Preliminary Ecological Assessment for the University of Sydney Campus Improvement Program

Prepared by Australian Museum Consulting
for the University of Sydney

Final Report

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Executive Summary

Australian Museum Consulting (AM Consulting) was commissioned by the University of Sydney to undertake a preliminary ecological assessment for their proposed Camperdown-Darlington Campus Improvement Program (CIP). The CIP is a seven year development and infrastructure program to develop and/or refurbish a number of sites across the campus between 2014 and 2020. The University is currently preparing a Stage 1 Concept application to the Department of Planning & Infrastructure (DPI) for the CIP. The CIP will seek the Minister for Planning's approval for generic site building envelopes and land uses for their strategic growth plan. Pending Stage 1 approval, the University will require Stage 2 DAs to go to the Department of Planning or Council on the specific development detailing of each precinct.

The Director General's Environmental Assessment Requirements (DGRs) for an Environmental Impact Statement stipulated that the University address impacts on flora and fauna, including known and potentially occurring threatened species, populations and endangered ecological communities and their habitats. The DGRs also state that opportunities to enhance and introduce additional flora and fauna should be investigated in consultation with Council. This preliminary assessment thus addresses the DGRs in relation to flora and fauna.

As part of this preliminary assessment of potential impacts on threatened species as a result of the proposed CIP, field surveys were undertaken of the vegetation across the Camperdown and Darlington campuses. Field surveys concentrated on those precincts identified as key areas in the campus improvement plan. A profile of the campus vegetation and fauna habitat features was built and then used to determine the location of any vegetation that might be considered to be potential habitat for threatened flora and/or fauna species. A desktop assessment was also performed. This assessment included a search of the NSW Office of Environment and Heritage Wildlife Atlas for records within 5 km of the study site of species listed under the Threatened Species Conservation Act (1995). An Environment Protection and Biodiversity Conservation Act (EPBC Act 1999) Protected Matters Report was also produced to identify federally listed threatened flora and fauna that could potentially occur within 5 km of the study site.

The site visits confirmed that the Camperdown and Darlington campuses are highly modified environments. Where vegetation occurs it is either as lawns, garden beds or tree plantings. Tree species are a mix of introduced and native species. Well-represented native species include *Corymbia citriodora* (Lemon scented Gum), *Lophostemon confertus* (Brushbox) and *Ficus* species (Figs). The large number of mature trees (including some non-native species) provides a canopy of relative importance within the City of Sydney given the highly urban environment surrounding the University campuses. A number of these large trees are considered to be significant by the Sydney City Council.

The native species that have been used to landscape the campuses are from a very narrow range of plant families, primarily Moraceae, Myrtaceae and Proteaceae. Shrubs are predominantly introduced garden species with very few native species present except for some recently landscaped areas. The diversity of native shrub and ground cover species is very low. To address the over representation of some native plant families within the university grounds, a list of potential plant species that could be used during future landscaping has been provided.

The only fauna recorded during the site visit were commonly occurring urban species such as Australian Magpie, Noisy Miner, Australian White Ibis, Sulphur-crested Cockatoo, Welcome Swallow, Rock Dove, and Striped Marsh Frog. Although Superb Fairy-wrens and Eastern Water Dragons have been reported to occur on the campus, none were detected during the site visit.

The desktop assessment revealed that 14 plant species and 42 animal species listed under the TSC Act have been recorded within 5 km of the Darlington and Camperdown campuses. Threatened fauna listed under the TSC Act include one frog species, 16 bird species and eight mammal species. No records were found of threatened species occurring within the study area. The EPBC Protected Matters Report indicated that 60 threatened species have the potential to occur within 5 km of the University. This list includes 13 plant species, two frog species, 24 bird species, nine mammal species, six reptile species and six fish species.

None of the threatened plant species identified through the desktop assessment are expected to occur within the Darlington and Camperdown campuses. Based on habitat available at the campuses, only three of the animal species identified have been adjudged to have any likelihood of occurrence at the study site. Potentially occurring species include the Grey-headed Flying-fox (TSC Act and EPBC Act) the Eastern Bentwing Bat (TSC Act) and the Large-eared Pied Bat (TSC Act and EPBC Act). The microbat species are predominantly cave-dwellers so no roosting habitat is likely to be impacted by the CIP. There is potential foraging habitat for Eastern Bentwing Bats over grassy areas but only marginal and limited foraging habitat exists for the Large-eared Pied Bat. Foraging habitat for the Grey-headed Flying-fox exists in the form of large mature trees including *Lophostemon confertus* and *Corymbia citriodora* and native *Ficus* species.

Potential impacts on threatened fauna as a result of the CIP include the loss of potential foraging habitat. Therefore, it is recommended that the removal of mature trees be avoided and the loss of open spaces be minimised. Most mature trees on the campuses grow adjacent to buildings and where these buildings are to be removed/refurbished measures should be taken to protect mature trees. As well as providing potential food and habitat for threatened and other fauna on the campuses, the mature tree canopy provides an island of connectivity within the highly urbanized Sydney city area. The University maintains a detailed tree inventory and acknowledges that the trees at the Darlington and Camperdown campuses make an important contribution to the local landscape. A Tree Management Plan for the CIP has been developed, which aims to maintain and increase the present campus tree canopy cover at both the Darlington and Camperdown campuses. Maintaining open space and adherence to the Tree Management Plan should ensure potential impacts on threatened species are minimal.

A number of opportunities exist for the enhancement of habitat for flora and fauna on the Darlington and Camperdown campuses. For example, establishment of plantings with good structure (i.e. trees, shrubs and groundcovers) would provide improved habitat for reptiles and small birds, such as the Superb Fairy Wren, and would provide better connectivity between habitats within the campuses. Currently, ground cover species are limited and consist almost entirely of introduced lawn species. Superb Fairy Wrens require a shrub layer, preferably comprised of native species, for shelter. The University has developed a list of planting principles within its Landscape Design Principles for the CIP. While it is recognised that the planting principles include a list of heritage plants and the use of exotic species in some circumstances, habitat for the wren and other fauna could be improved by replacing existing exotic plantings with a range of native shrub and groundcover species where possible. The use of native species originally found in the area would fulfil many of the criteria identified within the University's list of planting principles.

Additional fauna habitat could be created by providing natural and artificial refuges for fauna in the tree and ground layers. For example, bat boxes, logs, large rocks, and artificial ground layer refuges could be installed. The potential to provide fauna-friendly water features in low-lying areas and water collection points similar to the water feature adjacent to the Old Darlington School should also be considered. The possibility of including roof-top gardens and living walls in the design of new buildings should also be investigated. In addition to providing opportunities to increase the

diversity of native flora on the campuses, roof-top gardens could also enhance connectivity between areas which cannot currently be connected through additional plantings. While opportunities to connect with habitat outside of the campuses are limited due to the highly urbanised surrounding area, consultation with City of Sydney Council regarding potential ways to enhance connectivity to areas of habitat outside of the campuses would be beneficial.

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1 Introduction

1.1 Background

Australian Museum Consulting (AM Consulting) was commissioned by the University of Sydney to perform a preliminary ecological assessment for their proposed Camperdown-Darlington Campus Improvement Program (CIP). The CIP is a seven year development and infrastructure program to develop and/or refurbish a number of sites across the campus between 2014 and 2020. The University is currently preparing a Stage 1 Concept application to the Department of Planning & Infrastructure (DPI) for the CIP.

The CIP will seek the Minister for Planning's approval for generic site building envelopes and land uses for their strategic growth plan. Pending Stage 1 approval, the University will require Stage 2 DA's to go to the Department of Planning or Council on the specific development detailing of each precinct.

As a State Significant Development, Director General's Requirements (DGRs) for an Environmental Impact Statement were issued. Part 9 of the DGRs requires the University to address impacts on flora and fauna, including known and potentially occurring threatened species, populations and endangered ecological communities and their habitats. The DGRs also state that opportunities to enhance and introduce additional flora and fauna should be investigated in consultation with council. This report thus addresses the DGRs in relations to flora and fauna.

1.2 Location

The study area includes all of the buildings and facilities which service the Darlington and Camperdown Campuses of the University of Sydney on the western edge of the City of Sydney Local Government Area, including parts of the suburbs of Camperdown, Golden Grove and Darlington. The location of the study area in a regional context is shown in Figure 1.1 and in a local context in Figure 1.2.

1.3 Scope and Objectives

The University of Sydney indicate that DPI have clarified that the scope of the assessment would involve an appraisal of the relevant legislation and the known (i.e. documented) and potentially occurring threatened species, populations, communities and habitats that may exist across the Campus. This would draw upon available desktop data rather than involving detailed surveys. The specific objectives of this study are as follows:

1. Review background information regarding relevant legislation.
2. Desktop review of flora and fauna issues, focusing on threatened species or important ecological issues.
3. Identify other potential issues.
4. Make recommendations for management/mitigation/consent conditions.
5. Identify opportunities for local biodiversity improvements.

1.4 Authorship and Acknowledgements

Fauna surveys were undertaken by Terry O'Dwyer. Flora surveys were undertaken by Belinda Pellow. This report was written by Terry O'Dwyer, Belinda Pellow and James Bevan and reviewed by Glenn Muir. Portions of this document include intellectual property of ESRI and its licensors and are used herein under license.

Figure 1.1 Location of the study area in the regional context of the Sydney Basin.

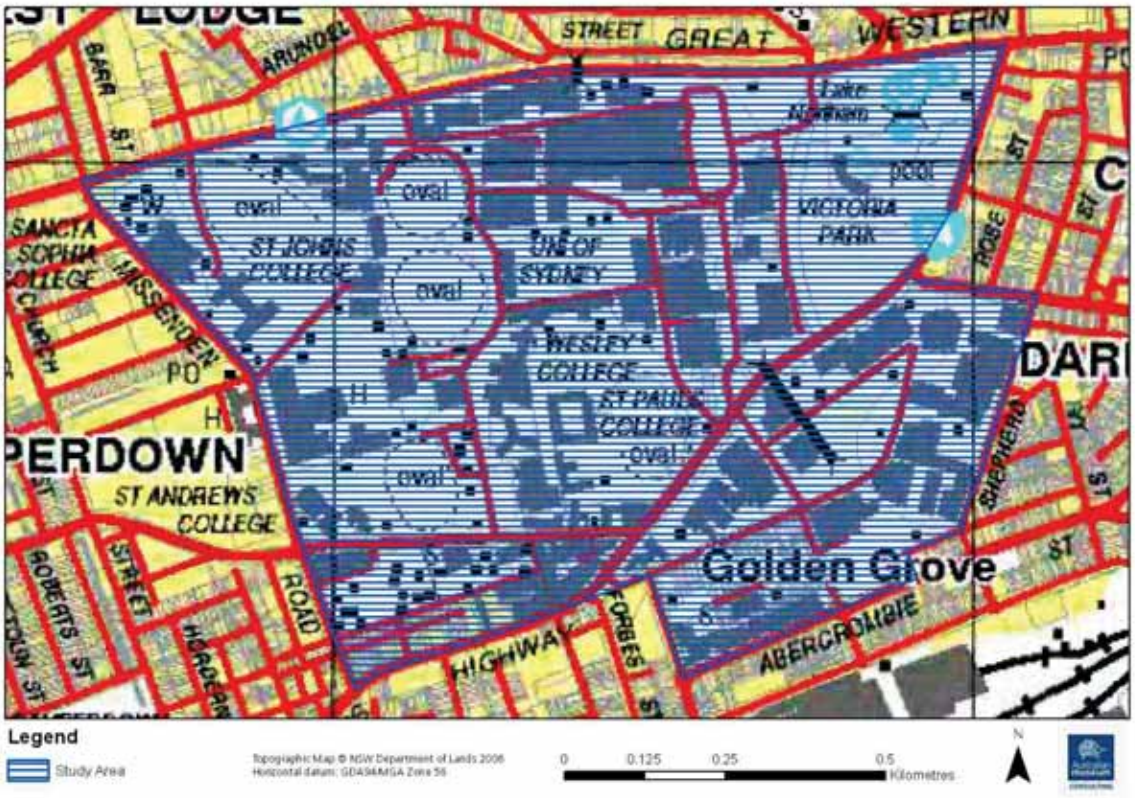

Figure 1.2 Local context of the study area

2 Description of the study area

The University of Sydney Darlington and Camperdown campuses are located close to the Sydney CBD in the suburbs of Camperdown and Darlington. The campuses are adjacent to each other but separated by City Road. Development of the campus sites started in 1855 on land that had been cleared and farmed for some time (Curtis 1981). Today the campuses are highly modified environments and consist almost entirely of formal gardens and lawns surrounding the University buildings, paved areas and sporting facilities.

A mature but broken canopy of both native and non-native tree species occurs across the campuses. Shrub species are restricted to garden beds and are predominately non-native while ground cover species are limited and consist almost entirely of formal lawns. No natural vegetation occurs on either campus.

Water features do not occur within the Campuses. Adjacent to the Old Darlington School two ponds previously built for water gardens are no longer used for this purpose although some water is still retained there (Plate 2.1). A large lake is located to the east (in Victoria Park).

The Darlington and Camperdown campuses (and the adjoining Victoria Park) are surrounded by dense urban development and represent one of a few areas within the Sydney CBD with broad open expanses of lawn and trees. Major roads (Parramatta Road, Missenden Road and City Road) form significant barriers to any nearby parkland. Connectivity with other nearby areas containing potential habitat for threatened species is largely limited to avian fauna.

Plate 2.1 Pond now being used as sunken garden bed

3 Legal and planning framework

A number of local government planning policies, State and Commonwealth Acts and policies and guidelines are relevant to the study area. A broad outline of these policies and legislation is provided in Appendix A. Policies and legislation specific to the study area are outlined in Section 3.1 (Local Government), Section 3.2 (State Government) and Section 3.3.(Commonwealth Government).

3.1 Local Government

3.1.1 Local Environmental Plan

The City of Sydney's Local Environmental Plan sets out eight land zones within the study area (Sydney LEP 2012). These are stated in Table 3.1.

Table 3.1 City of Sydney LEP Land Zones within the study area.

Zone Code	Zone Name
B2	Local Centre
B4	Mixed Use
R1	General Residential
RE1	Public Recreation
SP2	Infrastructure

Tree Management Controls are also set out in Section 5.9 of the Local Environmental Plan (Sydney LEP 2012).

More detail of each item is provided in Appendix A.

3.1.2 Development Control Plan

Section 3.5.3 of the City of Sydney's Development Control Plan (Sydney DCP 2012) sets out provisions for development in relation to tree management.

3.1.3 Policies, Registers, Strategies and Plans

City of Sydney has developed a number of tree policies to protect its urban forest. Items relevant to the study area include:

- Sustainable Sydney 2030 (CoS 2013a)
- Greening Sydney Plan (CoS 2012)
- Tree Management Policy (CoS 2013b)
- Urban Forest Strategy (CoS 2013c)
- Street Tree Master Plan (CoS 2011)
- Register of Significant Trees (CoS 2013d)
- Urban Ecology Strategic Action Plan (Draft) (CoS 2013e)
- Environmental Management Plan (CoS 2013f).

Each item is described in further detail in Appendix A. The relationship between each of these documents is illustrated below in Figure 3.1

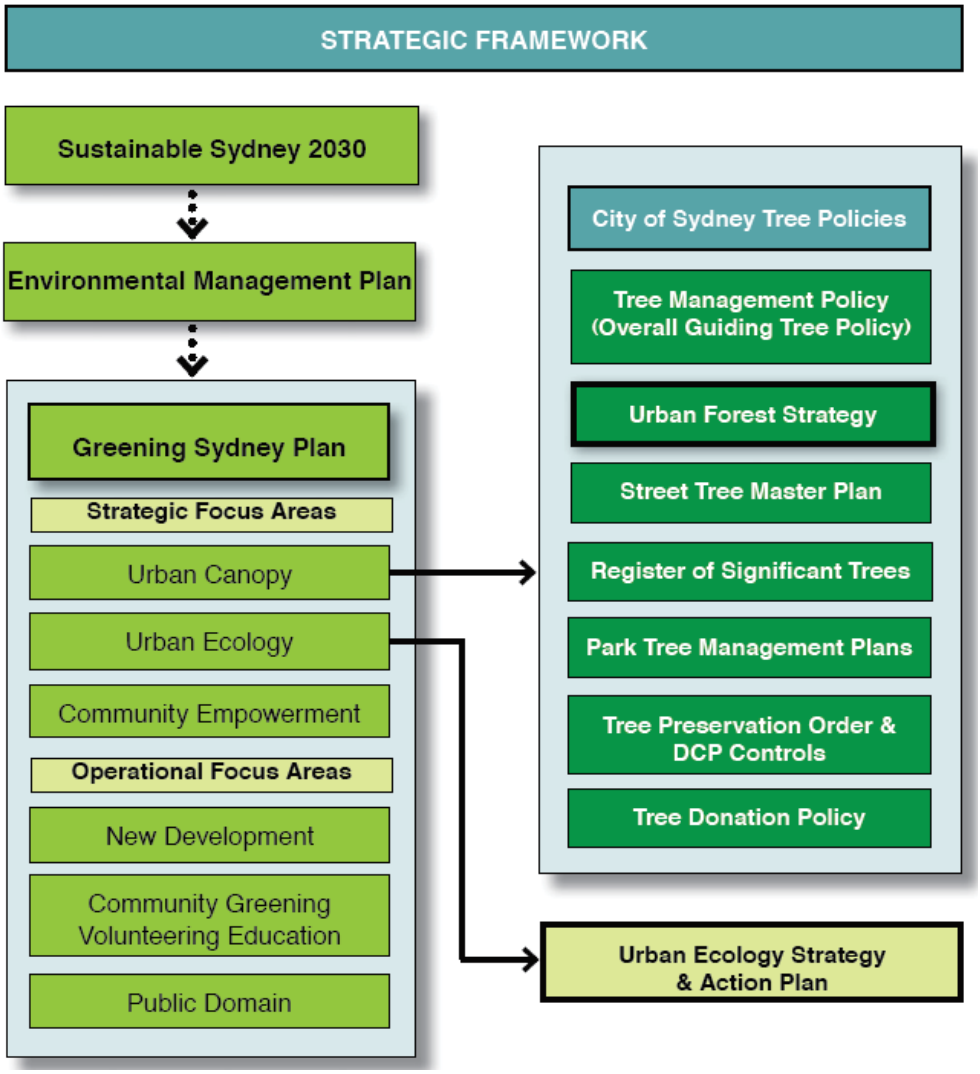

Figure 3.1 The strategic framework set out by the City of Sydney under Sustainable Sydney 2030

3.2 NSW State Government

3.2.1 Environment Planning and Assessment Act 1979

The Environment Planning and Assessment Act 1979 stipulates that a development must consider the significance of impacts to items listed under the NSW Threatened Species Conservation Act 1995 (TSC Act), and impacts to groundwater as part of an Environmental Impact Statement (EIS). If the study area supports items listed under the TSC Act these entities generally need to be assessed via 7 part tests (depending on the approval path under the Act).

3.2.2 Threatened Species Conservation Act 1995 & Amendment Act 2005

If threatened species and ecological communities listed under the TSC Act are recorded in the study area the provisions of the TSC Act are relevant and 7 part tests should be undertaken as part of an EIS (depending on the approval path). Appendices B and C list threatened taxa with the potential to occur within the study area.

3.2.3 Noxious Weeds Act 1993

Under the Noxious Weeds Act 1993 any noxious weeds occurring within the study area must be controlled by the land owner.

3.3 Commonwealth Government

3.3.1 Commonwealth Environment Protection and Biodiversity Conservation Act 1999

If threatened species and ecological communities listed under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) are recorded in the study area the provisions of the EPBC Act are relevant to any proposed works within the property. Appendices B and C list threatened taxa with potential to occur within the study area.

4 Methods

4.1 Desktop review

Desktop review involved the collation and synthesis of a broad range of information that is currently available regarding the ecological values of the study area and surrounds. This included:

- Searches of the NSW Office of Environment (OEH) *Atlas of NSW Wildlife* (OEH 2013) and the Commonwealth Department of the Environment (DOTE) – Protected Matters Database (DOTE 2103); and
- Consideration of relevant City of Sydney's plans, policies, registers and strategies including:
  - Sustainable Sydney 2030 (CoS 2013a);
  - Greening Sydney Plan (CoS 2012);
  - Tree Management Policy (CoS 2013b);
  - Urban Forest Strategy (CoS 2013c);
  - Street Tree Master Plan (CoS 2011);
  - Register of Significant Trees (CoS 2013d);
  - Urban Ecology Strategic Action Plan (Draft) (CoS 2013e);
  - Environmental Management Plan (CoS 2013f);
  - Local Environment Plan land zoning (Sydney LEP 2012); and
  - Development Control Plan (Sydney DCP 2012).

4.2 Site visit

Flora surveys and fauna habitat surveys were undertaken across the Camperdown and Darlington campuses on 8 November 2013 and 21 November 2013, respectively. Surveys concentrated on those precincts identified as key areas in the campus improvement plan. A profile of the campus vegetation and potential fauna habitat was built using field notes, photographs and GPS point locations. The profile was then used to determine the location of any vegetation that might be considered to be potential habitat for threatened flora and fauna species. Specific searches were also made in areas where fauna considered to be important for the campuses, such as the Superb Fairy Wren and the Eastern Water Dragon, had been previously recorded (Figure 4.1). Any fauna encountered during the surveys were recorded.

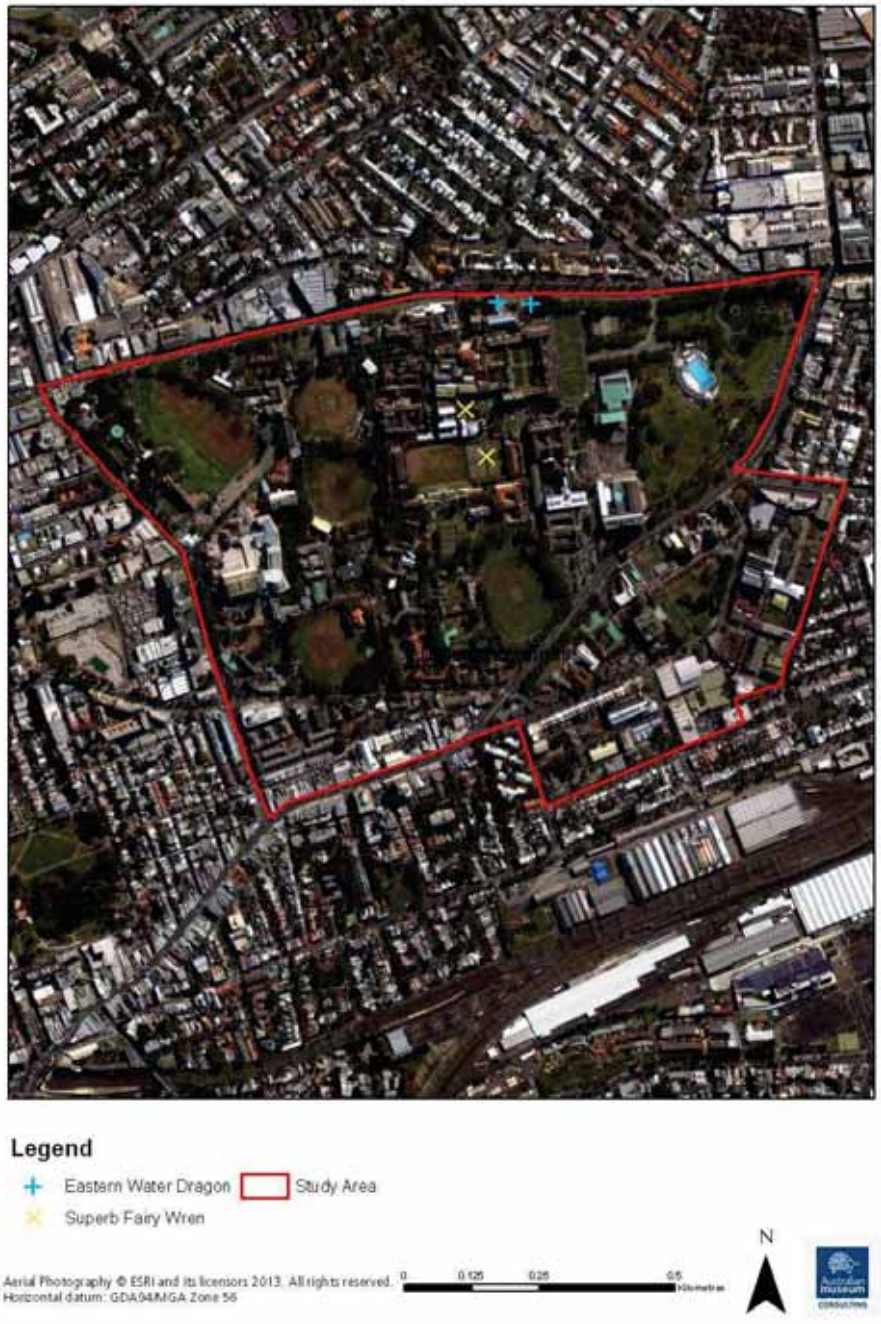

Figure 4.1 Sites where the Eastern Water Dragon and Superb Fairy Wren have been observed in the past

5 Results

5.1 Desktop review

Searches of the NSW Office of Environment and Heritage Atlas of Wildlife for threatened flora and fauna found that 14 threatened plant species and 42 threatened animal species have been recorded within 5 kilometres of the study area. The list of threatened animals includes one frog species, 16 bird species and eight mammal species.

The Environment Protection and Biodiversity Conservation Act Protected Matters Report found that 60 threatened species have the potential to occur within 5 km of the University. This list includes 13 plant species, two frog species, 24 bird species, nine mammal species, six reptile species and six fish species. A further 42 migratory species are also predicted by the Protected Matters report to occur within 5 km of the study site. A list of these species is provided in Appendix C

Scrutiny of the list of recorded and potentially occurring threatened species, and consideration of potential habitat on the campuses, found that no threatened plants are expected to occur on the Darlington and Camperdown campuses. Of the list of threatened fauna only three species, the Grey-headed Flying-fox, the Eastern Bentwing Bat, and the large-eared Pied Bat were adjudged to have potential to occur within the study area. One listed migratory species (the Great Egret) also has potential to occur.

An endangered population of the Long-nosed Bandicoot (*Perameles nasuta*) occurs within the City of Sydney LGA and potential foraging habitat for the bandicoot does occur on Campus; however, there are no recent records of individuals of this species at the site or in the vicinity.

5.2 Site visit

The Camperdown and Darlington campuses are highly modified environments. Where vegetation occurs it is either as lawns, garden beds or tree plantings (Plate 5.1& 5.2)

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Plate 5.1 Formal garden of Privet hedges and lawn

Plate 5.2 Formal plantings under canopy of Figs adjacent top Parramatta Road

Tree species are a mix of introduced and native with a few native species *Corymbia citriodora* (Lemon scented Gum), *Lophostemon confertus* (Brushbox) and *Ficus* species (Figs) well represented. Other native trees include *Casuarina cunninghamii*, *Melaleuca quinquenervia*, *Cupaniopsis anacardioides*, *Eucalyptus microcorys*, *Angophora costata* and *Angophora floribunda*. Non-native species are dominated by Jacaranda, *Platanus orientalis* (Plane tree), *Celtis sin*ensis (Hackberry), *Cinnamomum camphora* (Camphor Laurel) and Poplar species. The large number of mature trees provides a canopy of relative importance within the City of Sydney LGA given the highly urban environment surrounding the University campuses. A number of these large trees are considered to be significant by the City of Sydney.

Shrubs are predominantly introduced garden species with very few native species present except for some recently landscaped areas. The diversity of native shrub species is very low. The most common native species include *Syzygium* species (Lilli Pilli), *Callistemon* species (Bottlebrush), *Grevillea* species, *Doryanthes excelsa* (Gymea Lily) and *Banksia robur* (Swamp Banksia) (Plate 5.3).

Ground cover species are limited and are almost entirely introduced consisting mainly of lawn species. Those native species recorded during the field survey include, *Hibbertia scandens*, *Lomandra longifolia*, *Ficinia nodosa* (Knobby Club-Rush), *Dianella caerulea*, *Asplenium australasicum*, *Dichondra repens.*

The native plant species diversity of the campuses is low and reflects the history of the site having been cleared early in the 1800s for farming and used since that time for various activities none of which allowed for the regrowth of original vegetation. As has been highlighted in the Campus tree population study (tree iQ 2013) the native species used to landscape the campuses are from a very narrow range of plant families primarily Moraceae, Myrtaceae and Proteaceae.

Due to the highly modified environment no native vegetation capable of providing habitat for threatened flora species was located on the Camperdown or Darlington Campuses.

Weeds species are in the most part controlled and no serious weed infestations or significant occurrences of noxious weeds were seen.

Plate 5.3 Native shrubs planted under tree canopy adjacent to Parramatta Road (note lack of ground cover species)

The only fauna recorded during the site visit were commonly occurring urban species such as Australian Magpie, Noisy Miner, Australian White Ibis, Sulphur-crested Cockatoo, Welcome Swallow, and Rock Dove. Striped Marsh Frogs were also recorded calling in the water feature adjacent to the Old Darlington School. Other species have been seen within the campuses in the past, including Superb Fairy Wrens and Eastern Water Dragons. No sightings of Superb Fairy Wrens were made during searches of hedges adjacent or the Lawn Tennis Courts or the hedges in front of the Brennan McCallum Building and Manning House (Plate 5.4). Similarly, no Eastern Water Dragons were seen during searches behind the Macleay Building adjacent to Parramatta Road.

Plate 5.4 Area where Fairy Wrens have been sighted in the past

Due to the highly modified nature of the campus environment, the predominance of introduced garden plantings, and the highly urbanised surrounding area, habitat for native fauna is lacking. Large

mature trees, particularly fig trees, provide potential foraging habitat for Grey-headed Flying-foxes, which are listed as vulnerable under both the Threatened Species Conservation Act and the Environment Protection and Biodiversity Conservation Act. Open lawns and treed areas provide potential foraging habitat for threatened microbats such as the Eastern Bentwing Bat, the Little Bentwing Bat and the Large-eared Pied Bat. Habitat for these threatened species is marginal and limited in its utility, however, in the local context, the vegetation on campus provides potential connectivity both within the campuses and with the surrounding urban area. The lack of shrubs and the lack of complex structure in garden beds mean that connectivity within campus is lacking for smaller avian species. In addition, there is a lack of fauna habitat features, such as logs and rocks, in garden beds and thus only very limited habitat is available for fauna such as reptiles.

6 Potential issues

While no threatened flora species or threatened ecological communities exist on the campuses, the mature trees are important for biodiversity in the local context in that they provide an island of potential connectivity in the highly urbanised Sydney city area.

In regards to potential impacts on threatened fauna, there are three threatened species that have been adjudged to have the potential to occur on the Darlington and Camperdown campuses and thus have the potential to be impacted by the CIP. The list of threatened species includes the Grey-headed Flying-fox, the Eastern Bentwing Bat, and the Large-eared Pied Bat.

Foraging habitat exists for the Grey-headed Flying Fox in the large mature trees that occur on the campuses. The diet of this species consists of fruit, flowers, pollen, nectar and even leaves of a wide range of plant species. Species within the family Myrtaceae, which are common on the study site, make up a large portion of preferred foraging trees. They also eat the fruit of native *Ficus* species (figs), which also occur on the study site adjacent to St Pauls Oval. Potential impacts on this species could occur through the loss of mature trees in which this species could forage.

The Eastern Bentwing Bat is predominantly a cave-dwelling species but it will roost in road culverts and abandoned mines. Therefore, no roosting habitat for this species will be impacted by the CIP. The species forages over the tree canopy and over open grassy areas so there is potential foraging habitat for the species in the study area. The species has been recorded numerous times in the 5 km radius of the study site but no records exist for the study site itself. Potential impacts on this species could occur through the loss of open grassy areas and large mature trees.

The Large-eared Pied Bat roosts in caves, crevices in cliffs, and mines so no roosting habitat will be impacted by the CIP. This species occurs in a range of habitats but in the Sydney basin they are most common in areas of high fertility soils in wet sclerophyll forests. Therefore, while the species could occur on occasions, foraging habitat for this species in the study area is marginal and very limited. Potential impacts on this species could occur through clearing of mature trees and loss of open spaces.

7 Recommendations

Potential impacts on threatened fauna as a result of the CIP include the loss of potential foraging habitat for Grey-headed Flying-foxes, Eastern Bentwing Bats, and Large-eared Pied Bats. Therefore, it is recommended that the removal of mature trees be avoided and the loss of open spaces be minimised. Most mature trees on the campuses grow adjacent to buildings and where these buildings are to be removed/refurbished measures should be taken to protect mature trees. As well as providing potential food and habitat for threatened and other fauna on the campuses, the mature tree canopy provides an island of connectivity within the highly urbanized Sydney city area. The University maintains a

detailed tree inventory and acknowledges that the trees at the Darlington and Camperdown campuses make an important contribution to the local landscape. A Tree Management Plan for the CIP has been developed, which aims to maintain and increase the present campus tree canopy cover at both the Darlington and Camperdown campuses. Maintaining open space and adherence to the Tree Management Plan should ensure potential impacts on threatened species are minimal.

A number of opportunities exist for the enhancement of habitat for flora and fauna on the Darlington and Camperdown campuses. For example, establishment of plantings with good structure (i.e. trees, shrubs and groundcovers) would provide improved habitat for reptiles and small birds, such as the Superb Fairy Wren. Superb Fairy Wrens require a shrub layer, preferably comprised of native species, for shelter (Parsons 2009). The records of this species on the campuses occur in areas where there are manicured lawns adjacent to hedges where the species can seek shelter. However, these areas are isolated from other areas of potential habitat because most garden beds consist of a limited number of ground cover species, consist almost entirely of introduced lawn species, have no shrub layer and thus lack structural complexity. Planting more garden beds with native shrubs and ground cover would provide better connectivity between habitats within the campuses and therefore increase the amount of habitat available for Superb Fairy Wrens and other small species of birds, and reptiles. The University has developed a list of planting principles within its Landscape Design Principles for the CIP. While it is recognised that the planting principles include a list of heritage plants and the use of exotic species in some circumstances, habitat for the wren and other fauna could be improved by replacing existing exotic plantings with a range of native shrub and groundcover species where possible. The use of native species originally found in the area would fulfil many of the criteria identified within the University's list of planting principles.

The grounds of the University of Sydney lie primarily on Wianamatta shale overlaying sandstone. Originally the clay soils derived from this substrate are likely to have supported forest vegetation dominated by tall eucalypt trees, with a shrubby mid layer and a ground layer of herbs and grasses. By the time the land was granted to the University of Sydney the original vegetation had been cleared for farming.

Attempts to understand the type of vegetation that would have grown in the Sydney area prior to colonisation have been made in recent times. Doug Benson from the NSW Herbarium published a book on this topic in 1990 (Benson & Howell 1990). The book describes the vegetation likely to have occurred across the Sydney area and list typical species that would have occurred in these communities. In 1981 a staff member from the Botany department at the University surveyed the flora in the grounds of the University and as part of this used Benson & Howell (1990) to describe past vegetation and recommend a set of endemic species that could be used to landscape the University campus. The following list of potential plant species to be used when landscaping the university campus is drawn from both these sources. It has been developed to address the over representation of some native plant families within the university grounds. Any future plantings aiming to increase the biodiversity on campus could use these species to develop multi-structured vegetation plots.

Trees: *Casuarina torulosa, Homalanthus populifolius, Angophora costata, Eucalyptus paniculata, Eucalyptus eugenioides, Eucalyptus pilularis, Eucalyptus saligna, Exocarpos cupressiformis, Ceratopetalum gummifera, Pittosporum undulatum, Elaeocarpus reticulatus, Syncarpia glomulifera*

Shrubs: *Leucopogon juniperinus, Breynia oblongifolia, Acacia implexa, Notelaea longifolia, Platylobium formosum, Bursaria spinosa, Polyscias sambucifolia, Astroloma humifusa, Pultenaea retusa, Persoonia linearis, Dodonaea triquetra,*

Ground Covers: *Pseuderanthemum variabile, Dichondra repens, Centella asiatica, Solanum pungetium, Veronica plebeia, Pratia purpurascens, Plectranthus parviflorus, Hypericum japonicum, Cymbopogon refractus, Dichelachne rara, Digitaria parvifolia, Echinopogon caespitosus, Imperata cylindrica, Oplismenus aemulus, Poa affinis, Themeda australis, Entolasia marginata, Lomandra longifolia.*

Climbers: *Tylophora barbata, Pandorea pandorana, Hardenbergia violacea, Clematis aristata, Clematis glycinoides, Billardiera scandens, Morinda jasminoides, Cissus hypoglauca, Eustrephus latifolius, Commelina cyanea, Smilax glyciphylla.*

Ferns: *Adiantum aethiopicum, Blechnum cartilagineum, Doodia aspera, Pteridium esculentum.*

Given that the natural vegetation of the area was cleared many years ago and there has been no regrowth, the University may wish to include other native species that do not necessarily represent species that may have originally occurred across the Campuses. Under these circumstances plantings should be as diverse as possible and should include a mix of trees, shrubs, herbs and grasses to ensure robust structural layers are developed.

Additional fauna habitat could be created by providing natural and artificial refuges for fauna in the tree and ground layers. For example, bat boxes, logs, large rocks, and artificial ground layer refuges could be installed. The potential to provide fauna-friendly water features in low-lying areas and water collection points similar to the water feature adjacent to the Old Darlington School should also be considered. The possibility of including roof-top gardens or living walls in the design of new buildings should also be investigated (Plate 7.1). In addition to providing opportunities to increase the diversity of native flora on the campuses, roof-top gardens could also enhance connectivity between areas which cannot currently be connected through additional plantings. Selection of species that produce edible fruit or nectar would also enhance fauna habitat.

While opportunities to connect with habitat outside of the campuses are limited due to the highly urbanised surrounding area, consultation with City of Sydney Council regarding potential ways to enhance connectivity to areas of habitat outside of the campuses would be beneficial.

Plate 7.1 Example of a roof-top garden of native species with varying structural layers (Woolloomooloo, Sydney)

8 Conclusion

The study area contains no habitat for threatened flora and habitat for known threatened fauna is currently limited to foraging habitat for species such as the Grey-headed Flying-fox. There is potential habitat for some other threatened fauna, in particular, the endangered population of Long-nosed Bandicoot in inner western Sydney and the Powerful Owl (which has been recorded at the Botanical Gardens); however, there are no recent records of the Bandicoot in the vicinity and while the Powerful Owl could potentially forage at the site on occasion there are no records of any individuals doing so. Given that the CIP mainly involves the development of existing buildings within existing building envelopes, with most existing vegetation to be retained, potential impacts on threatened flora and fauna are limited.

Notwithstanding the above, it is recommended that, as detailed designs and development applications for the various components of the CIP are developed and submitted, a flora and fauna assessment is carried out for each specific component, in order to confirm and update the results of this preliminary study and to identify potential mitigation measures for local fauna that may occur (for example, microbats, should they be identified as occurring in the roofs of buildings at the time the development is proposed).

There are opportunities to improve habitat for local biodiversity on both campuses through the establishment of more complex and diverse vegetation plantings and the installation of features, such as water sources, ground shelter and roost sites, that could be used by a range of fauna.

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Appendix A: Local, State and Commonwealth Government Acts and policies relevant to the study area

Government Level	Relevant Policy/Legislation	Relevance
Local	Sydney Local Environmental Plan 2012 (Sydney LEP 2012)	Regulates development by providing the zoning and ultimate use of all land within the LGA. The objectives of relevant zoning categories are as follows. **B2 Local Centre** To provide a range of retail, business, entertainment and community uses that serve the needs of people who live in, work in and visit the local area. To encourage employment opportunities in accessible locations. To maximise public transport patronage and encourage walking and cycling. To allow appropriate residential uses so as to support the vitality of local centres. **B4 Mixed Use** To provide a mixture of compatible land uses. To integrate suitable business, office, residential, retail and other development in accessible locations so as to maximise public transport patronage and encourage walking and cycling. To ensure uses support the viability of centres. **R1 General Residential** To provide for the housing needs of the community. To provide for a variety of housing types and densities. To enable other land use that provide facilities or services to meet the day to day needs of residents. To maintain the existing land use pattern of predominantly residential uses. **RE1 – Public Recreation** To enable land to be used for public open space or recreational purposes. To provide a range of recreational settings and activities and compatible land uses. To protect and enhance the natural environment for recreational purposes. To provide links between open space areas. To retain and promote access by members of the public to areas in the public domain including recreation facilities and waterways and other natural features. **SP2 – Infrastructure** To provide for infrastructure and related uses. To prevent development that is not compatible with or that may detract from the provision of infrastructure.
	Development Control Plan	A development control plan is a non-legal document that supports the LEP with more detailed planning and design guidelines. There are a number of Development Control Plans which apply to development where the City of Sydney Council and the Central Sydney Planning Committee are the consent authority.

Government Level	Relevant Policy/Legislation	Relevance
	Sustainable Sydney 2030	Sustainable Sydney 2030 is the City's guiding strategic plan for the sustainable development of the City to 2030 and beyond. It sets a vision for a Green, Global and Connected City (CoS 2013a)
	City of Sydney Greening Sydney Plan 2012	The Greening Sydney Plan (CoS 2012) focuses on outlining the broad strategies and programs that are to be employed by the City to green its urban landscapes. It recognises and reinforces the importance of trees and other vegetation and their potential to support diverse ecosystems in an urban environment. There are six key policy initiatives of the Greening Sydney Plan (CoS 2012) : • Expanding the urban forest; • Creating greener streets; • Providing more parks and open space; • Ensuring greener outcomes for new development son private land; • Establishing green linkages and wildlife corridors; and • Empowering the community in the greening of the City.
	City of Sydney Tree Management Policy 2013	The purpose of the Tree Management Strategy (CoS 2013b) is to: • Establish the City of Sydney's commitment and future strategic direction for tree planting, protection, management and maintenance of its urban forest; • Address tree management and maintenance issues faced by the City of Sydney; and • Provide a framework for decision making, documentation and standardised processes to ensure consistency in the management of the City of Sydney's urban forest.
	City of Sydney Urban Forest Strategy 2013	The Urban Forest Strategy (CoS 2013c) outlines the way the City will work to improve the environment, using trees, while managing the associated risks and costs. Trees must be incorporated into the urban planning process and given the appropriate resources to grow and survive. The Urban Forest Strategy has the following key objectives: • Prioritise the maintenance and protection of its existing tree population in order to maximise the benefits already received from this asset; • Increase the average total canopy cover from the current 15.5% to 23.25% by 2030, and then to 27.13% by 2050 through targeted programs for trees located in streets, parks and private property; • Improve the age spread of our street and park trees. • Increase species diversity, by ensuring the population does not comprise more than 40% for any particular family, 30% for any particular genus, and 10% for any one species. • Engage and educate the community on the benefits of trees and their management requirements and assist community participation in the greening of Sydney.
	City of Sydney Street Tree Master Plan	The City of Sydney Street Tree Master Plan (CoS 2011) ensures streetscape planting is coordinated and robust. Each City village is taken into consideration in the Master Plan.

Government Level	Relevant Policy/Legislation	Relevance
	City of Sydney Register of Significant Trees 2013	City of Sydney Council has compiled a Register of Significant Trees (CoS 2013d) throughout the local government area. Numerous trees are listed from the study area on this register. It is recommended to consult the Register of Significant Trees and obtain permission from council prior to removal of trees.
	Urban Ecology Strategic Action Plan (Draft) 2013	The Draft Urban Ecology Strategic Action Plan (CoS 2013e) outlines the City of Sydney's approach to identify, protect and rebuild native plants and animals in the City. It is part of the City's work to create a liveable city for all of its inhabitants. It identifies 6 priority sites and 8 priority animal species, and outlines a 10-year management plan to conserve and enhance biodiversity across the City. The plan was on public exhibition until 23 September 2013.
	Environmental Management Plan 2013	As a manager of Australia's largest central business district, the City of Sydney has a responsibility to help rapidly reduce its environmental impact. The City of Sydney's Environmental Management Plan (CoS 2013f) establishes vision, goals and targets to create a sustainable city. The plan is developed in consultation with the community and environmental groups. It looks at: • energy and emissions • water • waste • plants and animals
NSW	NSW Environmental Planning and Assessment Act 1979 (EPA Act)	The NSW Environmental Planning and Assessment Act 1979 (EP&A Act) Act specifies environmental impact assessment requirements and procedures for some development and activities and establishes a planning system for State, regional and local plans. In NSW there are four different assessment systems under the There are currently four categories of assessment under the Environmental Planning and Assessment Act 1979Environmental Planning and Assessment Act 1979: • State significant assessment system; • Part 3A (not accepting new applications); • Part 4 (Local and regional development); and • Part 5 The State Significant Assessment System was reformed in 2011 to replace the former Part 3A assessment process. The current system includes only the largest, most intensive or significant proposals of their type in the state. Most State Significant Developments are worth at least $30 million (DPI 2011).
	Threatened Species Conservation Act 1995 & Amendment Act 2005 (TSC Act)	The TSC Act aims to conserve threatened species, populations and ecological communities; to promote their recovery; and manage the processes that threaten or endanger them. The NSW Scientific Committee established under the Act has listed a number of threatened species, populations and communities (flora and fauna). Threatened ecological communities and listed flora and fauna species are recorded as occurring in the study area (ref ATLAS). Schedule 1 of the TSC Act lists threatened species, populations and ecological communities and species that are endangered or presumed extinct. Schedule 2 lists vulnerable species and Schedule 3 lists key threatening processes. The following listing categories are used for threatened species: • A species is eligible to be listed as **Presumed extinct** if in the opinion of the Scientific Committee, the species has not been recorded in its known or expected habitat in New South Wales, despite targeted surveys, over a time frame appropriate, in the opinion of the Scientific Committee, to its life cycle and form. • A species is eligible to be listed as **Critically endangered** if, in the opinion of the Scientific Committee, the species is facing an extremely high risk of extinction in New South Wales in the immediate future, as determined in accordance with criteria prescribed by the regulations.

Government Level	Relevant Policy/Legislation	Relevance
		• A species is eligible to be listed as **Endangered** if, in the opinion of the Scientific Committee: a. it is facing a very high risk of extinction in New South Wales in the near future, as determined in accordance with criteria prescribed by the regulations, and b. it is not eligible to be listed as a critically endangered species. • A species is eligible to be listed as **Vulnerable** if, in the opinion of the Scientific Committee: a. it is facing a high risk of extinction in New South Wales in the medium-term future, as determined in accordance with criteria prescribed by the regulations, and b. it is not eligible to be listed as an endangered or critically endangered species. A population is eligible to be listed as an **endangered** population if, in the opinion of the Scientific Committee, it is facing a very high risk of extinction in New South Wales in the near future, as determined in accordance with criteria prescribed by the regulations. There are 34 **Key Threatening Processes** listed by the State of NSW under the TSC Act. Key threatening processes at the NSW State level are processes that threaten – or could threaten – the survival or evolutionary development of species, populations or ecological communities. A threatening process is eligible to be listed as a key threatening process if, in the opinion of the Scientific Committee: (a) it adversely affects threatened species, populations or ecological communities, or; (b) it could cause species, populations or ecological communities that are not threatened to become threatened. Potential impacts to listed entities are assessed via Seven Part Tests (7 part test) and Significant Impact Statements (SIS).
	Noxious Weeds Act 1993	The Act (as Amended 2006) aims to streamline administration and improve the implementation of noxious weed control. It has a strong emphasis on urban and environmental weeds. The NW Act allows for the declaration of noxious plants in five (5) classes – these being grouped according to the control actions required (see Appendix D). Where noxious plants (as identified by the Act) are present on private land, the landholder has a legal responsibility to control them and to prevent their spread to adjoining land. Similarly, noxious plants occurring on public land must also be controlled, with local and State governments also required to comply with the Act.
Commonwealth	Commonwealth EPBC Act 1999	The Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) is administered by the Department of Environment (DOE). It includes management of impacts on Matters of National Environmental Significance (MNES) including: • World heritage properties. • Ramsar wetlands. • National threatened species and ecological communities. • Migratory species. • Commonwealth marine areas. • Nuclear actions. A native species is eligible to be listed as **critically endangered** at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria. A species is eligible to be listed as **vulnerable** under the EPBC Act if: • It is not critically endangered or endangered; and • It is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria. A species is eligible to be included in the **endangered** category at a particular time if, at that time: • It is not critically endangered or endangered; and

Government Level	Relevant Policy/Legislation	Relevance
		• It is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria. Under the EPBC Act, Commonwealth approval is required for any 'controlled action', being a project or development that would have, or that would be likely to have, a significant impact on any MNES. In such cases, the action must be referred to the Commonwealth Minister for Environment and Heritage, and approvals sought. A person must not take an action that: 1. Has, or will have, a significant impact on a listed threatened species; or 2. Is likely to have a significant impact on a listed threatened species.

Appendix B: Likelihood of occurrence table for threatened flora

Results of database searches for threatened flora recorded within a 5 km radius of the Study Area.

Family	Scientific Name	Common Name	TSC Act	EPBC Act	Likelihood of Occurrence
Fabaceae	*Acacia gordonii*		Endangered	N/A	Unlikely
Fabaceae	*Acacia pubescens*	Downy Wattle	N/A	Vulnerable	Unlikely
Fabaceae	*Acacia terminalis subsp. terminalis*	Sunshine Wattle	Endangered	N/A	Unlikely
Casuarinaceae	*Allocasuarina glareicola*		N/A	Endangered	Unlikely
Orchidaceae	*Caladenia tessellata*	Thick Lip Spider Orchid	Vulnerable	Vulnerable	Unlikely
Orchidaceae	*Cryptostylis hunteriana*	Leafless Tongue-orchid	N/A	Vulnerable	Unlikely
Poaceae	*Dichanthium setosum*	Bluegrass	Vulnerable	N/A	Unlikely
Myrtaceae	*Eucalyptus fracta*	Broken Back Ironbark	Vulnerable	N/A	Unlikely
Myrtaceae	*Eucalyptus nicholii*	Narrow-leaved Black Peppermint	Vulnerable	N/A	Unlikely
Myrtaceae	*Eucalyptus pulverulenta*	Silver-leafed Gum	Vulnerable	N/A	Unlikely
Dilleniaceae	*Hibbertia puberula*		Endangered	N/A	Unlikely
Myrtaceae	*Melaleuca biconvexa*	Biconvex Paperbark	N/A	Vulnerable	Unlikely
Myrtaceae	*Melaleuca deanei*	Deane's Paperbark	Vulnerable	N/A	Unlikely
Geraniaceae	*Pelargonium sp. striatellum (G.W.Carr 10345)*	Omeo Storks bill	N/A	Endangered	Unlikely
Thymelaeaceae	*Pimelea curviflora var. curviflora*		N/A	Vulnerable	Unlikely
Thymelaeaceae	*Pimelea spicata*	Spiked Rice-flower	N/A	Endangered	Unlikely
Moraceae	*Streblus pendulinus*	Siah's Backbone	N/A	Endangered	Unlikely
Santalaceae	*Thesium australe*	Austral Toadflax, Toadflax	N/A	Vulnerable	Unlikely

Appendix C: Likelihood of occurrence table for threatened and migratory fauna

Results of database searches for threatened fauna recorded within a 5 km radius of the Study Area.

Group	Family	Common Name	Scientific Name	Conservation Status		Previously recorded in Locality (Desktop review)		Survey Records from Project area	Potential habitat in the Project area	Likelihood of occurrence
				TSC Act	EPBC Act	OEH Atlas	EPBC Report			
BIRDS	Accipitridae	Red Goshawk	*Erythrotriorchis radiatus*	CE				No	No	Unlikely
		White-bellied Sea-Eagle	*Haliaeetus leucogaster*		M			No	No	Unlikely
		Little Eagle	*Haliaeetus morphnoides*	V				No	No	Unlikely
	Anseranatidae	Magpie Goose	*Anseranas semipalmata*	V				No	No	Unlikely
	Apodidae	White-throated Needletail	*Hirundapus caudacutus*		M			No	No	Unlikely
		Fork-tailed Swift	*Apus pacificus*		M			No	No	Unlikely
	Ardeidae	Cattle Egret	*Ardea ibis*		M			No	No	Unlikely
		Great Egret	*Ardea alba*		M			No	Marginal and limited foraging habitat	Potentially
		Australasian Bittern	*Botaurus poiciloptilus*	E				No	No	Unlikely
	Burhinidae	Bush Stone-curlew	*Burhinus grallarius*	E				No	No.	Unlikely
	Charadriidae	Lesser Sand-plover	*Charadrius mongolus*		M			No	No	Unlikely
		Double-banded Plover	*Charadrius bicinctus*		M			No	No	Unlikely
		Pacific Golden Plover	*Pluvialis fulva*		M			No	No	Unlikely
	Columbidae	Superb Fruit-Dove	*Ptilinopus superbus*	V				No	Yes	Unlikely
	Dasyornithidae	Eastern Bristlebird	*Dasyornis brachypterus*	E	E			No	No	Unlikely
	Dicruridae	Black-faced Monarch	*Monarcha melanopsis*		M			No	No	Unlikely
		Spectacled Monarch	*Monarcha trivirgatus*		M			No	No	Unlikely
		Satin Flycatcher	*Myiagra cyanoleuca*		M			No	No	Unlikely
		Rufous Fantail	*Rhipidura rufifrons*		M			No	Marginal and limited foraging habitat	Unlikely
	Diomedeidae	Antipodean Albatross	*Diomedea exulans antipodensis*	V	V, M			No	No	Unlikely

Group	Family	Common Name	Scientific Name	Conservation Status		Previously recorded in Locality (Desktop review)		Survey Records from Project area	Potential habitat in the Project area	Likelihood of occurrence
				TSC Act	EPBC Act	OEH Atlas	EPBC Report			
		Southern Royal Albatross	*Diomedea epomophora epomophora*		V, M			No	No	Unlikely
		Northern Royal Albatross	*Diomedea epomophora sanfordi*		E, M			No	No	Unlikely
		Tristan Albatross	*Diomedea exulans exulans*		E, M			No	No	Unlikely
		Wandering Albatross	*Diomedea exulans*	E	E, M			No	No	Unlikely
		Gibson's Albatross	*Diomedea exulans gibsoni*	V	V, M			No	No	Unlikely
		Buller's Albatross	*Thalassarche bulleri*		V, M			No	No	Unlikely
		Shy Albatross	*Thalassarche cauta cauta*	V	V, M			No	No	Unlikely
		Salvin's Albatross	*Thalassarche cauta salvini*		V, M			No	No	Unlikely
		White-capped Albatross	*Thalassarche cauta steadi*		V, M			No	No	Unlikely
		Chatham Albatross	*Thalassarche eremita*		E, M			No	No	Unlikely
		Black-browed Albatross	*Thalassarche melanophris*	V	V, M			No	No	Unlikely
		Campbell Albatross	*Thalassarche melanophris impavida*		V, M			No	No	Unlikely
	Estrildidae	Diamond Firetail	*Stagonopleura guttata*	V				No	No	Unlikely
	Haematopodidae	Pied Oystercatcher	*Haematopus longirostris*	E	V			No	No	Unlikely
	Laridae	Caspian Tern	*Hydroprogne caspia*		M			No	No	Unlikely
		Common Tern	*Sterna hirundo*		M			No	No	Unlikely
		Little Tern	*Sternula albifrons*	E	M			No	No	Unlikely
	Meliphagidae	Regent Honeyeater	*Anthochaera phrygia*	CE	E, M			No	No	Unlikely
		White-fronted Chat	*Epthianura albifrons*	V				No	No	Unlikely
	Meropidae	Rainbow Bee-eater	*Merops ornatus*		M			No	Limited and marginal foraging habitat	Unlikely
	Procellariidae	White-bellied Storm-Petrel	*Fregetta grallaria grallaria*	V	V			No	No	Unlikely
		Southern Giant Petrel	*Macronectes giganteus*	E	E, M			No	No	Unlikely
		Northern Giant Petrel	*Macronectes halli*	V	V, M			No	No	Unlikely
		Kermadec Petrel (western)	*Pterodroma neglecta neglecta*	V	V			No	No	Unlikely

Group	Family	Common Name	Scientific Name	Conservation Status		Previously recorded in Locality (Desktop review)		Survey Records from Project area	Potential habitat in the Project area	Likelihood of occurrence
				TSC Act	EPBC Act	OEH Atlas	EPBC Report			
		Wedge-tailed Shearwater	*Ardenna/Puffinus pacificus*		M			No	No	Unlikely
		Flesh-footed Shearwater	*Puffinus carneipes*		M			No	No	Unlikely
		Swift Parrot	*Lathamus discolor*	E	E			No	Marginal and limited foraging habitat	Unlikely
		Orange-bellied Parrot	*Neophema chrysogaster*	E	CE, M			No	No.	Unlikely
		Superb Parrot	*Polytelis swainsonii*	V	V			No	No	Unlikely
	Rostratulidae	Australian Painted Snipe	*Rostratula australis*	E	V, M			No	No	Unlikely
	Scolopacidae	Common Sandpiper	*Actitis hypoleucos*		M			No	No	Unlikely
		Ruddy Turnstone	*Arenaria interpres*		M			No	No	Unlikely
		Red Knot	*Calidris acuminata*		M			No	No	Unlikely
		Great Knot	*Calidris tenuirostris*		M			No	No	Unlikely
		Grey-tailed Tattler	*Heteroscelus brevipes*		M			No	No	Unlikely
		Bar-tailed Godwit	*Limosa limosa*		M			No	No	Unlikely
		Sharp-tailed Sandpiper	*Calidris acuminata*		M			No	No	Unlikely
		Curlew Sandpiper	*Calidris ferruginea*	E	M			No	No	Unlikely
		Pectoral Sandpiper	*Calidris melanotos*		M			No	No	Unlikely
		Red-necked Stint	*Calidris ruficollis*		M			No	No	Unlikely
		Latham's Snipe	*Gallinago hardwickii*		M			No	No	Unlikely
		Little Curlew	*Numenius minutus*		M			No	No	Unlikely
		Whimbrel	*Numensis phaeopus*		M			No	No	Unlikely
		Eastern Curlew	*Numenius madagascariensis*		M			No	No	Unlikely
		Common Greenshank	*Tringa nebularia*		M			No	No	Unlikely
		Marsh Sandpiper	*Tringa stagnatilis*		M			No	No	Unlikely
	Stercorcariidae	Pomarine Jaeger	*Stercorarius pomarinus*		M			No	No	Unlikely
	Sternidae	Little Tern	*Sternula albifrons*	E	M			No	No	Unlikely

Group	Family	Common Name	Scientific Name	Conservation Status		Previously recorded in Locality (Desktop review)		Survey Records from Project area	Potential habitat in the Project area	Likelihood of occurrence
				TSC Act	EPBC Act	OEH Atlas	EPBC Report			
		Fairy Tern	*Sternula nereis nereis*		V			No	No	Unlikely
	Strigidae	Powerful Owl	*Ninox strenua*	V				No	Marginal and limited foraging habitat	Unlikely
MAMMALS	Balaenidae	Southern Right Whale	*Eubalaena australis*	E	E, M			No	No	Unlikely
	Balaenoptiidae	Bryde's Whale	*Balaenoptera edeni*		M			No	No	Unlikely
		Humpback Whale	*Megaptera novaeangilae*	V	V, M			No	No	Unlikely
	Cetotheriidae	Pygmy Right Whale	*Caperea marginata*		M			No	No	Unlikely
	Delphinidae	Indo-Pacific Humpback Dolphin	*Sousa chinensis*		M			No	No	Unlikely
		Dusky Dolphin	*Lagenorhynchus obscurus*		M			No	No	Unlikely
	Dasyuridae	Eastern Quoll	*Dasyurus viverrinus*	E	E			No	No	Unlikely
		Spotted-tail Quoll	*Dasyurus maculatus*	V	E			No	No	Unlikely
	Otariidae	New Zealand Fur-seal	*Arctocephalus forsteri*	V				No	No	Unlikely
	Otariidae	Australian Fur-seal	*Arctocephalus pusillus doriferus*	V				No	No	Unlikely
	Muridae	New Holland Mouse	*Pseudomys novaehollandiae*		V			No	No	Unlikely
	Peramelidae	Long-nosed Bandicoot*	*Perameles nasuta*	E				No	No	Unlikely
		Southern Brown bandicoot	*Isoodon obesulus obesulus*		E			No	No	Unlikely
	Phascolarctidae	Koala	*Phascolarctos cinereus*	V	V			No	No	Unlikely
	Potoroidae	Long-nosed Potoroo	*Potorous tridactylus tridactylus*	V	V			No	No	Unlikely
	Pteropodidae	Grey-headed Flying Fox	*Pteropus poliocephalus*	V	V			No	Limited foraging habitat	Potentially
	Vespertilionidae	Little Bentwing-bat	*Miniopterus australis*	V				No	Marginal and limited foraging habitat	Unlikely
		Eastern Bentwing-bat	*Miniopterus schreibersii oceanensis*	V				No	Marginal and limited foraging habitat	Potentially
		Large-eared Pied Bat	*Chalinolobus dwyeri*	V	V			No	Marginal and limited foraging habitat	Potentially

Group	Family	Common Name	Scientific Name	Conservation Status		Previously recorded in Locality (Desktop review)		Survey Records from Project area	Potential habitat in the Project area	Likelihood of occurrence
				TSC Act	EPBC Act	OEH Atlas	EPBC Report			
REPTILES	Elapidae	Broad-headed Snake	*Hoplocephalus bungaroides*	E	V			No	No	Unlikely
	Cheloniidae	Loggerhead Turtle	*Caretta caretta*	E	E, M			No	No	Unlikely
		Green Turtle	*Chelonia mydas*	V	V, M			No	No	Unlikely
		Hawksbill Turtle	*Eretmochelys imbricata*		V, M			No	No	Unlikely
		Flatback Turtle			M			No	No	Unlikely
	Dermochelyidae	Leatherback Turtle	*Dermochelys coriacea*	E	E, M			No	No	Unlikely
FROGS	Hylidae	Green and Golden Bell Frog	*Litoria aurea*	E	V			No	No	Unlikely
		Giant Burrowing Frog	*Heleioporus australiacus*	V	V			No	No	Unlikely
FISH	Retropinnidae	Australian Grayling	*Prototroctes maraena*		V			No	No	Unlikely
	Serranidae	Black Rockcod	*Epiniphelus daemelii*		V			No	No	Unlikely
	Odontaspididae	Grey Nurse Shark (eastern)	*Carcharius taurus*		CE			No	No	Unlikely
	Lamnidae	Great White Shark	*Carcharodon carcharias*		V, M			No	No	Unlikely
		Porbeagle	*Lamna nasus*		M			No	No	Unlikely
	Pristidae	Green Sawfish	*Pristis zijsron*		V			No	No	Unlikely
	Rhincodontidae	Whale Shark	*Rhincodon typus*		M			No	No	Unlikely

* = Population in inner western Sydney