



## Transport Access Program

Transport for New South Wales

Ecological Impact Assessment for the Berala Station Upgrade

5 February 2016



## Transport Access Program

Project no:  
Document title: Ecological Impact Assessment for Berala Station Upgrade  
Document No.: Final  
Revision: Rev02  
Date: 5 February 2016  
Client name: Transport for New South Wales  
Client no:  
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File name: \\Jacobs.com\SYDProjects\ENVR\Projects\IA078900\Berala\Berala Ecological Impact Assessment.docx

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### Document history and status

Revision	Date	Description	By	Review	Approved
0	18/01/2016	Draft	L Clews B Hays	C Thomson	C Thomson
1	27/01/2016	Revision 1	L Clews	C Thomson	C Thomson
2	05/02/2016	Final	L Clews	C Thomson	C Thomson

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## 1. Introduction

### 1.1 Background and purpose

As part of the Transport Access Program (TAP), Transport for NSW (TfNSW), the proponent of this program, is preparing a Review of Environmental Factors (REF) for the Berala Station Upgrade (the Proposal), under Part 5 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) and the provisions of the *State Environmental Planning Policy (Infrastructure) 2007*. The TAP is a government initiative to provide a better experience for public transport customers by delivering accessible, modern, secure and integrated transport infrastructure. This may include installation of lifts, family accessible toilets and canopies for weather protection at train stations; along with other interchange improvements like bicycle facilities, kiss and ride zones and commuter car parking.

The Proposal includes:

- installation of a lift from the underpass level to the station platform level
- extension of the existing platform canopy to the new lift
- demolition of the existing ticket office
- refurbishment of existing platform building to include a family accessible toilet, staff office and amenities
- provision of interchange facilities along Campbell Street including formal kiss and ride zones, two accessible parking spaces on Campbell Street and an upgraded bus shelter
- installation of sheltered bicycle racks at the Campbell Street entrance
- ancillary works including adjustments to lighting and ticketing machines, improvements to station communication systems with new infrastructure (including additional CCTV cameras) and improved wayfinding signage.

A temporary construction compound would be required to accommodate a site office, amenities, laydown and storage area for materials. The following two locations are being considered for the location of the construction compound:

- Compound 1 - approximately 14 metres south-west of the station platform. The site is primarily on land owned by RailCorp (Lot 2 DP 803675) and partially within the road reserve managed by Auburn City Council
- Compound 2 - approximately 25 metres north-east of the station platform on land owned by RailCorp (Lot 2 DP 803675).

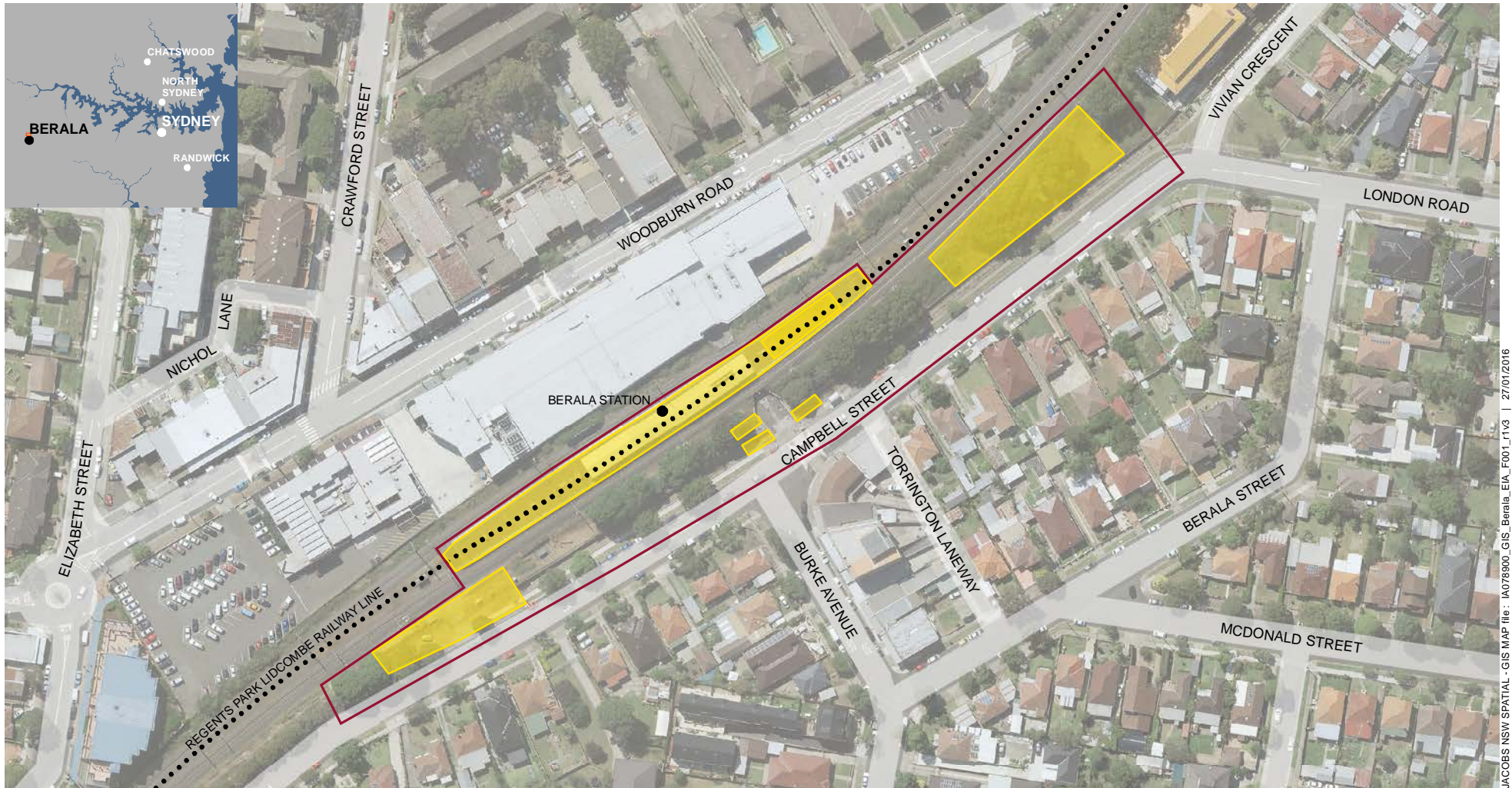
A temporary storage/laydown area would also be established on the station platform.

The purpose of this report is to present the findings of an Ecological Impact Assessment undertaken within the Berala Station study area (refer to Figure 1.1) to assess the potential impacts of the Berala Station Upgrade on flora and fauna.

### 1.2 Assessment aims

This Ecological Impact Assessment report aims to:

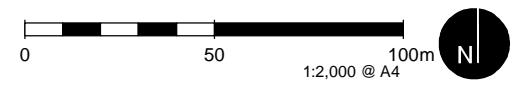
- identify the occurrence, or likelihood of occurrence of threatened species, populations and communities listed under the *Threatened Species Conservation Act 1995* (TSC Act) and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) within the area subject to the activity
- present data in sufficient detail to allow the potential impact of works at the study area to be quantified
- assess the significance of potential impacts to threatened biodiversity
- ensure the biodiversity values of the study area are protected from the effects of works (as much as is practicable)
- outline a mitigation strategy to minimise impacts to biodiversity as required.



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**Legend**

- Study area
- Proposal site



**Figure 1-1** | Site locality and study area

Data sources  
Jacobs 2015, Ausimage 2015, Land and Property Information 2014

## 2. Methodology

### 2.1 Personnel

Ecological surveys were conducted in the study area over one day by Lukas Clews, a Jacobs Senior Ecologist. Jacobs ecologists are licensed to conduct field surveys under the *National Parks and Wildlife Act 1974* (Scientific Research Permit SL100044) and hold ethical approval to conduct research by the Department of Primary Industries Animal Care and Ethics Committee (Animal Research Authority (09/1895)). An outline of the contributors to this assessment is provided in Table 2.1.

Table 2.1 : Contributors and qualifications

Team member	Qualifications	Role
Lukas Clews	Master of Scientific Studies, Diploma of Conservation and Land Management (general land management), Graduate Certificate in Applied Science, Bachelor of Science	Project Manager, Senior Ecologist – field survey and reporting
Brenton Hays	Bachelor of Environmental Science	Ecologist – reporting and database review
Chris Thomson	Bachelor of Applied Science (Coastal Management), Graduate Certificate in Natural Resources	Associate Ecologist, Technical review

### 2.2 Desktop Assessment

Prior to the commencement of fieldwork, a database search and literature review was completed. Relevant and available documents were reviewed for information on past land uses and presence of vegetation communities and flora and fauna. Relevant databases were searched for records of threatened species within a five kilometre radius search area around the study area. This review was used to prepare a list of threatened species and communities likely to occur in the study area and locality. The following sources of information were consulted:

- EPBC Act Protected Matters Search Tool (PMST) (five kilometre radius around study area) - Department of Environment (DoE)
- DoE Species Profile and Threats (SPRAT) database
- NSW Office of Environment and Heritage (OEH) Atlas of NSW Wildlife
- OEH Threatened species, populations and communities online search
- NSW Department of Primary Industries (Agriculture) noxious weed database
- PlantNet database (Royal Botanic Gardens)
- Aerial photographs (current and historic) and topographic maps
- Available vegetation mapping for the Sydney area (Office of Environment and Heritage 2013).

The review focused on identifying and listing the threatened flora and fauna species, populations and ecological communities previously recorded near the study area. Following collation of database records and species and community profiles a 'likelihood of occurrence' assessment was prepared with reference to the broad habitats contained within the study area. This was further refined following field surveys and assessment of habitat present.

### 2.3 Field Assessment

A one-day site inspection was undertaken of the study area on 8 January 2016 to identify flora and fauna, determine the nature of vegetation communities, the habitats present, and the likely impact of the works on biodiversity values. The site inspection focused on areas subject to the Proposal and a traverse was undertaken

outside of the rail corridor with opportunistic sightings of flora and fauna made to verify the ecological values and facilitate habitat condition assessments.

The purpose of the field assessment was to:

- identify flora species, populations and ecological communities, detailing suitability of habitat to support threatened fauna species
- identify and provide mapping of potential threatened and migratory species, populations and ecological communities listed under TSC Act, and EPBC Act
- assess and document important fauna and/or aquatic habitat (including hollow bearing trees, nectar producing plants, logs and bush rock), to be retained, mitigated or avoided
- assess the vegetation structure and floristics based on the number, percentage and type of ground cover/shrubs/mid-canopy and canopy cover present
- record dimensions, rating and status of existing trees likely to be affected by the Proposal and identify Tree Protection Zones (in line with relevant Australian standard)
- map the distribution and condition of native vegetation communities, where present, with particular regard to identifying threatened ecological communities in the study area
- identify the extent of weed invasion at each site including noxious weeds and occurrence of dieback
- locate potential local and regional wildlife corridors and their significance in relation to both study areas
- identify existing and potential indirect impacts to the ecological values.

The likely presence of threatened species was determined through habitat assessment, taking a precautionary approach likely to include species that are difficult to detect (i.e. cryptic species). A species was assumed to be present if suitable habitat was observed in the study area, and if that species was known to occur regionally. No detailed floristic surveys or fauna surveys were undertaken.

## **2.4 Determining the likelihood of occurrence of threatened species**

State and nationally listed threatened species identified from the background review were considered in terms of their likelihood to occur in the habitats present within the study area based on their identified habitat requirements. The results of this review are provided in Appendix B. The likelihood of occurrence for threatened species was classified according to the criteria described in Table 2.2.



Table 2.2 : Likelihood of occurrence includes one or more of the following criteria

Likelihood of occurrence	Criteria
Unlikely	Species not recorded during field surveys and fit one or more of the following criteria: <ul style="list-style-type: none"> <li>species highly restricted to certain geographical areas not within the works footprint</li> <li>specific habitat requirements are not present in the study area</li> </ul>
Low	Species not recorded during field surveys and fit one or more of the following criteria: <ul style="list-style-type: none"> <li>have not been recorded previously in the study area/surrounds and for which the study area is beyond the current distribution range</li> <li>use specific habitats or resources not present in the study area</li> <li>are a non-cryptic perennial flora species that were specifically targeted by surveys and not recorded</li> </ul>
Moderate	Species not recorded during the field surveys that fit one or more of the following criteria: <ul style="list-style-type: none"> <li>have infrequently been recorded previously in the study area/surrounds</li> <li>use specific habitats or resources present in the study area but in a poor or modified condition</li> <li>are unlikely to maintain sedentary populations, however may seasonally use resources within the study area opportunistically or during migration</li> <li>are cryptic flowering flora species that were not seasonally targeted by surveys and that have not been recorded</li> </ul>
High	Species recorded during the field surveys or species not recorded that fit one or more of the following criteria: <ul style="list-style-type: none"> <li>have frequently been recorded previously in the study area/surrounds</li> <li>use habitat types or resources that are present in the study area that are abundance and/or in good condition within the study area</li> <li>are known or likely to maintain resident populations surrounding the study area</li> <li>are known or likely to visit the site during regular seasonal movements or migration</li> </ul>

## 2.5 Significance assessments

Significance assessments were conducted for species, populations and communities that have been positively identified or that have a moderate or high potential to occur in the study area based on the above assessment criteria.

For threatened biodiversity listed under the TSC Act the threatened species assessment was undertaken as outlined under Section 5A of the EP&A Act (known as the 7-part test). The document *Threatened Species Assessment Guidelines: The Assessment of Significance* (Department of Environment and Climate Change 2007) outlines a set of guidelines to help applicants/proponents of a development or activity with interpreting and applying the factors of assessment in the 7-part test. The guidance provided by the Department of Environment and Climate Change (2007) has been used in this report.

For threatened biodiversity listed under the EPBC Act a significance assessment have been completed in accordance with the *Matters of National Environmental Significance Significant Impact Guidelines 1.1* (Department of the Environment 2013).

## 2.6 Limitations

The list of flora and fauna species recorded from this study should not be seen to be fully comprehensive, but rather an indication of the species present at the time of the survey. A period of several seasons or years is often needed to identify all the species present in an area, especially as some species are only apparent at certain times of the year e.g. orchids or migratory birds and require specific weather conditions for optimum detection e.g. frogs. The conclusions of this report are therefore based upon available data and the field surveys and are therefore merely indicative of the environmental condition of the site at the time of the survey. It should be recognised that site conditions, including the presence of threatened species, can change with time.

A precautionary approach was used with regards to presence of threatened species in areas of suitable habitat where there is insufficient evidence to discount the presence of the species due to seasonal limitations or other constraints. The rail corridor was not accessed during the field survey so the results are based on observation from outside the corridor and from train station platforms only. The identification of some species was not able to be confirmed as close inspection from within the rail corridor was not possible.

The tree assessment was visual and conducted from the ground only. No examination (below ground level) of tree roots was made. The inspection was limited to visual examination of the exterior of the trees without dissection, excavation, probing or coring. No internal inspections or tests were carried out. No tests or samples have been taken from the trees to determine tree health. Due to changing environmental conditions and circumstances in which trees grow, no tree can be considered absolutely safe and the assessments in this report should be used as a guide only. The trees assessed appeared healthy at the time of survey. The tree assessment should be considered preliminary in nature as no detailed tests or samples have been taken and no detailed inspection was undertaken by examining roots or by tree climbing to inspect the trees.

### 3. Existing environment

#### 3.1 Vegetation communities and fauna habitat

The study area is dominated by landscape plantings within the rail corridor and beside Campbell Street. Additionally, opportunistic vegetation (i.e. weeds) have established in the disturbed areas of the rail corridor. This vegetation was verified during the site visit (photos of the study area are provided in Appendix A). Importantly, no remnant native vegetation communities are present in the study area or immediate surrounds. The locality has been historically and comprehensively cleared of native vegetation with the closest native vegetation community being located approximately 1.4 kilometres to the west along the Duck River. No threatened ecological communities occur within or immediately surrounding the study area.

The planted trees within the study area are a mixture of species commonly planted as street trees and landscape plantings in the Sydney region including *Lophostemon confertus* (Brush Box), *Platanus X acerifolia* (London Plane Tree), *Fraxinus* sp. (Ash), *Jacaranda mimosifolia* (Jacaranda), *Cinnamomum camphora* (Camphor laurel), *Melaleuca styphelioides* (Prickly-leaved Tea Tree), and *Callistemon* sp. (Bottle Brush) (refer to Appendix A for photos). Other trees including palms (likely to be *Archontophoenix alexandrae* (Alexandra palm), *Morus* sp. (Mulberry), *Caesalpinia* sp., and a *Paulownia* sp. are present (refer to Appendix A for photos). Not all trees were able to be identified definitively as the rail corridor was not accessed. Therefore close inspection of the trees features was not possible and samples could not be taken.

The understorey vegetation is exotic. Herbaceous and grass weeds are present growing amongst the ballast on the rail line, down the corridor slope and to the drainage channel adjacent to Campbell Street. The ground layer is dominated by *Chloris gayana* (Rhodes Grass), *Paspalum dilatatum* (Paspalum), *Bidens pilosa* (Cobbler's Pegs), *Digitaria* sp. (Summer Grass), *Foeniculum vulgare* (Fennel), *Cyclospermum leptophyllum* (Slender Celery), *Cirsium vulgare* (Spear Thistle), *Hypochaeris radicata* (Cat's Ear) and *Conyza bonariensis* (Flea Bane). There is an area of *Cestrum parqui* (Green Cestrum) present in the rail corridor (see polygon 32 on Figure 3.1 and Figure A.17 in Appendix A for a photograph). *Cestrum parqui* is a noxious weed declared in the Local Control Authority area of Auburn City Council. *Cestrum parqui* is a regionally controlled noxious weed that must be fully and continuously suppressed and destroyed by the landowner.

The habitat that this vegetation provides for fauna is limited (photos are provided in Appendix A). The habitat lacks important features for shelter such as hollow bearing trees, dense litter layer, or woody debris. The vegetation in the study area does not provide any significant habitat for fauna but may provide limited foraging opportunities for urban adapted birds (e.g. Australian Magpie, Magpie Lark). The *Lophostemon confertus* trees and the palms may provide some limited foraging habitat for the threatened Grey-headed Flying-fox (*Pteropus poliocephalus*) but the contribution of these trees to the regional foraging resource would be very small.

##### 3.1.1 Trees

Forty-two trees were recorded in the study area during the field survey. The location of each tree is outlined in Figure 3.1. These trees range from very large mature *Cinnamomum camphora* (Camphor laurel) trees to smaller shrubs (i.e. *Callistemon*) and trees re-sprouting from previous trimming works within the rail corridor (i.e. *Morus* sp.). The most significant trees in terms of size were located in the north-east of the study area adjacent to the Lingyen Mountain Temple (see Appendix A). The *Lophostemon confertus* (Brush Box) trees in the south-west of the study area and the *Jacaranda mimosifolia* (Jacaranda) trees adjacent to the platform also contribute significantly to the streetscape and visual amenity of the area (see Appendix A for photos).

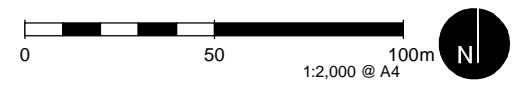
An assessment of each tree including suggested Tree Protection Zones according to the *Australian Standard 4970-2009 for the Protection of Trees on Development Sites* is provided in Appendix C.



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**Legend**

- Study area
- Proposal site
- Tree canopy



**Figure 3-1** | Location of trees within the study area

Data sources  
Jacobs 2015, Ausimage 2015, Land and Property Information 2014

### 3.2 Threatened flora

No threatened species were located during the site inspection. On the basis of regional records and reports and the presence of suitable habitat, 24 threatened flora species, and two endangered plant populations have been previously recorded or listed as having potential to occur in the locality based on modelled habitat. However, due to the historic disturbance that has occurred in the study area and the lack of suitable habitat for threatened flora species (habitat photos are provided in Appendix A), none are considered likely to occur (refer Appendix B). The list of threatened flora species considered further in this assessment is provided in Table B.1 of Appendix B.

### 3.3 Threatened fauna

No threatened species were located during the site inspection. Based on regional records, reports and the presence of suitable habitat, 53 threatened fauna species, and one endangered population, have been identified from the locality. This includes eight mammals, 34 birds, six reptiles, three amphibians, one fish and one invertebrate. These species are listed in Table B.2 of Appendix B which presents an assessment of their likelihood of occurrence in the study area using the criteria described in Table 2.2.

Many of the threatened species that were identified from the desktop assessment favour habitats that are not represented in the study area and these species were considered unlikely to occur or have a low likelihood of occurring and are not considered further in this assessment. One species, the Grey-headed Flying-fox (*Pteropus poliocephalus*) (listed as vulnerable under the TSC Act and EPBC Act), was considered to have a moderate likelihood of occurring based on the presence of some limited suitable foraging habitat (*Lophostemon confertus* trees and palm trees) and close proximity of known roost camps (i.e. the Duck River camp at Clyde, and the nationally important Cabramatta camp). This species is a highly mobile flyer and may utilise some of the trees and shrubs within the study area occasionally for foraging or resting. Importantly, no suitable breeding habitat is present in the study area. The fauna habitats in the study area are considered to be of poor quality (see photos in Appendix A).

### 3.4 Migratory species

Thirty seven migratory species are predicted to occur in the locality based on the PMST (see Appendix B). Of these, the White-throated Needletail (*Hirundapus caudacutus*) and the Fork-tailed Swift (*Apus pacificus*) are considered moderately likely to occur in the air space above the study area during their annual migration.

While migratory bird species do use the study area and locality, the study area would not be classed as an 'important habitat' as defined under the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines* (Department of the Environment 2013), in that the study area does not contain:

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species
- habitat utilised by a migratory species which is at the limit of the species range
- habitat within an area where the species is declining.

As such, it is unlikely that the works would significantly affect migratory species and this group is not considered any further in this report.

## 4. Potential impacts

Direct biodiversity impacts of the works are predicted to be minimal due to the disturbed nature of the vegetation in the study area, the lack of native vegetation and the nature of the construction methods. Vegetation and habitat clearing would be minimal and no impacts to remnant native vegetation or high quality fauna habitat are predicted. Direct trauma to native fauna is expected to be minimal as no high quality habitats would be removed. Noise, dust, light and contaminant pollution is predicted to be minimal. The mitigation measures outlined below in Section 5 would ensure that indirect impacts would be minimised.

The current proposed site compound and storage areas are located at either end of the study area and contain a number of trees which may need to be impacted. However, trees would be retained where possible. The north-eastern compound area (Compound 2) contains trees 33 and 36 (*Morus* sp.) and trees 37, 38, 40 and 41 (*Cinnamomum camphora*). The south-western compound site (Compound 1) contains trees 3, 4 and 5 (all *Lophostemon confertus* trees) which are roadside plantings along Campbell Street. These trees add to the local amenity but their removal (if required) is considered unlikely to result in any detrimental ecological impacts as these trees do not contain any hollows and do not provide any significant habitat for threatened species.

The shelter for 20 bikes on Campbell Street may also require some vegetation removal. Bike parking Option 1 is located in the area of the *Paulownia* sp. tree (tree 19) which would be removed if this option was chosen. The lilies in this area that currently surround the existing memorial may be removed and replaced with landscape plantings. Removal of this vegetation (if required) would not have any detrimental ecological impacts. However, options to relocate the lilies should be considered in consultation with Auburn City Council.

The ground layer vegetation within the rail corridor is dominated by exotic species. As such, proliferation of weed species is likely to be the main potential impact of the works. Without appropriate management strategies, construction activities have the potential to disperse weeds including *Cestrum parqui* which is listed as a Class 3 noxious weed for the Auburn control area under the *Noxious Weeds Act 1993*. The control and management of *Cestrum parqui* will be important for works in the north-east compound site (Compound 2) as this area contains the infestation (mitigation measures to address this weed species are provided in Section 5). Construction activities also have the potential to import new weed species into the study area. The most likely causes of weed dispersal and importation associated with the works include earthworks, movement of soil, and attachment of seed (and other propagules) to vehicles and machinery. There is also the chance of the introduction and spread of *Phytophthora cinnamomi* (Root rot) from machinery which could detrimentally affect the remaining vegetation along the rail corridor. The mitigation measures outlined below in Section 5 would ensure that weed and pathogen importation and spread is minimised.

There are no predicted significant impacts to threatened biodiversity from the works. While the threatened Grey-headed Flying-fox may utilise the study area as foraging habitat on occasion, the area of available foraging habitat is very small and is considered low quality. The Proposal is considered unlikely to have a significant impact on the Grey-headed Flying-fox (see Section 4.1 below). The Proposal would not impact on any significant habitat features (i.e. suitable for roosting or breeding) for this species and the Proposal is considered unlikely to interfere with the lifecycle of this species associated with a local population. As such, no significant impacts to threatened biodiversity are predicted.

### 4.1 Significance assessment

A significance assessment was conducted for the Grey-headed Flying-fox (vulnerable TSC Act and EPBC Act) as this species is considered to have a moderate likelihood of occurring in the study area with the presence of some limited suitable foraging habitat (i.e. *Lophostemon confertus* and palm trees) and close proximity of known roost camps for this species (Duck River and Cabramatta). As this TSC Act listed threatened species may occur in the study area, the EP&A Act requires that a 7-part test is undertaken to assess the likelihood of a significant impact occurring. As this species is also listed under the EPBC Act, a significance assessment has also been completed in accordance with the *Matters of National Environmental Significance Significant Impact Guidelines 1.1* (Department of the Environment 2013).

The significance assessments undertaken for the Grey-headed Flying-fox are provided in Appendix D. The outcome of the assessments was that there is unlikely to be a significant impact to the Grey-headed Flying-fox due to the minimal impacts predicted from the works. While some trees suitable as foraging habitat may need to be removed, the works would not result in the removal of any significant quantity of food resources or impact on an area of foraging or breeding habitat considered critical to survival, according to the national recovery plan for the Grey-headed Flying-fox (Department of Environment, Climate Change and Water 2009).

The works would have little effect on the local populations of Grey-headed Flying-fox and the potential for this species to occur in the study area is expected to continue after the works have been completed. Importantly, the habitat would remain in a similar state after the works have been completed.

## 5. Avoidance and mitigation measures

Prior to the commencement of construction the following vegetation management measures should be implemented according to the *TfNSW Vegetation Management (Protection and Removal) Guideline* (Transport for NSW 2015):

- review the Ecological Impact Assessment (this document) to identify the type and location of vegetation on the site
- incorporate specific vegetation management measures identified in the Ecological Impact Assessment into the site induction, toolbox talk and pre-start meetings
- incorporate specific vegetation management measures identified in the Ecological Impact Assessment into the Construction Environmental Management Plan and environmental control maps
- conduct a site inspection and mark vegetation to be removed and fence (through installation of Tree Protection Zones (TPZ)) and mark vegetation to be protected as identified in this report
- install highly visible barriers around the perimeter of the construction site
- install signs clearly identifying areas of protected native vegetation
- install branch and trunk protection where construction works are in very close proximity to trees
- locate construction parking, compounds, stockpiles and chemical storage away from vegetated areas (including tree protection zones) and in areas which do not necessitate anymore clearing of vegetation than necessary
- refer to the TfNSW *Weed Management and Disposal Guide* if weeds have been identified on the site and require specific management. Noxious weeds including *Cestrum parqui* have been identified and must be treated to prevent dispersal (this should include removal from site and disposal at a green waste facility).
- any trimming of trees or works within a TPZ is to be undertaken by a qualified arborist.

During construction, the following vegetation management measures should be implemented according to the *TfNSW Vegetation Management (Protection and Removal) Guideline* (Transport for NSW 2015):

- use only defined access tracks and entry/exit points for all vehicle movements
- use only designated areas for parking, stockpiles, materials and waste storage
- do not store materials or park equipment/vehicles within tree protection zones
- revegetate or mulch disturbed areas, particularly batter slopes at the earliest opportunity
- mulch and reuse cleared vegetation on site for site stabilisation and/or landscaping where appropriate
- undertake regular inspections of vegetation management measures to ensure they are in place and effective
- monitor the health of retained vegetation and seek advice from an arborist if vegetation shows signs of stress (discolouration, die back)
- submit for approval Removal or Trimming of Vegetation Application – 9TP-FT-078 for any removal or trimming of vegetation.

After construction, the following vegetation management measures should be implemented according to the *TfNSW Vegetation Management (Protection and Removal) Guideline* (Transport for NSW 2015):

- stabilise all disturbed areas, implement landscaping and remove vegetation protection measures
- ensure a maintenance program is in place for any landscaping or revegetation undertaken as part of the project.



## 5.1 Application of the TfNSW Vegetation Offsets Guide

As vegetation clearing may be required, and the impact of the proposed clearing is not deemed 'significant' for the purposes of section 111 of the EP&A Act (see Section 4.1 and Appendix D) the *TfNSW Vegetation Offsets Guide* (Transport for NSW 2013) would apply. The trees to be potentially removed do not form part of a native vegetation community, but do provide amenity value for station users. As such, offsets for individual trees would need to be applied (this offset requirement applies to remnant, regrowth, planted, native and exotic trees alike).

The following trees may require removal:

- two small *Morus* sp. (Mulberry) trees (trees 33 and 36) which are 10 cm diameter at breast height (dbh)
- three medium *Cinnamomum camphora* (Camphor laurel) trees (trees 37, 38, and 40) of 50 cm dbh and one large *Cinnamomum camphora* (Camphor laurel) tree (tree 41) of greater than 1 m dbh
- one medium *Paulownia* sp. tree (tree 19) of 20 cm dbh
- one large *Lophostemon confertus* (Brush Box) tree (tree 3) of 1.29m dbh and two medium *Lophostemon confertus* (Brush Box) trees (tree 4 and 5) of 58 cm and 48 cm dbh.

To offset the potential loss of these trees the following offsets would be required (based on the required offset in the *TfNSW Vegetation Offsets Guide* (Transport for NSW 2013):

- four trees to be planted for the two *Morus* sp. (Mulberry) trees
- twenty trees to be planted for the *Cinnamomum camphora* (Camphor laurel) trees
- four trees to be planted for the *Paulownia* sp. tree
- sixteen trees for the *Lophostemon confertus* (Brush Box) trees.

## 6. Conclusions

The key findings of the biodiversity assessment are that there are no native vegetation communities present in the study area and the fauna habitat that is present is suitable only for common urban adapted species. There would be no impact to any native vegetation communities. The vegetation within the rail corridor and along Campbell Street outside of the corridor is planted and opportunistic vegetation (predominately exotic species). There are no high quality areas of native vegetation or any high quality fauna habitats present within the area proposed for construction activity.

Forty-two trees (predominantly planted exotic species) were recorded in the study area during the field survey. These trees range from very large examples of mature *Cinnamomum camphora* (Camphor laurel) trees to smaller shrubs and trees re-sprouting from previous trimming works within the rail corridor. The most significant trees in terms of size were located in the north-east of the study area adjacent to the Lingyen Mountain Temple, and the *Lophostemon confertus* trees in the south-west of the study area. The *Jacaranda mimosifolia* (Jacaranda) trees adjacent to the platform also contribute significantly to the streetscape and visual amenity of the area.

The current proposed site compound and storage areas contain a number of trees which may be impacted; however, trees would be retained where possible. The north-eastern compound area (Compound 2) contains trees 33 and 36 (*Morus* sp.) and trees 37, 38, 40 and 41 (*Cinnamomum camphora*). The south-western compound site contains trees 3, 4 and 5 (all *Lophostemon confertus* trees). These trees add to the local amenity but their removal (if required) is considered unlikely to result in any detrimental ecological impacts as these trees do not provide any significant habitat for threatened species. The shelter for 20 bikes on Campbell Street may also require some vegetation removal as bike parking Option 1 is located in the area of the *Paulownia* sp. tree (tree 19) which would be removed if this option was chosen. The lilies in this area that currently surround the existing memorial may be removed and replaced with landscape plantings. This would have no biodiversity impacts. Removal of this vegetation (if required) would not have any detrimental ecological impacts. However, options to relocate the lilies should be considered in consultation with Auburn City Council.

There are no predicted significant impacts to threatened biodiversity from the works. While a threatened fauna species, the Grey-headed Flying-fox, may utilise the study area as foraging habitat on occasion, the works would not significantly impact this species. These works would not impact on any foraging or breeding habitat considered critical for survival according to the national recovery plan for the Grey-headed Flying-fox (Department of Environment, Climate Change and Water 2009). As such, no impacts to threatened biodiversity are predicted.

While negligible impacts to native biodiversity are predicted, the mitigation measures detailed in Section 5 would ensure that any impacts that do occur are minimised. Trees that are to be retained would be protected by implementation of the *Australian Standard 4970-2009 for the Protection of Trees on Development Sites*. The TfNSW *Vegetation Management (Protection and Removal) Guideline* (Transport for NSW 2015) would be followed to ensure that vegetation is protected and managed appropriately.

As vegetation removal may be required, and the impact of the potential removal is not deemed 'significant' for the purposes of section 111 of the EP&A Act (see Section 4.1 and Appendix D) the *TfNSW Vegetation Offsets Guide* (Transport for NSW, 2013) applies. The trees that may need to be cleared do not form part of a native vegetation community, but do provide streetscape amenity. As such, offsets for individual trees would be applied according to the *TfNSW Vegetation Offsets Guide* (Transport for NSW 2013) (see section 5.1).

## 7. References

Department of Environment and Climate Change 2007, *Threatened species assessment guidelines. The assessment of significance*, Department of Environment and Climate Change, Hurstville.

Department of Environment Climate Change and Water 2009, *Draft National Recovery Plan for the Grey-headed Flying-fox Pteropus poliocephalus*, Department of Environment, Climate Change and Water, Sydney.

Department of the Environment 2013, *Matters of National Environmental Significance Significant Impact Guidelines 1.1*, Commonwealth Government Department of the Environment, Canberra

Office of Environment and Heritage 2013, *The Native Vegetation of the Sydney Metropolitan Area. Volume 1: Technical Report. Version 2.0*, Office of Environment and Heritage, Department of Premier and Cabinet, Sydney,

Transport for NSW 2013, *Vegetation Offset Guide* Transport for NSW, Sydney.

Transport for NSW 2015, *Vegetation Management (Protection and Removal) Guideline* Transport for NSW, Sydney.

## Appendix A. Site photos



Figure A.1 : Trees 1 and 2 are two *Lophostemon confertus* (Brush Box) trees at the south-western edge of the study area along Campbell Street



Figure A.2 : Trees 3 and 4 are two *Lophostemon confertus* (Brush Box) trees at the south-western edge of the study area along Campbell Street.



Figure A.3 : Tree 5 is a *Lophostemon confertus* (Brush Box) tree in the south-western portion of the study area along Campbell Street near the rail corridor access gate.



Figure A.4 : Tree 6 behind the truck is a *Platanus X acerifolia* (London Plane Tree) and Tree 7 is a *Lophostemon confertus* (Brush Box) in the south-western portion of the study area along Campbell Street



Figure A.5 : Tree 8 is a *Platanus X acerifolia* (London Plane Tree) planted in the road reserve along Campbell Street



Figure A.6 : Tree 9 is a *Platanus X acerifolia* (London Plane Tree) planted in the road reserve along Campbell Street



Figure A.7 : Tree 10 is a *Jacaranda mimosifolia* (Jacaranda) directly opposite the platform in the south-west section of the study area in the rail corridor



Figure A.8 : Tree 11 is a *Jacaranda mimosifolia* (Jacaranda) in the rail corridor directly opposite the platform in the south-west section of the study area in the rail corridor



Figure A.9 : A row of five small palm trees (Tree 12 on the figure) between Tree 11 and Tree 14 in the rail corridor opposite the platform



Figure A.10 : Trees 13 and 14 are two *Jacaranda mimosifolia* (Jacaranda) trees in the rail corridor directly opposite the platform



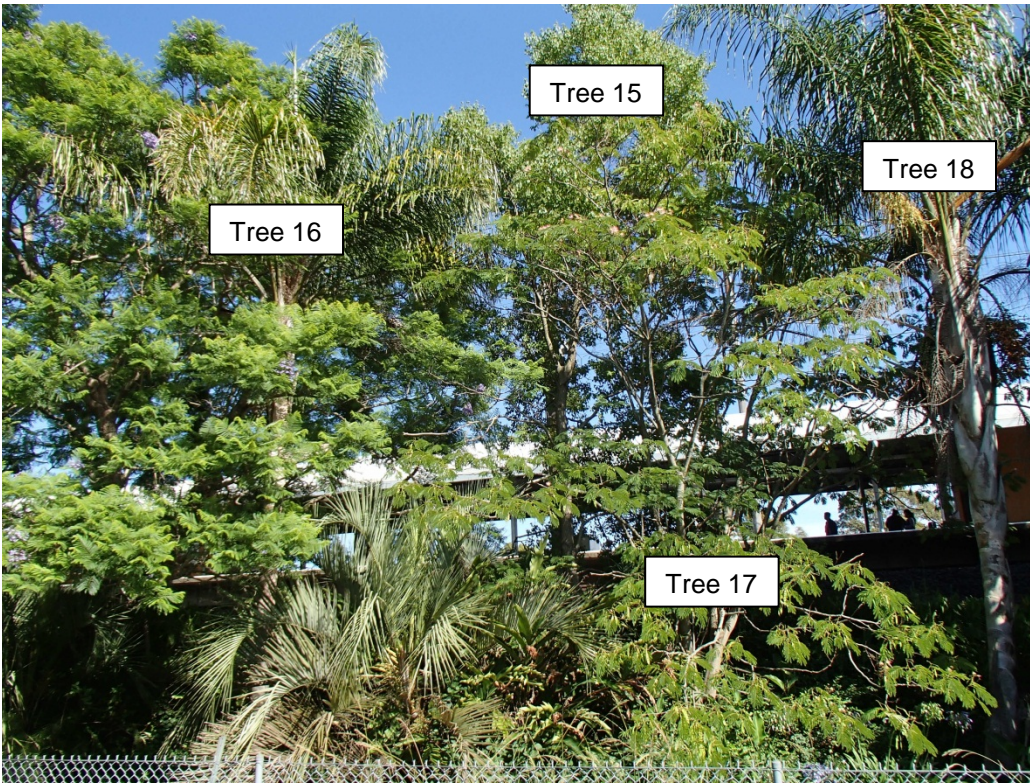


Figure A.11 : Tree 15 *Cinnamomum camphora* (Camphor laurel), Tree 16 *Archontophoenix alexandrae* (Alexandra Palm), Tree 17 *Caesalpinia* sp. and Tree 18 *Archontophoenix alexandrae* (Alexandra Palm) in the rail corridor opposite the platform



Figure A.12 : Tree 19 *Paulownia* sp. (identification not confirmed) within the rail corridor on the south-western side of the underpass. This tree may be removed if bike parking Option 1 is chosen



Figure A.13 : Tree 20 *Melaleuca styphelioides* (Prickly-leaved Tea Tree) within the rail corridor on the north-eastern side of the underpass

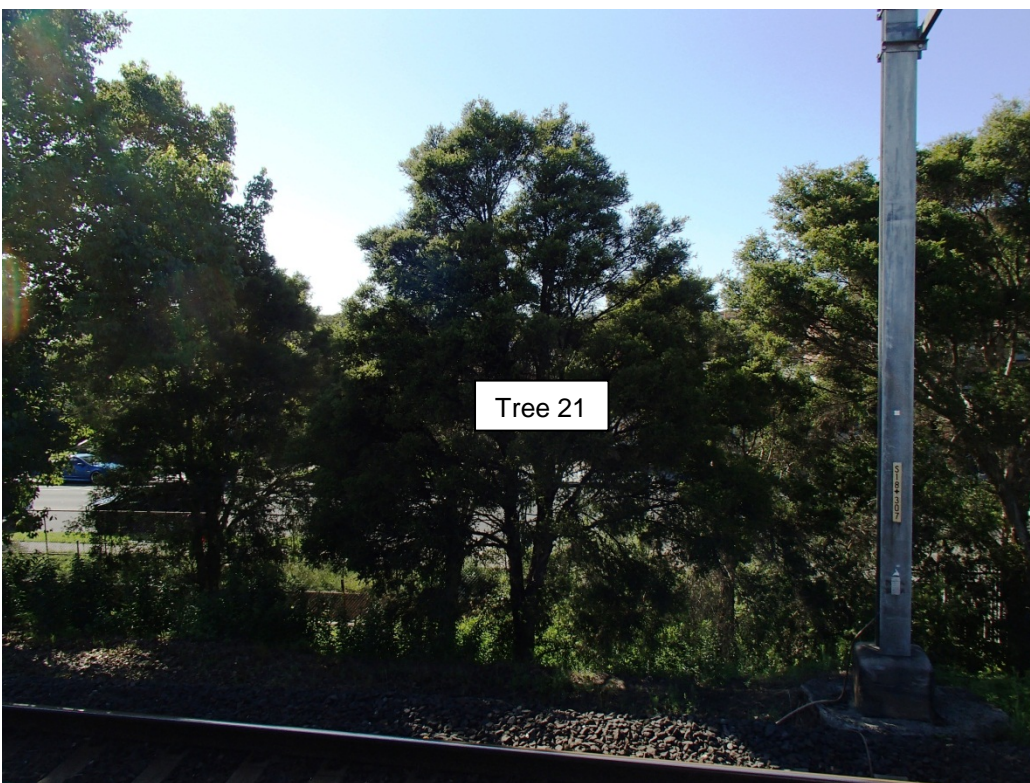


Figure A.14 : Tree 21 *Melaleuca styphelioides* (Prickly-leaved Tea Tree) within the rail corridor on the south-western side of the underpass



Figure A.15 : Tree 22 *Melaleuca styphelioides* (Prickly-leaved Tea Tree) 23 *Callistemon* sp. (Bottlebrush – two plants) and 24 *Melaleuca styphelioides* (Prickly-leaved Tea Tree) within the rail corridor on the north-eastern side of the underpass



Figure A.16 : Trees 25 to 31 *Cinnamomum camphora* (Camphor laurel) within the rail corridor opposite the northern edge of the platform on the north-eastern side of the underpass



Figure A.17 : A patch of the weed *Cestrum parqui* (Green Cestrum) within the rail corridor (polygon 32 on the figure). Compound 2 would encroach on this area



Figure A.18 : Tree 33 *Morus* sp. (Mulberry) growing in the rail corridor in the north-east of the study area.



Figure A.19 : Tree 34 *Fraxinus* sp. (Ash) growing along Campbell Street in the north-east of the study area. Tree 35 is the same species.



Figure A.20 : Tree 36 *Morus* sp. (Mulberry) growing in the rail corridor in the north-east of the study area.



Figure A.21 : Tree 37 and Tree 38 *Cinnamomum camphora* (Camphor laurel) trees growing in the rail corridor in the north-east of the study area.



Figure A.22 : Tree 39 *Fraxinus* sp. (Ash) growing along Campbell Street in the north-east of the study area



Figure A.23 : Tree 40 *Cinnamomum camphora* (Camphor laurel) growing in the rail corridor in the north-east of the study area.



Figure A.24 : Tree 41 *Cinnamomum camphora* (Camphor laurel) growing in the rail corridor in the north-east of the study area.

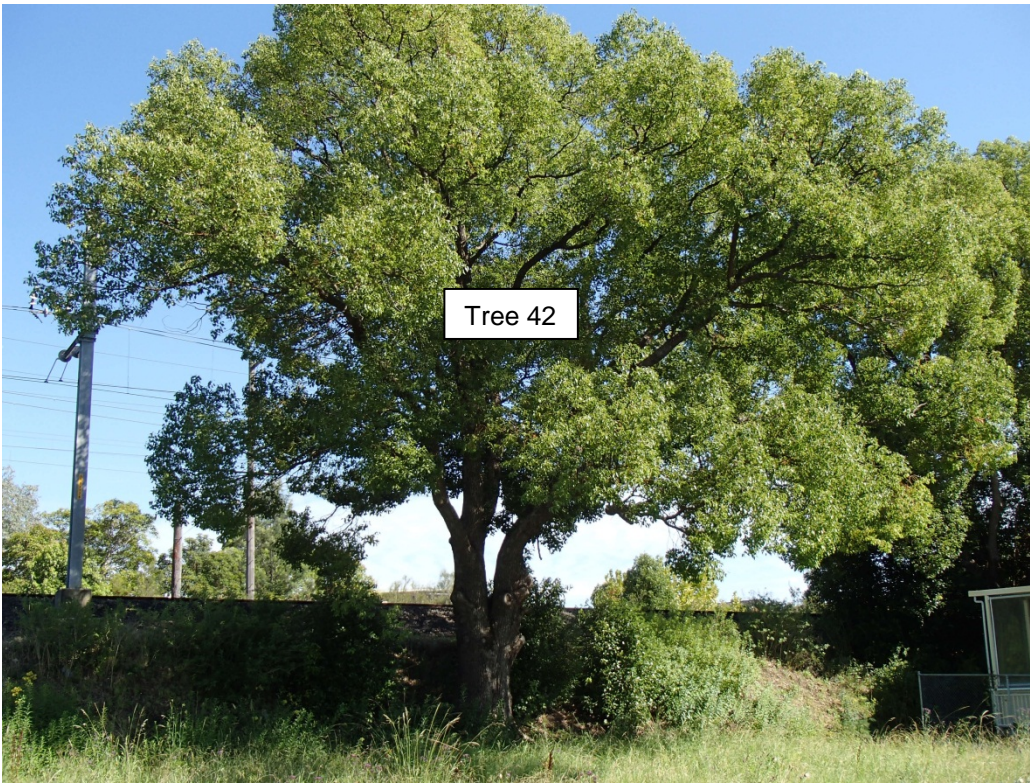


Figure A.25 : Tree 42 *Cinnamomum camphora* (Camphor laurel) growing in the rail corridor in the north-east edge of the study area adjacent to the Lingyen Mountain Temple



## Appendix B. Likelihood of occurrence assessment for threatened and migratory species

The following assessment identifies the list of threatened flora and fauna species recorded from the locality and compares the preferred habitat of these species with the habitats identified in the study area to make an assessment of the likelihood of the species being present in the study area (i.e. subject species). The criteria used in the assessment are detailed in Table B.1 and Table B.2.

Table B.1 : Known or potentially occurring threatened flora species

Species	Common Name	EPBC Act	TSC Act	Distribution and habitat	Data Source	Likelihood of occurrence in the study area
<i>Acacia pubescens</i>	Downy Wattle	V	V	Concentrated around the Bankstown-Fairfield-Rookwood area and the Pitt Town area, with outliers occurring at Barden Ridge, Oakdale and Mountain Lagoon. Occurs in open woodland and forest, in a variety of plant communities, including Cooks River/ Castlereagh Ironbark Forest, Shale/Gravel Transition Forest and Cumberland Plain Woodland. Occurs on alluviums, shales and at the intergrade between shales and sandstones. The soils are characteristically gravelly soils, often with ironstone.	2002 – OEH PMST	Low – unsuitable habitat in the study area.
<i>Allocasuarina glareicola</i>		E	E	Primarily restricted to the Richmond (NW Cumberland Plain) district, but with an outlier population found at Voyager Point, Liverpool. Grows in Castlereagh woodland on lateritic soil. Found in open woodland with <i>Eucalyptus parramattensis</i> , <i>Eucalyptus fibrosa</i> , <i>Angophora bakeri</i> , <i>Eucalyptus sclerophylla</i> and <i>Melaleuca decora</i> . Common associated understorey species include <i>Melaleuca nodosa</i> , <i>Hakea dactyloides</i> , <i>Hakea sericea</i> , <i>Dillwynia tenuifolia</i> , <i>Micromyrtus minutiflora</i> , <i>Acacia elongata</i> , <i>Acacia brownei</i> , <i>Themeda australis</i> and <i>Xanthorrhoea minor</i> .	PMST	Low – unsuitable habitat in the study area.
<i>Caladenia tessellata</i>	Thick-lipped Spider-orchid	V	E	Known from the Sydney area (old records), Wyong, Ulladulla and Braidwood in NSW. Populations in Kiama and Queanbeyan are presumed extinct. Generally found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil.	PMST	Low – unsuitable habitat in the study area.
<i>Callistemon linearifolius</i>	Netted Bottlebrush	-	V	Recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW. Was more widespread across its distribution in the past. Some populations are reserved in Ku-ring-gai Chase National Park, Lion Island Nature Reserve, and Spectacle Island Nature Reserve. Further north it has been recorded from Yengo National Park and Werakata National Park. Grows in dry sclerophyll forest on the coast and adjacent ranges.	3 – OEH	Low – unsuitable habitat in the study area.

Species	Common Name	EPBC Act	TSC Act	Distribution and habitat	Data Source	Likelihood of occurrence in the study area
<i>Cryptostylis hunteriana</i>	Leafless Tongue-orchid	V	V	The Leafless Tongue Orchid has been recorded from as far north as Gibraltar Range National Park south into Victoria around the coast as far as Orbost. The larger populations typically occur in woodland dominated by Scribbly Gum ( <i>Eucalyptus sclerophylla</i> ), Silvertop Ash ( <i>E. sieberi</i> ), Red Bloodwood ( <i>Corymbia gummifera</i> ) and Black Sheoak ( <i>Allocasuarina littoralis</i> ); appears to prefer open areas in the understorey of this community and is often found in association with the Large Tongue Orchid ( <i>C. subulata</i> ) and the Tartan Tongue Orchid ( <i>C. erecta</i> ).	PMST	Low – unsuitable habitat in the study area.
<i>Deyeuxia appressa</i>		E	E	A highly restricted NSW endemic known only from two pre-1942 records in the Sydney area. Was first collected in 1930 at Herne Bay, Saltpan Creek, off the Georges River, south of Bankstown. Was then collected in 1941 from Killara, near Hornsby. Has not been collected since and may now be extinct in the wild due to the level of habitat loss and development that has occurred within these areas.	PMST	Low – unsuitable habitat in the study area.
<i>Epacris purpurascens</i> var. <i>purpurascens</i>		-	V	Recorded from Gosford in the north, to Narrabeen in the east, Silverdale in the west and Avon Dam vicinity in the South. Found in a range of habitat types, most of which have a strong shale soil influence.	21 – OEH	Low – unsuitable habitat in the study area.
<i>Eucalyptus nicholii</i>	Narrow-leaved Black Peppermint	V	V	This species is sparsely distributed but widespread on the New England Tablelands from Nundle to north of Tenterfield, being most common in central portions of its range. Found largely on private property and roadsides, and occasionally conservation reserves. Planted as urban trees, windbreaks and corridors. Typically grows in dry grassy woodland, on shallow soils of slopes and ridges. Found primarily on infertile soils derived from granite or metasedimentary rock.  This species has been planted in the locality.	1 – OEH	Low – unsuitable habitat in the study area.
<i>Eucalyptus scoparia</i>	Wallangarra White Gum	V	E	In NSW it is known from only three locations near Tenterfield, including Bald Rock National Park. In Queensland it is equally rare, occurring at three sites of which only one has more than a dozen trees. In NSW it is known from only three locations near Tenterfield, including Bald Rock National Park. In Queensland it is equally rare, occurring at three sites of which only one has more than a dozen trees.	1 – OEH	Low – unsuitable habitat in the study area.

Species	Common Name	EPBC Act	TSC Act	Distribution and habitat	Data Source	Likelihood of occurrence in the study area
<i>Genoplesium baueri</i>	Bauer's Midge Orchid	E	E	Recorded from locations between Nowra and Pittwater and may occur as far north as Port Stephens. About half the records were made before 1960 with most of the older records being from Sydney suburbs including Asquith, Cowan, Galesville, Longville and Wahroonga. No collections have been made from those sites in recent years. The species has been recorded at locations now likely to be within the several conservation reserves including Berowra Valley Regional Park, Royal National Park and Lane Cove National Park. May occur in the Woronora, O'Hares, Metropolitan and Warragamba Catchments. Found in sparse sclerophyll forest and moss gardens over sandstone	PMST	Low – unsuitable habitat in the study area.
<i>Grevillea beadleana</i>	Beadle's Grevillea	E	E	Known from four separate areas, all in north-east NSW: the Torrington area west of Tenterfield, Oxley Wild Rivers National Park, Guy Fawkes River National Park and at Shannon Creek south-west of Grafton. Open eucalypt forest with a shrubby understorey. It is usually found on steep granite slopes at high altitudes, although the population at Shannon Creek is at a lower elevation on sandstone.	1 – OEH	Low – unsuitable habitat in the study area.
<i>Hypsela sessiliflora</i> (syn. <i>Isotoma sessiliflora</i> )		X	E	Currently known from only two adjacent sites on a single private property at Erskine Park in the Penrith LGA. Previous sightings are all from western Sydney, at Homebush and at Agnes Banks. Known to grow in damp places, on the Cumberland Plain, including freshwater wetland, grassland/alluvial woodland and an alluvial woodland/shale plains woodland ecotone.	1 – OEH	Low – unsuitable habitat in the study area.
<i>Pelargonium</i> sp. <i>G.W. Carr 10345</i>	Omeo Storksbill	E	E	Known from only 3 locations in NSW, with two on lake-beds on the basalt plains of the Monaro and one at Lake Bathurst. A population at a fourth known site on the Monaro has not been seen in recent years. The only other known population is at Lake Omeo, Victoria. It occurs at altitudes between 680 to 1030 m. It is known to occur in the local government areas of Goulburn-Mulwaree, Cooma-Monaro, and Snowy River, but may occur in other areas with suitable habitat; these may include Bombala, Eurobodalla, Palerang, Tumbarumba, Tumut, Upper Lachlan, and Yass Valley local government areas. It has a narrow habitat that is usually just above the high-water level of irregularly inundated or ephemeral lakes, in the transition zone between surrounding grasslands or pasture and the wetland or aquatic communities. It sometimes colonises exposed lake beds during dry periods.	PMST	Low – unsuitable habitat in the study area.
<i>Persoonia nutans</i>	Nodding Geebung	E	E	Restricted to the Cumberland Plain in western Sydney, between Richmond in the north and Macquarie Fields in the south. Core distribution occurs within the Penrith, and to a lesser extent, Hawkesbury LGAs, with isolated and relatively small populations also occurring in the Liverpool, Campbelltown, Bankstown and Blacktown LGAs. Confined to aeolian and alluvial sediments and occurs in a range of sclerophyll forest and woodland vegetation communities, with the majority of individuals occurring within Agnes Banks Woodland or Castlereagh Scribbly Gum Woodland.	6 – OEH PMST	Low – unsuitable habitat in the study area.

Species	Common Name	EPBC Act	TSC Act	Distribution and habitat	Data Source	Likelihood of occurrence in the study area
<i>Pimelea curviflora</i> <i>var. curviflora</i>	Slender Curved Rice Flowers	V	V	Confined to the coastal area of Sydney between northern Sydney in the south and Maroota in the north-west. Former range extended south to the Parramatta River and Port Jackson region including Five Dock, Bellevue Hill and Manly. Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands.	PMST	Low – unsuitable habitat in the study area.
<i>Pimelea spicata</i>	Spiked-rice Flower	E	E	Broad distribution in western Sydney, occurring on the Cumberland Plain (Narellan, Marayong, Prospect Reservoir areas). Another smaller population is recorded in districts (Landsdowne to Shellharbour to northern Kiama) Illawarra. It grows on well-structured clay soils. On the inland Cumberland Plain sites it is associated with Grey Box and Ironbark. In the coastal Illawarra it occurs commonly in Coastal Banksia open woodland with a more well developed shrub and grass understorey.	3 – OEH PMST	Low – unsuitable habitat in the study area.
<i>Pomaderris prunifolia</i> <i>(endangered population)</i>	<i>Pomaderris prunifolia</i> (a shrub population, Parramatta, Auburn, Strathfield and Bankstown local government areas	-	CE	Endangered population in the Parramatta, Auburn, Strathfield and Bankstown Local Government Areas. Known from only three sites within the listed local government areas, at Rydalmere, within Rookwood Cemetery and at The Crest of Bankstown. At Rydalmere it occurs along a road reserve near a creek, among grass species on sandstone. At Rookwood Cemetery it occurs in a small gully of degraded Cooks River / Castlereagh Ironbark Forest on shale soils.	17 - OEH	Low – unsuitable habitat in the study area.
<i>Pterostylis saxicola</i>	Sydney Plains Greenhood	E	E	Restricted to western Sydney between Freemans Reach in the north and Picton in the south. There are very few known populations and they are all very small and isolated. Only one population occurs within a conservation reserve at Georges River National Park. Most commonly found growing in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines. The vegetation communities above the shelves where it occurs are sclerophyll forest or woodland on shale/sandstone transition soils or shale soils.	PMST	Low – unsuitable habitat in the study area.
<i>Pultenaea parviflora</i>	Sydney-bush Pea	V	E	Endemic to the Cumberland Plain the core distribution is from Windsor to Penrith and east to Dean Park. Outlier populations are recorded from Kemps Creek and Wilberforce. May be locally abundant, particularly within scrubby/dry heath areas of Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays. May also be common in transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland. <i>Eucalyptus fibrosa</i> is usually the dominant canopy species. <i>Eucalyptus globoidea</i> , <i>E. longifolia</i> , <i>E. parramattensis</i> , <i>E. sclerophylla</i> and <i>E. sideroxylon</i> may also be present or co-dominant, with <i>Melaleuca decora</i> frequently forming a secondary canopy layer. Associated species may include <i>Allocasuarina littoralis</i> , <i>Angophora bakeri</i> , <i>Aristida</i> spp., <i>Banksia spinulosa</i> , <i>Cryptandra</i> spp., <i>Daviesia ulicifolia</i> , <i>Entolasia stricta</i> , <i>Hakea sericea</i> , <i>Lissanthe strigosa</i> , <i>Melaleuca nodosa</i> , <i>Ozothamnus diosmifolius</i> and <i>Themeda australis</i> .	1 – OEH	Low – unsuitable habitat in the study area.

Species	Common Name	EPBC Act	TSC Act	Distribution and habitat	Data Source	Likelihood of occurrence in the study area
<i>Pultenaea pedunculata</i>	Matted Bush-pea	-	V	Widespread in Victoria, Tasmania, and south-eastern South Australia, However in NSW it is represented by just three disjunct populations on the Cumberland Plains in Sydney, the coast between Tathra and Bermagui and the Windellama area south of Goulburn. NSW populations are generally among woodland vegetation but plants have also been found on road batters and coastal cliffs. It is largely confined to loamy soils in dry gullies in populations in the Windellama area.	6 – OEH	Low – unsuitable habitat in the study area.
<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	V	E	The Magenta Lilly Pilly is found only in NSW, in a narrow, linear coastal strip from Upper Lansdowne to Conjola State Forest. On the south coast the Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. On the central coast Magenta Lilly Pilly occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities.	1 – OEH PMST	Low – unsuitable habitat in the study area.
<i>Tetradlea glandulosa</i>	Glandular-pink Bell	V	V	Endemic to NSW, with around about 150 populations from Yengo National Park to Lane Cove National Park. Associates in areas with shale cappings over sandstone. Occurs in heath, scrublands to woodlands and open forest. Common woodland tree species include: <i>Corymbia gummifera</i> , <i>C. eximia</i> , <i>Eucalyptus haemastoma</i> , <i>E. punctata</i> , <i>E. racemosa</i> , and/or <i>E. sparsifolia</i> , with an understorey dominated by species from the families Proteaceae, Fabaceae, and Ericaceae.	1 – OEH	Low – unsuitable habitat in the study area.
<i>Thesium australe</i>	Austral Toadflax	V	V	Found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. It is also found in Tasmania and Queensland and in eastern Asia. Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Often found in association with Kangaroo Grass ( <i>Themeda australis</i> ).	PMST	Low – unsuitable habitat in the study area.
<i>Wahlenbergia multicaulis</i> (endangered population)	<i>Wahlenbergia multicaulis</i> (Tadgell's Bluebell) population, Auburn, Bankstown, Strathfield and Canterbury local government areas	-	EP	Endangered population in the in the local government areas of Auburn, Bankstown, Baulkham Hills, Canterbury, Hornsby, Parramatta and Strathfield LGAs. There are 13 known sites, two of which are in northern Sydney (i.e. Thornleigh and Mt Ku-Ring-Gai) with the remainder in western Sydney (e.g. at Rookwood, Chullora, Bass Hill, Bankstown, Georges Hall, Campsie, South Granville and Greenacre). In Western Sydney most sites are closely aligned with the Villawood Soil Series, which is a poorly drained, yellow podsolic extensively permeated with fine, concretionary ironstone (laterite). However, the sites in Hornsby LGA are on the 'Hawkesbury' soil landscape. Found in disturbed sites and grows in a variety of habitats including forest, woodland, scrub, grassland and the edges of watercourses and wetlands. Typically occurs in damp, disturbed sites (with natural or human disturbance of various forms), typically amongst other herbs rather than in the open. In Hornsby LGA it occurs in or adjacent to sandstone gully forest. In Western Sydney it is found in remnants of Cooks River/Castlereagh Ironbark Forest.	66 - OEH	Low – unsuitable habitat in the study area.

Species	Common Name	EPBC Act	TSC Act	Distribution and habitat	Data Source	Likelihood of occurrence in the study area
<i>Wilsonia backhousei</i>	Narrow-leaved <i>Wilsonia</i>	-	V	Found on the coast between Mimosa Rocks National Park and Wamberal north of Sydney. It grows in all southern states. This is a species of the margins of salt marshes and lakes, both coastal and inland.	35 – OEH	Low – unsuitable habitat in the study area.
<i>Zannichellia palustris</i>		-	E	A submerged aquatic plant. In NSW, known from the lower Hunter and in Sydney Olympic Park. Grows in fresh or slightly saline stationary or slowly flowing water. Flowers during warmer months. NSW populations behave as annuals, dying back completely every summer.	4 - OEH	Unlikely – unsuitable habitat in the study area.

\* Distribution and habitat requirement information adapted from:

- Australian Government Department of the Environment <http://www.environment.gov.au/biodiversity/threatened/index.html>
- NSW Office of Environment and Heritage <http://www.environment.nsw.gov.au/threatenedspecies/>
- Department of Primary Industries – Threatened Fish and Marine Vegetation <http://www.dpi.nsw.gov.au/fisheries/species-protection>

+ Data source includes

- Number of records from the NSW Office of Environment and Heritage Wildlife Atlas record data; and
- Identified from the Protected Matters Search Tool (PMST) <http://www.environment.gov.au/epbc/pmst/index.html>

Key:

- EP = endangered population
- CE = critically endangered
- E = endangered
- V = vulnerable
- M = migratory

Table B.2 : Known or potentially occurring threatened and migratory fauna species

Species	Common Name	EPBC Act	TSC Act	Distribution and habitat	Data Source	Likelihood of occurrence in the study area
<i>Anthochaera phrygia</i> ( <i>Xanthomyza phrygia</i> )	Regent Honeyeater	E	CE	Temperate woodlands and open forests of the inland slopes of south-east Australia. The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Regent Honeyeaters usually nest in horizontal branches or forks in tall mature eucalypts and Sheoaks.	3 – OEH PMST	Low – unsuitable habitat in the study area.
<i>Botaurus poiciloptilus</i>	Australasian Bittern	E	E	Occurs from south-east Queensland to south-east South Australia, Tasmania and the south-west of Western Australia. Occurs in terrestrial freshwater wetlands and, rarely, estuarine habitats.	4 – OEH PMST	Unlikely – no habitat in the study area
<i>Calidris ferruginea</i>	Curlew Sandpiper	CE	E	The breeding range of the Curlew Sandpiper is mainly restricted to the Arctic of northern Siberia, including Yamal Peninsula east to Kolyuchiskaya Gulf, Chokotka Peninsula, and also New Siberian Island. Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in salt works and sewage farms.	5 – OEH PMST	Unlikely – no habitat in the study area
<i>Charadrius leschenaultii</i>	Greater Sand plover	-	V	The Greater Sand-plover breeds in central Asia from Armenia to Mongolia, moving further south for winter. In Australia the species is commonly recorded in parties of 10-20 on the west coast, with the far northwest being the stronghold of the population. The species is apparently rare on the east coast, usually found singly. In NSW, the species has been recorded between the northern rivers and the Illawarra, with most records coming from the Clarence and Richmond estuaries. Almost entirely restricted to coastal areas in NSW, occurring mainly on sheltered sandy, shelly or muddy beaches or estuaries with large intertidal mudflats or sandbanks. Roosts during high tide on sandy beaches and rocky shores; begin foraging activity on wet ground at low tide, usually away from the edge of the water; individuals may forage and roost with other waders.	1 – OEH PMST	Unlikely – no habitat in the study area

Species	Common Name	EPBC Act	TSC Act	Distribution and habitat	Data Source	Likelihood of occurrence in the study area
<i>Charadrius mongolus</i>	Lesser Sand Plover	-	V	The Lesser Sand-plover breeds in central and north-eastern Asia, migrating further south for winter. In Australia the species is found around the entire coast but is most common in the Gulf of Carpentaria, and along the east coast of Queensland and northern NSW. Individuals are rarely recorded south of the Shoalhaven estuary, and there are few inland records. Almost entirely coastal in NSW, favouring the beaches of sheltered bays, harbours and estuaries with large intertidal sandflats or mudflats; occasionally occurs on sandy beaches, coral reefs and rock platforms. Highly gregarious, frequently seen in flocks exceeding 100 individuals; also often seen foraging and roosting with other wader species. Roosts during high tide on sandy beaches, spits and rocky shores; forage individually or in scattered flocks on wet ground at low tide, usually away from the water's edge.	PMST	Unlikely – no habitat in the study area
<i>Circus assimilis</i>	Spotted Harrier	-	V	The Spotted Harrier occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges, and rarely in Tasmania. Individuals disperse widely in NSW and comprise a single population. Occurs in grassy open woodland including Acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands.	2 – OEH	Low – unsuitable habitat in the study area.
<i>Dasyornis brachypterus</i>	Eastern Bristlebird	E	E	The distribution of the Eastern Bristlebird has contracted to three disjunct areas of south-eastern Australia. There are three main populations: Northern - southern Queensland/northern NSW, Central - Barren Ground NR, Budderoo NR, Woronora Plateau, Jervis Bay NP, Booderee NP and Beecroft Peninsula and Southern - Nadgee NR and Croajingalong NP in the vicinity of the NSW/Victorian border. Habitat for central and southern populations is characterised by dense, low vegetation including heath and open woodland with a heathy understorey. In northern NSW the habitat occurs in open forest with dense tussocky grass understorey and sparse mid-storey near rainforest ecotone; all of these vegetation types are fire prone.	PMST	Low – unsuitable habitat in the study area.



Species	Common Name	EPBC Act	TSC Act	Distribution and habitat	Data Source	Likelihood of occurrence in the study area
<i>Diomedea epomophora epomophora</i>	Southern Royal Albatross	V, M	-	During the non-breeding season, the Southern Royal Albatross has a wide and possibly circumpolar distribution, ranging north to about 35°S. The Southern Royal Albatross is moderately common throughout the year in offshore waters of southern Australia, mostly off southeastern NSW, Victoria and Tasmania. Off South Australia, they are mostly seen May to September. It breeds on Campbell, Adams, Enderby and Auckland Islands, south of New Zealand. Nests on flat or gently sloping ground on slopes, ridges, gullies and plateaux of large islands, and on the summits of islets. Depressions, gullies, lee slopes and vegetation provide shelter for its nests, but exposed sites are also needed nearby so that the Southern Royal Albatross can take off and land. Its nests are placed among vegetation that is sparse enough for easy access.	PMST	Unlikely – no habitat in the study area
<i>Diomedea epomophora sanfordi</i>	Northern Royal Albatross	E, M	-	The Northern Royal Albatross ranges widely over the Southern Ocean, with individuals seen in Australian waters off south-eastern Australia. It breeds on Chatham Island and Taiaroa Head on the South Island of New Zealand. Its habitat includes subantarctic, subtropical, and occasionally Antarctic waters. The Northern Royal Albatross nests on flat or gently sloping ground, on slopes, ridges, gullies and plateaux of large islands, and on the summits of islets. Depressions, gullies, lee slopes and vegetation provide shelter for its nests, but exposed sites are also needed nearby so that the Southern Royal Albatross can take off and land. Its nests are placed among vegetation that is open enough for adults to easily walk through.	PMST	Unlikely – no habitat in the study area
<i>Diomedea exulans (sensu lato)</i>	Wandering Albatross	V,M	E	The Wandering Albatross breeds on Macquarie Island. Macquarie Island lies in the southwest Pacific Ocean, about half-way between New Zealand and Antarctica. A single breeding pair has also been recorded on Heard Island. The Territory of Heard Island and McDonald Islands are an Australian external territory and volcanic group of barren Antarctic islands, about two-thirds of the way from Madagascar to Antarctica. It feeds in Australian portions of the Southern Ocean. On breeding islands, the Wandering Albatross nests on coastal or inland ridges, slopes, plateaux and plains, often on marshy ground. Nests of the Wandering Albatross are sited on moss terraces, in dense tussocks, and often in loose aggregations on the west (windward) side of islands. It prefers open or patchy vegetation (tussocks, ferns or shrubs), and it requires nesting areas that are near exposed ridges or hillocks so that it can take off.	PMST	Unlikely – no habitat in the study area

Species	Common Name	EPBC Act	TSC Act	Distribution and habitat	Data Source	Likelihood of occurrence in the study area
<i>Diomedea exulans antipodensis</i>	Antipodean Albatross	V, M	V	The Antipodean Albatross is endemic to New Zealand, however forages widely in open water in the south-west Pacific Ocean, Southern Ocean and the Tasman Sea, notably off the coast of NSW. It breeds on the New Zealand islands of Antipodes Island, Campbell Island, Pitt Island and the Auckland Islands. This subspecies nests in open patchy vegetation, such as among tussock grassland or shrubs on ridges, slopes and plateaus. On Antipodes Island, they nest in relatively uniform densities, but avoid areas of tall vegetation on steep coastal slopes, or amongst the tall ferns on poorly drained parts of the peaks near the island's centre (Walker & Elliott 2005).	PMST	Unlikely – no habitat in the study area
<i>Diomedea exulans exulans</i>	Tristan Albatross	E, M	-	The 'at sea' distribution of this newly described species is yet to be defined. There is currently only one definitive record of the Tristan Albatross from Australian waters. A bird banded as a chick on Gough Island was recaptured four years later off Wollongong (NSW). The Tristan Albatross occurs in a single population which breeds on Inaccessible Island and Gough Island in the Atlantic Ocean, having been eliminated from the main island of Tristan da Cunha by 1907. Tristan Albatrosses appear to wander widely from their subantarctic breeding islands within the Atlantic Ocean to about 35° S. They forage almost as far north as the equator. It breeds among grass tussocks on coastal plains, swampy valley floors, and crests of broad ridges or gentle slopes, usually in areas that are 0–300 m asl. It prefers to nest on open patchy vegetation (tussock, fern or shrubs), near exposed ridges or hillocks. It sleeps and rests on ocean waters when not breeding.	PMST	Unlikely – no habitat in the study area
<i>Diomedea exulans gibsoni</i>	Gibson's Albatross	V, M	V	In Australian territory, Gibson's Albatross has been recorded foraging between Coffs Harbour, NSW, and Wilson's Promontory, Victoria. Gibson's Albatrosses are rarely observed in the Pacific Ocean or Indian Ocean. The only Australian record of this species is from a recapture off Wollongong, NSW, in September 1997. Gibson's Albatross breeds on Adams Island and Auckland Island, New Zealand. There are no breeding colonies of Gibson's Albatross in Australian territory. This albatross visits Australian waters while foraging and during the non-breeding season.	PMST	Unlikely – no habitat in the study area

Species	Common Name	EPBC Act	TSC Act	Distribution and habitat	Data Source	Likelihood of occurrence in the study area
<i>Epthianura albifrons</i>	White-fronted Chat	-	V	The White-fronted Chat is found across the southern half of Australia, from southernmost Queensland to southern Tasmania, and across to Western Australia as far north as Carnarvon. Found mostly in temperate to arid climates and very rarely sub-tropical areas, it occupies foothills and lowlands up to 1000 m above sea level. In NSW, it occurs mostly in the southern half of the state, in damp open habitats along the coast, and near waterways in the western part of the state. Along the coastline, it is found predominantly in saltmarsh vegetation but also in open grasslands and sometimes in low shrubs bordering wetland areas. Gregarious species, usually found foraging on bare or grassy ground in wetland areas, singly or in pairs. They are insectivorous, feeding mainly on flies and beetles caught from or close to the ground. Have been observed breeding from late July through to early March, with 'open-cup' nests built in low vegetation. Nests in the Sydney region have also been seen in low isolated mangroves. Nests are usually built about 23 cm above the ground (but have been found up to 2.5 m above the ground).	4 - OEH	Low – unsuitable habitat in the study area.
<i>Epthianura albifrons</i> (endangered population)	White-fronted Chat <i>Epthianura albifrons</i> in the Sydney Metropolitan Catchment Management Authority area	-	EP	Two isolated sub-populations of White-fronted Chats are currently known from the Sydney Metropolitan Catchment Management Authority (CMA) area; one at Newington Nature Reserve on the Parramatta River and one at Towra Point Nature Reserve in Botany Bay. These sub-populations are separated from each other by 25 kilometre of urbanised land, across which the Chats are unlikely to fly. The nearest extant populations outside Sydney Metropolitan CMA are at Ash Island north of Newcastle and Lake Illawarra, south of Wollongong. White-fronted Chats were previously recorded at Penrith Lakes (2001), Hawkesbury Swamps (2002), Tuggerah Lake (1997) and Lake Macquarie (1998). Regularly observed in the saltmarsh of Newington Nature Reserve (with occasional sightings from other parts of Sydney Olympic Park and in grassland on the northern bank of the Parramatta River). Current estimates suggest this population consists of 8 individuals. Regularly observed in the saltmarsh and on the sandy shoreline of a small island of Towra Point Nature Reserve. This population is estimated to comprise 19-50 individuals.	4 - OEH	Low – unsuitable habitat in the study area.

Species	Common Name	EPBC Act	TSC Act	Distribution and habitat	Data Source	Likelihood of occurrence in the study area
<i>Falco subniger</i>	Black Falcon	-	V	Widely, but sparsely, distributed in New South Wales, mostly occurring in inland regions. Some reports of 'Black Falcons' on the tablelands and coast of New South Wales are likely to be referable to the Brown Falcon. In New South Wales there is assumed to be a single population that is continuous with a broader continental population, given that falcons are highly mobile, commonly travelling hundreds of kilometres (Marchant & Higgins 1993). The Black Falcon occurs as solitary individuals, in pairs, or in family groups of parents and offspring.	1 – OEH	Low – unsuitable habitat in the study area.
<i>Grantiella picta</i>	Painted Honeyeater	-	V	The Painted Honeyeater is nomadic and occurs at low densities throughout its range. The greatest concentrations of the bird and almost all breeding occur on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland. During the winter it is more likely to be found in the north of its distribution. Inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests.  A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus <i>Amyema</i> .	PMST	Low – unsuitable habitat in the study area.
<i>Hieraaetus morphnoides</i>	Little Eagle	-	V	The Little Eagle is found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. It occurs as a single population throughout NSW. Occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used.	2 – OEH	Low – unsuitable habitat in the study area.
<i>Lathamus discolor</i>	Swift Parrot	E	E	On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany ( <i>Eucalyptus robusta</i> ), Spotted Gum ( <i>Corymbia maculata</i> ), Red Bloodwood ( <i>C. Gummifera</i> ), Red Ironbark ( <i>E. sideroxylon</i> ), and White Box ( <i>E. albens</i> ).	PMST	Low – unsuitable habitat in the study area.
<i>Limosa limosa</i>	Black-tailed Godwit	M	V	A migratory wading bird that breeds in Mongolia and Eastern Siberia and flies to Australia for the southern summer, arriving in August and leaving in March. In NSW, it is most frequently found at Kooragang Island (Hunter River estuary). Occurs in sheltered bays, estuaries and lagoons with large intertidal mudflats and sand flats. Also found at inland mudflats, swamps.	2 – OEH PMST	Unlikely – no habitat in the study area

Species	Common Name	EPBC Act	TSC Act	Distribution and habitat	Data Source	Likelihood of occurrence in the study area
<i>Macronectes giganteus</i>	Southern Giant-petrel	E,M	E	The Southern Giant Petrel has a circumpolar pelagic range from Antarctica to approximately 20° S and is a common visitor off the coast of NSW. Over summer, the species nests in small colonies amongst open vegetation on Antarctic and subantarctic islands, including Macquarie and Heard Islands and in Australian Antarctic territory.	PMST	Unlikely – no habitat in the study area
<i>Macronectes halli</i>	Northern Giant-petrel	V, M	V	The Northern Giant-Petrel has a circumpolar pelagic distribution, usually between 40-64°S in open oceans. Their range extends into subtropical waters (to 28°S) in winter and early spring, and they are a common visitor in NSW waters, predominantly along the south-east coast during winter and autumn. Breeding in Australian territory is limited to Macquarie Island and occurs during spring and summer. Adults usually remain near the breeding colonies throughout the year (though some do travel widely) while immature birds make long and poorly known circumpolar and trans-oceanic movements. Hence most birds recorded in NSW coastal waters are immature birds. Northern Giant-Petrels seldom breed in colonies but rather as dispersed pairs, often amidst tussocks in dense vegetation and areas of broken terrain.	PMST	Unlikely – no habitat in the study area
<i>Ninox strenua</i>	Powerful Owl	-	V	In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered records on the western slopes and plains suggesting occupancy prior to land clearing. Now at low densities throughout most of its eastern range, rare along the Murray River and former inland populations may never recover. The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Turpentine <i>Syncarpia glomulifera</i> , Black She-oak <i>Allocasuarina littoralis</i> , Blackwood <i>Acacia melanoxylon</i> , Rough-barked Apple <i>Angophora floribunda</i> , Cherry Ballart <i>Exocarpus cupressiformis</i> and a number of eucalypt species.	1 – OEH	Low – unsuitable habitat in the study area.

Species	Common Name	EPBC Act	TSC Act	Distribution and habitat	Data Source	Likelihood of occurrence in the study area
<i>Numenius madagascariensis</i>	Eastern Curlew	CE	-	Within Australia, the Eastern Curlew has a primarily coastal distribution. The species is found in all states, particularly the north, east, and south-east regions including Tasmania. The Eastern Curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass.	PMST	Unlikely – no habitat in the study area
<i>Pachyptila turtur subantarctica</i>	Fairy Prion (southern)	V	-	Fairy Prions (including other subspecies) are often beachcast on the south-eastern coast of Australia, and are commonly seen offshore over the continental shelf and over pelagic waters. The southern subspecies of the Fairy Prion is a marine bird, found mostly in temperate and subantarctic seas. On Macquarie Island and adjacent islets, the burrows of Fairy Prions are usually in crevices, in hollows beneath cushions of <i>Colobanthus muscoides</i> or in burrows in peaty soil held together by a thick cover of <i>Cotula plumosa</i> .	PMST	Unlikely – no habitat in the study area
<i>Petroica boodang</i>	Scarlet Robin	-	V	The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and re-growth vegetation. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps.	1 – OEH	Low – unsuitable habitat in the study area.
<i>Rostratula australis</i>	Australian Painted Snipe	E, M	E	Most records are from the south east, particularly the Murray Darling Basin, with scattered records across northern Australia and historical records from around the Perth region in Western Australia. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds.	PMST	Unlikely – no habitat in the study area

Species	Common Name	EPBC Act	TSC Act	Distribution and habitat	Data Source	Likelihood of occurrence in the study area
<i>Sterna albifrons</i>	Little Tern	M	E	Migrating from eastern Asia, the Little Tern is found on the north, east and south-east Australian coasts, from Shark Bay in Western Australia to the Gulf of St Vincent in South Australia. In NSW, it arrives from September to November, occurring mainly north of Sydney. Almost exclusively coastal, preferring sheltered environments; however may occur several kilometres from the sea in harbours, inlets and rivers (with occasional offshore islands or coral cay records). Nests in small, scattered colonies in low dunes or on sandy beaches just above high tide mark near estuary mouths or adjacent to coastal lakes and islands.	3 – OEH	Unlikely – no habitat in the study area
<i>Thalassarche bulleri</i>	Buller's Albatross	V, M	-	Buller's Albatross breed in New Zealand (Snares, Solander and Chatham Islands), but are regular visitors to Australian waters. They are frequently seen off the coast from Coffs Harbour, south to Tasmania and west to Eyre Peninsula. In Australia, Buller's Albatross are seen over inshore, offshore and pelagic waters. They appear to congregate over currents where water temperature exceeds 16 °C.	PMST	Unlikely – no habitat in the study area
<i>Thalassarche cauta cauta</i>	Shy Albatross	V	V	This species is circumpolar in distribution, occurring widely in the southern oceans. Islands off Australia and New Zealand provide breeding habitat. In Australian waters, the Shy Albatross occurs along the east coast from Stradbroke Island in Queensland along the entire south coast of the continent to Carnarvon in Western Australia. Although uncommon north of Sydney, the species is commonly recorded off southeast NSW, particularly between July and November, and has been recorded in Ben Boyd National Park. This pelagic or ocean-going species inhabits subantarctic and subtropical marine waters, spending the majority of its time at sea. Occasionally the species occurs in continental shelf waters, in bays and harbours. Known breeding locations include Albatross Island off Tasmania, Auckland Island, Bounty Island and The Snares, off New Zealand, where nesting colonies of 6-500 nests occur and may contain other species such as the Australian Gannet. Located on sheltered sides of islands, on cliffs and ledges, in crevices and slopes, nests are used annually and consist of a mound of mud, bones, plant matter and rocks.	PMST	Unlikely – no habitat in the study area

Species	Common Name	EPBC Act	TSC Act	Distribution and habitat	Data Source	Likelihood of occurrence in the study area
<i>Thalassarche cauta eremita</i>	Chatham Albatross	E, M	-	Breeding for the Chatham Albatross is restricted to Pyramid Rock, Chatham Islands, off the coast of New Zealand. The principal foraging range for this species is in coastal waters off eastern and southern New Zealand, and Tasmania.	PMST	Unlikely – no habitat in the study area
<i>Thalassarche cauta salvini</i>	Salvin's Albatross	V, M	-	Salvin's Albatross breeds on Bounty, Snares and Chatham Islands, south of New Zealand, as well as on Crozet Island in the Indian Ocean. The species forages over most of the southern Pacific Ocean, where it is particularly common in the Humboldt Current, off South America. There are small numbers in the Indian Ocean and sometimes in the South Atlantic Ocean. During the non-breeding season, the species occurs over continental shelves around continents. It occurs both inshore and offshore and enters harbours and bays (Jehl 1973). Salvin's Albatross is scarce in pelagic waters.	PMST	Unlikely – no habitat in the study area
<i>Thalassarche cauta steadi</i>	White-capped Albatross	V, M	-	Breeding colonies occur on islands south of New Zealand. The White-capped Albatross is a marine species and occurs in subantarctic and subtropical waters. The White-capped Albatross is probably common off the coast of south-east Australia throughout the year.	PMST	Unlikely – no habitat in the study area
<i>Thalassarche melanophris</i>	Black-browed Albatross	M, V	V	The Black-browed Albatross has a circumpolar range over the southern oceans, and are seen off the southern Australian coast mainly during winter. This species migrates to waters off the continental shelf from approximately May to November and is regularly recorded off the NSW coast during this period. The species has also been recorded in Botany Bay National Park. Inhabits Antarctic, subantarctic, subtropical marine and coastal waters over upwellings and boundaries of currents. Can tolerate water temperatures between 0°C and 24°C. Spends most of its time at sea, breeding on small isolated islands.	PMST	Unlikely – no habitat in the study area
<i>Thalassarche melanophris impavida</i>	Campbell Albatross	V, M	-	The Campbell Albatross is a non-breeding visitor to Australian waters. Non-breeding birds are most commonly seen foraging over the oceanic continental slopes off Tasmania, Victoria and New South Wales. They breed only on sub-Antarctic Campbell Island (New Zealand), south of New Zealand. After breeding, birds move north and may enter Australia's temperate shelf waters.	PMST	Unlikely – no habitat in the study area



Species	Common Name	EPBC Act	TSC Act	Distribution and habitat	Data Source	Likelihood of occurrence in the study area
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	Forages over a broad range of open forest and woodland habitats, this species is a cave roosting bat which favours sandstone escarpment habitats for roosting, in the form of shallow overhangs, crevices and caves.	PMST	Low – unsuitable habitat in the study area.
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	E	V	Wet and dry sclerophyll forests and rainforests, and adjacent open agricultural areas. Generally associated with large expansive areas of habitat to sustain territory size. Requires hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites.	1 – OEH	Unlikely – no habitat in the study area
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	-	V	Occurs on east and north-west coasts of Australia. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other manmade structures.	20 – OEH	Low – unsuitable habitat in the study area.
<i>Myotis macropus</i>	Southern Myotis	-	V	Generally roost in groups close to water in caves, mine shafts, hollow-bearing trees, and storm water channels, buildings, under bridges and in dense foliage. Forages over streams and pools catching insects and small fish.	5 – OEH	Low – unsuitable habitat in the study area.
<i>Phascolarctos cinereus</i>	Koala	V	V	In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species.	PMST	Unlikely – no habitat in the study area
<i>Pseudomys novaehollandiae</i>	New Holland mouse	V	-	Distribution is fragmented across all eastern states of Australia, where it inhabits open heath lands, open woodlands with heath understorey and vegetated sand dunes.	PMST	Unlikely – no habitat in the study area

Species	Common Name	EPBC Act	TSC Act	Distribution and habitat	Data Source	Likelihood of occurrence in the study area
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V	Generally found within 200 kilometre of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. In times of natural resource shortages, they may be found in unusual locations. Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 kilometre of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young.	25 – OEH PMST	Moderate – This species may forage or rest in trees and shrubs within the study area on occasion. However, no significant habitat is present.
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail-bat	-	V	Wide-ranging species found across northern and eastern Australia. Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows.	1 – OEH	Low – unsuitable habitat in the study area.
<i>Caretta caretta</i>	Loggerhead Turtle	E, M	E	Loggerhead Turtles are found in tropical and temperate waters off the Australian coast. In NSW they are seen as far south as Jervis Bay and have been recorded nesting on the NSW north coast and feeding around Sydney. Loggerhead Turtles are ocean-dwellers, foraging in deeper water for fish, jellyfish and bottom-dwelling animals. The female comes ashore to lay her eggs in a hole dug on the beach in tropical regions during the warmer months.	PMST	Unlikely – no habitat in the study area
<i>Chelonia mydas</i>	Green Turtle	V, M	V	Widely distributed in tropical and sub-tropical seas. Usually found in tropical waters around Australia but also occurs in coastal waters of NSW, where it is generally seen on the north or central coast, with occasional records from the south coast. Ocean-dwelling species spending most of its life at sea. Carnivorous when young but as adults they feed only on marine plant material.	PMST	Unlikely – no habitat in the study area
<i>Dermochelys coriacea</i>	Leatherback Turtle	E, M	E	Throughout the world's tropical and temperate seas and in all coastal waters of Australia. Most sightings are in temperate waters. Occurs in inshore and offshore marine waters. Rarely breeds in Australia, with the nearest regular nesting sites being the Solomon Islands and Malayan Archipelago. Occasional breeding records from NSW coast, including between Ballina and Lennox Head in northern NSW.	PMST	Unlikely – no habitat in the study area

Species	Common Name	EPBC Act	TSC Act	Distribution and habitat	Data Source	Likelihood of occurrence in the study area
<i>Eretmochelys imbricate</i>	Hawksbill Turtle	V, M	-	Major nesting of Hawksbill Turtles in Australia occurs at Varanus Island and Rosemary Island in Western Australia, and in the northern Great Barrier Reef and Torres Strait, Queensland. Hawksbill Turtles spend their first five to ten years drifting on ocean currents.	PMST	Unlikely – no habitat in the study area
<i>Hoplocephalus bungaroides</i>	Broad-headed Snake	V	V	Shelters in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter and spring. Moves from the sandstone rocks to shelters in hollows in large trees within 200 m of escarpments in summer.	PMST	Low – unsuitable habitat in the study area.
<i>Natator depressus</i>	Flatback Turtle	V, M	-	The Flatback Turtle is found only in the tropical waters of northern Australia, Papua New Guinea and Irian Jaya and is one of only two species of sea turtle without a global distribution. Post-hatchling and juvenile Flatback Turtles do not have the wide dispersal phase in the oceanic environment like other sea turtles. Adults inhabit soft bottom habitat over the continental shelf of northern Australia, extending into Papua New Guinea and Irian Jaya although the extent of their range is not fully known.	PMST	Unlikely – no habitat in the study area
<i>Heleioporus australiacus</i>	Giant Burrowing Frog	V	V	The Giant Burrowing Frog is distributed in south-eastern NSW and Victoria, and appears to exist as two distinct populations: a northern population largely confined to the sandstone geology of the Sydney Basin and extending as far south as Ulladulla, and a southern population occurring from north of Narooma through to Walhalla, Victoria. Found in heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based. Spends more than 95% of its time in non-breeding habitat in areas up to 300 m from breeding sites. Whilst in non-breeding habitat it burrows below the soil surface or in the leaf litter. Individual frogs occupy a series of burrow sites, some of which are used repeatedly. The home ranges of both sexes appear to be non-overlapping suggesting exclusivity of non-breeding habitat. Home ranges are approximately 0.04 ha in size.	PMST	Unlikely – no habitat in the study area

Species	Common Name	EPBC Act	TSC Act	Distribution and habitat	Data Source	Likelihood of occurrence in the study area
<i>Litoria aurea</i>	Green and Golden Bell Frog	V	E	Since 1990 there have been approximately 50 recorded locations in NSW, most of which are small, coastal, or near coastal populations. These locations occur over the species' former range; however they are widely separated and isolated. Large populations in NSW are located around the metropolitan areas of Sydney, Shoalhaven and mid north coast (one an island population). There is only one known population on the NSW Southern Tablelands. Ephemeral and permanent freshwater wetlands, ponds, dams with an open aspect and fringed by Typha and other aquatics, free from predatory fish.	11395 – OEH PMST	Unlikely – no habitat in the study area
<i>Litoria raniformis</i>	Southern Bell Frog	V	E	The species is currently widespread throughout the Murray River valley and has been recorded from six Catchment Management Areas in NSW: Lower Murray Darling, Murrumbidgee, Murray, Lachlan, Central West and South East. Found mostly amongst emergent vegetation, including Typha sp. (bullrush), Phragmites sp. (reeds) and Eleocharis sp. (sedges), in or at the edges of still or slow-flowing water bodies such as lagoons, swamps, lakes, ponds and farm dams.	PMST	Unlikely – no habitat in the study area
<i>Epinephelus daemeli</i>	Black Cod	-	V	In Australia, the distribution of black cod ranges from southern Queensland through NSW to northern Victoria. However, records from Queensland and Victoria are rare, and the NSW coastline forms the species' main range, both in Australia and internationally. The use of estuaries may be an important part of the ecology of juvenile black cod in NSW waters.	PMST	Unlikely – no habitat in the study area
<i>Meridolum comeovirens</i>	Cumberland Land Snail	-	E	Primarily inhabits Cumberland Plain Woodland (an endangered ecological community). This community is grassy, open woodland with occasional dense patches of shrubs. Lives under litter of bark, leaves and logs, or shelters in loose soil around grass clumps. Occasionally shelters under rubbish.	2 – OEH PMST	Unlikely – no habitat in the study area
<i>Actitis hypoleucos</i>	Common Sandpiper	M	-	Found along all coastlines of Australia and in many areas inland, the Common Sandpiper is widespread in small numbers. The species utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins or rocky shores and rarely on mudflats.	7 – OEH	Unlikely – no habitat in the study area

Species	Common Name	EPBC Act	TSC Act	Distribution and habitat	Data Source	Likelihood of occurrence in the study area
<i>Apus pacificus</i>	Fork-tailed Swift	M	-	Recorded in all regions of NSW. The Fork-tailed Swift is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher.	PMST	Unlikely – no habitat in the study area
<i>Ardea alba</i>	Great Egret	M	-	Widespread in Australia. Reported in a wide range of wetland habitats (for example inland and coastal, freshwater and saline, permanent and ephemeral, open and vegetated, large and small, natural and artificial).	79 – OEH	Unlikely – no habitat in the study area
<i>Ardea ibis</i>	Cattle Egret	M	-	Widespread and common according to migration movements and breeding localities surveys. Occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands.	79 – OEH PMST	Unlikely – no habitat in the study area
<i>Arenaria interpres</i>	Ruddy Turnstone	M	-	Coastline and only occasionally inland. They are mainly found on exposed rocks or reefs, often with shallow pools, and on beaches.	1 – OEH PMST	Unlikely – no habitat in the study area
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	M	-	The Sharp-tailed Sandpiper spends the non-breeding season in Australia with small numbers occurring regularly in New Zealand. Most of the population migrates to Australia, mostly to the south-east and are widespread in both inland and coastal locations and in both freshwater and saline habitats. Many inland records are of birds on passage. Prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation.	22 – OEH PMST	Unlikely – no habitat in the study area
<i>Calidris canutus</i>	Red Knot	M	-	Common in all the main suitable habitats around the coast of Australia. Mainly inhabit intertidal mudflats, sandflats and sandy beaches of sheltered coasts, in estuaries, bays, inlets, lagoons and harbours; sometimes on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms or coral reefs.	PMST	Unlikely – no habitat in the study area
<i>Calidris melanotos</i>	Pectoral Sandpiper	M	-	In New South Wales (NSW), the Pectoral Sandpiper is widespread, but scattered. Records exist east of the Great Divide, from Casino and Ballina, south to Ulladulla. West of the Great Divide, the species is widespread in the Riverina and Lower Western regions. Prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands.	7 – OEH PMST	Unlikely – no habitat in the study area

Species	Common Name	EPBC Act	TSC Act	Distribution and habitat	Data Source	Likelihood of occurrence in the study area
<i>Calidris ruficollis</i>	Red-necked Stint	M	-	It is distributed along most of the Australian coastline with large densities on the Victorian and Tasmanian coasts. The Red-necked Stint breeds in Siberia and sporadically in north and west Alaska, probably from Taymyr region to Anadyr Territory and Koryakland. The Red-necked Stint mostly forages on bare wet mud on intertidal mudflats or sandflats, or in very shallow water; mostly in areas with a film of surface water and mostly close to edge of water. Roosts on sheltered beaches, spits, banks or islets, of sand, mud, coral or shingle, sometimes in saltmarsh or other vegetation.	PMST	Unlikely – no habitat in the study area
<i>Calidris tenuirostris</i>	Great Knot	M	V	In NSW, the species has been recorded at scattered sites along the coast down to about Narooma. It has also been observed inland at Tullakool, Armidale, Gilgandra and Griffith. Occurs within sheltered, coastal habitats containing large, intertidal mudflats or sand flats, including inlets, bays, harbours, estuaries and lagoons. Often recorded on sandy beaches with mudflats nearby, sandy spits and islets and sometimes on exposed reefs or rock platforms. Migrates to Australia from late August to early September, although juveniles may not arrive until October-November.	PMST	Unlikely – no habitat in the study area
<i>Charadrius bicinctus</i>	Double-banded Plover	M	-	The Double-banded Plover can be found in both coastal and inland areas. The Double-banded Plover is found on littoral, estuarine and fresh or saline terrestrial wetlands and also saltmarsh, grasslands and pasture. It occurs on muddy, sandy, shingled or sometimes rocky beaches, bays and inlets, harbours and margins of fresh or saline terrestrial wetlands such as lakes, lagoons and swamps, shallow estuaries and rivers.	PMST	Unlikely – no habitat in the study area
<i>Cuculus optatus</i>	Oriental Cuckoo	M	-	Migrates from Eurasia as far south as Indonesia, New Guinea and North Australia. Some remain through Australia in the winter. Inhabits rainforest margins, monsoon forest, vine scrub and mangroves.	PMST	Unlikely – no habitat in the study area
<i>Gallinago hardwickii</i>	Latham's Snipe	M	-	Recorded along the east coast of Australia from Cape York Peninsula through to south-eastern South Australia. Occurs in permanent and ephemeral wetlands up to 2000 m above sea-level.	425 – OEH PMST	Unlikely – no habitat in the study area

Species	Common Name	EPBC Act	TSC Act	Distribution and habitat	Data Source	Likelihood of occurrence in the study area
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	M	-	Distributed along the coastline (including offshore islands) of mainland Australia and Tasmania. Found in coastal habitats (especially those close to the sea-shore) and around terrestrial wetlands in tropical and temperate regions of mainland Australia and its offshore islands. The habitats occupied by the sea-eagle are characterised by the presence of large areas of open water (larger rivers, swamps, lakes, and the sea).	21 – OEH PMST	Unlikely – no habitat in the study area
<i>Heteroscelus brevipes</i>	Grey-tailed Tattler	M	-	Within Australia, the Grey-tailed Tattler has a primarily northern coastal distribution and is found in most coastal regions. The Grey-tailed Tattler is often found on sheltered coasts with reefs and rock platforms or with intertidal mudflats. It can also be found at intertidal rocky, coral or stony reefs as well as platforms and islets that are exposed at low tide.	PMST	Unlikely – no habitat in the study area
<i>Hirundapus caudacutus</i>	White-throated Needletail	M	-	Widespread in eastern and south-eastern Australia. Almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground. They also commonly occur over heathland but less often over treeless areas, such as grassland or swamps.	4 – OEH	Unlikely – no habitat in the study area
<i>Hydroprogne caspia</i>	Caspian Tern	M	-	Within Australia, the Caspian Tern has a widespread occurrence and can be found in both coastal and inland habitat. The Caspian Tern breeds on variable types of sites including low islands, cays, spits, banks, ridges, beaches of sand or shell, terrestrial wetlands and stony or rocky islets or banks. This species usually forages in open wetlands, including lakes and rivers.	1 – OEH	Unlikely – no habitat in the study area
<i>Limosa lapponica</i>	Bar-tailed Godwit	M	-	The Bar-tailed Godwit has been recorded in the coastal areas of all Australian states. The Bar-tailed Godwit is found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays.	2 – OEH PMST	Unlikely – no habitat in the study area
<i>Limosa limosa</i>	Black-tailed Godwit	M	V	A migratory wading bird that breeds in Mongolia and Eastern Siberia and flies to Australia for the southern summer, arriving in August and leaving in March. In NSW, it is most frequently found at Kooragang Island (Hunter River estuary). Occurs in sheltered bays, estuaries and lagoons with large intertidal mudflats and sand flats. Also found at inland mudflats, swamps.	PMST	Unlikely – no habitat in the study area

Species	Common Name	EPBC Act	TSC Act	Distribution and habitat	Data Source	Likelihood of occurrence in the study area
<i>Lamna nasus</i>	Porbeagle, Mackerel Shark	M	-	In Australia, the species occurs in waters from southern Queensland to south-west Australia. The Porbeagle primarily inhabits oceanic waters and areas around the edge of the continental shelf. They occasionally move into coastal waters, but these movements are temporary.	PMST	Unlikely – no habitat in the study area
<i>Manta alfredi</i>	Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray	M	-	This species has a circumglobal range in tropical and sub-tropical waters. Commonly sighted inshore, but also found around offshore coral reefs, rocky reefs and seamounts.	PMST	Unlikely – no habitat in the study area
<i>Manta birostris</i>	Giant Manta Ray, Chevron, Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray	M	-	The Giant Manta Ray occurs in tropical, sub-tropical and temperate waters of the Atlantic, Pacific and Indian Oceans. Commonly sighted along productive coastlines with regular upwelling, oceanic island groups and particularly offshore pinnacles and seamounts.	PMST	Unlikely – no habitat in the study area
<i>Merops ornatus</i>	Rainbow Bee-eater	M	-	Distributed across much of mainland Australia, and occurs on several near-shore islands. Occurs mainly in open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation.	PMST	Unlikely – no habitat in the study area
<i>Monarcha melanopsis</i>	Black-faced Monarch	M	-	Widespread in eastern Australia. Mainly occurs in rainforest ecosystems, including semi-deciduous vine-thickets, complex notophyll vine-forest, tropical (mesophyll) rainforest, subtropical (notophyll) rainforest, mesophyll (broadleaf) thicket/shrubland, warm temperate rainforest, dry (monsoon) rainforest and (occasionally) cool temperate rainforest.	PMST	Unlikely – no habitat in the study area
<i>Monarcha trivirgatus</i>	Spectacled Monarch	M	-	Occurs along the entire east coast of Australia. Breeds in dense scrub in gullies of coastal ranges.	PMST	Unlikely – no habitat in the study area
<i>Motacilla flava</i>	Yellow Wagtail	M	-	Rare but regular visitor around Australian coast, especially in the NW coast Broome to Darwin. Found in open country near swamps, salt marshes, sewage ponds, grassed surrounds to airfields, bare ground; occasionally on drier inland plains.	PMST	Unlikely – no habitat in the study area



Species	Common Name	EPBC Act	TSC Act	Distribution and habitat	Data Source	Likelihood of occurrence in the study area
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	M	-	Widespread in eastern Australia and vagrant to New Zealand. Inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests.	PMST	Unlikely – no habitat in the study area
<i>Numenius phaeopus</i>	Whimbrel	M	-	The Whimbrel is a regular migrant to Australia and New Zealand, with a primarily coastal distribution. The Whimbrel is often found on the intertidal mudflats of sheltered coasts. It is also found in harbours, lagoons, estuaries and river deltas, often those with mangroves, but also open, unvegetated mudflats.	PMST	Unlikely – no habitat in the study area
<i>Philomachus pugnax</i>	Ruff	M	-	The Ruff is a rare but regular non-breeding visitor to Australia, being recorded in all States and Territories. In NSW the species has been recorded at Kurnell, Tomki, Casino, Ballina, Kooragang Island, Broadwater Lagoon and Little Cattai Creek. The Ruff is found on generally fresh, brackish or saline wetlands with exposed mudflats at the edges.	3 – OEH PMST	Unlikely – no habitat in the study area
<i>Plegadis falcinellus</i>	Glossy Ibis	M	-	Preferred habitat for foraging and breeding are fresh water marshes at the edges of lakes and rivers, lagoons, flood-plains, wet meadows, swamps, reservoirs, sewage ponds, rice-fields and cultivated areas under irrigation.	21 – OEH	Unlikely – no habitat in the study area
<i>Pluvialis fulva</i>	Pacific Golden Plover	M	-	Most Pacific Golden Plovers occur along the east coast, and are especially widespread along the Queensland and NSW coastlines. In non-breeding grounds in Australia this species usually inhabits coastal habitats, though it occasionally occurs around inland wetlands. Pacific Golden Plovers usually occur on beaches, mudflats and sandflats (sometimes in vegetation such as mangroves, low saltmarsh such as <i>Sarcocornia</i> , or beds of seagrass) in sheltered areas including harbours, estuaries and lagoons, and also in evaporation ponds in salt works.	9 – OEH PMST	Unlikely – no habitat in the study area
<i>Pluvialis squatarola</i>	Grey Plover	M	-	Non-breeding visitor to Australia, Grey Plovers usually forage on large areas of exposed mudflats and beaches of sheltered coastal shores such as inlets, estuaries and lagoons. They usually roost in sandy areas, such as on unvegetated sandbanks or sand-spits on sheltered beaches or other sheltered environments such as estuaries or lagoons	1 – OEH	Unlikely – no habitat in the study area

Species	Common Name	EPBC Act	TSC Act	Distribution and habitat	Data Source	Likelihood of occurrence in the study area
<i>Rhipidura rufifrons</i>	Rufous Fantail	M	-	Occurs in coastal and near coastal districts of northern and eastern Australia. In east and south-east Australia, the Rufous Fantail mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts such as Tallow-wood ( <i>Eucalyptus microcorys</i> ), Mountain Grey Gum ( <i>E. cypellocarpa</i> ), Narrow-leaved Peppermint ( <i>E. radiata</i> ), Mountain Ash ( <i>E. regnans</i> ), Alpine Ash ( <i>E. delegatensis</i> ), Blackbutt ( <i>E. pilularis</i> ) or Red Mahogany ( <i>E. resinifera</i> ); usually with a dense shrubby understorey often including ferns.	PMST	Unlikely – no habitat in the study area
<i>Sterna hirundo</i>	Common Tern	M	-	The species is a non-breeding migrant to Australia, where it is widespread and common on the eastern coast south to eastern Victoria, and common on parts of the northern coast, mainly east of Darwin. Common Terns are marine, pelagic and coastal. In Australia, they are recorded in all marine zones, but are commonly observed in near-coastal waters, both on ocean beaches, platforms and headlands and in sheltered waters, such as bays, harbours and estuaries with muddy, sandy or rocky shores. However, off Wollongong, NSW, Common Terns were recorded in all marine zones but generally recorded in offshore and pelagic waters, 11–55 km from shore.		Unlikely – no habitat in the study area
<i>Tringa glareola</i>	Wood Sandpiper	M	-	The Wood Sandpiper has its largest numbers recorded in north-west Australia, with all areas of national importance located in Western-Australia. Uses well-vegetated, shallow, freshwater wetlands, such as swamps, billabongs, lakes, pools and waterholes.	1 – OEH	Unlikely – no habitat in the study area
<i>Tringa nebularia</i>	Common Greenshank	M	-	The Common Greenshank does not breed in Australia; however, the species occurs in all types of wetlands and has the widest distribution of any shorebird in Australia.	1 – OEH PMST	Unlikely – no habitat in the study area
<i>Tringa stagnatilis</i>	Marsh Sandpiper	M	-	Fresh or brackish (slightly salty) wetlands such as rivers, water meadows, sewage farms, drains, lagoons and swamps.	1 – OEH PMST	Unlikely – no habitat in the study area

\* Distribution and habitat requirement information adapted from:

- Australian Government Department of the Environment <http://www.environment.gov.au/biodiversity/threatened/index.html>
- NSW Office of Environment and Heritage <http://www.environment.nsw.gov.au/threatenedspecies/>
- Department of Primary Industries – Threatened Fish and Marine Vegetation [http://pas.dpi.nsw.gov.au/Species/All\\_Species.aspx](http://pas.dpi.nsw.gov.au/Species/All_Species.aspx)

+ Data source includes

- Number of records from the NSW Office of Environment and Heritage Wildlife Atlas record data; and
- Identified from the Protected Matters Search Tool (PMST) <http://www.environment.gov.au/epbc/pmst/index.html>

Key:

- EP = endangered population
- CE = critically endangered
- E = endangered
- V = vulnerable
- M = migratory

## Appendix C. Tree assessment

Tree No.	Species	Common name	Native or exotic	Dbh (m)	Crown width (m)	Height (m)	Structural Root Zone radius (m)	Calculated Tree Protection Zone radius (m)	Recommended Tree Protection Zone radius (m)	Tree health	Tree structure	Tree S.U.L.E	Habitat value for fauna
1	<i>Lophostemon confertus</i>	Brush Box	Native	0.81	12	15	3.0	9.7	10	Good	Good	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds, and the threatened Grey-headed Flying-fox
2	<i>Lophostemon confertus</i>	Brush Box	Native	0.92	13	15	3.2	11.0	11	Good	Good	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds, and the threatened Grey-headed Flying-fox
3	<i>Lophostemon confertus</i>	Brush Box	Native	1.29	13	15	3.7	15.5	16	Good	Good	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds, and the threatened Grey-headed Flying-fox
4	<i>Lophostemon confertus</i>	Brush Box	Native	0.58	8	8	2.6	7.0	7	Good	Good	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds, and the threatened Grey-headed Flying-fox

Tree No.	Species	Common name	Native or exotic	Dbh (m)	Crown width (m)	Height (m)	Structural Root Zone radius (m)	Calculated Tree Protection Zone radius (m)	Recommended Tree Protection Zone radius (m)	Tree health	Tree structure	Tree S.U.L.E	Habitat value for fauna
5	<i>Lophostemon confertus</i>	Brush Box	Native	0.48	6.5	8	2.4	5.8	6	Good	Good	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds, and the threatened Grey-headed Flying-fox
6	<i>Platanus X acerifolia</i>	London Plane Tree	Exotic	0.38	9.5	8	2.2	4.6	5	Good	Good	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds
7	<i>Lophostemon confertus</i>	Brush Box	Native	0.45	9	8	2.4	5.4	5	Good	Good	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds, and the threatened Grey-headed Flying-fox
8	<i>Platanus X acerifolia</i>	London Plane Tree	Exotic	0.43	9.5	10	2.3	5.2	5	Good	Good	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds
9	<i>Platanus X acerifolia</i>	London Plane Tree	Exotic	0.38	12	10	2.2	4.6	5	Good	Good	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds

Tree No.	Species	Common name	Native or exotic	Dbh (m)	Crown width (m)	Height (m)	Structural Root Zone radius (m)	Calculated Tree Protection Zone radius (m)	Recommended Tree Protection Zone radius (m)	Tree health	Tree structure	Tree S.U.L.E	Habitat value for fauna
10	<i>Jacaranda mimosifolia</i>	Jacaranda	Exotic	0.6	12	15	2.7	7.2	7	Fair	Fair	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds
11	<i>Jacaranda mimosifolia</i>	Jacaranda	Exotic	0.3 (4 stems)	13	10	2.0	3.6	4	Fair	Fair	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds
12	<i>Archontophoenix alexandrae</i>	Alexandra palms	Exotic	Unknown 5 trees	2	2	1.3	1.2	2	Good	Good	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds, and the threatened Grey-headed Flying-fox
13	<i>Jacaranda mimosifolia</i>	Jacaranda	Exotic	0.2 (3 stems)	10	10	1.7	2.4	2	Fair	Fair	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds
14	<i>Jacaranda mimosifolia</i>	Jacaranda	Exotic	0.3 (2 stems)	9	10	2.0	3.6	4	Fair	Fair	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds

Tree No.	Species	Common name	Native or exotic	Dbh (m)	Crown width (m)	Height (m)	Structural Root Zone radius (m)	Calculated Tree Protection Zone radius (m)	Recommended Tree Protection Zone radius (m)	Tree health	Tree structure	Tree S.U.L.E	Habitat value for fauna
15	<i>Cinnamomum camphora</i>	Camphor laurel	Exotic	0.15	4	11	1.5	1.8	2	Fair	Fair	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds
16	<i>Archontophoenix alexandrae</i>	Alexandra palm	Exotic	0.2	3.5	9	1.7	2.4	2	Good	Good	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds, and the threatened Grey-headed Flying-fox
17	<i>Caesalpinia</i> sp.	Caesalpinia	Exotic	0.1	5	8	1.3	1.2	2	Good	Fair	5 to 10 years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds
18	<i>Archontophoenix alexandrae</i>	Alexandra palm	Exotic	0.2	3	9	1.7	2.4	2	Good	Good	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds, and the threatened Grey-headed Flying-fox
19	<i>Paulownia</i> sp.	Paulownia	Exotic	0.2	15	15	1.7	2.4	2	Fair	Fair	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds

Tree No.	Species	Common name	Native or exotic	Dbh (m)	Crown width (m)	Height (m)	Structural Root Zone radius (m)	Calculated Tree Protection Zone radius (m)	Recommended Tree Protection Zone radius (m)	Tree health	Tree structure	Tree S.U.L.E	Habitat value for fauna
20	<i>Melaleuca styphelioides</i>	Prickly-leaved Tea Tree	Native	0.25	9.5	8	1.8	3.0	3	Good	Good	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds
21	<i>Melaleuca styphelioides</i>	Prickly-leaved Tea Tree	Native	0.2	5.5	6	1.7	2.4	2	Good	Good	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds
22	<i>Melaleuca styphelioides</i>	Prickly-leaved Tea Tree	Native	0.15	3.5	6	1.5	1.8	2	Good	Good	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds
23	<i>Callistemon</i> sp.	Bottle Brush (2 plants)	Native	0.1	1.5	2	1.3	1.2	2	Good	Good	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds
24	<i>Melaleuca styphelioides</i>	Prickly-leaved Tea Tree	Native	0.15	3	6	1.5	1.8	2	Good	Good	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds



Tree No.	Species	Common name	Native or exotic	Dbh (m)	Crown width (m)	Height (m)	Structural Root Zone radius (m)	Calculated Tree Protection Zone radius (m)	Recommended Tree Protection Zone radius (m)	Tree health	Tree structure	Tree S.U.L.E	Habitat value for fauna
25	<i>Cinnamomum camphora</i>	Camphor laurel	Exotic	0.5 (2 stems)	12.5	15	2.5	6.0	6	Good	Good	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds
26	<i>Cinnamomum camphora</i>	Camphor laurel	Exotic	0.5	12	15	2.5	6.0	6	Good	Good	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds
27	<i>Cinnamomum camphora</i>	Camphor laurel	Exotic	0.5	8.5	15	2.5	6.0	6	Good	Good	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds
28	<i>Cinnamomum camphora</i>	Camphor laurel	Exotic	0.5	12	15	2.5	6.0	6	Good	Good	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds
29	<i>Cinnamomum camphora</i>	Camphor laurel	Exotic	0.5	12.5	15	2.5	6.0	6	Good	Good	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds

Tree No.	Species	Common name	Native or exotic	Dbh (m)	Crown width (m)	Height (m)	Structural Root Zone radius (m)	Calculated Tree Protection Zone radius (m)	Recommended Tree Protection Zone radius (m)	Tree health	Tree structure	Tree S.U.L.E	Habitat value for fauna
30	<i>Cinnamomum camphora</i>	Camphor laurel	Exotic	0.5	9	15	2.5	6.0	6	Good	Good	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds
31	<i>Cinnamomum camphora</i>	Camphor laurel	Exotic	0.5	12	15	2.5	6.0	6	Good	Good	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds
32	<i>Cestrum parqui</i>	Green Cestrum	Exotic	0.02	14	1	0.6	0.2	NA	NA	NA	NA	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds
33	<i>Morus</i> sp.	Mulberry	Exotic	0.1	4	4	1.3	1.2	2	Fair	Fair	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds
34	<i>Fraxinus</i> sp.	Ash	Exotic	0.33	4	6	2.1	4.0	4	Fair	Good	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds

Tree No.	Species	Common name	Native or exotic	Dbh (m)	Crown width (m)	Height (m)	Structural Root Zone radius (m)	Calculated Tree Protection Zone radius (m)	Recommended Tree Protection Zone radius (m)	Tree health	Tree structure	Tree S.U.L.E	Habitat value for fauna
35	<i>Fraxinus</i> sp.	Ash	Exotic	0.33	5	6	2.1	4.0	4	Fair	Good	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds
36	<i>Morus</i> sp.	Mulberry	Exotic	0.1	4	4	1.3	1.2	2	Fair	Fair	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds
37	<i>Cinnamomum camphora</i>	Camphor laurel	Exotic	0.5	18	15	2.5	6.0	6	Good	Good	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds
38	<i>Cinnamomum camphora</i>	Camphor laurel	Exotic	0.5	14	15	2.5	6.0	6	Good	Good	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds
39	<i>Fraxinus</i> sp.	Ash	Exotic	0.33	5.5	15	2.1	4.0	4	Fair	Good	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds

Tree No.	Species	Common name	Native or exotic	Dbh (m)	Crown width (m)	Height (m)	Structural Root Zone radius (m)	Calculated Tree Protection Zone radius (m)	Recommended Tree Protection Zone radius (m)	Tree health	Tree structure	Tree S.U.L.E	Habitat value for fauna
40	<i>Cinnamomum camphora</i>	Camphor laurel	Exotic	0.5	6	15	2.5	6.0	6	Good	Good	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds
41	<i>Cinnamomum camphora</i>	Camphor laurel	Exotic	>1	17	15	3.3	12.0	12	Good	Good	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds
42	<i>Cinnamomum camphora</i>	Camphor laurel	Exotic	>1	18	15	3.3	12.0	12	Good	Good	20+ years	Limited - May provide roosting and foraging opportunities for common urban native and exotic birds

Notes: Tree species identification and diameter at breast height (dbh) has been estimated where plants were located in the rail corridor (no access to the rail corridor was undertaken for the assessment). Radius of the Tree Protection Zone (TPZ) calculated by the formula  $TPZ = dbh \times 12$ . Recommended TPZ radius has been rounded (minimum TPZ size is 2 m radius). Radius of the Structural Root Zone calculated from the formula  $R_{SRZ} = (\text{stem diameter} \times 50)^{0.42} \times 0.64$ . Palms (i.e. *Archontophoenix alexandrae*) do not have a SRZ formula so the standard SRZ formula was used which will over calculate the SRZ of a palm as a precautionary measure. Inspections of tree condition were visual and undertaken from the ground only. Tree health definitions are as follows:

- Good - the tree is demonstrating good or exceptional growth for the species. The tree should exhibit a full canopy of foliage and have only minor pest or disease problems. Foliage colour size and density should be typical of a healthy specimen of that species.
- Fair - the tree is in reasonable condition and growing well for the species. The tree should exhibit an adequate canopy of foliage. There may be some dead wood in the crown, some grazing by insect or animals may be evident, and/or foliage colour, size or density may be atypical for a healthy specimen of that species.
- Poor - tree is not growing to its full capacity. Extension growth of the lateral branches may be minimal. The canopy may be thinning or sparse. Large amounts of dead wood may be evident throughout the crown, as well as significant pest and disease problems. Other symptoms of stress indicating tree decline may be present.
- Very poor - The tree appears to be in a state of decline, and the canopy may be very thin and sparse. A significant volume of dead wood may be present in the canopy, or pest and disease problems may be causing a severe decline in tree health.
- Dead – the tree is dead.

Tree structure (the likelihood of the tree to fail under normal condition) was assessed according to the following criteria:

- **Good:** The tree has a well-defined and balanced crown. Branch unions appear to be strong, with no defects evident in the trunks or the branches. Major limbs are well defined. The tree would be considered a good example for the species. Probability of significant failure is highly unlikely.
- **Fair:** The tree has some minor problems in the structure of the crown. The crown may be slightly out of balance at some branch unions or branches may be exhibiting minor structural faults. If the tree has a single trunk, this may be on a slight lean, or be exhibiting minor defects. Tree may be re-sprouting from past cutting. Probability of significant failure is low.
- **Poor:** The tree may have a poorly structured crown, the crown may be unbalanced, or exhibit large gaps. Major limbs may not be well defined; branches may be rubbing or crossing over. Branch unions may be poor or faulty at the point of attachment. The tree may have suffered major root damage. Probability of significant failure is moderate.
- **Very poor:** The tree has a poorly structured crown. The crown is unbalanced, or exhibits large gaps. Major limbs are not well defined. Branch unions may be poor or faulty at the point of attachment. A section of the tree has failed, or is in imminent danger of failure. Active failure may be present, or failure is probably in the immediate future.
- **Failed:** A significant section of the tree or the whole tree has failed.

Tree Safe Useful Life Expectancy (SULE) is approximately how long a tree can be retained safely and usefully in the landscape providing site conditions remain unchanged and the recommended works are completed. The following ratings were used:

- **Unsafe or 0 years:** The tree is considered dangerous in the location and/or no longer provides any amenity value.
- **Less Than 5 years:** The tree under normal circumstances and without extra stress should be safe and have value of maximum of 5 years. The tree will need to be replaced in the short term. Replacement plants should be established as soon as possible if there is efficient space, or consideration should be given to the removal of the tree to facilitate replanting.
- **5 to 10 Years:** The tree under normal circumstances and without extra stress should be safe and have value of maximum of 10 years. Trees in this category may require regular inspections and maintenance particularly if they are large specimens. Replacement plants should be established in the short term if there is sufficient space, or consideration should be given to the removal of the tree to facilitate replanting. However, this is management decision and is beyond the scope of this inventory.
- **10 to 20 Years:** The tree under normal circumstances and without extra stress should be safe and of value of up to 20 years. During this period, regular inspections and maintenance will be required.
- **20 + Years:** The tree under normal circumstances and without extra stress should be safe and of value of more than 20 years. During this period, regular inspections and maintenance will be required.

## Appendix D. Assessment of significance

### D.1 EP&A Act significance assessment (7-part test)

While the Grey-headed Flying-fox (*Pteropus poliocephalus*) was not recorded in the study area during the field survey it is considered likely to occur based on the presence of suitable foraging habitat and the nearby location of roosting camps at Clyde (Duck River) (approximately two kilometres from the study area), Parramatta Park (approximately nine kilometres from the study area) and Cabramatta (approximately 11 kilometres from the study area). The Proposal may require the removal of three *Lophostemon confertus* (Brush Box) trees (trees 3, 4 and 5) that may provide some limited foraging habitat for the Grey-headed Flying-fox (*Pteropus poliocephalus*).

The factors to be considered when determining whether an action, development or activity is likely to significantly affect threatened species or their habitats are outlined below:

**1. 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**

The Grey-headed Flying-fox (*Pteropus poliocephalus*) occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 kilometres of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Annual mating commences in January and conception occurs in April or May; a single young is born in October or November.

There are no roost camps located in the study area and at the time of this assessment the Proposal would not directly impact on any known breeding / maternity site. As such, the impacts of the Proposal to the Grey-headed Flying-fox (*Pteropus poliocephalus*) would be limited to loss of feeding habitat caused by direct clearing or damage to native vegetation during the construction phase. The Proposal may require the removal of three *Lophostemon confertus* (Brush Box) trees (trees 3, 4 and 5) that may provide some limited foraging habitat for the Grey-headed Flying-fox (*Pteropus poliocephalus*). This impact is considered minimal in the context of the local foraging resource which is considerably large. *Lophostemon confertus* is a commonly planted street tree and the removal of three individuals (if required) is unlikely to cause any significant reduction in foraging habitat in the local area. As such, the Proposal is unlikely to reduce the population size of the Grey-headed Flying-fox (*Pteropus poliocephalus*) or decrease the reproductive success of this species.

Given the relative widespread nature of similar planted vegetation in the locality and abundance of higher quality foraging habitat within the feeding range of the camps located near the study area, the Proposal is not expected to significantly affect the life cycle of the species. While some trees suitable as foraging habitat may need to be removed, the works would not result in the removal of any significant quantity of food resources or impact on an area of foraging or breeding habitat considered critical to survival, according to the national recovery plan for the Grey-headed Flying-fox (Department of Environment, Climate Change and Water 2009).

**2. 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**

Not applicable.

**3. 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**

**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**

Not applicable.

- 4. 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**
  - 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.**

The potential habitat of the Grey-headed Flying-fox (*Pteropus poliocephalus*) within the study area is limited to foraging habitat and includes all fruiting and flowering trees and shrubs. The Proposal may require the removal three *Lophostemon confertus* (Brush Box) trees (trees 3, 4 and 5) that may provide some limited foraging habitat for the Grey-headed Flying-fox (*Pteropus poliocephalus*).

Importantly, the Proposal would not result in fragmentation of habitat for the Grey-headed Flying-fox (*Pteropus poliocephalus*). This species is highly mobile and will freely fly long distances (up to 50 kilometres) over open areas including urbanised city centres to move between roost camps and foraging sites. The Proposal would not affect the movement of the Grey-headed Flying-fox (*Pteropus poliocephalus*) between habitat patches.

Importantly, the Proposal would not impact on the most important habitats for Grey-headed Flying-fox (*Pteropus poliocephalus*) within the locality. The most important habitats for the local Grey-headed Flying-fox (*Pteropus poliocephalus*) sub-populations are the roosting camps at Parramatta Park, Clyde (Duck River), Cabramatta, Wetherill Park, Ropes Creek, and Emu Plains. These camps would not be affected by the Proposal. Foraging habitat within the study area is likely to form part of an overall foraging range of these sub-populations and would only form a very small proportion of available habitat for this species. The foraging habitat within the study area is unlikely to be of critical importance for the survival of the Grey-headed Flying-fox (*Pteropus poliocephalus*) within the locality.

While some trees suitable as foraging habitat may need to be removed, the works would not result in the removal of any significant quantity of food resources or impact on an area of foraging or breeding habitat considered critical to survival, according to the national recovery plan for the Grey-headed Flying-fox (Department of Environment, Climate Change and Water 2009).

- 5. whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)**

Critical habitat refers only to those areas of land listed in the Register of Critical Habitat kept by the NSW Office of Environment and Heritage (OEH). This question is not applicable as no critical habitat has been listed for the Grey-headed Flying-fox (*Pteropus poliocephalus*).

- 6. whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan**

The *Draft National Recovery Plan for the Grey-headed Flying-fox (Pteropus poliocephalus)* (Department of Environment Climate Change and Water 2009) outlines the following actions:

- identify and protect foraging habitat critical to the survival of Grey-headed Flying-foxes across their range
- enhance winter and spring foraging habitat for Grey-headed Flying-foxes
- identify, protect and enhance roosting habitat critical to the survival of Grey-headed Flying-foxes
- significantly reduce levels of deliberate Grey-headed Flying-fox destruction associated with commercial horticulture
- provide information and advice to managers, community groups and members of the public that are involved with controversial flying-fox camps
- produce and circulate educational resources to improve public attitudes toward Grey-headed Flying-foxes, promote the recovery program to the wider community and encourage participation in recovery actions

- monitor population trends for the Grey-headed Flying-fox
- assess the impacts on Grey-headed Flying-foxes of electrocution on power lines and entanglement in netting and barbed wire, and implement strategies to reduce these impacts
- oversee a program of research to improve knowledge of the demographics and population structure of the Grey-headed Flying-fox
- maintain a National Recovery Team to oversee the implementation of the Grey-headed Flying-fox National Recovery Plan.

A targeted strategy for managing threatened species is also being developed under the OEH Saving Our Species program. OEH is currently developing a targeted approach for managing threatened species. The Grey-headed Flying-fox (*Pteropus poliocephalus*) has been assigned to the landscape species management stream under the OEH Saving our Species program.

The recovery actions listed above, and those identified in the Saving Our Species program, that have been identified by the OEH to help recover the Grey-headed Flying-fox (*Pteropus poliocephalus*) are largely not applicable to the Proposal as they are actions for the OEH to complete and focus on priority conservation lands which are outside of the study area. The Proposal will not interfere with the recovery of the Grey-headed Flying-fox (*Pteropus poliocephalus*).

As the upgrade would not impact on an area of foraging or breeding habitat considered critical to survival, according to the national recovery plan for the Grey-headed Flying-fox (Department of Environment, Climate Change and Water 2009), this activity is consistent with the objectives of the national recovery plan.

**7. 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.**

A Key Threatening Process (KTP) is a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, population or ecological community. Key threatening processes are listed under the TSC Act and at the present there are currently 38 listed KTPs.

Of the 38 listed KTPs under the TSC Act, the only KTP relevant to the Grey-headed Flying-fox (*Pteropus poliocephalus*) that will be increased by the Proposal is clearing of native vegetation. The main threats to the Grey-headed Flying-fox (*Pteropus poliocephalus*) include:

- loss and disturbance of roosting sites
- unregulated shooting
- electrocution on power lines, entanglement in netting and on barbed-wire
- competition with Black Flying-foxes
- negative public attitudes and conflict with humans
- impacts from climate change
- disease.

The Proposal would not increase any of the above threats.

#### **D.1.1 Conclusion**

The Grey-headed Flying-fox (*Pteropus poliocephalus*) would suffer a very small reduction in extent of suitable foraging habitat (three trees) from the Proposal. No camps or other important habitat would be impacted. The Proposal would not reduce the population size of the Grey-headed Flying-fox (*Pteropus poliocephalus*) or decrease the reproductive success of this species. The Proposal would not interfere with the recovery of the Grey-headed Flying-fox (*Pteropus poliocephalus*) and would not contribute to the key threats to this species. After consideration of the factors above, an overall conclusion has been made that the Proposal is unlikely to result in a significant impact to the Grey-headed Flying-fox (*Pteropus poliocephalus*).



## D.2 EPBC Act significance assessment

While the Grey-headed Flying-fox (*Pteropus poliocephalus*) was not recorded in the study area during the field survey it is considered likely to occur based on the presence of suitable foraging habitat and the nearby location of roosting camps at Cabramatta and Clyde (Duck River).

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

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

There have been no roost camps identified in the study area to date and at the time of the REF the Proposal would not directly impact on any known breeding / maternity site. Therefore it is likely that the impacts of construction and operation of the Proposal would be confined to loss of some limited feeding habitat caused by direct clearing or damage to three trees during the construction phase.

The proposal may require the removal of three *Lophostemon confertus* (Brush Box) trees (trees 3, 4 and 5) that may provide some limited foraging habitat for the Grey-headed Flying-fox (*Pteropus poliocephalus*). The extent of similar foraging habitat in the locality is extensive and the removal of three trees is not likely to negatively impact this species. As such, the Proposal is not expected to lead to a long-term decrease in the size of an important population.

### 2. reduce the area of occupancy of an important population

The Proposal may require the removal of three *Lophostemon confertus* (Brush Box) trees (trees 3, 4 and 5) that may provide some limited foraging habitat for the Grey-headed Flying-fox (*Pteropus poliocephalus*).

This area of habitat may be defined as a portion of the potential area of occupancy for feeding life-cycle attributes of the population. The removal of these three trees would not cause the population to change its area of occupancy as the species would continue to forage in the Auburn locality after the works have been completed. The overall area of habitat available to the species and the area occupied by this species would remain the same.

### 3. fragment an existing important population into two or more populations

There is currently a high degree of habitat fragmentation across the study area and locality. Highly mobile species such as bats are expected to be less impacted by fragmentation (as evidenced by the movement of this species along the east coast) and the grey-headed flying-fox is particularly well adapted to accessing widely spaced habitat resources given its mobility and preference for seasonal fruits and blossom. The Proposal would not fragment an important population of the Grey-headed Flying-fox.

### 4. adversely affect habitat critical to the survival of a species

Habitat critical to the survival of a species refers to areas that are necessary for activities such as:

- foraging, breeding, roosting, or dispersal
- for the long-term maintenance of the species including the maintenance of other species essential to the survival of the species, such as pollinators
- to maintain genetic diversity and long-term evolutionary development
- for the reintroduction of populations or recovery of the species.

The proposed area of habitat loss represents a small percentage of the potential foraging habitat for the Grey-headed Flying-fox within a 50 kilometre radius of the Proposal boundary and known roost camps in the region. This species typically exhibits very large home ranges and Grey-headed Flying-fox are known to travel distances of at least 50 kilometres from roost sites to access seasonal foraging resources (Eby 1996). No evidence of a camp site has been identified from the study area.

The draft recovery plan for the Grey-headed Flying-fox (DECCW 2009) identifies critical foraging habitat for this species as:

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

The Proposal may require the removal of three *Lophostemon confertus* (Brush Box) trees (trees 3, 4 and 5) that may provide some limited foraging habitat for the Grey-headed Flying-fox (*Pteropus poliocephalus*). Given the extensive nature of similar planted vegetation in the locality and abundance of higher quality foraging habitat within the feeding range of regional populations, the Proposal is not expected to adversely affect habitat critical to the survival of the species. The project would not impact on an area of foraging or breeding habitat considered critical to survival, according to the national recovery plan for the Grey-headed Flying-fox (Department of Environment, Climate Change and Water 2009).

#### **5. disrupt the breeding cycle of an important population**

As stated above there would be a minor impact on foraging habitat identified as important during the breeding cycle of the species. The upgrade would not directly impact on a known roost camp / breeding or maternity site.

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

No evidence of a roost camp has been identified from the study area. Further, there would be a relatively minor impact on foraging habitat. This impact is not expected to lead to a decline in the species in this region.

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

The potential for weed invasion is considered possible with a Proposal of this nature and appropriate controls are required during construction and operation to reduce this threat. The management of invasive species would be managed under the construction environmental management plan.

#### **8. introduce disease that may cause the species to decline, or**

There are no known disease issues affecting this species in relation to the Proposal. The Proposal would be unlikely to increase feral animal abundance or the potential for significant disease vectors to affect local populations.

#### **9. interfere substantially with the recovery of the species.**

The *Draft National Recovery Plan for the Grey-headed Flying-fox (Pteropus poliocephalus)* (Department of Environment, Climate Change and Water NSW. 2009) outlines the following actions:

- identify and protect foraging habitat critical to the survival of Grey-headed Flying-foxes across their range
- enhance winter and spring foraging habitat for Grey-headed Flying-foxes
- identify, protect and enhance roosting habitat critical to the survival of Grey-headed Flying-foxes
- significantly reduce levels of deliberate Grey-headed Flying-fox destruction associated with commercial horticulture
- provide information and advice to managers, community groups and members of the public that are involved with controversial flying-fox camps

- produce and circulate educational resources to improve public attitudes toward Grey-headed Flying-foxes, promote the recovery program to the wider community and encourage participation in recovery actions
- monitor population trends for the Grey-headed Flying-fox
- assess the impacts on Grey-headed Flying-foxes of electrocution on power lines and entanglement in netting and barbed wire, and implement strategies to reduce these impacts
- oversee a program of research to improve knowledge of the demographics and population structure of the Grey-headed Flying-fox
- maintain a National Recovery Team to oversee the implementation of the Grey-headed Flying-fox National Recovery Plan.

The recovery actions listed above are largely not applicable to the Proposal as they focus on priority conservation lands which are outside of the study area.

Given the relative widespread nature of similar planted vegetation in the locality and abundance of higher quality foraging habitat within the feeding range of regional populations, the Proposal is not expected to interfere substantially with the recovery of the species.

#### **D.2.1 Conclusion**

The Proposal may require the removal of three *Lophostemon confertus* (Brush Box) trees (trees 3, 4 and 5) that may provide some limited foraging habitat for the Grey-headed Flying-fox (*Pteropus poliocephalus*). However, the Grey-headed Flying-fox (*Pteropus poliocephalus*) would not suffer a reduction in extent of suitable foraging habitat from the Proposal. No breeding camps or other important habitat would be impacted. The Proposal is unlikely to reduce the population size of the Grey-headed Flying-fox (*Pteropus poliocephalus*) or decrease the reproductive success of this species. The Proposal would not interfere with the recovery of the Grey-headed Flying-fox (*Pteropus poliocephalus*) and would not contribute to the key threats to this species. After consideration of the factors above, an overall conclusion has been made that the Proposal is unlikely to result in a significant impact to the Grey-headed Flying-fox (*Pteropus poliocephalus*).