Transport for NSW

Biodiversity assessment report for REF

New Lake Entrance Road and Pioneer Drive Additional Left Hand Lane, Oak Flats, NSW

April 2024

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Executive summary

A Biodiversity Assessment has been conducted as Transport for NSW is proposing to construct an auxiliary left turn lane on the southern approach to the New Lake Entrance Road and Pioneer Drive intersection, south of Oak Flats, in the Shellharbour Local Government Area.

This Biodiversity Assessment has been carried out by Lesryk Environmental Pty Ltd to accompany the Review of Environmental Factors being prepared for the proposal. The Biodiversity Assessment assesses the impact of the proposal to meet the requirements of the NSW *Environment Planning and Assessment Act 1979*.

To permit the proposal, based on a worst-case estimate, the impact footprint comprises about 1.05 hectares of vegetation mapped as Plant Community Type 0 – 'Not Classified' would be disturbed/removed, this including of the removal of 171 trees (comprised of 85 small and 86 medium), none of which were identified as hollow-bearing. Trees are to be retained where possible.

In line with Transport for NSW's *Tree and hollow replacement guidelines* (Transport 2023), 514 trees are required to be re-planted. Alternatively, Transport for NSW may opt to transfer $53,625 into the Transport Conservation Fund.

Within the area investigated, no recorded species or ecological communities listed, or currently being considered for listing, under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* or NSW *Biodiversity Conservation Act 2016* were recorded. In addition, no threatened plants that may be visible at other times of the year were considered to be present.

No Matters of National Environmental Significance listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* are present within, or within the vicinity of, the proposal.

Mitigation measures to reduce any ecological impact as a result of the proposed lane construction have been recommended in Section 6 of this report. The two primary measures include:

- Minimising impact through detailed design.
- Adhering to Transport's *Biodiversity Management Guideline* (Transport 2024a).

In addition, the following key mitigation measures have been provided:

- Limit vegetation removal to the minimum required to successfully permit the proposal.
- Replant 514 trees to replace the removal of 171 trees (comprised of 85 small and 86 medium).
  - Alternatively, Transport may opt to transfer $53,625 into the Transport Conservation Fund.
- The presence of Lantana (*Lantana camara*), Madeira Vine (*Anredera cordifolia*), Climbing Asparagus (*Asparagus plumosus*), Asparagus Fern (*Asparagus aethiopicus*) and Fireweed (*Senecio madagascariensis*) on-site would be controlled prior to the commencement of the proposal.
- Prepare an Erosion and Sediment Control Plan to minimise soil erosion and sediment transfer off-site.

Adoption of these measures would ensure that the work proposed is carried out in an ecologically sustainable manner.

1. Introduction

1.1 Proposal background

Transport for NSW (Transport) are proposing to construct an auxiliary left turn lane on the southern approach to the New Lake Entrance Road and Pioneer Drive intersection, south of Oak Flats (Figure 1-1). The proposal is located within the Sydney Basin Bioregion and Illawarra Subregion (Figure 1-1).

At the request of bd infrastructure, on behalf of Transport, Lesryk Environmental Pty Ltd (Lesryk) has conducted a Biodiversity Assessment to consider and assess all ecological matters affecting, or likely to affect, the environment as a result of the proposal. The BAR will accompany the REF being prepared for the proposal in compliance with the requirements of Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The objectives of the project are to:

- Improve efficiency, reduce delays and queue lengths through the intersection
- Ensure that the project is compatible with the long-term intersection upgrade design
- Maintain the existing pedestrian and Active Transport Network.

1.2 The proposal

Transport proposes to upgrade the intersection of New Lake Entrance Road and Pioneer Drive in Oak Flats, NSW in the Shellharbour LGA, to address existing congestion and reduce queuing (referred to as the proposal). The location of the proposal is shown in Figure 1-1. Currently, this intersection experiences congestion, with traffic queues often extending from the roundabout, south to the Oak Flats Interchange and back onto the Princes Highway. To relieve this congestion and reduce queuing, the upgrade involves a new left turn lane on New Lake Entrance Road, on the southern approach to the roundabout. (Figure 1-2).

Key features of the proposal include (Appendix A):

- Construct a rockfill retaining structure along the northbound side of New Lake Entrance Road to allow for up to 11 m of new road pavement.
- Construct up to 11 m of new road pavement to allow for:
  - an additional 3.5 m wide left hand turning lane, providing about 150 m length of additional waiting capacity for traffic turning left into Pioneer Drive from New Lake Entrance Road.
  - 3 m wide sealed shoulder.
  - 3 - 7.5 m of new pavement for the future long term intersection upgrade, and 3 m wide bike lane.
- Provision of a one m wide verge on the northbound side of New Lake Entrance Road.
- Install an ‘F type’ concrete safety barrier along the edge of the new pavement.
- Install a new SF kerb (with gaps) between the proposed left hand turning lane and bike lane.
- Reseal the existing travel lane adjacent to the new left hand turning lane.
- Reconstruct the impacted shared user path along the southern side of Pioneer Drive, including a new kerb ramp.
- Remove the existing drainage pipe along the existing left hand lane and install new pits and pipe drainage along the western edge of new pavement to tie in to existing drainage system.
- Provision of new signage and line marking.
- Protection and/or relocation of utilities.

To support construction of the proposal, an ancillary facility will be required. The proposed ancillary facility is located on the southern side of Pioneer Drive, on vacant land, adjacent to Lake Illawarra Police Station about 300 m west of the proposal footprint (Figure 1-1), currently owned by the DPHI. This area is currently used as an overflow parking area for the police station.

The ancillary facility would support hardstand areas, site offices, amenities, stockpiles and laydown areas and construction staff parking. The layout of the ancillary facility would be determined during detailed design of the proposal. Access to the ancillary facility would be provided by an existing driveway from Pioneer Drive, which traverses a public footpath parallel to Pioneer Drive. Traffic control would be provided for heavy vehicle movements. The eastern portion of the ancillary site will continue to be available for informal parking for the police station during construction of the proposal.

No substantial earthworks are required for the establishment of the ancillary facility. Properties located on the northern side of Pioneer Drive near the ancillary facility are mainly commercial and industrial premises, except for two residential properties.

Operational hours of the ancillary facility would align with the construction hours for the proposal.

Upon completion of construction of the proposal, the ancillary facility would be returned to a condition agreed on with the landowner.

Figure 1-1: Proposal context

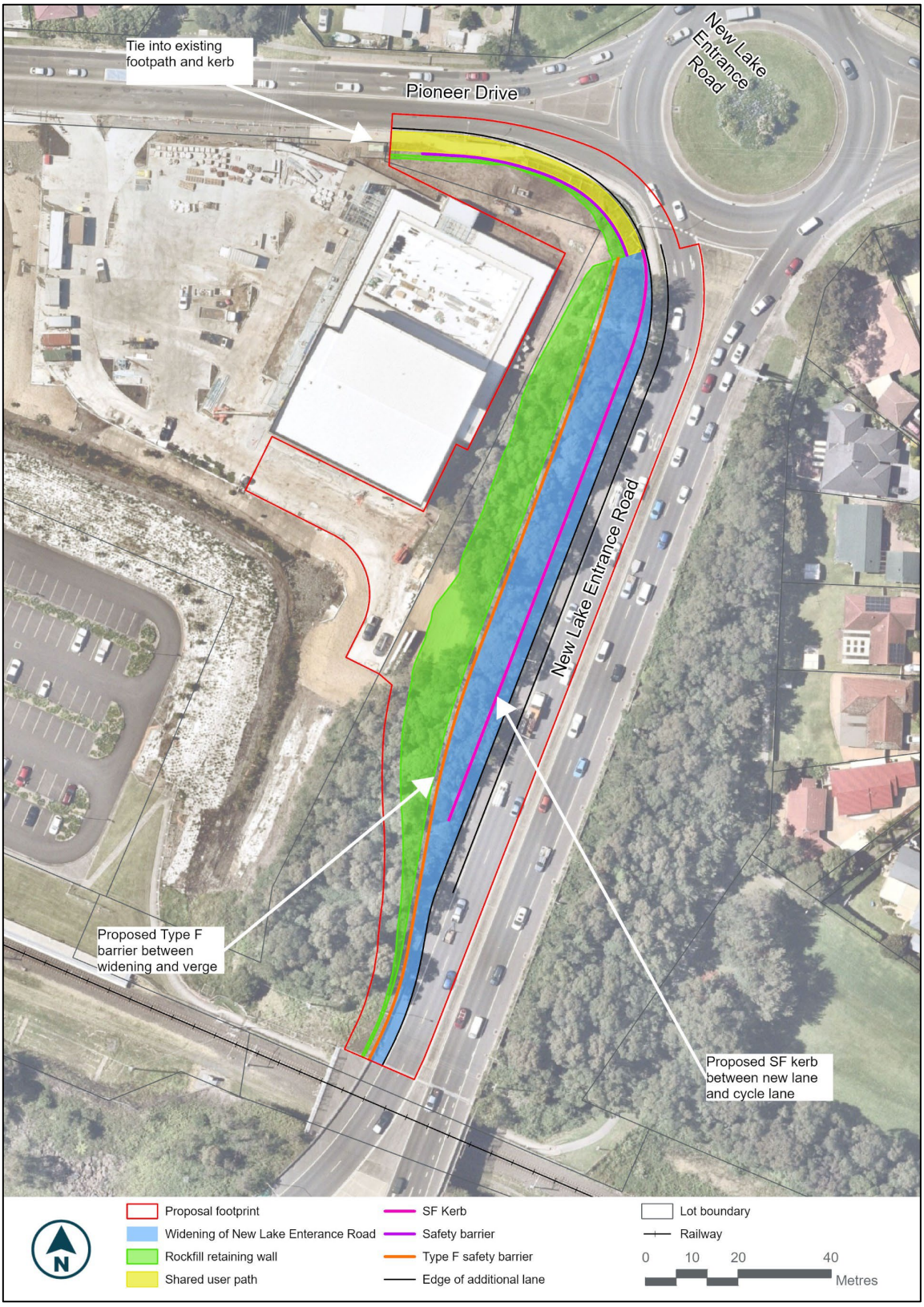

Figure 1-2: The proposal

Unless a specific aspect is referred to, the work would hereafter be referred to as 'the proposal'.

Plant and equipment expected to be used to during the proposal include:

- Excavators and loaders
- Graders
- Bobcat
- Road profiler
- Compactor asphalt
- Water carts
- Back-hoe
- Line-marker truck
- Lime spreader
- Dozer
- Material transfer vehicle
- Mulcher
- Portable toilet, crib room
- Fuel storage
- Demolition equipment
- Scissor lift
- Generator
- Temporary traffic lights
- Piling rigs
- Welding equipment
- Pneumatic hammer
- Trucks (incl. Moxy Dump Trucks)
- Aggregate spreaders
- Concrete trucks
- Road stabiliser
- Rollers
- Bitumen spray truck
- Light vehicles
- Vibrating compactors and rollers
- Scraper
- Paver
- Lighting tower
- Guardrail installation equipment
- Hand tools
- Fences
- Chainsaws
- Jack hammers, concrete saws
- Cranes
- Waste tanks
- Concrete pumps
- Sweepers
- Elevated work platform

1.2.1 Assessment areas

The study area assessed within this report is inclusive of the impact footprint, a nominated buffer that encompasses land immediately surrounding the impact footprint, and any additional areas which are likely to be affected by the proposal (i.e., the ancillary site), either directly or indirectly (i.e., in which 'disturbances would occur' [movement of machinery, personnel etc]). The study area is subject to the conducted ecological investigation.

Based on a worse-case estimate, the proposal would require a work area (i.e. impact footprint in which direct and/or indirect 'disturbances would occur') totaling about 1.24 ha in size: this composed of:

- 1.05 ha impact footprint:
  - The construction and establishment of the left turn lane on New Lake Entrance Road, encompassing an area of about 6200 m^2 (Figure 1-1 and 1-2), inclusive of:
    - Disturbance/ removal of 3000 m^2 of native and exotic vegetation to achieve the objectives of the proposal.
    - One ancillary site (totalling about 4300 m^2)
  - The movement of personnel and vehicles/machinery.

1.3 Legislative context

A REF is prepared to satisfy Transport's duties under s.5.5 of the EP&A Act to "examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity" and s.5.5 in making decisions on the likely significance of any environmental impacts. This biodiversity impact assessment forms part of the REF being prepared for the Lake Entrance Road and Pioneer Drive intersection and assesses the biodiversity impacts of the proposal to meet the requirements of the EP&A Act.

Part 7 of the BC Act requires that the significance of the impact on threatened species, populations and threatened ecological communities or their habitats is assessed using the assessment of significance (commonly known as 'five-part test') at Section 7.3 of the BC Act. Where a significant impact is likely to occur, a SIS must be prepared in accordance with the Environment Agency Head's requirements, or a BDAR must be prepared by an accredited assessor in accordance with the BAM.

In September 2015, a "strategic assessment" approval was granted by the Federal Minister in accordance with the EPBC Act. The approval applies to Transport's road activities being assessed under Division 5.1 (formerly Part 5) of the EP&A Act with respect to potential impacts on nationally listed threatened species, ecological communities and migratory species.

As a result, Transport road proposals assessed via an REF:

- Must address and consider potential impacts on EPBC Act listed threatened species, populations, ecological communities, and migratory species, including application of the "avoid, minimise, mitigate and offset" hierarchy.
- Do not require referral to the DCCEEW for these matters, even if the activity is likely to have a significant impact.
- Must use the BAM to calculate credits that would offset significant impacts on EPBC Act listed threatened species, ecological communities and migratory species.

To assist with this, assessments are required for all relevant biodiversity values in accordance with the *Matters of National Environmental Significance: Significant impact guidelines 1.1. Environment Protection and Biodiversity Conservation Act 1999* (DoE 2013).

2. Methods

2.1 Personnel

Personnel involved in the assessment, and their qualifications, are identified in Table 2-1.

Table 2-1: Personnel

Name	Role	Qualifications
Mr Deryk Engel	Director and Senior Ecologist. Project management, field investigation, Biodiversity Assessment Report (BAR) review and quality assurance	B.Env.Sc. (Hons)
Mr Edward Langston	Botanist, site investigation, BAR write-up	B.Sc, Cert. II Conservation and Land Management
Ms Lauren Crofts	Preparation of tree register	B.Sc Grad Cert Env.Sc M.EnvSc.Mngt
Ms Sarah Maher	Preparation of tree register	B. Sc.

2.2 Background research

Prior to carrying out any fieldwork, known databases and any previous studies conducted in the region were consulted to identify the diversity of ecological communities, flora and fauna species known for, or potentially occurring in, the study region. The identification of those known or potentially occurring native species and communities within this portion of the Shellharbour LGA, particularly those listed under the Schedules to the EPBC, BC and/or FM Acts, thereby permits the tailoring of the field survey strategies to the detection of these plants and animals, their vegetation associations and/or necessary habitat requirements. By identifying likely species, particularly any threatened plants and animals, either the most appropriate species-specific survey techniques may be selected (should their associated vegetation communities/habitat requirements be present) or a precautionary approach to their presence adopted.

The carrying out of a literature search also ensures that the results from surveys conducted during different climatic, seasonal and date periods are considered and drawn upon as required. This approach therefore increases the probability of considering the presence of, and possible impact on, all known and likely native species, particularly any plants and animals that are of regional, State and/or national conservation concern. This approach also avoids issues inherent with a one off 'snap-shot' study.

A list of all databases, date these were accessed, and the search area employed is provided in Table 2-2.

Other reports and documents referred to are provided within the bibliography section of this report.

All these databases and reports were reviewed and drawn upon where relevant. While reviewing these documents, particular attention was paid to identifying relevant ecological matters listed, or currently being considered for listing, under the Schedules of the EPBC, BC and/or FM Acts, plants, animals and ecological communities that have been recorded in the region and which may occur within, or in the vicinity of, the study area.

Field guides and standard texts used include:

- Brooker and Kleinig (1999) [used to identify eucalypts]
- Fairley and Moore (2010) [other vegetation]
- Cogger (2014) [reptiles and frogs]
- Anstis (2017) [frogs]
- Churchill (2008) [flying mammals]

- Simpson and Day (2010) [birds]
- Van Dyck and Strahan (2008) [non-flying mammals]
- Triggs (1996) [identification of scats, tracks and markings].

Table 2-2: Database searches

Database/Information sources	Date accessed	Search area
Protected Matters Search Tool (PMST) (DCCEEW 2024a)	March 2024	10 km buffer on study area
Register of critical habitat (DCCEEW 2024d)	March 2024	N/A
BioNet Atlas (NSW DCCEW 2024a)	March 2024	10 km buffer on study area
Areas of Outstanding Biodiversity Value register (NSW DCCEEW 2024c)	March 2024	N/A
NSW WeedWise Database (DPI 2024a)	March 2024	Shellharbour LGA
Fisheries NSW Spatial Data Portal (DPI 2024b)	March 2024	Southern Rivers layer
NSW State Vegetation Type Map (State Government of NSW and NSW DCCEW 2022)	March 2024	Study area
BioNet Vegetation Classification database (NSW Government 2024a)	March 2024	N/A
Biodiversity Values Map and Threshold Tool (NSW Government 2024b)	March 2024	Study area
PlantNet (2024)	March 2024	N/A
SEED map viewer (NSW Government 2024c)	March 2024	Study area
Threatened Species website (OEH 2024a)	March 2024	N/A
Groundwater Dependent Ecosystems Atlas (BoM 2024b)	March 2024	Study area
National Flying-fox monitoring viewer (DCCEEW 2024e)	March 2024	Study area

Nomenclature follows that in these texts, or within the EPBC and BC Acts. It is noted that the current accepted scientific names for some of the threatened fauna species previously recorded in this locality are not consistent with the names used/provided under either the EPBC and/or BC Acts. In these instances, nomenclature used within this report follows the current approved scientific conventions.

Where applicable, any TECs were classified and named according to the NSW Scientific Committee's Final and Preliminary Determinations [various dates].

The conservation significance of those ecological communities, plants and animals recorded is made with reference to:

- The EPBC and BC Acts.
- Vegetation mapping of the study region (State Government of NSW and NSW DCCEEW 2022).
- The BioNet Vegetation Classification database (NSW Government 2024a).

In addition to the above, the following publications were consulted prior to, and during the course, of the project:

- Hayes Environmental, *Oak Flats Interchange Post Work Completion Review, Flora and Fauna Assessment* (2005). Key Findings relevant to the proposal include:
  - The vegetation within the proposal was of Blue Condition (Area of generally good condition, with high proportion of *Acacia* species.
  - The vegetation present in the study area currently provides extremely limited foraging opportunities for native fauna.
  - Generally, the study area was in a healthy condition with Kikuyu (*Cenchrus clandestinus*) dominant.
- Niche Environment and Heritage, *Lake Entrance Road/Pioneer Drive Intersection, Oak Flats Biodiversity Assessment Report* (2020). Key Findings relevant to the proposal include:
  - The native vegetation present within the study area was identified as:
    - PCT 838 - Forest Red Gum - Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion. PCT 838 is part of the Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion (ILGW) Threatened Ecological Community (TEC), listed as critically endangered under the Commonwealth Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) and endangered under the NSW Biodiversity Conservation Act 2016 (BC Act).
    - PCT 1232 - Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion. PCT 1232 is part of the Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions (SOFF) TEC, listed as endangered under both the EPBC and BC Acts. With reference to the Commonwealth conservation advice for this community however, the SOFF stand present would not satisfy the condition thresholds provided to make it eligible for Commonwealth listing.
  - No threatened flora or fauna species listed under the EPBC or BC Acts were recorded within the study area.
  - No threatened aquatic species listed under the NSW Fisheries Management Act 1994 are considered likely to occur within the drainage lines that are present within the study area.

2.3 Vegetation assessment

2.3.1 Vegetation mapping

Vegetation of the locality has been mapped and described in the NSW State Vegetation Type Map (SVTM) (State Government of NSW and NSW DCCEW 2022). Mapping identifies the most likely PCT to occur in a given polygon. Figure 2-1 illustrates the SVTM in relation to the study area (inclusive of ancillary sites). Refer also to Section 3.1 for further details of PCTs.

2.3.2 Vegetation survey and classification

The purpose of the vegetation survey was to confirm the dominant species with reference to the mapped PCTs, assess the condition of the vegetation, search for threatened species (or their habitats) and identify weeds.

Surveys were conducted by traversing the study area and, as far as possible, identifying all plants present as well as documenting dominant species in each stratum.

As the vegetation did not conform to any PCT, no surveys conducted in accordance with the BAM were completed for this project as it was considered superfluous to do so. Therefore, associated template tables and figures have been removed from this report.

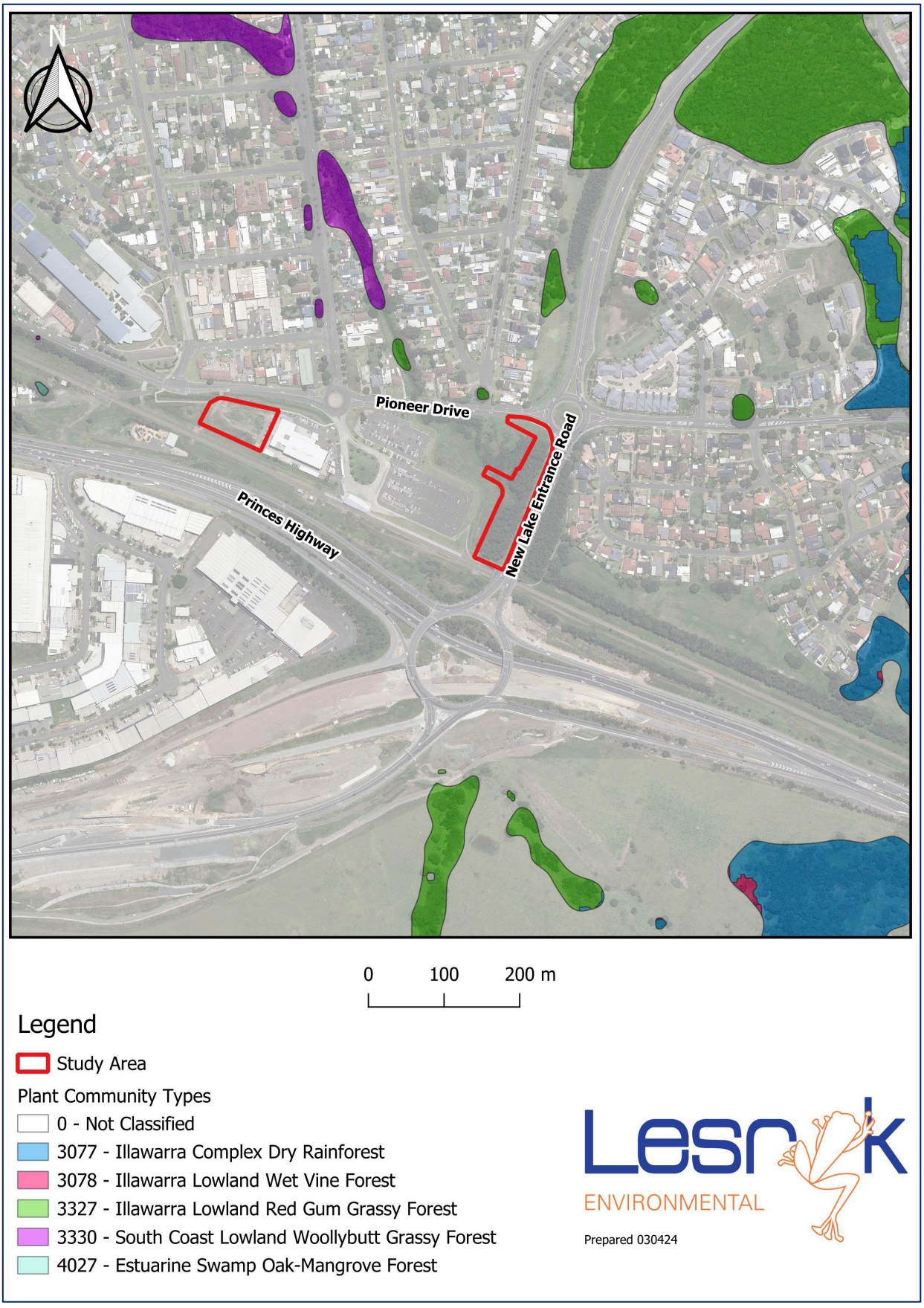

Figure 2-1: SVTM

2.4 Threatened species assessment

A biodiversity assessment of the study area was carried out by Deryk Engel and Edward Langston on 28 March 2024; with Lauren Crofts and Sarah Maher compiling the tree register on 11 April 2024.

The purpose of the March field investigation was to identify those vegetation communities, fauna habitats, plants and animals present within, and in close proximity to, the study area that are of State and/or national conservation significance as listed under the Schedules to the EPBC, BC and/or FM Acts.

While conducting the habitat assessments, efforts were made to identify features such as known vegetation associations, geological features [e.g., caves or suitable cave substitutes], feed trees, mature trees with hollows, connectivity of fauna corridors, aquatic environments and other habitat features important to the lifecycle requirements of those threatened plants and animals previously recorded in the study region (as listed in Appendix B).

The survey methods employed during the field investigation were:

- The identification of those plants present, including within any areas affected by direct and indirect impacts
- The identification of the structure of those vegetation communities and fauna habitats present at, and close to, the proposal area
- The direct observation of those fauna species present within or near to the study area
- Diurnal call identifications of those fauna species present, with all calls being identified in the field
- The identification of any indirect evidence such as tracks, scats, scratching, and diggings that would suggest the presence of a particular fauna species
- Leaf litter and ground debris searches for sheltering reptiles and amphibians.

Where required, a more detailed description on one or more of the survey methods employed is provided below.

2.4.1 Habitat suitability assessment

An assessment of available habitat for each threatened species, population or community identified in the database searches, and their likelihood of occurrence, is provided in Appendix B.

2.4.2 Targeted flora surveys

Targeted (species specific) surveys for threatened plants were conducted based on the results of the literature review, including consideration of the habitat requirements of those threatened flora species identified as potentially occurring in the study area (see Appendix B), aerial photography interpretation and the site specifics of the study area.

Given that the habitat within the proposal area were observed to be substantially degraded, no threatened flora was considered likely to occur within the area. As such, targeted flora surveys were not conducted.

2.4.3 Targeted fauna surveys

The proposal is located within an urban landscape, the area to be affected present between New Lake Entrance Road (to the east), a car park and recently constructure commercial building (to the west). The strip of vegetation present is in the order of 165 m long by 15 m wide. The vegetation present has been cleared to permit the adjacent commercial development, this including an Asset Protection Zone and car park. The vegetation present is even aged, this being planted as part of the previous New Lake Entrance Road works (the landscaping work conducted in 2003) (Hayes Environmental 2005). Connectivity to other developed areas of vegetation is limited to non-existent. Due to the presence of urban infrastructure such as roads, buildings, car parks, security fencing and concrete guard rails, the vegetation present is considered to be isolated to all bar the most tolerant of urban adapted species (such as birds and flying mammals). Ground traversing native mammals and gliders (particularly those that are dependent upon hollows), and the medium to large birds, would not occupy or utilise the vegetation surveyed.

The highly disturbed nature of the vegetation and proximate drainage line would preclude all bar the most tolerant of urban herpetofauna.

Given the nature of the vegetation present, no threatened fauna are considered to occur as resident populations within or close to the proposal. With reference to the Habitat Suitability Assessment (Appendix B) and based on the observations made during the diurnal investigation, including the identification of those habitats present, as none would occur, it was not considered necessary to employ any species-specific survey methods targeting threatened fauna (e.g., nocturnal surveys, echolocation [targeting Yangochiroptera hereafter referred to as microbats]). It is acknowledged the majority of fauna in Appendix B are considered to have a low likelihood of occurring and, of the few species considered to have a moderate likelihood, a precautionary assessment was conducted.

The survey methods that were conducted are as follows:

Diurnal investigation

During the field investigation, birds were identified using visual identification of observed individuals or aural identification of their vocalisations. In addition to a 20-minute dedicated survey that was conducted downslope of the proposal (researcher at Easting 300258; Northing 6172272), incidental birds heard while traversing the site.

The large concrete culvert that is under New Lake Entrance Road was searched for cave-dependent microbats, a hand-held torch being used to assist with this inspection.

Occurrence of suitable urban effuse and natural ground debris were also search for species such as reptiles and frogs. While conducting the ground debris searches, tracks, diggings and characteristic scats were also searched for, and identified in the field.

2.5 Tree and hollow survey

Tree removal count

The trees that are likely to require removal were identified and recorded. The survey area for this assessment included the impact footprint and a distance of up to 1 m beyond (downslope) of this (to account for root disturbance). The position of those native trees that were ≥ 5 cm at Diameter at Breast Height (DBH) at 1 m of height above ground level were recorded through use of the iPAD™ application 'Field Maps' by Esri's ArcGIS (Esri 2024) which incorporates a Global Positioning System (GPS) tool. In addition, for each tree assessed, the following data was collected (and is presented in Appendix C):

- Status: whether the tree is alive or dead
- Species identification, if alive, and
- DBH (indicative) and estimated size classes:
  - Small 5 – 20 cm
  - Medium 20 – 50 cm
  - Large 50 – 100 cm
  - Very large > 100 cm.

The tree mapping was conducted on 11 April 2024 by Lauren Crofts and Sarah Maher.

The growth form of those plants present within the study area was determined with reference to DPE's native species by growth form database (DPE undated).

Hollow-bearing tree survey

Though considered and targeted, within the impact footprint, no hollow-bearing trees were recorded.

Guidelines

The survey methods employed and level of effort required were generally based on descriptions provided in the following:

- DEC (2004 working draft) Threatened Biodiversity Survey and Assessment – Guidelines for Developments and Activities
- DECC (2009) Threatened species survey and assessment guidelines – field survey methods for fauna: amphibians
- DEWHA survey guidelines for Australia's threatened bats, bird and frogs (DEWHA 2010a, 2010b, 2010c)
- DSEWPC survey guidelines for Australia's threatened mammals and reptiles (DSEWPC 2011a, 2011b, 2011c)

- The 'Species credit' threatened bats and their habitats NSW survey guide for the Biodiversity Assessment Method (State of NSW and OEH 2018c), and
- The NSW Survey Guide for Threatened Frogs: A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method (State of NSW and DPIE 2020c).

2.6 Aquatic surveys

One waterway, an unnamed drainage line, is present within the study area. The unnamed drainage line traverses through a box culvert, directing its water from east to west, under New Lake Entrance Road, prior to discharging into Horsley Inlet (about 300 m south of the impact footprint). Upstream sections of the drainage line, leading into the box culvert, are dominated by the presence of Cumbungi (*Typha orientalis*).

The proposal will not require the direct or indirect disturbance of the unnamed drainage line, and it is not predicted that any inputs from the new impervious road surfaces will have an adverse cumulative impact on this environment or the aquatic fauna predicted to be present (which is likely to include Short (*Anguilla australis*) and Long-finned (*A.reinhardtii*) Eels. As the proposal will not impact any aquatic species or their habitat; therefore, no aquatic surveys were conducted for this proposal.

2.7 Limitations

By the completion of the field investigations a total of about eight person hours of active searches had been accumulated. Given the limited size and urban landscape of the area surveyed, this is considered more than adequate when endeavouring to determine the diversity of native species present, their habitats and vegetation associations, and the conservation status of each of these.

The inspection was undertaken on foot, no limitations (such as restricted access, or adverse weather conditions) to achieving the objectives of the survey being encountered. For refence, the weather experienced during the site investigations was generally moderate temperatures [~24°C], clear to partially cloudy skies, still to light breezes, and sunny conditions.

While not considered to compromise the scientific rigor of the field assessment, no specific surveys (i.e., nocturnal work) were carried out. To overcome this limitation:

- Database searches were conducted for threatened species, populations and ecological communities known to occur within the region.
- The precautionary principle was adopted where necessary (i.e., suitable habitat for those threatened species known to occur, or that have been previously recorded within the surrounding locality, was identified).

Not all flora and fauna can be fully accounted for within any given study area. The presence of threatened species is not static; and changes often in response to longer term natural forces that can, at any time, be dramatically influenced by human-made disturbances.

This report is based upon data acquired from the current investigation. However, data gathered is indicative of the environmental conditions of the site at the time the field work was conducted.

3. Existing environment

The study area is located adjacent to New Lake Entrance Road, about 900 m south of Oak Flats. The study area includes a vegetated embankment located to the west of New Lake Entrance Road, and exotic maintained grassland south of Pioneer Drive.

The native vegetation that is to be cleared was planted in 2003 as part of the landscaping works associated with the construction of the Oak Flats Interchange (Hayes Environmental 2005). As noted in the Hayes Environmental report '*revegetation of the project area was designed using locally indigenous native plant species, with the aim of re-creating self-sustaining native vegetation. It appears that planting mostly consisted of a range of Acacia, Eucalypt and Melaleuca species, with occasional plantings of other local native shrubs and trees. The only native grass that appears to have been planted in the project area is Lomandra longifolia (*Hayes Environmental 2005 page 1). Hayes Environmental notes that, during an inspection to examine the health and condition of the revegetation areas, the vegetation within the proposal area exhibited good quality regeneration with a high diversity of Acacia, Eucalypt and Melaleuca.

Hayes Environmental noted that '*The vegetation present in the study area currently provides extremely limited foraging opportunities for native fauna. Only common dominant birds such as the Australian Magpie, Australian Raven, Noisy Miner and Pied Currawong would be expected to occur at present, and only on occasions. However, in time when the plants mature and begin to flower more reliably and prolifically, it is likely that a range of disturbance-tolerant birds would forage on occasions. Some small insectivorous birds such as finches and fairy-wrens would be expected to occur in the larger areas of native shrubs almost year-round, whilst Honeyeaters would be expected to occur in these areas during prevalent flowering periods. The study area is not likely to attract native terrestrial or arboreal mammals either now or in the future due to its exposure to noise and other human impacts of the Princes Highway and interchange roads. In time, microchiropteran bats or flying-foxes may occasionally use the area for foraging. It will be a long time before suitable shelter and nesting habitats are provided in the form of tree hollows, den sites etc. The site provides some habitats for disturbance-tolerant reptiles and amphibians*' (Hayes Environmental 2005 page 4).

As per the Hayes Environmental 2005 study, the site investigation conducted to inform this Biodiversity Assessment Report noted that:

- only common birds were present
- the site is available to disturbance-tolerant birds to forage in
- the study area is not likely to attract native terrestrial or arboreal mammals exposure to noise and other human impacts
- microbats or flying-foxes may occasionally use the area for foraging (but would not shelter or roost in this site)
- suitable shelter and nesting habitats in the form of tree hollows, den sites etc are not present
- the site provides some habitats for disturbance-tolerant reptiles and amphibians.

Further, the BAR prepared by Niche for Transport (2020) described the proposal area as having been *'highly modified for the construction of the roads, the landform no longer occurring in its natural state. All the vegetation present is considered to have been planted or regenerated since the modification of the area. No remnant areas of vegetation are considered present. The area is weed infested and subject to edge effects and nutrient rich sediment runoff from the roads and the surrounding urban area. The high volume of traffic and urban character will continue to degrade the study area further.'*

During the field investigation the planted embankment within the subject site was characterised by a uniform canopy of trees 15 m in height, a midstory of scattered Melaleucas and Callistemons up to 8 m, an understorey dominated by the introduced plant Lantana (*Lantana camara*) up to 4 m, and groundcover to 1 m. The groundcover consists of exotic grasses, weeds, and vines.

The vegetation present has been established on battered slopes and fill material, these an artefact of the construction of New Lake Entrance Road.

Due to recent heavy rain fall, some sections of the embankment area exhibiting slumping where surface runoff has been concentrated. Erosion at these sites has exposed the deposited fill material.

One ancillary site would be required for the proposal, located with existing hardstand areas, previously disturbed/cleared and currently being used as an informal carpark, located 300 m west of the proposal.

Regarding ancillary site, none are proximate to any potential sensitive areas necessitating consideration. Mitigation measures have been recommended in Section 6 to ameliorate any potential impacts occurring beyond the study area as a result of the proposal.

Adjacent to Pioneer Drive, no canopy was present with the area characterised by a maintained grassland dominated by Kikuyu and annual weeds up to 1 m tall.

The ancillary site was comprised of hardstand areas, currently being used for overflow parking, unmaintained patches of exotic grasses and shrubs, and maintained exotic grassland. Several juvenile native trees were identified within the ancillary site.

The topography is a moderately steep slope that grades away from both New Lake Entrance Road and Pioneer Drive towards the western boundary of the proposal.

One waterway, an unnamed drainage line, is present within the study area. The unnamed drainage line is not mapped as KFH and would not be impacted by the scope of works.

For reference, a photographic record of the area investigated is provided in Appendix D.

Reference to the Biodiversity Values Map and Threshold Tool (BVMTT) (NSW Government 2024b) did not identify any areas mapped as having Biodiversity Values within, or close to, the study area.

With reference to the contaminated land record of notices (EPA 2024), did not identify any contaminated land within, or in proximity to, the proposal.

Reference to the Soil Landscape of the Kiama 1:100,000 Sheet report (Hazelton 1992) and mapping (State Government of NSW and NSW DCCEEW 1992) indicates the study area is located within the Albion Park soil landscape (Figure 3-1).

Albion Park landscape geology consists of Berry Formation—mid grey to dark grey siltstone, mudstone and fine sandstone with localised outcrops of Budgong Sandstone on mid to upper slopes and localised outcrops of Bumbo Latite occasionally occurring on crests (Hazelton 1992). This soil landscape covers short steep upper slopes grading into long gently inclined footslopes (Hazelton 1992). The main soils are Brown Podzolic Soils occurring on crests, Yellow Podzolic Soils on midslopes and Soloths occur on footslopes and drainage lines (Hazelton 1992). Limitations of this soil landscape include waterlogging, seasonally high watertable, shrink-swell, hardsetting (topsoil), sodicity, low wet bearing strength (subsoil), high available water-holding capacity (topsoil and subsoil) (Hazelton 1992).

Reference to the SEED map viewer (NSW Government 2024c) to identify the extent of acid sulfate soils within the study area shows that the area investigated is mapped wholly within Class 5 (Figure 3-1). Typically, acid sulfate soils are not found in Class 5 areas.

Figure 3-1: Soil landscapes and acid sulfate soil

For reference, Table 3-1 identifies attributes of the area investigated.

Table 3-1: Site attributes

Site Attributes	
Estimated size (ha)	Study area totals about 1.24 ha
Metres above sea level	Between 16 m and 25 m
Climate[1]	Mean summer high: 27 °C (January) Mean winter low: 6.4 °C (July) Mean annual rainfall: 1000.7 mm
Waterbody	Unnamed drainage line
Critical habitat	No
IBRA Bioregion/Subregion	Sydney Basin/ Illawarra
Mitchell Landscape	Dapto - Wollongong Coastal Slopes
Soil Landscape	Albion Park (Figure 3-1)
NPWS estate	N/A

3.1 Plant community types and vegetation zones

Reference to the SVTM (State Government of NSW and NSW DCCEW 2022) (see Figure 3-2) indicates that the following PCTs are present within the study area:

- PCT 0 – Not Classified

It is noted that a previous BAR incorporating the proposal (Niche 2020), classified the vegetation present as:

- PCT 0 – Not Classified
- PCT 838 – Forest Red Gum – Thin-leaved Stringybark grassy woodland on coastal lowlands, southern Sydney Basin Bioregion.
- PCT 1232 – Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion Basin.

By the completion of the field investigation, the vegetation present was found to differ from the BAM plot conducted in 2020 by Niche. The assemblage of canopy species differed and a greater number of exotic groundcover and vine species were recorded during the most recent survey.

With reference to the previous BAR conducted for broader scale road works, inclusive of the left turn lane, a BAM plot was conducted within the proposal area (Niche 2020) and incorporated into this report. The report found that both PCT 838 and PCT 1232 were present within the proposal (Niche 2020). The areas of PCT 1232 previously mapped as being present within the proposal have been cleared and developed upon. As no vegetation was present within the mapped areas of PCT 1232 previously surveyed, it's presence was absent from the proposal.

Reference to the Geotechnical Factual Report for the proposal, identifies the geology occupied within the study area to be comprised of fill, established as an embankment to New Lake Entrance Road (Stantec 2024). No native PCTs are described as occurring on fill (NSW Government 2024a), with previous assessment of the vegetation based on a closest match to the historic potentially occurring PCT in the area (Niche 2020) (this being PCT 838 [decommissioned to PCT 3327 and 3078]). Given the vegetation identified above, and its occurrence on fill, it does not meet the descriptive attributes to conform to either PCT 3327 nor PCT 3078 (NSW Government 2024a) and more accurately conformed to PCT 0. It is noted that there are no listed derived

[1] Albion Park (Shellharbour Airport) – This being the nearest operating weather station to the area investigated.

plant communities associated with the PCT 3327 or 3078 which could have occurred within the proposal area (NSW Government 2024a).

The field investigation conducted by Lesryk identified the vegetation within the study area consisted of a canopy of native plantings such as River Red Gum (*Eucalyptus tereticornis*), Spotted Gum (*Corymbia maculata*), Coast White-box (*Eucalyptus quadrangulata*) and Swamp She-Oak (*Casuarina glauca*) up to 15 m tall. The midstory was comprised of Bracelet Honey-myrtle (*Melaleuca armillaris* subsp. *armillaris*), Prickly-leaved Tea Tree, Large-leaved Privet (*Ligustrum lucidum*) and Sweet Pittosporum up to 5 m tall. The understory was dominated by Lantana up to 3 m tall. The groundcover was dominated by exotic species including Cockspur (*Echinochloa crus-galli*), Kikuyu, Asparagus Fern, and Turkey Rhubarb (*Rumex sagittatus*) up to 1 m tall. Vines were present within the proposal and included Moth Vine (*Araujia sericifera*), Scrambling Lily, Wonga-wonga Vine (*Pandorea pandorana*) and Madeira Vine (*Anredera cordifolia*).

Based on the above, the SVTM mapping as PCT 0 – Not Classified was identified to be accurate and that the vegetation within the proposal area does not conform to a native vegetation community.

The vegetation within the ancillary site conformed to PCT 0 – Not Classified. No canopy was present but contained a midstory of several juvenile Forest Red Gums. The understory, where present, was dominated exclusively by Lantana. The groundcover was dominated by exotic grasses and forbs including Kikuyu, Rhodes Grass (*Chloris gayana*) and Fennel (*Foeniculum vulgare*).

3.2 Threatened ecological communities

No TECs were identified within the study area.

3.3 Groundwater dependent ecosystems

GDE's are communities of plants, animals and other organisms whose extent and life processes are dependent on groundwater. Some examples of ecosystems which depend on groundwater are:

- Wetlands.
- Red gum forests, vegetation on coastal sand dunes and other terrestrial vegetation.
- Ecosystems in streams fed by groundwater.
- Limestone cave systems.
- Hanging valleys and swamps.

Reference to the Groundwater Dependent Ecosystems Atlas (BoM 2024b) did not identify any terrestrial, aquatic, or subterranean GDEs within the proposal area (Figure 3-3)

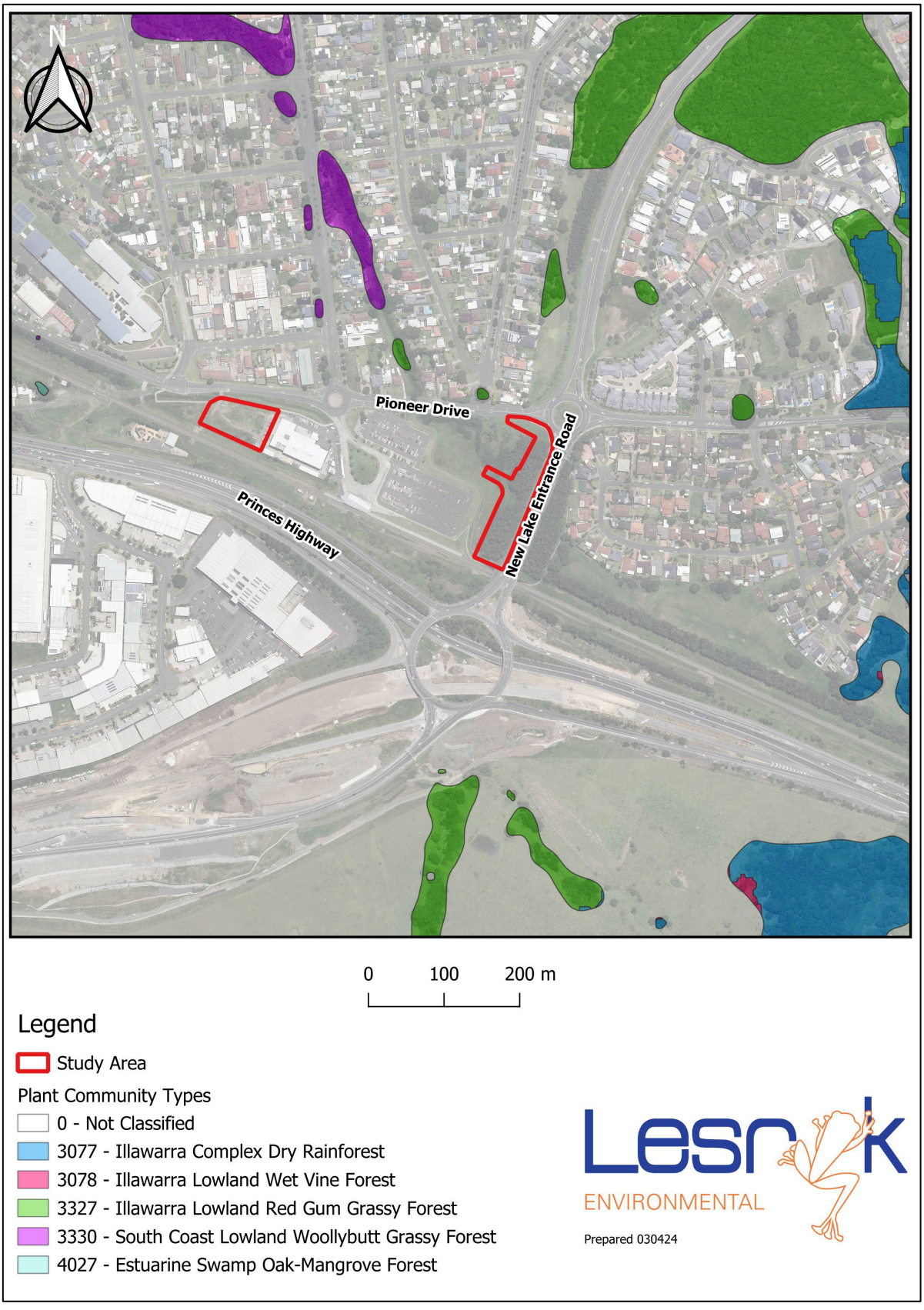

Figure 3-2: Plant community types within the study area

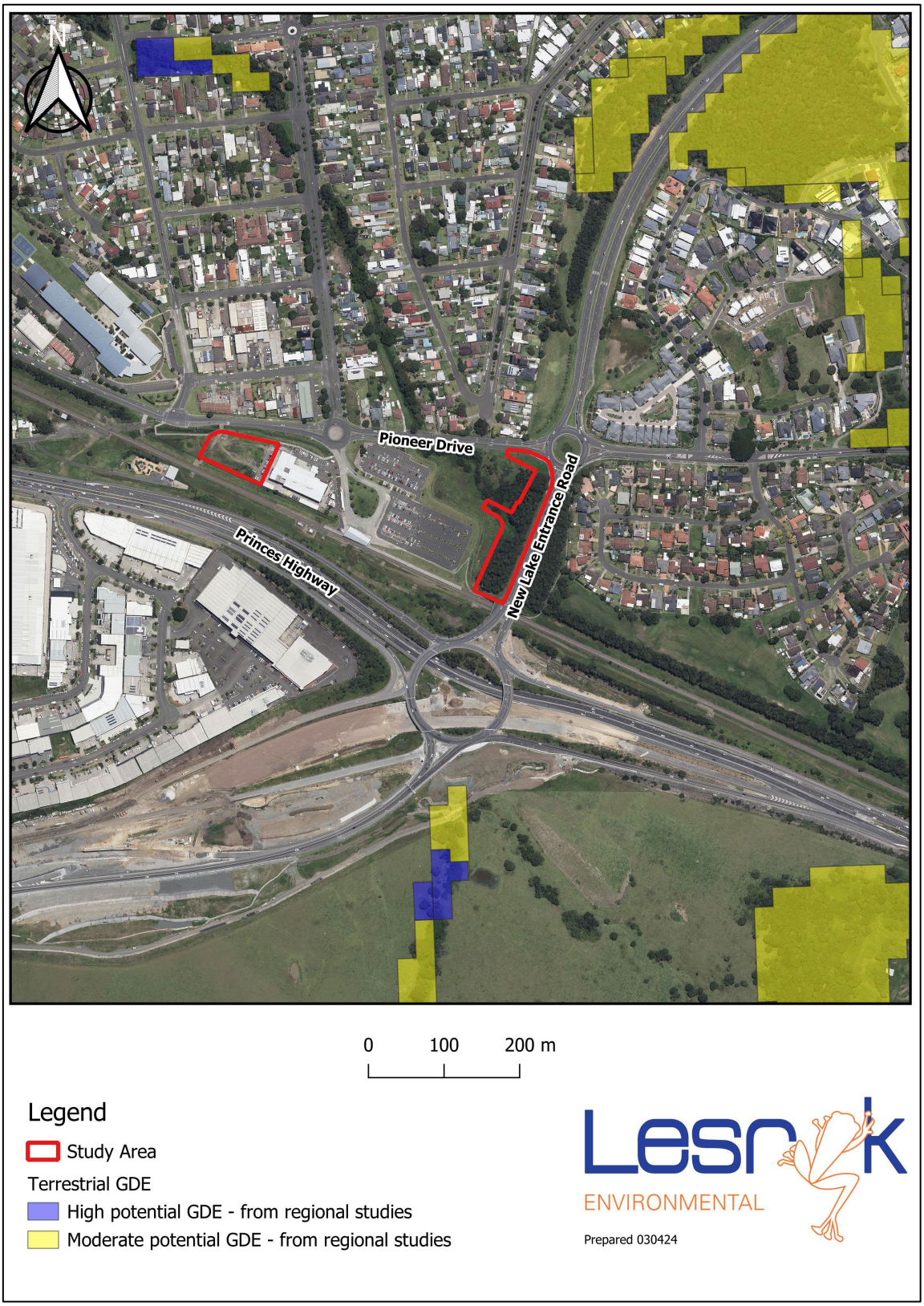

Figure 3-3: Groundwater dependent ecosystems

3.4 Threatened species

Prior to conducting the field investigation, a review of the DCCEEW PMST and BioNet databases (DCCEEW 2024a, NSW DCCEEW 2024a) identified 34 threatened flora species and 76 threatened fauna species listed under the EPBC and/or BC Acts that have been previously recorded or are considered to have habitat within 10 km of the study area (Appendix B). Those species that have been previously recorded within 10 km of the study area as per the BioNet Atlas are presented in Figures 3-4 and 3-5 (note: the locations where some species were recorded overlap). Due to a lack of their necessary habitats within the area investigated, oceanic, estuarine and wetland species were not considered.

While previously recorded within and/or predicted as having habitat within 10 km of the study area, the threatened species identified during the literature search were assessed to have only a 'low' likelihood of occurrence, given the small size and isolated character of vegetation present, and lack of any important habitat features. These species would not occur within, or be reliant upon, a limited area of road side landscape planting for any significant component of their life cycle requirements. The majority of these animals have specific habitat requirements (as identified in Appendix B), no significant components of which were observed within, or close to, the proposal.

In the case of fauna, numerous highly mobile threatened species with large territorial requirements (e.g., mega and microbats, birds) may fly over, perch or forage above (on insets) or within (on pollen) on occasions. That stated, these species would not be reliant upon the vegetation that would be cleared. Within the area surveyed, no hollow-bearing trees are present and no stick nests were observed. When in flower, the eucalypts present may attract species such as the Grey-headed Flying-fox, but similar plants are present at other localities within the surrounding urban area.

Whilst flying threatened fauna may occur on occasion, the clearing of the vegetation present would not have a significant effect on these species or their habitats. Therefore, the conducting of assessments with reference to the EPBC Significant Impact Guidelines and Section 7.2 of the BC Act are not required.

Reference to the National Flying-fox monitoring viewer (DCCEEW 2024e) identified one flying-fox camp (Shellharbour, Blackbutt Reserve [517]) present about 2 km east of the study area. The camp was last surveyed in May 2022, with between 1 and 499 Grey-headed Flying-fox (*Pteropus poliocephalus*) individuals being recorded. While individuals from this colony may fly over and/or forage within, and close to, the study area, the Grey-headed Flying-fox (Vulnerable, EPBC and BC Acts) is not considered to be reliant on the vegetation that would be cleared to permit the proposal for any of its lifecycle requirements.

As would be expected for a highly isolated and small stand of planted vegetation, few native species were recorded. Those that were detected within, or in proximity to, the proposal were 12 native birds and 2 reptiles (Table 3-2). None of the species recorded are listed, or currently being considered for listing, under the EPBC or BC Acts.

Though considered and targeted, no indirect evidence (such as large stick nests, damaged trees [indicative of Grey-headed Flying-foxes], white-wash accumulations and so forth) to suggest the presence of a viable local population of threatened fauna occurring within, or close to, the proposal was obtained.

The native species recorded are protected, as defined by the BC Act, but considered to be common to abundant throughout the surrounding region. The species recorded would not be solely reliant upon those habitats present within, or near to, the proposal such that the removal or further disturbance of these would threaten the 'local' occurrence of these animals. The species recorded are all expected to be present within both the study area and surrounding locality post-work.

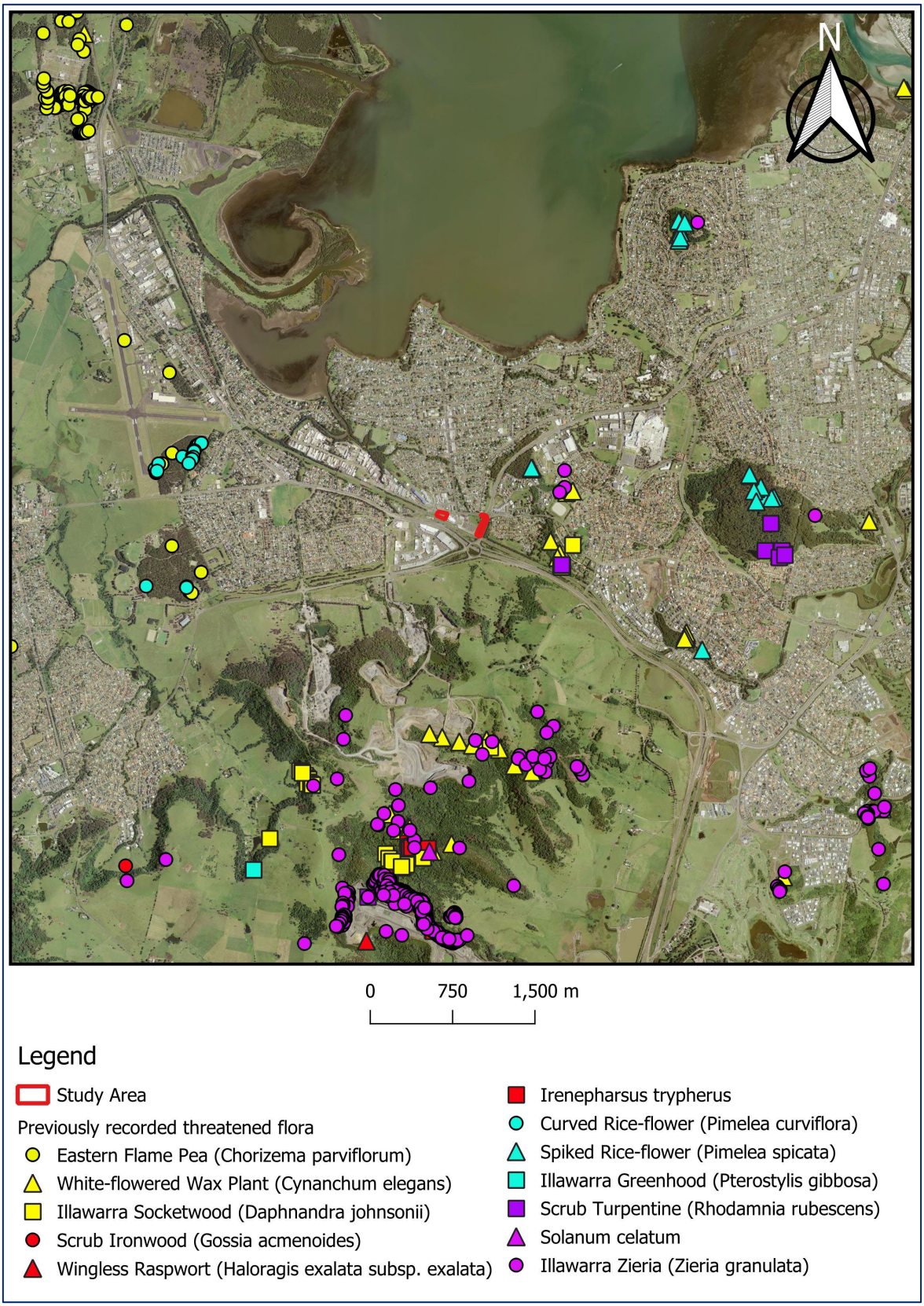

Figure 3-4: Threatened flora species previously recorded within 10 km, in the vicinity of the study area

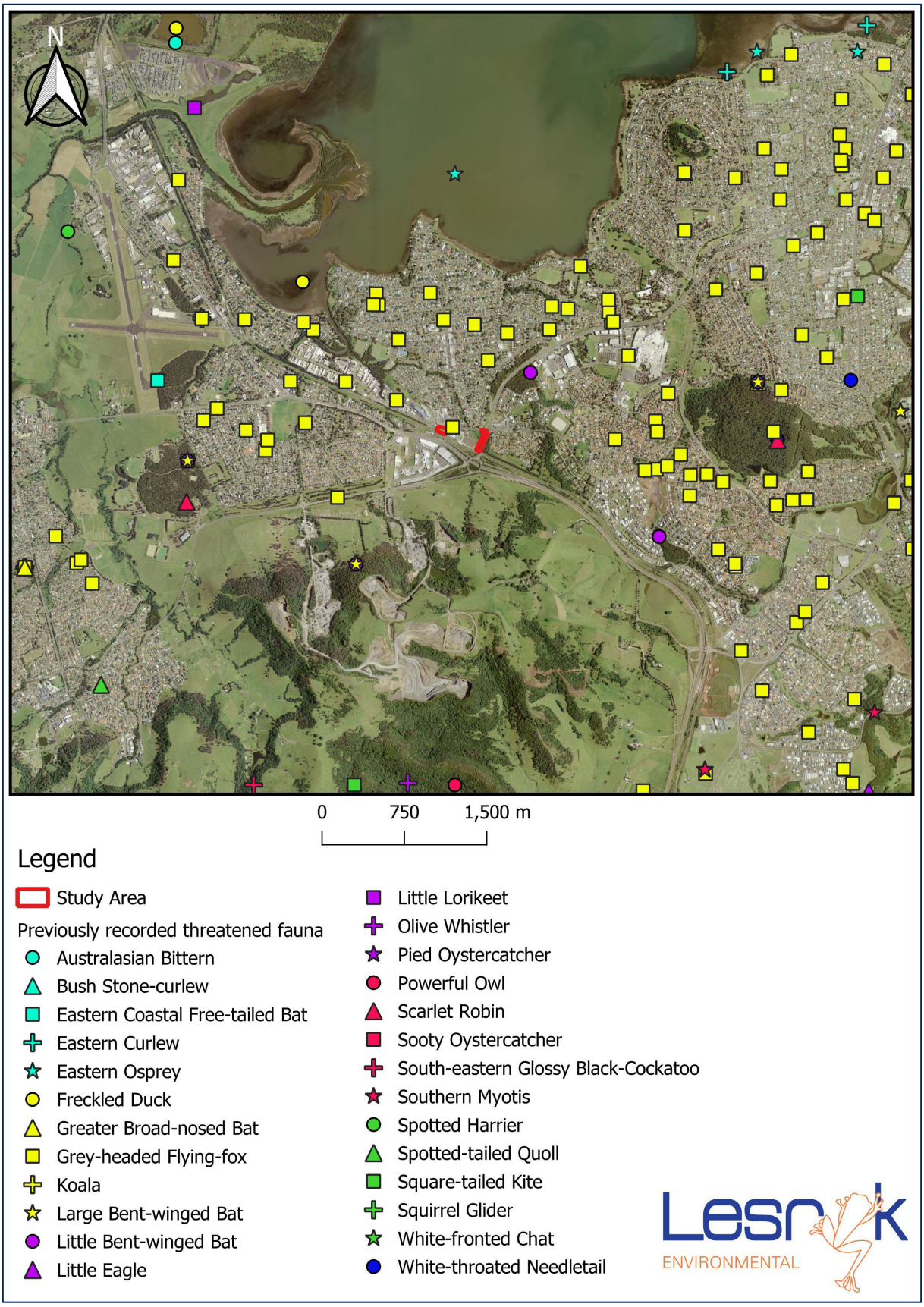

Figure 3-5: Threatened fauna species previously recorded within 10 km, in the vicinity of the study area

Table 3-2: Recorded fauna

Key

* - Exotic species

Common Name	Scientific Name	Detection method	On or off site?
BIRDS			
Rainbow Lorikeet	*Trichoglossus moluccanus*	Observed	Flying over
Superb Fairy-wren	*Malurus cyaneus*	Observed	On
White-browed Scrub-wren	*Sericornis frontalis*	Observed	On
New-holland Honeyeater	*Phylidonyris novaehollandiae*	Observed	On
Lewin's Honeyeater	*Meliphaga lewinii*	Observed	On
Eastern Whipbird	*Psophodes olivaceus*	Heard calling to east	Off
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	Observed	Flying over
Magpie-lark	*Grallina cyanoleuca*	Observed	Off (proximate car park)
Australian Magpie	*Gymnorhina tibicen*	Observed	Off (proximate car park)
Australian Raven	*Corvus coronoides*	Observed	Off (proximate car park)
Silvereye	*Zosterops lateralis*	Observed	On
Welcome Swallow	*Hirundo neoxena*	Observed	Flying over
* Red-whiskered Bulbul	*Pycnonotus jocosus*	Observed	On
* House Sparrow	*Passer domesticus*	Observed	On
MAMMALS			
Eastern Water Skink	*Eulamprus quoyii*	Observed	Off, associated with downslope drainage line
Dark-flecked Garden Sun-skink	*Lampropholis delicata*	Observed	On

3.5 Areas of outstanding biodiversity value

The DCCEEW's Register of Critical Habitat (DCCEEW 2024d) and NSW DCCEEW's AOBV register (NSW DCCEW 2024c) (in conjunction with Part 3 of the Biodiversity Conservation Regulation 2017) per listings provided under the EPBC and/or BC Acts, did not identify any gazetted areas of critical habitat or AOBV for any flora or fauna species or communities occurring within or near the proposal.

3.6 Wildlife connectivity corridors

The vegetation within, and close to the proposal, is not part of a local or regional corridor (State Government of NSW and NSW DCCEEW 2023) (Figure 3-6). Removal of the vegetation present will not affect the movement patterns of any native species, nor fragment any of their habitat resources. The works will not present a barrier to any fauna movement patterns or plant propagule mechanisms.

Figure 3-6: Fauna Corridors relative to the study area

3.7 Matters of national environmental significance

By the completion of the field investigation no threatened flora or fauna species, or TECs listed under the EPBC Act were recorded within the study area.

Reference to the PMST did not identify any World or national heritage listed places, nor Wetlands of international importance, within, or near to, the study area. Additionally, no threatened species or ecological communities predicted to occur near the proposal area would be reliant upon the fauna habitats or vegetation communities present, and none would be affected by the conducting of the activities proposed.

4. Avoidance and minimisation

The key principles of Transport's 2024 Biodiversity Policy (Transport 2024b), and the associated impact on the natural and social environment, is that Transport should aim to:

- avoid and minimise biodiversity impacts to the fullest extent reasonably practicable.
- apply mitigation measures, including measures to reduce habitat fragmentation effects, to the fullest extent reasonably practicable.
- provide offsets through either biodiversity credit purchase or BCF payment of the required number and type of biodiversity credits in accordance with recognised methodologies, and/or delivered conservation measures in accordance with the requirements of the Policy and guidelines.

Application of avoid and minimise principles

A key part of Transport's management of biodiversity for this proposal is the application of the 'avoid, minimise, mitigate and offset' hierarchy as follows:

- Avoid and minimise impacts.
- Mitigate impacts.
- Offset impacts in accordance with Transport's guidelines.
- This chapter of the BAR demonstrates the efforts taken to avoid and minimise impacts on biodiversity values.

The objective of Transport's proposal is to upgrade the intersection of New Lake Entrance Road and Pioneer Drive in Oak Flats to address existing congestion and reduce queuing. While disturbance/removal of about 1.05 ha of native and exotic vegetation is unavoidable in order to achieve the overall objectives of the project, the amount and quality of bushland to be cleared/disturbed is considered to provide minimal habitat resources for those species recorded, or potentially occurring, given the extent of similar retained vegetation within the surrounding locality.

The proposal would take place predominately within a cleared/previously modified road embankment and is adjacent to the road corridor of New Lake Entrance Road; as such, the potential to avoid wider impact to biodiversity is high.

To permit the proposal, 171 trees would be removed. In line with Transport's *Tree and hollow replacement guidelines* (Transport 2023), to replace the removal of 171 trees (comprised of 85 small and 86 medium), 514 trees are required to be re-planted. Alternatively, Transport may opt to transfer $53,625 into the Transport Conservation Fund.

Vegetation clearance would be limited to the minimum required to successfully complete the proposal; with the selection of equipment to be used also aimed at minimising clearance requirements. Vegetation clearance and work limits would be identified both on site maps/plans and on-site through the erection of temporary exclusion fencing, bunting or similar in accordance with Guide 2 of Transport's Biodiversity Guidelines (Transport 2024; Figure 4-1). Fencing etc. would be established at the outer limits of the drip line of any retained trees present and the areas marked as 'no-go zones', to avoid indirect impact.

TABLE 2.1: OPTIONS FOR FENCING OF EXCLUSION ZONES.

Fencing Type Option		Description
Type 1	 FIGURE 2.2: Chain wire fencing (Photo: Angie Radford).	Chain wire fencing for high risk and highly sensitive sites.
Type 2	 FIGURE 2.3: Split polypipe covering the upper strand of barbed wire prevents entanglement of fauna (Photo courtesy of www.wildlifefriendlyfencing.com).	Stock fencing or similar can be used where permanent protection is desired (eg boundary fencing). Barbed wire should not be installed in a designated wildlife crossing zone (eg near glider poles or rope canopy bridges).
Type 3	 FIGURE 2.4: Para-web material and signage to mark out exclusion zone (Photo: Josie Stokes).	Para-web material and star pickets are most commonly used for temporary fencing of specific and small areas (eg individual trees, small pockets of vegetation), or where there is high/moderate risk of intrusion.
Type 4	 FIGURE 2.5: Reflective spinning tape (Photo: Angie Radford).	Capped star pickets and reflective spinning tape (helicopter tape) is typically used for larger areas with moderate/low risk of intrusion.
Type 5	 FIGURE 2.6: Mulch berm (Photo: Angie Radford).	Where the risk of intrusion is low, earth bunding, mulch berms, sediment fencing or flagging tape may be used. It may not be suitable for exclusion zones but is often used to delineate areas.

Figure 4-1: Exclusion zone examples (Extract: Guide 2 – Biodiversity Management Guideline)

5. Impact assessment

Potential impacts as a result of conducting the activity include the construction footprint of about 1.05 ha, incorporating the disturbance/removal of all native and exotic vegetation within this, including the removal of up to 171 trees.

No TECs or threatened flora or fauna species were recorded. Similarly, upon completion of the survey and consideration of the condition of the vegetation, the threatened flora species that were considered to have a moderate to high likelihood of occurring prior to the survey were considered to have a low likelihood of occurrence in the proposal.

Further potential impacts include temporary noise and/or vibration levels, erosion, injury and/or mortality to fauna, edge effects, weed proliferation and introduction of pathogens which have been assessed as part of the REF.

No significant adverse impact is expected during the operational phase of the proposal.

Mitigation measures have been provided in Section 6 of this report.

5.1 Construction direct impacts

5.1.1 Removal of native vegetation

By the completion of the field survey a number of native and exotic species were recorded within the area investigated (Appendix E). It is noted that Appendix E is not intended to be a comprehensive list of all species present within the area investigated, and only represents those plants that were recorded while conducting searches for:

- those native species and ecological communities of State and/or national conservation concern that are known, or expected to occur, in the locality.
- weeds of significance that would require treatment (refer to Section 5.2.4).

Based on a worst-case estimate it is expected that 1.05 ha of native and exotic vegetation would be disturbed/removed to permit the proposal (Table 5-1). Similar resources will be retained within the study area and beyond. Post work, the site will not be permitted to naturally regenerate due to the expansion of the current road boundary.

Table 5-1: Summary of direct impact on vegetation

Veg. zone	Plant community type (PCT)	Broad condition class	TEC	Impact area (ha)
Study Area	PCT 0 – Not classified	Low - Disturbed	N/A	1.05

Table 5-2: Calculated tree replacement or alternative cost transfer into the Transport Conservation Fund

Tree size	Estimated native tree removal (worst-case scenario)	Required number of replacement trees	Required cost transfer into Transport Conservation Fund
Small trees	85	170	$10,625
Medium trees	86	388	$43,000
Total	171	514	$53,625

By the completion of the investigation, 171 trees had been recorded within the proposed impact footprint of the intersection upgrade work and face potential removal (Table 5-2; Figure 5-1). The 171 trees are comprised of 85 small and 86 medium, none of which are considered to be hollow-bearing. Three dead trees were recorded; however, these were not considered to be hollow-bearing. Of the trees to be removed, avoidance of significant increases in canopy width would be applied. No amenity trees, or large and extra-large trees require removal.

Relevant to the proposal's impact on vegetation, the following KTP's listed under Schedule 4 of the BC Act are applicable:

- Clearing of native vegetation – Schedule 4, BC Act.
- Removal of dead wood and dead trees – Schedule 4, BC Act.

Given the extent of similar resources within the study area and beyond, and provided recommended mitigation measures are adopted, the loss of 1.05 ha of native and exotic vegetation, including the removal of three dead trees, is not considered to significantly contribute to, or increase the impact of, these KTPs.

To minimize any impact associated with the removal of native vegetation, recommended mitigation measures are provided in Section 6. Additionally, those outcomes required per the *Tree and hollow replacement guidelines* for trees to be removed are provided in Section 7.2.

Figure 5-1: Tree removal (as per Tree and Hollow replacement guidelines)

5.1.2 Removal of threatened fauna habitat

The 14 birds and two reptiles recorded within, or in proximity to, the study area would not be solely reliant upon those habitats present within, or near to, the subject site such that the removal or disturbance of these would threaten the 'local' occurrence of these animals. These animals are protected, as defined by the BC Act, but are considered to be common to abundant throughout the surrounding region, all being well-conserved in the nearby conservation and protected lands areas. The species recorded are all expected to be present within both the study area and surrounding locality post-work.

No hollow-bearing trees (including the three dead trees) were recorded within the proposals impact footprint.

During the sight inspection, no V-notched trees indicative of the feeding behaviour of the Yellow-bellied Glider (*Petaurus australis*) (Vulnerable, BC Act) were observed. In addition, no crushed Casuarina cones indicative of the feeding behaviour of Glossy Black-cockatoos (*Calyptorhynchus lathami*), large stick nests, white-wash accumulations, caves or suitable cave-substitutes, or ephemeral drainage lines are present. The large culvert present was inspected and not found to be suitable for occupation by cave-dependent microbats. They were noted to support occurrences of spider webs and deep pools or water, the presence of these indicating that no animals are entering or exiting the culverts present (i.e. if animals were using these sites their movements would 'clear' the cobwebs).

With reference to Section 3.7, while the proposal will remove 1.05 ha of vegetation, including some Koala use trees, given retained suitable habitat within, and beyond, the study area (where the three past Koala records occur), the Koala (Endangered, EPBC and BC Acts) is not considered to rely on the study area for its lifecycle requirements. No Koala feed tree species were identified.

As no threatened fauna species listed under the EPBC or BC Acts were recorded during the investigation, and no suitable habitat is present, the species listed in Appendix B are not considered to occupy habitat within the study area that is to be impacted by the proposal.

The removal of up to 107 trees would not result in a significant amount of canopy vegetation being cleared at the investigated intersection of New Lake Entrance Road and Pioneer Drive.

No further threatened fauna habitat important to the local occurrence of threatened species previously recorded within the surrounding region was observed within the area investigated.

No further KTP than those identified above in Section 5.1.1 pertain to the removal of habitat.

Removal of habitat within the construction footprint would be carried out in accordance with Guide 4 of the Biodiversity Management Guideline (Transport 2024a).

5.1.3 Removal of threatened flora

No threatened flora species listed under the EPBC or BC Acts were recorded or considered likely to occur within the area investigated; as such, as no threatened species are considered to be adversely impacted by the proposal, the conducting of assessments referring to the EPBC Act's Significant Impact Guidelines and Section 7.3 of the BC Act is not required.

5.1.4 Aquatic impacts

Beyond existing conditions, the proposal would not result in any direct or indirect adverse impact on those unnamed drainage line that occurs within the proposal. The drainage line is a formalised concrete tunnel that occurs under the proposal area.

No land identified by SEPP Resilience and Hazards 2021 (i.e., coastal wetlands) occurs within, or near to, the study area.

No aquaculture, commercial or recreational fishing occurs within, or near, the study area.

During the proposal, where construction activities have the potential to impact the water quality of nearby waterways (i.e., changes to turbidity and sedimentation) through erosion, off-site sediment movement and dirty water. Erosion and sediment control measures will be implemented and maintained in accordance with *Managing Urban Stormwater: Soils and Construction* (Landcom 2004). Temporary stockpile sites will be managed in accordance with Transport's Stockpile Site Management Guideline (EMS-TG-10).

5.1.5 Injury and mortality

Vegetation clearing to permit the proposal would involve the removal of up to about 1.05 ha, inclusive of 171 trees, groundcover vegetation, shrubs and natural ground debris. Given the proposal would be conducted within a previously disturbed environment, and adjacent to a major road, there is minimal expectation that sheltering animals would be injured during the course of the proposal.

During the construction phase of the proposal, some urban adaptable/sheltering fauna species (i.e., frogs and ground-traversing mammals) could be present and be subject to injury. Mitigation measures to minimise the impact of the proposal on animals, if present (such as checking beneath vehicles/machinery prior to their use) have been provided to address this matter (Section 6).

Beyond current levels of impact due to the existing presence of New Lake Entrance Road and Pioneer Drive, and the volume of traffic that typically uses this network, the operation phase of the proposal is not expected to significantly increase injuring or mortality of fauna within the study area. The proposal is not expected to significantly alter vehicle strikes on those fauna species recorded or potentially occurring than may be currently transpiring. The proposal would not have an adverse impact on the long-term viability of these species or their local populations.

5.1.6 Groundwater dependent ecosystems

No terrestrial or aquatic GDEs were identified within the study area (BoM 2024b) (refer to section 3.3).

In reference to the DPI (Office of Water)'s *Risk assessment guidelines for groundwater dependent ecosystems* (Serov *et al.* 2012), Table 5-3 summarises potential impact to GDE. The proposed intersection upgrade work is not likely to result in changes to water quantity, water quality, an aquifer structure or land use to the extent that there is an expected impact to GDEs; nor would it involve groundwater extraction. With the adoption of mitigation measures, the conducting of the proposal would not contribute to the off-site movement of sediment.

Table 5-3: Potential impacts to GDE from the proposal

Potential impact	Activities	Likelihood of impact from proposal
Changes to water quantity	Water extraction; removal of water bodies; river regulation; drainage of swamps; water extraction from dewatering; aquifer and river flow direction alteration.	The proposed work within the existing alignment of Appin Road and St Johns Road is terrestrial and would not involve any activities that directly or indirectly impact a waterway/drainage line. The proposal is not likely to result in changes to water quantity that may impact GDEs.
Changes to water quality	Nutrient enrichment; turbidity; salinity; pesticide and fertiliser use; effluent discharge; contaminated sites (nutrients, heavy metals hydrocarbons); irrigation and mining tail water; exposure of acid sulfate soils.	The proposal is not likely to lead to an increase in groundwater contamination. There is not likely to be any impacts to downstream waterways from disturbance of acid sulfate soils.

Potential impact	Activities	Likelihood of impact from proposal
		Potential for turbidity from potential groundwater interaction during construction would be temporary and minimal. Therefore, the proposal is not likely to result in changes to water quality that may impact GDEs.
Changes to aquifer structure	Compaction of aquifer by dewatering; subsidence, fracturing and bedrock/stream bed cracking.	The proposed work does not involve dewatering. The proposal is not likely to result in changes to aquifer structure that may impact GDEs.
Changes to land use	Erosion and sedimentation; sealing of land surface by urban developments in highly porous recharge zones; sand and gravel extraction from alluviums and rivers; grazing; lakebed cropping; changes in drainage; modification of watercourse structure; afforestation or deforestation; fire; excavation for developments.	The CEMP would detail measures to prevent erosion and sedimentation impacts on local waterways, such as the use of sediment fencing. There is the potential for excavation works to intersect with the groundwater; however, it is unlikely an underlying aquifer would be impacted. The proposal is therefore not likely to result in changes to land use that may impact GDEs.

5.2 Indirect and operational impacts

5.2.1 Edge effects on adjacent native vegetation and habitat

Weeds are readily spread (and are spreading) by existing dispersal factors such as wind, birds, water and the movement of vehicles along New Lake Entrance Road and Pioneer Drive. Clearing and opening up of new vegetation edges can facilitate the recruitment of these species and provide opportunity for the establishment of other weed species. These weeds are often able to out-compete native flora and fauna species and reduce the habitat values of these areas. While this is the case, edge effects beyond those that are currently occurring along the section of investigated are not expected to be exacerbated due to the carrying out of the proposal.

5.2.2 Wildlife connectivity and habitat fragmentation

Temporary measures incorporated as part of the proposal (i.e., erosion and sediment controls, exclusion fencing) would be established in accordance with applicable guidelines to prevent direct or indirect impact on fauna.

The proposal, including the removal of about 1.05 ha of vegetation, including 171 small to medium trees, is not considered to isolate or further fragment any habitat areas or erect any additional barriers to the movement and dispersal patterns of flying species (i.e., birds, bats), any gliding arboreal mammals, nor ground traversing species that may be currently negotiating New Lake Entrance Road and Pioneer Drive. Similar resources retained within the study area, and the surrounding lands, permit the opportunity for dispersal of species.

In the operational phase of the proposal (post-work), flying species, and those highly tolerant of traversing urban environments/infrastructure, currently negotiating the proposal, are considered to continue to do so post-work.

5.2.3 Injury and mortality

The potential for fauna injury and mortality impact, beyond that identified during the construction phase of the proposal (Section 5.1.5) or currently occurring along New Lake Entrance Road and Pioneer Drive at this location, would not increase during the operational phase of the proposal.

5.2.4 Invasion and spread of weeds

Under the *Biosecurity Act 2015*, 'all plants are regulated with a general biosecurity duty to prevent, eliminate or minimize any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.'

Of the introduced plant species recorded, Lantana, Fireweed (*Senecio madagascariensis*), Climbing Asparagus (*Asparagus plumosus*), Asparagus Fern, Madeira Vine is listed:

- As Priority Weeds of the South East region (which includes the Shellharbour LGA) (DPI 2024a).
- Under Schedule 3 of the NSW Biosecurity Regulation 2017.
- WoNS[2] (DPI 2024c).

Where these exotic species occur on site, they must be controlled to result in their suppression. This would be done prior to the commencement of work to avoid further spread of this species.

5.2.5 Invasion and spread of pests

Beyond the existing diversity of exotic species and pests recorded and predicted to occur, the proposal and use of the ancillary areas (i.e., compounds/stockpile sites) will not have an adverse cumulative impact. The works will not benefit any exotic pests at the expense of native species. Exotic plants and animals currently occupy, and occur in proximity to, the proposal.

5.2.6 Invasion and spread of pathogens and disease

There is a risk that the proposal would introduce, spread or exacerbate the plant diseases caused by *Phytophthora cinnamomi* and Myrtle Rust (*Puccinia psidii*). These diseases are most likely introduced or spread through the importation or movement of soil, water and landscaping materials, either directly or through incidental attachment to machinery.

'Infection of native plants by *Phytophthora cinnamomi*' and 'Dieback caused by the root-rot fungus (*Phytophthora cinnamomi*)', are listed KTP's under the BC and EPBC Acts, respectively. 'Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae' is listed as a KTP under the BC Act and the disease is covered by the EPBC Act listing of 'Novel biota and their impact on biodiversity' as a KTP.

Although there was no obvious evidence for the presence of *Phytophthora cinnamomi* or Myrtle Rust in the vegetation of the study area, recommendations to disinfect vehicles and machinery prior to their use within the study area have been presented in Section 6.

5.2.7 Changes to hydrology

The proposal would not result in any direct or indirect adverse impact on surface hydrology within the study area. Provided recommended mitigation measures are adopted, the proposal is not considered to significantly impact the hydrological or ecological integrity of the surrounding environment.

5.2.8 Noise, light, dust and vibration

During construction, activities associated with the proposal have the potential to generate air quality, dust (i.e., earthwork, exposed soils and removal of vegetation), noise and/or vibration impact, and exhaust emissions associated with the movement of vehicles, use of machinery, the presence of personnel and the occupation of the proposal and ancillary site.

Based on the observations made during the field investigations, given the disturbed and modified nature of the impact footprint, it was not considered that any native species would be significantly reliant upon the habitat resources provided within the study area. There will be a temporary, uncommon increase in noise, light and/or vibration during night hours; however, this is expected to be short-term, for a period of up to two weeks, and will in be associated within:

- Installation of temporary traffic controls associated with site establishment, including temporary traffic signage, install temporary concrete safety barriers (gates for entry and exit), and pedestrian and cyclist detours.

[2] The list of WoNS is part of a combined State and Commonwealth initiative to combat invasive species.

- Relocation of utilities where traffic control is required.
- Placement of pavement layers.
- Line-marking.
- Installation of slotted curb.
- Removal of temporary concrete safety barriers.
- Installation of new concrete F-type barrier.

The night work is not expected to last the entire nominated 8-hour nightly period (8pm – 4am).

For those fauna species recorded, or expected to be present at other times of the year, considering their documented habits and habitat requirements, none would be adversely affected by matters such as alterations to the current level of vibration, dust, light or noise experienced as a result of the construction or operation of the proposed road works. 'Impacts' due to changes in the current levels of noise, light, dust or vibration due to the works proceeding as planned will not affect the local presence of any native animals.

There are artificial light sources along the Princes Highway, Pioneer Drive and New Lake Entrance Road, in proximity to the proposal.

The potential noise, vibration, light, dust, air quality impacts and exhaust emissions are considered to be minor, temporary and localised. Where required, the Draft Construction Noise Guideline (NSW EPA 2020) would be referenced, as would compliance of all vehicles and machinery with industry noise guidelines. Mitigation measures are provided in Section 6 of the BAR.

5.3 Cumulative impacts

Based on a worst-case estimate, the cumulative impact of the proposal (within an impact footprint of about 1.05 ha) would include the disturbance/removal of: native and exotic vegetation, 171 mature trees. There will also be a temporary impact in regard to changed traffic conditions within the locality, in order to permit the conducting of the work; though this will be limited to the duration of the work period.

In consideration of the vegetation and habitat disturbance/removal assessed within this report, the proposal is not expected to contribute to an adverse cumulative ecological impact in a local and regional context; nor is it considered to further contribute to the decline of any threatened species, populations or ecological communities within the locality.

The works will not affect any threatened flora species, nor significantly fragment or isolate areas of wildlife connectivity or habitat. No waterways will be affected by the proposal.

The proposal is not expected to have an overall adverse cumulative impact on any existing or planned developments within the surrounding locality.

5.4 Assessments of significance

No threatened flora, fauna or ecological communities listed under the EPBC or BC Acts were recorded, and none were considered to be present at other times of the year, within the proposal area. Assessments with reference to the EPBC Significant Impact Guidelines and criteria provided under Section 7.3 of the BC Act are not required.

6. Mitigation

Table 6-1 provides a number of mitigation measures that aim to ensure that the proposal does not have an adverse impact on those environments that occur within or near to the study area.

Where applicable, safeguards are made with reference to Transport's *Biodiversity Management Guideline: Protecting and Managing Biodiversity on Transport for NSW projects* (Transport 2024a).

Table 6-1: Mitigation measures

ID	Impact	Mitigation measure	Timing and duration	Likely efficacy of mitigation	Residual impacts anticipated?	Responsibility
B01	General	A Tree and Hollow Replacement Plan is to be prepared (this can be prepared as part of the proposal's CEMP).	Prior to construction	Effective	N/A	Transport/Project Manager
B02		The unexpected species find procedure is to be followed under Biodiversity Management Guideline: Protecting and managing biodiversity on Transport for NSW projects (Transport 2024a) if threatened ecological communities and threatened fauna or flora not assessed in the biodiversity assessment, are identified in the study area.	During construction	Proven	N/A	Environment manager
B03		Vegetation clearance limits would be identified both on site maps/plans and on-site through the erection of temporary exclusion fencing, bunting or similar in accordance with *Guide 2: Exclusion Zones* (Transport 2024a).	Prior to construction	Effective	There would be a residual impact from the loss of 1.05 ha of native/exotic vegetation, including 107 trees composed of 85 small and 86 medium trees; none of which are hollow-bearing.	Project Manager/ Environment manager/ Contractor
B04		Fencing etc. would be established at the outer limits of the drip line of any retained trees and the areas marked as 'no-go zones' to avoid direct impact.	Prior to construction	Effective		Project Manager/ Environment manager/ Contractor
B05		Pre-clearing surveys will be undertaken in accordance with *Guide 1: Pre-clearing process* (Transport 2024a).	Prior to construction	Effective		Project Manager/ Environment manager
B06		Vegetation removal will be undertaken in accordance with *Guide 4: Clearing of vegetation and removal of bushrock* (Transport 2024a) and limited to the minimum required to successfully permit the proposal.	During construction	Effective		Contractor
B07		Removed native and non-seed-bearing exotic vegetation would be mulched or re-used on-site (e.g., to stabilise disturbed areas).	During/post construction	Effective		Contractor
B08		To replace the loss of an estimated 171 trees, 514 trees will be planted per the *Tree and hollow replacement guidelines* (Transport 2022a).	Post construction	Effective	No	Project Manager/ Environment manager
B09		Where possible, relocate the felled trees locally as opposed to the mulching of these plants. Relocation of the felled trees would aim at providing habitat for native species and their prey (as per DEC 2004 *Threatened Species Survey and Assessment: Guidelines for developments and activities* and Transport's *Biodiversity Management Guideline: Protecting and managing biodiversity on Transport for NSW projects* (Transport 2024a).	During construction	Effective	Loss of fauna habitat and some Koala use trees.	Contractor/ Environment manager
B10	Invasion and spread of weeds	In accordance with the NSW Biosecurity Act 2015, the presence of Lantana, Madeira Vine, Climbing Asparagus, Asparagus Fern and Fireweed on-site would be controlled prior to the commencement of the proposal (i.e., treated in accordance with approved weed management techniques such as hand removal or application of a suitable herbicide), thereby mitigating impacts on adjoining land to which it could spread. A botanist/ Local Environmental Officer is to identify the location of this exotic plant at the commencement of the works thereby ensuring their removal. These species cannot be mulched and re-used on site and must be separated from other vegetation. No Lantana, Madeira Vine, Climbing Asparagus, Asparagus Fern or Fireweed waste is to be stockpiled.	Prior/During construction	Effective	No	Environment manager/ Botanist or similarly qualified personnel

ID	Impact	Mitigation measure	Timing and duration	Likely efficacy of mitigation	Residual impacts anticipated?	Responsibility
B11	Invasion and spread of pathogens and disease	Pathogens (e.g., *Phytophthora cinnamonmi*) will be managed in accordance with *Guide 2: Exclusion zones and Guide 7: Pathogen management* (Transport 2024a), including the following hygiene protocols: Before entering and leaving the work site, workers are to remove excess soil and mud and then spray boots, tools, gloves and small equipment with recommended disinfectant supplied by the contractor (70% Methylated spirits / 30% Water) until runoff is clear. Avoid unnecessary soil disturbance.	During construction	Effective	Minimal. With the implementation of measures, the risk of introducing pathogens would be low.	Project Manager/ Contractor

7. Offsets and other measures

7.1 Thresholds

The proposal would trigger thresholds set out by No Net Loss Guidelines (Transport 2022) listed in Table 7-1 and 7-2 (refer to Section 7.2 of this report).

Table 7-1: Offset thresholds (Transport No Net Loss Guidelines)

Impact	Threshold	Triggered
Works involving clearing of a CEEC	Where there is any clearing of an CEEC in 'moderate to good' condition	No
Works involving clearing of an EEC	Where clearing of a EEC ≥ 2 ha in 'moderate to good' condition	No
Works involving clearing of VEC	Where clearing of VEC ≥ 5 ha in 'moderate to good' condition	No
Works involving clearing of any habitat for a known species credit fauna species or clearing of breeding habitat (as defined by the TBDC) for dual-credit fauna species (excluding exotic and planted vegetation that cannot be assigned to a plant community type)	Where clearing ≥ 1 ha in 'moderate to good' condition	No
Works involving removal of known threatened flora species and their habitat	Where loss of individuals is ≥10 or where clearing of habitat is ≥ 1 ha	No
Type 1 or Type 2 key fish habitats	Where there is a net loss of habitat	No
Any residual biodiversity impact that doesn't require offsets in accordance with the No Net Loss Guideline is to be assessed against the requirements of the Tree and Hollow Replacement Guideline.	Any clearing of hollows and/or trees ≥5cm DBH	Yes – clearing of 171 trees (none identified as hollow-bearing). Refer to Table 7.2 below.

Table 7-2: Assessment of vegetation impacts against thresholds

Veg. zone	Plant community type (PCT)	Condition	TEC	Impact area (ha or m²)[1]	Threshold triggered?
Study Area	PCT 0	Low-Disturbed	Not a TEC	1.05 ha	Tree replacement is required.

7.2 Biodiversity offset strategy/tree and hollow replacement plan

The proposal will require the removal of 171 trees, including three dead trees; of which none were identified as hollow-bearing. The works do not meet any of the exclusions in the *Tree and hollow replacement guidelines*.

Transport's *Tree and hollow replacement guidelines* (Transport 2023) provides a calculation to assess the number of replacement plants (Table 7-3). In accordance with Section 2.4 of the Tree and hollow replacement guidelines, where tree replacement cannot be accommodated locally [or only partially], payment must be made to Transport's Conservation Fund as per the rates set out in Table 7-4. For trees with multiple stems/trunks, the replacement/payment required is only calculated for the largest stem DBH.

In accordance with Section 2.4 of the *Tree and hollow replacement guidelines*, the next step in the process is to determine whether the project is able to deliver the required tree and hollow replacement within the project boundary or on land adjacent or close to the project with landowner's consent (including travelling stock reserves, crown reserves, council managed reserves and private land). This option requires the preparation of a Tree and Hollow Replacement Plan or similar, which can be prepared as part of the proposal's CEMP.

To offset the loss of 171 trees (85 small and 86 medium), 514 plants require replacing within the project boundary or on land adjacent or close to the project with landowner's consent (Table 7-5). Should planting and hollow replacement within the project boundary or on land adjacent or close to the project not occur, Transport would be required to transfer a total of $53,625 into the Transport Conservation Fund (Table 7-5).

The works proposed do not meet any of the activities excluded from the requirement of replacing trees or hollows (Transport 2023). The works proposed are not considered low-risk activities and the area in which the activity is to occur is unlikely to naturally regenerate given the suite of plants recorded and replacement of vegetated areas with road infrastructure.

Table 7-3: Tree replacement requirements

Tree size	Tree replacement requirement
Small tree (DBH 5 – 20 cm)	Plant minimum two trees
Medium tree (DBH 20 – 50 cm)	Plant minimum four trees
Large tree (DBH 50 – 100 cm)	Plant minimum eight trees
Very Large tree (DBH > 100 cm)	Plant minimum 16 trees
Hollow replacement requirement	Provide three artificial hollows for every occupied hollow removed[3]

Table 7-4: Transport Conservation Fund contributions

Tree size	Tree replacement requirement
Small tree (DBH 5 – 20 cm)	$125
Medium tree (DBH 20 – 50 cm)	$500
Large tree (DBH 50 – 100 cm)	$1000
Very Large tree (DBH > 100 cm)	$2500
Hollow	$500

Table 7-5: Calculated tree replacement or [alternative] cost transfer into the Transport Conservation Fund

Tree size	Estimated native tree removal (worst-case scenario)	Required number of replacement trees	Required cost transfer into Transport Conservation Fund
Small trees	85	170	$10,625
Medium trees	86	344	$43,000
Total	171	514	$53,625

8. Conclusion

A Biodiversity Assessment has been conducted as Transport is proposing to construct an auxiliary left turn lane on the southern approach to the New Lake Entrance Road and Pioneer Drive intersection, south of Oak Flats.

To permit the proposal, based on a worst-case estimate, about 1.05 ha of vegetation mapped as PCT 0 – Not Classified would be disturbed/removed; this including the removal of 171 trees, none of which were identified as hollow-bearing.

To offset the loss of 171 trees, 514 trees would require re-planting in line with Transport's *Tree and hollow replacement guidelines*. Alternatively, Transport may transfer $53,625 into the Transport Conservation Fund. Transfer of funds must occur prior to commencement of work.

Within the area investigated, no TECs or threatened flora or fauna species listed, or currently being considered for listing, under the EPBC or BC Acts were recorded. Similarly, considering the quality and structure of the PCT present, no threatened flora was considered likely to occur.

No MNES listed under the EPBC Act are present within, or within the vicinity of, the proposal.

Mitigation measures have been recommended in Section 6, to reduce any ecological impact as a result of the proposal Two primary measures include:

- Minimising impact through detailed design
- Adhering to Transport's *Biodiversity Management Guideline* (Transport 2024a).

In addition, the following key mitigation measures have been provided:

- Limit vegetation removal to the minimum required to successfully permit the proposal.
- Replant 514 trees to replace the removal of 171 trees.
  - Alternatively, Transport may opt to transfer $53,625 into the Transport Conservation Fund.
- The presence of Lantana, Madeira Vine, Climbing Asparagus, Asparagus Fern and Fireweed on-site would be controlled prior to the commencement of the proposal.
- Prepare an ESCP to minimise soil erosion and sediment transfer off-site.

With adherence to those recommendations provided in this report, no ecological constraints to the proposal proceeding as planned were identified or considered likely to occur.

The adoption of the mitigation measures provided would ensure that the proposal is carried out in an ecologically sustainable manner.

9. Glossary

Term	Definition
Artificial hollows	Artificial hollows, including hollows carved into a tree, nest boxes attached to trees and salvaged hollows can be used to provide supplementary breeding habitat and shelter for hollow-dependent fauna where hollows have been removed. When designed, built, installed and monitored correctly artificial hollows can provide an alternative to natural fauna habitat.
Biodiversity Assessment Method	The Biodiversity Assessment Method is established under section 6.7 of the BC Act. The BAM is established for the purpose of assessing certain impacts on threatened species and threatened ecological communities (TECs), and their habitats, and the impact on biodiversity values.
Biodiversity offsets	The gain in biodiversity values achieved from the implementation of management actions on areas of land, to compensate for losses to biodiversity values from the impacts of development (State Government of NSW and DPIE 2020b).
BioNet Atlas	The NSW DCCEEW's database of flora and fauna records (formerly known as the NSW Wildlife Atlas). The Atlas contains records of plants, mammals, birds, reptiles, amphibians, some fungi, some invertebrates (such as insects and snails listed under the BC Act) and some fish.
BioNet Vegetation classification	Refers to the vegetation community-level classification for use in vegetation mapping programs and regulatory biodiversity impact assessment frameworks in NSW.
Impact/Construction footprint	The area to be directly impacted by the proposal during construction activities. See also definition for subject land.
Cumulative impact	The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Refer to Clause 228(2) of the EP&A Regulation 2000 for cumulative impact assessment requirements.
Direct impact	Direct impacts on biodiversity values include those related to clearing native vegetation and threatened species habitat and impacts on biodiversity values prescribed by the BC Regulation. This includes impacts from activities related to the construction or operational phase of the proposal (State Government of NSW and DPIE 2020b).
Habitat	An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic component (State Government of NSW and DPIE 2020b).
Indirect impact	Impacts that occur when the proposal affects native vegetation and threatened species habitat beyond the development footprint or within retained areas (e.g., transporting weeds or pathogens, dumping rubbish). This includes impacts from activities related to the construction or operational phase of the proposal and prescribed impacts (State Government of NSW and DPIE 2020b).
Landscape assessment area	The area which includes the subject land and a 1500 m buffer surrounding the outside edge of the boundary of the subject land or 500 m along each side of the centre line of a linear-shaped proposal.
Local population	The population that occurs in the study area. The assessment of the local population may be extended to include individuals beyond the study area if it can be clearly demonstrated that contiguous or interconnecting parts of the population continue beyond the study area, according to the following definitions: • The local population of a threatened plant species comprises those individuals occurring in the study area or the cluster of individuals that extend into habitat adjoining and contiguous with the study area that could reasonably be expected to be cross-pollinating with those in the study area.

Term	Definition
	• The local population of resident fauna species comprises those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas (contiguous or otherwise) that are known or likely to utilise habitats in the study area. • The local population of migratory or nomadic fauna species comprises those individuals that are likely to occur in the study area from time to time or return year to year.
Matter of national environmental significance	A MNES is any of the nine defined components protected by a provision of Part 3 of the EPBC Act.
Mitigation	Action to reduce the severity of an impact.
Native vegetation	Has the same meaning as in section 1.6 of the BC Act and section 60B of the LLS Act. In summary, a) trees (including any sapling or shrub or any scrub) b) understorey plants c) groundcover (being any type of herbaceous vegetation) d) plants occurring in a wetland. A plant is native to New South Wales if it was established in New South Wales before European settlement (BC Act). Native vegetation does not extend to marine vegetation (being mangroves, seagrasses or any other species of plant that at any time in its life cycle must inhabit water other than fresh water). Marine vegetation is covered by the provisions of the FM Act.
NSW (Mitchell) landscape	Landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1:250,000 (State Government of NSW and DPIE 2020b).
Operational footprint	The area that will be subject to ongoing operational impacts from the proposal. This includes the road, surrounding safety verges and infrastructure, fauna connectivity structures and maintenance access tracks and compounds.
PlantNET	An online database of the flora of New South Wales which contains currently accepted taxonomy for plants found in the State, both native and exotic.
Population	A group of organisms, all of the same species, occupying a particular area (DPIE 2020a).
Species credit species	Threatened species or components of species habitat that are identified in the Threatened Species Data Collection as requiring assessment for species credits (State Government of NSW and DPIE 2020b). This is analogous with the definition of 'candidate species.'
Species credits	The class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. Species that require species credits are listed in the Threatened Biodiversity Data Collection (State Government of NSW and DPIE 2020b).
Study area	The area directly affected by the proposal (subject land or construction footprint) and any additional areas likely to be affected by the proposal, either directly or indirectly.
Threatened Biodiversity Data Collection	A publicly assessable online database (registration required) which contains information for listed threatened species, populations and ecological communities (State Government of NSW and DPIE 2020b). Part of the BioNet database.
Tree	As per Australian Standard 4970-2009 a tree is considered to be a long-lived woody perennial plant greater than (or usually greater than) 3 m in height with one or relatively few main stems or trunks (or as defined by the determining authority).

10. Abbreviations

Term	Definition
AOBV	Area of Outstanding Biodiversity Value
BAM	Biodiversity Assessment Method
BAR	Biodiversity Assessment Report
BC Act	*Biodiversity Conservation Act 2016* (NSW)
BC Regulation	Biodiversity Conservation Regulation 2017 (NSW)
BDAR	Biodiversity Development Assessment Report
BCF	Biodiversity Conservation Fund
CEEC	Critically Endangered Ecological Community
CEMP	Construction Environmental Management Plan
DBH	Diameter at Breast Height
DCCEEW	Department of Climate Change, Energy, the Environment and Water (Commonwealth)
DPE	Department of Planning and Environment
DPHI	Department of Planning, Housing and Infrastructure
DPI	Department of Primary Industries
EEC	Endangered ecological community
EP&A Act	*Environment Planning and Assessment Act 1979* (NSW)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
FM Act	*Fisheries Management Act 1994* (NSW)
GDE	Groundwater dependent ecosystems
KFH	Key Fish Habitat
KTP	Key Threatening Process
LGA	Local Government Area
mm/cm/m/m^2/km/ha	Millimetres, centimetres, metres, square metres, kilometres, hectares
MNES	Matters of national environmental significance
NSW	New South Wales
OOHW	Out Of Hours Work
PCT	Plant community type
PMST	Protected Matters Search Tool
REF	Review of Environmental Factors
SEPP	State Environmental Planning Policy
SIS	Species Impact Statement
TBDC	Threatened Biodiversity Data Collection
TECs	Threatened ecological communities (VECs, EECs and CEECs)
Transport	Transport for NSW
WoNS	Weeds of National Significance

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Appendix A: Transport brief

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Appendix B: Habitat suitability assessment

Likelihood	Criteria
Recorded	The species was observed in the study area during the current survey or has been recorded within the past five years (known from a reputable source).
High	A species is considered highly likely to occur in the study area if: • *There are previous credible records on BioNet within the study area from the last 10 years and suitable habitat is present.* **OR** • *The species is highly mobile, is dependent on identified suitable habitat within the study area (i.e., for breeding or important life cycle periods such as winter flowering resources) and has been recorded recently (within five years) on BioNet in the locality. This also includes species known or likely to visit the study area during regular seasonal movements or migration.*
Moderate	A species is considered moderately likely to occur in the study area if: • *Any suitable habitat (e.g., foraging) is present in the study area, the species is highly mobile and has been recorded in the locality in the last 10 years on BioNet. The species may be unlikely to maintain sedentary populations, however, may seasonally use resources within the study area opportunistically or during migration. The species is unlikely to be dependent (i.e., for breeding or important life cycle periods such as winter flowering resources) on habitat within the study area.* **OR** • *The species is not highly mobile, is dependent on identified suitable habitat features (e.g., hollows, rocky outcrops) within the study area and has been recorded in the locality in the last 10 years on BioNet.* **OR** • *For flora species that are associated with PCTs in the study area (see TBDC) or have been recorded in the locality in the last 10 years on BioNet – the associated PCT/habitat present in the study area is not degraded and the species was not targeted by surveys in accordance with the BAM and relevant survey guidelines. In addition, for flora species known to occur in disturbed areas (e.g., orchids), records from any time within the locality may warrant inclusion in this category.*
Low	A species is considered to have a low likelihood of occurring in the study area if: • *For highly mobile species, the species may be an occasional visitor, but habitat similar to the study area is widely distributed in the locality, meaning that the species is not dependent (i.e., for breeding or important life cycle periods such as winter flowering resources) on habitats in the study area and the species has not been recorded in the locality in the last 10 years on BioNet.* **OR** • *The species is not highly mobile, is dependent on identified suitable habitat features (e.g., hollows, rocky outcrops) within the study area and has not been recorded in the locality in the last 10 years on BioNet.* **OR** • *For flora species that are associated with PCTs in the study area (see TBDC) and the species was not identified following targeted surveys in accordance with the BAM and relevant survey guidelines. Flora species that have been recorded in the locality on BioNet at any time, associated suitable habitat (see the TBDC) is not present in the study area, though similar habitats of the same vegetation formation is present in the study area.*
Unlikely	Suitable habitat for the species is absent from the study area.

Note: Species underlined are those which only the EPBC PMST predicted as having habitat in the search area. All other species have been recorded within 10 km of the study area.

Note: As these habitats are not present, no pelagic, estuarine, wetland or fish species have been included in the following table.

Given that the proposed work is not located within the Commonwealth marine area, this being from 3 to 200 nautical miles from the coast, no species listed as marine under the EPBC Act have been considered; nor has the marine status of any species been acknowledged. Therefore, of those species listed as Migratory on the EPBC Act only those in the Migratory Terrestrial category are included.

Key

V – vulnerable E – endangered CE – critically endangered EP – Endangered Population M – migratory Ma – Marine

Habitat requirements were generally extracted from DCCEEW (2024a), NSW DCCEEW (2024), Harden (1992-2002), Frith (2007), Churchill (2008), Cogger (2014) and Van Dyck and Strahan (2008) with other references used being identified in the bibliography.

Habitat suitability assessment table

Common Name	Status		BAM credit type	Primary habitat requirements	No. of records	Likelihood of Occurrence[4]	Significance assessment undertaken
	EPBC Act	BC Act					
PLANTS							
Bynoe's Wattle *Acacia bynoeana*	V	E	Species	Occurs in heath or dry sclerophyll forest on sandy soils.	PMST	Unlikely	No
Deane's Boronia *Boronia deanei*	V	V	Species	Grows in wet heath, often at the margins of open forest adjoining swamps or along streams.	PMST	Unlikely	No
Thick-lipped Spider-orchid *Caladenia tessellata*	V	E	Species	Generally found in grassy sclerophyll woodland on clay loam or sandy soils.	PMST	Unlikely	No
Pretty Beard Orchid *Calochilus pulchellus*		E	Species	The life cycle of *C. pulchellus* is typical for temperate zone members of the genus, with the leaf emerging from a subterranean tuber in mid-winter, and flowering occurring from late October to late November, with only one or two flowers open at a time and each flower lasting only 2-4 days. The plant dies back to tubers in later summer.	PMST	Unlikely	No
Chorizema parviflorum Chorizema parviflorum Benth. in the Wollongong and Shellharbour LGAs		EP	-	Recorded from between Austinmer and Albion Park in the local government areas of Wollongong and Shellharbour. All known sites (excluding the site at Austinmer) occupy woodland or forest dominated by Forest Red Gum (*Eucalyptus tereticornis*) and/or Woollybutt (*E. longifolia*). At Austinmer, the species is recorded from a coastal headland.	122 (BioNet)	Unlikely	No

[4] For the site to support, and be important for the lifecycle requirements of, a locally viable population of this species.

Leafless Tongue Orchid *Cryptostylis hunteriana*	V	V	Species	Does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland.	PMST	Unlikely	No
White-flowered Waxplant *Cynanchum elegans*	E	E	Species	Usually occurs on the edge of dry rainforest vegetation but also in littoral rainforest, coastal scrub and aligned open forest and woodland.	96 (BioNet) PMST	Unlikely	No
Illawarra Socketwood *Daphnandra johnsonii*	E	E	Species	Occupies the rocky hillsides and gullies of the Illawarra lowlands, occasionally extending onto the upper escarpment slopes. Associated vegetation includes rainforest and moist eucalypt forest.	78 (BioNet) PMST	Unlikely	No
Bauer's Midge Orchid *Genoplesium baueri*	E	E	Species	Grows in dry sclerophyll forest and moss gardens over sandstone.	PMST	Unlikely	No
Scrub Ironwood *Gossia acmenoides* population in the Sydney Basin Bioregion south of the Georges River		EP	-	Dry rainforest and subtropical rainforest.	5 (BioNet)	Unlikely	No
Grevillea raybrownii		V	Species	Generally, occurs on ridgetops and, less often, slopes and benches of Hawkesbury Sandstone and Mittagong Formation. Occurs in Eucalyptus open forest and woodland with a shrubby understorey on sandy, gravelly loam soils derived from sandstone that are low in nutrients.	PMST	Unlikely	No
Wingless Raspwort *Haloragis exalata* subsp. *exalata*	V	V	Species	Appears to require protected and shaded damp situations in riparian habitats.	1 (BioNet) PMST	Unlikely	No
Hibbertia acaulothrix	E		-	Known from several widely separated localities in New South Wales (NSW), from Wadbilliga National Park in the Southern Tablelands, through the Nattai Wollondilly area in the Southern Central Tablelands, to the Mt Baker and Mt Coricudgy (Wollemi) area in northern part of the Central Coast and Tableland. Found on rocky outcrops and has been recorded growing in Eucalyptus sieberi woodland or in association with Allocasuarina littoralis (black she-oak), Corymbia gummifera (red bloodwood), and Leptospermum trinervium (flaky-barked tea-tree).	PMST	Unlikely	No
Illawarra Irene *Irenepharsus trypherus*	E	E	Species	Typically inhabits steep rocky slopes near cliff lines and ridge tops.	54 (BioNet) PMST	Unlikely	No
Lespedeza juncea subsp. sericea in the Wollongong LGA		EP	-	Known from just one roadside population of approximately 200 plants that occurs south of Dapto. This population is located in a small strip of open forest dominated by Forest Red Gum, Woollybutt), and White Feather Honeymyrtle, on Budgong Sandstone. Also originally recorded in Kikuyu grassland directly across the road from this site. This grassland was subsequently cleared and the species has not regenerated. Flowers between February and March.	10 (BioNet)	Unlikely	No

Woronora Beard-heath *Leucopogon exolasius*	V	V	Species	Occurs in woodland on sandstone.	PMST	Unlikely	No
Biconvex Paperbark *Melaleuca biconvexa*	V	V	Species	Scattered and dispersed populations of this species are 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	Unlikely	No
Tall Knotweed *Persicaria elatior*	V	V	Species	This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.	PMST	Unlikely	No
Persoonia oxycoccoides		E	-	Currently known from the Wingecarribee Shire in the south-eastern portion of the Central Tablelands, with the easternmost records in the municipality of Kiama, and a south-western outlier at Tallong in Goulburn-Mulwaree Shire in the Southern Tablelands.	PMST	Unlikely	No
Pimelea curviflora var. curviflora	V	V	Species	Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands.	30 (BioNet)	Unlikely	No
Spiked Rice-flower *Pimelea spicata*	E	E	Species	Found on well-structured clay soils. In the coastal Illawarra it occurs commonly in Coast Banksia open woodland with a better developed shrub and grass understorey. Coastal headlands and hilltops are the favoured sites.	29 (BioNet) PMST	Unlikely	No
Rufous Pomaderris *Pomaderris brunnea*	V	E	Species	Grows in moist woodland or forest on clay and alluvial soils of flood plains and creek lines.	PMST	Unlikely	No
Jervis Bay Leek Orchid *Prasophyllum affine*	E	E	Species	Grows on poorly drained grey clay soils that support low heathland and sedgeland communities.	PMST	Unlikely	No
Illawarra Greenhood *Pterostylis gibbosa*	E	E	Species	All known populations grow in open forest or woodland, on flat or gently sloping land with poor drainage. Near Nowra, the species grows in an open forest of Spotted Gum *Corymbia maculata*, Forest Red Gum and Grey Ironbark *E. paniculata*.	146 (BioNet)	Unlikely	No
Waterfall Greenhood *Pterostylis pulchella*	V	V	Species	The Waterfall Greenhood is found only at Fitzroy Falls, Belmore Falls, upper Bundanoon Creek (Meryla) and Minnamurra Falls. Found on cliff faces close to waterfalls and creek banks and mossy rocks alongside running water.	PMST	Unlikely	No
Sydney Plains Greenhood *Pterostylis saxicola*	E	E	Species	Most commonly found growing in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines.	PMST	Unlikely	No
Prickly Bush-pea *Pultenaea aristata*	V	V	Species	Restricted to the Woronora Plateau where it occurs in dry sclerophyll woodland or wet heath on sandstone.	PMST	Unlikely	No
Eastern Underground Orchid *Rhizanthella slateri*	E	V	Species	Habitat requirements are poorly understood and no particular vegetation type has been associated with the species, although it is known to occur in sclerophyll forest.	PMST	Unlikely	No
Scrub Turpentine *Rhodamnia rubescens*	CE	CE	Species	Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils.	14 (BioNet) PMST	Unlikely	No

Native Guava *Rhodomyrtus psidioides*	CE	CE	Species	Pioneer species found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest often near creeks and drainage lines.	PMST	Unlikely	No
Solanum celatum		E	Species	Restricted to an area from Wollongong to just south of Nowra, and west to Bungonia. Grows in rainforest clearings, or in wet sclerophyll forests.	31 (BioNet)	Unlikely	No
Magenta Lilly Pilly *Syzygium paniculatum*	V	E	Species	Found only in NSW, in a narrow, linear coastal strip from Upper Lansdowne to Conjola State Forest. On the south coast the Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest.	PMST	Unlikely	No
Austral Toadflax *Thesium australe*	V	V	Species	Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast.	PMST	Unlikely	No
Illawarra Zieria *Zieria granulata*	E	E	Species	Restricted to the Illawarra region where it is recorded from a number of sites. Typical habitat is dry ridge tops and rocky outcrops on shallow volcanic soils, usually on Bumbo Latite. Less frequently found on the moist slopes of the Illawarra escarpment and in low-lying areas on Quaternary sediments.	674 (BioNet) PMST	Unlikely	No
MAMMALS							
Spotted-tailed Quoll *Dasyurus maculatus*	E	V	Ecosystem	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline.	4 (BioNet) PMST	Unlikely	Not required
Southern Brown Bandicoot *Isoodon obesulus obesulus*	E	E	Species	Generally, only found in heath or open forest with a heathy understorey on sandy or friable soils.	PMST	Unlikely	Not required
Long-nosed Potoroo *Potorous tridactylus*	V	V	Species	Inhabits coastal heath and dry and wet sclerophyll forests with dense cover which provides diurnal sheltering sites and protection from predators, while foraging in adjacent, open areas.	PMST	Unlikely	Not required
Koala *Phascolarctos cinereus*	E	E	Species/Ecosystem	Open eucalypt forest and woodland, containing a variety of 'preferred' food tree species.	3 (BioNet) PMST	Unlikely	Not required
Parma Wallaby *Macropus parma*	V	V	Species	Preferred habitat is moist eucalypt forest with thick, shrubby understorey, often with nearby grassy areas, rainforest margins and occasionally drier eucalypt forest.	PMST	Unlikely	Not required
Brush-tailed Rock-wallaby *Petrogale penicillata*	V	E	Species	Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges.	PMST	Unlikely	Not required
Yellow-bellied Glider *Petaurus australis*	V	V	Ecosystem	Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils.	PMST	Unlikely	Not required
Squirrel Glider *Petaurus norfolcensis*		V	Species	Inhabits woodlands and dry sclerophyll forests, usually in diverse stands of shrubs and trees. Shelters and breeds in tree hollows, and is primarily an insectivorous animal but, has also been known to ingest plant exudates.	1 (BioNet)	Unlikely	Not required
Southern Greater Glider	E	E	Species	Largely restricted to eucalypt forests and woodlands, utilising tree hollows.	PMST	Unlikely	Not required

Petauroides volans							
Grey-headed Flying-fox *Pteropus poliocephalus*	V	V	Species/Ecosystem	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops.	422 (BioNet) PMST	Low	Not required
Yellow-bellied Sheathtailbat *Saccolaimus flaviventris*		V	Ecosystem	Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.	9 (BioNet)	Low	Not required
Large-eared Pied Bat *Chalinolobus dwyeri*	V	V	Speices	Cave-roosting bat that forages in timbered woodland and dry sclerophyll forest.	12 (BioNet) PMST	Low	Not required
Eastern False Pipistrelle *Falsistrellus tasmaniensis*		V	Ecosystem	Prefers moist habitats, with trees taller than 20 m. Generally, roosts in hollow-bearing trees (eucalypts), but has also been found under loose bark on trees or in buildings.	13 (BioNet)	Low	Not required
Southern Myotis *Myotis macropus*		V	Species	Generally, roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface.	18 (BioNet)	Low	Not required
Greater Broad-nosed Bat *Scoteanax rueppellii*		V	Ecosystem	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. Usually roosts in tree hollows but also in buildings.	15 (BioNet)	Low	Not required
Little Bent-winged Bat *Miniopterus australis*		V	Species/Ecosystem	Generally found in well-timbered areas. Roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day.	21 (BioNet)	Low	Not required
Large Bent-winged Bat *Miniopterus orianae oceanensis*		V	Species/Ecosystem	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures.	32 (BioNet)	Low	Not required
Eastern Coastal Free-tailed Bat *Mormopterus norfolkensis*		V	Ecosystem	Occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures.	17 (BioNet)	Low	Not required
New Holland Mouse *Pseudomys novaehollandiae*	V		Ecosystem	Open heathland, open woodland with a heathland understorey and vegetated sand dunes.	PMST	Unlikely	Not required
BIRDS							
Freckled Duck *Stictonetta naevosa*		V	Ecosystem	Prefer permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds.	41 (BioNet)	Unlikely	Not required
Blue-billed Duck *Oxyura australis*		V	Ecosystem	Prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation.	39 (BioNet)	Unlikely	Not required

Australasian Bittern *Botaurus poiciloptilus*	E	E	Ecosystem	Occupies shallow, vegetated freshwater or brackish swamps, usually dominated by tall, dense reed beds of *Typha* sp., *Juncus* sp. and *Phragmites* sp. Nests on platforms of reeds and rushes, usually built over water in dense cover.	2 (BioNet) PMST	Unlikely	Not required
Black Bittern *Ixobrychus flavicollis*		V	Ecosystem	Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves.	5 (BioNet)	Unlikely	Not required
Spotted Harrier *Circus assimilis*		V	Ecosystem	Occurs in grassy open woodland including Acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands.	10 (BioNet)	Unlikely	Not required
White-throated Needletail *Hirundapus caudacutus*	V, M, Ma		-	Almost exclusively aerial. Takes insects on wing over a range of habitat types. Recorded most often above wooded areas, including open forest and rainforest.	7 (BioNet) PMST	Low	Not required
Eastern Osprey *Pandion cristatus*	M, Ma	V	Species/ Ecosystem	Occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands.	34 (BioNet)	Low	Not required
Square-tailed Kite *Lophoictinia isura*		V	Species/ Ecosystem	Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses.	6 (BioNet)	Low	Not required
White-bellied Sea-eagle *Haliaeetus leucogaster*	Ma	V	Species/ Ecosystem	Found in coastal habitats (especially those close to the sea-shore) and around terrestrial wetlands in tropical and temperate regions of mainland Australia.	50 (BioNet)	Low	Not required
Little Eagle *Hieraaetus morphnoides*		V	Species/ Ecosystem	Occupies open eucalypt forest, woodland or open woodland. Sheoak or *Acacia* woodlands and riparian woodlands of interior NSW are also used.	10 (BioNet)	Low	Not required
Australian Painted Snipe *Rostratula australis*	E, Ma	E	Ecosystem	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	PMST	Unlikely	Not required
Latham's Snipe *Gallinago hardwickii*	M, Ma		-	Wet, treeless, tussocky grasslands, short grasses and/or marshes along freshwater streams and channels, though it can also be found in any vegetation around freshwater wetlands, in sedges, grasses, lignum, reeds and rushes, saltmarshes, creek edges, crops and pastures.	PMST	Unlikely	Not required
Gang-gang Cockatoo *Callocephalon fimbriatum*	E	V	Species/ Ecosystem	Prefers tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests during summer, these being at higher altitudes. In winter, occurs at lower altitudes in drier, more open eucalypt forests and woodlands, or in dry forest in coastal areas.	1 (BioNet) PMST	Unlikely	Not required
South-eastern Glossy Black-Cockatoo *Calyptorhynchus lathami lathami*	V	V	Species/ Ecosystem	Inhabits eucalypt woodland and feeds almost exclusively on Casuarina fruits.	2 (BioNet) PMST	Unlikely	Not required

Little Lorikeet *Glossopsitta pusilla*		V	Ecosystem	Forages primarily in the open Eucalypt forest and woodland canopies, particularly along water courses; occasionally in Angophoras, Melaleucas and other tree species, also riparian habitats are used.	1 (BioNet)	Low	Not required
Blue-winged Parrot *Neophema chrysostoma*	V, Ma	V	Ecosystem	The main populations of Blue-winged Parrots are in Tasmania and Victoria, particularly in southern Victoria and the midlands and eastern areas of Tasmania. Sparser populations are found in western New South Wales and eastern South Australia, extending to south-west Queensland and occasionally into the Northern Territory. The Blue-winged Parrot inhabits a range of habitats from coastal, sub-coastal and inland areas, right through to semi-arid zones. Throughout their range, they favour grasslands and grassy woodlands. They are often found near wetlands both near the coast and in semi-arid zones. Blue-winged Parrots can also be seen in altered environments such as airfields, golf courses and paddocks.	PMST	Unlikely	Not required
Turquoise Parrot *Neophema pulchella*		V	Ecosystem	Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland.	2 (BioNet)	Unlikely	Not required
Swift Parrot *Lathamus discolor*	CE, Ma	E	Species/ Ecosystem	Eucalypt forests. When over-wintering on the mainland, this species is dependent on winter-flowering eucalypt species.	11 (BioNet) PMST	Unlikely	Not required
Orange-bellied Parrot *Neophema chrysogaster*	CE	CE	Species	On the mainland, the Orange-bellied Parrot spends winter mostly within 3 km of the coast in sheltered coastal habitats including bays, lagoons, estuaries, coastal dunes and saltmarshes.	1 (BioNet) PMST	Unlikely	Not required
Powerful Owl *Ninox strenua*		V	Species/ Ecosystem	Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest.	5 (BioNet)	Low	Not required
Sooty Owl *Tyto tenebricosa*		V	Species/ Ecosystem	Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests.	1 (BioNet)	Low	Not required
Masked Owl *Tyto novaehollandiae*		V	Species/ Ecosystem	Lives in dry eucalypt forests and woodlands from sea level to 1100 m.	1 (BioNet)	Low	Not required
Eastern Bristlebird *Dasyornis brachypterus*	E	E	Species	Habitat for central and southern populations is characterised by dense, low vegetation including heath and open woodland with a heathy understorey.	PMST	Unlikely	Not required
Brown Treecreeper (eastern subsp) *Climacteris picumnus victoriae*	V	V	Ecosystem	The western boundary of the range of *Climacteris picumnus victoriae* runs approximately through Corowa, Wagga Wagga, Temora, Forbes, Dubbo and Inverell and along this line the subspecies intergrades with the arid zone subspecies of Brown Treecreeper *Climacteris picumnus picumnus* which then occupies the remaining parts of the state. Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species.	PMST	Unlikely	Not required
Pilotbird *Pycnoptilus floccosus*	V		-	Found in wet forested areas and heathland in eastern Victoria and south-eastern New South Wales. Forages on the ground, turning over leaf litter using strong legs.	PMST	Unlikely	Not required

Regent Honeyeater *Anthochaera phrygia*	CE	CE	Species/Ecosystem	Inhabits dry open forest and woodland. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes.	1 (BioNet) PMST	Unlikely	Not required
Painted Honeyeater *Grantiella picta*	V	V	Ecosystem	Inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus *Amyema*.	PMST	Unlikely	Not required
White-fronted Chat *Epthianura albifrons*		V	Ecosystem	Usually found foraging on bare or grassy ground in wetland areas, singly or in pairs.	4 (BioNet)	Unlikely	Not required
Varied Sittella *Daphoenositta chrysoptera*		V	Ecosystem	Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and *Acacia* woodland.	1 (BioNet)	Low	Not required
Dusky Woodswallow *Artamus cyanopterus cyanopterus*		V	Ecosystem	Primarily inhabit dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris.	3 (BioNet)	Low	Not required
Scarlet Robin *Petroica boodang*		V	Ecosystem	Lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs.	3 (BioNet)	Unlikely	Not required
Flame Robin *Petroica phoenicea*		V	Ecosystem	Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes. Prefers clearings or areas with open understoreys.	1 (BioNet)	Unlikely	Not required
Pink Robin *Petroica rodinogaster*		V	Species	Inhabits rainforest and tall, open eucalypt forest, particularly in densely vegetated gullies.	1 (BioNet)	Unlikely	Not required
Hooded Robin (south-eastern) *Melanodryas cucullata cucullata*	E	V	Ecosystem	Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas.	PMST	Unlikely	Not required
Olive Whistler *Pachycephala olivacea*		V		Mostly inhabit wet forests above about 500m. During the winter months they may move to lower altitudes.	1 (BioNet)	Unlikely	Not required
Diamond Firetail *Stagonopleura guttata*		V	Ecosystem	Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum *Eucalyptus pauciflora* Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland.	PMST	Unlikely	Not required
REPTILES							
Broad-headed Snake *Hoplocephalus bungaroides*	V	E	Species/Ecosystem	Shelters in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter and spring.	PMST	Unlikely	Not required
AMPHIBIANS							
Green and Golden Bell Frog *Litoria aurea*	V	E	Species	Inhabits a variety of environments, including disturbed sites, ephemeral ponds, wetlands, marshes, dams and stream-sides, particularly those that contain one or more of the following aquatic plants: bullrush (*Typha* spp.), spikerush (*Eleocharis* spp.), *Juncus kraussii, Schoenoplectus littoralis* and *Sporobolus virginicus.*	5 (BioNet)	Unlikely	Not required

Appendix C: Tree Register

Tree ID	GPS		Species	Native or Amenity tree	DBH (cm)	Tree size category
1	150.8229494	-34.57151058	*Eucalyptus*	Native	40	Medium
2	150.8229151	-34.57143376	*Eucalyptus*	Native	32	Medium
3	150.822775	-34.5720234	*Eucalyptus*	Native	26	Medium
4	150.822741	-34.57199898	*Eucalyptus*	Native	15	Small
5	150.8228308	-34.57147037	*Eucalyptus*	Native	28	Medium
6	150.8227973	-34.57200071	*Eucalyptus*	Native	25	Medium
7	150.8225953	-34.57210352	*Eucalyptus*	Native	13	Small
8	150.82275	-34.57176757	*Casuarina*	Native	7	Small
9	150.8227362	-34.57174594	*Eucalyptus*	Native	20	Medium
10	150.8228619	-34.57138574	*Eucalyptus*	Native	7	Small
11	150.8227122	-34.5717328	*Eucalyptus*	Native	20	Medium
12	150.822837	-34.57199172	*Casuarina*	Native	20	Medium
13	150.8228486	-34.57140845	*Eucalyptus*	Native	25	Medium
14	150.8227904	-34.572043	*Eucalyptus*	Native	25	Medium
15	150.8227349	-34.57157605	*Casuarina*	Native	7	Small
16	150.8228177	-34.57168198	*Eucalyptus*	Native	17	Small
17	150.822849	-34.57159283	*Eucalyptus*	Native	22	Medium
18	150.8227973	-34.5714742	*Eucalyptus*	Native	18	Small
19	150.8228326	-34.57164918	*Eucalyptus*	Native	13	Small
20	150.822769	-34.57151162	*Casuarina*	Native	10	Small
21	150.8227231	-34.57162279	*Eucalyptus*	Native	14	Small
22	150.8227793	-34.57149583	*Casuarina*	Native	16	Small
23	150.822821	-34.57186843	*Eucalyptus*	Native	27	Medium
24	150.8227864	-34.57188255	*Eucalyptus*	Native	20	Medium
25	150.8227993	-34.57202189	*Eucalyptus*	Native	30	Medium
26	150.8227101	-34.5720831	*Eucalyptus*	Native	12	Small
27	150.8228011	-34.57161181	*Eucalyptus*	Native	19	Small
28	150.8228153	-34.57163291	*Eucalyptus*	Native	15	Small
29	150.8227029	-34.57215935	*Eucalyptus*	Native	19	Small
30	150.8228746	-34.57154547	*Casuarina*	Native	15	Small
31	150.8228912	-34.57144913	*Eucalyptus*	Native	13	Small
32	150.8229032	-34.5715283	*Eucalyptus*	Native	46	Medium
33	150.8227635	-34.57173044	*Casuarina*	Native	16	Small
34	150.8227802	-34.57155334	*Eucalyptus*	Native	22	Medium
35	150.8229851	-34.57142132	*Corymbia*	Native	16	Small
36	150.822873	-34.57145606	*Eucalyptus*	Native	24	Medium
37	150.8228331	-34.57170968	*Corymbia*	Native	8	Small
38	150.8227496	-34.57179911	*Eucalyptus*	Native	35	Medium
39	150.822685	-34.57207481	*Corymbia*	Native	30	Medium
40	150.8227223	-34.57171136	*Eucalyptus*	Native	23	Medium

41	150.8229393	-34.57170342	*Casuarina*	Native	10	Small
42	150.823076	-34.57125051	*Eucalyptus*	Native	20	Medium
43	150.8227487	-34.57179351	*Corymbia*	Native	23	Medium
44	150.8226658	-34.57204996	*Casuarina*	Native	20	Medium
45	150.8226009	-34.57234072	*Casuarina*	Native	18	Small
46	150.822812	-34.571939	*Corymbia*	Native	28	Medium
47	150.8228364	-34.57149031	Dead tree (not hollow-bearing)	Native	8	Small
48	150.8229571	-34.57167524	*Corymbia*	Native	28	Medium
49	150.8226958	-34.57174632	*Eucalyptus*	Native	22	Medium
50	150.8227186	-34.5715903	*Corymbia*	Native	8	Small
51	150.8228309	-34.57190404	*Casuarina*	Native	10	Small
52	150.8228025	-34.57173469	*Corymbia*	Native	20	Medium
53	150.8228975	-34.57154361	*Casuarina*	Native	9	Small
54	150.8228784	-34.57143877	*Corymbia*	Native	20	Medium
55	150.8229205	-34.5717108	*Casuarina*	Native	16	Small
56	150.8226673	-34.57208379	*Eucalyptus*	Native	29	Medium
57	150.8227408	-34.5716428	*Eucalyptus*	Native	26	Medium
58	150.8227441	-34.57160707	*Corymbia*	Native	28	Medium
59	150.8228836	-34.57164754	*Eucalyptus*	Native	20	Medium
60	150.8229449	-34.57168908	*Eucalyptus*	Native	27	Medium
61	150.8227662	-34.57158259	*Eucalyptus*	Native	21	Medium
62	150.8228419	-34.57153816	*Eucalyptus*	Native	25	Medium
63	150.8228413	-34.57183384	*Casuarina*	Native	5	Small
64	150.8225326	-34.5724402	*Eucalyptus*	Native	31	Medium
65	150.8226074	-34.57208766	*Casuarina*	Native	12	Small
66	150.8227017	-34.57213153	*Casuarina*	Native	10	Small
67	150.8227237	-34.57166892	*Eucalyptus*	Native	18	Small
68	150.8229345	-34.57173228	*Eucalyptus*	Native	16	Small
69	150.8228754	-34.57167847	*Casuarina*	Native	10	Small
70	150.8186365	-34.57112553	*Eucalyptus*	Native	8	Small
71	150.8225496	-34.5719796	*Corymbia*	Native	22	Medium
72	150.8227076	-34.57163169	Dead tree (not hollow-bearing)	Native	15	Small
73	150.8228074	-34.57186184	*Casuarina*	Native	20	Medium
74	150.8228168	-34.57192838	*Corymbia*	Native	6	Small
75	150.8226036	-34.57199564	*Corymbia*	Native	18	Small
76	150.8225985	-34.5720578	*Corymbia*	Native	18	Small
77	150.8226972	-34.571951	*Corymbia*	Native	10	Small
78	150.8228387	-34.5714511	*Casuarina*	Native	11	Small
79	150.8228785	-34.57152313	*Eucalyptus*	Native	15	Small
80	150.8229442	-34.57137902	*Casuarina*	Native	20	Medium
81	150.822823	-34.57153851	*Eucalyptus*	Native	24	Medium
82	150.8224894	-34.57243261	*Casuarina*	Native	12	Small
83	150.8226076	-34.57213174	*Casuarina*	Native	12	Small
84	150.8228125	-34.57174884	*Casuarina*	Native	10	Small
85	150.8227916	-34.57175965	*Eucalyptus*	Native	45	Medium

86	150.8228821	-34.57150103	*Corymbia*	Native	15	Small
87	150.8225499	-34.57242797	*Eucalyptus*	Native	38	Medium
88	150.8226211	-34.57235936	*Corymbia*	Native	20	Medium
89	150.8229901	-34.57158776	*Eucalyptus*	Native	24	Medium
90	150.8231179	-34.57119925	*Corymbia*	Native	8	Small
91	150.8228772	-34.57170623	*Eucalyptus*	Native	21	Medium
92	150.8228132	-34.57145962	*Eucalyptus*	Native	7	Small
93	150.8230876	-34.57120936	*Eucalyptus*	Native	18	Small
94	150.8227442	-34.57219396	*Corymbia*	Native	24	Medium
95	150.8226925	-34.5717117	*Corymbia*	Native	28	Medium
96	150.822658	-34.57164652	*Corymbia*	Native	22	Medium
97	150.8228362	-34.57168248	*Eucalyptus*	Native	6	Small
98	150.8228385	-34.57142839	*Casuarina*	Native	22	Medium
99	150.822814	-34.57184015	*Casuarina*	Native	14	Small
100	150.8227266	-34.57173387	*Casuarina*	Native	22	Medium
101	150.8228576	-34.5715797	*Casuarina*	Native	26	Medium
102	150.8227774	-34.57173462	*Casuarina*	Native	20	Medium
103	150.822866	-34.57157776	*Casuarina*	Native	30	Medium
104	150.8229527	-34.57155511	*Casuarina*	Native	20	Medium
105	150.8229838	-34.57137395	*Casuarina*	Native	13	Small
106	150.8230441	-34.57124739	*Casuarina*	Native	16	Small
107	150.8230696	-34.57118789	*Eucalyptus*	Native	17	Small
108	150.8225714	-34.57232474	*Casuarina*	Native	15	Small
109	150.8228146	-34.57165665	*Corymbia*	Native	15	Small
110	150.8227461	-34.57204476	*Eucalyptus*	Native	23	Medium
111	150.8227015	-34.572185	*Eucalyptus*	Native	30	Medium
112	150.8228119	-34.57149501	*Eucalyptus*	Native	23	Medium
113	150.8227519	-34.57177077	*Casuarina*	Native	15	Small
114	150.8227953	-34.57168023	*Eucalyptus*	Native	17	Small
115	150.8229206	-34.57137513	*Casuarina*	Native	10	Small
116	150.8228779	-34.57169361	*Eucalyptus*	Native	20	Medium
117	150.8228301	-34.57186207	*Casuarina*	Native	10	Small
118	150.8226958	-34.57198085	*Eucalyptus*	Native	18	Small
119	150.8226873	-34.57209187	*Eucalyptus*	Native	45	Medium
120	150.8227284	-34.57206155	*Casuarina*	Native	14	Small
121	150.8228009	-34.57162313	*Eucalyptus*	Native	18	Small
122	150.8229074	-34.57171959	*Eucalyptus*	Native	30	Medium
123	150.8226329	-34.57232517	*Eucalyptus*	Native	8	Small
124	150.8229977	-34.57138966	*Casuarina*	Native	10	Small
125	150.8227053	-34.57207931	*Casuarina*	Native	6	Small
126	150.8227714	-34.57165158	*Eucalyptus*	Native	25	Medium
127	150.8228741	-34.57136788	*Casuarina*	Native	8	Small
128	150.8230343	-34.57140282	*Eucalyptus*	Native	28	Medium
129	150.8225582	-34.57246729	*Casuarina*	Native	6	Small
130	150.8224811	-34.57246884	*Eucalyptus*	Native	25	Medium

131	150.822602	-34.57196903	*Casuarina*	Native	6	Small
132	150.8226424	-34.57200796	*Eucalyptus*	Native	22	Medium
133	150.8226938	-34.57171592	*Casuarina*	Native	23	Medium
134	150.823004	-34.57152537	*Eucalyptus*	Native	24	Medium
135	150.8227422	-34.57206069	*Eucalyptus*	Native	18	Small
136	150.8226678	-34.57165859	*Eucalyptus*	Native	23	Medium
137	150.8226982	-34.57165793	*Eucalyptus*	Native	17	Small
138	150.8226864	-34.57202699	*Eucalyptus*	Native	18	Small
139	150.8229504	-34.57159653	*Eucalyptus*	Native	37	Medium
140	150.822554	-34.57237492	*Casuarina*	Native	23	Medium
141	150.8230764	-34.57123143	*Eucalyptus*	Native	19	Small
142	150.8226699	-34.57169301	*Casuarina*	Native	14	Small
143	150.82301	-34.57157118	*Eucalyptus*	Native	13	Small
144	150.8226261	-34.57196458	*Casuarina*	Native	10	Small
145	150.8227716	-34.57175929	*Eucalyptus*	Native	16	Small
146	150.8227375	-34.57212799	*Casuarina*	Native	35	Medium
147	150.8226565	-34.57205774	*Casuarina*	Native	28	Medium
148	150.8226932	-34.57175022	*Eucalyptus*	Native	24	Medium
149	150.8228169	-34.57161151	*Casuarina*	Native	17	Small
150	150.8228309	-34.57158409	*Casuarina*	Native	6	Small
151	150.8227631	-34.57153956	*Eucalyptus*	Native	29	Medium
152	150.8228884	-34.57138556	*Eucalyptus*	Native	20	Medium
153	150.8225961	-34.57241849	*Eucalyptus*	Native	17	Small
154	150.8225214	-34.57250921	*Eucalyptus*	Native	25	Medium
155	150.822899	-34.57163309	*Eucalyptus*	Native	29	Medium
156	150.8227982	-34.57159015	*Casuarina*	Native	10	Small
157	150.8228475	-34.57198219	*Eucalyptus*	Native	25	Medium
158	150.8227614	-34.571667	*Casuarina*	Native	22	Medium
159	150.8231026	-34.57123521	*Eucalyptus*	Native	19	Small
160	150.8229051	-34.57174115	*Casuarina*	Native	20	Medium
161	150.8230242	-34.57150014	*Casuarina*	Native	20	Medium
162	150.8226721	-34.5717202	*Eucalyptus*	Native	22	Medium
163	150.822748	-34.57211141	*Eucalyptus*	Native	14	Small
164	150.8228593	-34.57170494	Dead tree (not hollow-bearing)	Native	40	Medium
165	150.8226729	-34.57212965	*Eucalyptus*	Native	26	Medium
166	150.8230252	-34.57138359	*Eucalyptus*	Native	25	Medium
167	150.8226321	-34.57229703	*Eucalyptus*	Native	27	Medium
168	150.8226655	-34.57170421	*Casuarina*	Native	18	Small
169	150.823072	-34.57134205	*Casuarina*	Native	18	Small
170	150.8228015	-34.57194504	*Casuarina*	Native	25	Medium
171	150.82285	-34.5717073	*Eucalyptus*	Native	18	Small

Appendix D: Photographic record of area investigated

	Character of the vegetation within the proposal. Photo taken looking south-east through site from toe of embankment.
	Character of the vegetation within the proposal. Photo taken looking north through site.
	Character of vegetation present within the proposal area adjacent to New Lake Entrance Road. Photo taken facing north.

	Character of vegetation within northern portion of clearing area. Photograph taken looking south through the proposal.
	Character of vegetation within northern portion of clearing area. Note extent of Asset Protection Area and proximate new commercial building. Photo taken looking south through site.
	Character of existing culverts and modified unnamed drainage line.

Appendix E: Flora species recorded

Key

* - introduced species

- WoNS

FAMILY	Scientific Name	Common Name
MAGNOLIOPSIDA - DICOTYLEDONS		
Apiaceae	*Foeniculum vulgare* *	Fennel
Apocynaceae	*Araujia sericifera**	Moth vine
Asteraceae	*Bidens pilosa* *	Farmers Friend
	Galinsoga parviflora *	Gallant Soldier
	# Senecio madagascariensis *	Fireweed
Basellaceae	*# Anredera cordifolia* *	Madeira Vine
Bignoniaceae	*Pandorea pandorana*	Wonga-Wonga Vine
Casuarinaceae	*Casuarina glauca*	Swamp She-Oak
Fabaceae: Mimosoideae	*Acacia binervata*	Two-veined Hickory
	Acacia floribunda	Sally Wattle
Malvaceae	*Brachychiton acerifolius*	Illawarra Flame Tree
	Modiola caroliniana *	Carolina Mallow
	Sida rhombifolia *	Paddy's Lucerne
Myrtaceae	*Callistemon salignus*	Willow Bottlebrush
	Corymbia maculata	*Spotted Gum*
	Eucalyptus eugenioides	Thin-leaved stringybark
	Eucalyptus quadrangulata	Coast White-box
	Eucalyptus robusta	Swamp Mahogany
	Eucalyptus tereticornis	Forest Red Gum
	Melaleuca armillaris subsp. *armillaris*	Bracelet Honey-myrtle
	Melaleuca decora	White Feather Honey myrtle
	Melaleuca styphelioides	Prickly-leaved Tea Tree
	Syncarpia glomulifera	Turpentine
Ochnaceae	*Ochna serrulata* *	Ochna
Oleaceae	*Ligustrum lucidum* *	Large-leaved Privett
	Ligustrum sinense *	Small-leaved Privett
	Olea europaea subsp. *cuspidata* *	African Olive
Passifloraceae	*Passiflora subpeltata**	White Passionflower
Phytolaccaceae	*Phytolacca octandra* *	Inkweed
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum
Polygonaceae	*Rumex sagittatus* *	Turkey Rhubarb
	Persicaria sp.	Knotweed
	Rumex brownii *	Swamp Dock
Solanaceae	*Datura stramonium* *	Common Thornapple
	Solanum nigrum *	Blackberry Nightshade
Ulmaceae	*Trema tomentosa*	Poison Peach
Verbenaceae	*# Lantana camara* *	Lantana
	Verbena bonariensis *	Purpletop
	Viola hederacea	Ivy-leaved Violet
Vitaceae	*Cayratia clematidea*	Native Grape
MAGNOLIOPSIDA - MONOCOTYLEDONS		
Asparagaceae	*# Asparagus plumosus* *	Climbing Asparagus
	# Asparagus aethiopicus *	Asparagus Fern
Asphodelaceae	*Geitonoplesium cymosum*	Scrambling Lily
Phormiaceae	*Dianella carulea* var. *producta*	Blue Flax Lily
Poaceae	*Cenchrus clandestinus* *	Kikuyu Grass
	Chloris gayana *	Rhodes grass
	Echinochloa crus-galli *	Cockspur
	Ehrharta erecta *	Panic Veldt Grass
Strelitziaceae	*Strelitzia nicolai**	Bird of Paradise
Typhaceae	*Typha orientalis*	Cumbungi

NSW GOVERNMENT