Transport Access Program

Transport for New South Wales

Ecological Impact Assessment for Jannali Station

Final | Rev 03

21 January 2016

2863/003

Transport Access Program

Project No:	IA078900
Document Title:	Ecological Impact Assessment for Jannali Station
Document No.:	Final
Revision:	Rev 03
Date:	21 January 2016
Client Name:	Transport for New South Wales
Client No:	2863/003
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File Name:	Document1

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Document history and status

Revision	Date	Description	By	Review	Approved
0	03/07/2015	Draft	L Clews	A Carty	C Thomson
01	24/07/2015	Application of TfNSW Vegetation Offsets Guide, figure updates	L Clews	A Carty	L Clews
02	12/01/2016	Final draft	L Clews	A Carty	C Thomson
03	18/01/2016	Final	L Clews	A Carty	C. Thomson

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1. Introduction

1.1 Background

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 Jannali 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 purpose of this report is to present the findings of an Ecological Impact Assessment undertaken within the Jannali study area (refer to Figure 1.1) to assess the potential impacts of the Jannali Station Upgrade Proposal on biodiversity. The Proposal includes:

- new stairs, lift and upgraded entry plaza on each side of the station
- new pedestrian bridge to provide access to both platforms and across the railway
- new canopies for weather protection above the pedestrian bridge, stairs, lift landings and entry plazas
- new Family Accessible Toilet on Platform 1
- installation of undercover bicycle racks on both sides of the station
- upgraded footpaths/ramps on Jannali Avenue, Mitchell Avenue and Railway Crescent
- bus zone works including construction of a shelter closer to the station entrance on Jannali Avenue and a new bus zone on Mitchell Avenue
- provision of five accessible parking spaces (three upgraded and two relocated), two kiss and ride spaces and vehicle turning area in the Oxley Avenue car park connected to the station by a widened footpath
- provision of up to three part-time kiss and ride spaces in Railway Crescent
- ancillary works, including localised platform regrading (as necessary), adjustments to lighting, improvements to station communication systems with new infrastructure (including CCTV cameras), way finding signage, services diversion and/or relocation, station power supply upgrade, and minor drainage works.

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 (where practicable)
- Outline a mitigation strategy to minimise impacts to biodiversity as required.

Data sources
Jacobs 2015
Ausimage 2014
Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community

Figure 1.1 | Site locality and study area

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	Graduate Ecologist – reporting and database review
Andrew Carty	Bachelor of Environmental Science, Natural Area Restoration and Management Cert. IV, Bush Regeneration Cert. II, OEH Accredited BioBanking Assessor	Ecological Technical Advisor, Senior Botanist, Technical 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 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 Special 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 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 to 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 visit was undertaken of the study area on 18 June 2015 to determine the nature of vegetation communities, the habitats present, and the likely impact of the Proposal on biodiversity values. During the site visit, 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 Standards).
- Map the distribution and condition of vegetation communities with particular regard to 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: • Species highly restricted to certain geographical areas not within the Proposal footprint • Specific habitat requirements are not present in the study area
Low	Species not recorded during field surveys and fit one or more of the following criteria: • Have not been recorded previously in the study area/surrounds and for which the study area is beyond the current distribution range • Use specific habitats or resources not present in the study area • Are a non-cryptic perennial flora species that were specifically targeted by surveys and not recorded
Moderate	Species not recorded during the field surveys that fit one or more of the following criteria: • Have infrequently been recorded previously in the study area/surrounds • Use specific habitats or resources present in the study area but in a poor or modified condition • Are unlikely to maintain sedentary populations, however may seasonally use resources within the study area opportunistically or during migration • Are cryptic flowering flora species that were not seasonally targeted by surveys and that have not been recorded
High	Species recorded during the field surveys or species not recorded that fit one or more of the following criteria: • Have frequently been recorded previously in the study area/surrounds • Use habitat types or resources that are present in the study area that are abundance and/or in good condition within the study area • Are known or likely to maintain resident populations surrounding the study area • Are known or likely to visit the site during regular seasonal movements or migration

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 seven 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 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 form 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 part of a highly modified urban environment in the suburb of Jannali within the Sutherland Local Government Area (LGA). The vegetation within the study area is largely a mixture of large remnant trees (*Eucalyptus pilularis*), landscape plantings, street trees and opportunistic vegetation (i.e. weeds) that has established in the disturbed areas of the rail corridor (particularly the slopes). The vegetation in the western side of the rail corridor is mapped as Urban Exotic/Native by the Office of Environment and Heritage (2013). This vegetation was verified during the site visit (photos of the study area are provided in Appendix A). No native remnant vegetation communities are present in the study area or immediate surrounds.

According to the PMST there are three listed threatened ecological communities that may occur within the area and five listed threatened ecological communities that are likely to occur within the area. Twenty two threatened ecological communities listed under the TSC Act may occur in the locality. However, No threatened ecological communities occur within or immediately surrounding the study area.

The vegetation within the study area is a mixture of species commonly planted as street trees and landscape plantings in the Sydney region including *Eucalyptus pilularis* (Blackbutt), *Lophostemon confertus* (Brush Box), *Jacaranda mimosifolia* (Jacaranda), *Angophora costata* (Smooth-barked Apple), *Callistemon* sp. (Bottle Brush), *Ligustrum lucidum* (Large-leaf privet), *Celtis sinensis* (Hackberry), *Agonis flexuosa* (Willow Myrtle), *Tristaniopsis laurina* (Water Gum), and *Banksia integrifolia* (Old Man Banksia) (refer to Appendix A for photos). Vegetation within the rail corridor is primarily exotic with *Lantana camara* (Lantana) very abundant.

Underneath the plantings is predominantly exotic vegetation. The understorey varies from sparse areas of herbaceous and grass weed growing amongst ballast, to areas of dense shrubs and small trees. Dominant exotic shrub and small tree species include *Acacia saligna* (Golden Wreath Wattle), and *Cinnamomum camphora* (Camphor Laurel). The ground layer is dominated by grass and herbaceous weeds including *Stenotaphrum secundatum* (Buffalo Grass), *Pennisetum clandestinum* (Kikuyu), *Sida rhombifolia* (Paddy's Lucerne), *Bidens pilosa* (Cobbler's Pegs), *Conyza bonariensis* (Fleabane), *Asparagus aethiopicus* (Asparagus Fern), and *Lactuca serriola* (Prickly Lettuce) with some native ground covers including *Dianella caerulea* (Blue Flax-lily), and *Lomandra longifolia* (Spiny-headed Mat-rush). Exotic vines including *Araujia sericifera* (Moth Vine), *Anredera cordifolia* (Madeira Vine), and *Ipomoea indica* (Morning Glory) are common.

The habitat that this vegetation provides for fauna is limited and generally of low quality (photos are provided in Appendix A). However, the large *Eucalyptus pilularis* trees are likely to provide some habitat for birds and mammals and due to their size may provide an important fauna refuge in the urban environment. No obvious hollows were observed in these trees during the site survey. Overall, the habitat within the study area lacks important features such as hollow bearing trees, dense litter, and abundant woody debris.

Four noxious weeds declared for the Local Control Authority area of Sutherland Shire Council are present within the study area (see Table 3.1) and were restricted to the rail corridor. These are all locally controlled weeds.

Table 3.3 : Noxious weeds present within the study area

Species	Common name	Control Class	Control required
Asparagus aethiopicus	Asparagus fern	4 – Locally controlled weed	The plant must not be sold, propagated or knowingly distributed
Celtis sinensis	Hackberry	4 – Locally controlled weed	The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed
Lantana camara	Lantana	4 – Locally controlled weed	The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread
Ligustrum lucidum	Broad-leaf Privet	4 – Locally controlled weed	The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread

3.1.1 Trees

Fifty seven trees were recorded in the study area during the field survey. These trees range from very large examples of mature *Eucalyptus pilularis* and *Lophostemon confertus* to smaller shrubs and trees re-sprouting from previous trimming works within the rail corridor. The most significant trees were located along Jannali Avenue and Mitchell Avenue (see Figures A.8 and A.9 in Appendix A). These trees are large and contribute considerably to the local character of the area and provide important visual amenity. Trees also listed as heritage trees under Schedule five of the Sutherland Shire Local Environmental Plan 2015 (LEP) include:

- Stand of *Eucalyptus pilularis* (Blackbutt) on Jannali Avenue between Mitchell Avenue and Louise Street (MGA Zone 56, 321290°E, 6234155°N) (item number 2101).
- Cultural planting, comprising *Lophostemon confertus* (Brush Box) on Mitchell Avenue at the corner of Oxley Avenue (MGA Zone 56, 321180°E, 6234390°N) (item number 2102).

The location of each tree identified in the study area is outlined in Figure 3.1. 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.

Legend

Study area

Tree canopy
Refer to Appendix C of Ecological Impact Assessment for tree details

Area of works

0 30 60m

N

Data sources
Jacobs 2015
Ausimage 2014

Figure 3.1 | Location of trees within the study area

3.2 Threatened flora

On the basis of regional records and reports and the presence of suitable habitat, 21 threatened flora species, and one endangered plant population, have been previously recorded or listed as having potential to occur in the locality based on previous records and 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). No threatened flora species were observed on site. The list of threatened flora species considered in this assessment is provided in Table B.1 of Appendix B.

3.3 Threatened fauna

Based on regional records, reports and the presence of suitable habitat, 60 threatened fauna species have been identified from the locality. This includes 13 mammals, 38 birds, two reptiles, six amphibians, 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 2.1. Many of these species favour habitats that are not represented in the study area and these were considered unlikely to occur or have a low likelihood of occurring. No threatened fauna species were observed on site during the inspection.

From the review, the Grey-headed Flying-fox (*Pteropus poliocephalus*) was considered to have a high chance to occur and four species were considered to have a moderate chance of occurring: the Powerful Owl (*Ninox strenua*), Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*), Eastern Freetail-bat (*Mormopterus norfolkensis*), and Greater Broad-nosed Bat (*Scoteanax rueppellii*). These species are highly mobile flyers 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 generally considered to be of poor quality (see photos in Appendix A).

3.4 Migratory species

Thirty one migratory species are predicted to occur in the study area 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 are likely to 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 Proposal would significantly affect migratory species and this group is not considered any further in this report.

4. Potential impacts

Direct biodiversity impacts of the Proposal are predicted to be minimal due to the disturbed nature of vegetation in the study area and the nature of the construction methods. Vegetation and habitat clearing will be minimal and no impacts to native vegetation or high quality fauna habitat are predicted. For construction of the new entry plaza on the Jannali Avenue side of the station, the *Acacia binervia* tree (tree number 20 shown in Figure 3.1 and listed in Appendix C) will be removed. Additionally, two *Lophostemon confertus* (Brush Box) trees (trees number 22 and 23 shown in Figure 3.1 and listed in Appendix C) will be removed and replaced with a new tree in a planter. These trees are part of the heritage listing identified in the LEP (cultural planting, comprising Lophostemon confertus (Brush Box) on Mitchell Avenue at the corner of Oxley Avenue (MGA Zone 56, 321180°E, 6234390°N) (item number 2102). No other trees are nominated for removal however there is some risk to trees 19, 21 and 48 as works will be undertaken within close proximity to these trees and some accidental damage may occur. Tree 19, 21 and 48 will be retained if possible (however tree 48 is a noxious weed *Celtis sinensis*) and does not provide any ecological benefit if it were to be retained). Some exotic shrubs that form a hedge adjacent to the station entrance off Railway Crescent may also need to be removed for the construction of a new station entrance canopy.

Direct trauma to native fauna is expected to be minimal as no high quality habitats will be removed. Noise, dust, light and contaminant pollution is predicted to be minimal. The mitigation measures outlined below in Section 5 will ensure that indirect impacts will be minimised.

Proliferation of weed species is likely to be the main potential impact of the Proposal. Without appropriate management strategies, construction activities have the potential to disperse weeds including species listed as noxious under the *Noxious Weeds Act 1993*. 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 Proposal 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 vegetation along the rail corridor. The mitigation measures outlined below in Section 5 will ensure that weed and pathogen importation and spread is minimised. Specifically, the measures outlined in the TfNSW *Weed Management and Disposal Guide* and appropriate hygiene measures such as vehicle and machinery wash down procedures should be followed.

There are no predicted significant impacts to threatened biodiversity from the Proposal. While some threatened fauna species (i.e. Powerful Owl, Grey-headed Flying-fox, Yellow-bellied Sheathtail-bat, Eastern Freetail-bat, and Greater Broad-nosed Bat) may utilise the study area as habitat on occasion, the habitat is considered low quality and the Proposal is considered unlikely to impact these species if they are present. The Proposal will not impact on any significant habitat features (i.e. suitable for breeding) for these species. The Proposal is considered unlikely to interfere with the lifecycles of any threatened species and 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 as this species is considered to have a high likelihood of occurring in the study area with the presence of suitable foraging habitat and close proximity of known roost camps. Considering the potential presence of Grey-headed Flying-fox 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).

Other potentially occurring threatened fauna species subject to significance assessments have a moderate potential to occur intermittently in the study area to forage in habitats including the Powerful Owl, Grey-headed Flying-fox, Eastern Bentwing Bat, Yellow-bellied Sheathtail-bat, Eastern Freetail-bat and Greater Broad-nosed Bat. Assessments of significance for these are provided in Appendix D.

The outcome of the assessments was that there is unlikely to be a significant impact to any threatened species due to the minimal impacts predicted from the Proposal. The Proposal will not result in the removal of any high quality habitat or breeding habitat for these species and they will be able to persist in the study area after the works have been completed. The habitat will 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 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.

1) Refer to the TfNSW *Weed Management and Disposal Guide* if weeds have been identified on the site and require specific management. Noxious weeds including *Asparagus aethiopicus, Celtis sinensis, Lantana camara* and *Ligustrum lucidum* will be disposed of off-site and not reused as mulch.

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 not identified in the EIA.

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 Proposal.

5.1 Application of the TfNSW Vegetation Offsets Guide

As tree clearing is proposed, 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 Offset Guide* (Transport for NSW 2013) applies. The trees to be cleared do not form part of a native vegetation community, but do provide streetscape amenity. As such, offsets for individual trees will be applied (this offset requirement applies to remnant, regrowth, planted, native and exotic trees alike).

The following trees are to be removed:

- Tree No. 20 a small *Acacia binervia* tree of 10 centimetres diameter at breast height (dbh).
- Tree No. 22 a medium *Lophostemon confertus* tree of 50 centimetres dbh.
- Tree No. 23 a medium *Lophostemon confertus* tree of 60 centimetres dbh.

To offset the loss of Tree No. 20 (one small) a minimum of two trees must be planted. To offset the loss of Trees No. 22 and 23 (two medium) a minimum of four trees must be planted for each tree removed (i.e. a minimum of eight trees to be replanted).

Trees number 19, 21 and 48 may be impacted by the Proposal as works will be conducted in close proximity to these trees, but should be retained where possible. These trees are as follows:

- Tree No. 19 a medium *Banksia integrifolia* tree of 25 centimetres dbh.
- Tree No. 21 a medium *Angophora costata* tree of 65 centimetres dbh.
- Tree No. 48 a medium *Celtis sinensis* tree of 45 centimetres dbh.

If trees 19, 21 and 48 become damaged and require removal they will need to be offset in accordance with the TfNSW *Vegetation Offset Guide* (Transport for NSW 2013). To offset the loss of tree 19 and 48, a minimum of four trees must be planted for each tree removed (i.e. a minimum of eight trees to be replanted). Tree 21 will require offsetting with planting of eight trees as it is a large tree.

6. Conclusions

The key findings of the biodiversity assessment are that there would be minimal impacts to native vegetation and fauna habitat due to the general absence of these values in the Proposal area. The vegetation within and outside of the rail corridor is largely planted and opportunistic vegetation (predominately exotic species). There are no high quality areas of remnant native vegetation or any high quality fauna habitats present within the area proposed for construction activity.

For construction of the new entry plaza on the Jannali Avenue side of the station, the *Acacia binervia* tree (tree number 20 shown in Figure 3.1 and listed in Appendix C) will be removed. Additionally, two *Lophostemon confertus* (Brush Box) trees (trees number 22 and 23 shown in Figure 3.1 and listed in Appendix C) will be removed and replaced with a new tree in a planter. These two trees are part of a heritage listing under the LEP. No other trees are nominated for removal. However, there exists the potential for tree 19, 21 and 48 to be accidentally damaged as works will be undertaken in close proximity to these trees.

Fifty seven trees were recorded in the study area during the field survey. The most significant trees were located along Jannali Avenue and Mitchell Avenue and these trees are listed as heritage trees under Schedule 5 of the *Sutherland Shire Local Environmental Plan 2015*. These trees are important heritage items and contribute considerably to the local character of the area. These trees also provide some fauna habitat values. Two of these trees will be removed by the Proposal.

There are no predicted significant impacts to threatened biodiversity from the Proposal. While threatened fauna species including the Powerful Owl, Grey-headed Flying-fox, Yellow-bellied Sheathtail-bat, Eastern Bentwing-bat, Eastern Freetail-bat, and Greater Broad-nosed Bat may utilise the study area as foraging habitat on occasion, the works are considered unlikely to significantly impact these species. The Proposal will not impact on any significant habitat features (i.e. breeding habitat, important feeding areas) for these species. As such, no significant impacts to threatened biodiversity are predicted.

While negligible impacts to native biodiversity are predicted, the avoidance and mitigation measures detailed in Section 5 will ensure that no impacts to native biodiversity occur from the Proposal. Trees that are to be retained will 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) will be followed to ensure that vegetation is protected and managed appropriately.

As tree clearing is proposed, 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 Offset Guide* applies (Transport for NSW 2013). The trees to be cleared do not form part of a native vegetation community, but do provide streetscape amenity. As such, offsets for individual trees (including exotic species) will be applied according to the TfNSW *Vegetation Offset Guide* (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. Verson 2.0*, Office of Environment and Heritage, Department of Premier and Cabinet, Sydney,

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

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

Appendix A. Site Photos

Figure A.1 : Tree No. 1, the *Tristaniopsis laurina* tree at the corner of Railway Crescent

Figure A.2 : Trees No. 2 to 7 the *Cotoneaster glaucophyllus* shrub with *Acacia parramattensis* on the rail corridor slope opposite Railway Crescent. *Lantana camara* is present on the slope

Figure A.3 : The slope behind Tree No. 43 showing *Ligustrum lucidum, Lantana camara, Cupressus* sp. in the rail corridor opposite Railway Crescent

Figure A.4 : Tree No. 46, a *Celtis sinensis* near the station entrance on Railway Crescent

Figure A.5 : Tree No. 47 to 52, the row of *Agonis flexuosa* opposite the platform on Railway Crescent

Figure A.6 : Row of planted shrubs including *Westringia fruticosa, Melaleuca hypericifolia, Hakea sericea, Acacia saligna,* and *Lomandra longifolia* adjacent to the rail line on Railway Crescent

Figure A.7 : Trees No. 9 to 13 (*Eucalyptus pilularis* trees) and shrubs in the rail corridor on Jannali Avenue south of Railway Crescent

Figure A.8 : Large remnant *Eucalyptus pilularis* trees (trees No. 14 and 15) along Jannali Avenue to the north of Railway Crescent

Figure A.9 : The row of *Lophostemon confertus* trees (trees No. 25 to 28) along Mitchell Avenue

Figure A.10 : *Lophostemon confertus* tree (tree No. 29) adjacent to the houses and station ramp to the north west of the station

Figure A.11 : Vegetation including *Callistemon* sp. and *Banksia integrifolia* (tree No. 42) along the watercourse outside of the rail line to the north of the station

Figure A.12 : Trees No. 29 to 31, the *Melaleuca linearifolia, Lophostemon confertus* and *Jacaranda mimosifolia* along the pedestrian footpath to the north west of the station

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 a 10 kilometre radius of the Proposal 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 Proposal 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
Acacia bynoeana	Bynoe's Wattles	V	E	Found in central eastern NSW, from the Hunter District south to the Southern Highlands and west to the Blue Mountains. It has recently been found in the Colymea and Parma Creek areas west of Nowra. Occurs in heath or dry sclerophyll forest on sandy soils. Seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches. Associated overstorey species include Red Bloodwood (*Corymbia gummifera*), Scribbly Gum (*Eucalyptus haemastoma*), Drooping Red Gum (*E. parramattensis*), Old Man Banksia (*Banksia serrata*) and Small-leaved Apple (*Angophora bakeri*).	PMST	Low – unsuitable habitat in the study area.
Acacia pubescens	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 gravely soils, often with ironstone.	11 – OEH PMST	Low – unsuitable habitat in the study area.
Allocasuarina diminuta subsp. *mimica* (endangered population)	*Allocasuarina diminuta* subsp. *mimica* L.A.S.Johnson population in the Sutherland and Liverpool local government areas	-	EP	The endangered population occurs along sandstone ridges and upper hillsides in the region northwest from Heathcote, towards Menai and Holsworthy, in heathy and low open woodland communities. It is restricted to the Local Government Areas listed in this instance (Sutherland and Liverpool). Other occurrences in the Blue Mountains and Southern Highlands (Blackheath to Bundanoon and Taralga), and also in the coastal communities from Kingsford to Little Bay) are not included in the Endangered population listing. Occurs in Heathy woodland, Heathlands and Low open woodlands.	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
Allocasuarina glareicola		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 *Eucalyptus parramattensis*, *Eucalyptus fibrosa*, *Angophora bakeri*, *Eucalyptus sclerophylla* and *Melaleuca decora*. Common associated understorey species include *Melaleuca nodosa*, *Hakea dactyloides*, *Hakea sericea*, *Dillwynia tenuifolia*, *Micromyrtus minutiflora*, *Acacia elongata*, *Acacia brownei*, *Themeda australis* and *Xanthorrhoea minor*.	PMST	Low – unsuitable habitat in the study area.
Asterolasia elegans		E	E	Occurs north of Sydney, in the Baulkham Hills, Hawkesbury and Hornsby local government areas. Also likely to occur in the western part of Gosford local government area. Known from only seven populations, only one of which is wholly within a conservation reserve. Occurs on Hawkesbury sandstone. Found in sheltered forests on mid- to lower slopes and valleys, e.g. in or adjacent to gullies which support sheltered forest. The canopy at known sites includes Turpentine (*Syncarpia glomulifera* subsp. *glomulifera*), Smooth-barked Apple (*Angophora costata*), Sydney Peppermint (*Eucalyptus piperita*), Forest Oak (*Allocasuarina torulosa*) and Christmas Bush (*Ceratopetalum gummiferum*).	PMST	Low – unsuitable habitat in the study area.
Astrotricha crassifolia	Thick-leaf Star-hair	V	V	Occurs near Patonga (Gosford LGA), and in Royal NP and on the Woronora Plateau (Sutherland and Campbelltown LGAs). There is also a record from near Glen Davis (Lithgow LGA). Occurs in dry sclerophyll woodland on sandstone. Flowers in spring.	PMST	Low – unsuitable habitat in the study area.
Caladenia tessellata	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.
Callistemon linearifolius	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.	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
Cryptostylis hunteriana	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 (*Eucalyptus sclerophylla*), Silvertop Ash (*E. sieberi*), Red Bloodwood (*Corymbia gummifera*) and Black Sheoak (*Allocasuarina littoralis*); appears to prefer open areas in the understorey of this community and is often found in association with the Large Tongue Orchid (*C. subulata*) and the Tartan Tongue Orchid (*C. erecta*).	PMST	Low – unsuitable habitat in the study area.
Eucalyptus camfieldii	Camfield's Stringybark	V	V	Restricted distribution in a narrow band with the most northerly records in the Raymond Terrace area south to Waterfall. Poor coastal country in shallow sandy soils overlying Hawkesbury sandstone. Coastal heath mostly on exposed sandy ridges. Occurs mostly in small scattered stands near the boundary of tall coastal heaths and low open woodland of the slightly more fertile inland areas. Associated species frequently include stunted species of E. oblonga Narrow-leaved Stringybark, E. capitellata Brown Stringybark and E. haemastoma Scribbly Gum.	PMST	Low – unsuitable habitat in the study area.
Genoplesium baueri	Bauer's Midge Orchid	E	E	Recorded from locations between Nowra and Pittwater and may occur as far north as Port Stephens. About half the records were made before 1960 with most of the older records being from Sydney suburbs including Asquith, Cowan, Gladesville, Longueville and Wahroonga. No collections have been made from those sites in recent years. The species has been recorded at locations now likely to be within the several conservation reserves including Berowra Valley Regional Park, Royal National Park and Lane Cove National Park. May occur in the Woronora, O'Hares, Metropolitan and Warragamba Catchments. Found in sparse sclerophyll forest and moss gardens over sandstone	PMST	Low – unsuitable habitat in the study area.
Leucopogon exolasius	Woronora Beard-heath	V	V	Woronora Beard-heath is found along the upper Georges River area and in Heathcote National Park. The plant occurs in woodland on sandstone. Flowering occurs in August and September.	PMST	Low – unsuitable habitat in the study area.
Melaleuca biconvexa	Biconvex Paperbark	V	V	Found only in NSW, with scattered and dispersed populations found in the Jervis Bay area in the south and the Gosford-Wyong area in the north. Generally grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects.	PMST	Low – unsuitable habitat in the study area.
Melaleuca deanei	Deane's Paperbark	V	V	Deane's Paperbark occurs in two distinct areas, in the Ku-ring-gai, Berowra, Holsworthy and Wedderburn areas, and there are also more isolated occurrences at Springwood, Wollemi National Park, Yalwal and the Central Coast areas. The species grows in heath on sandstone	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
Pelargonium sp. G.W. Carr 10345	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.
Persoonia hirsuta	Hairy Geebung	E	E	The Hairy Geebung has been recorded in the Sydney coastal area, the Blue Mountains area and the Southern Highlands. Found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone.	4 – OEH PMST	Low – unsuitable habitat in the study area.
Pimelea curviflora var. curviflora	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.
Pimelea spicata	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.	PMST	Low – unsuitable habitat in the study area.
Pterostylis saxicola	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.

Species	Common Name	EPBC Act	TSC Act	Distribution and habitat	Data Source	Likelihood of occurrence in the study area
Streblus brunonianus (syn. Streblus pendulinus)	Siah's Backbone	E	-	Occurs from Cape York Peninsula to Milton, south-east New South Wales (NSW), as well as Norfolk Island. Found in warmer rainforests, chiefly along watercourses. On the Australian mainland, Siah's Backbone is found in warmer rainforests, chiefly along watercourses. The altitudinal range is from near sea level to 800 m above sea level. The species grows in well-developed rainforest, gallery forest and drier, more seasonal rainforest.	PMST	Low – unsuitable habitat in the study area.
Thelymitra sp. Kangaloon	Kangaloon Sun Orchid	CE	CE	Only known to occur on the southern tablelands of NSW in the Moss Vale / Kangaloon / Fitzroy Falls area at 550-700 m above sea level. It is known to occur at three swamps that are above the Kangaloon Aquifer. It is found in swamps in sedgelands over grey silty grey loam soils	PMST	Low – unsuitable habitat in the study area.
Thesium australe	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 (*Themeda australis*).	PMST	Low – 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://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

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
Anthochaera Phrygia (Xanthomyza phrygia)	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.	1 – OEH	Low – marginal habitat in the study area.
Botaurus poiciloptilus	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.	PMST	Unlikely – unsuitable habitat in the study area.
Callocephalon fimbriatum	Gang-gang Cockatoo	-	V	In summer, occupies tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. Also occur in subalpine Snow Gum woodland and occasionally in temperate or regenerating forest. In winter, occurs at lower altitudes in drier, more open eucalypt forests and woodlands, particularly in box ironbark assemblages, or in dry forest in coastal areas. It requires tree hollows in which to breed.	2 – OEH	Low – marginal habitat in the study area.
Calyptorhynchus lathami	Glossy-black Cockatoo	-	V	The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina. An isolated population exists on Kangaroo Island, South Australia Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. Black Sheoak (Allocasuarina littoralis) and Forest Sheoak (A. torulosa) are important foods. Inland populations feed on a wide range of sheoaks, including Drooping Sheoak, Allocasuarina diminuta, and A. gymnanthera. Belah is also utilised and may be a critical food source for some populations. In the Riverina, birds are associated with hills and rocky rises supporting Drooping Sheoak, but also recorded in open woodlands dominated by Belah (Casuarina cristata).	1 – OEH	Low – marginal habitat in the study area.
Daphoenositta chrysoptera	Varied Sittella	-	V	The Varied Sittella is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands. Distribution in NSW is nearly continuous from the coast to the far west. The Varied Sittella's population size in NSW is uncertain but is believed to have undergone a moderate reduction over the past several decades. Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees and small branches and twigs in the tree canopy.	1 – OEH	Low – marginal habitat in the study area.

Species	Common Name	EPBC Act	TSC Act	Distribution and habitat	Data Source	Likelihood of occurrence in the study area
Dasyornis brachypterus	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	unlikely – unsuitable habitat in the study area.
Diomedea epomophora epomophora	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
Diomedea epomophora sanfordi	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
Diomedea exulans (sensu lato)	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
Diomedea exulans antipodensis	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
Diomedea exulans exulans	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
Diomedea exulans gibsoni	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
Ephippiorhynchus asiaticus	Black-necked Stork	-	E	In Australia, Black-necked Storks are widespread in coastal and subcoastal northern and eastern Australia, as far south as central NSW (although vagrants may occur further south or inland, well away from breeding areas). In NSW, the species becomes increasingly uncommon south of the Clarence Valley, and rarely occurs south of Sydney. Since 1995, breeding has been recorded as far south as Buladelah. Floodplain wetlands (swamps, billabongs, watercourses and dams) of the major coastal rivers are the key habitat in NSW for the Black-necked Stork. Secondary habitat includes minor floodplains, coastal sandplain wetlands and estuaries. Storks usually forage in water 5-30cm deep for vertebrate and invertebrate prey. Eels regularly contribute the greatest biomass to their diet, but they feed on a wide variety of animals, including other fish, frogs and invertebrates (such as beetles, grasshoppers, crickets and crayfish). Black-necked Storks build large nests high in tall trees close to water. Trees usually provide clear observation of the surroundings and are at low elevation (reflecting the floodplain habitat).	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
Glossopsitta porphyrocephala	Purple-crowned Lorikeet	-	V	The Purple-crowned Lorikeet occurs across the southern parts of the continent from Victoria to south-west Western Australia. It is uncommon in NSW, with records scattered across the box-ironbark woodlands of the Riverina and south west slopes, the River Red Gum forests and mallee of the Murray Valley as far west as the South Australian border, and, more rarely, the forests of the South Coast. The species is nomadic and most, if not all, records from NSW are associated with flowering events. Found in open forests and woodlands, particularly where there are large flowering eucalypts. Also recorded from mallee habitats.	1 – OEH	Low – marginal habitat in the study area.
Glossopsitta pusilla	Little Lorikeet	-	V	Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in apples (angophora sp.), paperbarks (melaleuca sp.) and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Isolated flowering trees in open country (e.g. paddocks, roadside remnants) and urban trees also help sustain viable populations of the species.	1 – OEH	Low – marginal habitat in the study area.
Haematopus fuliginosus	Pied Oystercatcher	-	E	The species is distributed around the entire Australian coastline, although it is most common in coastal Tasmania and parts of Victoria, such as Corner Inlet. In NSW the species is thinly scattered along the entire coast, with fewer than 200 breeding pairs estimated to occur in the State. Favours intertidal flats of inlets and bays, open beaches and sandbanks. Forages on exposed sand, mud and rock at low tide, for molluscs, worms, crabs and small fish. The chisel-like bill is used to pry open or break into shells of oysters and other shellfish. Nests mostly on coastal or estuarine beaches although occasionally they use saltmarsh or grassy areas. Nests are shallow scrapes in sand above the high tide mark, often amongst seaweed, shells and small stones.	3 – OEH	Unlikely – no habitat in the study area
Ixobrychus flavicollis	Black Bittern	-	V	The Black Bittern is found along the coastal plains within NSW, although individuals have rarely being recorded south of Sydney or inland. It inhabits terrestrial and estuarine wetlands such as flooded grasslands, forests, woodlands, rainforests and mangroves with permanent water and dense waterside vegetation. The Black Bittern typically roosts on the ground or in trees during the day and forages at night on frogs, reptiles, fish and invertebrates. The breeding season extends from December to March. Nests are constructed of reeds and sticks in branches overhanging the water.	1 – OEH	Unlikely – no habitat in the study area
Lathamus discolour	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 (Eucalyptus robusta), Spotted Gum (Corymbia maculate), Red Bloodwood (C. Gummifera), Red Ironbark (E. sideroxylon), and White Box (E. albens).	2 – OEH PMST	Low – marginal habitat in the study area.
Lophochroa leadbeateri	Major Mitchell's Cockatoo	-	V	Found across the arid and semi-arid inland, from south-western Queensland south to north-west Victoria, through most of South Australia, north into the south-west Northern Territory and across to the west coast between Shark Bay and about Jurien. In NSW it is found regularly as far east as about Bourke and Griffith, and sporadically further east than that. Inhabits a wide range of treed and treeless inland habitats, always within easy reach of water. Nesting, in tree hollows, occurs throughout the second half of the year; nests are at least 1 kilometre apart, with no more than one pair every 30 square kilometres.	3 – OEH	Low – marginal habitat in the study area.

Species	Common Name	EPBC Act	TSC Act	Distribution and habitat	Data Source	Likelihood of occurrence in the study area
Lophoictinia isura	Square-tailed Kite	-	V	Typically inhabits coastal forested and wooded lands of tropical and temperate Australia. In NSW it is often associated with ridge and gully forests dominated by Eucalyptus longifolia, Corymbia maculata, E. elata, or E. smithii. Individuals appear to occupy large hunting ranges of more than 100 km2. They require large living trees for breeding, particularly near water with surrounding woodland /forest close by for foraging habitat. Nest sites are generally located along or near watercourses, in a tree fork or on large horizontal limbs.	5 – OEH	Low – marginal habitat in the study area.
Macronectes giganteus	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
Macronectes halli	Northern Giant-petrel	V, M	V	The Northern Giant-Petrel has a circumpolar pelagic distribution, usually between 40-64ºS in open oceans. Their range extends into subtropical waters (to 28ºS) 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
Neophema chrysogaster	Orange-bellied Parrot	CE	CE	The Orange-bellied Parrot breeds in the south-west of Tasmania and migrates in autumn to spend the winter on the mainland coast of south-eastern South Australia and southern Victoria. There are occasional reports from NSW, with the most recent records from Shellharbour and Maroubra in May 2003. On the mainland, the Orange-bellied Parrot spends winter mostly within 3 kilometre of the coast in sheltered coastal habitats including bays, lagoons, estuaries, coastal dunes and saltmarshes. The species also inhabits small islands and peninsulas and occasionally saltworks and golf courses. Birds forage in low samphire herbland or taller coastal shrubland.	PMST	Low – unsuitable habitat in the study area.
Ninox strenua	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 Syncarpia glomulifera, Black She-oak Allocasuarina littoralis, Blackwood Acacia melanoxylon, Rough-barked Apple Angophora floribunda, Cherry Ballart Exocarpus cupressiformis and a number of eucalypt species.	841 – OEH	Moderate – potential forgaing habitat in the study area.

Species	Common Name	EPBC Act	TSC Act	Distribution and habitat	Data Source	Likelihood of occurrence in the study area
Numenius madagascariensis	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.	13 – OEH	Unlikely – no habitat in the study area
Pandion cristatus	Eastern Osprey	M	V	The Osprey has a global distribution with four subspecies previously recognised throughout its range. Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water.	12 – OEH	Unlikely – unsuitable habitat in the study area.
Petroica rodinogaster	Pink Robin	-	V	The Pink Robin is found in Tasmania and the uplands of eastern Victoria and far south-eastern NSW, almost as far north as Bombala. On the mainland, the species disperses north and west and into more open habitats in winter, regularly as far north as the ACT area, and sometimes being found as far north as the central coast of NSW. Inhabits rainforest and tall, open eucalypt forest, particularly in densely vegetated gullies.	1 – OEH	Low – marginal habitat in the study area.
Ptilinopus superbus	Superb Fruit-dove	-	V	The Superb Fruit-dove occurs principally from north-eastern in Queensland to north-eastern NSW. Inhabits rainforest and similar closed forests where it forages high in the canopy, eating the fruits of many tree species such as figs and palms. It may also forage in eucalypt or acacia woodland where there are fruit-bearing trees.	1 – OEH	Low – unsuitable habitat in the study area.
Rostratula australis	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
Thalassarche bulleri	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

Species	Common Name	EPBC Act	TSC Act	Distribution and habitat	Data Source	Likelihood of occurrence in the study area
Thalassarche cauta cauta	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
Thalassarche cauta eremita	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
Thalassarche cauta salvini	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
Thalassarche cauta steadi	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
Thalassarche melanophris	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 0ºC and 24ºC. Spends most of its time at sea, breeding on small isolated islands.	PMST	Unlikely – no habitat in the study area
Thalassarche melanophris impavida	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
Tyto novaehollandiae	Masked Owl	-	V	Extends from the coast where it is most abundant to the western plains. Overall records for this species fall within approximately 90% of NSW, excluding the most arid north-western corner. There is no seasonal variation in its distribution. Dry eucalypt forests and woodland, typically prefers open forest with low shrub density. Requires old trees for roosting and nesting	1 – OEH	Low – marginal habitat in the study area.
Tyto tenebricosa	Sooty Owl	-	V	Occupies the easternmost one-eighth of NSW, occurring on the coast, coastal escarpment and eastern tablelands. Territories are occupied permanently. Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests.	12 – OEH	Low – marginal habitat in the study area.
Cercartetus nanus	Eastern Pygmy-possum	-	V	Found in a broad range of habitats from rainforest through to wet and dry sclerophyll forest and woodland to heath, but in most areas woodlands and heath appear to be preferred.	2 – OEH	Low – marginal habitat in the study area.
Chalinolobus dwyeri	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 – marginal habitat in the study area.
Dasyurus maculatus	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.	PMST	Unlikely – no habitat in the study area
Dugong dugon	Dugong	-	E	Extends south from warmer coastal and island waters of the Indo-West Pacific to northern NSW, where it's known from incidental records only. Major concentrations of Dugongs occur in wide shallow protected bays, wide shallow mangrove channels and in the lee of large inshore islands.	PMST	Unlikely – no habitat in the study area
Isoodon obesulus obesulus	Southern Brown Bandicoot	E	E	This species prefers sandy soils with scrubby vegetation and/or areas with low ground cover that are burn from time to time. A mosaic of post fire vegetation is important for this species.	PMST	Unlikely – no habitat in the study area
Miniopterus schreibersii oceanensis	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.	9 – OEH	Moderate – some suitable habitat in the study area.
Mormopterus norfolkensis	Eastern Freetail-bat	-	V	Occur in dry sclerophyll forest and woodland east of the Great Dividing Range. Roosts mainly in tree hollows but will also roost under bark or in human-made structures.	2 – OEH	Moderate – some suitable habitat in the study area.

Species	Common Name	EPBC Act	TSC Act	Distribution and habitat	Data Source	Likelihood of occurrence in the study area
Petrogale penicillata	Brush-tailed Rock-wallaby	V	E	Range extends from south-east Queensland to the Grampians in western Victoria, roughly following the line of the Great Dividing Range. Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north. Browse on vegetation in and adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees.	PMST	Unlikely – no habitat in the study area
Phascolarctos cinereus	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.	27 – OEH PMST	Low – unsuitable habitat in the study area.
Pseudomys novaehollandiae	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.	1 – OEH PMST	Low – unsuitable habitat in the study area.
Pteropus poliocephalus	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.	37 – OEH PMST	High – suitable foraging habitat in the study area.
Saccolaimus flaviventris	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	Moderate – some suitable habitat in the study area.
Scoteanax rueppellii	Greater Broad-nosed Bat	-	V	Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings.	2 – OEH	Moderate – some suitable habitat in the study area.
Hoplocephalus bungaroides	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.

Species	Common Name	EPBC Act	TSC Act	Distribution and habitat	Data Source	Likelihood of occurrence in the study area
Varanus rosenbergi	Rosenberg's Goanna	-	V	Rosenberg's Goanna occurs on the Sydney Sandstone in Wollemi National Park to the north-west of Sydney, in the Goulburn and ACT regions and near Cooma in the south. There are records from the South West Slopes near Khancoban and Tooma River. Also occurs in South Australia and Western Australia. Found in heath, open forest and woodland. Associated with termites, the mounds of which this species nests in; termite mounds are a critical habitat component. Shelters in hollow logs, rock crevices and in burrows, which they may dig for themselves, or they may use other species' burrows, such as rabbit warrens.	3 – OEH	Low – unsuitable habitat in the study area.
Heleioporus australiacus	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	Low – unsuitable habitat in the study area.
Litoria aurea	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.	PMST	Unlikely – no habitat in the study area
Litoria littlejohni	Littlejohn's Tree Frog	V	V	Distribution includes the plateaus and eastern slopes of the Great Dividing Range from Watagan State Forest (90 kilometre north of Sydney) south to Buchan in Victoria. This species breeds in the upper reaches of permanent streams and in perched swamps. Non-breeding habitat is heath based forests and woodlands where it shelters under leaf litter and low vegetation, and hunts for invertebrate prey either in shrubs or on the ground.	PMST	Unlikely – no habitat in the study area
Litoria raniformis	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
Mixophyes balbus	Stuttering Frog	E	V	Occur along the east coast of Australia from southern Queensland to north-eastern Victoria. Found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range. Outside the breeding season adults live in deep leaf litter and thick understorey vegetation on the forest floor.	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
Pseudophryne australis	Red-crowned Toadlet	-	V	It has restricted distribution from Pokolbin to Nowra and west to Mt Victoria. Occurs in open forests and wet drainage lines below sandstone ridges that often have shale lenses or cappings in the Hawkesbury and Narrabeen Sandstones.	4 – OEH	Low – unsuitable habitat in the study area.
Pommerhelix duralensis	Dural Land Snail	E	-	The Dural land snail is endemic to New South Wales. The species is a shale-influenced habitat specialist, which occurs in low densities along the northwest fringe of the Cumberland Plain on shale-sandstone transitional landscapes. The species has been observed resting in exposed areas, such as on exposed rock or leaf litter, however it will also shelter beneath leaves, rocks and light woody debris.	PMST	Low – unsuitable habitat in the study area.
Actitis hypoleucos	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.	1 – OEH	Unlikely – no habitat in the study area
Apus pacificus	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.	1 – OEH PMST	Unlikely – no habitat in the study area
Ardea alba	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).	PMST	Unlikely – no habitat in the study area
Ardea ibis	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.	PMST	Unlikely – no habitat in the study area
Gallinago hardwickii	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.	PMST	Unlikely – no habitat in the study area
Haliaeetus leucogaster	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).	23 – OEH PMST	Unlikely – no habitat in the study area
Hirundapus caudacutus	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.	3 – 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
Hydroprogne caspia	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.	3 – OEH	Unlikely – no habitat in the study area
Limosa lapponica	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.	3 – OEH	Unlikely – no habitat in the study area
Merops ornatus	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
Monarcha melanopsis	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
Monarcha trivirgatus	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
Myiagra cyanoleuca	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
Numenius phaeopus	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.	1 – OEH	Unlikely – no habitat in the study area
Rhipidura rufifrons	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 (Eucalyptus microcorys), Mountain Grey Gum (E. cypellocarpa), Narrow-leaved Peppermint (E. radiata), Mountain Ash (E. regnans), Alpine Ash (E. delegatensis), Blackbutt (E. pilularis) or Red Mahogany (E. resinifera); usually with a dense shrubby understorey often including ferns.	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

+ 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	Dbh (m)	Crown width (m)	Height (m)	Structural Root Zone radius (m)	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	*Tristaniopsis laurina*	0.57	7	4	2.61	6.84	7	Good	Good	20+ years	May provide roosting and foraging opportunities for common urban native and exotic birds
2	*Acacia parramattensis*	0.2	8	5	1.68	2.4	2.5	Good	Good	5 - 10 years	May provide roosting and foraging opportunities for common urban native and exotic birds
3	*Acacia parramattensis*	0.2	8	5	1.5	2.4	2.5	Good	Good	5 - 10 years	May provide roosting and foraging opportunities for common urban native and exotic birds
4	*Acacia parramattensis*	0.2	8	5	1.68	2.4	2.5	Good	Good	5 - 10 years	May provide roosting and foraging opportunities for common urban native and exotic birds
5	*Acacia parramattensis*	0.2	8	5	1.68	2.4	2.5	Good	Good	5 - 10 years	May provide roosting and foraging opportunities for common urban native and exotic birds
6	*Acacia parramattensis*	0.2	8	5	1.68	2.4	2.5	Good	Good	5 - 10 years	May provide roosting and foraging opportunities for common urban native and exotic birds
7	*Cotoneaster glaucophyllus*	0.2	4	2	1.68	2.4	2.5	Good	Good	5 - 10 years	May provide roosting and foraging opportunities for common urban native and exotic birds
8	*Acacia parramattensis*	0.25	8	7	1.85	3	3	Good	Good	5 - 10 years	May provide roosting and foraging opportunities for common urban native and exotic birds

Tree No.	Species	Dbh (m)	Crown width (m)	Height (m)	Structural Root Zone radius (m)	Tree Protection Zone radius (m)	Recommended Tree Protection Zone radius (m)	Tree health	Tree structure	Tree S.U.L.E	Habitat value for fauna
9	*Eucalyptus pilularis*	0.3	5	6	2.00	3.6	4	Good	Good	20+ years	May provide roosting and foraging opportunities for birds and Grey-headed Flying-fox. No obvious hollows were seen
10	*Eucalyptus pilularis*	0.8	17	20	3.01	9.6	10	Good	Good	20+ years	May provide roosting and foraging opportunities for birds and Grey-headed Flying-fox. No obvious hollows were seen
11	*Eucalyptus pilularis*	0.81	12	20	3.03	9.72	10	Good	Good	20+ years	May provide roosting and foraging opportunities for birds and Grey-headed Flying-fox. No obvious hollows were seen
12	*Eucalyptus pilularis*	0.72	18	20	2.88	8.64	9	Good	Good	20+ years	May provide roosting and foraging opportunities for birds and Grey-headed Flying-fox. No obvious hollows were seen
13	*Eucalyptus pilularis*	0.47	19	20	2.41	5.64	6	Good	Good	20+ years	May provide roosting and foraging opportunities for birds and Grey-headed Flying-fox. No obvious hollows were seen
14	*Eucalyptus pilularis*	1.14	22	20	3.50	13.68	14	Good	Good	20+ years	May provide roosting and foraging opportunities for birds and Grey-headed Flying-fox. No obvious hollows were seen (branches trimmed by council)
15	*Eucalyptus pilularis*	0.67	14	20	1.5	8.04	8	Good	Good	20+ years	May provide roosting and foraging opportunities for birds and Grey-headed Flying-fox. No obvious hollows were seen (branches trimmed by council)
16	*Eucalyptus pilularis*	0.65	15	20	2.76	7.8	8	Good	Good	20+ years	May provide roosting and foraging opportunities for birds and Grey-headed Flying-fox. No obvious hollows were seen (branches trimmed by council)

Tree No.	Species	Dbh (m)	Crown width (m)	Height (m)	Structural Root Zone radius (m)	Tree Protection Zone radius (m)	Recommended Tree Protection Zone radius (m)	Tree health	Tree structure	Tree S.U.L.E	Habitat value for fauna
17	*Eucalyptus pilularis*	1.2	17	20	3.57	14.4	14.5	Good	Good	20+ years	May provide roosting and foraging opportunities for birds and Grey-headed Flying-fox. No obvious hollows were seen
18	*Eucalyptus pilularis*	1.25	20	20	3.63	15	15	Good	Good	20+ years	May provide roosting and foraging opportunities for birds and Grey-headed Flying-fox. No obvious hollows were seen (branches trimmed by council)
19	*Banksia integrifolia*	0.25	3	2	1.5	1.2	2	Good	Good	20+ years	May provide foraging opportunities for birds.
20	*Acacia binervia*	0.1	5	4	2.00	3.6	4	Good	Good	20+ years	May provide roosting and foraging opportunities for birds.
21	*Angophora costata*	0.65	12	15	2.76	7.8	8	Good	Good	20+ years	May provide roosting and foraging opportunities for birds and Grey-headed Flying-fox. No obvious hollows were seen but possesses a dead branch.
22	*Lophostemon confertus*	0.5	10	15	2.47	6	6	Good	Good	20+ years	May provide roosting and foraging opportunities for birds and Grey-headed Flying-fox. No obvious hollows were seen
23	*Lophostemon confertus*	0.6	8	12	2.67	7.2	7.5	Good	Good	20+ years	May provide roosting and foraging opportunities for birds and Grey-headed Flying-fox. No obvious hollows were seen
24	*Callistemon* sp.	0.1	3	2	1.5	1.2	2	Good	Good	20+ years	May provide foraging opportunities for birds and Grey-headed Flying-fox.
25	*Lophostemon confertus*	0.81	14	10	3.03	9.72	10	Good	Fair	20+ years	May provide roosting and foraging opportunities for birds and Grey-headed Flying-fox. No obvious hollows were seen

Tree No.	Species	Dbh (m)	Crown width (m)	Height (m)	Structural Root Zone radius (m)	Tree Protection Zone radius (m)	Recommended Tree Protection Zone radius (m)	Tree health	Tree structure	Tree S.U.L.E	Habitat value for fauna
26	*Lophostemon confertus*	0.75	11	10	1.5	9	9	Good	Good	20+ years	May provide roosting and foraging opportunities for birds and Grey-headed Flying-fox. No obvious hollows were seen
27	*Lophostemon confertus*	0.9	10	15	1.5	10.8	11	Good	Good	20+ years	May provide roosting and foraging opportunities for birds and Grey-headed Flying-fox. No obvious hollows were seen
28	*Lophostemon confertus*	0.76	10	10	2.95	9.12	9.5	Good	Good	20+ years	May provide roosting and foraging opportunities for birds and Grey-headed Flying-fox. No obvious hollows were seen
29	*Lophostemon confertus*	0.4	5	12	2.25	4.8	5	Good	Good	20+ years	May provide roosting and foraging opportunities for birds and Grey-headed Flying-fox. No obvious hollows were seen
30	*Lophostemon confertus*	0.5	11	12	2.47	6	6	Good	Good	20+ years	May provide roosting and foraging opportunities for birds and Grey-headed Flying-fox. No obvious hollows were seen
31	*Lophostemon confertus*	0.2	8	15	1.68	2.4	2.5	Good	Good	20+ years	May provide roosting and foraging opportunities for birds and Grey-headed Flying-fox. No obvious hollows were seen
32	*Melaleuca linearifolia*	0.6	10	15	2.67	7.2	7.5	Good	Good	20+ years	May provide roosting and foraging opportunities for birds and Grey-headed Flying-fox. No obvious hollows were seen
33	*Lophostemon confertus*	0.6	12	15	1.5	7.2	7.5	Good	Good	20+ years	May provide roosting and foraging opportunities for birds and Grey-headed Flying-fox. No obvious hollows were seen
34	*Jacaranda mimosifolia*	0.49	12	10	1.5	5.88	6	Good	Good	20+ years	May provide roosting and foraging opportunities for common urban native and exotic birds

Tree No.	Species	Dbh (m)	Crown width (m)	Height (m)	Structural Root Zone radius (m)	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	*Jacaranda mimosifolia*	0.3	14	10	1.5	3.6	4	Good	Good	20+ years	May provide roosting and foraging opportunities for common urban native and exotic birds
36	*Jacaranda mimosifolia*	0.3	14	10	2.00	3.6	4	Good	Good	20+ years	May provide roosting and foraging opportunities for common urban native and exotic birds
37	*Lophostemon confertus*	0.2	10	8	1.68	2.4	2.5	Good	Good	20+ years	May provide roosting and foraging opportunities for birds and Grey-headed Flying-fox. No obvious hollows were seen
38	*Jacaranda mimosifolia*	0.2	13	10	1.5	2.4	2.5	Good	Good	20+ years	May provide roosting and foraging opportunities for common urban native and exotic birds
39	*Melaleuca quinquenervia*	0.3	7	8	1.5	3.6	4	Good	Good	20+ years	May provide roosting and foraging opportunities for common urban native and exotic birds
40	*Jacaranda mimosifolia*	0.5	15	10	1.5	6	6	Good	Good	20+ years	May provide roosting and foraging opportunities for common urban native and exotic birds
41	*Banksia integrifolia*	0.2	3	8	1.5	2.4	2.5	Good	Good	20+ years	May provide roosting and foraging opportunities for birds and Grey-headed Flying-fox. No obvious hollows were seen
42	*Banksia integrifolia*	0.2	4	8	1.5	2.4	2.5	Good	Good	20+ years	May provide roosting and foraging opportunities for birds and Grey-headed Flying-fox. No obvious hollows were seen
43	*Banksia integrifolia*	0.3	4	8	1.5	3.6	4	Good	Good	20+ years	May provide roosting and foraging opportunities for birds and Grey-headed Flying-fox. No obvious hollows were seen

Tree No.	Species	Dbh (m)	Crown width (m)	Height (m)	Structural Root Zone radius (m)	Tree Protection Zone radius (m)	Recommended Tree Protection Zone radius (m)	Tree health	Tree structure	Tree S.U.L.E	Habitat value for fauna
44	*Banksia integrifolia*	0.2	4	8	1.5	2.4	2.5	Good	Good	20+ years	May provide roosting and foraging opportunities for birds and Grey-headed Flying-fox. No obvious hollows were seen
45	*Banksia integrifolia*	0.3	4	8	1.5	3.6	4	Good	Good	20+ years	May provide roosting and foraging opportunities for birds and Grey-headed Flying-fox. No obvious hollows were seen
46	*Celtis sinensis*	0.2	5	4	1.5	2.4	2.5	Good	Good	20+ years	May provide roosting and foraging opportunities for common urban native and exotic birds
47	*Angophora costata*	0.2	5	8	1.5	2.4	2.5	Good	Good	20+ years	May provide roosting and foraging opportunities for birds and Grey-headed Flying-fox. No obvious hollows were seen
48	*Celtis sinensis*	0.45	13	6	1.5	5.4	5.5	Good	Good	20+ years	May provide roosting and foraging opportunities for common urban native and exotic birds
49	*Celtis sinensis*	0.43	12	6	1.5	5.16	5.5	Good	Good	20+ years	May provide roosting and foraging opportunities for common urban native and exotic birds
50	*Agonis flexuosa*	0.6	8	8	1.5	7.2	7.5	Good	Good	20+ years	May provide roosting and foraging opportunities for common urban native and exotic birds
51	*Agonis flexuosa*	0.45	9	10	1.5	5.4	5.5	Good	Good	20+ years	May provide roosting and foraging opportunities for common urban native and exotic birds
52	*Agonis flexuosa*	0.23	7	8	1.5	2.76	3	Good	Good	20+ years	May provide roosting and foraging opportunities for common urban native and exotic birds

Tree No.	Species	Dbh (m)	Crown width (m)	Height (m)	Structural Root Zone radius (m)	Tree Protection Zone radius (m)	Recommended Tree Protection Zone radius (m)	Tree health	Tree structure	Tree S.U.L.E	Habitat value for fauna
53	*Agonis flexuosa*	0.3	7	8	1.5	3.6	4	Good	Good	20+ years	May provide roosting and foraging opportunities for common urban native and exotic birds
54	*Agonis flexuosa*	0.6	8	8	1.5	7.2	7.5	Good	Good	20+ years	May provide roosting and foraging opportunities for common urban native and exotic birds
55	*Agonis flexuosa*	0.22	7	8	1.5	2.64	3	Good	Good	20+ years	May provide roosting and foraging opportunities for common urban native and exotic birds
56	*Celtis sinensis*	0.3	9	8	1.5	3.6	4	Good	Good	20+ years	May provide roosting and foraging opportunities for common urban native and exotic birds
57	*Callistemon* sp.	0.2	8	6	1.5	2.4	2.5	Good	Good	20+ years	May provide roosting and foraging opportunities for birds and Grey-headed Flying-fox.

Notes: Radius of the Tree Protection Zone (TPZ) calculated by the formula TPZ = diameter at breast height (dbh) x 12. Recommended TPZ radius has been rounded up to nearest 50cm. Radius of the Structural Root Zone calculated from the formula R_{SRZ} = (stem diameter x 50)$^{0.42}$ x 0.64. Inspections of tree condition were visual and undertaken from the ground only. Tree health definitions area 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 deed 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 map 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) y 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 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)

D.1.1 Grey-headed Flying-fox (*Pteropus poliocephalus*)

The Grey-headed Flying-fox (*Pteropus poliocephalus*) is considered likely to occur within the study area based on the presence of suitable foraging habitat and the presence of nearby records. The nationally important Kareela roosting camp is located to the east of the study area (within two kilometres) and this sub-population may utilise the habitats within the study area.

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 within 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*) will be limited to loss of feeding habitat caused by clearing or damage to native vegetation during the construction phase.

The Proposal would remove three trees that provide potential foraging habitat however removal of additional vegetation will be avoided where possible. Foraging habitat mainly comprises nectar resources from planted native trees and shrubs as well as fruit resources. The affected area of foraging habitat would represent a small percentage of the total extent of important foraging vegetation types present within the locality. 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.

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:**

iii. **the extent to which habitat is likely to be removed or modified as a result of the action proposed**

iv. **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**

v. **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. The extent of habitat for the Grey-headed Flying-fox (*Pteropus poliocephalus*) will be reduced by three trees. This amount of habitat removal is small when the amount of available foraging habitat in the locality is considered.

Importantly, the Proposal will 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 km) over open areas including urbanised city centres to move between roost camps and foraging sites. The Proposal will not affect the movement of the Grey-headed Flying-fox (*Pteropus poliocephalus*) between habitat patches.

Importantly, the Proposal will not impact on the most important habitats for Grey-headed Flying-fox (*Pteropus poliocephalus*) within the locality which is the roosting camp at Kareela. This camp will not be affected by the Proposal. Foraging habitat within the study area is likely to form part of an overall foraging range of the Kareela sub-population and would only form a 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 as it does not form a significant food resource.

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 powerlines and entanglement in netting and barbed wire, and implement strategies to reduce these impacts
- Oversee a program of research to improve knowledge of the demographics and population structure of the Grey-headed Flying-fox
- Maintain a National Recovery Team to oversee the implementation of the Grey-headed Flying-fox National Recovery Plan

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*).

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. Broadly, the KTPs include threats to threatened species and other plants and animals in NSW including:

- Pest animals that can compete with or prey upon native animals. They can also damage native plants and degrade natural habitats.
- Weeds that compete with native plants for resources such as light and nutrients. They can aggressively invade areas, displacing native plants and animals.
- Diseases, those exotic fungal infections, viruses and other pathogens can weaken and kill native species.
- Habitat loss or change (e.g. through large-scale land clearing).

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 powerlines, 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 will not increase any of the above threats.

D.1.1.1 Conclusion

The Grey-headed Flying-fox (*Pteropus poliocephalus*) will suffer a small reduction in extent of suitable foraging habitat from the Proposal. No camps or other important habitat will 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 will not interfere with the recovery of the Grey-headed Flying-fox (*Pteropus poliocephalus*) and will 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.1.2 Microbats (Yellow-bellied Sheathtail-bat, Eastern Freetail-bat, Eastern Bentwing-bat and Greater Broad-nosed Bat)

Microbat species (including tree hollow roosting and cave roosting bats) have been recorded in the locality. Considering the high mobility of these species and foraging behaviour it is likely that the study area is utilised intermittently for foraging purposes by the local population of these species. No roosting or breeding habitat was observed for these species in the study area for these species however Eastern Bentwing Bats may potentially roost in culverts and other structures in the locality. No culverts or other potential roosting habitat will be impacted by the Proposal.

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 Proposal requires the removal of vegetation along the cutting on both sides and up to two metres over the cutting crest. No tree hollows were observed within this work area and limited available habitat for hollow-roosting or cave-roosting bats. Removal of any native vegetation (limited to shrubs, small trees and regrowth) will not reduce the area of available habitat for these species.

Considering the moderate potential of microbats in the area the rail corridor would potentially be used as a flight path for foraging bats. Many microbats do not fly through dense forests, but around the edges and use natural and artificial clearings to feed on insects.

Considering the small scale of vegetation removal (three trees) and the nocturnal ecology of microbats, the Proposal is unlikely to adversely affect the lifecycle of any microbat species.

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.**

Hollow-roosting microbats seek refuge during the day in tree hollows, decorticating bark and sometimes in man-made structures. Cave-roosting bats seek refuge in caves and deep rock crevices as well as artificial structures such as culverts, buildings and other structures with suitable cavities. Ground truthing did not observe apparent

tree hollows in the immediate work area and no structures were identified that are for roosting microbats. No roosting habitat is likely to be impacted by the Proposal.

The potential habitat for microbats within the study area is limited to foraging habitat. The extent of foraging habitat for the microbats will be reduced by approximately three trees. This amount of habitat removal is small when the amount of available foraging habitat in the locality is considered. Microbats are considered likely to still utilise the study area for foraging and flying through once works are completed.

Importantly, the work will not result in fragmentation of habitat for microbats. These species are highly mobile and will freely fly long distances over open areas to move between roost sites and foraging sites. The Proposal will not affect the movement of microbats between habitat patches.

There is a low potential that the vegetation to be cleared will be used by microbats as roosting habitat based on the lack of hollows observed. The vegetation is likely to be used by microbats as foraging habitat. Considering the small scale and low-moderate quality of the vegetation to be cleared, and the presence of microbat food resources (insects) regardless of the presence of the vegetation, the habitat is not considered to be important to the long-term survival of microbat species in the area.

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

There is no critical habitat present in the study area. 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 threatened microbats.

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

There are no recovery plans for the microbat species considered likely to occur around the study area; however they are all listed in The Action Plan for Australian Bats. The proposed activity does not relate to the Action Plan for Australian Bats or the recovery of these species.

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.**

Of the key threatening processes listed under the TSC Act, the *clearing of native vegetation* has the greatest potential to impact foraging habitat for microbat species but is considered to impose only minimal impact on the total extent of potential habitat in the area. Invasion, establishment and spread of noxious weeds is likely to occur from the Proposal if weed control is not implemented during and after the works. However, weed invasion is likely to be limited to ground cover grass and herbaceous weeds and these weeds are unlikely to greatly impact on these threatened microbat species..

D.1.2.1 Conclusion

There are extensive areas of potential foraging and roosting habitat for these species throughout the broader locality. In relation to the available habitat in adjacent surrounding areas, the Proposal is not considered likely to affect these species at the local level. The Proposal is unlikely to affect the feeding, breeding or gestation of any microbat species occurring in the area.

D.1.3 Powerful Owl (*Ninox strenua*)

The Powerful Owl is considered likely to occur within the study area based on the presence of suitable foraging habitat and the presence of nearby records.

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 Powerful Owl is known to occupy very large territories particularly in fragmented areas, which is a reflection of their high mobility and diversity of prey species taken. Whilst the Powerful Owl is known to occasionally roost by day in dense thickets of vegetation or foliage their nesting requirements are more specialised being totally dependent on suitably large tree-hollows generally found in the trunks of tall, living, mature trees.

The Proposal will result in the removal of approximately three trees that provide potential foraging habitat for this species that may support prey species such as possums and gliders. Tree hollows potentially suitable as nesting habitat were not identified in the project footprint although are a common feature of the surrounding landscape. There is limited potential for mortality of owls from the Proposal. The Proposal is unlikely to reduce the population size of the Powerful Owl or decrease the reproductive success of this species as no breeding habitat will be affected.

Potential habitats in the locality are extensive and the small loss of potential foraging habitat associated with the clearing is not expected to adversely affect the life cycle of the Powerful Owl and the local population is unlikely to be placed at risk of extinction.

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 Proposal will result in the removal of three trees.

Importantly, the Proposal will not result in fragmentation of habitat for the Powerful Owl. No large blocks of high quality habitat for this species will be broken apart by the Proposal. The Powerful Owl is a highly mobile species that occupies a large home range and they are able to persist in areas where small scale disturbances occur. The Proposal will not affect the movement of the Powerful Owl between habitat patches.

No important habitat for the Powerful Owl will be removed. Tree hollows potentially suitable as nesting habitat for large forest owls were not observed in areas to be cleared although tree hollows suitable for prey species are likely to be common in the surrounding landscape and are important to maintain prey populations. It is unlikely that the Proposal will impact on foraging, movement and other life-cycle attributes of the Powerful Owl.

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 Powerful Owl.

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

The NSW Recovery Plan for the Large Forest Owls identifies the following objectives for recovery of the Powerful Owl:

- Model and map owl habitat and validate with surveys.
- Monitor owl population parameters.
- Audit forestry prescriptions.
- Manage and protect habitat off reserves and state forests.
- Undertake research.
- Increase community awareness and involvement in owl conservation.
- Provide organisational support and integration.

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 Powerful Owl 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 Powerful Owl 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 Powerful Owl.

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. Of the 38 listed KTPs under the TSC Act, the only KTP relevant to the Powerful Owl that will be increased by the Proposal is clearing of native vegetation. The main threats to the Powerful Owl include:

- Historical loss and fragmentation of suitable forest and woodland habitat from land clearing for residential and agricultural development. This loss also affects the populations of arboreal prey species, particularly the Greater Glider which reduces food availability for the Powerful Owl.
- Inappropriate forest harvesting practices that have changed forest structure and removed old growth hollow-bearing trees. Loss of hollow-bearing trees reduces the availability of suitable nest sites and prey habitat.
- Can be extremely sensitive to disturbance around the nest site, particularly during pre-laying, laying and downy chick stages. Disturbance during the breeding period may affect breeding success.
- High frequency hazard reduction burning may also reduce the longevity of individuals by affecting prey availability.
- Road kills.
- Secondary poisoning.
- Predation of fledglings by foxes, dogs and cats.

The work will not increase any of the above threats.

D.1.3.1 Conclusion

The Powerful Owl will suffer a small reduction in extent of suitable foraging habitat from the removal of three trees. No breeding trees or other important habitat will be impacted. The Proposal is unlikely to reduce the population size of the Powerful Owl or decrease the reproductive success of this species. The Proposal will not interfere with the recovery of the Powerful Owl. 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 Powerful Owl.

D.2 EPBC Act significance assessment

The Grey-headed Flying-fox (*Pteropus poliocephalus*) is considered likely to occur within the study area based on the presence of suitable foraging habitat and the presence of nearby records. The nationally important Kareela roosting camp is located to the east of the study area (within two kilometres) and this sub-population may utilise the habitats within the study area.

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 Proposal boundary to date and at the time of writing the report 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 feeding habitat caused by direct clearing or damage to native vegetation during the construction phase.

The Proposal will directly remove three trees that provide potential foraging habitat, however removal of additional vegetation will be avoided where possible. Foraging habitat mainly comprises nectar resources from planted native trees and shrubs as well as fruit resources from planted fig trees and some exotic trees. 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 affected area of foraging habitat would represent a small percentage of the total extent of important foraging vegetation types present within a 50 kilometre radius of the Proposal boundary. 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 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 would directly remove three trees that may provide foraging habitat however vegetation will be avoided where possible. Foraging habitat mainly comprises nectar resources from planted native trees and shrubs as well as fruit resources from planted fig trees and some exotic trees. 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 Proposal will reduce the area of habitat available to the species; however, the area occupied by this species will 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. Highly mobile species such as bats are expected to be less impacted by fragmentation 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 footprint of the Proposal.

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 >30,000 individuals, within an area of 50 kilometre radius
- Productive during the final weeks of gestation, and during the weeks of birth, lactation and conception (Sept-May)
- Productive during the final stages of fruit development and ripening in commercial crops affected by Grey-headed Flying-foxes
- Known to be continuously occupied as a camp site.

The Proposal would directly remove three trees that may provide foraging habitat however vegetation will be avoided where possible. The affected area of foraging habitat would represent a small percentage of the total extent of important foraging vegetation types present within a 50 kilometre radius of the Proposal boundary. 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 adversely affect habitat critical to the survival of the species.

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 Proposal 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 critical 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 was considered possible with a Proposal of this nature and appropriate controls are required during construction and operation of the road 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 Grey-headed Flying-fox (*Pteropus poliocephalus*) will suffer a small reduction in extent of suitable foraging habitat from the Proposal. No breeding camps or other important habitat will 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 will not interfere with the recovery of the Grey-headed Flying-fox (*Pteropus poliocephalus*) and will 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*).