained soils and dry heathland communities. Prefers periodically burnt areas as this increases insect abundance.	EPBC Act Protected matters search	Nil. No suitable habitat present.



Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
Myotis macropus	Southern 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.	BioNet	Low. Could forage in the area however there are no records of the species in this location in the last 30 years. No evidence during surveys. No breeding habitat present.
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.	EPBC Act Protected matters search	Nil. No suitable habitat present. Highly urban, modified landscape.
Petaurus norfolcensis	Squirrel Glider	V		Occurs along the drier inland slopes as well as coastal habitats. Inhabits woodland and open forest with a Eucalyptus, Corymbia or Angophora overstorey and a shrubby understorey of Acacia or Banksia. Key habitat components include reliable winter and early-spring flowering Eucalypts, Banksia or other nectar sources, and hollow-bearing trees for roost and nest sites, with social groups moving between multiple hollows. Social groups include one or two adult males and females with offspring, and have home ranges of 5–10ha within NSW.	BioNet	Nil. No suitable habitat present.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V		Migrates from tropics to SE Aus 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.	BioNet	Likely. Could forage on occasion in the project site. No breeding habitat present.

Sydney Gateway Road Project Technical Working Paper 14 – Biodiversity Development Assessment Report

Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence			
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 200 m of escarpments in summer. Feeds mostly on geckos and small skinks, and occasionally on frogs and small mammals.	EPBC Act Protected matters search	Nil. No suitable habitat present.			
Hoplocephalus bitorquatus	Pale-headed Snake	V		Occurs north from Tuggerah along the coast and to the western side of the Great Divide. Inhabits dry eucalypt forests and woodlands, cypress woodland and occasionally in rainforest or moist eucalypt forest. Favours streamside areas, particularly in drier habitats. Shelters during the day between loose bark and tree- trunks or in hollow trunks and limbs of dead trees.	BAM calculator	Nil. No suitable habitat present. Outside known distribution.			
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. The species is associated with sandy soil on sandstone ridges that support heath vegetation. Breeds in ephemeral to intermittent streams with persistent pools. Only infrequently moves to breeding sites, most commonly found on ridges away from creeks, several hundred metres from water.	EPBC Act Protected matters search	Nil. No suitable sandstone or heath habitat present.			
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. <i>Gambusia holbrooki</i> is a key threat as they feed on Green and Golden Bell Frog eggs and tadpoles.	BioNet, EPBC Act Protected matters search	Unlikely. Known to occur in lower Cooks River area, however thought to be extinct at Botany Wetland. Extant population known from Marsh Street wetland. No evidence despite targeted surveys in suitable conditions.			

Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
Litoria brevipalmata	Green-thighed Frog	V		Occurs north from Gosford to Queensland. Breeding occurs in flooded semi-permanent or ephemeral pools, usually in grassy areas and within 100 m of significant stands of native vegetation. Can tolerate some disturbance but not found in >50% cleared grazing land or entirely urban areas. Usually associated with moist forest (swamp forest, wet sclerophyll or rainforest) but often recorded from dry sclerophyll forests in the northern part of its range.	BAM calculator	Nil. No suitable habitat present. Outside known distribution.
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.	EPBC Act Protected matters search	Nil. No suitable habitat present. Outside known distribution.
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 100 m of ridgelines. Breeds in ephemeral feeder creeks or flooded depressions, requiring unpolluted water between 5.5 and 6.5 pH. Shelters under rocks, among masses of dense vegetation or leaf litter. Populations restricted to immediate vicinity of breeding areas.	BioNet	Nil. No suitable habitat present.
Mixophyes balbus	Stuttering Frog	E	V	Occurs along the east coast of Australia. Has undergone a massive range reduction particularly in the south of its range. Inhabits rainforest and wet, tall, open forest. Shelters in deep leaf litter and thick understorey vegetation on the forest floor. Feeds on insects and smaller frogs, breeding in streams during summer after heavy rain. The species does not occur in areas where the riparian vegetation has been disturbed or where there have been significant upstream human impacts.	EPBC Act Protected matters search	Nil. No suitable habitat present.

Sydney Gateway Road Project Technical Working Paper 14 – Biodiversity Development Assessment Report



Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence
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.	BioNet	Nil. No suitable habitat present.
Fish	•			•	·	· · · · · · · · · · · · · · · · · · ·
Prototroctes maraena	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 in cool, clear waters with a gravel substrate and alternating pool and riffle zones, however, can also occur in turbid water. The species can penetrate well inland, being recorded over 100 km inland from the sea. (Backhouse et al 2008).	EPBC Act Protected matters search	Nil. No suitable habitat present. Outside known range.
Epinephelus daemelii	Black Rockcod		V	Found in warm temperate/sub-tropical parts of south- western Pacific. Naturally occurs along NSW Coast including Lord Howe Island. Adults generally found on rocky reefs. Juveniles found in coastal rock pools and around rocky shores in estuaries. (DPI 2013).	EPBC Act Protected matters search	Nil. No suitable habitat present. May occur around rocky headlands of Botany Bay.
Macquaria australasica	Macquarie Perch	V	E	Occurs in the upper reaches of the Lachlan, Murrumbidgee and Murray Rivers, and in parts of the Hawkesbury and Shoalhaven catchment areas. Inhabits river and lake habitats, especially the upper reaches of rivers and their tributaries. Requires clear water with deep, rocky holes and abundant cover (including aquatic vegetation, woody debris, large boulders and overhanging banks). Spawning occurs in spring and summer in shallow upland streams or flowing sections of river systems.	EPBC Act Protected matters search	Nil. No suitable habitat present.

Scientific name	Common name	BC Act Status ¹	EPBC Act Status ¹	Habitat association	Nature of record	Likelihood of occurrence		
Gastropods								
Pommerhelix duralensis	Dural Land Snail	E	E	This species is a shale-influenced habitat specialist, which occurs in low densities along the northwest fringes of the Cumberland Plain on shale-sandstone transitional landscapes. The majority of confirmed records for the species occur within The Hills Shire Local Government Area. The species is also found within the Local Government Areas of Blue Mountains City, Penrith City, Hornsby Shire and Parramatta City.	EPBC Act Protected matters search	Nil. No suitable habitat present.		

(1) CE – critically endangered; E – endangered; EP – endangered population; V – vulnerable

A3. Likelihood of occurrence of migratory species

Scientific name	Common name	EPBC Act Status	Habitat association	Nature of record	Likelihood of occurrence
Limosa Iapponica	Bar-tailed Godwit	Migratory	Has been recorded in the coastal areas of all Australian states. It is widespread in the Torres Strait and along the east and south-east coasts of Queensland, NSW and Victoria, including the offshore islands. Breeds in the north of Scandinavia, Russia and north-west Alaska. Found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays.	EPBC Act Protected matters search	Low. Negligible area of poor- quality habitat within the project site. Does not breed in Australia.
Monarcha melanopsis	Black-faced Monarch	Migratory	Found along the coast of eastern Australia, becoming less common further south. Found in rainforests, eucalypt woodlands, coastal scrub and damp gullies. It may be found in more open woodland when migrating. Resident in the north of its range but is a summer breeding migrant to coastal south-eastern Australia, arriving in September and returning northwards in March. It may also migrate to Papua New Guinea in autumn and winter.	EPBC Act Protected matters search	Low. Negligible area of poor- quality habitat within the project site. Does not breed in Australia.
Limosa limosa	Black-tailed Godwit	Migratory	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 or sandflats. It has also been found around muddy lakes and swamps, wet fields and sewerage treatment works.	EPBC Act Protected matters search	Low. Negligible area of poor- quality habitat within the project site. Does not breed in Australia.

Scientific name	Common name	EPBC Act Status	Habitat association	Nature of record	Likelihood of occurrence
Limicola falcinellus	Broad-billed Sandpiper	Migratory	Breeds in the northern hemisphere. In the non-breeding season most common in north and north-west Australia, but is a regular visitor in small numbers to the NSW coast from Ballina to Shoalhaven Heads. Occurs on sheltered parts of the coast, favouring estuarine mudflats but also occasionally in saltmarshes, freshwater lagoons, saltworks and sewerage farms. Forages on exposed mudflats or wet sand.	EPBC Act Protected matters search	Low. Negligible area of poor- quality habitat within the project site. Does not breed in Australia.
Tringa nebularia	Common Greenshank	Migratory	Does not breed in Australia but occurs in all types of wetlands. In NSW, has been recorded in most coastal regions and is widespread west of the Great Dividing Range, particularly in the north-west, Macquarie Marshes and areas between the Lachlan and Murray Rivers and Darling River drainage basin. The Hunter River estuary is an internationally important site for the species. In coastal areas, it typically occurs in sheltered habitats with large mudflats and saltmarsh, mangroves or seagrass.	EPBC Act Protected matters search	Low. Negligible area of poor- quality habitat within the project site. Does not breed in Australia.
Actitis hypoleucos	Common Sandpiper	Migratory	Does not breed in Australia. When in Australia, it is found on all coastlines and in inland areas but is concentrated in the north and west with important areas in WA, NT and Qld. Utilises a wide range of coastal and inland wetlands with varying salinity levels.	EPBC Act Protected matters search	Low. Negligible area of poor- quality habitat within the project site. Does not breed in Australia.
Calidris ferruginea	Curlew Sandpiper	Migratory	Breeds in northern hemisphere. In Australia, generally occupies littoral and estuarine habitats. In NSW, mainly found in intertidal mudflats on sheltered coasts. Roosts on beaches, spits or islands on the coast, in wetlands or in saltmarsh on rocky shores.	EPBC Act Protected matters search	Low. Negligible area of poor- quality habitat within the project site. Does not breed in Australia.

Sydney Gateway Road Project Technical Working Paper 14 – Biodiversity Development Assessment Report

Scientific name	Common name	EPBC Act Status	Habitat association	Nature of record	Likelihood of occurrence
Charadrius bicinctus	Double-banded Plover	Migratory	Found in both coastal and inland areas. During the non- breeding season, it is common in eastern and southern Australia. Breeds only in New Zealand. Found on littoral, estuarine and fresh or saline terrestrial wetlands and also saltmarsh, grasslands and pasture. It occurs on muddy, sandy, shingled or sometimes rocky beaches, bays and inlets, harbours and margins of fresh or saline terrestrial wetlands such as lakes, lagoons and swamps, shallow estuaries and rivers.	EPBC Act Protected matters search	Low. Negligible area of poor- quality habitat within the project site. Does not breed in Australia.
Numenius madagascariensis	Eastern Curlew	Migratory	Within Australia, the species has a primarily coastal distribution. The species is found in all states, particularly the north, east, and south-east regions including Tasmania. Breeds in Russia and north-eastern China. Most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass. Occasionally, the species occurs on ocean beaches (often near estuaries), coral reefs, rock platforms or rocky islets. The birds are often recorded among saltmarsh and on mudflats fringed by mangroves, and sometimes use the mangroves. The birds are also found in saltworks and sewage farms.	EPBC Act Protected matters search	Low. Negligible area of poor- quality habitat within the project site. Does not breed in Australia.
Calidris tenuirostris	Great Knot	Migratory	Breeds in northern hemisphere. In Australia, prefers sheltered coastal habitats with large intertidal mud or sandflats, including inlets, bays, harbours, estuaries and lagoons. Occasionally found on exposed reefs or rock platforms, mangroves, saltwork ponds, near-coastal swamps, saltlakes and non-tidal lagoons. Rarely occurs on inland lakes and swamps. Roosts in large groups in open areas, often at the water's edge or in shallow water close to feeding areas.	EPBC Act Protected matters search	Low. Negligible area of poor- quality habitat within the project site. Does not breed in Australia.

Scientific name	Common name	EPBC Act Status	Habitat association	Nature of record	Likelihood of occurrence
Charadrius Ieschenaultii	Greater Sand Plover	Migratory	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. Forages on wet ground at low tide.	EPBC Act Protected matters search	Low. Negligible area of poor- quality habitat within the project site. Does not breed in Australia.
Pluvialis squatarola	Grey Plover	Migratory	Breeds in the northern hemisphere. Widespread on Australian coast in the non-breeding season. Occurs almost entirely in coastal areas, usually in sheltered bays with mud or sandflats and occasionally on rocky coasts or near-coastal lakes and swamps. Very occasionally recorded further inland. Forages on exposed mudflats and beaches.	EPBC Act Protected matters search	Low. Negligible area of poor- quality habitat within the project site. Does not breed in Australia.
Tringa brevipes	Grey-tailed Tattler	Migratory	Non-breeding visitor to Australia. In NSW, occurs along the coast from the Queensland border south to Tilba Lake, and has been recorded as far south as Gippsland. It is recorded more frequently north of Sydney. Found on sheltered coasts with reefs and rock platforms or with intertidal mudflats. Inland records are rare. Forages in shallow water in intertidal areas. Usually roosts in the branches of mangroves or rocks which may be partly submerged. Also rarely recorded in dense shrubs, on driftwood or sand dunes.	EPBC Act Protected matters search	Low. Negligible area of poor- quality habitat within the project site. Does not breed in Australia.
Gallinago hardwickii	Latham's Snipe	Migratory	Occurs along the coast and west of the Great Dividing Range. Non breeding visitor to Australia. Inhabits permanent and ephemeral wetlands up to 2000 m asl. Typically in open, freshwater wetlands with low, dense vegetation (incl. swamps, flooded grasslands and heathlands). Can also occur in saline/brackish habitats and in modified or artificial habitats close to human activity.	EPBC Act Protected matters search	Low. Negligible area of poor- quality habitat within the project site. Does not breed in Australia.

Scientific name	Common name	EPBC Act Status	Habitat association	Nature of record	Likelihood of occurrence
Charadrius mongolus	Lesser Sand Plover	Migratory	Does not breed in Australia. Found along the entire coast of Australia, most common in northern NSW, QLD and the Gulf of Carpentaria. Rarely recorded south of the Shoalhaven. In NSW, almost entirely coastal, on beaches of sheltered bays, harbours and estuaries with large intertidal sand or mudflats, occasionally on sandy beaches, coral reefs and rock platforms.	EPBC Act Protected matters search	Low. Negligible area of poor- quality habitat within the project site. Does not breed in Australia.
Numenius minutus	Little Curlew	Migratory	Generally spends the non-breeding season in northern Australia. In 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. Recorded breeding in Siberia. Most often found feeding in short, dry grassland and sedgeland, including dry floodplains and blacksoil plains, which have scattered, shallow freshwater pools or areas seasonally inundated. Open woodlands with a grassy or burnt understorey, dry saltmarshes, coastal swamps, mudflats or sandflats of estuaries or beaches on sheltered coasts, mown lawns, gardens, recreational areas, ovals, racecourses and verges of roads and airstrips are also used.	EPBC Act Protected matters search	Low. Negligible area of poor- quality habitat within the project site. Does not breed in Australia.
Calidris subminuta	Long-toed Stint	Migratory	Widely scattered records around coastal NSW. They prefer shallow freshwater or brackish wetlands including lakes, swamps, river floodplains, streams, lagoons and sewage ponds. The species is also fond of areas of muddy shoreline, growths of short grass, weeds, sedges, low or floating aquatic vegetation, reeds, rushes and occasionally stunted samphire. They roost or loaf in sparse vegetation at the edges of wetlands and on damp mud near shallow water and forage on wet mud or in shallow water.	EPBC Act Protected matters search	Low. Negligible area of poor- quality habitat within the project site. Does not breed in Australia.



Scientific name	Common name	EPBC Act Status	Habitat association	Nature of record	Likelihood of occurrence
Tringa stagnatilis	Marsh Sandpiper	Migratory	Breeds in the northern hemisphere. Occurs in coastal and inland wetlands, including freshwater and estuarine habitats, throughout Australia. All regions of NSW but particularly central and south coasts and western slopes and plains. Sites of national importance in NSW include Parkes Wetlands, Macquarie Marshes and Tullakool Evaporation Ponds.	EPBC Act Protected matters search	Low. Negligible area of poor- quality habitat within the project site. Does not breed in Australia.
Cuculus optatus	Oriental Cuckoo	Migratory	This species migrates to northern and eastern Australia in the warmer months. Occurs south to the Shoalhaven area. Occurs in a range of habitats, including monsoon forest, rainforest edges, leafy trees in paddocks, river flats, roadsides and mangroves.	EPBC Act Protected matters search	Low. Negligible area of poor- quality habitat within the project site. Does not breed in Australia.
Charadrius veredus	Oriental Plover	Migratory	The Oriental Plover is a non-breeding visitor to Australia, where the species occurs in both coastal and inland areas, mostly in northern Australia. Most records are along the north-western coast, between Exmouth Gulf and Derby in Western Australia. Oriental Plovers spend a few weeks in coastal habitats such as estuarine mudflats and sandbanks, on sandy or rocky ocean beaches, nearby reefs or in near-coastal grasslands, before dispersing further inland. Oriental Plovers usually forage among short grass or on hard stony bare ground (McCrie 1984), but also on mudflats or among beachcast seaweed on beaches.	EPBC Act Protected matters search	Low. Negligible area of poor- quality habitat within the project site. Does not breed in Australia.
Pandion haliaetus	Osprey	Migratory	The Osprey is found around the Australian coast line, except for Victoria and Tasmania. They favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Ospreys feed on fish over clear, open water and breed from July to September in NSW. Nests are made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea.	EPBC Act Protected matters search	Low. Could forage along Alexandra Canal on occasions. No nests observed.
Pluvialis fulva	Pacific Golden Plover	Migratory	Breeds in the northern hemisphere. In Australia, occurs mainly in coastal areas but also recorded inland. Important sites in NSW include the Hunter and Shoalhaven River estuaries. Usually occurs on beaches, mudflats and sandflats in sheltered areas.	EPBC Act Protected matters search	Low. Negligible area of poor- quality habitat within the project site. Does not breed in Australia.

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Scientific name	Common name	EPBC Act Status	Habitat association	Nature of record	Likelihood of occurrence
Calidris melanotos	Pectoral Sandpiper	Migratory	Widespread but scattered records across NSW, east of the divide and in the Riverina and Lower Western regions. Breeds in the northern hemisphere. In Australasia, prefers shallow fresh to saline wetlands and is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. Usually in coastal or near-coastal habitats, and prefers wetlands with open mudflats and low emergent or fringing vegetation such as grass or samphire.	EPBC Act Protected matters search	Low. Negligible area of poor- quality habitat within the project site. Does not breed in Australia.
Gallinago stenura	Pin-tailed Snipe	Migratory	The species distribution within Australia is not well understood. There are confirmed records from NSW, south-west Western Australia, Pilbara and the Top End. In NSW a single banded bird was reported near West Wyalong. During non-breeding period, the Pin-tailed Snipe occurs most often in or at the edges of shallow freshwater swamps, ponds and lakes with emergent, sparse to dense cover of grass/sedge or other vegetation. The species is also found in drier, more open wetlands such as claypans in more arid parts of species' range. It is also commonly seen at sewage ponds; not normally in saline or inter-tidal wetlands (Higgins & Davies 1996).	EPBC Act Protected matters search	Low. Negligible area of poor- quality habitat within the project site. Does not breed in Australia.
Calidris canutus	Red Knot	Migratory	Breeds in northern hemisphere. Occurs in coastal areas around Australia, with important sites in VIC, SA, WA, NT and Qld. Mainly inhabits intertidal mudflats, sandflats and sandy beaches. Occasionally seen in terrestrial saline wetlands but rarely in freshwater wetlands. Forages in soft substrates in intertidal areas.	EPBC Act Protected matters search	Low. Negligible area of poor- quality habitat within the project site. Does not breed in Australia.

Scientific name	Common name	EPBC Act Status	Habitat association	Nature of record	Likelihood of occurrence
Calidris ruficollis	Red-necked Stint	Migratory	Distributed along most of the Australian coastline with large densities on the Victorian and Tasmanian coasts. Breeds in Siberia and sporadically in north and west Alaska. In Australasia, mostly found in coastal areas, including in sheltered inlets, bays, lagoons and estuaries with intertidal mudflats, often near spits, islets and banks and, sometimes, on protected sandy or coralline shores. Occasionally they have been recorded on exposed or ocean beaches, and sometimes on stony or rocky shores, reefs or shoals.	EPBC Act Protected matters search	Low. Negligible area of poor- quality habitat within the project site. Does not breed in Australia.
Arenaria interpres	Ruddy Turnstone	Migratory	Breeds in northern Hemisphere. In non-breeding season, widespread in most coastal regions of Australia with occasional inland records. Strongly prefers rocky shores or beaches with large seaweed deposits.	EPBC Act Protected matters search	Low. Negligible area of poor- quality habitat within the project site. Does not breed in Australia.
Philomachus pugnax	Ruff	Migratory	In NSW, the species has been recorded at Kurnell, Tomki, Casino, Ballina, Kooragang Island, Broadwater Lagoon and Little Cattai Creek. The species has also been found around the Riverina, including Windouran Swamp, Wanganella, Fivebough Swamp and the Tullakool Saltworks. Most NSW records come from the Sydney region. In Australia, the Ruff is found on generally fresh, brackish or saline wetlands with exposed mudflats at the edges. It is found in terrestrial wetlands including lakes, swamps, pools, lagoons, tidal rivers, swampy fields and floodlands. They are occasionally seen on sheltered coasts, in harbours, estuaries, seashores and are known to visit sewage farms and saltworks. They are sometimes found on wetlands surrounded by dense vegetation including grass, sedges, saltmarsh and reeds.	EPBC Act Protected matters search	Low. Negligible area of poor- quality habitat within the project site. Does not breed in Australia.
Rhipidura rufifrons	Rufous Fantail	Migratory	Found along NSW coast and ranges. Inhabits rainforest, dense wet forests, swamp woodlands and mangroves. During migration, it may be found in more open habitats or urban areas (Birds Australia 2008).	EPBC Act Protected matters search	Low. Minimal habitat within the project site.

Sydney Gateway Road Project
Technical Working Paper 14 - Biodiversity Development Assessment Report

Scientific name	Common name	EPBC Act Status	Habitat association	Nature of record	Likelihood of occurrence
Calidris alba	Sanderling	Migratory	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.	EPBC Act Protected matters search	Low. Negligible area of poor- quality habitat within the project site. Does not breed in Australia.
Myiagra cyanoleuca	Satin Flycatcher	Migratory	In NSW, widespread on and east of the Great Divide, sparsely scattered on the western slopes, very occasional records on the western plains. Inhabits heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, often near wetlands and watercourses. On migration, occurs in coastal forests, woodlands, mangroves and drier woodlands and open forests. Generally not in rainforests.	EPBC Act Protected matters search	Low. Minimal habitat within the project site.
Calidris acuminata	Sharp-tailed Sandpiper	Migratory	Spends the non-breeding season in Australia with small numbers occurring regularly in New Zealand. Most of the population migrates to Australia, mostly to the south-east and are widespread in both inland and coastal locations and in both freshwater and saline habitats. Many inland records are of birds on passage. In Australasia, prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. Breeds in northern Siberia.	EPBC Act Protected matters search	Low. Negligible area of poor- quality habitat within the project site. Does not breed in Australia.
Monarcha trivirgatus	Spectacled Monarch	Migratory	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.	EPBC Act Protected matters search	Low. Negligible area of poor- quality habitat within the project site.





Scientific name	Common name	EPBC Act Status	Habitat association	Nature of record	Likelihood of occurrence
Gallinago megala	Swinhoe's Snipe	Migratory	Swinhoe's Snipe is recorded in north Australia, particularly the Kimberley region, from October–April. It is a non- breeding migrant to Australia and occurs at the edges of wetlands, such as wet paddy fields, swamps and freshwater streams. The species is also known to occur in grasslands, drier cultivated areas (including crops of rapeseed and wheat) and market gardens (Higgins & Davies 1996).	EPBC Act Protected matters search	Low. Negligible area of poor- quality habitat within the project site. Does not breed in Australia.
Xenus cinereus	Terek Sandpiper	Migratory	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. Roosts communally in mangroves or dead trees. Forages in open intertidal mudflats.	EPBC Act Protected matters search	Low. Negligible area of poor- quality habitat within the project site. Does not breed in Australia.
Tringa incana	Wandering Tattler	Migratory	Breeds in the northern hemisphere. Generally found on rocky coasts, occasionally on coral reefs or beaches and tends to avoid mudflats. Forages among rocks or shingle or in shallow pools, mainly along the tideline. Roosts and perches on top of boulders surrounded by or close to water.	EPBC Act Protected matters search	Low. Negligible area of poor- quality habitat within the project site. Does not breed in Australia.
Numenius phaeopus	Whimbrel	Migratory	A regular migrant to Australia and New Zealand, with a primarily coastal distribution. There are also scattered inland records in all regions. It is found in all states but is more common in the north. It is found along almost the entire coast of Queensland and NSW. Breeds in north and west Alaska, Eurasia and Iceland. Often found on the intertidal mudflats of sheltered coasts. It is also found in harbours, lagoons, estuaries and river deltas, often those with mangroves, but also open, unvegetated mudflats. It is occasionally found on sandy or rocky beaches, on coral or rocky islets, or on intertidal reefs and platforms.	EPBC Act Protected matters search	Low. Negligible area of poor- quality habitat within the project site. Does not breed in Australia.

Scientific name	Common name	EPBC Act Status	Habitat association	Nature of record	Likelihood of occurrence
Hirundapus caudacutus	White-throated Needletail	Migratory	Recorded along NSW coast to the western slopes and occasionally from the inland plains. Breeds in northern hemisphere. Almost exclusively aerial while in Australia. Occurs above most habitat types but is more frequently recorded above more densely vegetated habitats (rainforest, open forest and heathland) than over woodland or treeless areas.	EPBC Act Protected matters search	Low. May forage high above the project site on occasion.
Tringa glareola	Wood Sandpiper	Migratory	Breeds in the northern hemisphere. Occurs in largest numbers in NW Australia, with all sites of national importance within WA. In NSW there are records east of the Divide north from Nowra, and inland from the upper and lower Western regions. Uses well-vegetated, shallow, freshwater wetlands and is typically associated with wetlands supporting emergent aquatic plants or grass and taller fringing vegetation such as dense reeds/rushes, shrubs or trees. Also frequent flooded grasslands and irrigated crops. Rarely in brackish wetlands or saltmarsh. Known from artificial wetlands.	EPBC Act Protected matters search	Low. Negligible area of poor- quality habitat within the project site. Does not breed in Australia.
Motacilla flava	Yellow Wagtail	Migratory	This species breeds in temperate Europe and Asia. They occur within Australia in open country habitat with disturbed ground and some water. Recorded in short grass and bare ground, swamp margins, sewage ponds, saltmarshes, playing fields, airfields, ploughed land and town lawns.	EPBC Act Protected matters search	Low. Negligible area of poor- quality habitat within the project site. Does not breed in Australia.
Limosa lapponica	Bar-tailed Godwit	Migratory	Has been recorded in the coastal areas of all Australian states. It is widespread in the Torres Strait and along the east and south-east coasts of Queensland, NSW and Victoria, including the offshore islands. Breeds in the north of Scandinavia, Russia and north-west Alaska. Found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays.	EPBC Act Protected matters search	Low. Negligible area of poor- quality habitat within the project site. Does not breed in Australia.








B1. Flora surveys

Flora species recorded during field surveys

RM – recorded during random meander survey

Q1-Q6 – recorded during vegetation integrity plot surveys

Family	Species	Common name	RM	Q1	Q2	Q3	Q4	Q5	Q6
Acanthaceae	Avicennia marina subsp. australasica	Grey Mangrove							х
Acanthaceae	Thunbergia alata*	Black-eyed Susan	х			х	x		
Agavaceae	Agave americana*	Century Plant	x						
Alliaceae	Agapanthus praecox subsp. orientalis*	Agapanthus	x						
Aloeaceae	Aloe sp.*	-	x						
Anacardiaceae	Harpephyllum caffrum*	Kaffir Plum					x		
Apiaceae	Daucus carota*	Wild Carrot	x						
	Foeniculum vulgare*	Fennel							x
	Hydrocotyle bonariensis*	A Pennywort							х
Apocynaceae	Araujia sericifera*	Moth Vine	x			х		x	
	Gomphocarpus fruticosus*	Narrow-leaved Cotton Bush	x						
	Nerium oleander*	Oleander	x						
Arecaceae	Phoenix canariensis*	Canary Island Date Palm					x		
	Syagrus romanzoffiana*	Cocos Palm	x						
Asparagaceae	Asparagus aethiopicus*	Asparagus Fern	x			х			
Asparagaceae	Asparagus plumosus*	Climbing Asparagus Fern		х					

Family	Species	Common name			Q2	Q3	Q4	Q5	Q6
Asteraceae	Ageratina riparia*	Mistflower	x						
	Aster subulatus*	Wild Aster	x						
	Bidens pilosa*	Cobbler's Pegs	x	х	х	х		х	
	<i>Chrysanthemoides monilifera</i> subsp. <i>rotundata*</i>	Bitou Bush	x						
	Cirsium vulgare*	Spear Thistle	x	х				х	x
	Conyza bonariensis*	Flaxleaf Fleabane	x						
	Conyza sumatrensis*	Tall Fleabane	x		х			х	
	Gamochaeta americana*	Cudweed	x					x	
	Hypochaeris radicata*	Smooth Catsear	x						
	Senecio madagascarensis*	Fireweed	x					х	
	Sigesbeckia orientalis subsp. orientalis	Indian Weed							x
	Soliva sessilis*	Bindii	x						
	Sonchus asper*	Prickly Sowthistle	x						
	Sonchus oleraceus*	Common Sowthistle	x	х		x		x	
	Tagetes minuta*	Stinking Roger	x						
	Taraxacum officinale*	Dandelion	x						
Basellaceae	Anredera cordifolia*	Madeira Vine	x	х					
Bignoniaceae	Jacaranda mimosifolia*	Jacaranda	x						
Brassicaceae	Brassica rapa*	Field Mustard	x		x	х			
	Capsella bursa-pastoris*	Shepherd's Purse	x						
	Cardamine flexuosa*	Wood Bittercress	x						
Casuarinaceae	Casuarina glauca	Swamp Oak	x		х	х	х	х	

Sydney Gateway Road Project Technical Working Paper 14 – Biodiversity Development Assessment Report



Family	Species	Common name	RM	Q1	Q2	Q3	Q4	Q5	Q6
Chenopodiaceae	Chenopodium album*	Fat Hen	х	х					
	Sarcocornia quinqueflora subsp. quinqueflora	Samphire							х
	Suaeda australis	Austral Seablite							х
Convolvulaceae	Ipomoea cairica*	Coast Morning Glory	x	х		х			
	Ipomoea indica*	Blue Morning Glory	х			х		х	
Crassulaceae	Bryophyllum delagoense*	Mother of millions	х						
Cyperaceae	Cyperus eragrostis*	Umbrella Sedge	x						
	Cyperus polystachyos	A Sedge	х						
Euphorbiaceae	Euphorbia peplus*	Petty Spurge	x						
	Homalanthus populifolius	Bleeding Heart	х						
	Ricinus communis*	Castor Oil Plant		х					
Fabaceae (Caesalpinioideae)	Senna pendula var. glabrata*		x						
Fabaceae (Faboideae)	Erythrina crista-galli*	Cockspur Coral Tree	х						
	Genista monspessulana*	Montpellier Broom	х					х	
	Melilotus indicus*	Hexham Scent	х		х				
	Trifolium pratense*	Red Clover	х					x	
	Trifolium repens*	White Clover	x						
	Vicia sativa subsp. sativa*	Common Vetch	x					x	

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Family	Species	Common name	RM	Q1	Q2	Q3	Q4	Q5	Q6
Fabaceae (Mimosoideae)	Acacia decurrens	Green Wattle					х		
	Acacia floribunda	White Sally	x						
	Acacia longifolia subsp. longifolia	Sydney Golden Wattle							
	Acacia longifolia subsp. sophorae	Coastal Wattle	х		x				х
	Acacia parramattensis	Parramatta Wattle							
	Acacia saligna*	Golden Wreath Wattle	x			х	х	x	
Fumariaceae	Fumaria muralis*		х						
Gentianaceae	Centaurium erythraea*	Common Centaury	x						
Geraniaceae	Geranium molle subsp. molle*	Cranesbill Geranium	х						
Iridaceae	Crocosmia X crocosmiiflora*	Montbretia	х						
	Freesia hybrid*	Freesia	х						
	Gladiolus sp.*	Gladiolus	х						
Iridaceae	Romulea minutiflora*	Small-flowered Onion Grass	х						
Juncaceae	Juncus acutus*	Sharp Rush	x						
	Juncus continuus	A Rush	x						
	Juncus kraussii subsp. australiensis	Sea Rush							x
Juncaginaceae	Triglochin striata	-	x						х
Lamiaceae	Prunella vulgaris*	Self-heal				х	х		
	Stachys arvensis*	Stagger Weed	x						
Lauraceae	Cinnamomum camphora*	Camphor Laurel	x						
Malaceae	Rhaphiolepis indica*	Indian Hawthorn	x						

Sydney Gateway Road Project Technical Working Paper 14 – Biodiversity Development Assessment Report



Family	Species	Common name	RM	Q1	Q2	Q3	Q4	Q5	Q6
Malvaceae	Abutilon grandifolium*		x						
	Modiola caroliniana*	Red-flowered Mallow		х					
	Sida rhombifolia*	Paddy's Lucerne	x			x	х		
Meliaceae	Melia azedarach	Meliaceae	x						
Moraceae	Ficus microcarpa var. hillii*	Small-fruited Fig	x						
	Ficus pumila*	Climbing Fig	x						
	Ficus rubiginosa	Port Jackson Fig	x						
Myrsinaceae	Anagallis arvensis*	Scarlet/Blue Pimpernel	x						
Myrtaceae	Agonis flexuosa*	Willow Myrtle	x						
	Angophora costata	Smooth-barked Apple	x						
	Callistemon citrinus	Crimson Bottlebrush	x						
	Callistemon salignus	Willow Bottlebrush	x						
	Callistemon sp. (Cultivar)*	-	x						
	Corymbia citriodora*	Lemon-scented Gum	x						
	Corymbia maculata	Spotted Gum	x						
	<i>Eucalyptus</i> sp. (Planted)*	Eucalyptus	x			x	х		
	Eucalyptus tereticornis	Forest Red Gum					х		
	Leptospermum polygalifolium subsp. polygalifolium	Yellow Tea-tree					x		
	Melaleuca styphelioides	Prickly-leaved Tea Tree	x			х			
Oleaceae	Ligustrum lucidum*	Large-leaved Privet	x		х				
	Ligustrum sinense*	Small-leaved Privet	x						
	Olea europaea subsp. cuspidata*	African Olive			х		х		х

Family	Species	Common name	RM	Q1	Q2	Q3	Q4	Q5	Q6
Oxalidaceae	Oxalis corniculata*	Creeping Oxalis	х						
	Oxalis pes-caprae*	Soursob	х						
Passifloraceae	Passiflora subpeltata*	White Passionflower	х						
Pinaceae	Pinus sp*	Pine							х
Pittosporaceae	Bursaria spinosa subsp. spinosa	Native Blackthorn	х			х	х		
Plantaginaceae	Plantago lanceolata*	Lamb's Tongues	х		х			х	
Plantaginaceae	Plantago major*	Greater Plantain			х				
Poaceae	Andropogon virginicus*	Whisky Grass	х						
	Anthoxanthum odoratum*	Sweet Vernal Grass	х						
	Arundo donax*	Giant Reed							
	Avena fatua*	Wild Oats	х						х
	Axonopus fissifolius*	Narrow-leaved Carpet Grass	х						
	Briza maxima*	Quaking Grass	х						
	Briza minor*	Shivery Grass	х						
	Briza subaristata*	-	х						
	Bromus catharticus*	Prairie Grass	х						
	Cenchrus clandestinus*	Kikuyu Grass	х	х		х			
	Chloris gayana*	Rhodes Grass	х		х			х	
	Cortaderia selloana*	Pampas Grass	х	х	х			х	
	Cynodon dactylon	Common Couch	х		х		х		х

Sydney Gateway Road Project Technical Working Paper 14 – Biodiversity Development Assessment Report

Family	Species	Common name	RM	Q1	Q2	Q3	Q4	Q5	Q6
Poaceae	Digitaria ciliaris*	Summer Grass	х						
	Digitaria sanguinalis*	Summer Grass, Crab Grass	х						
	Echinochloa crus-galli*	Barnyard Grass	х				x		
	Ehrharta erecta*	Panic Veldtgrass	х			х	х	х	
	Ehrharta longiflora*	Annual Veldtgrass	х						
	Eleusine indica*	Crowsfoot Grass	x						
	Eragrostis curvula*	African Lovegrass	х		х				
	Microlaena stipoides var. stipoides	-	х			х			
	Paspalum dilatatum*	Paspalum	x						х
	Paspalum quadrifarium*	Tussock Paspalum	х						
	Paspalum urvillei*	Vasey Grass	х						
	Poa annua*	Winter Grass	x						
	Setaria parviflora*	Slender Pigeon Grass	х						
	Sporobolus africanus*	Parramatta Grass	х						
	Sporobolus virginicus	Marine Couch							x
	Stenotaphrum secundatum*	Buffalo Grass				х			
	Vulpia myuros*	Rat's Tail Fescue	х						
Polygonaceae	Persicaria lapathifolia	Pale Knotweed							x
Polygonaceae	Rumex brownii	Swamp Dock	x						
	Rumex crispus*	Curled Dock	x						
Proteaceae	Banksia integrifolia subsp. integrifolia	Coastal Banksia	х						



Family	Species	Common name	RM	Q1	Q2	Q3	Q4	Q5	Q6
Rosaceae	Cotoneaster sp.*	Cotoneaster	х		х				
	Prunus persica*	Peach					x		
	Rubus fruticosus agg.*	Blackberry	x						
Rubiaceae	Galium aparine*	Goosegrass	x						
	Richardia brasiliensis*	Mexican Clover	x						
	Richardia stellaris*		x						
Salicaceae	Salix babylonica*	Weeping Willow							x
Sapindaceae	Cardiospermum grandiflorum*	Balloon Vine	x						
	Dodonaea triquetra	Large-leaf Hop-bush					х		
Solanaceae	Cestrum parqui*	Green Cestrum	x				х		x
	Salpichroa origanifolia*	Pampas lily-of-the-valley		х					
	Solanum nigrum*	Black-berry Nightshade	x	х					
	Solanum sisymbriifolium*	Viscid Nightshade	x						
Sterculiaceae	Brachychiton acerifolius*	Illawarra Flame Tree	x						
Thelypteridaceae	Christella dentata	-	x						
Tropaeolaceae	Tropaeolum majus*	Nasturtium	x						
Ulmaceae	Celtis sinensis*	Chinese Nettle Tree	x	х	x		х		x
	Ulmus parvifolia*	Chinese Elm	x						
Urticaceae	Parietaria judaica*	Asthma Weed	x			х			x
Verbenaceae	Lantana camara*	Lantana	x	х	x	x	x	х	х
	Verbena bonariensis*	Purpletop	x		х			х	
	Verbena officinalis*	Common Verbena	x						
	Verbena rigida*	Veined Verbena		х					

Key: * exotic species

B2. Fauna surveys

Fauna species recorded during field surveys

Scientific Name	Common Name	Exotic	NSW Status	EPBC Status	Alexandra Canal	Tempe Lands	Tempe Wetland
Limnodynastes peronii	Brown-striped Frog						0
Crinia signifera	Common Eastern Froglet						W
Litoria fallax	Eastern Dwarf Tree Frog						0
Litoria peronii	Peron's Tree Frog						0
Sphecotheres vieilloti	Australasian Figbird						0
Cracticus tibicen	Australian Magpie					0	
Corvus coronoides	Australian Raven					0	
Threskiornis molucca	Australian White Ibis				0		
Sturnus tristis	Common Myna	*				0	
Sturnus vulgaris	Common Starling	*				0	
Ocyphaps lophotes	Crested Pigeon					0	
Gallinula tenebrosa	Dusky Moorhen						0
Acanthorhynchus tenuirostris	Eastern Spinebill					0	
Fulica atra	Eurasian Coot						0
Cacomantis flabelliformis	Fan-tailed Cuckoo					W	
Colluricincla harmonica	Grey Shrike-thrush						W
Aythya australis	Hardhead						0
Chalcites basalis	Horsfield's Bronze-Cuckoo					0	
Ardea intermedia	Intermediate Egret				0		

Scientific Name	Common Name	Exotic	NSW Status	EPBC Status	Alexandra Canal	Tempe Lands	Tempe Wetland
Phalacrocorax sulcirostris	Little Black Cormorant				0		
Egretta garzetta	Little Egret				0		
Grallina cyanoleuca	Magpie-lark					0	
Falco cenchroides	Nankeen Kestrel					0	
Phylidonyris novaehollandiae	New Holland Honeyeater					0	0
Manorina melanocephala	Noisy Miner					0	
Anas superciliosa	Pacific Black Duck						0
Phalacrocorax varius	Pied Cormorant				0		
Strepera graculina	Pied Currawong					0	
Porphyrio porphyrio	Purple Swamphen						0
Trichoglossus haematodus	Rainbow Lorikeet					0	0
Anthochaera carunculata	Red Wattlebird						0
Neochmia temporalis	Red-browed Finch					0	
Pycnonotus jocosus	Red-whiskered Bulbul	*				0	0
Columba livia	Rock Dove					0	
Chroicocephalus novaehollandiae	Silver Gull				0		
Zosterops lateralis	Silvereye					0	
Turdus philomelos	Song Thrush						0
Pardalotus punctatus	Spotted Pardalote						W
Streptopelia chinensis	Spotted Turtle-dove	*				0	
Butorides striatus	Striated Heron				0		
Cacatua galerita	Sulphur-crested Cockatoo					0	

Sydney Gateway Road Project Technical Working Paper 14 - Biodiversity Development Assessment Report

Scientific Name	Common Name	Exotic	NSW Status	EPBC Status	Alexandra Canal	Tempe Lands	Tempe Wetland
Malurus cyaneus	Superb Fairy-wren					0	0
Podargus strigoides	Tawny Frogmouth					0	
Hirundo neoxena	Welcome Swallow					0	0
Sericornis frontalis	White-browed Scrubwren					0	0
Ardea pacifica	White-necked Heron				0		
Ptilotula penicillatus	White-plumed Honeyeater						0
Rhipidura leucophrys	Willie Wagtail				0	0	0
Caligavis chrysops	Yellow-faced Honeyeater						0
Pseudocheirus peregrinus	Common Ringtail Possum						0
Miniopterus schreibersii oceanensis	Eastern Bentwing-Bat		V				D
Mormopterus ridei	Eastern Free-tailed Bat						PR
Chalinolobus gouldii	Gould's Wattled Bat						D
Pteropus poliocephalus	Grey-headed Flying-fox		V	V			0
Vespadelus sp.	Unidentified Eptesicus						
Austronomus australis	White-striped Freetail-Bat						D
Tiliqua scincoides	Eastern Blue-tongue						0
Intellagama lesueurii	Eastern Water Dragon						0
Eulamprus quoyii	Eastern Water-Skink						0
Lampropholis guichenoti	Pale-flecked Garden Sunskink					0	

Key: * - exotic; D – definite call (Anabat); PR – probable call (Anabat); V – vulnerable, O – observed, W – heard

V



	BA	Site S	heet no:	0Ť						
		Survey Na	ame	Plot Id	entifier	Recorders				
Date	14/09/18	Gateway R	end.	QI	11 - 112	Mark Stables.				
Zone 56.	Datum UT M	IBRA region	Sydnoy	Busin.	Photo #		Zone ID			
Easting 330684	Northing 6244542	Plot Dimen (e.g. 20 x 2	sions 20 in 20 x 50)		ές.	Orientation of midli from the 0 m poi	ne / 20 nt.	- Nejmetr		
Likely Vegeta	ation Class	Mistellane	ev teo.	system	- Hyphy	Assistance a kea	s with	Confidence: H M I		
Plant Commu	inity Type	May limited .	nachive b	rejetutor			EEC: N	Confidence:		

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

BAM	Attribute	Constant	BAM Attribute	(20 x 50 m plot)	Stem Class	ses and Hollows	-
(400	m² plot)	Sum values	dbh	Euc*	Non Euc	Hollows [†]	(Euc*) and living native
	Trees		80 + cm	-			non-eucalypt (Non Euc) stems separately
	Shrubs					-	Data needed is presence
Count of Grasse Native Richness Forbs Ferns Other	Grasses etc.		50 – 79 cm	× .			only (tick) unless a 'large tree' for that veg class.
Richness	Forbs		30 – 49 cm			Hollows 20cm+	* includes all species of Eucalyptus, Corymbia,
	Ferns					- V	Angophora, Lophosternon
	Other		20 – 29 cm	-			T For hollows count only the
	Trees	s sibs ses etc.	10 – 19 cm	-			presence of a stem containing hollows, not the count of hollows in that
Sum of Cover	Shrubs		5 – 9 cm	-			stem. Only count as 1 stem per tree where tree is multi-
of native	Grasses etc.					This size class	stemmed. The hollow- bearing stem may be a dead
vascular plants by	Forbs		< 5 cm	-		records tree regeneration	stem.
form group	form group Ferns		Length of logs (≥10 cm diameter,	Length of logs (m) (≥10 cm diameter, >50 cm			total
	Other		in length)				
High Threat	Weed cover %	100.	Each size class is DBH values and c stem is included in	noted as present by ounts may be needed the count/estimate it	the living tree s d for a size class f it is required by	tems only. Dependir For a multi-stemm the large tree catego	g on the Vegetation Class, ed tree, only the largest living bry for that vegetation class.
This table may	t e completed after ente	nng luate (nto)	Hollows at least 20	om across are recor	ded for the purp	oses of habitat of sor	ne threatened species

svelistile tops if is into top, red while in the field

BAM Attribute (1 x 1 m plots)		Litter cover (%)					Bare ground cover (%)			Cryptogam cover (%)			Rock cover (%)			
Subplot score (% in each)	10	80	50	30	. 20											Τ
Average of the 5 subplots		5													<u> </u>	- 1

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

Physiograph	y + site features that may	help in determining PCT a	and Management Zone (optional)
Morphological	Landform	Landform	Microrelief
Type	Element	Pattern	
Lithology	Soil Surface	Soil	Soil
	Texture	Colour	Depth
Slope	Aspect	Site Drainage	Distance to nearest water and type

Plot Disturbance	Severity code	Age code	Free Text Section for brief site description
Clearing (inc. logging)	ACCOUNT AND ANY ACCOUNT OF	CONTRACTOR CONTRACTOR	Exertie weed plume
Cultivation (inc. pasture)			and prone.
Soil erosion			hantann dominant.
Firewood / CWD removal			No over stores
Grazing (identify native/stock)			
Fire damage			(xotic shrub herult bo 20
Storm damage			1 - 0.97.2
Weediness			2
Other			

S derate, d=severe

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

Form version designed 15 September 2017

Printed 9 November 2017

400 m ² j	olot: Sheet 🛃 of 👱	Survey Name	Plot Identifier		Recorde	ers		
Date	14/09/18	Cateway Road.	RI	Marke Stabl	ed / 3	ulau W	plue,	
GF Code	Full species name mand survey. Data from here	datory, or a unique means o will be used to assign growt	f identifying separate taxa withi h form counts and covers.	n a N, E or HTE	Cover	Abund	stratu m	vouch er
	Sulpichren	origanitalia /			15	200.		
	Lentona cam	ain /			60	1000		
	Importe de	iacin /			10.	500		
	Richinicus 1.	emminus.	Ċ.		/	5		
	- Consium un	your /	N. N	We Could and a second	7	20	191	
	Lonchon o	ilessen /			0.8	10		
	Chenop-dim	r album /			0-1	5,		190
	Verkene a	lizida /			0-6.	20		
-) C.N. 1993	Celatis du	reand .			3.	20.		
	Bielens poloso	×. /			1	50		
	Contaderia	selloana-			0.5	2		
	Modiola Co	erolena /	/		0.2	10.		
	lencheus c	landestinui. /			0.7	30		
	Anielein	conditation /			0-1	2		
1	dolanum p	igna /			0-1	5		
	. Aspavogus	· plumotunt			0-2	5		
						V		
						i i		
			1991.1					
		e e						
			1					
		10		and the second sec				
	Vetah sp	/						
	Side ihombils	ban /						
	Bromes profil	iya.						
- Jonata	Planto jo la	acould 1						
	Melilotas in	ndiam /						
	Niega thicis	mersile /						
	Gomocropus	frechoor.						
	Pou anna.	/						3
	Melin azern	reben.						
	Keibenn od	Montaly. /						
	Alter Jubile	str.						
	lado sperma	guidelles /						
	Jenna pendi	ila va glabou . /						
	Cynon de	apt 7						
	Cypens es	reget. /						
	Ageralon .	Actonopher -						
	Nerrow of	enodan / .				_		
	Chloris say	arn /						

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. N: native, **E**: exotic, **HTE**: high threat exotic. **Cover:** 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); **Note:** 0.1% cover represents an area of approximately 63×63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4×1.4 m, and $1\% = 2.0 \times 2.0$ m, $5\% = 4 \times 5$ m, $25\% = 10 \times 10$ m **Abundance:** 1, 2, 3, ..., 10, 20, 30, ..., 100, 200, ..., 1000, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded. Form version designed 15 September 2017 Printed 9 November 2017

BAM Plot - Field Survey Form

Site Sheet no: 1 of

		Survey N	ame	Plot Id	lentifier	R	ecorde	rs	
Date	14/09/18.	Galeway Rocid.		Q 2.		Mark Stables			
Zone 56	Datum U MTW	IBRA region	Sychary	Barn.	Photo #		Zor	ne ID	
Easting 330676-	Northing 6244627	Plot Dimen	sions 20 in 20 x 50)		61	Orientation of midl from the 0 m po	ine int.	190	Mantsheller
Likely Vegeta	tion Class	Pet 1232 -	low co	n olithor					Confidence:
Plant Commu	inity Type						EEC:		Confidence:

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

Attribute	Sum undured	BAM Attribute	e (20 x 50 m plot) Stem Class	ses and Hollows	-
m ² plot)	Sum values	dbh	Euc*	Non Euc	Hollows [†]	 Record living eucalypt* (Euc*) and living native
Trees		80 + cm	-			non-eucalypt (Non Euc) stems separately
Shrubs Grasses etc.		50 – 79 cm	~		-	Data needed is presence only (tick) unless a 'large tree' for that veg class.
Forbs		30 – 49 cm			Hollows 20cm+	* includes all species of Eucalyptus, Corymbia,
Ferns			-			Angophora, Lophostemon and Syncarpia
Other		20 – 29 cm	ž	8	~	TFor hollows count only the
Trees		10 – 19 cm			1	containing hollows, not the count of hollows in that
Shrubs		5 – 9 cm	-			stem. Only count as 1 stem per tree where tree is multi-
Grasses etc.			1		This size class	bearing stem may be a dead
Forbs		< 5 cm	~		records tree regeneration	stem.
Ferns		Length of logs	s (m)			total
Other		in length)	, >50 cm	3		3
Weed cover %		Each size class is DBH values and c stem is included it	noted as present b counts may be need n the count/estimate	by the living tree s ded for a size class e if it is required by	tems only. Dependir For a multi-stemm the large tree categ	ng on the Vegetation Class, and tree, only the largest living ory for that vegetation class.
	Attribute m ² plot) Trees Shrubs Grasses etc. Forbs Ferns Other Trees Shrubs Grasses etc. Forbs Ferns Other Weed cover %	Attribute m² plot)Sum valuesTreesImage: Sum valuesShrubsImage: ShrubsGrasses etc.Image: Sum valuesFernsImage: Sum valuesOtherImage: Sum valuesTreesImage: Sum valuesShrubsImage: Sum valuesGrasses etc.Image: Sum valuesForbsImage: Sum valuesFernsImage: Sum valuesOtherImage: Sum valuesWeed cover %Image: Sum values	Attribute Sum values m² plot) Sum values Trees dbh Shrubs 50 - 79 cm Grasses etc. 50 - 79 cm Forbs 30 - 49 cm Perns 20 - 29 cm Other 10 - 19 cm Shrubs 5 - 9 cm Grasses etc. < 5 cm	Attribute Sum values m² plot) Sum values Trees dbh Shrubs 50 - 79 cm Grasses etc. 50 - 79 cm Forbs 30 - 49 cm Ferns 20 - 29 cm Other 10 - 19 cm Shrubs 5 - 9 cm Grasses etc. 5 - 9 cm Forbs Length of logs (m) (≥0 cm diameter, >50 cm in length) Weed cover % Each size class is noted as present I	Attribute Sum values m² plot) Sum values Trees dbh Euc* Non Euc Shrubs 80 + cm Grasses etc. 50 - 79 cm Forbs 30 - 49 cm Perns 20 - 29 cm Other 10 - 19 cm Shrubs 5 - 9 cm Grasses etc. 5 - 9 cm Forbs 5 - 9 cm Grasses etc. 5 - 9 cm Forbs 5 - 9 cm Grasses etc. 5 - 9 cm Forbs Length of logs (m) (≥10 cm diameter, >50 cm in length) Each size class is noted as present by the living tree s DBH values and counts may be needed for a size class stem is included in the count/estimate if it is required by	Attribute Sum values BAW Attribute (20 x 50 m plot) Stem Classes and Hollows m² plot) dbh Euc* Non Euc Hollows† Trees 80 + cm - - - Shrubs 50 - 79 cm - - - Forbs 30 - 49 cm Hollows 20cm+ - Ferns - - - - Other 20 - 29 cm - - - Shrubs 5 - 9 cm - - - Grasses etc. - 10 - 19 cm - - Shrubs 5 - 9 cm - - - Grasses etc. - - - - Ferns - - - - Other - - - - Weed cover % - - - - Weed cover % - - - -

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)			Cryptogam cover (%)				Rock cover (%		
Subplot score (% in each)	4/5	50	80	65.	40										
Average of the 5 subplots													-	<u></u>	

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

Physiograph	y + site features that may	help in determining PCT :	and Management Zone (optiona	al)
Morphological Type	Landform Element	Landform Pattern	Microrelief	
Lithology	Soil Surface Texture	Soil Colour	Soil Depth	
Slope	Aspect	Site Drainzoe	Distance to nearest	

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

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

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

Form version designed 15 September 2017

Printed 9 November 2017

400 m ²	plot: Sheet $\frac{2}{2}$ of $\frac{2}{2}$	Survey Name	Plot Identifier		Recorde	ers		
Date	14 09 18	Galeway hourd.	Q2.	Mark St	obles. J	JUIA	Wyllo	
GF Code	Full species name mand survey. Data from here v	latory, or a unique means c will be used to assign grow	of identifying separate taxa within a the form counts and covers.	N, E or HTE	Cover	Abund	stratu m	vouch er
	· Ceserina John	in. /			40.	700.		
	Chlores gayan	a. /	×		10	100		
	Plantage la.	nisolata /			0.6	りつ		
	: Contradence	pelloana. /	18		,20.	30.		
II.	Cynonum da	tylen /	N	-	3	40.	15	
	Meliotus M	idica. /			1	5.6		¥.
	Acaesa long	cholun ver hopkore	. /		3	8.		10
	· Verbenon be	on al angel.	/		2	40.		
	Lantana e	aman /	/		9.	20.	15	
	Olen errop		/		0.6	3		
	Biden Filoo	. /			0.5	46.		
	Conzja Se	innertena /			0.5	30		
	Celatii si	accordin /			1	1		
	Exage-stor	envola /			0-5	10		
	Legeston	lundep.			0.2	1		
	Binssia i	inspin /			D.Z	20.		
	Co the nasles	SPP - /			7.3	1		
	Plants-1 e	major			0.1	.1		
	RM.	3						
	Generate morop	referen /						
	denour pradag	227. /						
	Fennel.	/		4				
	Mosh vine.	/						
	Atucia Julijan	. /						
	Buddetan genel	. /						
	Phone y cann	yonin /						
	Dbunion gland.	She . /						
	Februin para.	. l.h						025
	Asmaltino Wee	da /						
	Thumberna el	itne /						
	Lementer log	+h. /	an a					
	A161214.	/						
	Busana Spinosa	. /						
	Gallin opens	~ / .						
	Homo lenthers	populouna						

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. N: native, **E**: exotic, **HTE**: high threat exotic. **Cover:** 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); *Note:* 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and $1\% = 2.0 \times 2.0 \text{ m}$, $5\% = 4 \times 5 \text{ m}$, $25\% = 10 \times 10 \text{ m}$ **Abundance:** 1, 2, 3, ..., 10, 20, 30, ..., 1000, ..., 1000, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded. Form version designed 15 September 2017 Printed 9 November 2017

BAM Plot – Field Survey Form

Site Sheet no:

		Survey Name	Plot Identifier	Reco	orders
Date	14 9 18	haleway	Q3.	MS+JW	
Zone 56	Datum	IBRA region SUD	Photo #		Zone ID
3 30310	Northing 6244217	Plot Dimensions (e.g. 20 x 20 in 20 x 5	20+20 "20+50	Orientation of midline from the 0 m point.	230° Magnetic
Likely Vegeta	tion Class	Mis cell aneous	erosystem urb	ian exotic Inati	Confidence: H M L
Plant Community Type		lacolscope pl	antrys Jen	pelanols, EE	C: Confidence:

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

BAM (400	Attribute m ² plot)	Sum values
	Trees	
	Shrubs	
Count of Native Richness	Grasses etc.	
	Forbs	
	Ferns	
	Other	
	Trees	
Sum of	Shrubs	
of native	Grasses etc.	
plants by	Forbs	
form group	Ferns	2
	Other	

BAM Attribute	(20 x 50 m plot)	Stem Class	ses and Hollows	Deced B. L.
dbh	Euc*	Non Euc	Hollows [†]	(Euc*) and living native
80 + cm	15	Nun Birri	0	non-eucalypt (Non Euc) stems separately
50 – 79 cm	-	-		Data needed is presence only (tick) unless a 'large tree' for that veg class.
30 – 49 cm	-	~	Hollows 20cm+	* includes all species of Eucalyptus, Corymbia, Angophora, Lophostemon
20 – 29 cm	/	26	D a	and Syncarpia
10 – 19 cm	\checkmark	/		containing hollows, not the count of hollows in that
5 – 9 cm	V	/		stem. Only count as 1 stem per tree where tree is multi- stemmed. The hollow-
< 5 cm	-	/	This size class records tree regeneration	bearing stem may be a dead stem.
Length of logs (≥10 cm diameter, in length)	(m) >50 cm	Im The second	ByB	total 4m

Each size class is noted as present by the living tree stems only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a multi-stemmed tree, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class. Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

This table may be completed after entering data into vallable tools. It is not required while in the field.

BAM Attribute (1 x 1 m plots)		Litter	r cov	er (%)		Ba	re gro	ound	cove	(%)	Cry	ptog	am c	over	(°⁄v)		Rock	COVE	r (%)	
Subplot score (% in each)	10	10	60	20	10	÷.	-	1	-	-	90	90	40	80	90	-		*~	-	-
Average of the 5 subplots															-					1

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

Physiograph	y + site features that may	help in determining PCT a	and Management Zone (optional)
Morphological	Landform	Landform	Microrelief
Type	Element	Pattern	
Lithology	Soll Surface	Soil	Soil
	Texture	Colour	Depth
Slope	Aspect	Site Drainage	Distance to nearest water and type

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

Free Text Section for brief site description	
rasucilina giauca, planted Eurolynis, 68, 351	
Aracia stillgha 4m, 101	
lantana lamara, (glaura 1-2m, Bit.	
Ehuharta evecto, lenchuus, Buitfalo BSI 011	.5

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

Form version designed 15 September 2017

Printed 12 March 2018

400 m ²	plot: Sheet _ of _ Survey Name Plot Identifier		Recorde	ers		
Date	14 9 18 Uateway foul Q3.	MS+	JW			
GF Code	Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.	N, E or HTE	Cover	Abund	stratu m	vouch er
	Ehrhauta erecta	E	60	500	45	
	2 Euralyptus Sp. (planled)	N	15	10	C	
	lasvanna glavia	N	20	30	C	
	Aracia saligna	N	5	3	C	
	stantaha remaina	T.	4	10	ms	
	(stenophorum securium (Buffalo Uvasi) /	[7	40	US	
-	"Brassica haya	E	1	20	45	
	·livinstona australis	N	1	1	US	
	Avujía servicea	E	0.4	(0)	US	
	megathius maximus Panicum.		4	60	US	
ø	I LAMIAIPA (Spille (10000) Firmthe sugaris.	E	20	(00)	NS	
	sida uhumbifolia	E	1	30	us	
	domandua longifalia /	N	2	4	US	
	Isidens pilosa	E	01	1	ns	
	(Asthma weed) paviethia judicea /	E	6.2	5	us	
	sonchus plenus	E	0.4	(0)	US	
	microleana stipoides	N	0.2	3	US	
	renchrus cladeustine (Ikikyu)	E	2	50	LAS	
	pomea ravica /	E	1	20	ms	5
	Burravia spinosa	N	1	1	ms	
	Aspavagus acthiopicus	E	01	2	40	
	Thunbeugia allata	E	0,3	10	US	
	pomea indica	E	05	4	ms	
	21 Metaleura stypheiloricles /	M	1)	ms	
	×					
	e e					
	6					
		_				
		-				
	1/4					
	39.	V				
	2					
	35					
	40,					

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. **N:** native, **E:** exotic, **HTE:** high threat exotic. **Cover:** 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); **Note:** 0.1% cover represents an area of approximately 63×63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4×1.4 m, and $1\% = 2.0 \times 2.0$ m, $5\% = 4 \times 5$ m, $25\% = 10 \times 10$ m **Abundance:** 1, 2, 3, ..., 10, 20, 30, ..., 1000,

BAM Plot – Field Survey Form Site Sheet no: 1 Survey Name Plot Identifier Recorders

and the second se						Recorders					
Date	14/09/18.	Gale way Ros	r.ol	Q4		Mut Dable	1 0010	Wylle.			
Zone Sb	Datum UTM	IBRA region	Sydney	Sapa.	Photo #		Zone ID				
Easting 230518	Northing 6244333	Plot Dimen (e.g. 20 x 1	sions 20 in 20 x 50)		-15	Orientation of midline from the 0 m point	230-	MG-Cherley			
Likely Vegeta	tion Class	Miscettoneo	v ecos	ychom	- viban	exotre Plants	d.	Confidence:			
Plant Commu	inity Type	namie la	E	EC:	Confidence:						

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

BAM (400	Attribute m ² plot)	Sum values
	Trees	
	Shrubs	
Count of Native Richness	Grasses etc.	
	Forbs	
	Ferns	
	Other	
	Trees	
Sum of	Shrubs	
of native	Grasses etc.	
plants by	Forbs	
form group	Ferns	14
	Contraction of the second	

BAM Attribute (20 x 50 m plot)	Stem Class	es and Hollows	-
dbh	Euc*	Non Euc	Hollows [†]	(Fuc*) and living native
80 + cm	×			non-eucalypt (Non Euc) stems separately
50 – 79 cm	-		~	Data needed is presence only (tick) unless a 'large tree' for that veg class.
30 – 49 cm	-		Hollows 20cm+	* includes all species of Eucalyptus, Corymbia, Angophora, Lophostemon
20 – 29 cm	1			and Syncarpia
10 – 19 cm	\checkmark		-	containing hollows, not the count of hollows in that
5 – 9 cm	1			stem. Only count as 1 stem per tree where tree is multi- stemmed. The hollow-
< 5 cm	\checkmark		This size class records tree regeneration	bearing stem may be a dead stem.
Length of logs ((≥10 cm diameter, > in length)	m) ⊳50 cm	5. , 2	ŝ	total 7

Each size class is noted as present by the living tree stems only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a multi-stemmed tree, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class. Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

his table may be completed after entering dots into reliable tools, it is not movined while in the relia

BAM Attribute (1 x 1 m plots)	Litter cover (%)						Bare ground cover (%)				Cryptogam cover (%)				Rock cover (%)		
Subplot score (% in each)	10.	50	45	5	30												
Average of the 5 subplots												·					

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

Physiograph	y + site features that may	help in determining PCT	and Management Zone (optional)
Morphological Type	Landform Element	Landform	Microrelief
Lithology	Soil Surface Texture	Soil Colour	Soll Depth
Slope	Aspect	Site Drainage	Distance to nearest water and type

Plot Disturbance	Severity code	Age code	Free Text Section for brief site description
Clearing (inc. logging)			Derbl et al.
Cultivation (inc. pasture)			sistioned tand form - highly deshaled
Soil erosion			Nature planting . EU. 8-12m.
Firewood / CWD removal			Sovenp oak ayrouth 6-10m.
Grazing (identify native/stock)			Sharp laws Rules have been
Fire damage			a gen bornen, repra, In 3.
Storm damage			Gierdlages esphe perend gaspes 0.1 -1.2
Weediness			
Other			

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

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

Form version designed 15 September 2017

400 m ² j	olot: Sheet 2 of 2	Survey Name	Plot Identifier		Recorde	ers		
Date	14/09/18	Galeway Road.	ILIN Stat	les J J.	lin Wyl	lk		
					(T	otrotu	vouch
GF Code	Full species name mand survey. Data from here	datory, or a unique means o will be used to assign grow	of identifying separate taxa within a the form counts and covers.	N, E or	Cover	Abund	m	er
	· Casarona Sh	wer /	/		8	15		
	Lantana cu	mara.	/		6.	10.		
	Acuera Sali	gine . /	/		10	7		
100	Meganthese m	evening. Punicopa			45	500		
	thouth ever	ta	/		35	500		
	Busana Spina	082.	/		/	5		2
	Celatis Sino	n1/1. /	/		1	2.	10	
	Thumbergin	alutu			0-8	10	5.6	
	Phenonix lan	nasionsis /			0.2	1		
	Acacin decase	ons.			5.	20,		
	Poolone in tv	igvoten /	/		1	5		
	Evenlyphi 4	ereturnil 2			5	4.		
	Lomandia long	gehele.			0.6	4		
	. Evicklown	inservelli /			2	50.		
	Olen evioper	n. /		0.5	1			
	Haspephyllun	caffirm /	F:		1	1		
	Lopt- spermun	so long leas		0.2	/			
	Cynonium dat		1	50		-		
	Sidn ihombil	alia /			0-7	3-0		
	Green costa	·m /			10.2	1	,	
	Prunus La	/			0.1	3		
	Evenlyst S SF	· plunted	/		1	2.		
	haninga	Soine Phone Piva	ella Volgaris		4	50	1	
		3t				1		
	Patrick Lan						·	
·····	Freyd Manap	when with 1	/					
	Thenna mai	tia /				1		-
	Ehalter longy	4. /						
	Convertine en	1				1		100
	Alaran Claut	unte /						1
U.,	Molaleuro St	and the last						
	Jolanno or	ipueroso e						1
	E.				1	-		
	D	Laborand /			-			-
	Augua Chi	Var royman	(1)(1)(1)(1)(1)(1)(1)(1)(1)(1)(1)(1)(1)(1	
	Avinan 1		τ.			-		
	C	non low 1					-	
	L'ANDRECEN DE	1 . /						
	LIVISION" av	states /			8			
						1		1) =

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. N: native, E: exotic, HTE: high threat exotic. **Cover:** 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); **Note:** 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = $2.0 \times 2.0 \text{ m}$, 5% = $4 \times 5 \text{ m}$, 25% = $10 \times 10 \text{ m}$ **Abundance:** 1, 2, 3, ..., 10, 20, 30, ..., 1000, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded. Form version designed 15 September 2017 Printed 9 November 2017

BAM Plot – Field Survey Form

					·······				
		Survey Name		Plot Identifier		R			
Date	25 12 18 Gateway 2000 Q 5 11.		Mark Stab	Mark Stables					
Zone 56	Datum VTM	IBRA region	Sychney	Besin	Photo #		Zone ID)	
Easting	Northing	Plot Dimensi	0 NS a 26 x 68}			Orientation of mid from the 0 m po	line pint.	lig gars sign	
Likely Vegetation Class		FORIL J L	h. No.C	-				Confidence:	
Plant Community Type		PCT 1232 , low condition					EEC:		

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

BAM (400	Attribute m² plot)	Sum values
	Trees	
	Shrubs	
Count of Native Richness	Grasses etc.	
	Forbs	
	Ferns	
	Other	
	Trees	5.
Sum of	Shrubs	
of native	Grasses etc.	
plants by	Forbs	
form group	Ferns	
	Other	
High Threat		

BAM Attribute	(20 x 50 m plot)	Stem Class	ses and Hollows	
dbh	Euc*	Non Euc	Hollows [†]	(Euc*) and living eucalypt*
80 + cm			0	non-eucalypt (Non Euc) stems separately
50 – 79 cm			-	Data needed is presence only (tick) unless a 'large tree' for that veg class.
30 – 49 cm			Hollows 20cm+	* includes all species of Eucalyptus, Corymbia, Angophora, Lophostemon
20 – 29 cm			6	and Syncarpia [†] For hollows count only the
10 – 19 cm				containing hollows, not the count of hollows in that
5 – 9 cm				stem. Only count as 1 stern per tree where tree is multi- stemmed. The hollow-
< 5 cm			This size class records tree regeneration	bearing stem may be a dead stem.
Length of logs (셈0 cm diameter, in length)	(m) >50 cm 0			total

Site Sheet no:

High Threat Weed cover %

I

This table may be completed after entering data into svallable tools. It is not required while in the field. Each size class is noted as present by the living tree stems only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a multi-stemmed tree, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class. Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

BAM Attribute (1 x 1 m plots)	Litter cover (%)		Bar	Bare ground cover (%)			Cryptogam cover (%)				Rock cover (%)								
Subplot score (% in each)	45 65	80	30	10.															
Average of the 5 subplots		*************	4			L					k			L					

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

Physiography + site	e features the	at may help in determining	g PCT and Ma	nagement Zon	∋ (optional)
Morphological	Landform	Landform		 	
Гуре	Element	Pattern		Microrelier	

lype	Element	Pattern	wicrorener	
Lithology	Soil Surface	Soil	Soil	
	Texture	Colour	Depth	
Slope	Aspect	Site Drainage	Distance to nearest	
		Jone Mainage	water and type	

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

Free Text Section for brief site description Regrowth Casperene glacen (Shang Bak).

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

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

400 m ² r	m ² plot: Sheet \preceq of \preceq Survey Name Plot Identifier Recorders							
Date	05 12 18.	Galeway Zoad.	Q5	Mark JASU	1.			
	,							
GF Code	Full species name mand survey. Data from here	datory, or a unique means o will be used to assign growt	f identifying separate taxa within h form counts and covers.	a N, E or HTE	Cover	Abund	stratu m	er
	Casuran stave	C. *#	/		30	100		
	Lentena Can	in the	/		15	50.		
	Ireca ind	tron	/		15	100		
	Sideus pilo	J~~	/		٦, ک	2-0.		
	Verbenen 60	on ~ lensit	/		3	50.		
	flantaja (a	incro loh	1		/	30		
	Pampar gra	ss. conduction	/		15	50		
	Classing Vily	4-1 F-800			0.8	12		
	Moth vine				よ	5		
	Alecino Ja	lijner			2٢.	300		
	Chlorit , 5	yer om			0.8	40		
	Ehrenten e.	it the			0.1	40		
	denecio M.	adagene vis -			0.4	20.		
	Y.t. h. Sut.	<i>1</i> ~			0-3	10		
	forekan o	tores -			0-1	/		
	Tr. Jalanas	readence.			1	80		
	Gamochanete	- OMERICANA,			0.8	50		·
<u> </u>	Genista Me	nspessedma			2	10		
	Conzyn SU	matiensis			0-1	3		
Í	<u> </u>							
		·····						
			·····					
<u> </u>								

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. N: native, **E**: exotic, **HTE**: high threat exotic. **Cover:** 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); **Note:** 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and $1\% = 2.0 \times 2.0 m$, $5\% = 4 \times 5 m$, $25\% = 10 \times 10 m$ **Abundance:** 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded. Form version designed 15 September 2017 Printed 17 December 2018

BAM Plot – Field Survey Form

Site Sheet no: 1 of

2

		Survey Name		Plot lo	lentifier	Recorders				
Date	17 12 18-	Galeway Rev	d Els.	06.		Mark Stubbel.				
Zone 56.	Datum	IBRA region	Sydne	1 Buin	Photo #		Zone ID	VZI		
Easting 33 196/	Northing 6244 <u>871</u>	Plot Dimens (e.g. 20 x 20	sions 0 in 20 x 50)	10x 40.	n -	Orientation of midline from the 0 m point	13	8 Magnetic		
Likely Vegeta	tion Class	Saline Wetland.						Confidence: H M L		
Plant Commu	inity Type	Pcr 120.					EC: N	Confidence: H M L		

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

BAM (400	Attribute m ² plot)	Sum values
	Trees	
	Shrubs	
Count of	Grasses etc.	
Richness	Forbs	
	Ferns	
	Other	
An Anti-	Trees	
Sum of	Shrubs	
of native	Grasses etc.	
plants by	Forbs	
form group	Ferns	
	Other	

BAM Attribute (2	0 x 50 m plot)	Stem Class	ses and Hollows	
dbh	Euc*	Non Euc	Hollows [†]	(Euc*) and living native
80 + cm	(File)	Non Euc		non-eucalypt (Non Euc) stems separately
50 – 79 cm			11	Data needed is presence only (tick) unless a 'large tree' for that veg class.
30 – 49 cm	<u>.</u>		Hollows 20cm+	* includes all species of Eucalyptus, Corymbia, Angophora, Lophostemon
20 – 29 cm		1		[†] For hollows count only the
10 – 19 cm		1.00		presence of a stem containing hollows, not the count of hollows in that
5 – 9 cm				stem. Only count as 1 stem per tree where tree is multi- stemmed. The hollow-
< 5 cm			This size class records tree regeneration	bearing stem may be a dead stem.
Length of logs (r (셈이 cm diameter, > in length)	n) 50 cm	Tary sy	- 22 	total

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a multi-stemmed tree, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class. Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

This table may be completed after entering data into available tools. It is not required while in the field.

BAM Attribute (1 x 1 m plots)	Litter cov	Ba	re gro	ound	cover	(%)	Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	a 11 a	1	10	ţ,	2	3	39	100			ť		5	10	d l	- 6
Average of the 5 subplots	1				1											

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

Physiography + site features that may help in determining PCT and Manager	ent Zone (optiona	1)
---	-------------------	----

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

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

Free Text Section for brief site description
This regetition type was seened in - salve todal
influenced drange chand that is concept to
The vegetities was recorded between Port Bothing Fail
and Soral Recycley .

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

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

Form version designed 15 September 2017

400 m ²	plot: Sheet 4 of 1 Survey Name Plot Identifier		Recorde	ers		
Date	17 12 118. Galeny Road Qb. A	1~k Ste	later			
GF Code	Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.	N, E or HTE	Cover	Abund	stratu m	vouch er
	Mangrove gogg.	9. 1	65.	500.		
	2 Sarronan quarquelas		0.4	10.		
	Scherbelt orete		1	20.		
	1 Guten viljen		0 14	10.		
	Latertain Contra		5	80.		
	Cynon ditte		3	50.		
	1 Avene ann		~	80		
	Olen engra salay. caspidate /		10.	20.		
	Reserver 149 at hitalia. /	5.	02	5.		
	Lennel. Formerlin veljuits		3	50		
	Junes Herry !!!!		0.8	10		
	Celhi Aprilis. /		3	1		
	Addreelly bene /		10	100		
	Asmell with Parkatana Judacia		6-6	20		
	Aluen Poplan		1	1		
	6 stra parge		0.4	2		
	Weiden australia		0-2	2		
	Trighter Steenter		0-4	30.		
	19 Sperobeler Virginiele		0-1	5.		
	Paspalum dealchm.		10=4	10.		
	· Culix babala-jum		/	24		
	Provis sp.		3.	1		
r						
4						
				<u> </u>		
	×					
	Pampal Junes /					
	Genitic Mongda /					
	Anigente dais		2			
	- 14					

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. **N:** native, **E:** exotic, **HTE:** high threat exotic. **Cover:** 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); *Note:* 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and $1\% = 2.0 \times 2.0 \text{ m}$, $5\% = 4 \times 5 \text{ m}$, $25\% = 10 \times 10 \text{ m}$ **Abundance:** 1, 2, 3, ..., 10, 20, 30, ... 1000, ...

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Appendix D

Biodiversity Assessment Method (BAM) requirements

D1. BAM Vegetation integrity plot data

Q1			Covers	Native	Trees	Shrubs	Grass	Forb	Fern	Other	Exotic	HighThreat		
Miscellaneous ecosystem - highly disturbed areas				Count										
with no or limited native vegetation			#spp	oount	Count	Count	Count	Count	Count	Count	Count	Count		
			16	0	0	0	0	0	0	0	16	6	Easting	33340
Species	Cover	Abundance	Sum cover	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Northing	6243282
			94.3	0	0	0	0	0	0	0	94.3	71.8	Orientation	263
Anredera cordifolia*	0.1	2	HT									0.1	Plot size	20 x 20 x 50
Asparagus plumosus*	0.2	5	HT									0.2	BAM Attributes 20x	50m plot
Bidens pilosa*	1	50	EX								1		Stem classes	
Celtis sinensis*	3	20	EX								3		80+	0
Cenchrus clandestinus*	0.7	30	EX								0.7		50-79	0
Chenopodium album*	0.1	5	EX								0.1		30-49	0
Cirsium vulgare*	1	20	EX								1		20-29	0
Cortaderia selloana*	0.5	2	HT									0.5	10-19	0
Ipomoea cairica*	10	500	HT									10	5-9	0
Lantana camara*	60	1000	HT									60	<5	0
Modiola caroliniana*	0.2	10	EX								0.2		Hollows	0
Ricinus communis*	1	5	HT									1	Length logs (m)	0
Salpichroa origanifolia*	15	200	EX								15			
Solanum nigrum*	0.1	5	EX								0.1		BAM Attributes 1x1	plot (%)
Sonchus oleraceus*	0.8	10	EX								0.8		Litter (%)	38
Verbena rigida*	0.6	20	EX								0.6			

Q2			Covers	Native	Trees	Shrubs	Grass	Forb	Fern	Other	Exotic	HighThreat		
PCT 1232 Sw amp Oak floodplain sw amp forest, Sydney Basin Bioregion and South East Corner Bioregion - Low condition			#spp	Count	Count	Count	Count	Count	Count	Count	Count	Count		
			18	3	1	1	1	0	0	0	15	7	Easting	330676
Species	Cover	Abundance	Sum cover	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Northing	6244627
			93.1	46	40	3	3	0	0	0	47.1	40.9	Orientation	190
Acacia longifolia subsp. sophorae	3	8	SG			3							Plot size	20 x 20 x 50
Bidens pilosa*	0.5	40	EX								0.5		BAM Attributes 20x	50m plot
Brassica rapa*	0.2	20	EX								0.2		Stem classes	
Casuarina glauca	40	200	TG		40								80+	0
Celtis sinensis*	1	1	EX								1		50-79	0
Chloris gayana*	10	100	HT									10	30-49	No
Conyza sumatrensis*	0.8	30	EX								0.8		20-29	No
Cortaderia selloana*	20	50	HT									20	10-19	No
Cotoneaster spp.*	0.3	1	HT									0.3	5-9	No
Cynodon dactylon	3	40	GG				3						<5	Yes
Eragrostis curvula*	0.8	10	HT									0.8	Hollows	0
Lantana camara*	9	20	HT									9	Length logs (m)	3
Ligustrum lucidum*	0.2	1	HT									0.2		
Melilotus indicus*	1	50	EX								1		BAM Attributes 1x1	plot (%)
Olea europaea*	0.6	3	HT									0.6	Litter (%)	52
Plantago lanceolata*	0.6	30	EX								0.6			
Plantago major*	0.1	1	EX								0.1			
Verbena bonariensis*	2	40	EX								2			

Sydney Gateway Road Project Technical Working Paper 14 – Biodiversity Development Assessment Report

Q3			Covers	Native	Trees	Shrubs	Grass	Forb	Fern	Other	Exotic	HighThreat		
Miscellaneous ecosystem - urban exotic / native				Count										
landscape plantings			#spp	Count	Count	Count	Count	Count	Count	Count	Count	Count		
			24	6	1	2	2	0	0	1	18	7	Easting	333516
Species	Cover	Abundance	Sum cover	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Northing	6243313
			147.5	25.2	20	2	2.2	0	0	1	122.3	73	Orientation	295
Acacia saligna*	5	3	EX								5		Plot size	20 x 20 x 50
Araujia sericifera*	0.4	10	HT									0.4	BAM Attributes 20x	50m plot
Asparagus aethiopicus*	0.1	2	HT									0.1	Stem classes	
Bidens pilosa*	0.1	1	EX								0.1		80+	0
Brassica rapa*	1	20	EX								1		50-79	0
Bursaria spinosa subsp. spinosa	1	1	SG			1							30-49	0
Casuarina glauca	20	30	TG		20								20-29	0
Cenchrus clandestinus*	2	50	EX								2		10-19	0
Ehrharta erecta*	60	500	HT									60	5-9	0
Eucalyptus sp.	15	10	EX								15		<5	0
Ipomoea cairica*	1	20	нт									1	Hollows	0
Ipomoea indica*	0.5	4	нт									0.5	Length logs (m)	4
Lantana camara*	4	10	HT									4		
Livistona australis	1	1	OG							1			BAM Attributes 1x1	plot (%)
Lomandra longifolia	2	4	GG				2						Litter (%)	22
Melaleuca styphelioides	1	1	SG			1								
Microlaena stipoides var. stipoides	0.2	3	GG				0.2							
Panicum maximum var. maximum*	4	60	EX								4			
Parietaria judaica*	0.5	2	EX								0.5			
Prunella vulgaris*	20	100	EX								20			
Sida rhombifolia*	1	30	EX								1			
Sonchus oleraceus*	0.4	10	EX								0.4			
Stenotaphrum secundatum*	7	40	HT									7		
Thunbergia alata*	0.3	10	EX								0.3			

Q4			Covers	Native	Trees	Shrubs	Grass	Forb	Fern	Other	Exotic	HighThreat		
Miscellaneous ecosystem – urban exotic / native landscape plantings			#spp	Count	Count	Count	Count	Count	Count	Count	Count	Count		
			23	8	3	3	2	0	0	0	15	3	Easting	333487
Species	Cover	Abundance	Sum cover	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Northing	6243325
-			129.8	21.8	18	2.2	1.6	0	0	0	108	41.2	Orientation	10
Acacia decurrens	5	20	TG		5								Plot size	20 x 20 x 50
Acacia saligna*	10	7	EX								10		BAM Attributes 20x	50m plot
Bursaria spinosa subsp. spinosa	1	5	SG			1							Stem classes	
Casuarina glauca	8	15	TG		8								80+	0
Celtis sinensis*	1	2	EX								1		50-79	0
Cestrum parqui*	0.2	1	нт									0.2	30-49	0
Cynodon dactylon	1	50	GG				1						20-29	0
Dodonaea triquetra	1	5	SG			1							10-19	0
Echinochloa crus-galli*	2	50	EX								2		5-9	0
Ehrharta erecta*	35	500	нт									35	<5	0
Eucalyptus sp.	1	2	EX								1		Hollows	0
Eucalyptus tereticornis	5	4	TG		5								Length logs (m)	7
Harpephyllum caffrum*	1	1	EX								1			
Lantana camara*	6	10	нт									6	BAM Attributes 1x1	plot (%)
Leptospermum polygalifolium subsp. polygalifolium	0.2	1	SG			0.2							Litter (%)	28
Lomandra longifolia	0.6	4	GG				0.6							
Olea europaea subsp. cuspidata*	0.8	1	EX								0.8			
Panicum maximum var. maximum*	45	500	EX								45			
Phoenix canariensis*	0.2	1	EX								0.2			
Prunella vulgaris*	4	50	EX								4			
Prunus persica*	0.1	1	EX								0.1			
Sida rhombifolia*	0.9	30	EX								0.9			
Thunbergia alata*	0.8	10	EX								0.8			

Sydney Gateway Road Project Technical Working Paper 14 - Biodiversity Development Assessment Report

Q5			Covers	Native	Trees	Shrubs	Grass	Forb	Fern	Other	Exotic	HighThreat		
PCT 1232 Sw amp Oak floodplain sw amp forest,														
Sydney Basin Bioregion and South East Corner				Count										
Bioregion - Low condition			#spp		Count	Count	Count	Count	Count	Count	Count	Count		
			19	1	1	0	0	0	0	0	18	8	Easting	331441
Species	Cover	Abundance	Sum cover	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Northing	6245384
			117.6	30	30	0	0	0	0	0	87.6	74	Orientation	165
Acacia saligna*	2	5	EX								2		Plot size	20 x 20 x 50
Araujia sericifera*	0.8	10	HT									0.8	BAM Attributes 20x50m plot	
Bidens pilosa*	5	200	EX								5		Stem classes	
Casuarina glauca	30	80	TG		30								80+	0
Chloris gayana*	25	300	HT									25	50-79	0
Cirsium vulgare*	0.4	20	EX								0.4		30-49	No
Conyza sumatrensis*	0.1	3	EX								0.1		20-29	No
Cortaderia selloana*	15	50	HT									15	10-19	Yes
Ehrharta erecta*	0.8	40	HT									0.8	5-9	Yes
Gamochaeta americana*	0.7	50	EX								0.7		<5	Yes
Genista monspessulana*	2	10	HT									2	Hollows	0
Ipomoea indica*	15	100	HT									15	Length logs (m)	0
Lantana camara*	15	50	HT									15		
Plantago lanceolata*	1	30	EX								1		BAM Attributes 1x1 plot (%)	
Senecio madagascarensis*	0.4	20	HT									0.4	Litter (%)	46
Sonchus oleraceus*	0.1	1	EX								0.1			
Trifolium pratense*	1	60	EX								1			
Verbena bonariensis*	3	50	EX								3			
Vicia sativa*	0.3	10	EX								0.3			

V

Q6			Covers	Native	Trees	Shrubs	Grass	Forb	Fern	Other	Exotic	HighThreat			
PCT 920 Mangrove Forests in estuaries of the															
Sydney Basin Bioregion and South East Corner				Count											
Bioregion - Poor condition			#spp		Count	Count	Count	Count	Count	Count	Count	Count			
			22	10	1	3	3	3	0	0	12	6	Easting	331061	
Species	Cover	Abundance	Sum cover	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Sum	Northing	6244871	
			100.9	62.1	55	1.6	3.9	1.6	0	0	38.8	19.8	Orientation	138	
Acacia longifolia subsp. sophorae	1	1	SG			1							Plot size	20 x 20 x 50	
Avena fatua*	2	80	EX								2		BAM Attributes 20x50m plot		
Avicennia marina subsp. australasica	55	500	TG		55								Stem classes		
Celtis sinensis*	3	1	EX								3		80+	0	
Cestrum parqui*	0.4	2	HT									0.4	50-79	0	
Cirsium vulgare*	0.4	10	EX								0.4		30-49	0	
Cynodon dactylon	3	50	GG				3						20-29	0	
Foeniculum vulgare*	3	80	EX								3		10-19	0	
Hydrocotyle bonariensis*	10	100	EX								10		5-9	0	
Juncus kraussii subsp. australiensis	0.8	10	GG				0.8						<5	0	
Lantana camara*	5	80	HT									5	Hollows	0	
Olea europaea*	10	20	HT									10	Length logs (m)	0	
Parietaria judaica*	0.6	20	EX								0.6				
Paspalum dilatatum*	0.4	10	HT									0.4	BAM Attributes 1x1 plot (%)		
Persicaria lapathifolia	0.2	5	FG					0.2					Litter (%)	0	
Pinus sp*	3	1	HT									3			
Salix sp*	1	1	HT									1			
Sarcocornia quinqueflora subsp. quinqueflora	0.4	10	SG			0.4									
Sigesbeckia orientalis subsp. orientalis	1	20	FG					1							
Sporobolus virginicus	0.1	5	GG				0.1								
Suaeda australis	0.2	2	SG			0.2									
Triglochin striata	0.4	30	FG					0.4							

Appendix E EPBC Act assessments of significance



E1. Assessment of significance for the Greyheaded Flying-fox

Grey-headed Flying-fox

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

All of the Grey-headed Flying-fox populations in eastern NSW are linked and hence can be considered one important population.

The project site does not contain any diurnal roost sites or breeding camps for the Grey-headed Flying-fox and the project 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 project site comprises planted trees such as eucalypts and figs. Individuals from various roost camps are likely to forage in the study area on an opportunistic basis when food trees are flowering or fruiting. The project would remove about 4.85 hectares of planted trees that may be used as a foraging resource by the Grey-headed Flying-fox. More extensive areas of higher quality foraging habitat, including patches of intact native vegetation are present in the wider locality, such as Wolli Creek and Centennial Park. Planted trees throughout the local suburbs also provide foraging habitat for the species.

While Grey-headed Flying-foxes are likely to forage in the project site on occasion, the 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 project site 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

The project will not directly impact on any known roost camps in the locality. The impacts of construction of the project on the Grey-headed Flying-fox population would be primarily confined to loss of foraging 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 4.85 hectares of planted trees that contain 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.

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 project will not affect a breeding camp of diurnal roost site of the important population of the Grey-headed Flyingfox, and will not fragment the 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.

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



Grey-headed Flying-fox

Adversely affect habitat critical to the survival of a species

Grey-headed Flying-foxes require a continuous temporal sequence of productive foraging habitats, linked by migration corridors or stopover habitats, and suitable roosting habitat within nightly commuting distance of foraging areas. All foraging habitat has the potential to be productive during general food shortages and therefore provide a critical resource (DoEE 2017).

No breeding camps are present in the project site and there would be no direct impact to any Grey-headed Flying-fox camp sites.

The project would result in the removal of patches of planted vegetation 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. Additional foraging habitat is present in planted vegetation throughout the locality.

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

Disrupt the breeding cycle of an important population

The project site does not contain any Grey-headed Flying-fox camp sites and none will be affected by the project. The project 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 4.85 hectares of planted trees. This total is made up of small, isolated patches of planted vegetation, typically distributed in linear patches along the edges of existing roads, 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 km 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 project 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 through this already highly urbanised landscape.

The project will not directly impact on any local roost camps. The loss 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.

Given the above considerations the proposed action is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat for the Grey-headed Flying-fox to the extent that the species is likely to decline.

Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

The project is not likely to introduce new feral animals to the area or encourage the spread of feral animals.

The project 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 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.



Grey-headed Flying-fox

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 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 (DoEE 2017) 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 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 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 is restricted to 4.85 hectares, comprising small patches of planted trees located along existing urban roads
- 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.

E2. Impacts on plants and animals in Commonwealth land

Impacts on plants and animals

Impacts on plants

Is there a real chance or possibility that the action will:

involve medium or large-scale native vegetation clearance

The project would predominantly impact already cleared hardstand areas with no biodiversity value. The project would remove about 0.91 hectares of native vegetation. The majority of the vegetation to be removed for the project is not native vegetation and comprises exotic plants or planted, often non-indigenous, native species on fill material.

involve any clearance of any vegetation containing a listed threatened species which is likely to result in a long-term decline in a population or which threatens the viability of the species

No threatened flora species listed under the EPBC Act or BC Act were recorded or are considered likely to occur in the project site.

introduce potentially invasive species

The project site and adjoining land has been extensively cleared for the Sydney Airport and industrial and urban development. Of the 130 introduced species recorded within the project site, 12 species are listed under the NSW Biosecurity Act 2015 as priority weeds for the Greater Sydney region (Department of Primary Industries, 2018) and eight are also listed as Weeds of National Significance (Australian Weeds Committee, 2018). No new weeds are likely to be introduced as a result of the project. A weed management plan would be developed to manage weeds during the construction phase of the project. This would include the management and disposal of the weeds that were recorded within the project site, as well as management of novel impacts.

involve the use of chemicals which substantially stunt the growth of native vegetation, or

The project would not include the use of chemicals that would substantially stunt the growth of native vegetation in the wider area.

involve large-scale controlled burning or any controlled burning in sensitive areas, including areas which contain listed threatened species?

Controlled burning is not proposed as part of the project.

Impacts on animals

Is there a real chance or possibility that the action will:

cause a long-term decrease in, or threaten the viability of, a native animal population or populations, through death, injury or other harm to individuals

The project would predominantly impact already cleared hardstand areas with no biodiversity value. Terrestrial fauna habitats comprise small patches of native vegetation, planted trees and patches of thickets of weeds such as Lantana. Aquatic habitats include Alexandra Canal and small, disturbed drainage lines. Fauna habitats occur as small fragments within a highly modified landscape. Most fauna present are common and mobile species. The project is unlikely to cause a long-term decrease in, or threaten the viability of, any native animal populations.

displace or substantially limit the movement or dispersal of native animal populations

Most fauna that occur are mobile and likely move between patches of fragmented and isolated habitat. The project will not affect these movements. The loss of small, disturbed fragments of predominantly non-native vegetation would not result in the displacement of fauna populations or impacts their movement or dispersal.




Impacts on plants and animals

substantially reduce or fragment available habitat for native species;

The project would remove about 0.91 hectares of native vegetation, and 4.85 hectares of planted trees and exotic species, and this is already fragmented into small patches. Fauna habitats occur as small fragments within a highly modified landscape. The loss of small, fragmented patches of predominantly non-native vegetation would not substantially reduce or fragment available habitat for native species.

reduce or fragment available habitat for listed threatened species which is likely to displace a population, result in a long-term decline in a population, or threaten the viability of the species.

One threatened species listed under the EPBC Act, the Grey-headed Flying-fox, was recorded in the study area. The project would remove a very small area of planted trees that would comprise foraging habitat for this species. No breeding camps would be impacted. The population would not be displaced or have its viability reduced as a result of the project. No other threatened species listed under the EPBC Act are likely to be impacted by the project.

introduce exotic species which will substantially reduce habitat or resources for native species, or

No exotic species would be introduced that would substantially reduce habitat or resources for native species.

undertake large-scale controlled burning or any controlled burning in areas containing listed threatened species?

Controlled burning is not proposed as part of the project.

Conclusion

The project would have limited impacts on habitat for native flora and fauna or their habitat.

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