

Appendix J

Biodiversity Assessment



Biodiversity Assessment

Westconnex Enabling Works Airport East Precinct

Prepared for Roads and Maritime Services

June 2014



EXECUTIVE SUMMARY

This biodiversity specialist report provides an ecological impact assessment of the proposed WestConnex Enabling Works – airport east precinct, which generally involves upgrades to roads immediately east of Sydney Airport. The proposal includes widening of Joyce Drive and General Holmes Drive from four lanes to six lanes, modifying Mill Pond Road, closing the General Holmes Drive level-crossing and extending Wentworth Avenue by constructing an underpass.

The scope of the study is to describe flora and fauna species and habitat within the study area, determine the likelihood of occurrence of threatened species and ecological communities listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and other Matters of National Environmental Significance (MNES) listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), assess the impacts of the proposal on them and recommend mitigation measures to avoid or minimise these impacts. This technical study will be used to inform a Review of Environmental Factors (REF) under Part 5 of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act).

To supplement earlier surveys undertaken within the study area, ecological surveys were undertaken on 9 and 10 December 2013. Ecological surveys focused on flora and fauna habitat and the validation of previous vegetation mapping within the study area, as well as some targeted survey for the threatened Green and Golden Bell Frog.

The study area is adjacent to areas of vegetation including poor quality remnant native vegetation, weeds and exotics and landscaped/planted road verges. Approximately 3.4 hectares of vegetation would be removed to accommodate the proposed road widening and upgrade, associated ancillary sites, landscaping works and site restoration. About 2.54 hectares of this is remnant native trees, roadside vegetation or landscaping predominantly composed of local native species and native cultivars, with some exotics species also present. The remainder of the vegetation to be removed are weeds and exotics and a small area of street plantings. None of the vegetation to be removed would meet the definition of a natural vegetation community.

Assessments were undertaken for one endangered ecological community (EEC) Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions, seven flora and four fauna species with potential to occur in the study area that are currently listed as threatened or migratory under state and federal legislation. Approximately 0.45 hectares of Freshwater Wetlands on Coastal Floodplain EEC is present within the study area. None of the wetland vegetation would be removed by the proposal and potential indirect impacts will be avoided. It was concluded that the impact on these communities and species would be minor, with the impacts determined not to be significant.

Recommendations to minimise the impacts of the proposal include the retention of remnant coastal scrub and wetland habitat, implementation of effective sediment and erosion control, protection of nectar producing trees, weed management and rehabilitation

of affected habitat. With the adoption of specific mitigation measures, the overall impact of the proposal on biodiversity would be low.

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ACRONYMS

Acronyms	Definition
cm	Centimeters
CEMP	Construction Environmental Management Plan
DEC	(Former) Department of Environment and Conservation (NSW)
DECC	(Former) Department of Environment Climate & Change (NSW)
DECCW	(Former) Department of Environment Climate Change & Water (NSW)
DoE	Department of the Environment
DSEWPaC	(Former) Department of Sustainability, Environment, Water, Population and Communities (Commonwealth)
ESU	Ecological sampling unit
EEC	Endangered Ecological Community
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EPBC Act	<i>Environmental Protection and Biodiversity Conservation Act 1999</i>
FM Act	<i>Fisheries Management Act 1994</i>
GGBF	Green and Golden Bell Frog
ha	Hectare
km	Kilometres
KTP	Key Threatening Process
LEP	Local Environmental Plan
LGA	Local Government Area
m	Metres
MNES	Matters of National Environmental Significance
MU	Mapping Unit
NPWS	National Parks and Wildlife Service, NSW
NSW	New South Wales

Acronyms	Definition
OEH	Office of Environment and Heritage, NSW.
PCT	Plant Community Type
REF	Review of Environmental Factors
RMS	Roads and Maritime Services
ROTAP	Rare or Threatened Australian Plants
SEPP	State Environmental Planning Policy
SMCMA	Sydney Metropolitan Catchment Management Authority
SMEC	Snowy Mountains Engineering Corporation
TEC	Threatened Ecological Community
TSC Act	<i>Threatened Species Conservation Act 1995 (NSW)</i>
WoNS	Weeds of National Significance

1 INTRODUCTION

1.1 Background

The airport east precinct at Mascot is located adjacent to two of Australia's most significant international gateways, Port Botany and Sydney Airport. The area is heavily congested and considered a pinch point in the road and freight rail network.

Roads and Maritime Services (Roads and Maritime) proposes to upgrade roads east of Sydney Airport and replace the rail level crossing at General Holmes Drive with a road underpass as part of the WestConnex enabling works – Airport east precinct (the proposal). The proposal would improve rail throughput and improve traffic flow and access to the airport, Port Botany and, in the future, the WestConnex motorway. Roads and Maritime proposes to widen Joyce Drive and General Holmes Drive from four lanes to six lanes, modify Mill Pond Road, close the General Holmes Drive level crossing and extend Wentworth Ave in the form of an underpass. The proposal would increase capacity and legibility of the precinct and wider network.

The proposal is consistent with the State Infrastructure Strategy, Long Term Transport Master Plan and draft Airport Master Plan. A number of options to support future growth, improve access, reduce congestion and improve the movement of freight have been considered. The current proposal has been assessed as best meeting the needs with the least impacts.

The primary and supporting objectives of the proposal are outlined below.

Primary objectives

- Reduce current levels of congestion and improve the flow of road and rail traffic.
- Provide as a minimum, a light vehicle standard road underpass to replace the General Holmes Drive level crossing.

Supporting objectives

- Maintain or improve road and rail safety.
- Provide a constructible design solution.
- Minimise environmental and work health and safety risks during road construction.
- Minimise the social and environmental impacts of the development including minimising the property acquisition footprint as far as possible.
- Maintain existing flood immunity.
- Provide a fit for purpose urban landscape outcome that complements the surrounding urban environment.
- Provide value for money.

Roads and Maritime commissioned SMEC Australia to undertake ecological investigations into the proposal targeting threatened species, populations and ecological communities that potentially occur in the area.

1.2 Proposal description

The key features and benefits of the proposal are:

- Replacing the General Holmes Drive rail level crossing with a road underpass that links General Holmes Drive, Botany Road and Wentworth Avenue to improve the movement of rail freight and improve access to the airport, Mascot and the eastern suburbs.
- Improvements to the Mill Pond Road intersections with General Holmes Drive and Botany Road to support future traffic growth and efficient access to the airport.
- Widening Joyce Drive and General Holmes Drive between O’Riordan Street and Mill Pond Road to three lanes in each direction to improve traffic flow around the airport and to Port Botany.

The proposal would also include provision of a shared path linking the existing cycleway at Wentworth Avenue, 300m to the east of Botany Rd and extending northwards to the intersection of Botany Road and Baxter Street.

Ancillary works associated with the project would include landscaping and reshaping of ground contours in the area generally bound by Mill Pond Rd, General Holmes Drive and the rail line. This area would also be used during construction of the proposal. Provision has also been made for a construction site compound at the corner of Wentworth Avenue and Dransfield Avenue.

1.3 Study area

The proposal is located in Mascot, about eight kilometres south of the Sydney central business district and adjacent to Sydney Airport. It is located within the City of Botany Bay local government area (LGA). The study area includes:

- General Holmes Drive, from just south of Mill Pond Road to the Botany Road intersection. Botany Road between Mill Pond Road and King Street.
- Joyce Drive between General Holmes Drive and just east of the O’Riordan Street intersection.
- Wentworth Avenue between Botany Road and Sutherland Street.
- Mill Pond Road.
- Potential site compound on corner of Wentworth Ave and Dransfield Ave, Mascot.

The location of the study area is shown in Figure 1.

The proposal area refers to those areas that would be directly impacted during construction including locations of ancillary works.

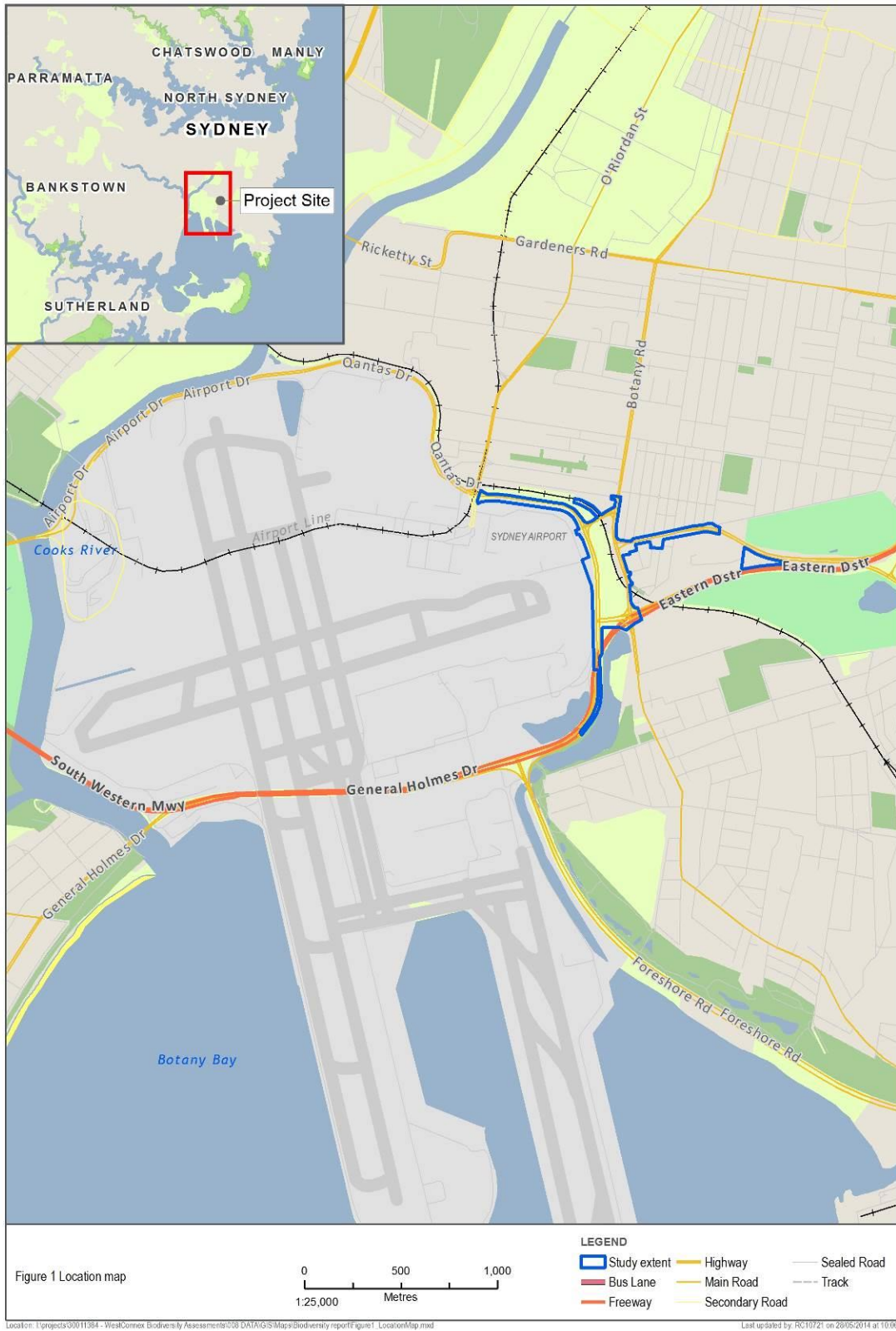


Figure 1 **Location of the Study Area**

1.4 Legislative context

1.4.1 Environmental Planning and Assessment Act 1999

This technical report has been prepared to consider the potential environmental impact of the proposal, in keeping with the legislative requirements of Part 5 of the *Environmental Planning and Assessment Act 1999* (EP&A Act). The EP&A Act provides the statutory basis for planning and environmental assessment in New South Wales (NSW). This biodiversity specialist report is provided as part of the environmental assessment and technical considerations prepared to inform a Review of Environmental Factors (REF) for the proposal.

1.4.2 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) requires that Commonwealth approval be obtained for certain actions, and establishes an assessment and approvals system for actions that have or are likely to have, a significant impact on Matters of National Environmental Significance (MNES). Matters of NES considered in this technical report include listed threatened species, populations and ecological communities as well as migratory species protected under international agreements. Particular consideration has been given to potential impacts on threatened biota that occur or could occur in the study area. Potential impacts are discussed in Section 4 and Appendix 6 of this technical report.

1.4.3 Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) protects threatened flora and fauna species, endangered populations and ecological communities and their habitats within NSW. Particular attention has been given to potential impacts on threatened biota that occur or could occur in the study area. Potential impacts are discussed in Section 4 and Appendix 5 of this technical report.

1.4.4 Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) protects threatened species, populations and ecological communities of fish and marine vegetation, and other living resources of Australian waters. Section 3.7 of this technical report considers potential habitat of threatened fish species that may occur in the study area.

1.4.5 Noxious Weeds Act 1993

Under the *Noxious Weeds Act 1993*, public authorities are required to control noxious weeds which are likely to spread to adjoining land. Section 4.4 of this technical report considers weeds declared as noxious in the City of Botany Bay LGA that occur within the study area.

I.5 Study purpose

The key aims of this study are to:

- Undertake a review of published documentation and a desktop study of flora and fauna relevant to the study area, identifying species and communities that may be present.
- Conduct a field survey (flora and fauna habitat assessment) of the study area, with particular attention to impacts on species, populations and ecological communities listed under the TSC Act and the EPBC Act.
- Identify and assess likely impacts to flora and fauna arising from the proposal.
- Undertake assessments under Section 5A of the EP&A Act and the EPBC Act with tests of significance for threatened biota where required.
- Identify mitigating measures for managing impacts on threatened biota during design, construction and operation.

2 METHODOLOGY

2.1 Database searches and literature reviews

Desktop research was undertaken prior to the commencement of field surveys and included database searches and a review of relevant literature to determine if targeted surveys for specific species were required. Additionally these searches helped to identify threatened biota known or likely to occur in the study area.

The following databases and resources were investigated:

- NSW Office of Environment and Heritage (OEH) Atlas of NSW Wildlife Database within a 10 kilometre radius of the site.
- Protected Matters Report that documents all Matters of National Environmental Significance (NES) within 10 kilometres of the site; NES include threatened species, communities and migratory species which are listed under the EPBC Act (Department of the Environment).
- NSW Flora Online Search – Rare or Threatened Australian Plants (ROTAP) species (The Royal Botanic Gardens and Domain Trust 2012).
- NSW Office of Environment and Heritage (2012), Vegetation Types Database and Threatened Species Profile Database.
- OEH (2013) The Native Vegetation of the Sydney Metropolitan Area, Office of Environment Heritage NSW, Hurstville.
- OEH (2008) Rapid Fauna Habitat Assessment of the Sydney Metropolitan Catchment Management Authority Area, Office of Environment Heritage NSW, Hurstville.
- Lesryk Environmental Consultants (2013) Preliminary Ecological Investigation, RMS project, Mill Pond Road, Botany, Lesryk Environmental Consultants, Bundeena.
- Department of Primary Industry – Fishing and Aquaculture: Threatened and Protected Species, City of Botany Bay LGA (DPI, 2013a).
- NSW Department of Primary Industries Noxious Weeds List (DPI, 2013b).

Survey methods were developed following a review of the OEH guidelines *Threatened Species Survey and Assessment: Guidelines for developments and activities* (working draft) (DEC 2004).

2.2 Field survey

The study area is shown in Figures 1 and 2. It is based on original design files provided to SMEC by Roads and Maritime in November 2013 and confirmed with Roads and Maritime Services representatives at the project inception meeting held on site.

A terrestrial flora and fauna habitat assessment of the study area was conducted on 9 and 10 December 2013. Figure 2 shows the existing vegetation community mapping (OEH 2013).

The field surveys undertaken by SMEC in December 2013 added to, and updated, previous flora and fauna surveys undertaken in parts of the study area by Lesryk Environmental Consultants in 2013.

2.2.1 Flora surveys

The majority of the study area has been mapped as 'Weeds and Exotics', 'Urban Native and Exotic Cover' and 'Plantations' (OEH 2013). There is also a small area (0.45 ha) of mapped 'Coastal Freshwater Wetland'. Field survey aimed to groundtruth existing mapping, describe vegetation type and condition in more detail and identify any areas of higher quality vegetation habitat that could support threatened species that may occur in the study area.

The random meander technique was used to cover the whole site and record all species encountered and target threatened species with a medium to high likelihood of occurring in the study area. Individual patches of vegetation or 'sites' were identified in the field based on obvious changes to vegetation structure and composition observed or by physical separation of different patches of vegetation by roads, railway line or urban development.

2.2.2 Fauna habitat assessment

The fauna habitat assessment was conducted to assist in determining the likelihood of presence of threatened fauna species. Habitat characteristics considered for all Ecological Sampling Units (ESUs) include the presence of nectar-producing trees, hollow bearing trees, fallen logs, leaf litter and other ground debris, drainage lines, ponds, the structure of vegetation communities and the presence of fruiting/flowering plant species to assess the habitat suitability for a range of fauna species.

Using the random meander technique, searches were carried out for signs of fauna activity such as tracks, scats, scratches and notches on trees, as well as any opportunistic sightings, to identify the presence of common and threatened fauna species.

2.2.3 Green and Golden Bell Frog Survey

A small area of potential Green and Golden Bell Frog (*Litoria aurea*) habitat was identified in the study area. This habitat consisted of a single small wetland (about 0.45 ha in area) dominated by Bullrush (*Typha* sp.). A survey was accordingly conducted for this species on the day/evening of 9 and 10 December 2013.

Diurnal habitat searches were conducted on two consecutive days for 1.5 person-hours per occasion. The searches included the terrestrial grassy/shrubby area surrounding the wetland, the edges of the wetland (where the wetland and terrestrial vegetation meet) and traverses within the wetland.

Nocturnal surveys were also conducted on two consecutive nights, commencing at dusk. Upon arrival at the wetland, ten minutes was spent listening for Green and Golden Bell Frog calls. A recorded call of the target species (Stewart) was then played for two minutes followed by three minutes of listening. This sequence was repeated for 30 minutes. A 20 minute spotlight search within the wetland was then conducted. Following five minutes of listening, a further 15 minutes of call playback was then conducted from the centre of the wetland in the manner previously described. An additional 20 minutes of spotlighting was then conducted. Each nocturnal survey took a minimum of 100 minutes to complete.

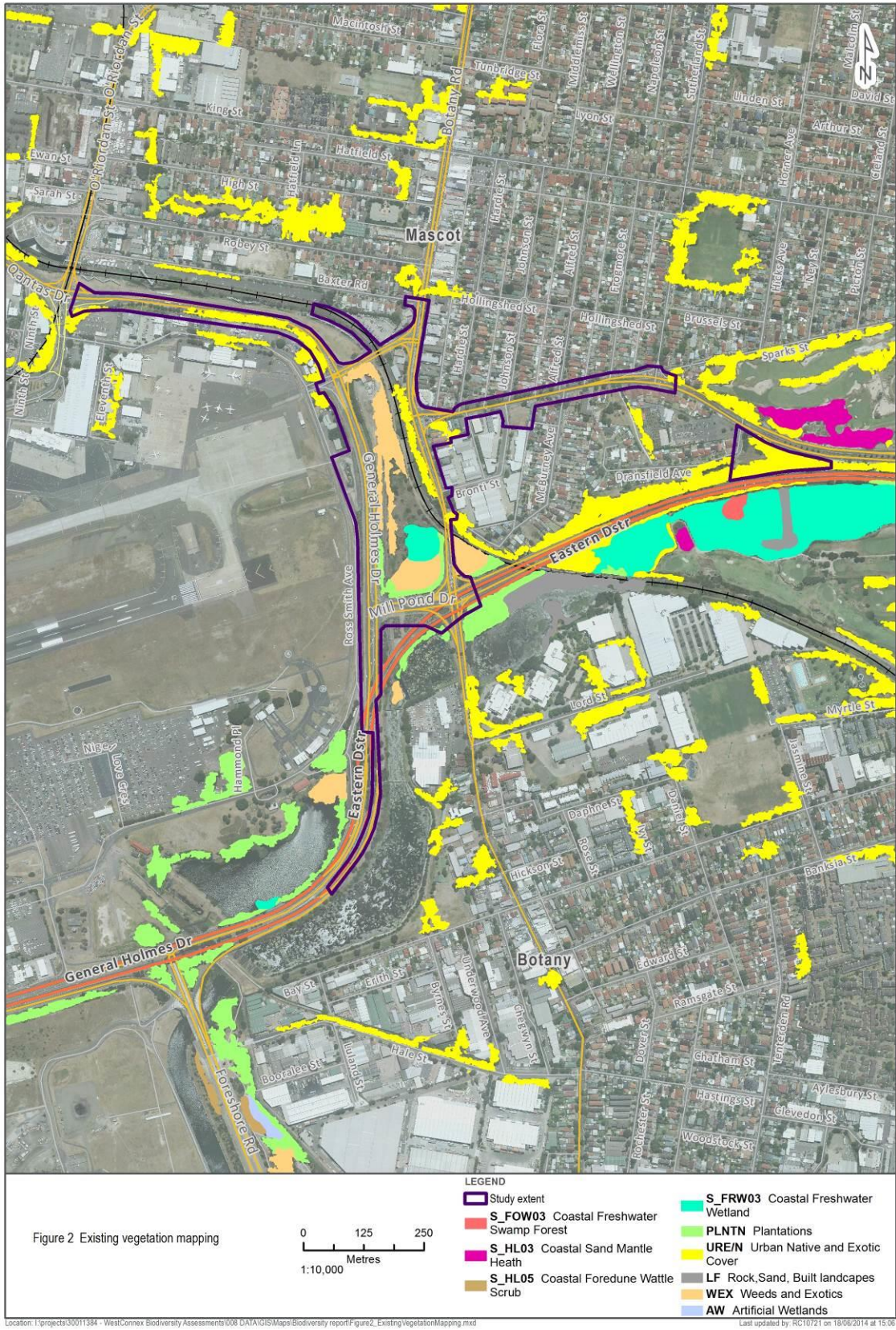


Figure 2 Existing vegetation mapping (OEH 2013)

2.3 Limitations

Limitations to the flora and fauna surveys, which may impact on survey results, include:

- The Significant Impact Guidelines suggest that a four-night survey should be conducted to increase the Green and Golden Bell Frog detection rate. Surveys should be conducted following rainfall and include tadpole surveys. A reference site should be used to determine whether Green and Golden Bell Frogs are active and calling on that particular night. The surveys undertaken in December did not meet the Significant Impact Guidelines in several respects:
 - Two day/nights were conducted instead of four because i) the habitat is only tenuously connected to other areas of potential habitat in the locality (see below) and because weather conditions were not ideal.
 - There was no rainfall preceding the surveys.
 - A reference site was not used. Given the age of some of the nearby records, the use of a reference site may not have been useful.
 - Tadpole surveys were not conducted because no surface water was present at the time of survey.
- While fauna habitat assessments were undertaken, this technique is not an adequate substitute for fauna surveys. Fauna are capable of inhabiting sub-optimal habitat. In addition fragmentation, isolation or species density can all influence the presence and distribution of a particular species. Species likelihood of occurrence was informed by habitat characteristics and opportunistic sightings. No fauna trapping was undertaken.
- No aquatic survey was undertaken of the waterways located within the study area. There is a canal running through the site and a small area of wetland. Two threatened amphibians have been recorded within 10 kilometres of the study area. Species likelihood of occurrence was informed by habitat characteristics and opportunistic sightings.
- The flora surveys conducted in December 2013 allowed considerable validation of the existing Sydney Metropolitan Area vegetation mapping (OEH 2013). This provided a high level of confidence in the plant communities identified and associated threatened species that may occur in the study area. Consideration has been given to the occurrence of areas of disturbance and associated clearing adjacent to the roadside in undertaking the assessments of significance concerning potential impacts.

3 EXISTING ENVIRONMENT

3.1 Landscape context

The study area is located in the Sydney Basin Bioregion, Pittwater subregion. The study area is within the City of Botany Bay local government area (LGA) and the Sydney Metropolitan Catchment. The topography of the study area is level to gently undulating coastal flats with elevation between two and 10 metres.

The proposal is located within an area of former sand dunes and coastal swamps. Underlying geology is Hawkesbury sandstone overlain by Quaternary sediments. Large-scale mapping of Soil Landscape Series Sheet 9029-9129 (Hazelton et al. 1990) indicate the influence of two Soil Landscape Groups in the study area, Tuggerah and Disturbed Terrain. The Tuggerah Soil Landscape is characterised by gently undulating to rolling coastal dunefields and highly permeable podzols that have very low fertility and are susceptible to wind erosion. The disturbed terrain within the study area is man-made fill.

Although the majority of the study area is highly built up, it fringes the Botany wetland complex regarded as one of the areas of highest fauna habitat value for migratory shorebirds and other waterbirds within the Sydney Metropolitan Catchment (DECC 2008).

3.2 Land use

The study area is within a heavily urbanised part of Sydney with a range of residential, industrial and infrastructure developments, including the existing road network, Sydney airport and a rail corridor. Interspersed amongst these built up areas are managed parklands, golfcourses, landscaped roadverge and remnant vegetation.

The biodiversity primarily reflects street landscaping, open parks (school yards and John Curtis Reserve), and open land (between General Holmes Drive, Mill Pond Road, Botany Road and the level crossing).

3.3 Vegetation communities

Native vegetation in the study area comprises a mosaic of disturbed remnant coastal heath and freshwater wetland on the underlying sandmass and landscaped areas on fill and imported soil.

The Sydney Metropolitan Area vegetation mapping undertaken by OEH (2013) identifies only one native plant community within the study area (Figure 2):

- Coastal Freshwater Wetland

OEH (2013) has also mapped the following disturbed landscapes in the study area:

- Weeds and Exotics
- Urban Native and Exotic Cover
- Plantations

The 0.45 hectares of Coastal Freshwater Wetland vegetation community mapped by OEH (2013) and shown in Figure 2 meets the definition of Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions Endangered Ecological Community under the NSW *Threatened Species Conservation Act*. The wetland is degraded and is moderately affected by weeds with buffer vegetation more heavily weed infested, however the wetland itself still contains positive diagnostic native species that enable identification of the EEC. This vegetation community is also equivalent to the NSW Plant Community Type 781: Coastal Freshwater Lagoons of the Sydney Basin and South East Corner in the NSW Vegetation Types Database (OEH 2012). It is not listed under the Commonwealth EPBC Act.

The majority of vegetation in the study area is disturbed and it is difficult to determine what the natural vegetation would have been pre-disturbance. It is likely that the vegetation was originally a coastal heath/scrub community that occurs on moderate to deep sands such as Coastal Sandplain Heath or Coastal Fore-dune Wattle Scrub (OEH 2013).

Although habitat within the study area is limited and fragmented due to the urbanised landscape, it is located on the fringes of the Botany wetland complex regarded as one of the areas of highest fauna habitat value for migratory shorebirds and other waterbirds within the Sydney Metropolitan Catchment (DECC2008).

Further detail on vegetation and habitat values of the study area is provided below in Section 3.3.1.

3.3.1 Field Survey Results

The study area has been divided into 17 sites representing each patch of vegetation in the study area. Sites are numbered 1-17 as per Table 1 and then described in relation to vegetation observed on the ground during field survey. The location of the 17 sites is shown in Figure 3. A full list of flora species recorded during the field survey is given in Table 6 (Appendix 2). Site photos are included in Appendix 7.

Table 1. Description of vegetation within each site.

Site	Location	Vegetation community (OEH 2013)	Description
1	Wetland	Coastal Freshwater Wetland	Coastal Freshwater Wetland dominated by dense Bullrush (<i>Typha sp.</i>) ~2m tall. Consistent with the EEC Freshwater Wetlands on Coastal Floodplains.
2	Rail corridor and adjacent disturbed area.	Weeds and Exotics Urban Native and Exotic Cover	Disturbed, dominated by exotic herbs, grasses and shrubs; some Coast Banksia and <i>Leptospermum laevigatum</i> ; dense groundcover, open shrub layer.

Site	Location	Vegetation community (OEH 2013)	Description
3	North-east side of rail corridor (east of corridor, north of bridge).	Urban Native and Exotic Cover	Linear roadside planting dominated by <i>Casuarina spp.</i>
4	South-east side of rail corridor (east of corridor, south of bridge).	Urban Native and Exotic Cover	Linear roadside planting of mixed native species; groundcover exotic herbs and grasses.
5	Roadside south	Urban Native and Exotic Cover	Linear roadside planting of mixed native species; groundcover exotic herbs and grasses.
6	Roadside west and north	Urban Native and Exotic Cover	Linear roadside planting of mixed native species; groundcover exotic herbs and grasses.
7	Rail north	Urban Native and Exotic Cover	Linear planting of mixed native species on south side of railway; sparse exotic herbs and grasses in rail corridor.
8	Joyce Drive	Urban Native and Exotic Cover	Linear roadside planting; some native trees present; midstorey hedged native and exotic species.
9	Wentworth Avenue	Street Plantings	Roadside trees in pavement.
10	General Homes Drive - north of corner with Southern Cross Drive.	Urban Native and Exotic Cover	Roadside planting of mixed native species, weedy groundcover.
11	General Homes Drive - south of corner with Southern Cross Drive.	Urban Native and Exotic Cover	Linear roadside planting of <i>Casuarina spp.</i> with mown grass groundcover with weeds.
12	Southern Cross Drive - NW corner.	Urban Native and Exotic Cover	Small roadside planting of native shrubs, weedy.
13	Southern Cross Drive - NE corner.	Urban Native and Exotic Cover	Sparse planting of native shrubs, low weed abundance.
14	Southern Cross Drive - SE corner.	Urban Native and Exotic Cover	Small roadside planting, mix of native and exotic species.
15	Botany Rd	Street Plantings	Linear roadside planting of Liquidambar in pavement.

Site	Location	Vegetation community (OEH 2013)	Description
16	Potential Compound	Urban Native and Exotic Cover	Native trees planted on fill, very weedy including dense Lantana.
17	West side General Homes Drive.	Urban Native and Exotic Cover	Roadside planting dominated by <i>Grevillea</i> cultivar and <i>Lomandra sp.</i>

Eight species of Class 3 and 4 noxious weeds listed in the Botany Bay City LGA have been identified in the study area as follows:

- Bridal Creeper (*Asparagus asparagoides*)
- Bitou Bush (*Chrysanthemoides monolifera*)
- Prickly Pear (*Opuntia stricta*)
- Castor Oil Plant (*Ricinus communis*)
- Gorse (*Ulex europaeus*)
- Large-leaved Privet (*Ligustrum lucidum*)
- Green Cestrum (*Cestrum parqui*)
- Lantana (*Lantana camara*)

Resilience of vegetation in the study area

Ground-truthing during field surveys confirmed that the study area contains a mix of wetland vegetation and poor condition former coastal heath described as disturbed landscapes including cleared areas, areas of vegetation dominated by weeds and landscaped road verges.

Weed dominated areas comprise about five hectares, being the majority of the study area, in disturbed and landscaped sites. These areas have low resilience and little ecological value.



Figure 3 **Vegetation survey sites**

3.4 Fauna Habitat

3.4.1 Field Survey Results

Habitats in the study area are generally highly modified and their capacity to support threatened and migratory fauna is accordingly low. This is because the vegetation is no longer of an appropriate structural form and/or key food and/or shelter resources are missing (e.g. *Allocasuarina* spp., hollow-bearing trees). The habitat in the study area consists mainly of planted roadside trees and an area that has been previously cleared and is now dominated by exotic species. The main habitat features of the study area are:

- A densely-vegetated freshwater wetland.
- Street trees and some small patches of treed vegetation. However, the vegetation is too young to provide tree hollows.
- Nectar-producing trees, mostly present as linear street plantings.
- Exotic grassland.

The study area may provide some limited foraging habitat for highly mobile birds and micro-bats. While specific habitat types or shelter sites are absent, it remains possible that these species may use the study area on very rare occasions or at least fly over it. For example, nectar producing trees are available, including winter-flowering species. Such trees provide food resources for the Swift Parrot (*Lathamus discolor*) and Regent Honeyeater (*Anthochaera phrygia*), but they are unlikely to use the area due to the impact of existing development.

The Oriental Plover and the Little Curlew sometimes use exotic grasslands for foraging and small patches of grassland are present. However, the study area includes a network of roads with a high traffic volume, which is likely to curtail their use. The White-bellied Sea-eagle (*Haliaeetus leucogaster*) is a highly mobile raptor that is likely to fly over the study area and may on rare occasions take prey there. The Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*) and Southern Myotis (*Myotis macropus*) are insectivorous bats that may fly over or forage over the site occasionally, but are unlikely to shelter there during the day.

A small wetland dominated by Bullrush (*Typha* sp.) is present within an area of highly disturbed vegetation (Site 1 in Figure 3). Given past records in the locality, it is possible that this wetland may be used by the Green and Golden Bell Frog (*Litoria aurea*). The wetland would not be removed by the proposed development, and potential indirect impacts will be avoided.

Two aerial insectivores, the Fork-tailed Swift (*Apus pacificus*) and the White-throated Needletail (*Hirundapus caudacutus*), may occasionally forage in the aerial space over the study area. These species are summer migrants and do not breed in the study area. Indeed, the White-throated Needletail is thought to remain on the wing during its entire Australian migration. Both appear to track low pressure systems where they feed on rising insects. As such, their appearance over the study area would be intermittent and difficult to predict.

One species, the Grey-headed Flying-fox (*Pteropus poliocephalus*) was observed in the study area during the nocturnal Green and Golden Bell Frog surveys. A number of nectar-producing tree species are present, but they do not constitute significant resources. Most are

tree species that have been planted along the edges of busy roads. A small number of Coast Banksias (*Banksia integrifolia*) are also present in Site 2. There was only very limited nectar availability at the time of the survey (e.g. Bangalay was heavily in bud, but a small number of flowers were open). Moderate use of the study area is likely when nectar is more available. There are no suitable roost sites in or proximate to the study area.

Green and Golden Bell Frog Habitat

The Commonwealth Significant Impact Guidelines for the Green and Golden Bell Frog suggest habitat assessment (Table 2) as the first step in determining whether the species is likely to be at a site, followed by field surveys if suitable habitat is identified.

The study area is within the expected range of the Green and Golden Bell Frog and there are proximate records. The records within the same catchment are 650 – 2500 metres away and were mostly obtained in the 1960s and then in the 1990s. The nearest contemporary record (2007) is about 1.8 kilometres away and there are three other post-1995 records in the catchment, but the DoE (2014) suggests that the species is actually extinct in these areas. However, the NSW Office of Environment and Heritage (DEC 2005) makes reference to possible reintroductions in this area. The current status of the Green and Golden Bell Frog in and proximate to the study area remains unclear.

There are other records in the locality (i.e. within 10 km), many of which are contemporary records obtained repeatedly over a number of years in the early 2000s at the Kogarah Golf Course on the western side of the airport. Occupied sites within 10 kilometres are generally considered to be part of the same population. However, the Significant Impact Guidelines note that this criterion should be relaxed in urbanised areas, particularly when locations are in different catchments. It is likely that most of the locations where the Green and Golden Bell Frog has been recorded are isolated from the study area (Figure 4 showing frog locations). However, the species appears to remain extant in reasonable proximity to the study area. The precise distribution of the Green and Golden Bell Frog in the locality is difficult to determine as DECC (2008b) show that it can turn up in unexpected sites and at sites after years of apparent absence.

There was a small area (0.45ha) of suitable habitat in the study area (Figure 2). This site is separated from the nearest habitat areas by high density urban development, industrial areas, a rail corridor and major road infrastructure. There may be tenuous connection between the proximate habitat and the study area via a concrete canal that has some weed cover established in the cracks. The wetland vegetation is dominated by Bullrush (*Typha* sp.). The vegetation surrounding the wetland is dominated by weeds, including exotic grasses on a sandy substrate. There are no rocks or logs that could be used as shelter sites. The wetland is surrounded by major roads. It is immediately across General Holmes Drive from Sydney Airport and is adjacent to the flight path for the east/west runway. While the airport used to be known habitat for this species, it has not been recorded there for a number of decades (Sydney Airport Corporation Limited 2010). The wetland is ephemeral and does not contain Gambusia or other predatory fish.

Given the small area of the wetland, the lack of suitable fringing habitat and its relative isolation from proximate habitat, it is reasonably unlikely that the Green and Golden Bell Frog would be present. However, due to the tenuous connection along the concrete canal, a precautionary approach was adopted and a field survey was conducted using the methods described in Section 2.2.3. Due to the limitation outlined in Section 2.3, the study was only of

two days/nights duration. While this is less than the four nights required by DEWHA (2009), it is consistent with the requirements of DEC (2005).

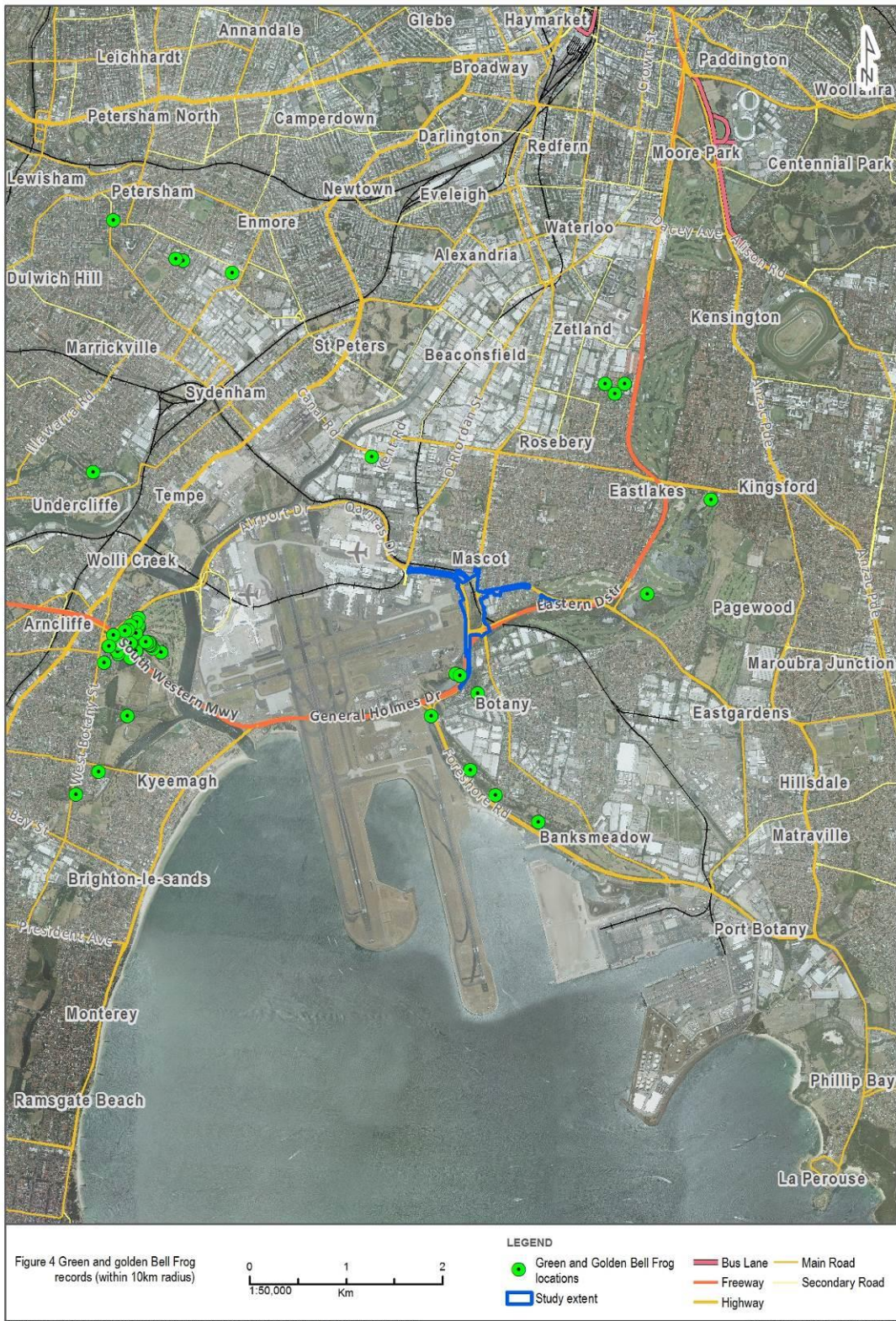


Figure 4. Green and Golden Bell Frog records within 10km radius

Table 2. Habitat assessment for the Green and Golden Bell Frog using the Commonwealth Significant Impact Guidelines.

Criterion	Response
Is the site within the expected range of the species?	Yes
Are there records of the species within the local area/catchment?	Yes, the NSW Wildlife Atlas has six records from 650-2500m in the catchment of the study area. There are other records in the local area. However, the study area is separated from these locations by high density urban development and major road infrastructure.
Does the site support potentially suitable habitat for the species?	Yes, the study area contains a small ephemeral wetland dominated by <i>Typha</i> sp.
Are there other frog species on site? If so, what species?	None known, though likely. However, no species recorded during a two-night survey.
What vegetation occurs on and around the site?	The study area contains a small wetland dominated by <i>Typha</i> sp. The surrounding vegetation is dominated by weed species, with native species only contributing about 5% cover. The weeds are a mix of small trees and grasses (particularly African Lovegrass).
How close is the nearest water body?	The nearest waterbody is 215m away. However, it is separated from the wetland by Southern Cross Drive.
How many water bodies occur within 10 kilometres?	Twelve water bodies (fresh water) occur within a 10km radius, though it is not known how many support suitable habitat.
Is there habitat connectivity (terrestrial or aquatic) between water bodies on site, and between on-site water bodies and those on neighbouring sites?	The study area is isolated from proximate waterbodies by urban areas, major road infrastructure, including Southern Cross Drive, and a rail corridor. A concrete canal passes adjacent to the wetland and an open cover of weeds has become established in cracks and sediment. This canal may provide connectivity.
Is there any evidence of disturbance on site? Has this habitat been modified as a result of previous development actions?	The site is highly disturbed and is likely to have been totally cleared in the past. The currently vegetation is dominated by weed species. The study area is roughly triangular and surrounded by four-lane roads (General Homes Drive and Botany Road), a single-track railway. It is under the flight path of the east-west runway at Sydney Airport.
Are water bodies infested with mosquito fish or other predatory species that prey on green and golden bell frogs?	The wetland did not contain water at the time of the habitat assessment, though the soil remained moist. It is unlikely that Mosquito Fish and other predatory species would occupy the wetland due to its periodic drying and its isolation, which would prevent recolonisation. However, it should be noted that <i>Gambusia</i> may be

Criterion	Response
	transported on bird's feet.
Are there other threats to green and golden bell frogs occurring on site?	The study area is surrounded by four-lane roads and a rail corridor. It is under the flight path of the east-west runway at Sydney Airport. Due to the site's proximity to the airport, planes are very low and their landing lights illuminate the habitat.

3.5 Threatened ecological communities

Six Threatened Ecological Communities were identified in 10 kilometre radius desktop searches as occurring or potentially occurring, in the study area. These are Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion, Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions, Eastern Suburbs Banksia Scrub of the Sydney Region, Littoral Rainforest and Coastal Vine Thickets of Eastern Australia, Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions and Western Sydney Dry Rainforest and Moist Shale Woodland on Shale.

Only one ecological community listed under the TSC Act as endangered (EEC) was identified during field surveys and confirmed to be present within the study area (Figure 5):

- ***Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions***

Associated with coastal areas subject to periodic flooding and in which standing fresh water persists for at least part of the year in most years. Typically occurs on silts, muds or humic loams in low-lying parts of floodplains, alluvial flats, depressions, drainage lines, backswamps, lagoons and lakes but may also occur in backbarrier landforms where floodplains adjoin coastal sandplains. Generally occur below 20 m elevation on level areas. They are dominated by herbaceous plants and have very few woody species. The structure and composition of the community varies both spatially and temporally depending on the water regime: Those that lack standing water most of the time are usually dominated by dense grassland or sedgeland vegetation, often forming a turf less than 0.5 metre tall and dominated by amphibious plants including *Paspalum distichum* (water couch), *Leersia hexandra* (swamp rice-grass), *Pseudoraphis spinescens* (mud grass) and *Carex appressa* (tussock sedge). Where they are subject to regular inundation and drying the vegetation may include large emergent sedges over 1 metre tall, such as *Baumea articulata*, *Eleocharis equisetina* and *Lepironia articulata*, as well as emergent or floating herbs such as *Hydrocharis dubia* (frogbit), *Philydrum lanuginosum* (frogsmouth), *Ludwigia peploides subsp. montevidensis* (water primrose), *Marsilea mutica* (nardoo) and *Myriophyllum spp.* (milfoils). As standing water becomes deeper or more permanent, amphibious and emergent plants become less abundant, while floating and submerged aquatic herbs become more abundant.

This EEC is not currently listed under Commonwealth legislation.

The area of the freshwater wetland was about 0.45 ha. It was dominated by Broad-leaved Cumbungi (*Typha orientalis*). A number of other native aquatic plants were also present and weed impact was low (Table 6). Overall, the wetland appeared to be in relatively good condition.



Figure 5. Endangered Ecological Communities

3.6 Groundwater-dependent ecosystems

No further groundwater-dependent ecosystems occur within the study area. Potential impacts to the area of Freshwater Wetlands EEC have been addressed in Section 3.5 above.

3.7 Threatened species and endangered populations

Flora

Twenty-three flora species and one endangered flora population listed under the TSC Act have been recorded within 10 kilometres of the study area (OEH 2013), seventeen of which are also protected under the EPBC Act (Appendix 3). A further eight threatened flora species are identified as potentially occurring in the study area (DSEWPaC 2103). Using a risk based approach of the likelihood of occurrence (Appendix 4), the study area is considered to provide suitable habitat for seven of these species. Species that have a medium to high chance of occurring within the study area include:

- *Acacia terminalis* subsp. *terminalis* (Sunshine Wattle)
- *Cryptostylis hunteriana* (Leafless Tongue-orchid)
- *Persoonia hirsuta* (Hairy Persoonia)
- *Pterostylis* sp. Botany Bay (Botany Bay Bearded Orchid)
- *Senecio spathulatus* (Coast Groundsel)
- *Tetraloche juncea* (Black-eyed Susan)
- *Thelymitra atronitida* (Black-hooded Sun Orchid)

None of the seven threatened flora species identified in the desktop assessment as having a medium to high likelihood of occurring were observed at the study area during the field survey. However, potential habitat for these species is present. Accordingly, a precautionary approach will be adopted to manage potential impacts of the project.

A full list of flora recorded within the study area is provided in Appendix 2. Threatened flora records within 10km of the study area are shown in Figure 6.

Fauna

A total of fifty-nine threatened and migratory fauna species have been recorded within 10 km of the study area, of which 31 are listed as threatened under the TSC Act, 7 are listed as threatened and 38 as migratory under the EPBC Act (Appendix 3). Using a risk based approach the likelihood of occurrence of these species was determined (Appendix 4). The study area provides suitable habitat and availability of resources for four of these species. Threatened species that have a medium to high chance of occurring, or which have been observed within the study area include:

- *Litoria aurea* (Green and Golden Bell Frog)
- *Pteropus poliocephalus* (Grey-headed Flying Fox)

As described in Sections 2.2.3 and 3.4 Green and Golden Bell Frog surveys were undertaken on 9 and 10 December 2013. No Green and Golden Bell Frogs were recorded during the field survey. While there was no rain prior to or during the surveys, the study period was warm and slightly humid, with temperatures between 17.6°C and 34.4°C. Potential insect prey was readily observed on the Bullrush leaves at night. There was reasonable potential that, if present, the Green and Golden Bell Frog would be foraging during these conditions, though the probability of it calling would be low.

Several Grey-headed Flying-foxes (*Pteropus poliocephalus*) were observed flying over the freshwater wetland during the nocturnal GGBF surveys. This species is thought to forage intermittently throughout the study area when nectar producing tree species are flowering, however there is no roosting habitat available.

Threatened fauna records within 10 kilometres of the study area are shown in Figure 6.

There were no records of fish species occurring in the City of Botany Bay LGA that are threatened under the *Fisheries Management Act*.

3.8 Migratory species

The results of the 10 kilometre database searches included numerous migratory species. Many of these species have not been considered in this technical study due to the unsuitable nature of this terrestrial environment to provide any necessary habitat requirements. Species that may be impacted offsite by the proposal have been retained. Species removed include pelagic seabirds (ie. albatross and petrel spp.) and marine species.

The following two species listed as Migratory under the EPBC Act have been identified as likely to visit the study area:

- *Apus pacificus* (Fork-tailed Swift).
- *Hirundapus caudacutus* (White-throated Needletail).

Both species breed in the northern hemisphere and migrate to Australia during the southern summer. They feed in the aerial space over a variety of habitat types and occasionally occur in urban areas. Given the proximity of vegetated habitats in the locality and the high mobility of these species, it is possible they may feed over the study area on occasion.

3.9 Critical Habitat

The subject site is not registered as critical habitat under NSW or Commonwealth legislation.

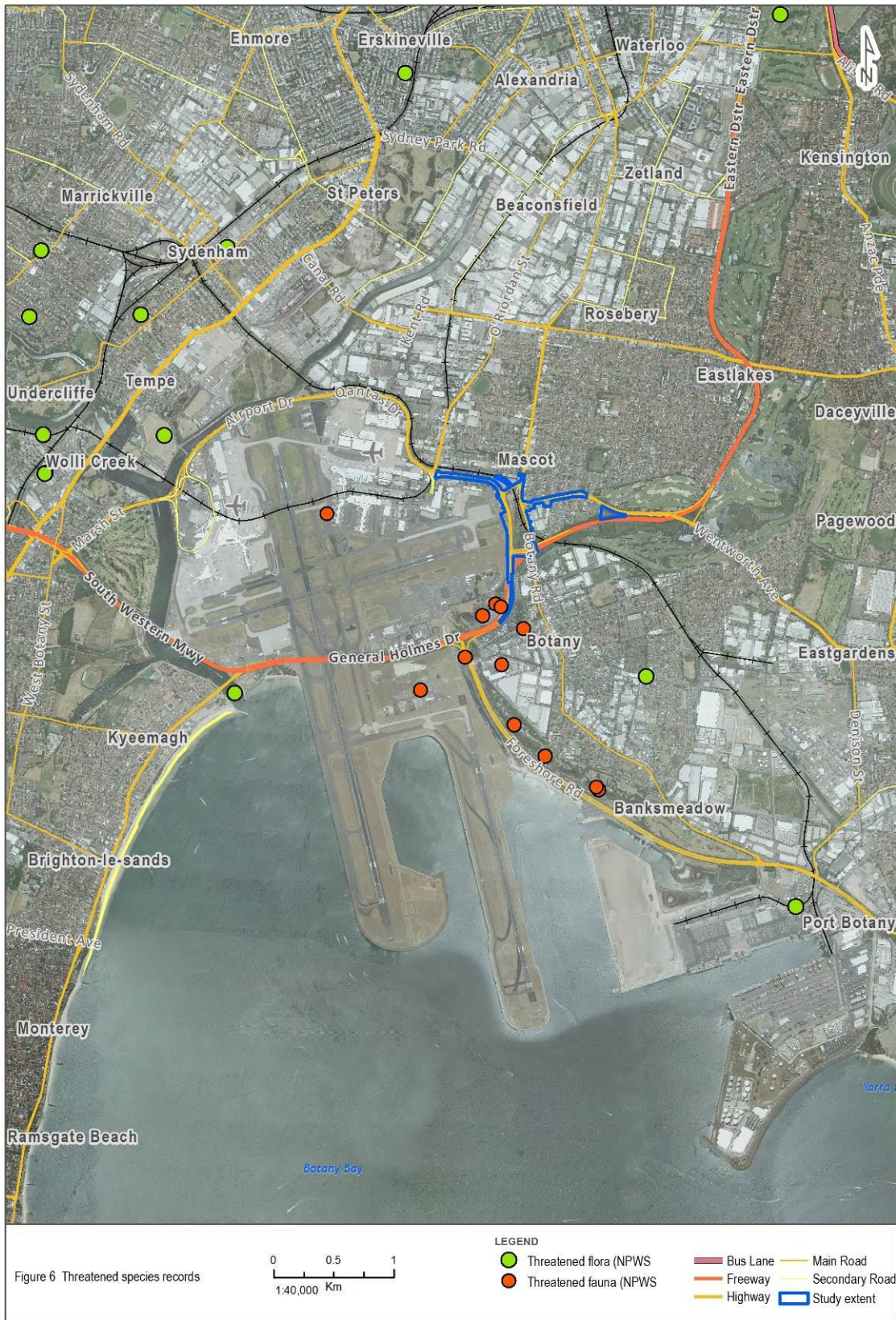


Figure 6 Threatened species records within 10km radius

3.10 Wildlife connectivity corridors

The study area is within a heavily urbanised part of Sydney with a range of residential, industrial and infrastructure developments. The study area is on the fringes of the Botany Wetlands complex that forms a corridor downstream from Gardeners Road, including adjacent remnant vegetation in Eastlake and The Lakes Golf Courses; Sir Joseph Banks Park; around the Botany foreshore and vegetation backing onto the boundary of Sydney Airport to the east side of Penrhyn Bay (DECC 2008). The Botany Wetlands incorporates the largest freshwater wetland complex in the Sydney Metropolitan Catchment and is broadly consistent with the areas of Coastal Freshwater Wetland vegetation mapped by OEH (2013) in Figure 5 to the south and south-east of the study area. Situated on and adjoining Botany Bay, the area includes extensive wetlands, patches of native vegetation cover as well as intertidal flats, sandy beaches and open water. The area is important for migratory shorebirds and other waterbirds. The Botany Wetlands are considered to be 'nationally important wetlands' by the Commonwealth Government mainly due to their habitat value for wetland birds.

Lesryk Environmental Consultants (2013) noted that the only animals likely to utilise this corridor are the flying mammals (i.e. micro and megachiropterans) and birds (Lesryk 2013).

DECC (2008) also acknowledge that, in the Sydney metropolitan area, small and degraded remnants and even stands of original trees and ornamental gardens can have significant value for individual species or groups of species, for example, the extensive mowed grasslands of Sydney Airport provides habitat for regionally significant shorebirds such as the Double-banded Plover and nesting habitat for the threatened Pied Oystercatcher.

'Coastal Heathland' and 'Freshwater Wetland' vegetation communities have been identified as 'priority fauna habitats' by DECC (2008). Priority fauna habitats are those that have exceptional importance for the conservation of vertebrate fauna, particularly threatened species. These habitats are found within the study area, although they have undergone moderate to high levels of disturbance and weed infestation.

4 POTENTIAL IMPACTS

The biodiversity values of the study area would be affected by a variety of indirect and direct impacts across the construction and operation phases of the proposal. Impacts occur as a result of direct intervention or changes from indirect effects to the biophysical and ecological processes that establish and support the biodiversity values of the study area. For this proposal, these direct and indirect impacts are a result of changes to the biophysical environment that ultimately result in biodiversity, i.e. vegetation, landform, soils and hydrology.

The potential impacts identified in this chapter consider:

- Direct and indirect impacts to biodiversity.
- The scale (local and regional), timing, frequency and duration of activities that may result in impacts during construction and operational phases of the proposal.
- The significance of the impact, including reasoning from the assessments of significance (AoS) in the Appendices.
- Other anthropogenic activities that influence cumulative impacts to biodiversity in the area.

4.1 Loss of vegetation/habitats

The proposal would result in the clearing of about 3.4 ha of vegetation (slightly less if Site 16 is not required as a compound) ranging in quality from highly disturbed to moderate condition (Figure 5). The proposal would not result in the removal of any good quality native vegetation, EECs (Figure 5) or species listed under the TSC Act or EPBC Act, as shown in Table 3 below. Because all the vegetation that would require removal is either planted or highly modified and weed impacted, it was not necessary to map the extent of such vegetation within the locality. Vegetation described as 'Urban Native and Exotic Cover' in the proposal area is a mix of remnant native trees, roadside vegetation or landscaped areas composed of local native species, native cultivars and some exotics. None of the vegetation to be removed would meet the definition of a native plant community.

Table 3 Summary of area of vegetation to be cleared

Vegetation	TSC Act	EPBC Act	Area to be cleared (ha) ¹	Locality (10km) ²
Weeds and Exotics	-	-	0.82	-
Urban Native and Exotic Cover	-	-	2.54 ³	-
Street Plantings	-	-	0.05	-
Total			3.41	

1 Area to be cleared based on design footprint and ancillary sites within the study area.

2 Based on mapped extent within 10km radius (OEH 2013).

3 Note, Area 16 (potential compound) may not require clearing.

The proposed clearing of vegetation would result in the loss or degradation of habitat including:

- Loss of nectar-producing trees. The removal of some Coast Banksias and nectar-producing street trees (e.g. Bangalay, Red Bloodwood) would occur. This would affect a minor amount of foraging habitat for the Grey-headed Flying-fox. The number of trees that would be removed has not been calculated at this stage. This is because many of these trees are somewhat scattered street plantings (making calculations from aerial photographs difficult) and because the precise clearing footprint was not finalised at the time of the field study. A species list is provided in Table 6 (Appendix 2).
- Potential indirect impacts on wetland plant communities with local, regional and state conservation significance (including one EEC) that either have restricted ranges or contain threatened species habitat.
- Minor loss of structural diversity suitable to provide shelter and nutritional resources to a range of fauna species known to occur, or could potentially occur within the study area.
- Minor loss of foraging habitat for the migratory Fork-tailed Swift and White-throated Needletail.

Vegetation removal would occur early during the construction phase of the proposal, and may be staged in accordance with construction limitations of high traffic volume during peak periods. The exact extent of clearing, and associated impacts, will depend on finalisation of a detailed design and construction methods that may require additional areas of native vegetation to be modified or removed. Clearing within the site will be undertaken in accordance with the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA Environmental Branch 2011) to minimise disturbance to surrounding flora and fauna habitats.

The NSW Wetlands Policy (DECCW 2010) recommends maintaining a vegetated buffer for protection of wetlands. The policy states that adequate widths of buffers required will depend on a range of local and catchment parameters including hydrology, soils, vegetation and topography, and on the adjacent land use.

Assessments of Significance have been undertaken to address potential impacts on the habitat of threatened and migratory species identified in Sections 3.7 and 3.8 (Appendix 5 and 6).

4.2 Wildlife connectivity and habitat fragmentation

The study area has been identified as fringing an important area of fauna habitat that forms a corridor downstream from Gardeners Road, including adjacent remnant vegetation in Eastlake and The Lakes Golf Courses; Sir Joseph Banks Park; around the Botany foreshore and vegetation backing onto the boundary of Sydney Airport to the east side of Penrhyn Bay (DECC 2008).

Existing culvert structures and drainage canals are likely to provide some limited opportunity for movement and breeding of some native species if present, such as reptiles, rodents and frogs. Intensification of traffic movements and road widening may result in a minor reduction in dispersal opportunities for the Green and Golden Bell Frog.

Although actual impacts to connectivity would depend on the final design and footprint of the proposed roadworks, widening to accommodate the Westconnex enabling works is unlikely to have a significant impact on overall connectivity at the regional scale. The existing road network and heavily urbanised surroundings are already a barrier to fauna movement with the corridor likely to only have any real value for highly mobile bird and bat species that can move more easily through such a highly fragmented landscape. The proposed roadworks are unlikely to significantly increase the barrier effect of the existing road network if indirect impacts are managed, including edge effects from weed intrusion, water quality and erosion.

4.3 Injury and mortality

Habitat clearing to accommodate the roadworks may lead to incidences of fauna injury or mortality through interactions with vehicles. Although the existing road network already poses a threat to native fauna for injury and mortality, it is likely that the risk would be higher during construction, particularly during habitat removal when fauna may be forced to move. Given the proposal would involve habitat clearing directly adjacent the existing roadway, this may result in an increase in individuals being injured or killed by cars in the short-term. This risk is most relevant to frogs, if present, and small native skinks, as it is unlikely that there would be any resident native arboreal or ground-dwelling mammals within the study area, due to lack of suitable habitat. Once constructed, it is anticipated the proposal would facilitate increases in traffic volumes through the study area, which could increase the likelihood of vehicle strike in the long term. This is particularly likely as the existing rail level crossing would become an underpass extending to Wentworth Ave, with the potential to trap fauna.

4.4 Weeds

Eight species of Class 3 and 4 noxious weeds listed in the Botany Bay City LGA have been identified in the study area as discussed in Section 3.3.1. Mechanical vegetation removal, earthworks and increased human activity during construction has the potential to facilitate spread of these and other weeds.

However, it is considered that the proposal is not likely to significantly increase the presence or distribution of weeds within the study area, but can provide an opportunity to undertake weed control works and habitat enhancement following construction of the proposal in accordance with the Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA projects (RTA Environmental Branch 2011).

4.5 Pests and pathogens

Although vegetation in the study area did not appear to be obviously affected by dieback, the study area is potentially contaminated with *Phytophthora cinnamomi*. Infection of native plants by *P. cinnamomi* is listed as a key threatening process both in NSW and nationally. Evidence of *P. cinnamomi* induced die-back has been identified in several vegetation classes including coastal heaths and woodlands (DECC 2008b). Ongoing loss of understorey species infested with *Phytophthora* can indirectly affect threatened fauna species through the loss of cover, food resources and nesting habitat (DECC 2008b).

The study area is likely to provide habitat for other pest animals such as the black rat (*Rattus rattus*), European Rabbit (*Oryctolagus cuniculus*) and European red fox (*Vulpes vulpes*).

There is a small area of potential Green and Golden Bell Frog habitat within the study area. This species is susceptible to the amphibian chytrid fungus. Development activities associated with this proposal have the potential risk of introducing or spreading disease to the study area so a precautionary approach to manage disease should be taken.

4.6 Hydrology and drainage

While there is the potential for hydrological changes due to the proposal, it is likely that they can be managed to ensure there is no net impact. The proposal is unlikely to result in any changes to hydrology and drainage that would affect the Coastal Freshwater Wetland, which is consistent with the EEC Freshwater Wetlands on Coastal Floodplains. It is unlikely that landscaping works associated with the proposal would result in noticeable changes to overland flows and sediment and erosion control measures would be put in place to avoid impacts on the area of EEC. Earthworks would be undertaken to reshape the landform outside the proposed wetland buffer, however, this would not result in any change to hydrology within the buffer zone.

4.7 Noise, vibration and light

It is unlikely the proposal would result in significant changes to existing levels of noise, vibration and light such that there would be a significant impact to native fauna species. This is because the existing road network, airport and surrounding urbanised environment already provide high levels of these types of disturbance.

There is potential for some resident and visiting native fauna to temporarily avoid habitats directly adjacent to the proposal during construction, with bat species being particularly sensitive to any change in street lighting that may be associated with road upgrades. This is likely because most construction work will take place at night to avoid traffic congestion during the day and due to the operational requirements of Sydney Airport.

4.8 Impact on relevant key threatening processes

The following eleven KTPs are considered relevant to the proposal:

- Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands.
- Clearing of native vegetation.
- Competition and grazing by the feral European rabbit (*Oryctolagus cuniculus*).
- Infection of frogs by amphibian chytrid causing the disease chytridiomycosis.
- Invasion and establishment of exotic vines and scramblers.
- Invasion, establishment and spread on Lantana (*Lantana camara*).
- Invasion of native plant communities by *Chrysanthemoides monilifera* (bitou bush and boneseed).
- Invasion by native plant communities by exotic perennial grasses.

- Invasion of native plant communities by African Olive (*Olea europaea* L. subsp. *cuspidate*).
- Predation by the European red fox (*Vulpes vulpes*).
- Predation by the Plague Minnow (*Gambusia holbrooki*).

These are discussed in more detail in the following sections.

4.8.1 Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands

Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands is recognised as a major factor contributing to loss of biological diversity and ecological function in aquatic ecosystems. The proposal would not result in changes to the hydrology or drainage of the small wetland within the proposal area.

As discussed in Section 4.6, earthworks would be undertaken to reshape the landform outside the wetland buffer, however, this would not result in any change to hydrology within the buffer zone.

4.8.2 Clearing of native vegetation

The proposal would result in the clearing of about 3.4 ha of mostly low condition vegetation. Highly modified areas in low condition are weed dominated and other areas are existing planted or landscaped road verges.

4.8.3 Competition and grazing by the feral European rabbit (*Oryctolagus cuniculus*)

While rabbits were not observed in the study area, they are likely to occur. The final determination for this KTP states that grazing and burrowing by rabbits can result in erosion and significant changes to the landscape. Competition for food resources and displacement from burrows is not relevant as no native ground dwelling mammals are likely to utilise this site. Grazing by rabbits may reduce regrowth of vegetation post-construction and limit revegetation through landscape plantings.

4.8.4 Infection of frogs by amphibian chytrid causing the disease chytridiomycosis

Chytridiomycosis is a fatal disease of amphibians and is caused by the chytrid *Batrachochytrium dendrobatidis* (NSW Scientific Committee 2002). It is potentially fatal to all native species of amphibian. The Green and Golden Bell Frog is susceptible to chytridiomycosis. However, it is mainly associated with permanent water (stream, ponds, seeps) and cool temperatures. It is mitigated by high temperatures. Thus, frog populations were more susceptible to chytridiomycosis at higher elevations or during winter (Commonwealth of Australia). While chytrid has potential to occur in the study area, the site is hot and exposed and infection would only be likely to occur during winter. While it is also possible that chytrid could be introduced into the study area during construction, there are many other agents that could also introduce the disease as the site is adjacent to multiple transport corridors.

4.8.5 Invasion and establishment of exotic vines and scramblers

The final determination for this KTP states that exotic vines and scramblers may act as transformer species altering the nature of the environment where they become dominant (NSW Scientific Committee 2006a). Exotic vines and scramblers may smother existing vegetation, both in the ground layer and canopy. This alters the light climate in the invaded community and may suppress regeneration of native species. This KTP is relevant to the study area because bridal creeper (*Asparagus asparagoides*), madeira vine (*Anredera cordifolia*), coastal morning glory (*Ipomea cairica*), potato vine (*Acetosa sagittata*) and moth vine (*Araujia serrifera*) occur. If not properly managed these exotic species could spread further throughout remnant native vegetation in the study area.

4.8.6 Invasion, establishment and spread on Lantana (*Lantana camara*)

The final determination for this KTP states that *Lantana camara* readily invades disturbed sites and communities. Various types of sclerophyll woodlands, sclerophyll forests, rainforests and dry rainforests are all susceptible to lantana establishment, although in communities with a naturally dense canopy, Lantana colonisation may be heavily dependent on and limited to disturbance zones, edges, and canopy breaks. There is a strong correlation between lantana establishment and disturbance with critical factors being disturbance-mediated increases in light and available soil nutrients (NSW Scientific Committee 2003a). Lantana is present in the study area and thus this KTP is also relevant to the proposal. If not properly managed this exotic species could spread further throughout the study area.

4.8.7 Invasion of native plant communities by *Chrysanthemoides monilifera* (bitou bush and boneseed)

The final determination for this KTP states that vigorous growth, prolific seed production and effective seed dispersal of both subspecies enable them to compete strongly with, or in some places eliminate, native vegetation (Scientific Committee 1999). The dense monoculture of *Chrysanthemoides monilifera* which can develop after invasion threatens local vegetation at all sites which are affected. This may result in local and regional declines of many plant species and communities. The changed structure of the habitat may adversely impact on both native vertebrate and invertebrate fauna and may favour the proliferation of non-indigenous species. Bitou Bush is present in the study area and thus this KTP is also relevant to the proposal. If not properly managed this exotic species could spread further throughout the study area and adjoining lands.

4.8.8 Invasion of native plant communities by exotic perennial grasses

The final determination for this KTP states that the characteristics of vigorous growth, prolific seed production and effective seed dispersal enable many exotic perennial grasses to compete strongly with, or in some places displace, native vegetation (NSW Scientific Committee 2006b). Exotic perennial grasses may also change the fuel load in plant communities. The changed structure and fire regimes of the habitat are likely to adversely impact on both native vertebrate and invertebrate fauna. This KTP may be relevant because there are a number of exotic perennial grass species that are listed in the final determination that were recorded within the study area including kikuyu (*Pennisetum clandestinum*) and African Lovegrass (*Eragrostis curvula*). If not properly managed these exotic species could spread further throughout remnant native vegetation in the study area.

4.8.9 Invasion of native plant communities by African Olive (*Olea europaea* L. subsp. *cuspidate*)

The final determination for this KTP states that African Olive is a highly persistent and long lived tree which fundamentally alters ecosystem structure through the formation of a dense mid-canopy in native vegetation communities. The dense canopy structure of African Olive creates deep shade at the ground level, preventing the growth of native grasses and herbs. This species produces large crops of small black fruits which are readily consumed and dispersed by a range of native and introduced birds (NSW Scientific Committee 2010). African Olive is present in the study area and thus this KTP is also relevant to the proposal. If not properly managed this exotic species could spread further throughout the study area and adjoining lands.

4.8.10 Predation by the European Red Fox (*Vulpes vulpes*)

In their final determination for this KTP the NSW Scientific Committee found that predation by the fox is a major threat to the survival of native Australian fauna (NSW Scientific Committee 2004). While no foxes were recorded in the study area in the current surveys, it is likely they occur in the locality as they are known to inhabit ports and transport corridors (e.g. railways). Therefore, this KTP is considered to be potentially relevant.

4.8.11 Predation by the plague minnow (*Gambusia holbrooki*)

Gambusia holbrooki is an aggressive and voracious predator (Scientific Committee 1999). Presence of *Gambusia holbrooki* has been linked to the decline of the Green and Golden Bell Frog (*Litoria aurea*). Recent research has documented that *Gambusia holbrooki* preys upon eggs and tadpoles of the Green and Golden Bell Frog and breeding by this species is almost completely restricted to ephemeral water bodies lacking *Gambusia* (NSW National Parks and Wildlife Service 2003). Although the Green and Golden Bell Frog was not recorded during field surveys, potential habitat exists in the study area and the proposal may result in changes to local hydrology, therefore this KTP is considered to be potentially relevant.

4.9 Cumulative impacts

It should be noted that there is an existing high level of anthropogenic change occurring in the study area that also acts to alter or change the biophysical and ecological process supporting biodiversity. While these other changes are not necessarily a direct or indirect result of this proposal, the cumulative effects of other activities can be insidious and falsely attributed to this proposal. In this regard, cumulative impacts identified in this section are those which are obviously associated with other development nearby.

The main impact of the project would be the removal of low quality vegetation and street trees. The existing urban development in the locality and the quality of this vegetation already limit its value as fauna habitat. While the project would entail further removal of habitat, it would not cause loss of connectivity with proximate habitat areas. Therefore, the impact of habitat clearing in this context is likely to be negligible.

The road network servicing the Sydney Airport and Port Botany precinct is becoming increasingly congested due to the rising volumes of light and heavy vehicles. The proposal

would support future development of the Westconnex motorway, which would improve access between this area and western Sydney. Westconnex is a 33 kilometre project that will bring together a number of important road projects including a widening of the M4 east of Parramatta, a duplication of the M5 East and new sections of motorway to provide a connection between the two key corridors and a new access link to the Sydney Airport area. Cumulative impacts of the broader project have not been quantified.

4.10 Other sensitive ecological sites protected by State or local planning instruments

4.10.1 Botany Bay Local Environment Plan 2013

The small area of Coastal Freshwater Wetland vegetation in the study area (Figure 5) has been identified as an area of terrestrial biodiversity significance in the Botany Bay LEP. The objective of this clause of the LEP is to maintain terrestrial biodiversity by:

- (a) protecting native fauna and flora, and*
- (b) protecting the ecological processes necessary for their continued existence, and*
- (c) encouraging the conservation and recovery of native fauna and flora and their habitats.*

Before determining a development application for development on land to which this clause applies, the consent authority must consider:

- (a) whether the development is likely to have:*
 - (i) any adverse impact on the condition, ecological value and significance of the fauna and flora on the land, and*
 - (ii) any adverse impact on the importance of the vegetation on the land to the habitat and survival of native fauna, and*
 - (iii) any potential to fragment, disturb or diminish the biodiversity structure, function and composition of the land, and*
 - (iv) any adverse impact on the habitat elements providing connectivity on the land, and*
- (b) any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development.*

All of these considerations have been addressed in this Biodiversity Assessment report.

4.10.2 Sydney Airport Master Plan 2033 and Environment Strategy 2013 – 2018

The Sydney Airport Master Plan assigns landuse zones and corresponding land use and management objectives to land owned by Sydney Airport. Part of the study area, including the area of Coastal Freshwater Wetland (Figure 5), is zoned Environment Conservation (EC1). Objectives of the EC1 zone are to:

- Protect the ecological and scenic values of the waterways in this area.
- Maintain the health and natural flows of the waterway.
- Enable maintenance dredging of Mill Stream and related activities to maintain water depths and to ensure sedimentation accumulation is managed and controlled.

- To ensure heritage items are appropriately considered and managed.

Before development approval is granted within this zone, the consent authority must first be satisfied that the development of the kind being proposed will not adversely impact on neighbouring environmentally sensitive areas. The design, construction and operation of such developments will need to consider the proximity to the sensitive areas and investigate the incorporation of appropriate mitigating strategies such as the provision of setbacks and reserves.

Part of the study area is zoned Business Development (BD1). The objectives of this zone are to:

- Encourage employment opportunities and promote businesses along main roads.
- Enable a limited range of other land uses that will provide facilities and services to meet the day-to-day needs of local workforce.
- To ensure heritage items are appropriately considered and managed.
- To maximise, where possible the use of existing access and egress points.

'Road' is a permissible use with consent in both of these landuse zones according to the Master Plan.

The study area has not been identified as 'environmentally significant' in the Sydney Airport Environment Strategy. However, the strategy states that developments that may affect an environmentally significant area are to be designed, constructed and managed in an environmentally responsible and appropriate manner.

This biodiversity assessment and report for the proposal includes measures to construct and manage works in an environmental responsible manner consistent with the objectives of this strategy and in a way that minimises impacts on adjacent environmentally sensitive lands.

4.10.3 Botany Wetlands Plan of Management

The study area is adjoining the Botany Wetlands complex. The Botany Wetlands Environmental Management Steering Committee formed to oversee management of the wetlands is convened by Sydney Water and includes representatives from local councils, Sydney Airport Corporation, Sydney Metropolitan Catchment Management Authority, NSW Department of Water and Energy, RailCorp and the Centennial and Moore Park Trust. Sydney Water is currently developing a new strategic plan of management for Botany, Arncliffe and Chullora wetlands. The plan will outline how the wetlands will be used and maintained over the next five years.

There will be no direct incursion into the Botany Wetlands by the project. However, depending on the exact locations of road widening (e.g. along General Holmes Drive) sedimentation has the potential to cause indirect impacts on the wetlands. The installation of appropriate sediment control measures and avoiding construction during rain should reduce any such risk to negligible levels.

5 MITIGATION MEASURES

5.1 Recommended mitigation measures

1. Minimise loss of native vegetation to the proposed development activities in the study area.

- Where possible, retain native vegetation in the study area,
- No clearing of the Freshwater Wetland on Coastal Floodplains EEC to be undertaken.
- During pre-construction, establish exclusion zones around the identified buffer zone for the Coastal Freshwater Wetland EEC of between four and five metres, consistent with Figure 5. Native shrubs present within the buffer zone are to be protected.
- The area within the wetland buffer area will be rehabilitated as part of the project, including weed control (including minor weed control within the wetland), landscaping and site rehabilitation works with locally indigenous species. Woody debris recovered from the construction footprint should be relocated to the wetland buffer to provide shelter sites for the Green and Golden Bell Frog. A rehabilitation plan should be developed and implemented prior to or concurrently with the initiation of construction work that includes these measures.
- Construction access tracks, ancillary facilities and construction areas along the road verge should be sited in previously cleared/disturbed areas, where possible.

2. Manage threats to threatened species habitat.

- Manage threats to threatened species habitat including weed invasion, stormwater, sedimentation and public access to habitat. These issues could be addressed within a Construction Environmental Management Plan (CEMP).
- Implement a Site Erosion and Sediment Control Plan or Soil Water Management Plan, in accordance with the Blue Book (Landcom 2004). This could be incorporated with the CEMP.
- Manage stormwater to ensure that the hydrology of the wetland is maintained, including periodic drying to prevent colonisation by *Gambusia* (*Gambusia holbrooki*).

3. Minimise risk of establishment and spread of invasive species due to the proposed development activities in the study area.

- Implement controls on the movement of vehicles, and human traffic into areas of native vegetation. This can be achieved by identifying exclusion areas and delineating them using exclusion fencing installed prior to onset of construction. Appropriate signage to be attached to exclusion fencing at regular intervals. Designated vehicle access points and movement tracks will also be identified and marked.
- Undertake weed control in accordance with the Roads and Maritime Services Biodiversity Guidelines.

4. Minimise risk of introduction of diseases that may cause decline of threatened biota due to the proposed development activities in the study area.

- Follow protocol to prevent introduction or spread of *Phytophthora cinnamomi*. The protocols used should be either the Sydney Region Pest Management Strategy or Best Practice Guidelines for *Phytophthora cinnamomi* (DECC 2008c).
- Implement measures to prevent the spread of chytrid fungus. Adopt hygiene protocol standards for the control of disease in frogs.

5. Maintenance of habitat corridor and wildlife connectivity.

- Minimise impacts to habitat within the study area including on the Coastal Freshwater Wetland potential habitat for the Green and Golden Bell Frog.
- Explore options for maintaining opportunities for Green and Golden Bell Frog movement through the urban landscape e.g. through under or overpasses, drainage canals and structures.
- Minimise removal of nectar producing trees and shrubs where possible. These will need to be identified prior to construction and any near a construction zone protected with exclusion fencing if possible. The root zones of retained trees will also need to be protected.
- Undertake post-construction revegetation and restoration in accordance with Roads and Maritime Services Biodiversity Guidelines using local native species.

6. Minimise impact on native fauna and their habitat.

- Assist in reducing key threatening processes e.g. spread of frog chytrid fungus, habitat disturbance and competition for habitat resources.
- Adopt hygiene protocol standards for the control of disease in frogs. Consistent with DECC (2008d) the tyres of vehicles entering the construction site in the area of the freshwater wetland should be washed with disinfectant.
- Restrict use of pesticides to control weeds particularly near watercourses and immediately before or during wet weather.
- Minimise the loss of nectar producing trees and shrubs where possible.
- Undertake post-construction revegetation and restoration in accordance with Roads and Maritime Services Biodiversity Guidelines using local native species including species in the families Proteaceae and Myrtaceae.
- Undertake post-construction revegetation and restoration in accordance with Roads and Maritime Services Biodiversity Guidelines using local native species including species in the families Proteaceae and Myrtaceae. Trees and/or shrubs and groundcovers can be established as street plantings, landscaping around new road sections and in land retained around the freshwater wetland.

7. Minimise potential impacts on threatened fauna species and their habitat.

- Conduct further pre-construction surveys for the Green and Golden Bell Frog under suitable conditions to determine the level of management commitment required and whether a monitoring program is required. As two days/nights have already been completed minimum of two additional days/nights survey should be undertaken when weather conditions are optimal.

- Revegetate the margins of the wetland with suitable native species to the maximum extent possible. Suitable vegetation will consist of groundcovers, shrubs and small trees indigenous to the local area. Some grassy patches should also be included as basking sites for the Green and Golden Bell Frog.
- Incorporate rocks and logs into the landscaping surrounding the wetland as shelter for the Green and Golden Bell Frog.
- Implement measures to prevent pollution of waterways and drainage lines in the area surrounding the proposed works.

6 SIGNIFICANCE ASSESSMENTS

6.1 Summary of assessments

A summary of the findings of significance assessments for all species listed under the TSC and EPBC Acts which were found to occur, or have potential to occur, in the study area is provided in Table 4 and 5 respectively. The comprehensive details of the 7-Part test in accordance with the requirements of Section 5A of the EP&A Act for each threatened species or community are shown in Appendix 5. Details associated with impacts of the proposed project on threatened species and communities of National Environmental Significance (NES) are provided in Appendix 6. The risk matrix used to determine the likelihood of occurrence is shown in Appendix 4.

With the adoption of the mitigation measures identified above, there is unlikely to be a significant impact on Freshwater Wetlands on Coastal Floodplains Endangered Ecological Community. This includes the adoption of a buffer zone to exclude major earthworks, with rehabilitation within the buffer zone. While field surveys did not identify any threatened species, the study area contains potential habitat for seven threatened flora species and two threatened fauna species listed under the TSC Act (Table 4).

Surveys did not identify any species listed as threatened under the EPBC Act, however the site contains potential habitat for five threatened flora species, two threatened fauna species and two migratory species listed under this Act (Table 5).

These assessments were undertaken with the following provisions in mind; the road widening and associated ancillary works would result in the loss of approximately 3.4 ha of mostly modified vegetation and mitigation measures are to be followed.

There is likely to be no species significantly impacted by the proposal under the TSC Act or EPBC Act if the mitigation measures (Section 5) are adopted.

Table 4: Summary of the findings of significance assessments under the TSC Act.

Threatened species, population or communities	Significance assessment question ¹							Likely significant impact?
	a	b	c	d	e	f	g	
<i>Litoria aurea</i> (Green and Golden Bell Frog)	N	X	X	N	N	N	N	No
<i>Pteropus poliocephalus</i> (Grey-Headed Flying-Fox)	N	X	X	N	N	N	N	No
Freshwater Wetlands on Coastal Floodplains Ecological Community	X	X	N	N	X	N	N	No
<i>Acacia terminalis</i> subsp. <i>terminalis</i> (Sunshine Wattle)	N	X	X	N	X	N	N	No
<i>Cryptostylis hunteriana</i> (Leafless Tongue Orchid)	N	X	X	N	X	N	N	No
<i>Persoonia hirsuta</i> (Hairy Geebung)	N	X	X	N	X	N	N	No
<i>Pterostylis</i> sp. <i>Botany Bay</i> (Botany Bay Bearded Orchid)	N	X	X	N	X	N	N	No
<i>Senecio spathulatus</i> (Coastal Groundsel)	N	X	X	N	X	N	N	No
<i>Tetradlea juncea</i> (Black-eyed Susan)	N	X	X	N	X	N	N	No
<i>Thelymitra atronitidia</i> (Black-hooded Sun Orchid)	N	X	X	N	X	N	N	No

Table 5 Summary of the findings of significance assessments under EPBC Act.

Threatened species, or communities	Significance assessment criteria ^{2,3}									Likely significant impact?
	i	ii	iii	iv	v	vi	vii	viii	ix	
<i>Litoria aurea</i> (Green and Golden Bell Frog)	N	N	N	X	N	N	N	N	N	No
<i>Pteropus poliocephalus</i> (Grey-headed Flying Fox)	N	N	N	X	N	N	N	N	N	No
<i>Apus pacificus</i> (Fork-tailed Swift)	N	N	N							No
<i>Hirundapus caudacutus</i> (White-throated Needletail)	N	N	N							No
<i>Acacia terminalis</i> subsp. <i>terminalis</i> (Sunshine Wattle)	N	N	N	X	N	N	N	N	N	No
<i>Cryptostylis hunteriana</i> (Leafless Tongue-orchid)	N	N	N	X	N	N	N	N	N	No
<i>Persoonia hirsuta</i> (Hairy Geebung)	N	N	N	X	N	N	N	N	N	No
<i>Pterostylis</i> sp. <i>Botany Bay</i> (Botany Bay Bearded Orchid)	N	N	N	X	N	N	N	N	N	No
<i>Tetraloche juncea</i> (Black-eyed Susan)	N	N	N	X	N	N	N	N	N	No

Notes for Table 4 and Table 5: Y= Yes (negative impact), N= No (no or positive impact), X= not applicable, ?= unknown impact.

1. Significance Assessment Questions as set out in the *Threatened Species Conservation Act 1995/ Environmental Planning and Assessment Act 1979*.
 - a in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,
 - b in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,
 - c in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
 - (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
 - (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,
 - d in relation to the habitat of a threatened species, population or ecological community:
 - (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
 - (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
 - (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,
 - e whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),
 - f whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,
 - g whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.
2. **An action is likely to have a significant impact on a critically endangered or endangered species if there is a real**

chance or possibility that it will::

- i. lead to a long-term decrease in the size of a population;
- ii. reduce the area of occupancy of the species;
- iii. fragment an existing population into two or more populations;
- iv. adversely affect habitat critical to the survival of a species;
- v. disrupt the breeding cycle of a population;
- vi. modify, destroy, remove isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;
- vii. result in invasive species that are harmful to an endangered species becoming established in the endangered species' habitat.
- viii. Introduce disease that may cause the species to decline;
- ix. Interfere substantially with the recovery of the species.

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

- i. Lead to a long-term decrease in the size of an important population of a species;
- ii. reduce the area of occupancy of an important population*;
- iii. fragment an existing important population into two or more populations;
- iv. adversely affect habitat critical to the survival of a species;
- v. disrupt the breeding cycle of an important population.
- vi. modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
- vii. result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.
- viii. Introduce disease that may cause the species to decline.
- ix. Interfere substantially with the recovery of the species.

*Important Population as determined by the *Environment Protection and Biodiversity Conservation Act 1999*, is one that for a vulnerable species:

- is likely to be key source populations either for breeding or dispersal
- is likely to be necessary for maintaining genetic diversity
- is at or near the limit of the species range.

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

- i. substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species
- ii. result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or
- iii. seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

7 CONCLUSION

7.1 Overview of key findings

The key findings of this report are as follows.

Flora

- The proposal would result in vegetation clearing, with a 'worst case assessment' of:
 - A loss of approximately 3.4 hectares of vegetation (of mostly low quality due to previous disturbance and weed impacts) for road widening, construction, associated ancillary sites, landscaping and site rehabilitation works. The areas included in this calculation are shown in Figure 5.
 - About 2.54 hectares of this is remnant native trees, roadside vegetation or landscaping predominantly composed of local native species and native cultivars, with some exotics species also present. The remainder of the vegetation to be removed are weeds and exotics and a small area of street plantings. None of the vegetation to be removed would meet the definition of a natural vegetation community.
- 0.45 ha of vegetation in the study area has been identified as Freshwater Wetlands on Coastal Floodplain EEC. There will be no impact to the EEC.
- No threatened flora species have been found in the study area, however, there is low quality potential habitat for seven threatened flora species within the study area including *Acacia terminalis subsp. terminalis*, *Cryptostylis hunteriana*, *Persoonia hirsuta*, *Pterostylis sp.* Botany Bay, *Senecio spathulatus*, *Tetratheca juncea* and *Thelymitra atronitida*.

Fauna

- The study area contains low to moderate quality habitat, with a combination of highly disturbed coastal heath and freshwater wetland vegetation. The study area is close to the Botany Wetland complex, an important area of habitat for a number of threatened and migratory waterbirds.
- Potential habitat is available within the study area for threatened fauna species including Green and Golden Bell Frog and Grey-headed Flying Fox. There will be no loss of potential Green and Golden Bell Frog habitat. A small area of potential foraging habitat for the Grey-headed Flying-fox would be removed and is not considered a significant impact with implementation of recommended mitigation measures.
- Two migratory species, the Fork-tailed Swift and White-throated Needletail have also been identified as having habitat in the study area. The minor area of potential foraging habitat likely to be removed is not considered significant.
- Mitigation strategies have been suggested to minimise impact on native fauna.

7.2 Recommendations

The proposed Westconnex enabling works road widening and construction of associated temporary ancillary sites has the potential to cause impacts to the Freshwater Wetlands on Coastal Floodplains EEC and potential habitat for threatened fauna and flora if the range of

mitigation measures outlined in Section 5 are not adopted. These measures have been developed to limit the risks associated with the proposed roadworks.

Impacts can be mitigated through the retention of EECs and remnant vegetation where possible, adequate sediment and erosion control, retention of nectar-producing trees and shrubs where possible, locating ancillary sites and stockpile sites in already disturbed areas and suitable site restoration following construction. Risks that need to be managed include:

- Accidental construction incursions into areas of high ecological significance.
- Additional impacts to areas not identified in the concept design.
- Degradation of vegetation, local waterways and riparian areas.

The implementation of mitigation measures would help reduce the risk of further impacts occurring during the construction and operational phases of this proposal. As such, the overall impact of the proposal on threatened biodiversity is considered low.

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9 APPENDICES

Appendix 1: Vegetation community descriptions

The following vegetation descriptions come from The Native Vegetation of the Sydney Metropolitan Area (OEH 2013).

Coastal Freshwater Wetland

Coastal Freshwater Wetland is associated with freshwater lagoons and swamps on alluvial flats and sand depressions across the New South Wales east coast. Lagoons have fluctuating levels of standing water that gives rise to a varied assemblage of species. They include a range of sedges, rushes and aquatic herbs with woody shrubs and small trees found only on the margins of the wetlands in low abundance. Tall reedlands (reaching over three metres in height) may dominate individual wetlands. Cumbungi (*Typha orientalis*) is typically dominant in urban wetlands and may be joined by common reed (*Phragmites australis*). Other tall reeds include *Eleocharis sphacelata* and tall sedges such as twig-rushes (*Baumea* spp.). The margins of open water carry a range of aquatic herbs such as *Isachne gibbosa* and *Persicaria decipiens*. Less frequently inundated wetlands support only a few species of sedges or rushes such as *Carex appressa* and or *Baumea* spp. which do not reach the height of the taller reedlands found elsewhere.

In the Sydney metropolitan area Coastal Freshwater Wetland is most commonly found at low elevations less than five metres above sea level on coastal plains and flats. Several swamps occur on highly disturbed floodplains of the Cumberland Plain where elevations reach 20 metres above sea level. Many of the remaining swamps are situated amongst intensely developed urban landuses. In these environments drainage patterns have been altered and weeds may be prolific.

Non-native vegetation

Non-native vegetation cover comprised two classes: 'weeds and exotics' and 'urban exotics and natives'. The label 'weeds and exotics' was applied to vegetation patches greater than 0.1 hectare in size with a complete cover of exotic species in the upper strata (i.e. where no visible native species could be discerned). The label 'urban exotics and natives' was applied to polygons greater than 0.1 hectares in size for which urban landuse covered more than 70 per cent of the polygon and there was evidence of both exotic and native species in the upper or lower strata. Typically these areas include backyard trees, street trees, gardens, median strips and other small-scale features that are small isolated stands.

Appendix 2: Flora species recorded during field survey

Table 6: Flora species recorded during December 2013 field survey

Family	Species name	Common name	Site																
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Adiantaceae	<i>Cheilanthes sieberi</i>	Rock Fern		x															
Aizoaceae	<i>Carpobrotus sp.</i>	Pigface											x						
Amaryllidaceae	<i>Agapanthus sp.*</i>	Agapanthus												x					
Apiaceae	<i>Foeniculum vulgare*</i>	Fennel		x						x									x
Apiaceae	<i>Hydrocotyle bonariensis*</i>	Pennywort	x														x		
Apocynaceae	<i>Araujia sericifera*</i>	Moth Vine		x		x													x
Araucariaceae	<i>Araucaria heterophylla*</i>	Norfolk Island Pine							x										
Arecaceae	<i>Phoenix sp.*</i>							x					x				x		x
Asparagaceae	<i>Asparagus asparagoides*+</i>	Bridal Creeper													x				
Asteraceae	<i>Ageratina adenophora*</i>	Crofton Weed		x															
Asteraceae	<i>Bidens pilosa*</i>	Farmer's Friend		x					x						x				x
Asteraceae	<i>Chrysanthemoides monilifera*+</i>	Bitou Bush		x				x	x				x		x				x
Asteraceae	<i>Conyza bonariensis*</i>	Fleabane		x					x	x			x	x					x
Asteraceae	<i>Coreopsis sp.*</i>			x															
Asteraceae	<i>Lactuca serriola*</i>	Prickly Lettuce		x															
Asteraceae	<i>Onopordum acanthium*</i>	Scotch Thistle		x															
Asteraceae	<i>Parietaria judaica*</i>	Asthma Weed		x															
Asteraceae	<i>Senecio madagascariensis*</i>	Fireweed		x					x					x					x
Asteraceae	<i>Sphagneticola trilobata*</i>	Singapore Daisy		x															
Asteraceae	<i>Taraxacum officinale*</i>	Dandelion				x								x			x		x

Family	Species name	Common name	Site																
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Basellaceae	<i>Anredera cordifolia</i> *	Madeira Vine		x		x													
Brassicaceae	<i>Brassica sp.</i> *			x		x		x	x				x						
Cactaceae	<i>Opuntia stricta</i> *+	Prickly Pear		x															
Campanulaceae	<i>Wahlenbergia gracilis</i>	Sprawling Bluebell		x								x	x	x	x	x		x	
Casuarinaceae	<i>Casuarina cunninghamiana</i>	River Oak			x														
Casuarinaceae	<i>Casuarina glauca</i>	Swamp Oak			x	x	x	x		x		x	x	x	x			x	
Commelinaceae	<i>Commelina cyanea</i>	Commelina		x															
Commelinaceae	<i>Tradescantia albens</i> *	Wandering Dew		x															
Convolvulaceae	<i>Ipomoea cairica</i> *	Coastal Morning Glory																	x
Cyperaceae	<i>Baumea articulata</i>	Jointed Twig-rush	x																
Cyperaceae	<i>Gahnia clarkei</i>	Tall Saw-sedge	x	x										x					
Doryanthaceae	<i>Doryanthes excelsa</i>	Gynea Lily					x	x		x									
Euphorbiaceae	<i>Ricinus communis</i> *	Castor Oil Plant		x				x	x			x							x
Fabaceae	<i>Acacia linifolia</i>	White Wattle				x													
Fabaceae	<i>Acacia longifolia var. sophorae</i>	Coastal Wattle		x				x				x	x	x	x				
Fabaceae	<i>Acacia parramattensis</i>	Parramatta Wattle		x			x	x											
Fabaceae	<i>Acacia saligna</i> *	Golden Wreath Wattle		x		x	x	x						x					x
Fabaceae	<i>Acacia sp.</i>					x													
Fabaceae	<i>Bauhinia cunninghamii</i> *						x												
Fabaceae	<i>Castanospermum australe</i> *	Black Bean										x							
Fabaceae	<i>Erythrina x sykesii</i> *	Coral Tree												x					x
Fabaceae	<i>Senna pendula</i> *	Winter Senna													x				
Fabaceae	<i>Trifolium repens</i> *	White Clover																	x
Fabaceae	<i>Ulex sp.</i> *+	Gorse		x															
Jamamelidaceae	<i>Liquidambar styraciflua</i> *	Liquidambar			x									x				x	
Juncaceae	<i>Juncus sp.</i>		x																

Family	Species name	Common name	Site																
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Laminaceae	<i>Rosmarinus officinalis</i> *	Rosemary									x								
Laminaceae	<i>Westringia fruticosa</i>	Coastal Rosemary												x					
Lauraceae	<i>Cinnamomum camphora</i> *	Camphor Laurel		x															
Lomandraceae	<i>Lomandra longifolia</i>	Spiny Mat-rush												x	x				
Lomandraceae	<i>Lomandra sp.</i>	cultivar					x	x	x			x							x
Malvaceae	<i>Hibiscus diversifolius</i>	Swamp Hibiscus		x															
Malvaceae	<i>Malva neglecta</i> *	Dwarf Mallow											x						
Malvaceae	<i>Modiola caroliniana</i> *	Modiola		x															
Malvaceae	<i>Sida rhombifolia</i> *	Paddys Lucerne		x									x						x
Meliaceae	<i>Melia azedarach</i>	White Cedar		x															
Moraceae	<i>Ficus elastica</i> *	Rubber Tree																	
Moraceae	<i>Morus sp.</i> *	Mulberry		x															x
Myrsinaceae	<i>Anagallis arvensis</i> *	Scarlet Pimpernel		x		x													
Myrtaceae	<i>Angophora costata</i>	Sydney Red Gum						x											x
Myrtaceae	<i>Callistemon citrinus</i>	Crimson Bottlebrush				x		x				x		x		x			
Myrtaceae	<i>Callistemon viminalis</i>	Weeping Bottlebrush				x													
Myrtaceae	<i>Corymbia citriodora</i> *	Lemon-scented Gum						x											
Myrtaceae	<i>Corymbia gummifera</i>	Red Bloodwood																	x
Myrtaceae	<i>Corymbia maculata</i>	Spotted Gum							x	x						x			
Myrtaceae	<i>Eucalyptus botryoides</i>	Bangalay								x	x								x
Myrtaceae	<i>Eucalyptus grandis</i>	Flooded Gum																	x
Myrtaceae	<i>Eucalyptus microcorys</i>	Tallowood				x													
Myrtaceae	<i>Eucalyptus piperata</i>	Sydney Peppermint																	x
Myrtaceae	<i>Eucalyptus robusta</i>	Swamp Oak																	x
Myrtaceae	<i>Eucalyptus saligna</i>	Sydney Blue Gum																	x
Myrtaceae	<i>Eucalyptus sp.</i>											x							

Family	Species name	Common name	Site																
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Myrtaceae	<i>Leptospermum laevigatum</i>	Coast Tea-tree		x			x	x											
Myrtaceae	<i>Leptospermum petersonii</i> *	Lemon-scented Tea-tree								x									
Myrtaceae	<i>Melaleuca bracteata</i>					x													
Myrtaceae	<i>Melaleuca nodosa</i>			x				x											
Myrtaceae	<i>Melaleuca quinquenervia</i>	Broad-leaved Paperbark								x	x	x							
Myrtaceae	<i>Melaleuca sp.</i>										x					x		x	
Myrtaceae	<i>Melaleuca styphelioides</i>	Prickly-leaved Paperbark								x									
Myrtaceae	<i>Tristaniopsis laurina</i>	Water Gum									x								
Ochanaceae	<i>Ochna serrulata</i> *	Ochna		x															
Oleaceae	<i>Ligustrum lucidum</i> *	Large-leaved Privet		x															
Oleaceae	<i>Olea europaea ssp. cuspidate</i> *	African Olive						x											x
Phormiaceae	<i>Dianella caerulea</i>	Flax-lily						x					x						
Phormiaceae	<i>Dianella revoluta</i>	Blueberry Lily					x												
Phytolaccaceae	<i>Phytolacca octandra</i> *	Inkweed			x														
Pittosporaceae	<i>Pittosporum undulatum</i>	Sweet Pittosporum		x															
Plantaginaceae	<i>Plantago sp.</i> *	Plantain		x				x				x							x
Poaceae	<i>Avena fatua</i> *	Wild Oats						x				x		x					
Poaceae	<i>Cynodon dactylon</i>	Couch		x															
Poaceae	<i>Digitaria didactyla</i>	Queensland Blue Couch		x									x						
Poaceae	<i>Entolasia marginata</i>	Bordered Panic		x															
Poaceae	<i>Eragrostis curvula</i> *	African Lovegrass		x								x	x	x	x				x
Poaceae	<i>Melinis repens</i> *	Red Natal Grass		x						x									
Poaceae	<i>Pennisetum clandestinum</i> *	Kikuyu		x															
Poaceae	<i>Pennisetum sp.</i>	Foxtail		x															
Poaceae	<i>Sporobolus virginicus</i>	Sand Couch		x								x							x
Polygonaceae	<i>Acetosa sagittata</i> *	Potato Vine		x															

Family	Species name	Common name	Site																
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Polygonaceae	<i>Persicaria sp.</i>							X											
Polygonaceae	<i>Persicaria strigosa</i>	Spotted Knotweed	X																
Proteaceae	<i>Banksia integrifolia</i>	Coast Banksia		X		X	X	X	X			X				X			
Proteaceae	<i>Banksia serrata</i>	Saw Banksia						X					X	X					
Proteaceae	<i>Grevillea sp.*</i>	cultivar																	X
Proteaceae	<i>Hakea salicifolia*</i>	Willow-leaved Hakea																	X
Ranunculaceae	<i>Ranunculus sp.</i>	Buttercup	X																
Rosaceae	<i>Rubus fruticosus*</i>	Blackberry																	X
Salicaceae	<i>Salix sp.*</i>	Willow		X															
Sapindaceae	<i>Cardiospermum grandiflorum*</i>	Balloon Vine	X	X															
Sapindaceae	<i>Cupaniopsis anacardioides</i>	Broad-leaved Tuckeroo						X		X									X
Sapindaceae	<i>Dodonaea triquetra</i>	Hop Bush													X				
Solanaceae	<i>Cestrum parqui*</i>	Green Cestrum		X		X		X	X					X					
Solanaceae	<i>Solanum mauritianum*</i>	Bush Tobacco		X															
Solanaceae	<i>Solanum nigrum*</i>	Blackberry Nightshade		X					X				X						
Strelitziaceae	<i>Strelitzia sp.*</i>	Bird-of-Paradise							X										
Typhaceae	<i>Typha orientalis</i>	Broad-leaved Cumbungi	X																
Verbenaceae	<i>Lantana camara*+</i>	Lantana	X	X			X	X	X			X	X	X	X	X			X
Verbenaceae	<i>Lantana montevidensis*+</i>	Trailing Lantana				X						X							X
Verbenaceae	<i>Verbena bonariensis*</i>	Purpletop		X		X													X

* denotes introduced species, + denotes weed of national significance (WONS)

Appendix 3: Flora and fauna species with the potential to occur in the study area.

Note: List of threatened species, populations, or ecological communities which may be affected directly or indirectly by the Proposal is derived from searches of the following databases as well as on ground survey conducted December 2013: Likelihood of occurrence is based on the risk matrix in Appendix 4. An assessment of significance under the TSC Act and/or the EPBC Act has been undertaken for those with a medium to high likelihood of occurrence.

1. NSW Office of Environment and Heritage (OEH) Atlas of NSW Wildlife Database.
2. Protected Matters Report that documents all Matters of National Environmental Significance (MNES) within 10 km of site (Department of Sustainability, Environment, Water, Population and Communities).
3. Department of Environment and Conservation (now OEH) Endangered Ecological Community and Threatened Species Profiles (OEH, 2013).
4. NSW Flora Online Search – Rare or Threatened Australian Plants (ROTAP) species (The Royal Botanic Gardens and Domain Trust 2013).

Table 7: Threatened species with potential to occur and assessment of likelihood of occurrence

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in study area / 10 km radius	Influenced by off-site impacts	Likelihood of occurrence
Threatened Ecological Communities						
Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion.	-	E	Tall open eucalypt forests with a sparse to dense layer of shrubs and vines, and a diverse understorey of native grasses, forbs, twiners and ferns. Found on basalt and basalt-like substrates usually at elevations between 650 m and 1050 m above sea level.	-	No	Habitat not present. Risk Low: unlikely to occur

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in study area / 10 km radius	Influenced by off-site impacts	Likelihood of occurrence
Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions.	E	-	This community is found on the coastal floodplains of NSW. It has a dense to sparse tree layer in which <i>Casuarina glauca</i> (swamp oak) is the dominant species.	-	No	Habitat not suitable. Risk Low: unlikely to occur.
Eastern Suburbs Banksia Scrub of the Sydney Region.	E	E	Structural form of sclerophyllous heath or scrub occasionally with small areas of woodland, forest or wetland vegetation on nutrient poor sand deposits. Common species of ESBS include <i>Banksia aemula</i> , <i>B. ericifolia</i> , <i>B. serrata</i> , <i>Eriostemon australasius</i> , <i>Lepidosperma laterale</i> , <i>Leptospermum laevigatum</i> , <i>Monotoca elliptica</i> and <i>Xanthorrhoea resinifera</i> .	-	No	Habitat not present. Risk Low: unlikely to occur
Littoral Rainforest and Coastal Vine Thickets of Eastern Australia	CE	CE	A complex of rainforest and coastal vine thickets, including some that are deciduous. Occurs within two kilometres of the coast or adjacent to a large salt water body on a range of landforms derived from coastal processes in warm temperate, sub-tropical or tropical climatic zones.	-	No	Habitat not suitable. Risk Low: unlikely to occur.

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in study area / 10 km radius	Influenced by off-site impacts	Likelihood of occurrence
Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions.	E	-	Associated with coastal areas subject to periodic flooding and in which standing fresh water persists for at least part of the year in most years. Typically occurs in low-lying parts of floodplains, alluvial flats, depressions, drainage lines, backswamps, lagoons and lakes but may also occur in back barrier landforms where floodplains adjoin coastal sandplains. They are dominated by herbaceous plants and have very few woody species.	0.45 hectares mapped in study area.	Yes	Occurs in the study area. Risk High: known to occur in the study area.
Western Sydney Dry Rainforest and Moist Woodland on Shale.	E	CE	This is a dry vine scrub community of the Cumberland Plain with a restricted distribution. It occurs in areas of higher elevation, high rainfall and hilly country in the sheltered lower slopes and gullies.	-	No	Habitat not suitable. Risk Low: unlikely to occur.
Threatened Flora						

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in study area / 10 km radius	Influenced by off-site impacts	Likelihood of occurrence
<i>Acacia prominens</i> (Gosford Wattle) population, Hurstville and Kogarah Local Government Areas.	E	-	Occurs at a few sites along the railway line at Penshurst, at Carss Bush Park, Carss Park and there is an unconfirmed siting at Oatley Park, Oatley. This population is disjunct from other populations (Hunter Valley to Gosford region) and at the southern limit of the range of the species. Grows mainly in wet sclerophyll forest and margins of rainforest, usually in moist, protected areas in loamy and clayey soils.	1	No	Habitat not suitable. Risk Low: unlikely to occur.
<i>Acacia pubescens</i> (Downy Wattle)	V	V	Occurs on alluviums, shales and at the intergrade between shales and sandstones. The soils are characteristically gravelly soils, often with ironstone. Occurs in open woodland and forest, in a variety of plant communities, including Cooks River/Castlereagh Ironbark Forest, Shale/Gravel Transition Forest and Cumberland Plain Woodland. Concentrated around the Bankstown-Fairfield-Rookwood area and the Pitt Town area.	5	No	Habitat not suitable. Risk Low: unlikely to occur.

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in study area / 10 km radius	Influenced by off-site impacts	Likelihood of occurrence
<i>Acacia terminalis</i> subsp. <i>terminalis</i> (Sunshine Wattle)	E	E	Habitat requirements include coastal scrub and dry sclerophyll woodland on sandy soils. Habitat is generally sparse and scattered. Very limited distribution, mainly in near-coastal areas from the northern shores of Sydney Harbour south to Botany Bay, with most records from the Port Jackson area and the eastern suburbs of Sydney.	84	No	Suitable habitat occurs in the study area. Risk High: likely to occur.
<i>Allocasuarina glareicola</i>	E	E	Occurs in Castlereagh woodland on lateritic soil. Primarily restricted to the Richmond (NW Cumberland Plain) district, but with an outlier population found at Voyager Point, Liverpool.	0	No	Habitat not suitable. Risk Low: unlikely to occur.
<i>Allocasuarina portuensis</i> (Nielsen Park She-oak)	E	E	This species has only been recorded from Nielsen Park, within Sydney Harbour NP. Occurs on the slope of a sandstone headland, with shallow sandy soils that are highly siliceous, coarsely textured and devoid of a soil profile. The original habitat is tall closed woodland.	37	No	Habitat not suitable. Risk Low: unlikely to occur.

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in study area / 10 km radius	Influenced by off-site impacts	Likelihood of occurrence
<i>Asterolasia buxifolia</i>	E	-	Known from a single site at a granite outcrop in the riparian zone of the Lett River. Apparently restricted to dense riparian scrub along rocky watercourses with a granitic substrate.	1	No	Habitat not suitable. Risk Extremely Low: extremely unlikely to occur.
<i>Caladenia tessellata</i> (Thick Lip Spider Orchid)	E	V	Requires low, dry sclerophyll woodland with a heathy or sometimes grassy understorey on clay loams or sandy soils, specifically in dry, low Brittle Gum (<i>Eucalyptus mannifera</i>), Inland Scribbly Gum (<i>E. rossii</i>) and <i>Allocasuarina</i> spp. woodland with a sparse understorey and stony soil.	1	No	Habitat not suitable. Risk Low: unlikely to occur.
<i>Callistemon linearifolius</i> (Netted Bottle Brush)	V	-	Inhabits dry sclerophyll forest on the coast and adjacent ranges. For the Sydney area, recent records are limited to the Hornsby Plateau area near the Hawkesbury River.	2	No	Habitat not suitable. Risk Low: unlikely to occur.
<i>Cryptostylis hunteriana</i> (Leafless Tongue Orchid).	V	V	Occurs across a wide variety of habitats including coastal districts, heathlands, heathy woodlands, sedgeland, forests, and Spear Grass-tree (<i>Xanthorrhoea resinosa</i>) plains. Soils are generally considered to be moist and sandy, however, this species is also known to grow in dry soils and peaty soils.	0	No	Potential habitat occurs on site, but no local records. Risk Medium: could possibly occur.

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in study area / 10 km radius	Influenced by off-site impacts	Likelihood of occurrence
<i>Diuris arenaria</i> (Sand Doubletail)	E	-	Sand Doubletail is known from the Tomaree Peninsula near Newcastle. This species occurs in coastal heath and dry grassy eucalypt forest on sandy flats. Grows in gently undulating country in eucalypt forest with a grassy understorey on clay soil.	1	No	Outside area of known distribution. Risk Low: unlikely to occur.
<i>Eucalyptus fracta</i> (Broken Back Ironbark)	V	-	Confined largely to State Forest. Locally common but restricted to the northern Broken Back Range near Cessnock, NSW. The dominant tree in a narrow band along the upper edge of a sandstone escarpment. Occurs in dry eucalypt woodland in shallow soils.	1	No	Outside area of known distribution. No suitable habitat. Risk Low: unlikely to occur.
<i>Eucalyptus nicholii</i> (Narrow-leaved Black Peppermint)	V	V	Occurs in grassy sclerophyll woodland in association with other eucalyptus species. This species is sparsely distributed but widespread on the New England Tablelands from Nundle to north of Tenterfield. (Planted as street tree in the Sydney Metropolitan area).	8	No	Outside area of known distribution. No suitable habitat. Risk Low: unlikely to occur.

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in study area / 10 km radius	Influenced by off-site impacts	Likelihood of occurrence
<i>Eucalyptus scoparia</i> (Wallangarra White Gum)	E	V	Found in open eucalypt forest and woodland on well-drained granite hilltops, slopes and rocky outcrops, typically at high altitudes. At lower elevations can occur in less rocky soils in damp situations. In NSW it is known from only three locations near Tenterfield, including Bald Rock National Park.	3	No	Outside area of known distribution. No suitable habitat. Risk Extremely Low: extremely unlikely to occur.
<i>Melaleuca biconvexa</i> (Biconvex Paperbark)	V	V	The species may occur in dense stands forming a narrow strip adjacent to watercourses, in association with other <i>Melaleuca</i> species or as an understorey species in wet forest.	0	No	Habitat not suitable. Risk Low: unlikely to occur.
<i>Melaleuca deanei</i> (Deane's Paperbark)	V	V	Endemic to Sydney Basin region and grows in heath on sandstone or flat broad ridge tops. Strongly associated with sandy loam soils that are low in nutrients, sometimes with ironstone present.	1	No	Habitat not suitable. Risk Low: unlikely to occur.
<i>Pelargonium sp. Striatellum</i> (Omeo Stork's-bill)	E	E	Normally located in habitat just above high water mark of ephemeral lakes and can colonise exposed lake beds. Known from only 3 locations in NSW in the Monaro Plains and Lake Bathurst.	0	No	Habitat not suitable. Risk Low: unlikely to occur.

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in study area / 10 km radius	Influenced by off-site impacts	Likelihood of occurrence
<i>Persoonia hirsuta</i> (Hairy Geebung)	E	E	Found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone. Usually present as isolated individuals or very small populations.	1	No	Potential habitat occurs on site. Risk Medium: could possibly occur.
<i>Pimelea curviflora</i> var. <i>curviflora</i>	V	V	Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands. Often grows amongst dense grasses and sedges.	0	No	Habitat not suitable. Risk Low: unlikely to occur.
<i>Pimelea spicata</i>	E	E	Occurs on an undulating topography of substrates derived from Wianamatta Shale in Cumberland Plain Woodland Vegetation Community. Found on well-structured clay soils.	2	No	Habitat not suitable. Risk Low: unlikely to occur.
<i>Prasophyllum fuscum</i> (Slaty Leek Orchid)	CE	V	The type specimen is from "moist meadows towards the Georges River" in the Sydney area. The species is likely to be extinct from this area. Harden (1993) states that it is confined to the Blue Mountains area. Grows in moist heath, often along seepage lines.	1	No	Habitat not suitable. Risk Low: unlikely to occur.

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in study area / 10 km radius	Influenced by off-site impacts	Likelihood of occurrence
<i>Prostanthera marifolia</i> (Seaforth Mintbush)	CE	CE	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. Currently only known from the northern Sydney suburb of Seaforth.	3	No	Habitat not suitable. Risk Low: unlikely to occur.
<i>Pterostylis saxicola</i> (Sydney Plains Greenhood)	E	E	Restricted to western Sydney between Freemans Reach in the north and Picton in the south. Most commonly found growing in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines.	0	No	Habitat not suitable. Risk Low: unlikely to occur.
<i>Pterostylis</i> sp. Botany Bay (Botany Bay Bearded Orchid)	E	E	Restricted to the Sydney region where it is known from a small number of sites within Botany Bay National Park on the Kurnell Peninsula. Occupies moist level sites on skeletal sandy soils derived from sandstone. Associated vegetation is coastal heath dominated by <i>Melaleuca nodosa</i> and <i>Baeckea imbricata</i> .	3	No	Potential habitat occurs on site. Risk Medium: could possibly occur.

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in study area / 10 km radius	Influenced by off-site impacts	Likelihood of occurrence
<i>Pultenaea parviflora</i>	E	V	Endemic to the Cumberland Plain. Core distribution is from Windsor to Penrith and east to Dean Park. May be locally abundant, particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays.	1	No	Habitat not suitable. Risk Low: unlikely to occur.
<i>Senecio spathulatus</i> (Coast Groundsel)	E	-	A specialised coastal species occurring mostly on frontal dunes and forming low, broad clumps.	6	No	Habitat marginal. Risk Medium: could possibly occur.
<i>Streblus pendulinus</i> (Siah's Backbone)	-	E	Occurs in warm temperate rainforest along watercourses.	0	No	Habitat not suitable. Risk Low: unlikely to occur.
<i>Syzygium paniculatum</i> (Magenta Lilly Pilly)	E	V	Grows in subtropical and littoral rainforest on sandy soils or stabilised dunes near the sea.	16	No	Habitat not suitable. Risk Low: unlikely to occur.

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in study area / 10 km radius	Influenced by off-site impacts	Likelihood of occurrence
<i>Tetradlea glandulosa</i> (Glandular Pink-bell)	V	V	Strongly associated with areas of shale-sandstone transition habitat where shale-cappings occur over sandstone. Occupies ridgetops, upper-slopes and mid-slope sandstone benches. Preferred vegetation includes heaths, scrub, woodlands/open woodlands and open forest.	1	No	Habitat not suitable. Risk Low: unlikely to occur.
<i>Tetradlea juncea</i> (Black-eyed Susan)	V	V	Confined to the local government areas of Wyong, Lake Macquarie, Newcastle, Port Stephens, Great Lakes and Cessnock. Usually found in low open forest/woodland with a mixed shrub understorey and grassy groundcover. However, it has also been recorded in heathland and moist forest.	3	No	Potential habitat occurs on site. Outside area of known distribution. Risk Medium: could possibly occur.
<i>Thelymitra atronitida</i> (Black-hooded Sun Orchid)	CE	-	Known from two localities, Cape Solander in Botany Bay National Park in southern Sydney, and Bago State Forest south of Tumut. Recorded from shallow black peaty soil in coastal heath on sandstone and open forest with a heathy understorey on well-drained sand or clay-loam soils.	2	No	Potential habitat occurs on site. Outside area of known distribution. Risk Medium: could possibly occur.

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in study area / 10 km radius	Influenced by off-site impacts	Likelihood of occurrence
<i>Thesium australe</i> (Austral Toadflax, Toadflax)	V	V	Suitable habitat for this species includes grassland and grassy woodland, often in damp sites.	0	No	Habitat not suitable. Risk Low: unlikely to occur.
<i>Triplarina imbricata</i>	E	E	Found only in a few locations in the ranges south-west of Glenreagh and near Tabulam in north-east NSW. Found along watercourses in low open forest with Water Gum (<i>Tristaniopsis laurina</i>).	1	No	Habitat not suitable. Risk Low: unlikely to occur.
Threatened Fauna (Amphibians)						
<i>Crinia tinnula</i> (Wallum Froglet)	V	-	Wallum, a mosaic of wet heath and paperbark swamp and acid groundwater; usually on coastal sands	37	No	No suitable habitat; possible habitat in area prior to disturbance. Risk Low: unlikely to occur.
<i>Litoria aurea</i> (Green and Golden Bell Frog)	E	V	Freshwater wetlands with bulrush (<i>Typha sp.</i>) with nearby grassy areas and diurnal sheltering sites	741	No	Suitable habitat, but small in area and likely to be functionally isolated from proximate areas of habitat. Risk Medium: could possibly occur.

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in study area / 10 km radius	Influenced by off-site impacts	Likelihood of occurrence
Threatened Fauna (Birds)						
<i>Anseranas semipalmata</i> (Magpie Goose)	V	-	Typically found in shallow open wetlands with fringing rushes or sedges.	10	No	No shallow open wetlands present. Risk Low: unlikely to occur.
<i>Stictonetta naevosa</i> (Freckled Duck)	V	-	Prefers heavily vegetated wetlands; uses more open wetlands during drought in non-breeding period.	1	No	No suitable inundated wetlands present. Risk Low: unlikely to occur.
<i>Ptilinopus superbis</i> (Superb Fruit-Dove)	V	-	Rainforests, occasionally wet eucalypt forest; feeds in trees with fleshy fruit.	8	No	No rainforest or trees with fleshy fruit present. Risk Low: unlikely to occur.
<i>Apus pacificus</i> (Fork-tailed Swift)	-	M	Aerial space over a variety of habitat types; feeds on insects; breeds in Asia.	-	No	Present in locality and foraging habitat requirements general; tolerant of urbanised areas. Risk Medium: could possibly occur.

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in study area / 10 km radius	Influenced by off-site impacts	Likelihood of occurrence
<i>Hirundapus caudacutus</i> (White-throated Needletail)	-	M	Aerial space over a variety of habitat types, but prefers to forage over treed habitats as these would provide a greater abundance of insect prey; often forage on the edge of low pressure systems and may follow these systems ; breeds in Asia.	-	No	Present in locality and foraging habitat requirements general; occasionally observed over urbanised areas Risk Medium: could possibly occur.
<i>Diomedea exulans</i> (Wandering Albatross)	E	E	Oceans.	1434	No	No suitable habitat. Risk Low: unlikely to occur.
<i>Ardenna pacificus</i> (Wedge-tailed Shearwater)	-	M	Oceans.	-	No	No suitable habitat. Risk Low: unlikely to occur.
<i>Ardenna tenuirostris</i> (Short-tailed Shearwater)	-	M	Oceans	-	No	No suitable habitat. Risk Low: unlikely to occur.
<i>Ardea ibis</i> (Cattle Egret)	-	M	Pastures; associates with large grazing animals, particularly cattle	-	No	No suitable habitat or appropriate land use. Risk Low: unlikely to occur.

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in study area / 10 km radius	Influenced by off-site impacts	Likelihood of occurrence
<i>Botaurus poiciloptilus</i> (Australasian Bittern)	E	E	Heavily vegetated permanent freshwater wetlands	12	No	No permanent freshwater wetlands present. Risk Low: unlikely to occur.
<i>Haliaeetus leucogaster</i> (White-bellied Sea-Eagle)	-	M	Coastlines, estuaries, large rivers and lakes; occasionally over adjacent habitats; builds a large stick nest in a tall tree, rarely on artificial structures	-	No	Present in locality, may very rarely fly over the study area, but unlikely to forage there due to disturbance by adjacent land uses. Risk Low: unlikely to occur.
<i>Hieraaetus morphnoides</i> (Little Eagle)	V	-	Open forest and woodland; preys upon mammals and birds; builds a stick nest in a large tree	3	No	No suitable foraging habitat. Risk Low: unlikely to occur.
<i>Burhinus grallarius</i> (Bush Stone-curlew)	E	-	Open forest and woodland with a sparse grassy understorey	6	No	No suitable habitat. Risk Low: unlikely to occur.
<i>Haematopus fuliginosus</i> (Sooty Oystercatcher)	V	-	Rocky headlands, rock shelves, occasionally beaches	126	No	No suitable habitat. Risk Low: unlikely to occur.

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in study area / 10 km radius	Influenced by off-site impacts	Likelihood of occurrence
<i>Haematopus longirostris</i> (Pied Oystercatcher)	E	-	Intertidal sandflats and mudflats in estuaries, beaches	845	No	No suitable habitat. Risk Low: unlikely to occur.
<i>Charadrius leschenaultii</i> (Greater Sandplover)	V	M	Sheltered beaches; estuaries with large intertidal sandflats or mudflats	13	No	No suitable habitat. Risk Low: unlikely to occur.
<i>Charadrius mongolus</i> (Lesser Sandplover)	V	M	Sheltered bays; estuaries with large intertidal sandflats or mudflats	54	No	No suitable habitat. Risk Low: unlikely to occur.
<i>Charadrius veredus</i> (Oriental Plover)	-	M	Open plains, bare rolling country, marshes, sportsfields, grassy areas of airports, lawns, intertidal mudflats, sandy or muddy wastes; often far from water	-	No	Some open grassy areas within study area, but grasses not maintained and probably too tall; mowed grassy areas are all on sides of busy roads. Risk Low: unlikely to occur.
<i>Pluvialis fulva</i> (Pacific Golden Plover)	-	M	Estuaries, mudflats, mangroves, saltmarsh	-	No	No suitable habitat. Risk Low: unlikely to occur.

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in study area / 10 km radius	Influenced by off-site impacts	Likelihood of occurrence
<i>Pluvialis squatarola</i> (Grey Plover)	P	C, J, K	Mudflats, saltmarsh, tidal reefs, estuaries	-	No	No suitable habitat. Risk Low: unlikely to occur.
<i>Actitis hypoleucos</i> (Common Sandpiper)	-	M	Shallow muddy or sandy edges of rivers, lakes, tidal rivers, waterways in mangroves or saltmarsh	-	No	No suitable habitat. Risk Low: unlikely to occur.
<i>Arenaria interpres</i> (Ruddy Turnstone)	-	M	Tidal reefs and pools, shorelines, mudflats	-	No	No suitable habitat. Risk Low: unlikely to occur.
<i>Calidris acuminata</i> (Sharp-tailed Sandpiper)	-	M	Tidal sandflats or mudflats, saltmarsh, mangroves, wetlands	-	No	No suitable habitat. Risk Low: unlikely to occur.
<i>Calidris alba</i> (Sanderling)	V	M	Sandy beaches and intertidal mudflats where it feeds by following receding waves	18	No	No suitable habitat. Risk Low: unlikely to occur.
<i>Calidris bairdii</i> (Baird's Sandpiper)	-	M	Mudflats, beaches with seaweed, edges of fresh and saline wetlands	-	No	No suitable habitat. Risk Low: unlikely to occur.

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in study area / 10 km radius	Influenced by off-site impacts	Likelihood of occurrence
<i>Calidris canutus</i> (Red Knot)	-	M	Tidal mudflats, sandflats, beaches, saltmarsh, ploughed fields, flooded pasture	-	No	No suitable habitat. Risk Low: unlikely to occur.
<i>Calidris ferruginea</i> (Curlew Sandpiper)	E	M	Intertidal mudflats, saltmarsh, fresh, brackish or saline wetlands	302	No	No suitable habitat. Risk Low: unlikely to occur.
<i>Calidris melanotos</i> (Pectoral Sandpiper)	-	M	Shallow freshwaters with low vegetation, flooded pasture, swamp margins, sewage ponds; occasionally mudflats and saltmarsh	-	No	Wetland in study area heavily vegetated and lacking low fringing vegetation. Risk Low: unlikely to occur.
<i>Calidris ruficollis</i> (Red-necked Stint)	-	M	Tidal sandflats and mudflats, saltmarsh, sandy beaches, wetlands with shallow edges	-	No	No suitable habitat. Risk Low: unlikely to occur.
<i>Calidris tenuirostris</i> (Great Knot)	V	M	Estuaries, bays or lagoons with extensive intertidal sandflats or mudflats	48	No	No suitable habitat. Risk Low: unlikely to occur.
<i>Gallinago hardwickii</i> (Latham's Snipe)	-	M	Soft wet ground, shallow water with tussocks, inundated parts of paddocks, seepage below dams, saltmarsh and mangrove fringes	-	No	Wetland in study area too heavily vegetated. Risk Low: unlikely to occur.

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in study area / 10 km radius	Influenced by off-site impacts	Likelihood of occurrence
<i>Limicola falcinellus</i> (Broad-billed Sandpiper)	V	M	Estuarine sandflats and mudflats, saltmarsh, wetlands	10	No	No suitable habitat. Risk Low: unlikely to occur.
<i>Limosa lapponica</i> (Bar-tailed Godwit)	-	M	Tidal mudflats, estuaries, shallow river margins, flooded pastures	-	No	No suitable habitat. Risk Low: unlikely to occur.
<i>Limosa limosa</i> (Black-tailed Godwit)	V	M	Estuaries and lagoons with large intertidal sandflats or mudflats	12	No	No suitable habitat. Risk Low: unlikely to occur.
<i>Numenius madagascariensis</i> (Eastern Curlew)	-	M	Estuaries, tidal mudflats, sandspits, saltmarsh, mangroves	-	No	No suitable habitat. Risk Low: unlikely to occur.
<i>Numenius minutus</i> (Little Curlew)	-	M	Grasslands, floodplains, margins of drying swamps, tidal mudflats, airfields, sportsfields, crops, sewage ponds	-	No	Some open grassy areas within study area, but grasses not maintained and probably too tall; mowed grassy areas are all on sides of busy roads. Risk Low: unlikely to occur.

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in study area / 10 km radius	Influenced by off-site impacts	Likelihood of occurrence
<i>Tringa brevipes</i> (Grey-tailed Tattler)	-	M	Tidal mudflats, estuaries, shallow river margins, mangroves	-	No	No suitable habitat. Risk Low: unlikely to occur.
<i>Tringa glareola</i> (Wood Sandpiper)	-	M	Muddy margins of wetlands, mangroves, tidal mudflats, saltmarsh, sewage ponds	-	No	Wetland in study area lacks muddy margins. Risk Low: unlikely to occur.
<i>Tringa incana</i> (Wandering Tattler)	-	M	Coral islands, rocky reefs and islands, rock platforms, rarely other tidal areas	-	No	No suitable habitat. Risk Low: unlikely to occur.
<i>Tringa nebularia</i> (Common Greenshank)	-	M	Mudflats, estuaries, saltmarsh, margins of wetlands	-	No	Wetland in study area too heavily vegetated. Risk Low: unlikely to occur.
<i>Tringa stagnatilis</i> (Marsh Sandpiper)	-	M	Salt, brackish or freshwater wetlands, mangroves, intertidal mudflats, estuaries	-	No	Wetland in study area too heavily vegetated. Risk Low: unlikely to occur.
<i>Xenus cinereus</i> (Terek Sandpiper)	V	M	Intertidal sandflats and mudflats near mangroves	50	No	No suitable habitat. Risk Low: unlikely to occur.

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in study area / 10 km radius	Influenced by off-site impacts	Likelihood of occurrence
<i>Chlidonias leucopterus</i> (White-winged Black Tern)	-	M	Large wetlands, sewage ponds, estuaries, coastal waters	-	No	No suitable habitat. Risk Low: unlikely to occur.
<i>Hydroprogne caspia</i> (Caspian Tern)	-	M	Coastal waters, beaches, mudflats, large rivers, dams and lakes	-	No	No suitable habitat. Risk Low: unlikely to occur.
<i>Sterna hirundo</i> (Common Tern)	-	M	Offshore waters, bays, estuaries, large freshwater wetlands	-	No	No suitable habitat. Risk Low: unlikely to occur.
<i>Sternula albifrons</i> (Little Tern)	E		Primarily sheltered coastal waters such as bays, estuaries, coastal lagoons and large rivers; sometimes off ocean beaches. Nests on sandy beaches or in low dunes	1899	No	No suitable habitat. Risk Low: unlikely to occur.
<i>Calyptorhynchus lathamii</i> (Glossy Black-Cockatoo)	V	-	Forest and woodlands with she-oaks (<i>Allocasuarina</i> spp.); nests in large tree hollows	2	No	No <i>Allocasuarina</i> spp. present; no large tree hollows. Risk Low: unlikely to occur.

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in study area / 10 km radius	Influenced by off-site impacts	Likelihood of occurrence
<i>Lathamus discolor</i> (Swift Parrot)	E	E	Over-winters in NSW, associating with winter flowering trees, e.g. spotted gum (<i>Corymbia maculata</i>), swamp mahogany (<i>Eucalyptus robusta</i>), red gums and ironbarks (<i>Eucalyptus</i> spp.)	9	No	A small number of winter flowering trees present (e.g. swamp mahogany) as street trees, rare use of these trees may occur, possibly as a staging area to facilitate broader movement. Risk Low: unlikely to occur.
<i>Anthochaera phrygia</i> (Regent Honeyeater)	E	E	A predominately inland species, but highly nomadic in response to flowering events. Three main breeding areas, all inland, are recognised, though a number of smaller breeding sites are also known. Use of coastal habitat primarily associated with shortage of food resources in preferred habitat, but may also occasionally breed in coastal habitats. In coastal NSW associates with nectar-producing trees, e.g. spotted gums (<i>Corymbia</i> spp.), bangalay (<i>E. botryoides</i> and swamp mahogany (<i>E. robusta</i>); rare use of <i>Banksia</i> sp. and paperbarks (<i>Melaleuca</i> sp.)	6	No	A small number of flowering trees present (e.g. bangalay, swamp mahogany) as street trees, rare use of these trees may occur. Study area unlikely to be associated with breeding habitat. Risk Low: unlikely to occur.

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in study area / 10 km radius	Influenced by off-site impacts	Likelihood of occurrence
<i>Epthianura albifrons</i> (White-fronted Chat)	V	-	Open damp ground, grass clumps, fencelines, heath, samphire saltmarsh, mangroves, dunes, saltbush plains	36	No	No suitable habitat. Risk Low: unlikely to occur.
<i>Stagonopleura guttata</i> (Diamond Firetail)	V	-	Open grassy Eucalypt forest and woodland, main area of distribution western slopes and plains; feeds on grass seeds	3	No	No native grasses present. Risk Low: unlikely to occur.
Threatened Fauna (Mammals)						
<i>Pteropus poliocephalus</i> (Grey-headed Flying-fox)	V	V	Forests with fruiting or flowering trees; roosts in forest near water (including mangroves)	570	No	Observed flying over the study area; suitable nectar-producing Eucalypts and Bankias present. Risk High: observed over study area.
<i>Miniopterus schreibersii oceanensis</i> (Eastern Bentwing-bat)	V	-	Forages in forested areas but know to occur in urban areas, particular on fertile soils where tree cover is present; catches flying insect above the canopy and other open habitats; roosts mainly in caves, but also uses abandoned mines, stormwater tunnels and other artificial structures	61	No	Lack of tree cover and infertile sandy soils in study area; unlikely to roost in the study area. Risk Low: unlikely to occur.

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in study area / 10 km radius	Influenced by off-site impacts	Likelihood of occurrence
<i>Myotis macropus</i> (Southern Myotis)	V	-	Forages over water, raking the surface for insects and small fish; various roosts, including caves, mine shafts, stormwater channels, bridges and hollow-bearing trees; usually roosts near water	204	No	Foraging habitat present in the locality but not in study area; may fly over study area occasionally; unlikely to roost in the study area
<i>Dugong dugon</i> (Dugong)	E	-	Estuaries, bays, near-shore waters; feeds on seagrass.	10	No	No suitable habitat. Risk Low: unlikely to occur.
<i>Arctocephalus pusillus doriferus</i> (Australian Fur-seal)	V	-	Oceans and rocky shores.	12	No	No suitable habitat. Risk Low: unlikely to occur.
<i>Eubalaena australis</i> (Southern Right Whale)	E	E	Oceans.	6	No	No suitable habitat. Risk Low: unlikely to occur.

Note: V = Vulnerable, E = Endangered, EP = Endangered Population, CE = Critically Endangered

Appendix 4: Risk matrix – likelihood of occurrence based on desktop and ground-truthing

	Likelihood of Occurrence based on further investigations e.g. on-ground						
	Descriptions	Species not identified and suitable habitat occurs > 10 km away from the Study area	Species not identified but suitable habitat occurs within 1 km of the Study area	Species not identified and no suitable habitat occurs within the Study area	Species not identified but partially disturbed or degraded habitat occurs within the Study area	Species not identified but suitable habitat occurs within the Study area	Species identified and suitable habitat occurs within the Study area
Likelihood of Occurrence - based on desktop assessments		F	E	D	C	B	A
Expected to occur during the Project or beyond the Project (i.e. recent records exist in high numbers)	A	M	M	H	H	H	H
Could occur during the Project or beyond the Project (i.e. recent records exists)	B	L	M	M	H	H	H
Possible under exceptional circumstances (i.e. recent records exists but low in number)	C	L	L	M	M	H	H
Unlikely to occur during the Project (i.e. old records but low in number)	D	L	L	L	M	M	H
Very unlikely to occur during the Project (i.e. only old records)	E	EL	L	L	L	M	M
Extremely rare or previously unknown to occur (i.e. no records)	F	EL	EL	L	L	L	M

Risk extremely Low (EL): extremely unlikely to occur	Risk Low (L): unlikely to occur	Risk Medium (M): could possibly occur	Risk High (H): Highly likely to occur/does occur
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Appendix 5: EP&A Act assessments of significance

NOTE:

The following seven part test(s) associated with the assessment of significant effect on threatened species, populations or ecological communities, or their habitats have been undertaken in accordance with the requirements of Section 5A of the Environmental Planning and Assessment Act 1979 ('Act').

These/this assessment(s), under Section 5A of the Act, may have been undertaken with prescribed designated mitigation measures that form part of the 'Action Proposed'¹ for the 'Development'². The effect of which is that these mitigation measures become a mandatory obligation based on Consent Authority approval to proceed.

¹ Action Planned is as detailed in Section 5A of the Environmental Planning and Assessment Act 1979

² 'Development' has the same meaning as determined under Section 4 of the Environmental Planning and Assessment Act 1979

Ecological Community: Freshwater Wetland on Coastal Floodplain Ecological Community

Criterion	(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction
Response	Not applicable.
Conclusion	Not applicable.
Criterion	(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction
Response	Not applicable.
Conclusion	Not applicable.
Criterion	(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction
Response	The study area contains some Freshwater Wetlands on Coastal Floodplains Endangered Ecological Community. Vegetation would be removed as part of the proposal and is permanent, however there would be no removal or modification of the Freshwater Wetland EEC on site. Other areas of Freshwater Wetlands on Coastal Floodplains occur in the locality of Botany Bay that are subject to a Plan of Management.
Conclusion	The proposed activity is unlikely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction.
Criterion	(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.
Response	The study area contains some Freshwater Wetlands on Coastal Floodplains Endangered Ecological Community. Vegetation would be impacted/removed as part of the proposal and is permanent, however there would be no removal or modification of the Freshwater Wetland on site. Other areas of Freshwater Wetlands on Coastal Floodplains occur in the Botany Bay locality.
Conclusion	The proposed activity is not likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Criterion	<p>(d) in relation to the habitat of a threatened species, population or ecological community:</p> <p>(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed</p>
Response	<p>The study area contains some Freshwater Wetlands on Coastal Floodplains Endangered Ecological Community.</p> <p>Vegetation would be impacted/removed as part of the proposal and is permanent, however there would be no removal or modification of the Freshwater Wetland on site.</p>
Conclusion	<p>The proposed activity may result in a limited amount of habitat to be removed or modified.</p>
Criterion	<p>(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action</p>
Response	<p>There would be no removal or modification of the Freshwater Wetland on site.</p> <p>The proposed activity would marginally increase the distance between remaining habitat areas.</p>
Conclusion	<p>Disturbance of narrow strips of roadside vegetation as a result of the proposed action is not likely to cause habitat to become fragmented and isolated from other areas of habitat.</p>
Criterion	<p>(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.</p>
Response	<p>Freshwater Wetlands on Coastal Floodplains is restricted to the NSW North Coast, Sydney Basin and South East Corner Bioregions, however, other areas of Freshwater Wetlands on Coastal Floodplains occur in the Botany Bay locality that are managed under the Botany Wetlands Plan of Management.</p> <p>Vegetation would be impacted/removed as part of the proposal and is permanent, however there would be no removal or modification of the Freshwater Wetland on site.</p> <p>The proposed activity would marginally increase the distance between remaining habitat areas.</p>
Conclusion	<p>The habitat that may be removed is not likely to be critical to the long-term survival of this vegetation community.</p>
Criterion	<p>(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).</p>
Response	<p>Not applicable.</p>
Conclusion	<p>Not applicable.</p>

Criterion	(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.
Response	There is no recovery plan or threat abatement plan for Freshwater Wetlands on Coastal Floodplains. However, the OEH community profile sets out a number of priority actions to assist in the conservation of this EEC including: Install stormwater control mechanisms to prevent off-site impacts from adjacent development. Undertake weed control as required using removal methods that would not damage the community. Restore natural drainage conditions.
Conclusion	The proposed mitigation measures are consistent with the priority actions recommended to assist this EEC.
Criterion	(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.
Response	Land clearing and associated fragmentation is identified as a threat to the survival of this EEC.
Conclusion	The proposed action constitutes the key threatening process 'Clearing of native vegetation', however there would be no clearing of the EEC on site.

Overall Conclusion

There would be no removal or modification of the Freshwater Wetland on site. Indirect impacts would be managed in accordance with best practice sediment and erosion control. There is unlikely to be a significant impact on the Freshwater Wetlands on Coastal Floodplains EEC. A Species Impact Statement is not required.

Species Names: *Cryptostylis hunteriana* (Leafless Tongue Orchid), *Thelymitra atronitida* (Black-hooded Sun Orchid).

Reason for grouping: *Terrestrial orchids with similar habitat requirements*

Criterion	(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction
Response	Leafless Tongue Orchid and Black-hooded Sun Orchid can occur in a range of habitat types including vegetation communities within the study area. The vegetation on the site may provide potential habitat for these species and its removal is permanent. These species were not found in the study area during field surveys.
Conclusion	Given that no individuals of these species would be removed, the proposed activity is unlikely to have an adverse effect on the life cycle of these species.
Criterion	(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction
Response	Not applicable.
Conclusion	Not applicable.
Criterion	(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
	(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction
Response	Not applicable.
Conclusion	Not applicable.
Criterion	(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.
Response	Not applicable.
Conclusion	Not applicable.

Criterion	(d) in relation to the habitat of a threatened species, population or ecological community:
	(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed
Response	Extensive areas of known and potential habitat for these species occur in the region. Potential habitat for these species has been identified in the study area, however no individuals were identified during detailed targeted survey.
Conclusion	It is unlikely there would be any impacts to known habitat as a result of the proposed action.
Criterion	(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action
Response	Potential habitat for this species has been identified in the study area, however no individuals were identified during detailed targeted survey. Clearing or disturbance of potential habitat, up to 2.54 ha, may be required in vegetated areas. The proposed activity would marginally increase the distance between remaining potential habitat areas.
Conclusion	It is unlikely that any known habitat would become more isolated or fragmented from other areas of known habitat.
Criterion	(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.
Response	Other extensive areas of potential habitat for these species occur in the locality. Potential habitat for these species has been identified in the study area, however no individuals were identified during detailed targeted survey.
Conclusion	The habitat to be removed is not important to the long-term survival of the Leafless Tongue Orchid and Black-hooded Sun Orchid.
Criterion	(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).
Response	No critical habitat has been declared for these species.
Conclusion	Not applicable.

Criterion	(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.
Response	<p>No recovery plan has been developed for Leafless Tongue Orchid, three activities have been identified to aid its recovery, including:</p> <p>Co-operatively develop (local governments and OEH) guidelines for survey and assessment, to be followed by developers, consultants and approval authorities.</p> <p>Alert road maintenance staff to the presence of this species.</p> <p>Monitor populations to determine the most appropriate timing and frequency of burning.</p> <p>No recovery plan has been developed for Black-hooded Sun Orchid, however three activities have been identified to aid its recovery, including:</p> <p>Encourage the use of fencing to protect seedlings from grazing and soil disturbance.</p> <p>Seek long term protection of both populations.</p> <p>Conduct searches for additional populations.</p>
Conclusion	The proposed activity does not affect any individuals or populations of these species. The proposed activity is not inconsistent with these priority actions.
Criterion	(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.
Response	<p>Potential habitat removal is permanent, yet no individuals or populations have been identified.</p> <p>The proposed action constitutes the Key Threatening Process 'Clearing of native vegetation'.</p>
Conclusion	Given that no individuals of these species are present on site, the proposed activity is unlikely to result in an increase in the impact of this KTP on these species.

Overall Conclusion

No individual species were identified during survey and targeted searches for threatened flora. While the proposed activity would permanently remove approximately 2.54 ha of vegetation that has been identified as low quality potential habitat, the species is not considered to be present nor affected.

Species Name: *Pterostylis* sp. Botany Bay (Botany Bay Bearded Orchid)

Criterion	(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction
Response	Leafless Tongue Orchid and Black-hooded Sun Orchid can occur in coastal heath dominated by <i>Melaleuca nodosa</i> and <i>Baeckea imbricata</i> . Although habitat on site is very disturbed, <i>Melaleuca nodosa</i> does occur on site and the vegetation was probably originally a form of coastal heath. Therefore the vegetation on the site may provide potential habitat for this species and its removal is permanent. This species was not found in the study area during field surveys.
Conclusion	Given that no individuals of this species would be removed, the proposed activity is unlikely to have an adverse effect on the life cycle of the species.
Criterion	(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction
Response	Not applicable.
Conclusion	Not applicable.
Criterion	(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction
Response	Not applicable.
Conclusion	Not applicable.
Criterion	(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.
Response	Not applicable.
Conclusion	Not applicable.

Criterion	<p>(d) in relation to the habitat of a threatened species, population or ecological community:</p> <p>(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed</p>
Response	<p>Other areas of better quality known and potential habitat for this species occur in the region.</p> <p>Potential habitat for this species has been identified in the study area, however no individuals were identified during detailed targeted survey.</p>
Conclusion	<p>It is unlikely there would be any impacts to known habitat as a result of the proposed action.</p>
Criterion	<p>(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action</p>
Response	<p>Potential habitat for this species has been identified in the study area, however no individuals were identified during detailed targeted survey.</p> <p>Clearing or disturbance of potential habitat, up to 2.54 ha, may be required in vegetated areas.</p> <p>The proposed activity would marginally increase the distance between remaining potential habitat areas.</p>
Conclusion	<p>It is unlikely that any known habitat would become more isolated or fragmented from other areas of known habitat.</p>
Criterion	<p>(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.</p>
Response	<p>Other better quality areas of potential habitat for this species occur in the locality.</p> <p>Potential habitat for this species has been identified in the study area, however no individuals were identified during detailed targeted survey.</p>
Conclusion	<p>The habitat to be removed is not important to the long-term survival of the Botany Bay Bearded Orchid.</p>
Criterion	<p>(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).</p>
Response	<p>No critical habitat has been declared for this species.</p>
Conclusion	<p>Not applicable.</p>

Criterion	(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.
Response	<p>A recovery plan has been developed for the Botany Bay Bearded Orchid (September 2001) and 12 priority actions have been identified to aid in its recovery, including:</p> <p>Protection of populations of the Botany Bay Bearded Greenhood through the implementation of appropriate management strategies by relevant government authorities.</p> <p>Ensuring appropriate fire management of the known population and possible habitat of the Botany Bay Bearded Greenhood.</p> <p>Undertake a systematic survey of potential habitat to further determine the full distribution of the Botany Bay Bearded Greenhood.</p>
Conclusion	The proposed activity does not affect any individuals or populations of this species. The proposed activity is not inconsistent with these priority actions.
Criterion	(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.
Response	<p>Potential habitat removal is permanent, yet no individuals or populations have been identified.</p> <p>The proposed action constitutes the Key Threatening Process 'Clearing of native vegetation'.</p>
Conclusion	Given that no individuals of this species are present on site, the proposed activity is unlikely to result in an increase in the impact of this KTP on this species.

Overall Conclusion

No individuals were identified during survey and targeted searches for threatened flora. While the proposed activity would permanently remove approximately 2.54 ha of vegetation that has been identified as potential habitat, the species is not considered to be present nor affected.

Species Names: *Acacia terminalis* subsp. *terminalis* (Sunshine Wattle), *Persoonia hirsuta* (Hairy Geebung), *Tetradlea juncea* (Black-eyed Susan)

Reason for grouping: Shrub species with similar habitat requirements

Criterion	(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction
Response	The study area contains coastal scrub/heath communities that although heavily disturbed, may provide potential habitat for these species. Removal of vegetation and habitat is permanent. None of these species were identified during field surveys and targeted searches.
Conclusion	Given that no individuals of these species would be removed, the proposed activity is unlikely to have an adverse effect on the life cycle of these species.
Criterion	(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction
Response	Not applicable.
Conclusion	Not applicable.
Criterion	(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction
Response	Not applicable.
Conclusion	Not applicable.
Criterion	(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction
Response	Not applicable.
Conclusion	Not applicable.

Criterion	(d) in relation to the habitat of a threatened species, population or ecological community:
	(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed
Response	Other areas of better quality known and potential habitat for these species occur in the region. The proposed activity would remove potential habitat of these species, however no populations or individuals of these species have been recorded on the site.
Conclusion	It is unlikely there would be any impacts to known habitat as a result of the proposed action.
Criterion	(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action
Response	Potential habitat for these species has been identified in the study area, however no individuals were identified during detailed targeted survey. Clearing or disturbance of potential habitat, up to 2.54 ha, may be required in vegetated areas. The proposed activity would marginally increase the distance between remaining potential habitat areas.
Conclusion	It is unlikely that any known habitat would become more isolated or fragmented from other areas of known habitat.
Criterion	(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.
Response	Other areas of known and potential habitat for these species occur in the locality. Potential habitat for these species has been identified in the study area, however no individuals were identified during detailed targeted survey.
Conclusion	Given that no individuals of these species are present on site, it is unlikely the potential habitat to be removed is important to the long-term survival of these species.
Criterion	(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).
Response	No critical habitat has been declared for any of these species.
Conclusion	Not applicable.

Criterion	(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.
Response	<p>A national recovery plan has been developed for Sunshine Wattle (April 2010) and 29 actions have been identified to aid in its recovery, including:</p> <p>Facilitate survey of potential habitat.</p> <p>Review of Plans of Management or Fire Management Plans.</p> <p>Encourage private landholders to implement threat abatement measures.</p> <p>No recovery plan has been developed for Hairy Geebung, but nine priority actions have been identified, including:</p> <p>Searches should be conducted in suitable habitat in proposed development areas.</p> <p>Minimise habitat loss, fragmentation or disturbance by retaining native vegetation containing the species and maintaining connectivity between populations.</p> <p>Develop a fire management plan for the populations.</p> <p>No recovery plan has been developed for Black-eyed Susan, but seven priority actions have been identified, including:</p> <p>Install stormwater control mechanisms to prevent off-site impacts from development upslope of populations.</p> <p>Undertake weed control as required using removal methods that would not impact on the species (hand pull or cut and paint weeds).</p> <p>Undertake targeted searches for the species in known or potential habitat during its flowering period prior to any clearing or development.</p>
Conclusion	The proposed activity does not affect any individuals or populations of this species. The proposed activity is not inconsistent with these priority actions.
Criterion	(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.
Response	<p>Potential habitat removal is permanent, yet no individuals or populations have been identified.</p> <p>The proposed action constitutes the Key Threatening Process 'Clearing of native vegetation'.</p>
Conclusion	Given that no individuals of these species will be removed, the proposed activity it is unlikely to result in an increase in the impact of this KTP on these species.

Overall Conclusion

No individual species were identified during survey and targeted searches for threatened flora. While the proposed activity will permanently remove approximately 2.54 ha of vegetation that identified as potential habitat, these species are not considered to be present nor affected.

Species Name: *Senecio spathulatus* (Coastal Groundsel)

Criterion	(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction
Response	The study area contains potential former coastal foredune habitat that although heavily disturbed, may provide potential habitat for this species. Removal of vegetation and habitat is permanent. No individuals of this species were identified during field surveys and targeted searches.
Conclusion	Given that no individuals of this species will be removed, the proposed activity is unlikely to have an adverse effect on the life cycle of the species.
Criterion	(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction
Response	Not applicable.
Conclusion	Not applicable.
Criterion	(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction
Response	Not applicable.
Conclusion	Not applicable.
Criterion	(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction
Response	Not applicable.
Conclusion	Not applicable.

Criterion	(d) in relation to the habitat of a threatened species, population or ecological community:
	(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed
Response	Other areas of better quality known and potential habitat for this species occurs in the region. The proposed activity will remove potential habitat of this species, however no populations or individuals have been recorded on the site.
Conclusion	It is unlikely there will be any impacts to known habitat as a result of the proposed action.
Criterion	(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action
Response	Potential habitat for this species has been identified in the study area, however no individuals were identified during detailed targeted survey. Clearing or disturbance of potential habitat, up to 2.54 ha, may be required in vegetated areas. The proposed activity will marginally increase the distance between remaining potential habitat areas.
Conclusion	It is unlikely that any known habitat will become more isolated or fragmented from other areas of known habitat.
Criterion	(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.
Response	Other areas of known and potential habitat for this species occurs in the locality. Potential habitat for this species has been identified in the study area, however it is highly disturbed and no individuals were identified during detailed targeted survey.
Conclusion	Given that no individuals of this species are present on site, it is unlikely the potential habitat to be removed is important to the long-term survival of the species.
Criterion	(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).
Response	No critical habitat has been declared for this species.
Conclusion	Not applicable.

Criterion	(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.
Response	<p>No recovery plan has been developed for Coastal Groundsel, but four priority actions have been identified:</p> <p>Searches should be conducted in suitable habitat in proposed development areas.</p> <p>Position beach access tracks away from Coast Groundsel sites.</p> <p>Do not permit vehicle access in known or suspected Coast Groundsel habitat.</p> <p>Undertake Bitou Bush control in known or suspected Coast Groundsel habitat.</p>
Conclusion	The proposed activity does not affect any individuals or populations of this species. The proposed activity is not inconsistent with these priority actions.
Criterion	(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.
Response	<p>Potential habitat removal is permanent, yet no individuals or populations have been identified.</p> <p>The proposed action constitutes the Key Threatening Process 'Clearing of native vegetation'.</p>
Conclusion	Given that no individuals of this species will be removed, the proposed activity it is unlikely to result in an increase in the impact of this KTP on this species.

Overall Conclusion

No individual species were identified during survey and targeted searches for threatened flora. While the proposed activity will permanently remove approximately 2.54 ha of vegetation that identified as poor quality potential habitat, the species is not considered to be present nor affected.

Species Name: *Litoria aurea* (Green and Golden Bell Frog)

Criterion	(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction
Response	<p>There is a small area of wetland habitat (0.45ha) in the study area. This wetland is isolated from other areas of potential habitat nearby by high levels of disturbance and barrier effects due to high density urban development and major roads, such as Southern Cross Dr and General Holmes Dr.</p> <p>The proposed development would not directly impact the wetland and appropriate sediment control measures will be put in place prior to the onset of any works.</p> <p>Due to the impacted nature of the Study Area and the locations of other areas of potential habitat, the proposal would not impede movement pathways for the Green and Golden Bell Frog.</p>
Conclusion	It is unlikely that the proposal is of a sufficient scale to place a viable local population of the Green and Golden Bell Frog, if it remains extant, at risk of extinction.
Criterion	(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction
Response	Not applicable.
Conclusion	Not applicable.
Criterion	(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
	(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction
Response	Not applicable.
Conclusion	Not applicable.
Criterion	(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction
Response	Not applicable.
Conclusion	Not applicable.

Criterion	(d) in relation to the habitat of a threatened species, population or ecological community: (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed
Response	No habitat for the Green and Golden Bell Frog would be removed by the proposal. Due to the disturbed vegetation in the majority of the study area and the urbanised context of the locality, no habitat would be modified by the proposal.
Conclusion	It is unlikely there will be any impacts to known habitat as a result of the proposed action.
Criterion	(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action
Response	The proposal would occur in an area already highly impacted by urban development. Major roads already fragment areas of potential Green and Golden Bell Frog habitat in and adjacent to the study area. The proposed road construction would not further isolate any areas of potential habitat.
Conclusion	It is unlikely that any known habitat will become more isolated or fragmented from other areas of known habitat.
Criterion	(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.
Response	No habitat would be removed, modified, fragmented or isolated by the proposal. However, if the Green and Golden Bell Frog is extant in proximity to the study area, all these habitat areas would be important to the survival of the species in the locality.
Conclusion	Given that no individuals of this species are present on site and no habitat will be removed, the proposal is unlikely to affect the long-term survival of the species.
Criterion	(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).
Response	No critical habitat has been declared for this species.
Conclusion	Not applicable.

Criterion	(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.
Response	<p>A draft recovery plan has been developed for Green and Golden Bell Frog (DECC 2005). The main objectives of the recovery plan are:</p> <p>Increase the security of key Green and Golden Bell Frog (GGBF) populations by way of preventing the further loss of GGBF habitat at key populations and secure opportunities for increasing protection of habitat areas.</p> <p>Ensure extant GGBF populations are managed to eliminate or attenuate the operation of factors that are known or discovered to be detrimentally affecting the species.</p> <p>Implement habitat management initiatives.</p> <p>Establish self sustaining and representative captive populations.</p> <p>Increase the level of regional and local awareness of the conservation status of the GGBF.</p> <p>The study area or proximate habitat (e.g. the Engine Pond) are not regarded as supporting a key population of the Green and Golden Bell Frog (DECC 2005).</p>
Conclusion	The proposed activity does not interfere with the objectives of the draft recovery plan.
Criterion	(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.
Response	<p>The following KTPs are considered relevant to the Green and Golden Bell Frog:</p> <p>Predation by the introduced Plague Minnow or Mosquito Fish <i>Gambusia holbrooki</i>.</p> <p>Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands.</p> <p>Amphibian chytridiomycosis.</p> <p>Clearing of Native Vegetation.</p> <p>Predation of the European Red Fox <i>Vulpes vulpes</i>(Linnaeus, 1758).</p> <p>The proposal would not introduce or increase of the impact of these KTPs because:</p> <p>It would not cause the introduction or increase the presence of Mosquito Fish.</p> <p>It was recommended that stormwater runoff from the road construction be managed to ensure that the hydrological conditions of the wetland be maintained, including periodic drying to prevent the colonisation of Mosquito Fish.</p> <p>It would not cause the introduction of Amphibian chytridiomycosis.</p> <p>The vegetation in the study area is highly disturbed and could not be considered native vegetation. It is recommended that the disturbed vegetation remaining be rehabilitated with suitable native species endemic to the area.</p> <p>The study area is highly urbanised it is unlikely that the Red Fox is present. The proposal would not result in the introduction of this species.</p>
Conclusion	The proposed activity is unlikely to result in an increase in the impact of any of these KTPs on this species.

Overall Conclusion

It is unlikely that the proposed actions will have any negative impact on any local population of the green and golden bell frog. A Species Impact Statement is not required for the GGBF.

Species Name: *Pteropus poliocephalus* (Grey-headed Flying-fox)

Criterion	(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction
Response	<p>The proposal would require the removal of some street trees to permit road widening and possibly the removal of a small number of Coast Banksias within Site 2.</p> <p>The exact number of trees to be removed has not been determined at this stage, but a significant foraging resource would not be affected. Post-construction revegetation and restoration would incorporate using local native species including species in the families Proteaceae and Myrtaceae.</p> <p>The proposal would not affect a Grey-headed Flying-fox roost site or interfere with breeding activity.</p>
Conclusion	With these considerations in mind, it is unlikely that the proposal is of a sufficient scale to place a viable local population of the Grey-headed Flying-fox at risk of extinction.
Criterion	(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction
Response	Not applicable.
Conclusion	Not applicable.
Criterion	(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
	(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction
Response	Not applicable.
Conclusion	Not applicable.
Criterion	(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction
Response	Not applicable.
Conclusion	Not applicable.

Criterion	(d) in relation to the habitat of a threatened species, population or ecological community:
	(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed
Response	<p>The habitat in the study area is highly disturbed and weed-dominated.</p> <p>The proposal would require the removal of a small number of nectar-producing trees to permit road widening and the construction of the Botany Road fly-over and link to General Holmes Drive.</p> <p>The number of trees to be removed has not yet been determined pending a final detailed design, however, the extent of tree removal would be relatively minor.</p> <p>The Grey-headed Flying-fox is a highly mobile species.</p>
Conclusion	It is highly unlikely any potential Grey-headed Flying-fox habitat will become fragmented or isolated as a result of the proposed action.
Criterion	(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action
Response	<p>Potential habitat for this species has been identified in the study area, however no individuals were identified during detailed targeted survey.</p> <p>Clearing or disturbance of potential habitat, about 3.4 ha, may be required in vegetated areas.</p> <p>The proposed activity will marginally increase the distance between remaining potential habitat areas.</p>
Conclusion	It is unlikely that any known habitat will become more isolated or fragmented from other areas of known habitat.
Criterion	(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.
Response	<p>The amount of habitat that would be removed by the proposed development is very small.</p> <p>Due to the disturbed nature of the study area, the affected habitat consists of individual trees rather than an area(s) of continuous habitat. Therefore, the proposal would not affect the long-term viability of the Grey-headed Flying-fox in the locality.</p>
Conclusion	The habitat to be removed/modified as a result of the proposal is likely to have little importance to the long-term survival of this species.
Criterion	(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).
Response	No critical habitat has been declared for this species.
Conclusion	Not applicable.

Criterion	(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.
Response	A draft recovery plan for the grey-headed flying-fox was developed in 2009 (DECCW, 2009). The main objectives of the recovery plan are: Reduce the impact of threatening processes. Conserve their functional role as seed dispersers and pollinators. Improve information available to guide recovery plan.
Conclusion	Given the small extent of potential foraging habitat to be potentially removed/modified, the proposal is unlikely to negatively impact on the objectives of the recovery plan.
Criterion	(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.
Response	The proposed action constitutes the Key Threatening Process 'Clearing of native vegetation'.
Conclusion	The small extent of habitat loss would not increase the operation of the threat of land clearing on the Grey-headed Flying-fox in this locality.

Overall Conclusion

It is unlikely that the proposed actions will have any negative impact on any local population of the grey-headed flying-fox. A Species Impact Statement is not required for the Grey-headed Flying-fox.

Appendix 6: EPBC Act assessments of significance

NOTE:

In assessing Matters of National Environmental Significance (MNES) associated with impact or potential impact on:

- Wetlands of international importance³
- Listed threatened species and communities⁴
- Listed migratory species⁵

These/this assessment(s) may have been undertaken with prescribed designated mitigation measures that form part of the 'Action⁶'. The effect of which is that these mitigation measures become a mandatory obligation based on Consent Authority approval to proceed.

³ As detailed in Subdivision B, Division 1, Part 3 of the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

⁴ As detailed in Subdivision C, Division 1, Part 3 of the EPBC Act

⁵ As detailed in Subdivision D, Division 1, Part 3 of the EPBC Act

⁶ Action is as detailed in Section 523 of the EPBC Act

Species Names: *Acacia terminalis* subsp. *terminalis* (Sunshine Wattle) - E, *Persoonia hirsuta* (Hairy Geebung) - E, *Pterostylis* sp. Botany Bay (Botany Bay Bearded Orchid) – E.

Criterion	An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:
Response	These species are known to occur in coastal heath communities which occur in the study area. Vegetation on site is degraded. No individuals of these species were recorded in the study area during field survey and targeted searches.
Conclusion	Given that no individuals of these species occur on the site, the proposed action is not likely to have a significant impact on these species leading to a long-term decrease in the size of a population.
Criterion	ii. reduce the area of occupancy of the species
Response	2.54 ha of potential habitat for these species is proposed to be removed in the study area. These species will not be able to occupy the study area after the proposed activity.
Conclusion	Given that no individuals of these species occur on the site, the proposed action is not likely to have a significant impact on these species leading to a reduction in the area of occupancy of these species.
Criterion	iii. fragment an existing population into two or more populations
Response	No critically endangered or endangered species' populations were recorded in the study area following field survey and targeted searches. There are no records of these species in the study area and no other existing records of these species are known to occur in close proximity to the site.
Conclusion	The proposed activity is unlikely to fragment an existing population into two or more populations.
Criterion	iv. adversely affect habitat critical to the survival of a species
Response	No critical habitat has been declared for these species.
Conclusion	The proposed activity is unlikely to adversely affect habitat critical to the survival of these species.
Criterion	v. disrupt the breeding cycle of a population
Response	No critically endangered or endangered species' populations were recorded on the study area following extensive targeted searches.
Conclusion	Given that no individuals of these species will be removed, is unlikely to disrupt the breeding cycle of a population of these species.

Criterion	vi. modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
Response	<p>2.54 ha of poor to moderate quality potential habitat within study area will be removed.</p> <p>These species is known to occur in coastal heath vegetation communities which occur in the study area.</p> <p>These species were not recorded in the study area during field survey and targeted searches.</p>
Conclusion	Although there will be some removal of potential habitat, is unlikely to be to the extent that these species are likely to decline as no individuals or populations were found in the study area.
Criterion	vii. result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat
Response	<p>The proposal has the potential to aid the spread of weeds due to the movement and/or introduction of soil, vehicles and equipment.</p> <p>A Site Erosion and Sediment Control Plan or Soil Water Management Plan, in accordance with the Blue Book, is to be implemented for the proposal.</p> <p>Weed, stormwater and pest management activities should be implemented as part of the environmental management framework for the site.</p>
Conclusion	It is unlikely that the proposed action will result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat.
Criterion	viii. introduce disease that may cause the species to decline
Response	<p>The study area is potentially infected with <i>Phytophthora cinnamomi</i>.</p> <p>This species is potentially susceptible to <i>Phytophthora</i> infection since it has been recorded in the vicinity of known <i>Phytophthora</i> infection.</p> <p>Habitat disturbance may aid the spread of <i>Phytophthora</i>.</p> <p>Controls on the movement of vehicles, and human traffic into native vegetation habitat will be implemented.</p> <p>Follow protocol to prevent introduction or spread of <i>Phytophthora cinnamomi</i>, either Sydney Region Pest Management Strategy or Best Practice Guidelines for <i>Phytophthora cinnamomi</i> (DECC 2008).</p> <p>The proposed management controls for <i>Phytophthora</i> will reduce the risk of spread of this pathogen.</p>
Conclusion	It is unlikely that the proposed action will introduce disease that may cause these species to decline.

Criteria	ix. interfere with the recovery of the species
Response	The proposed activity will result in the removal of 2.54 ha of poor to moderate quality vegetation on the subject site. Proposed habitat loss is not consistent with the recovery plan for these species. No individuals of these species were observed in the study area.
Conclusion	The proposed activity is unlikely to interfere with the recovery of these species.

Overall Conclusion

The proposed activity will permanently remove approximately 2.54 ha of vegetation, which provides potential habitat for these species. However, despite targeted surveys, no individuals of these species were located within the study area. While it is unlikely these species are present, mitigation measures have been proposed to protect potential habitat and reduce threats. The proposed activity is unlikely to have a significant impact on these endangered species.

Referral to Department of Environment is not required.

Species: *Cryptostylis hunteriana* (Leafless Tongue-orchid) – V, *Tetratheca juncea* (Black-eyed Susan) - V

Criterion	An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:
	i. lead to a long-term decrease in the size of an important population of a species
Response	These species are known to occur in the coastal heath vegetation communities that occur in the study area. Vegetation on site is degraded. No important populations of these species have been identified in relation to the study area.
Conclusion	The proposal will not lead to a long-term decrease in the size of an important population of these species.
Criterion	ii. reduce the area of occupancy of an important population
Response	There are no records of these species close to the study area, and no specimens were found after targeted surveys for these species on the study area. No important populations of these species have been identified in relation to the study area.
Conclusion	The proposal will not reduce the extent of area of occupancy of an important population of these species.
Criterion	iii. fragment an existing important population into two or more populations
Response	There are no records of these species close to the study area, and no specimens were found after targeted surveys for these species on the study area. Potential habitat to be removed is in an already degraded, fragmented, urbanised area bounded by roads, residential and industrial development.
Conclusion	The proposal will not fragment an existing population into two or more populations.
Criterion	iv. adversely affect habitat critical to the survival of a species
Response	No critical habitat has been declared for these species.
Conclusion	The proposal will not adversely affect habitat critical to the survival of these species.
Criterion	v. disrupt the breeding cycle of an important populations
Response	No important populations of these species have been identified in relation to the study area.
Conclusion	The proposal will not adversely affect the breeding cycle of an important population of these species.

Criterion	vi. modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
Response	<p>2.54 ha of poor to moderate quality potential habitat within the study area will be removed.</p> <p>These species are known to occur in the coastal heath communities that occur in the study area.</p> <p>These species were not recorded in the study area during field survey and targeted searches.</p>
Conclusion	Although there will be some removal of potential habitat, is unlikely to be to the extent that these species are likely to decline as no individuals or populations were found in the study area.
Criterion	vii. result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat
Response	<p>The proposal has the potential to aid the spread of weeds due to the movement and/or introduction of soil, vehicles and equipment.</p> <p>A Site Erosion and Sediment Control Plan or Soil Water Management Plan, in accordance with the Blue Book, is to be implemented for the proposal.</p> <p>Weed, stormwater and pest management activities should be implemented as part of the environmental management framework for the site.</p>
Conclusion	The proposed actions are unlikely to result in the spread of invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.
Criterion	viii. introduce disease that may cause the species to decline
Response	<p>The study area is potential infected with <i>Phytophthora cinnamomi</i></p> <p>Habitat disturbance may aid the spread of <i>Phytophthora</i>.</p> <p>Controls on the movement of vehicles, and human traffic into vegetation habitat.</p> <p>Follow protocol to prevent introduction or spread of <i>Phytophthora cinnamomi</i>, either Sydney Region Pest Management Strategy or Best Practice Guidelines for <i>Phytophthora cinnamomi</i> (DECC 2008).</p> <p>The proposed management controls for <i>Phytophthora</i> will reduce the risk of spread this pathogen.</p>
Conclusion	The proposed activity is unlikely to spread a pathogen with potential to cause these species to decline.

Criterion	ix. interfere substantially with the recovery of the species
Response	<p>Recovery Plans have been prepared for some of these species.</p> <p>Threats that have been identified that interfere with the recovery of these species, which are relevant to the proposed activity include vegetation removal.</p> <p>Approximately 2.54 ha of potential habitat will be removed.</p> <p>Proposed habitat loss is not consistent with the recovery plans or activities for these species.</p> <p>None of these species have been observed in the study area.</p>
Conclusion	The proposed activity is unlikely to interfere with the recovery of these species.

Overall Conclusion

The proposed activity will permanently remove approximately 2.54 ha of vegetation, which provides potential habitat for these species. However, despite targeted surveys, these species were not located within the study area. While it is unlikely these species are present, mitigation measures have been proposed to protect potential habitat and reduce threats. The proposed activity is unlikely to have a significant impact on these vulnerable species.

Referral to Department of Environment is not required.

Species: *Litoria aurea* (Green and Golden Bell Frog) – V

Criterion	<p>There is a possibility of a significant impact on the green and golden bell frog if the action results in:</p> <p>i. the removal or degradation of aquatic or ephemeral habitat either where the GGBF has been recorded since 1995 or habitat that has been assessed as being suitable.</p>
Response	<p>Approximately 0.45 ha of potential GGBF habitat occurs within the study area. The proposal does not require the removal of the wetland in the study area identified as potential GGBF habitat.</p>
Conclusion	<p>The proposal will not result in the removal of GGBF habitat.</p>
Criterion	<p>ii. the removal or degradation of terrestrial habitat within 200 metres of habitat identified in (i).</p>
Response	<p>Approximately 3.4ha of disturbed terrestrial vegetation will be removed as a result of the proposal.</p> <p>Clearing would occur within 200 m of the wetland identified in (i). However, the land on which the clearing would occur is highly disturbed and the vegetation is dominated by exotic species with an approximate native cover of 5%.</p> <p>It is proposed to rehabilitate the area that would remain between the wetland and the development footprint with native vegetation and incorporating structures such as rock and logs that provide shelter sites for the GGBF.</p>
Conclusion	<p>There will be some removal of already degraded terrestrial habitat within 200 metres of habitat identified in (i).</p>
Criterion	<p>iii. breaking the continuity of vegetation fringing ephemeral or permanent waterways or other vegetated corridors linking habitats meeting the criteria in (i).</p>
Response	<p>Clearing for the proposed development would occur to the north of the wetland identified in (i).</p> <p>Proximate areas of habitat for the GGBF are to the east and south.</p> <p>While some minor road widening would also occur in these directions, this would occur along existing major roads, such as Southern Cross Drive and General Holmes Drive. These roads are already sufficient to prevent movement by the GGBF. Thus, the proposal would not break the continuity of any vegetated linkages between areas of habitat.</p>
Conclusion	<p>The action will not result in a break to the continuity of vegetation fringing ephemeral or permanent waterways or other vegetated corridors linking habitats meeting the criteria in (i).</p>

Criterion	An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:
	iv. lead to a long-term decrease in the size of an important population of a species
Response	The study area is proximate to a much broader area considered to be habitat for the Lower Cooks River key population (DECC 2005). The study area or nearby habitat (e.g. the Engine Pond) are not regarded as supporting a key population of the Green and Golden Bell Frog (DECC 2005). No habitat will be removed as a result of the proposal.
Conclusion	The proposal will not lead to a long-term decrease in the size of an important population of this species.
Criterion	v. reduce the area of occupancy of an important population
Response	Approximately 0.45 ha of potential GGBF habitat occurs within the study area. The proposal does not require the removal of the wetland in the study area identified as potential GGBF habitat.
Conclusion	The proposal will not reduce the extent of area of occupancy of an important population of this species.
Criterion	vi. fragment an existing important population into two or more populations
Response	While some minor road widening would also occur as a result of the proposal, this would occur along existing major roads, such as Southern Cross Drive and General Holmes Drive. These roads are already sufficient to prevent movement by the GGBF. Thus, the proposal would not result in fragmenting an existing population.
Conclusion	The proposal will not fragment an existing population into two or more populations.
Criterion	vii. adversely affect habitat critical to the survival of a species
Response	No critical habitat has been declared for these species. The proposal does not require removal of potential GGBF habitat. Larger areas of better quality habitat occur elsewhere in the locality.
Conclusion	The proposal will not adversely affect habitat critical to the survival of this species.
Criterion	viii. disrupt the breeding cycle of an important populations
Response	There are no records of GGBF from within the study area. It is likely that most of the locations where the GGBF has been recorded in the locality are isolated from the study area. The proposal does not require removal of potential GGBF habitat.
Conclusion	The proposal will not adversely affect the breeding cycle of an important population of this species.

Criterion	ix. modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
Response	<p>There are no records of GGBF from within the study area.</p> <p>It is likely that most of the locations where the GGBF has been recorded in the locality are isolated from the study area.</p> <p>The proposal does not require removal of potential GGBF habitat.</p>
Conclusion	Although there will be some removal of disturbed terrestrial vegetation, it is unlikely to affect the quality of GGBF habitat to the extent that these species are likely to decline.
Criterion	x. result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat
Response	<p>The proposal would not cause the introduction or increase the presence of Mosquito Fish.</p> <p>It is recommended that stormwater runoff from the road construction be managed to ensure that the hydrological conditions of the wetland are maintained, including periodic drying to prevent the colonisation of Mosquito Fish.</p> <p>The vegetation in the study area is highly disturbed. It is recommended that the disturbed vegetation remaining be rehabilitated with suitable native species endemic to the area.</p>
Conclusion	The proposed actions are unlikely to result in the spread of invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.
Criterion	xi. introduce disease that may cause the species to decline
Response	<p>The proposal would not cause the introduction of Amphibian chytridiomycosis.</p> <p>A hygiene protocol would be adopted to prevent potential spread of disease.</p>
Conclusion	The proposed activity is unlikely to introduce disease with potential to cause these species to decline.

Criterion	xii. interfere substantially with the recovery of the species
Response	<p>A draft recovery plan has been developed for Green and Golden Bell Frog (DECC 2005). The main objectives of the recovery plan are:</p> <p>Increase the security of key GGBF populations by way of preventing the further loss of GGBF habitat at key populations and secure opportunities for increasing protection of habitat areas.</p> <p>Ensure extant GGBF populations are managed to eliminate or attenuate the operation of factors that are known or discovered to be detrimentally affecting the species.</p> <p>Implement habitat management initiatives.</p> <p>Establish self sustaining and representative captive populations.</p> <p>Increase the level of regional and local awareness of the conservation status of the GGBF.</p> <p>The study area or nearby habitat (e.g. the Engine Pond, around 575m south-west of the freshwater wetland) are not regarded as supporting a key population of the Green and Golden Bell Frog (DECC 2005).</p>
Conclusion	The proposed activity is unlikely to interfere with the recovery of this species.

Overall Conclusion

The proposed development is not considered to negatively impact on the Green and Golden Bell Frog. This is because the proposal would not directly or indirectly impact on potential living and breeding habitat for this species despite development activities occurring within 200 m of a potential wetland habitat, nor would it affect dispersal opportunities, which are already very poor. Referral to Department of Environment is not required.

Species: *Pteropus poliocephalus* (Grey-headed Flying-fox) – V

Criterion	<p>An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:</p> <p>i. lead to a long-term decrease in the size of an important population of a species</p>
Response	<p>The study area is highly urbanised and supports a minor amount of foraging resources.</p> <p>A small proportion of nectar-producing trees may be removed from the study area, but the precise number is yet to be determined.</p> <p>Post-construction revegetation and restoration would incorporate using local native species including species in the families Proteaceae and Myrtaceae.</p> <p>There are no roost sites in or proximate to the study area.</p>
Conclusion	<p>The proposal will not lead to a long-term decrease in the size of an important population of this species.</p>
Criterion	<p>ii. reduce the area of occupancy of an important population</p>
Response	<p>The study area is highly urbanised and supports a minor amount of foraging resources.</p> <p>A small proportion of nectar-producing trees may be removed from the study area, but the precise number is yet to be determined.</p> <p>Post-construction revegetation and restoration would incorporate using local native species including species in the families Proteaceae and Myrtaceae.</p> <p>There are no roost sites in or proximate to the study area.</p>
Conclusion	<p>The proposal will not reduce the extent of area of occupancy of an important population of this species.</p>
Criterion	<p>iii. fragment an existing important population into two or more populations</p>
Response	<p>The Grey-headed Flying-fox is a highly mobile species that can fly long distances to reach seasonal foraging resources.</p>
Conclusion	<p>The proposal will not fragment an existing population into two or more populations.</p>
Criterion	<p>iv. adversely affect habitat critical to the survival of a species</p>
Response	<p>No critical habitat has been declared for these species.</p>
Conclusion	<p>The proposal will not adversely affect habitat critical to the survival of this species.</p>
Criterion	<p>v. disrupt the breeding cycle of an important populations</p>
Response	<p>There are no roost sites in the study area and only a minor foraging resource is present.</p>
Conclusion	<p>The proposal will not adversely affect the breeding cycle of an important population of this species.</p>

Criterion	vi. modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
Response	Habitat on the site is highly modified with only a small amount of feed tree species. The Grey-headed Flying-fox is a highly mobile species that can fly long distances to reach seasonal foraging resources.
Conclusion	Although there will be some removal of potential foraging habitat, is unlikely to be to the extent that these species are likely to decline.
Criterion	vii. result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat
Response	The proposal would not cause the establishment of an invasive species. Invasive species, such as the Red Fox (<i>Vulpes vulpes</i>) may already be present in the study area, but it is not likely to affect the Grey-headed Flying-fox.
Conclusion	The proposed actions are unlikely to result in the spread of invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.
Criterion	viii. introduce disease that may cause the species to decline
Response	The proposed works do not involve procedures that are likely to increase the potential for introduction of diseases that may affect the Grey-headed Flying-fox.
Conclusion	The proposed activity is unlikely to introduce disease with potential to cause these species to decline.
Criterion	ix. interfere substantially with the recovery of the species
Response	The proposal would not have a significant impact on the foraging resources of the Grey-headed Flying-fox. Any impact would be offset at a minimum ratio of 5:1. No roost sites are present within the study area.
Conclusion	The proposed activity is unlikely to interfere with the recovery of this species.

Overall Conclusion

The proposed development is not considered to negatively impact on the Grey-headed Flying-fox. This is due to the low value of the potential habitat and the lack roosting or feeding resources within the study area.

Referral to Department of Environment is not required.

Species Name: Fork-tailed Kite and White-throated Needletail

Criterion	<p>An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:</p> <p>i. substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species</p>
Response	<p>The Study Area is highly modified and occurs in a heavily urbanised context. The majority of vegetation is highly disturbed and weed dominated. Use of the study area by the Fork-tailed Swift and White-throated Needletail would be rare. Part of the study area would be impacted by the proposal, but the remainder would be retained and rehabilitated.</p>
Conclusion	<p>Given the degraded state of the study area and its infrequency of use, the proposal would not substantially modify, destroy or isolate an important area of habitat for the Fork-tailed Swift or the White-throated Needletail.</p>
Criterion	<p>ii. result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species</p>
Response	<p>The proposal would not cause the establishment of an invasive species. Invasion species, such as the Red Fox (<i>Vulpes vulpes</i>) may already be present in the study area, but it is not likely to affect these species.</p>
Conclusion	<p>The proposed actions are unlikely to result in an invasive species that is harmful to one of the migratory species becoming established in an area of important habitat for the migratory species.</p>
Criterion	<p>iii. seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species</p>
Response	<p>Use of the study area by the Fork-tailed Swift and White-throated Needletail would be rare and would not involve an ecologically significant proportion of their populations.</p> <p>Both species breed in the northern hemisphere.</p>
Conclusion	<p>It is highly unlikely that the proposed actions will disrupt the lifecycle of an ecologically significant proportion of the population of these migratory species.</p>

Overall Conclusion

As the study site provides only intermittent suitable habitat it is considered that the proposal will not have a significant impact on these migratory species.

Referral to Department of Environment is not required.

Appendix 7: Site photos



Site 2



Site 5



Site 3



Site 6



Site 4



Site 7



Site 8



Site 11



Site 9



Site 13



Site 10



Site 14



Site 15



Site 16