TECHNICAL REPORT NO 3

FLORA, FAUNA AND AQUATIC IMPACT ASSESSMENT REPORT

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REMONDIS Integrated Recycling Park - Grand Avenue, Camellia Flora and Fauna Assessment

July 2010

Natural & Cultural Heritage Consultants 18-20 Mandible St Alexandria NSW 2015

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Report for:

NECS on behalf of REMONDIS Pty Ltd

REMONDIS Integrated Recycling Park Grand Avenue, Camellia

Flora and Fauna Assessment

July 2010

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ABBREVIATIONS

CAMBA	China-Australia Migratory Bird Agreement
CMA	Catchment Management Authority
DECCW	NSW Department of Environment, Climate Change and Water (formerly NSW Department of Environment and Climate Change)
DEWHA	Department of the Environment, Water, Heritage and the Arts (formerly Department of Environment and Water Resources)
DPI	Department of Primary Industries
DoP	Department of Planning
EEC	Endangered Ecological Community
EPA	NSW Environment Protection Authority (now part of DECCW)
EP&A Act	*Environmental Planning and Assessment Act* 1979
EPBC Act	*Environment Protection and Biodiversity Conservation Act* 1999
FM Act	*Fisheries Management Act* 1994
JAMBA	Japan-Australia Migratory Bird Agreement
KTP	Key Threatening Process
LEP	Local Environment Plan
LGA	Local Government Area
Locality	5 km radius of Study Area
MNES	Matter of National Environmental Significance
NECS	National Environmental Consulting Services
NPWS	NSW National Parks and Wildlife Service (now part of DECCW)
ROKAMBA	Republic of Korea-Australia Migratory Bird Agreement
SEPP	State Environmental Planning Policy
SIS	Species Impact Statement
Study Area	Area of direct impact and any areas subject to potential indirect impacts
Subject site	Area of direct impact
TSC Act	*Threatened Species Conservation Act* 1995
sp.	species (singular)
spp.	species (plural)
subsp.	subspecies
var.	variety
WM Act	*Water Management Act 2000*

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1.0 SUMMARY

Biosis Research Pty. Ltd. was commissioned by National Environmental Consulting Services on behalf of REMONDIS Pty. Ltd. to undertake a flora and fauna assessment for construction and operation of an integrated Alternative Waste Treatment facility, to be known as the Integrated Recycling Park, at 1 Grand Avenue, Camellia (Study Area). The Study Area was inspected by a botanist and zoologist on 6 July, 2010.

The subject site consists of the an area of approximately 4.5 hectares and a will comprise:

- A Commercial and Industrial Resource Recovery Facility (CIRRF); and,
- A Source Separated Organic Resource Recovery Facility (SSORRF).

The Study Area is subject to asbestos contamination which has been sealed with concrete capping. The project will be designed to avoid the penetration of the capping for the construction of the main buildings and structures once all required services (e.g. stormwater, power, telecommunication, process water and pipelines) have been installed.

The current proposal has been included as a Major Project under Part 3A of the NSW EP&A Act and State Environmental Planning Policy (Major Projects) 2005.

Vegetation and threatened flora

The majority of the Study Area is sealed with concrete with few trees (mostly planted specimens) present on the property perimeter. Most other vegetation was represented by weeds and exotics and the Study Area was assessed as an Unnatural Landscape. The proposal would require minimal vegetation clearing with the only non planted trees to be removed being a small patch (3 – 4 trees) of suckering *Casuarina glauca* growing in disturbed fill. No Endangered Ecological Communities (EECs) as listed under the NSW *Threatened Species Conservation Act* 1995 (TSC Act) or *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) were recorded within the Study Area.

The non local, threatened tree species, *Eucalyptus nicholii* was recorded on the perimeter of the Study Area, near Camellia train station. Due to the proximity of previous records and the presence of associated estuarine vegetation (Mangrove Forest), potential habitat may exist on the northern perimeter of the Study Area for the threatened species; *Wilsonia backhousei.*

Based on the nature of the proposal, database interrogation, literature review regarding the ecology of each species, and information gathered during the current and previous field surveys within the Study Area, neither of these species are considered likely to be subject to negative impacts resulting from the proposal.

Fauna

The fauna habitats within the Study Area have been highly modified from their natural state and are considered to be in Poor condition. Despite the poor condition of habitats, potential habitat for six threatened and/or migratory species occurs within the Study Area.

An underground stormwater drainage channel runs south to north across the western side of the Study Area. Some cave dwelling microchiropteran species such as the Eastern Bentwing Bat *Miniopterus schreibersii oceanensis* and Southern Myotis *Myotis macropus* are known to roost within man-made structures and may roost within the concrete opening of this artificial channel. No impacts are proposed in relation to the potential habitats afforded by the stormwater drainage channel.

The Study Area shares its northern border with the Parramatta River, with the site being raised approximately 4 m from the bank of the river. It is expected that a number of migratory waterbirds and waders may forage along the muddy banks and within the mangroves along the Parramatta River on the perimeter of the Study Area. The proposal is not considered to impact these foraging areas.

No threatened or migratory fauna are considered as likely to be subject to negative impacts resulting from the proposal.

Aquatic Ecology

Aquatic fauna habitat within the Study Area was present in the form of the southern foreshore of the Parramatta River and provided suboptimal habitat quality including areas of Mangrove Forest within the riparian zone.

Database searches indicated that no known occurrences of threatened fish species have been recorded within a 10km radius of the Study Area. Small patches of Mangrove Forest were recorded on the northern perimeter of the Study Area, which are protected as marine vegetation under the NSW *Fisheries Management Act* 1994 (FM Act). No impacts are likely to occur on the Mangrove Forest patches as a result of the proposal.

Recommendations

A number of recommendations have been made to ensure any potential impacts of the proposal are minimised, including (but not limited to):

- All vegetative waste and materials potentially containing noxious weed propagules should be removed and disposed of at an appropriate waste disposal facility.
- Noxious and environmental weeds occurring within the Study Area should be controlled and suppressed during and post construction.
- Current best practice sediment and erosion controls for the construction industry (Landcom 2004) should be implemented including preparation of erosion and sediment control plans.
- Post construction inspections of the stormwater infrastructure should be undertaken to ensure their integrity and potential downstream impacts should be monitored, especially after heavy rainfall events.
- Where and if stormwater infrastructure to the north west of the site is to be upgraded, further assessment of the potential impacts on threatened bat species should be undertaken.

2.0 INTRODUCTION

Biosis Research Pty. Ltd. (Biosis Research) was commissioned by National Environmental Consulting Services (NECS) on behalf of REMONDIS Pty. Ltd. to undertake a flora and fauna assessment for construction and operation of an integrated Alternative Waste Treatment facility, to be known as the Integrated Recycling Park, at 1 Grand Avenue, Camellia (Study Area).

2.1 Background

The Study Area consists of a wider buffer zone and the subject site comprising of an area of approximately 4.5 hectares (ha) zoned Regional Enterprise under the Sydney Regional Environmental Plan No 28 – Parramatta. The Study Area is part of a larger area of land which prior to 1996 was occupied by James Hardie for the manufacture of fibrous cement (Asbestos) and related products and chemical manufacturing. The Study Area consisted mainly of warehouse buildings which have been demolished to slab level. It was acquired by Sydney Water in 1996.

In 2000, the NSW Environment Protection Authority (EPA) declared that the Study Area represented a significant risk of harm. A Voluntary Remediation Agreement (Agreement No 26012) was entered into between Sydney Water and the EPA under Section 26 of the *Contaminated Land Management* Act 1997.

During 2001 and 2002, Sydney Water undertook works for remediation of the James Hardy site. The buried asbestos waste was well covered with hardstand providing an effective barrier to human contact and no further remedial work was considered necessary. Subsequent determination by the EPA (14 May 2003) found that remediation had been satisfactorily completed and that the EPA considered that contamination no longer presented a significant risk of harm to human health or the environment. In accordance with a Section 26 (5) of the CLM Act the EPA determined that the terms of the Voluntary Remediation Agreement had been carried out.

2.2 Proposed development activity

The proposed REMONDIS Integrated Recycling Park in Camellia (hereafter referred to as ‘the proposal’) will process commercial and industrial waste and organic materials collected in the Metropolitan Sydney area with the objective of maximising resource recovery and minimising landfill disposal.

The proposal will comprise:

- A Commercial and Industrial Resource Recovery Facility (CIRRF); and,
- A Source Separated Organic Resource Recovery Facility (SSORRF).

The Integrated Recycling Park will include ancillary facilities such as a weighbridge, administrative offices, parking and workshops. It will operate 24 hours per day, seven days per week.

One of the main objectives for the project design is to avoid the penetration of the concrete capping for the construction of the main buildings and structures once all required services (e.g. stormwater, power, telecommunication, process water and pipelines) have been installed during site preparation for the proposed development.

The site water management system ensures that no contaminated stormwater will be allowed to discharge or flow from the site. There is a separate and enclosed system for leachate and process water collection and storage to ensure no contaminated water can enter the stormwater or groundwater systems. Separate to the process water collection and recycling system, rainwater tanks will be provided to collect rainfall from the building roof areas for utilisation as either make-up water into the composting process or other purposes. Surface stormwater will be contained and directed to a first flush system. A more detailed review of the proposed on site water management system has been undertaken by Consulting Earth Scientists (2010).

In accordance with the Sydney Regional Environmental Plan, No – 28 Parramatta, an Environment Protection Zone will be established adjacent to the Parramatta River. No development work is proposed within the 30m wide area defined by this zone. The existing concrete capping within the Environment Protection Zone will be maintained.

2.3 Description and features of the Study Area

The Study Area is located at 1 Grand Avenue, Camellia within the Parramatta City Local Government Area (LGA) off James Ruse Drive and adjacent to Rosehill Racecourse. Access to the site is through a signalised intersection on James Ruse Drive and across an overpass crossing the Clyde-Carlingford Railway line. The Study Area is bounded by vacant land adjacent to the Clyde-Carlingford Railway line to the west, a spur goods rail line to the south, industrial premises to the east and the Parramatta River to the north as shown on Figure 1.

The Study Area consists of a wider buffer zone and the subject site comprising of an area of approximately 4.5 hectares (ha) zoned Regional Enterprise under the Sydney Regional Environmental Plan (SREP) No 28 – Parramatta. It is level

with approximately 95% of the area covered with "hard" surfaces of concrete and bitumen (Plate 1). All other areas are grassed. There are no permanent buildings on site. The Study Area is elevated approximately 4 m above the adjacent Parramatta River with a concrete wall (Plate 2) and intermittent patches of mangrove forest (Plate 2) along the river foreshore. A constructed concrete drainage easement exists to the west of the Study Area (Plate 3) near the Clyde-Carlingford railway line, draining north to an outlet flowing into the patch of Mangroves along the Parramatta River. While most stormwater from the site will be collected for re-use, excess stormwater would continue to drain from the site into this stormwater system.

2.4 Aims

The general aim of this report is to undertake a terrestrial and aquatic flora and fauna assessment of the Study Area and to determine the impact of the proposal on matters of conservation significance.

The specific aims are to:

- Address relevant agency Director Generals Requirements (e.g. Department of Environment, Climate Change and Water (DECCW) and Department of Planning (DoP)), more specifically those in relation to threatened species, communities and their habitats;
- Conduct a literature review and database search for the Study Area;
- Describe the natural values associated with the Study Area;
- Map significant flora and fauna (including habitats);
- Undertake a desktop aquatic assessment to examine the nature, extent and condition of aquatic habitats and assess the potential impacts upon aquatic flora and fauna values within the Study Area;
- Undertake targeted field surveys for habitat of threatened terrestrial species, populations and ecological communities listed under the schedules of the TSC and/or EPBC Acts that are known or likely to occur within the Study Area;
- Undertake impact assessment under the *Environment Planning and Assessment Act 1979* (EP&A Act, *Threatened Species Conservation Act 1995* (TSC Act) and/or Significance Impact Criteria under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) for threatened species, populations and ecological communities that are either directly or indirectly impacted by the proposal; and,
- Provide recommendations to minimise environmental impacts from the proposal.

3.0 LEGISLATIVE FRAMEWORK

***Environmental Protection and Biodiversity Conservation Act* 1999 (Commonwealth)**

The EPBC Act is a Commonwealth mechanism that requires proposed actions to be assessed in terms of their potential impact upon "Matters of National Environmental Significance" (MNES). MNES currently listed under the EPBC Act include:

- World Heritage properties;
- Natural heritage places;
- Wetlands of international importance (Ramsar wetlands, CAMBA, JAMBA and ROKAMBA);
- Threatened species and ecological communities;
- Migratory species;
- Commonwealth marine areas; and,
- Nuclear actions (including uranium mining).

Where a potential impact on a MNES is likely to occur as a result of a proposed action, the significance of that impact must be assessed. Guideline criteria for determining whether an impact is significant are provided under the Act. Where a proposed action will, or is likely to, have a significant impact on a MNES, a Referral to the Commonwealth Environment Minister must be prepared. The purpose of the Referral is to determine whether a proposed action requires approval and/or controls under the EPBC Act.

***Environmental Planning and Assessment Act* 1979 (NSW)**

One objective of the EP&A Act is to encourage the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities and their habitats. A second objective is to encourage the principles of ecologically sustainable development, including the precautionary principle as defined under the *Protection of the Environment Administration Act* 1991.

The current proposal has been included as a Major Project under Part 3A of the NSW EP&A Act and State Environmental Planning Policy (Major Projects) 2005. The EP&A Act was amended in June 2005 to reform the land-use planning and development assessment and approval system, particularly as it relates to major infrastructure and other significant development. In the new Part 3A, the Act provides a single assessment and approval regime for all major infrastructure and other projects previously undertaken under Part 4 and/or Division 4 of Part 5

of the EP&A Act. The new Part applies to major State government infrastructure projects, development that was previously classified as State significant development and other projects, plans or programs declared by the Minister for Planning.

Provisions have been made in the amended Act for:

- Independent Hearings and Panel Assessments to strengthen the assessment process;
- Concept plans for complex projects, plans or programs so that the overall provisions can be evaluated prior to consideration of the details of the project(s). This provides for matters such as the suitability of the site/route and environmental issues to be resolved up-front and provides for the simplification of subsequent approvals where environmental impacts can be avoided or minimised; and,
- The Minister to declare projects to be 'critical infrastructure projects'. Prior to making such a declaration, a preliminary risk assessment will be required to consider the financial, economic, social and environmental risks of declaring the project a critical infrastructure project. These projects only require a concept approval and there are no appeal rights except if initiated by the Minister.

***Fisheries Management Act* 1994 (NSW) (FM Act)**

The object of the FM Act is to conserve threatened species, populations and ecological communities of fish and marine vegetation native to NSW and to promote ecologically sustainable development, including the conservation of biological diversity. It also aims to reduce the threats faced by native fish and marine vegetation (including Mangroves) in NSW.

If a planned development or activity will have an impact on ecological communities, threatened species, populations or their potential habitats as listed under the FM Act, this must be taken into account in the development approval process. In some cases, the Minister for the Environment will also need to be consulted.

***Threatened Species Conservation Act* 1995 (NSW)**

The TSC Act protects all threatened plants and animals native to NSW (with the exception of fish and marine plants). It provides for the identification, conservation and recovery of threatened species and their populations and communities. It also aims to reduce the threats faced by those species.

If a planned development or activity will have an impact on a threatened species, population or ecological community listed under the TSC Act this must be taken into account in the development approval process. In some cases, the Minister for the Environment will also need to be consulted.

4.0 METHODS

The Study Area was inspected on 5 July, 2010. The general condition of the site was assessed and observations made of plant communities, habitats and extant plant and animal species (as detailed below). During the site visit the weather was cool and partly overcast, with a maximum temperature of approximately 16 degrees Celsius. Aquatic habitat assessments (desk top) were carried out on 9 August 2010 using available survey data (including photographic records) and applying relevant indices to assess the relative health of the aquatic habitat.

4.1 Taxonomy

The plant taxonomy (method of classification) used in this report follows Harden (1990, 1992, 1993, 2002) and subsequent advice from the National Herbarium of NSW. In the body text of this report plants are referred to by their scientific names only. Common names, where available, have been included in threatened species tables and in the Appendices.

Names of vertebrates follow the Census of Australian Vertebrates maintained by Department of the Environment, Water, Heritage and the Arts (DEWHA). In the body of this report vertebrates are referred to by both their common and scientific names when first mentioned. Subsequent references to these species cite the common name only. Common and scientific names are included in the Appendices.

4.2 Literature and database review

Records of threatened terrestrial species, populations and communities were obtained from the DECCW Atlas of NSW Wildlife from within a 10 km radius of the Study Area. Records of threatened species, populations and ecological communities listed on the EPBC Act were obtained from the DEWHA Online EPBC Database from within a 10 km radius of the Study Area. Records of threatened aquatic species, populations and communities were obtained from the NSW Department of Primary Industries (DPI) Fisheries Database within the Parramatta LGA. Database searches were conducted in July 2010.

A list of documents used to prepare this report is located in *References*. Descriptions of the proposal have been provided by NECS.

4.3 Flora survey

Plant species and their habitat were surveyed by undertaking general habitat assessments along with targeted searches for threatened species. Given the lack of native vegetation present in the Study Area, no stratified or plot based surveys have been undertaken.

4.3.1 Flora habitat assessment

The condition of the vegetation was assessed according to the degree to which it resembled relatively natural, undisturbed vegetation using the following criteria:

- Species composition (species richness, degree of weed invasion); and,
- Vegetation structure (representation of each of the original layers of vegetation).

The four categories used to evaluate general habitat value were Good, Moderate, Poor and Unnatural as detailed below:

Good: containing a high number of indigenous species; no weeds present or weed invasion restricted to edges and track margins; plant community contains original layers of vegetation; vegetation layers (ground, shrub, canopy etc) are intact;

Moderate: containing a moderate number of indigenous species; moderate level of weed invasion; weeds occurring in isolated patches or scattered throughout; one or more of original layers of vegetation are modified; vegetation layers (ground, shrub, canopy etc) are largely intact;

Poor: containing a low number of indigenous species; high level of weed invasion; weeds occurring in dense patches or scattered throughout; one or more of the original layers of vegetation are highly modified; one or more original vegetation layers (ground, shrub, canopy etc) are modified or missing; and,

Unnatural landscape: highly modified landscape containing few or no indigenous species; exotic species dominant; original native vegetation layers removed; natural soil profile disturbed; unable to be regenerated to natural condition; high input intervention required to revegetate.

4.4 Fauna survey

Animal species and their habitat were surveyed by undertaking general habitat assessments and active searching and listening, as well as recording incidental observations.

4.4.1 Fauna habitat assessment

The site assessment was primarily a habitat-based assessment and trapping for animal species was not undertaken. The habitat assessment was based on the presence of one or more of the following features:

- Vegetation cover;
- Size range and abundance of tree hollows;
- Abundance of leaf litter and logs;
- Rock outcrops, overhangs or crevices;
- Freestanding water bodies, ephemeral drainage or seepage areas;
- Disturbances, including weed invasion, clearing, rubbish dumping or fire;
- Connectivity to off site habitats; and,
- Surrounding habitat.

The three categories used to evaluate habitat value were Good, Moderate or Poor, as detailed below:

Good: ground flora containing a high number of indigenous species; plant community structure, ground, log and litter layer intact and undisturbed; a high level of breeding, nesting, feeding and roosting resources available; a high richness and diversity of native animal species;

Moderate: ground flora containing a moderate number of indigenous species; plant community structure, ground log and litter layer moderately intact and undisturbed; a moderate level of breeding, nesting, feeding and roosting resources available; a moderate richness and diversity of native fauna; and,

Poor: ground flora containing a low number of indigenous species, plant community structure, ground log and litter layer disturbed and modified; a low level of breeding, nesting, feeding and roosting resources available; a low richness and diversity of native animal species.

Other habitat features, such the value of the Study Area as a habitat corridor, the presence of remnant communities or unusual ecological plant community structures were also used to assess habitat quality.

4.5 Aquatic habitat assessment

The aquatic habitat assessment was a desktop based assessment only. For the purpose of this report, descriptions of aquatic habitat are based on:

- Analysis of aerial imagery;
- Analysis of topographical maps;
- Examination of available photos of the Study Area;
- Extrapolation of information from the terrestrial ecology field surveys to the desktop aquatic assessment; and,
- The completion of HABSCORE assessments. 'HABSCORE is a visually based habitat assessment that evaluates the structure of the surrounding physical habitat that influences the quality of the water resource and the condition of the resident aquatic community' (Barbour *et al.* 1999).

Stream and channel widths, substrate descriptions, widths of riparian zones and habitat composition were estimated from available data in the form of photos and field observations.

4.5.1 Aquatic habitat and condition assessment

The habitat assessment was based on the presence and condition of the following features:

- Pool substrate characterisation;
- Pool variability;
- Channel flow status;
- Bank vegetation (score for each bank);
- Bank stability (score for each bank);
- Width of riparian zone (score for each bank); and,
- Epifaunal substrate / available cover.

The aquatic habitat within the Study Area of the Parramatta River was described in terms of four category types (Fairfull and Witheridge 2003; Barbour *et al.* 1999). The four categories used to evaluate habitat value were Optimal, Suboptimal, Marginal or Poor, as detailed below:

Optimal: watercourses that contain numerous large, permanent pools and generally have flow connectivity except during prolonged drought. They provide extensive and diverse aquatic habitat for aquatic flora and fauna.

Suboptimal: watercourses that contain some larger permanent and semi-permanent refuge pools, which would persist through prolonged drought although, become greatly reduced in extent. These watercourses should support a relatively diverse array of aquatic biota including some fish, freshwater crayfish and aquatic macroinvertebrates. There may also be some aquatic plant species present.

Marginal: watercourses that contain some small semi-permanent refuge pools which are unlikely to persist through prolonged drought. Flow connectivity would only occur during and following significant rainfall. These pools may provide habitat for some aquatic species including aquatic macroinvertebrates and freshwater crayfish.

Poor: water courses or drainages that only flow during and immediately after significant rainfall. Permanent or semi-permanent pools that could provide refuge for aquatic biota during prolonged dry weather are absent.

4.6 Limitations

This study was by design a habitat-based assessment and, as such, no trapping, spotlighting or call playback sampling techniques were used. Bird species potentially occurring in the locality such as some migratory waders are unlikely to have been encountered (if present) due to the time at which the survey was undertaken.

Assessment of aquatic/marine ecology is based on desktop study only, aside from a habitat based description of the riparian zone. No sampling of aquatic/marine biota or water chemistry within the nearby Parramatta River has been undertaken as part of this assessment. Furthermore, assessment of the riparian zone was limited by accessibility within the riparian zone. Observation could only be made from directly above, along a constructed wall (see Plate 2). The potential presence of aquatic fauna, including threatened species, is therefore based on assumptions in relation to the presence of potential habitat as determined by the desktop assessment.

Some plant species that occur in the local area are annuals (completing their life cycle within a single season) and are present only in the seed bank for much of the year. Other plant species are perennial, but are inconspicuous unless flowering or in fruit. Despite these limitations, the assessment of impact is based on the presence or absence of suitable habitat for threatened flora and fauna (which is adequate to satisfy the requirements of the EP&A Act), and as such, species are taken into account during the assessment even though they may not have been detected during the survey.

5.0 RESULTS

A list of the flora and fauna recorded during the survey is provided in Appendix 1 and Appendix 2 respectively.

5.1 Geology and soils

The soil landscapes of the Study Area are mapped at a 1:100,000 scale as disturbed terrain (Chapman and Murphy 1989). Based on the mapping of more intact soil landscapes nearby, the original soils are likely to have constituted the Blacktown (map unit bt) and or Lucas Heights (map unit lh) soil landscape groupings.

Disturbed terrain soil landscapes are described by Chapman (1989) as level plain that has been extensively disturbed by human activity, including the complete disturbance, removal or burial of soil. The disturbed soils are generally considered subject to poor drainage, low fertility and may include toxic materials (Chapman and Murphy 1989). Vegetation has been completely cleared and typically supports opportunistic weeds as described below.

5.2 Plant communities

5.2.1 Vegetation mapping

Native vegetation within the locality has been mapped by the NSW National Parks and Wildlife Service (NPWS 2002b) which illustrates that no native vegetation is present in the Study Area (Figure 3). However, based on aerial photo interpretation and observation of estuarine vegetation along the fringes of the Parramatta River, small patches of Mangrove/Saltmarsh Complex are present on the northern perimeter of the Study Area. Given the dominance of Mangroves (see Section 5.2.2 below) these areas are more characteristic of Mangrove Forest as opposed to Saltmarsh.

Recent and more detailed DECCW vegetation mapping for the Sydney Metropolitan Catchment Management Authority (CMA) describes Mangrove Forest as a low closed to open forest on mudflats found along Sydney's harbour, river coves and estuaries (DECCW 2009). It comprises very few species other than the canopy, with the understorey mostly an open mudflat sometimes with scattered saltmarsh herbs (DECCW 2009). Application of the DECCW Sydney Metropolitan CMA mapping is not currently permitted until finalisation of the draft.

5.2.2 Current vegetation survey

Based on the field surveys, native vegetation within the Study Area was mostly absent and represented by weeds and exotics. Small patches of Mangrove Forest were present on the perimeter of the Study Area adjoining the Parramatta River and would not be impacted by the current proposal.

Weeds, Exotics and Plantings

Based on the field survey, most of Study Area consisted of sealed surfaces (mostly concrete) with disturbed areas dominated by weeds and exotics (see cover photo) along with native tree plantings. Dominant weed species included exotic perennial grasses such as *Eragrostis curvula*, *Melinis repens* and *Paspalum urvillei.* Exotic annual and perennial shrubs such as *Ageratina adenophora, Bidens pilosa*, *Foeniculum vulgare* and *Crassocephalum crepidioides* were also a prominent feature. Scattered woody weeds were also present and included *Olea europaea* subsp. *cuspidata.*

The perimeter of the Study Area included planted native and exotic trees such as *Populus nigra* 'Italica', *Lophostemon confertus, Eucalyptus tereticornis, Casuarina glauca, Acacia parramattensis* and *Melaleuca quinquenervia.* The current proposal is unlikely to require the removal of these trees. A small patch of immature *Casuarina glauca* (approximately 4 trees) had also colonised some disturbed fill on the edge of the Study Area (see Plate 4) and would be removed by the proposal.

Based on the highly altered soil conditions and subsequent lack of natural vegetation, the Study Area was considered to constitute an Unnatural Landscape in accordance with the condition categories prescribed in Section 4.3.1.

Mangrove Forest

Small patches of riparian vegetation represented by Mangrove Forest occurred on the Parramatta River foreshore to the north east and north west of the Study Area (Plate 2). These areas have undergone substantial disturbance due to previous land uses and ongoing erosion largely resulting from turbulence (e.g. from the Rivercat) within the boat wash and tidal zone. The narrow patches of Mangrove Forest ranged between one and four metres in width along the river foreshore with some Mangroves actively collapsing into the river (Plate 2). Large stretches of the foreshore no longer included a vegetated riparian zone with the river being in direct contact with the constructed wall.

The dominant Mangrove canopy species present was *Avicennia marina* with some individuals up to six metres in height. The smaller, *Aegiceras corniculatum* was also present in small numbers. Scattered native groundcovers such as

Tetragona tetragonoides were also present. Weed species were also present along the edges of the Mangrove Forest and included the perennial shrub, *Ageratina adenophora* along with the woody weed, *Olea europaea* subsp. *cuspidata.* Weeds species were notably present in proximity of the stormwater outlet adjacent to the Mangrove Forest.

Based on the presence of weeds, high degree of disturbance and subsequent erosion, Mangrove Forest within the study was considered to be in Moderate to Poor condition according to the condition categories prescribed in Section 4.3.1.

5.3 Flora

A total of 57 vascular plant species were recorded from the Study Area during the current survey, comprising 9 (16 %) locally indigenous and or naturally occurring native species and 48 (84 %) exotic weeds, planted natives and ornamentals. A list of plant species recorded is provided in Appendix 1.

Included among the exotic species are five plant species that are listed under the *Noxious Weeds Act* 1993 and the *Noxious Weeds Amendment Act* 2005 for the Parramatta LGA. These are: *Cardiospermum grandiflorum, Cortaderia selloana Ipomoea indica, Parietaria judaica* and *Ricinus communis*. These plants fall under the weed classes listed below (Table 1) and incur the following legal obligations under the *Noxious Weeds Act* (DPI 2005).

Table 1: Noxious weed species

Weed Species	Class	Legal Requirements
Cardiospermum grandiflorum *Ipomoea indica* *Parietaria judaica* *Ricinus communis*	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed.
Cortaderia selloana	3	The plant must be fully and continuously suppressed and destroyed

5.3.1 Significant flora

Based on a literature and database review, a total of 22 threatened plant species listed on the TSC and/or EPBC Acts have previously been recorded or have potential habitat within 10 km of the Study Area (Table 2, DECC Atlas of NSW Wildlife; DEWHA Online EPBC Database). A more detailed description of potential habitats for each threatened species is provided in Appendix 3.

The non local, threatened tree species, *Eucalyptus nicholii* was recorded on the perimeter of the Study Area, near Camellia train station. Due to the proximity of previous records and the presence of associated estuarine vegetation (Mangrove Forest), potential habitat may exist on the northern perimeter of the Study Area for the threatened species; *Wilsonia backhousei.*

Potential impacts on *Eucalyptus nicholii* and the potential habitat of *Wilsonia backhousei* have been considered further in Section 6.3 of this report.

Table 2: Terrestrial flora listed on the TSC and/or EPBC Acts that may occur in the local area

Key: 1) Listed on the EPBC Act as Endangered (E) or Vulnerable (V)
2) Listed on the TSC Act as Endangered (E), Vulnerable (V), (Ex) Extinct or Endangered Population (EP)

Latin Name Common Name	EPBC Act[1]	TSC Act [2]	Potential Habitat?
Acacia bynoeana Bynoe's Wattle	V	E1	No
Acacia prominens Gosford Wattle	-	EP	No
Acacia pubescens Downy Wattle	V	V	No
Apatophyllum constablei	E	-	No
Bothriochloa biloba Lobed Blue-grass	V	-	No
Caladenia tessellata Tessellated Spider Orchid	V	E1	No
Callistemon linearifolius	-	V	No
Cryptostylis hunteriana Leafless Tongue Orchid	V	V	No
Darwinia biflora	V	V	No
Deyeuxia appressa	E	E1	No
Dillwynia tenuifolia	V	V1	No
Epacris purpurascens var. purpurascens	-	V	No

Latin Name Common Name	EPBC Act[1]	TSC Act [2]	Potential Habitat?
Eucalyptus nicholii Narrow-leaved Black Peppermint	V	V	No **Planted specimens recorded just outside the Study Area near Camellia train station**.
Genoplesium baueri Bauer's Midge Orchid	-	V	No
Grammitis stenophylla Narrow-leaf Finger Fern	-	E1	No
Grevillea parviflora ssp. parviflora Small-flower Grevillea	V	V	No
Hibbertia superans	-	E1	No
Leptospermum deanei	V	V	No
Marsdenia viridiflora ssp. Viridiflora Native Pear	-	EP	No
Melaleuca biconvexa Biconvex Paperbark	V	V	No
Melaleuca deanei Dean's Melaleuca	V	V	No
Persoonia nutans Nodding Geebung	E	E1	No
Pimelea curviflora var. curviflora	V	V	No
Pimelea spicata Spiked Rice-flower	E	E1	No
Pomaderris prunifolia	-	E2	No
Prostanthera marifolia	X	E4	No
Pultenaea pedunculata Matted Bush-pea	-	E1	No
Syzygium paniculatum Magenta Lilly Pilly	V	V	No
Tetratheca glandulosa	V	V	No
Wahlenbergia multicaulis Tadgell's Bluebell	-	EP	No
Wilsonia backhousei Narrow-leafed Wilsonia	-	V	**Yes** **Marginal potential habitat within open patches of Mangrove Forest on northern perimeter of Study Area**

5.4 Fauna

5.4.1 Terrestrial fauna habitats

The fauna habitat within the Study Area had been highly modified from its natural state. A concrete base extended across most of the Study Area with machinery and remnant infrastructure remaining on site which provided some habitat complexity. Finer scale habitat features included areas of cultivated garden vegetation, scattered planted trees, leaf litter, urban debris and man-made infrastructure. Animal species may utilise some of these features wholly or partly, in conjunction with one another, or may depend entirely on one specific habitat type. Habitats in this area were considered to be in Poor condition.

Myrtaceaeous trees (Melaleuca and Eucalypt species) were scattered sparsely along the periphery of the Study Area (predominantly the south and western sides), providing direct (foliage, nectar, exudates) and indirect food (arthropods) for a range of vertebrates, particularly birds. Despite being in poor condition, patches of woody weed infestations may still provide habitat for small birds such as the Superb Fairy-wren *Malurus cyaneus*. Leaf litter and fallen branches (predominantly occurring just to the north-west of the site) may provide habitat for small reptiles and frogs.

Given the cleared and disturbed nature of the Study Area, shelter habitats for small mammals and birds were largely absent. No hollow-bearing trees were recorded in the Study Area. However, an underground stormwater drainage channel runs south to north across the western side of the Study Area (Plate 3). Some cave dwelling microchiropteran species such as the Eastern Bentwing Bat *Miniopterus schreibersii oceanensis* and Southern Myotis *Myotis macropus* are known to roost within man-made structures such as drainage culverts (Churchill 2008) and may roost within the concrete opening of this artificial channel.

The Study Area shares its northern border with the Parramatta River, with the site being raised approximately 4 m from the bank of the river. It is expected that a number of migratory waterbirds and waders may forage along the muddy banks and within the mangroves along the Parramatta River on the perimeter of the Study Area. The proposal is not considered to impact these foraging areas.

5.4.2 Animal species

A detailed fauna survey (e.g. including trapping and nocturnal survey work) was not undertaken for this assessment. Incidental observations of animal species utilising the Study Area are listed in Appendix 2. In total twenty-one birds were recorded.

5.4.3 Significant species of animals

A total of 80 threatened and/or migratory animal species listed (or preliminarily listed) under the TSC and/or EPBC Acts or their habitats, have been previously recorded within a 10 km radius of the Study Area (Table 3, DECC Atlas of NSW Wildlife; DEWHA Online EPBC Database). A more detailed description of potential habitats for each threatened species is provided in Appendix 4.

Potential habitat for six threatened and/or migratory species occurs within the Study Area. No threatened or migratory species were recorded in the Study Area.

Table 3: Terrestrial fauna listed on the TSC and/or EPBC Acts that may occur in the local area

Key: 1) Listed on the EPBC Act as Endangered (E), Vulnerable (V) or covered under migratory provisions (M) on the EPBC Act
2) Listed on the TSC Act as Endangered (E) or Vulnerable (V)

Family Name	Latin Name Common Name	EPBC Act[1]	TSC Act [2]	Potential Habitat?
Amphibians				
Hylidae	*Litoria aurea* Green and Golden Bell Frog	V	E1	No
Hylidae	*Litoria raniformis* Southern Bell Frog	V	E1	No
Myobatrachidae	*Heleioporus australiacus* Giant Burrowing Frog	V	V	No
Myobatrachidae	*Mixophyes balbus* Stuttering Frog	V	E1	No
Myobatrachidae	*Mixophyes iterates* Giant Barred Frog	E	E1	No
Myobatrachidae	*Pseudophryne australis* Red-crowned Toadlet	-	V	No
Birds				
Accipitridae	*Haliaeetus leucogaster* White-bellied Sea-eagle	M	-	No, but may fly over site.
Accipitridae	*Pandion haliaetus* Osprey	M	V	No, but may fly over site.
Anatidae	*Stictonetta naevosa* Freckled Duck	-	V	No
Apodidae	*Apus pacificus* Fork-tailed Swift	M	-	No
Apodidae	*Hirundapus caudacutus* White-throated Needletail	M	-	No

Family Name	Latin Name Common Name	EPBC Act[1]	TSC Act [2]	Potential Habitat?
Ardeidae	*Ardea alba* Great Egret	M	-	No
Ardeidae	*Ardea ibis* Cattle Egret	M	-	No
Ardeidae	*Botaurus poiciloptilus* Australasian Bittern	-	V	No
Ardeidae	*Ixobrychus flavicollis* Black Bittern	-	V	No
Artamidae	*Artamus superciliosus* White-browed Woodswallow	-	PD (V)	No
Cacatuidae	*Callocephalon fimbriatum* Gang-gang Cockatoo	-	V	No
Cacatuidae	*Calyptorhynchus lathami* Glossy Black-cockatoo	-	V	No
Charadriidae	*Charadrius bicinctus* Double-banded Plover	M	-	No
Charadriidae	*Charadrius leschenaultia* Greater Sand Plover	M	V	No
Charadriidae	*Charadrius mongolus* Lesser Sand Plover	M	V	No
Charadriidae	*Pluvialis fulva* Pacific Golden Plover	M	-	No
Charadriidae	*Pluvialis squatarola* Grey Plover	M	-	No
Columbidae	*Ptilinopus superbus* Superb Fruit-Dove	-	V	No
Cuculidae	*Cuculus saturatus* Oriental Cuckoo	M	-	No
Dicruridae	*Monarcha melanopsis* Black-faced Monarch	M	-	No
Dicruridae	*Myiagra cyanoleuca* Satin Flycatcher	M	-	No
Dicruridae	*Rhipidura rufifrons* Rufous Fantail	M	-	No
Laridae	*Sterna albifrons* Little Tern	M	E1	No
Laridae	*Sterna hirundo* Common Tern	M	-	No

Family Name	Latin Name Common Name	EPBC Act[1]	TSC Act [2]	Potential Habitat?
Meliphagidae	*Anthochaera Phrygia* Regent Honeyeater	E	E1	No
Meropidae	*Merops ornatus* Rainbow Bee-eater	M	-	No
Neosittidae	*Daphoenositta chrysoptera* Varied Sittella	-	V	No
Petroicidae	*Petroica boodang* Scarlet Robin	-	V	No
Petroicidae	*Petroica phoenicea* Flame Robin	-	V	No
Petroicidae	*Petroica rodinogaster* Pink Robin	-	V	No
Psittacidae	*Glossopsitta pusilla* Little Lorikeet	-	V1	No
Psittacidae	*Lathamus discolour* Swift Parrot	E	E1	No
Psittacidae	*Polytelis swainsonii* Superb Parrot	V	V	No
Rostratulidae	*Rostratula australis* Australian Painted Snipe	VM	E1	No
Scolopacidae	*Actitis hypoleucos* Common Sandpiper	M	-	**Yes**
Scolopacidae	*Arenaria interpres* Ruddy Turnstone	M	-	No
Scolopacidae	*Calidris acuminate* Sharp-tailed Sandpiper	M	-	No
Scolopacidae	*Calidris canutus* Red Knot	M	-	No
Scolopacidae	*Calidris ferruginea* Curlew Sandpiper	M	-	No
Scolopacidae	*Calidris mauri* Western Sandpiper	M	-	No
Scolopacidae	*Calidris melanotos* Pectoral Sandpiper	M	-	No
Scolopacidae	*Calidris ruficollis* Red-necked Stint	M	-	No
Scolopacidae	*Calidris tenuirostris* Great Knot	M	V	No

Family Name	Latin Name Common Name	EPBC Act[1]	TSC Act [2]	Potential Habitat?
Scolopacidae	*Gallinago hardwickii* Latham's Snipe	M	-	No
Scolopacidae	*Gallinago megala* Swinhoe's Snipe	M	-	No
Scolopacidae	*Heteroscelis brevipes* Grey-tailed Tattler	M	-	No
Scolopacidae	*Limicola falcinellus* Broad-billed Sandpiper	M	V	No
Scolopacidae	*Limosa lapponica* Bar-tailed Godwit	M	-	No
Scolopacidae	*Limosa limosa* Black-tailed Godwit	M	V	No
Scolopacidae	*Numenius madagascariensis* Eastern Curlew	M	-	No
Scolopacidae	*Numenius minutus* Little Curlew	M	-	No
Scolopacidae	*Numenius phaeopus* Whimbrel	M	-	**Yes**
Scolopacidae	*Philomachus pugnax* Ruff	M	-	No
Scolopacidae	*Tringa glareola* Wood Sandpiper	M	-	No
Scolopacidae	*Tringa nebularia* Common Greenshank	M	-	No
Scolopacidae	*Tringa stagnatilis* Marsh Sandpiper	M	-	**Yes**
Strigidae	*Ninox connivens* Barking Owl	-	V	No
Strigidae	*Ninox strenua* Powerful Owl	-	V	No
Threskiornithidae	*Plegadis falcinellus* Glossy Ibis	M	-	No
Tytonidae	*Tyto capensis* Grass Owl	-	V	No
Invertebrates				
Camaenidae	*Meridolum corneovirens* Cumberland Plain Land Snail	-	E1	No
Mammals				

Family Name	Latin Name Common Name	EPBC Act[1]	TSC Act [2]	Potential Habitat?
Burramyidae	*Cercartetus nanus* Eastern Pygmy-possum	-	V	No
Dasyuridae	*Dasyurus maculatus maculatus* Spotted-tailed Quoll (southeastern mainland)	E	V	No
Macropodidae	*Petrogale penicillata* Brush-tailed Rock-wallaby	V	E1	No
Molossidae	*Mormopterus norfolkensis* Eastern Freetail Bat	-	V	No
Potoroidae	*Potorous tridactylus* Long-nosed Potoroo	V	V	No
Pteropodidae	*Pteropus poliocephalus* Grey-headed Flying-fox	V	V	**Yes**
Vespertilionidae	*Chalinolobus dwyeri* Large-eared Pied Bat	V	V	No
Vespertilionidae	*Falsistrellus tasmaniensis* Eastern False Pipistrelle	-	V	No
Vespertilionidae	*Miniopterus schreibersii oceanensis* Eastern Bentwing Bat	-	V	**Yes** Within stormwater drain
Vespertilionidae	*Myotis macropus* Large-footed Myotis	-	V	**Yes** Within stormwater drain
Vespertilionidae	*Scoteanax rueppellii* Greater Broad-nosed Bat	-	V	No
Reptiles				
Elapidae	*Hoplocephalus bungaroides* Broad-headed Snake	V	E1	No

5.5 Aquatic fauna

Aquatic/Marine flora within the Study Area broadly correspond to the vegetation types and conditions described in Section 5.2.2.

Parramatta River Southern Foreshore / Mangrove Forest

The Parramatta River flows from west to east across the northern portion of the Study Area. The southern foreshore of the Parramatta River forms the northern boundary of the Study Area and extends for a length of approximately 20 km. with a catchment of approximately 130km^2. Based on topographic data (1:25,000 scale), the size and complexity of the Parramatta River within the Study Area would be categorised as a fifth order stream under the Strahler Stream Order (Strahler 1957). Current and previous land uses have altered the natural hydrological regimes of the Parramatta River, resulting in an alteration of flows to the Parramatta River from the surrounding landscape.

Currently the Parramatta River within the Study Area lacks significant riparian vegetation, indicative of historical and current land use. However, within the Study Area small patches of riparian vegetation represented by Mangrove Forest occur on the Parramatta River southern foreshore to the north east and north west of the Study Area (Plate 2). These areas have undergone substantial disturbance due to historical land uses. There was sloughing of the bank substrate largely due to the turbulence and wash generated by the Rivercat. These small Mangrove Forest areas were of minimal width along the river foreshore highlighting the removal of riparian vegetation, further highlighting areas of the foreshore that no longer include a vegetated riparian zone.

The dominant Mangrove canopy species present was *Avicennia marina* with small numbers of *Aegiceras corniculatum*. Based on the absence of a significant buffer zone and evidence of unstable banks within the Study Area, the Parramatta River southern foreshore within the Study Area was considered to be in suboptimal condition according to the condition categories prescribed in Section 4.5.1.

5.5.1 Aquatic fauna habitat

The aquatic habitat within the surveyed reach was present within the southern foreshore of the Parramatta River and was dominated by the Mangrove Forest within the Study Area. Channel widths along the length of the Parramatta River within the Study Area were estimated at between 70m to 80m. Width of riparian zone habitats was estimated at < 1m across the Study Area, providing limited aquatic fauna habitats.

Based on a modified HABSCORE assessment, the Parramatta River southern foreshore on the northern boundary of the Study Area (Plate 2) was classed suboptimal habitat. The sloughing of bank substrates and lack of riparian buffer, limit the preferred habitat for native species through the reduction in trailing bank vegetation and epifaunal substrate cover. However, the small Mangrove Forest areas that are present provide important cover and habitat for local native species.

In general, the habitat assessment considers that the aquatic environments provided by the southern foreshore of the Parramatta River within the Study Area are of high aquatic significance, and contain habitats that are of suboptimal quality for native fish and macroinvertebrate species.

5.5.2 Significant aquatic fauna

Database searches have indicated that no known threatened fish species listed under the FM Act and/or EPBC Act have been recorded within a 10km radius of the Study Area (DPI Fisheries Database).

6.0 IMPACT ASSESSMENT

6.1 Potential impacts of the proposal

6.1.1 Key Threatened Processes

Clearing of native vegetation

'Clearing of native vegetation' is listed as a Key Threatening Processes (KTP) under Schedule 3 of the TSC Act, 'Land clearance' is listed as a KTP under the EPBC Act.

The proposal may require the removal of a few planted trees, weeds and the small patch of *Casuarina glauca* (Plate 4) within the Study Area. The impacts of vegetation removal associated with the proposal are considered negligible and are not considered likely to increase the operation of this KTP.

Degradation of native riparian vegetation along NSW water courses

'The degradation of native riparian vegetation along NSW water courses' is listed as a KTP under Schedule 6 of the FM Act. The Final Determination in the FM Act for this KTP lists some of the impacts as:

- Increasing the amount of sediment and nutrients reaching streams as runoff, and increasing light penetration of the water body;
- Reducing the inputs of organic carbon, via leaves, twigs, and branches;
- Reducing the amount of large woody debris entering the aquatic ecosystem and thereby negatively impacting on habitat and spawning sites of several vulnerable and endangered species listed under the FM Act; and,
- Destabilising river banks.

The proposal will not involve the removal of riparian vegetation and therefore degradation of riparian vegetation as a result of the proposal is considered negligible.

Removal of large woody debris

'The removal of large woody debris' is listed as a KTP under Schedule 6 of the FM Act. The Final Determination in the FM Act for this KTP lists some of the values of large woody debris as:

- Habitat for benthic plants;

- Organic enrichment by capturing detritus and contributing to secondary production by degradation of the debris itself;
- Refuges from predators and interactions between competitors;
- Velocity refuges that minimise energy costs of swimming;
- Spawning sites essential for successful reproduction;
- Refuge and spawning habitats in the riparian zone during overbank flooding;
- Erosion prevention by sedimentary stabilisation of stream banks and riparian zones; and,
- Temperature and drought refuges formed by scouring of deep holes adjacent to large woody debris.

The proposal will not involve the removal of large woody debris during construction or operation and therefore this KTP will not apply.

Weed invasion

'Invasion of native plant communities by exotic perennial grasses' is listed as a KTP under Schedule 3 of the TSC Act. Exotic perennial grasses are those that are not native to NSW and have a life-span of more than one growing season (NSW Scientific Committee 2003b). A relatively small number of these perennial grasses threaten native plant communities, and it is these species which are of concern (NSW Scientific Committee 2003b). *Cortaderia selloana* (Pampas Grass), a grass species listed as being of specific concern under this KTP is present in the Study Area along with other species such as *Eragrostis curvula*. Disturbance as a result of the proposal has the potential to increase the dispersal of these weed species within the Study Area. However, given the lack of native vegetation in proximity of the Study Area, invasion of native plant communities by exotic perennial grasses is unlikely to result from the proposal.

Changes in drainage patterns and water quality

'Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands' is a KTP listed under Schedule 3 of the TSC Act. Alteration to natural flow regimes can occur through reducing or increasing flows, altering seasonality of flows, changing the frequency, duration, magnitude, timing, predictability and variability of flow events, altering surface and sub-surface water levels and changing the rate of rise or fall of water levels (NSW Scientific Committee 2002).

The Study Area has completely altered drainage patterns as a result of previous land uses. Given that the proposal includes the re-use of stormwater collected on

site, alterations to the existing stormwater drainage infrastructure are likely to decrease the amount of flows from the site into the adjoining Parramatta River. This is likely to have a positive effect on the receiving waters and Mangrove Forest located in proximity of the existing stormwater outlet.

6.2 Potential impacts on Endangered Ecological Communities

No EECs as listed on the TSC or EPBC Acts were detected in the Study Area.

The small patch of immature and suckering *Casuarina glauca* occurs in the Study Area and appears to have colonised an area of disturbed fill. While this species is characteristic of the EEC, Swamp Oak Floodplain Forest, *Casuarina glauca* is known to be a fast growing pioneering species (DECCW 2009) capable of recolonising highly disturbed environments. It should be noted that prior to clearing, infilling and industrial development, Swamp Oak Floodplain Forest was probably the dominant vegetation cover within the Study Area.

The occurrence of *Casuarina glauca* in the Study Area is within a completely artificial or constructed infill environment (concrete slab with fill) and therefore is not considered part of the Swamp Oak Floodplain Forest EEC. Removal of this patch of *Casuarina glauca* would not result in fragmentation or isolation of any patches of native vegetation and is unlikely to impact on the movement of local wildlife or interfere with the pollination and dispersal of native plant species in the local area.

The EEC, Coastal Saltmarsh is known to occur on the landward side of Mangrove Forests occurring along the Parramatta River (DECCW 2009) and is likely to occur within the locality. Given the predominant cover of Mangroves along the Parramatta River within the Study Area, these areas do not constitute the Coastal Saltmarsh EEC. It should be noted that Mangrove Forests are protected as marine vegetation under the FM Act.

6.3 Potential impacts on threatened plant species

Two threatened plant species were considered to be potentially impacted by the proposal, *Wilsonia backhousei* and *Eucalyptus nicholii*. The potential impacts on these species are discussed further below.

6.3.1 Wilsonia backhousei

Due to the proximity of previous records and the presence of broadly associated vegetation formations, potential habitat may exist within the Study Area for the threatened plant species *Wilsonia backhousei.* This species is known to occur in association with Mangrove forest in estuaries including those along the

Parramatta River. The nearest records of this species are approximately 2 km east of the Study Area (Figure 3) in proximity of the Parramatta River and associated tributaries.

Impacts to potential habitat of this species are considered negligible due to the following;

- Direct impacts resulting from the proposal will be contained to an area outside the potential habitat of this species;
- Indirect impacts on the potential habitat (Mangrove Forest) of this species such as altered hydrology (e.g. increased stormwater runoff) or downstream pollution are unlikely to result from the proposal;
- The proposal will not create any new edges and will not result in the isolation or fragmentation of potential habitat; and,
- The proposal is unlikely to interfere with the pollination and dispersal of native plant species within the local area.

On the basis of the above, impacts on the potential habitat of *Wilsonia backhousei* is considered negligible.

6.3.2 *Eucalyptus nicholii*

Two individuals of the threatened plant species *Eucalyptus nicholii* were recorded on the western perimeter of the Study Area close to Camellia train station. *Eucalyptus nicholii* is native to the New England Tablelands of NSW but has been widely planted as an urban street tree and in gardens (DEC 2005h). This species is not local to the Study Area, furthermore no impacts on planted individuals would result form the current proposal. On this basis, this species has not been considered further.

6.4 Potential impacts on threatened fauna

Where there is potential habitat (foraging or breeding resources) for threatened animal species in the Study Area, further consideration must be given to the potential impact of the proposal on these species. The proposal may impact on threatened species by causing any of the following:

- Death or injury of individuals;
- Loss or disturbance of limiting foraging resources; and/or
- Loss or disturbance of limiting breeding resources.

Limiting resources are specialised habitat components that species are dependent on for their ongoing survival. Such limiting resources are predominantly associated with specialised breeding habitats (such as tree hollows or suitable nest/maternity roost sites) that occur at low densities, with high levels of competition from a range of species. However, for some species, limiting resources include specialised foraging habitats that have a restricted distribution (e.g. Glossy Black-cockatoos *Calyptorhynchus lathami* feeding only on specific tree species).

6.4.1 TSC Act

Three species listed under the TSC Act have potential habitat in the Study Area.

Based on the nature of the proposal, database interrogation, literature review regarding the ecology of each species, and information gathered during the field survey within the Study Area, none of these species are considered as likely to be subject to negative impacts resulting from the proposal. As shown below (Table 4), no limiting breeding habitat and no limiting foraging habitat is expected to be impacted for these species, and no species are likely to suffer injury or death as a result of the proposal. The proposal is unlikely to have a significant impact on these species.

Table 4: Potential Impacts on Threatened and Migratory Species

Key: 1) Listed on the EPBC Act as Endangered (E), Vulnerable (V) or Migratory (M)
2) Listed on the TSC Act as Endangered (E) or Vulnerable (V). Preliminary (P) listings also included.

Common Name	EPBC Act[1]	TSC Act[2]	Potential Impacts on Threatened or Migratory Species			Impact Assessment Required?	Reasoning
			Individual death or injury?	Loss or disturbance of limiting foraging resources?	Loss or disturbance of limiting breeding resources?		
BIRDS							
Common Sandpiper	M	-	No	No	No	No	The Common Sandpiper is generally uncommon, occupying protected and narrow banks of wetlands, rivers, mangroves and rocky beaches. This species may forage along the banks of the Parramatta River from time to time. However, the proposal is considered unlikely to significantly impact this potential foraging habitat.
Whimbrel	M	-	No	No	No	No	Irregular migrant to the south-east of Australia. The Whimbrel breeds in Russia and China and migrates to Australia during the warmer months. The narrow strip of mangroves and mudbank along the Parramatta River does provide some foraging habitat for this species although it is not extensive. The proposal is unlikely to significantly impact this foraging habitat.
Marsh Sandpiper	M	-	No	No	No	No	This species breeds in Asia and migrates to Australia over the summer months. It forages within wetlands, estuarine waters and sometimes within mangroves. The mangroves and muddy banks along the Parramatta River to the north of the Study Area provides some potential foraging habitat the Marsh Sandpiper although this habitat would not support large numbers of individuals and is not considered to be a limiting habitat resource. The proposal is unlikely to significantly impact this foraging habitat.
MAMMALS							

Common Name	EPBC Act[1]	TSC Act[2]	Potential Impacts on Threatened or Migratory Species			Impact Assessment Required?	Reasoning
			Individual death or injury?	Loss or disturbance of limiting foraging resources?	Loss or disturbance of limiting breeding resources?		
Grey-headed Flying-fox	V	V	No	No	No	No	The Grey-headed Flying-fox is a large and conspicuous species and no signs of a camp (roost site) were observed during the site visit. The species may forage on the fruit of the Morton Bay Fig in the north-east corner of the site or on the blossoms of the Eucalypts and Melaleucas along the periphery of the Study Area from time to time, but is unlikely to rely heavily on the limited feeding resources within the Study Area. The proposal is unlikely to significantly impact this species habitat in Study Area.
Southern Myotis	-	V	No	No	No	No	The Southern Myotis forages over rivers and waterbodies, often roosting in proximity to these foraging areas. The Parramatta River just north of the Study Area provides potential foraging habitat for this species and the culverts to the west of the Study Area may provide potential suitable roosting habitat. However, the proposal is unlikely to impact this potential roosting habitat and no foraging habitat will be impacted.
Eastern Bentwing Bat	-	V	No	No	No	No	The Eastern Bentwing Bat forages within a range of habitats following flyways over water bodies as well as hunting above tree canopies. The culverts to the west of the Study Area provide potential suitable winter roosting sites for this species. However, the proposal is unlikely to impact this potential roosting habitat and no foraging habitat will be impacted.

6.4.2 EPBC Act

One species listed as vulnerable under the EPBC Act (Grey-headed Flying-fox *Pteropus poliocephalus*) has potential habitat in the Study Area. As shown above (Table 4), no limiting breeding habitat or foraging habitat is expected to be impacted for these species.

As such, no assessments have been carried out for this species, in accordance with the EPBC Act significant impact criteria (DEH 2006). A Referral to the Federal Environment Minister is not considered necessary for any EPBC Act-listed threatened animal species.

6.4.3 Potential impacts on migratory fauna

The list of migratory species under the EPBC Act is a compilation of species listed under four international conventions: China-Australia Migratory Bird Agreement (CAMBA), Japan-Australia Migratory Bird Agreement (JAMBA), Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA), and the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention).

Many species listed as migratory under the EPBC Act have been previously recorded within 10 km of the Study Area (Table 3), particularly shorebird species, due to the proximity of Parramatta River. These species do not have habitat in the Study Area. The proposal is unlikely to lead to the loss, degradation or increased disturbance of habitat, or direct mortality of birds that would lead to a substantial reduction in migratory shorebirds frequenting the Parramatta River.

The Osprey *Pandion haliaetus* and the White-bellied Sea-eagle *Haliaeetus leucogaster* could forage along the Parramatta River in the locality, but the proposal is unlikely to impact roosting or foraging habitat for these species.

No assessments in accordance with the EPBC Act significant impact criteria (DEH 2006) have been conducted for migratory species. A Referral to the Commonwealth Environment Minister is not considered necessary for any EPBC Act-listed migratory animal species.

7.0 RECOMMENDATIONS

In order to minimise the overall impacts of the proposal, the following recommendations should be implemented:

- All vegetative waste and materials potentially containing noxious weed propagules should be removed and disposed of at an appropriate waste disposal facility.
- Noxious and environmental weeds occurring within the Study Area should be controlled and suppressed during and post construction.
- Current best practice sediment and erosion controls for the construction industry (Landcom 2004) should be implemented including preparation of erosion and sediment control plans.
- Post construction inspections of the stormwater infrastructure should be undertaken to ensure their integrity and potential downstream impacts should be monitored, especially after heavy rainfall events.
- Where and if stormwater infrastructure to the north west of the site is to be upgraded, further assessment of the potential impacts on threatened bat species should be undertaken.

8.0 CONCLUSION

This report assesses the ecological significance of threatened plant and animal species, populations and ecological communities that occur, or have the potential to occur, within the Study Area affected by the proposal, in accordance with the requirements of the EP&A, FM, TSC and EPBC Acts.

No EECs as listed under the TSC or EPBC Act were recorded within the Study Area.

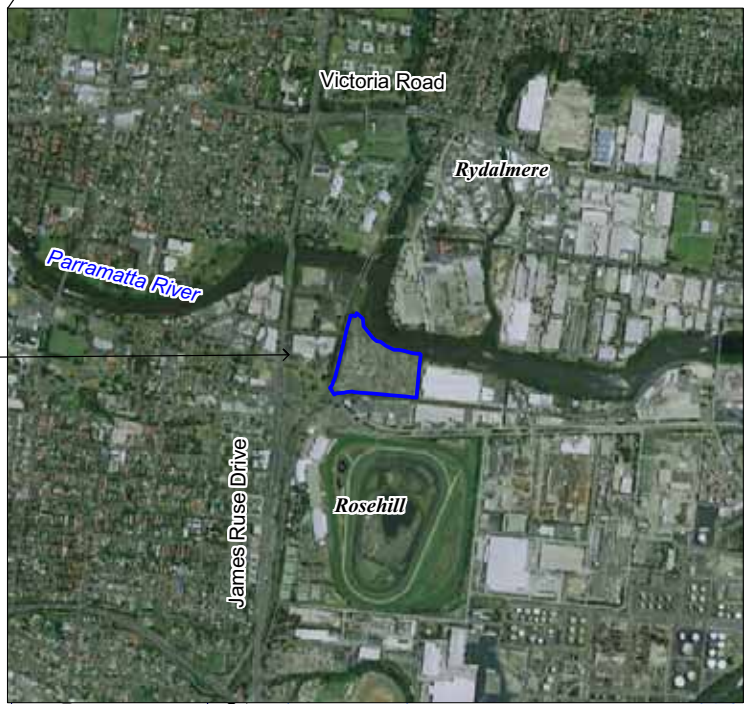
The non local threatened tree species, *Eucalyptus nicholii,* was recorded on the perimeter of the Study Area, near Camellia train station. Due to the proximity of previous records and the presence of associated estuarine vegetation (Mangrove Forest), potential habitat may exist on the northern perimeter of the Study Area for the threatened species; *Wilsonia backhousei.*

An underground stormwater drainage channel runs south to north across the western side of the Study Area (Plate 3). Some cave dwelling microchiropteran species such as the Eastern Bentwing Bat and Southern Myotis are known to roost within man-made structures and may roost within the concrete opening of this artificial channel. No impacts are proposed in relation to the potential habitats afforded by the stormwater drainage channel.

Based on the nature of the proposal, database interrogation, literature review regarding the ecology of each species, and information gathered during the current and previous field surveys within the Study Area, no threatened or migratory species are considered likely to be subject to negative impacts resulting from the proposal.

No known occurrences of threatened fish species have been recorded within a 10km radius of the Study Area. Small patches of Mangrove Forest were recorded on the northern perimeter of the Study Area, which are protected as marine vegetation under the FM Act. No impacts are likely to occur on the Mangrove Forest patches as a result of the proposal.

FIGURES



Source: (c) Land and Property Management Authority, Panorama Avenue Bathurst NSW 2795, www.lpma.nsw.gov.au

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Alexandria
NEW SOUTH WALES 2015

Figure 1: Location of the Study Area in a regional context

Date: 18 August 2010	Drawn by: ANP
File number: 11755	Checked by: AKT
Location: P:\11700s\11755\Mapping\11755 F1_Locality.WOR	

Scale: 0 0.3 0.6 0.9 1.2 kilometres

N W E S

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Alexandria
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Figure 2: Overview of the study area

Date: 18 August 2010	Drawn by: ANP
File number: 11755	Checked by: AKT
Location:-..P:\11800s\11888\Mapping\11755 F2_Overview.WOR	

Scale: 0 50 100 150 200 250
Metres

N W E S

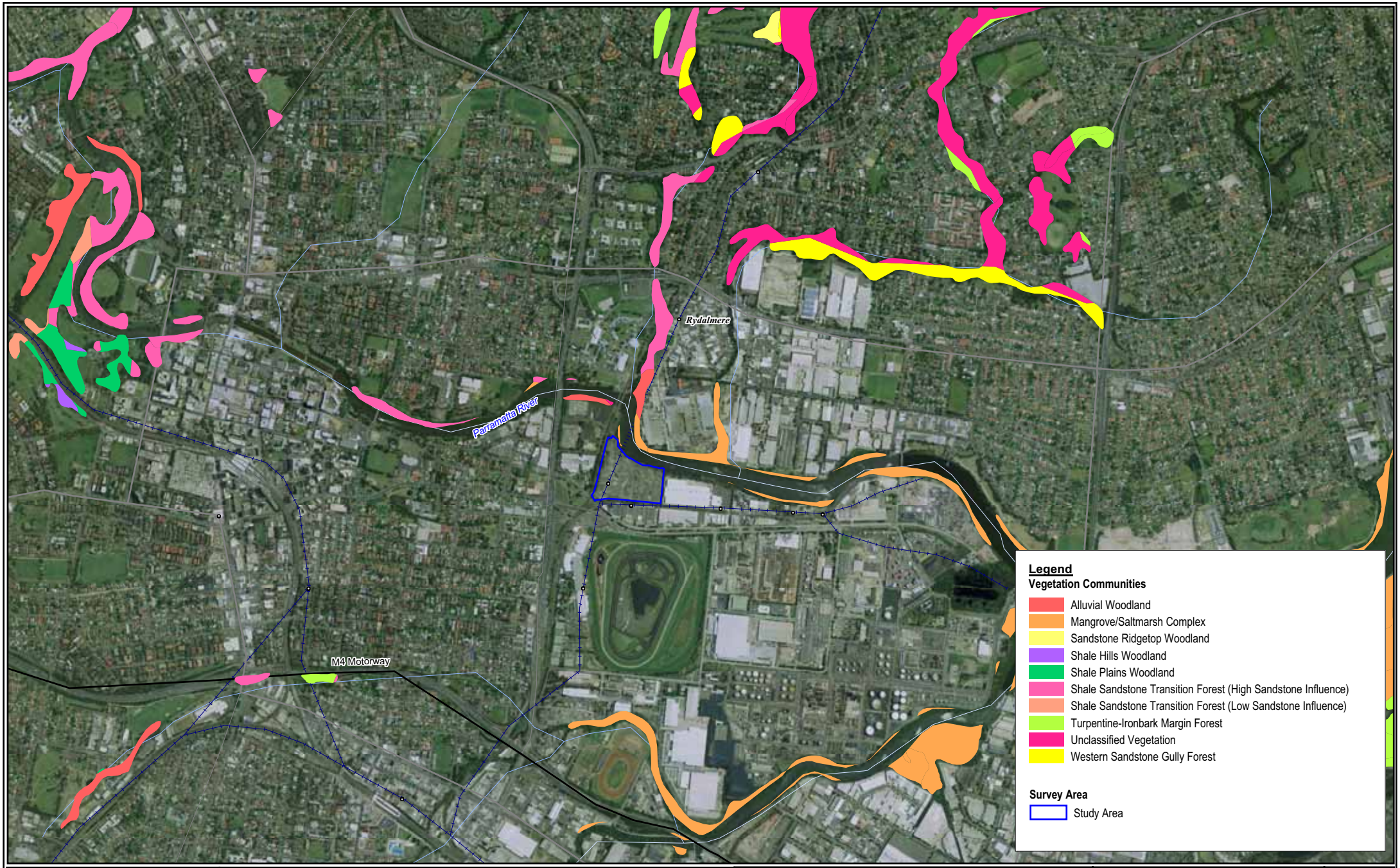

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Figure 3: Vegetation mapping for the study area

Date: 18 August 2010	Drawn by: ANP
File number: 11755	Checked by: BJS
Location:-..P:\11700s\11755\Mapping\11755 F3 Vegetation.WOR	

Acknowledgements:
Data from DECCW/NPWS
This product incorporates Data which is copyright to the Commonwealth of Australia (c.2003-)

Source: (c) Land and Property Management Authority
Panorama Avenue Bathurst NSW 2795
www.lpma.nsw.gov.au

0 0.175 0.35 0.525 0.7 5
kilometres

Scale: 1:100,000at A3
Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

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Figure 3

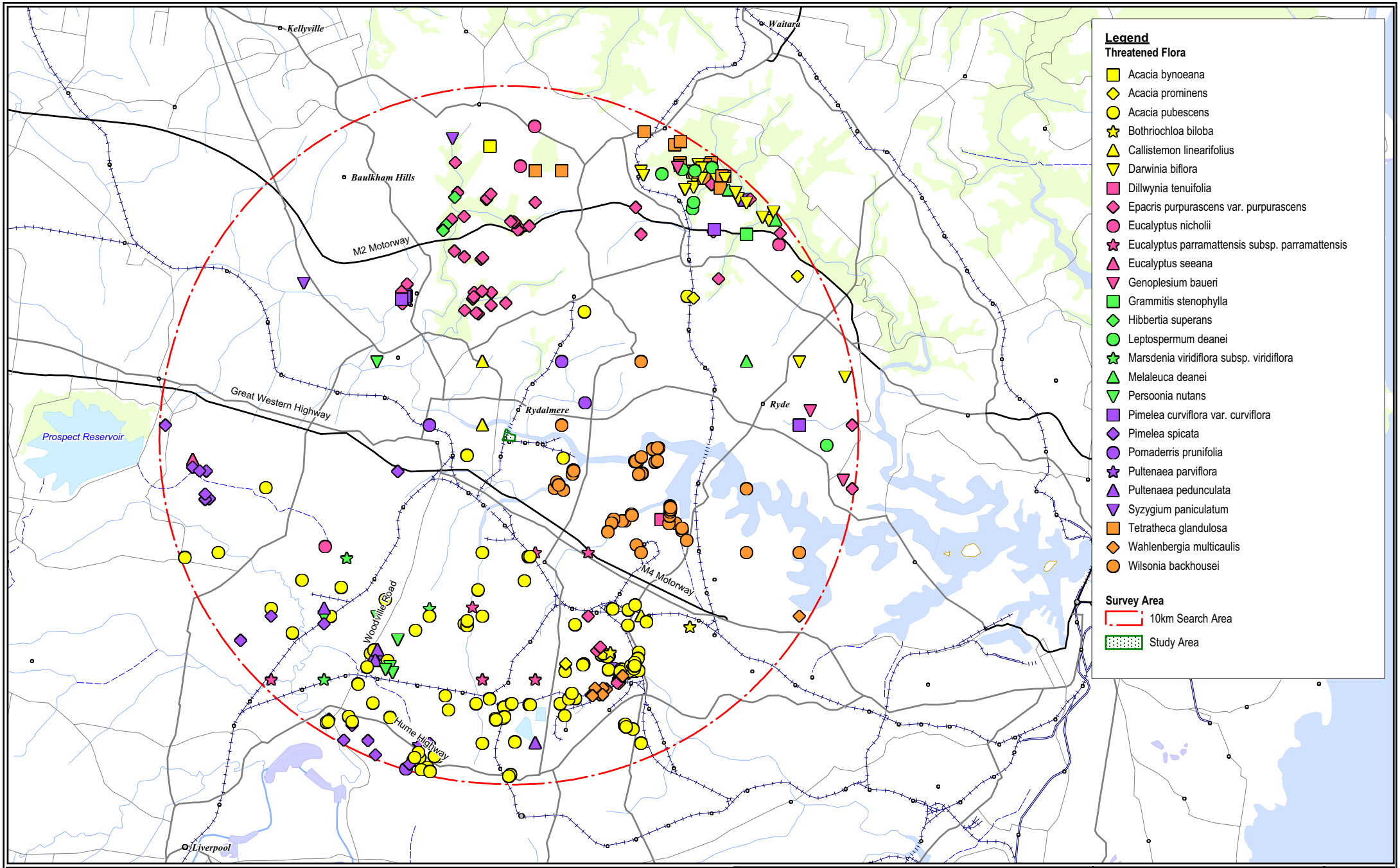

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Figure 4: Threatened flora listed on the TSC and EPBC Acts that have been recorded within 10 km of the study area

Date: 18 August 2010	Drawn by: ANP
File number: 11755	Checked by: BJS
Location:-..P:\11700s\11755\Mapping\11755 F4 Flora.WOR	

Acknowledgements:
Species data from DECCW/NPWs and Biosis Research Pty Ltd

0 1 2 3 4 5
kilometres

Scale: 1:100,000at A3
Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

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Figure 4

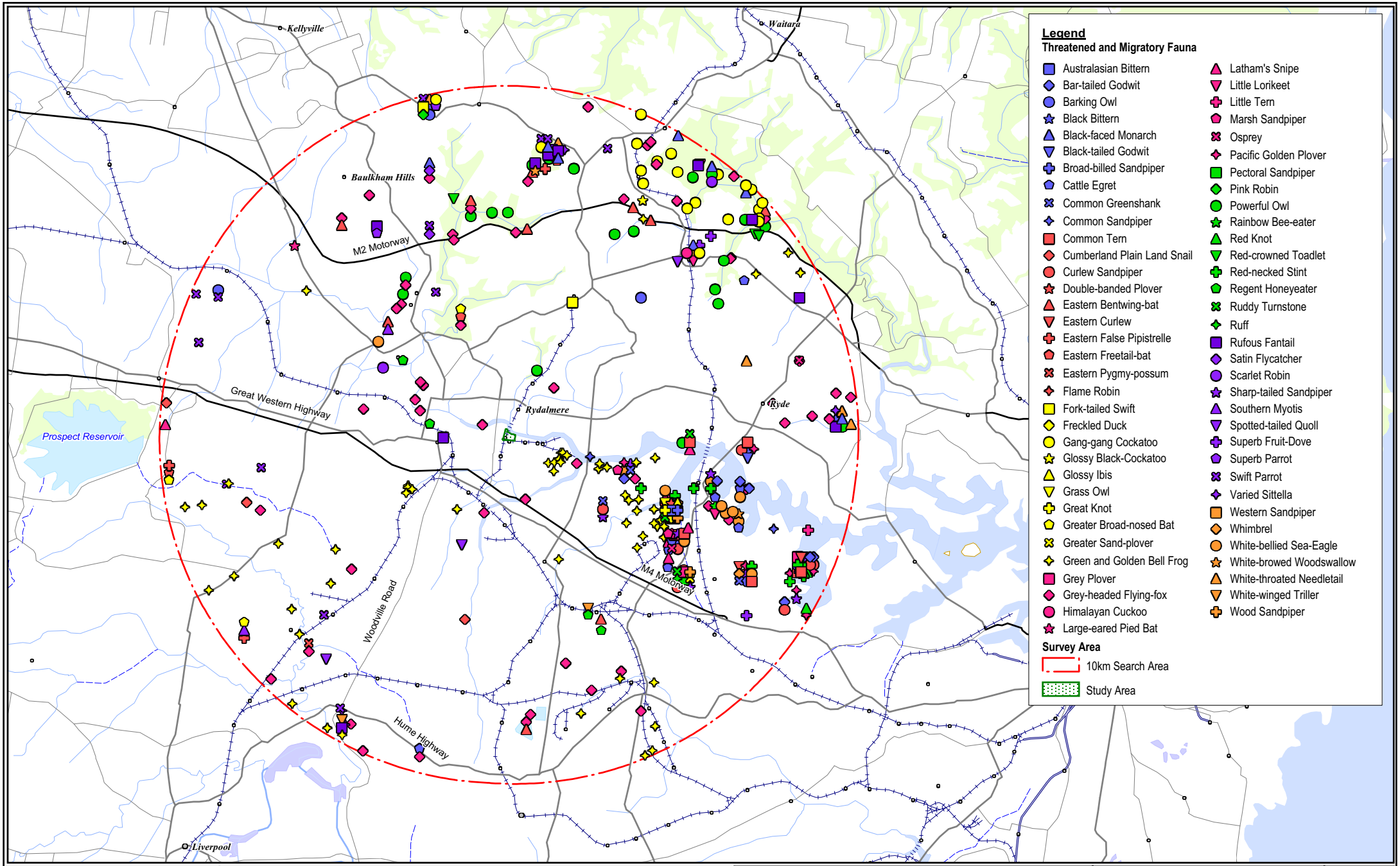

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Figure 5: Threatened and migratory fauna listed on the TSC and EPBC Acts that have been recorded within 10 km of the study area

Date: 18 August 2010	Drawn by: ANP
File number: 11755	Checked by: BJS
Location:-..P:\11700s\11755\Mapping\11755 F5 Fauna.WOR	

Acknowledgements:
Species data from DECCW/NPWs and Biosis Research Pty Ltd

0 1 2 3 4 5
kilometres

Scale: 1:100,000at A3
Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

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Figure 5

PLATES

Plate 1: Concrete capping within the Study Area.

Plate 2: Concrete wall adjacent to Parramatta River. Note foreshore erosion and patch of Mangrove Forest.

Plate 3: Stormwater drain to the north west of the Study Area.

Plate 4: Recolonising *Casuarina glauca* within the Study Area

APPENDICES

APPENDIX 1

Flora Results

Plant species recorded in the Study Area.

Weeds	Scientific Name	Common Name
P	*Acacia parramattensis*	Parramatta Wattle
	Aegiceras corniculatum	River Mangrove
*	*Ageratina adenophora*	Crofton Weed
*	*Araujia sericifera*	Moth Vine
	Avicennia marina subsp. *australasica*	White Mangrove
*	*Bidens pilosa*	Cobbler's Pegs
P	*Bursaria spinosa* subsp. *spinosa*	Sweet Bursaria
P	*Callitris columellaris*	Callitris
*	*Cardiospermum grandiflorum*	Balloon Vine
	Casuarina glauca	Swamp Oak
*	*Cinnamomum camphora*	Camphor Laurel
*	*Conyza albida*	Tall Fleabane
*	*Cortaderia selloana*	Pampas Grass
P	*Corymbia eximia*	Yellow Bloodwood
*	*Cotoneaster spp.*	Cotoneaster
*	*Crassocephalum crepidioides*	Thickhead
	Cynodon dactylon	Common Couch
*	*Cyperus eragrostis*	Umbrella Sedge
*	*Cyperus papyrus*	Cyperus
*	*Ehrharta erecta*	Panic Veldtgrass
*	*Erythrina crista-galli*	Cockspur Coral Tree
P	*Eucalyptus microcorys*	Tallowwood
P	*Eucalyptus nicholii*	Narrow-leaved Black Peppermint
P	*Eucalyptus saligna*	Sydney Blue Gum
P	*Eucalyptus* sp.	Eucalyptus
P ?	*Eucalyptus tereticornis*	Forest Red Gum
*	*Euphorbia spp.*	Euphorbia
P	*Ficus macrophylla ssp. macrophylla*	Moreton Bay Fig
	Ficus rubiginosa	Ficus
P	*Ficus microcarpa* var. *hillii*	Hills Weeping Fig
*	*Foeniculum vulgare*	Fennel
P	*Grevillea robusta*	Silky Oak
*	*Hedera helix*	English Ivy
*	*Hyparrhenia hirta*	Coolatai Grass
*	*Ipomoea indica*	Blue Morning Glory
*	*Jacaranda mimosifolia*	Jacaranda
	Juncus sp.	Juncus
P	*Lomandra longifolia*	Spiny-headed Mat-rush
P	*Lophostemon confertus*	Brush Box
P	*Melaleuca quinquenervia*	Paperbark
*	*Melinis repens*	Red Natal Grass
*	*Olea europaea* subsp. *cuspidata*	Olea
*	*Parietaria judaica*	Pellitory
*	*Pennisetum clandestinum*	Kikuyu Grass
*	*Plantago lanceolata*	Lamb's Tongues
P	*Populus nigra* cv. *'Italica'*	Populus
	Pteris vittata	Chinese Brake

Weeds	Scientific Name	Common Name
*	*Ricinus communis*	Castor Oil Plant
*	*Rubus fruticosus*	Blackberry complex
P	*Schefflera actinophylla*	Umbrella Tree
*	*Setaria gracilis*	Slender Pigeon Grass
*	*Sida rhombifolia*	Paddy's Lucerne
	Suaeda australis	Austral Seablite
	Tetragonia tetragonioides	New Zealand Spinach
P	*Ulmus parvifolia*	Ulmus
*	*Verbena bonariensis*	Purpletop
*	*Washintonia filifera*	Cotton Palm

LEGEND

* Denotes exotic species
P - Denotes planted individuals

APPENDIX 2

Fauna Results

Family Name	Latin Name	Common Name	Introduced	Observation
Columbidae	*Columba livia*	Rock Dove	*	O
Columbidae	*Streptopelia chinensis*	Spotted Turtle-Dove	*	O
Sturnidae	*Acridotheres tristis*	Common Myna	*	OH
Sturnidae	*Sturnus vulgaris*	Common Starling	*	H
Artamidae	*Grallina cyanoleuca*	Magpie-lark		OH
Artamidae	*Strepera graculina*	Pied Currawong		OH
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike		O
Corvidae	*Corvus coronoides*	Australian Raven		O
Dicruridae	*Rhipidura leucophrys*	Willie Wagtail		OH
Falconidae	*Falco cenchroides*	Nankeen Kestrel		O
Hirundinidae	*Hirundo neoxena*	Welcome Swallow		O
Maluridae	*Malurus cyaneus*	Superb Fairy-wren		OH
Meliphagidae	*Anthochaera chrysoptera*	Little Wattlebird		OH
Meliphagidae	*Lichenostomus penicillatus*	White-plumed Honeyeater		O
Meliphagidae	*Manorina melanocephala*	Noisy Miner		H
Pardalotidae	*Acanthiza nana*	Yellow Thornbill		OH
Passeridae	*Taeniopygia bichenovii*	Double-barred Finch		OH
Pelecanidae	*Pelecanus conspicillatus*	Australian Pelican		O
Phalacrocoracidae	*Phalacrocorax melanoleucos*	Little Pied Cormorant		O
Psittacidae	*Trichoglossus haematodus*	Rainbow Lorikeet		OH
Threskiornithidae	*Threskiornis molucca*	Australian White Ibis		O

Key: Type of record O – Seen, H – Heard

APPENDIX 3

Threatened Flora Habitat Descriptions

Table 5: Threatened flora listed on the TSC and/or EPBC Acts that may occur in the local area

Key: 1) Listed on the EPBC Act as Endangered (E) or Vulnerable (V)
2) Listed on the TSC Act as Endangered (E), Vulnerable (V), (Ex) Extinct or Endangered Population (EP)

Latin Name Common Name	EPBC Act[1]	TSC Act [2]	Habitat	Potential Habitat?
Acacia bynoeana Bynoe's Wattle	V	E1	*Acacia bynoeana* is found in central eastern NSW, in the following catchment regions – Hawkesbury/Nepean, Hunter/Central Rivers, Southern Rivers, and Sydney Metropolitan. It seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and recently burnt patches (DEC 2005a). It grows in sandy clay soils often containing ironstone gravels (Fairley 2004). Main vegetation types include heath or dry sclerophyll forest on sandy soils (DEC 2005a).	No
Acacia prominens Gosford Wattle	-	EP	Occurs at a few sites along the railway line at Penshurst, at Carss Bush Park, Carss Park and there is an unconfirmed siting at Oatley Park, Oatley. Grows in open situations on clayey or sandy soils.	No
Acacia pubescens Downy Wattle	V	V	*Acacia pubescens* is found in Sydney Metropolitan. It occurs on alluviums, shales and at the intergrade between shales and sandstones. The species occurs in open woodland and forest, in a variety of plant communities, including Cooks River/ Castlereagh Ironbark Forest, Shale/ Gravel Transition Forest and Cumberland Plain Woodland (NPWS 2003).	No
Apatophyllum constablei	E	-	Known from four sites, three of which are within Wollemi National Park near Gospers Mountain and Coorongooba Creek, the fourth of which is about 2 km from Glen Davis. Occurs in dry sclerophyll forest on slopes with a north to north-westerly aspect.	No

Latin Name Common Name	EPBC Act[1]	TSC Act [2]	Habitat	Potential Habitat?
Bothriochloa biloba Lobed Blue-grass	V	-	Found in woodland on nutrient poor soils (Harden 1993). This species has a strong preference for heavier textured soils and has previously been recorded on volcanic soils.	No
Caladenia tessellate Tessellated Spider Orchid	V	E1	*Caladenia tessellata* is found in the following Catchment Management Regions Sydney Metropolitan. It is generally found in grassy, dry sclerophyll forests/woodland, particularly those associated with clay loam, or sandy soils.	No
Callistemon linearifolius	-	V	Occurs chiefly from Georges River to the Hawkesbury River where it grows in dry sclerophyll forest (Harden 2002), open forest, scrubland (Fairley and Moore 2000) or woodland on sandstone.	No
Cryptostylis hunteriana Leafless Tongue Orchid	V	V	This species does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland. Often found in association with *Cryptostylis subulata* (DEC 2005d).	No
Darwinia biflora	V	V	Occurs in Sydney Metropolitan. Is found on the edges of weathered shale-capped ridges, where these intergrade with Hawkesbury Sandstone. Vegetation communities include: Sydney Coastal Dry Sclerophyll Forest and Sydney Coastal Heaths.	No
Deyeuxia appressa	E	E1	Only occurs in Sydney Metropolitan Catchment Region. A highly endemic species known only from two pre-1942 records in the Sydney area. Was first collected in 1930 at Herne Bay, Saltpan Creek. Was then collected in 1941 from Killara, near Hornsby. Has not been collected since and may now be extinct (DEC 2005e).	No

Latin Name Common Name	EPBC Act[1]	TSC Act [2]	Habitat	Potential Habitat?
Dillwynia tenuifolia	V	V1	The core distribution is the Cumberland Plain In western Sydney, may be locally abundant particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays. May also be common in transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland (DEC 2005f).	No
Epacris purpurascens var. purpurascens	-	V	*Epacris purpurascens var. purpurascens* grows in Dry Sclerophyll forests, scrub and swamps (Harden 1992a). Characteristically found in a range of habitat types, most of which have a strong shale soil influence.	No
Eucalyptus nicholii Narrow-leaved Black Peppermint	V	V	This species is widely planted as an urban street tree and in gardens but is quite rare in the wild. It is confined to the New England Tablelands of NSW, where it occurs from Nundle to north of Tenterfield, largely on private property. Grows in dry grassy woodland, on shallow and infertile soils, mainly on granite (DEC 2005h).	Yes, Planted within proximity of the Study Area.
Genoplesium baueri Bauer's Midge Orchid	-	V	This terrestrial orchid species grows in open sclerophyll forest or moss gardens on sandstone.	No
Grammitis stenophylla Narrow-leaf Finger Fern	-	E1	Occurs in eastern NSW in the Sydney Metropolitan Area. Common vegetation communities associated are Dry Sclerophyll Forest, Forested wetlands, Freshwater wetlands, Rainforests, and wet sclerophyll forests (DEC 2005j).	No
Grevillea parviflora ssp. *parviflora* Small-flower Grevillea	V	V	*Grevillea parviflora* ssp. *parviflora* grows on sandy clay loam soils, often with ironstone gravels. Soils are mostly derived from Tertiary sands or alluvium and from the Mittagong Formation with alternating bands of shale and fine-grained sandstones (NPWS 2002a).	No

Latin Name Common Name	EPBC Act[1]	TSC Act [2]	Habitat	Potential Habitat?
Hibbertia superans	-	E1	Occurs in both open woodland and heathland, and appears to prefer open disturbed areas, such as tracksides. Most occurrences are in or near Shale/Sandstone Transition Forest.	No
Leptospermum deanei	V	V	The species grows on sandy alluvial soils and sand over sandstone on lower hill slopes and riparian zones. Associated vegetation communities include riparian shrubland, woodland and open forest.	No
Marsdenia viridiflora ssp. *viridiflora* Native Pear	-	EP	Grows in woodland and scrub (Harden 1992a) and is typically found in Sydney Turpentine Ironbark Forest (NSW Scientific Committee 2003a). Grows in vine thickets and open shale woodland.	No
Melaleuca biconvexa Biconvex Paperbark	V	V	Biconvex Paperbark generally grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects. Flowering occurs over just 3-4 weeks in September and October (DEC 2005l).	No
Melaleuca deanei Dean's Melaleuca	V	V	The species grows in wet heath on sandstone (Harden 1991) and Dry Sclerophyll Forests. Flowers appear in summer but seed production appears to be small and consequently the species exhibits a limited capacity to regenerate (DEC 2005m).	No
Persoonia nutans Nodding Geebung	E	E1	Confined to aeolian and alluvial sediments and occurs in a range of sclerophyll forest and woodland vegetation communities with the majority of individuals occurring within Agnes Banks Woodland or Castlereagh Scribbly Gum Woodland (DEC 2005n).	No
Pimelea curviflora var. *curviflora*	V	V	Occurs on lateritic soils and shale-sandstone transition soils on ridge tops in woodland. Associated with Dry Sclerophyll forests and Coastal valley grassy woodlands.	No

Latin Name Common Name	EPBC Act[1]	TSC Act [2]	Habitat	Potential Habitat?
Pimelea spicata Spiked Rice-flower	E	E1	Once widespread on the Cumberland Plain, *Pimelea spicata* occurs in two disjunct areas, the Cumberland Plain and the Illawarra. In western Sydney, *P. spicata* occurs on an undulating topography of substrates derived from Wianamatta Shale in areas supporting, or that previously supported, Cumberland Plain Woodland.	No
Pomaderris prunifolia	-	E2	At Rydalmere it occurs along a road reserve near a creek, among grass species on sandstone. At Rookwood Cemetery it occurs in a small gully of degraded Cooks River / Castlereagh Ironbark Forest on shale soils (DEC 2005o).	No
Prostanthera marifolia	X	E4	Grows in sclerophyll forest and woodland, usually near the coast, in sandy loamy soils, overlying sandstone; confined to the Sydney district (Harden 1992b).	No
Pultenaea pedunculata Matted Bush-pea	-	E1	Restricted to the Cumberland Plain and near Merimbula where it grows in dry sclerophyll forest and disturbed sites (Harden 2002).	No
Syzygium paniculatum Magenta Lilly Pilly	V	V	Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest.	No
Tetratheca glandulosa	V	V	Associated with shale-sandstone transition habitat where shale-capping occur over sandstone, with associated soil landscapes such as Lucas Heights, Gymea, Lambert and Faulconbridge. Vegetation structure varies from heaths and scrub to woodlands/open woodlands, and open forest.	No
Wahlenbergia multicaulis Tadgell's Bluebell	-	EP	Grows in forest, woodland and grassland, chiefly in coastal and tablelands Found in damp, disturbed sites and grows in a variety of habitats including forest, woodland, scrub, grassland and the edges of watercourses and wetlands.	No

Latin Name Common Name	EPBC Act[1]	TSC Act [2]	Habitat	Potential Habitat?
Wilsonia backhousei Narrow-leafed Wilsonia	-	V	In NSW *Wilsonia backhousei* is found in the Southern Rivers and Sydney Metropolitan Catchment Area, including on the Parramatta River at Ermington (DEC 2005u). This is a species of the margins of salt marshes and lakes, both coastal and inland, chiefly in the Sydney district.	**Yes Marginal potential habitat within Mangrove Forest**

† Unless otherwise specified, all habitat information is derived from DECC threatened species profiles, see http://threatenedspecies.environment.nsw.gov.au/tsprofile/index.aspx

APPENDIX 4

Threatened Fauna Habitat Descriptions

Table 6: Terrestrial fauna listed on the TSC and/or EPBC Acts that may occur in the local area

Key: 1) Listed on the EPBC Act as Endangered (E), Vulnerable (V) or covered under migratory provisions (M) on the EPBC Act
2) Listed on the TSC Act as Endangered (E) or Vulnerable (V)

Family Name	Latin Name Common Name	EPBC Act[1]	TSC Act [2]	Habitat	Potential Habitat?
Amphibians					
Hylidae	*Litoria aurea* Green and Golden Bell Frog	V	E1	Most existing locations for the species occur as small, coastal, or near coastal populations, with records occurring between south of Grafton and northern VIC (NSW Government 2009). The species is found in marshes, dams and stream sides, particularly those containing bullrushes or spikerushes. Preferred habitat contains water bodies that are unshaded, are free of predatory fish, have a grassy area nearby and have diurnal sheltering sites nearby such as vegetation or rocks (NPWS 1999f; White and Pyke 1996), although the species has also been recorded from highly disturbed areas including disused industrial sites, brick pits, landfill areas and cleared land. Breeding usually occurs in summer. Tadpoles, which take approximately 6 weeks to develop, feed on algae and other vegetative matter. Adults eat insects as well as other frogs, including juveniles of their own species (DEC 2005k).	No

Family Name	Latin Name Common Name	EPBC Act[1]	TSC Act [2]	Habitat	Potential Habitat?
Hylidae	*Litoria raniformis* Southern Bell Frog	V	E1	In NSW the species is known to exist only in isolated populations in the Coleambally Irrigation Area, the Lowbidgee floodplain and around Lake Victoria. Usually found in or around permanent or ephemeral swamps or billabongs with an abundance of bulrushes and other emergent vegetation along floodplains and river valleys. They are also found in irrigated rice crops, particularly where there is no available natural habitat. Outside the breeding season animals disperse away from the water and take shelter beneath ground debris such as fallen timber and bark, rocks, grass clumps and in deep soil cracks (Robinson 1993; DEC 2005r).	No
Myobatrachidae	*Heleioporus australiacus* Giant Burrowing Frog	V	V	Prefers hanging swamps on sandstone shelves adjacent to perennial non-flooding creeks (Daly 1996; Recsei 1996). Can also occur within shale outcrops within sandstone formations. Known from wet and dry forests and montane woodland in the southern part range (Daly 1996). Individuals can be found around sandy creek banks or foraging along ridge-tops during or directly after heavy rain. Males often call from burrows located in sandy banks next to water (Barker *et al.* 1995). Spends the majority of its time in non-breeding habitat 20-250m from breeding sites (Penman *et al.* 2008).	No

Family Name	Latin Name Common Name	EPBC Act[1]	TSC Act [2]	Habitat	Potential Habitat?
Myobatrachidae	*Mixophyes balbus* Stuttering Frog	V	E1	This species is usually associated with mountain streams, wet mountain forests and rainforests (Barker *et al.* 1995). It rarely moves very far from the banks of permanent forest streams, although it will forage on nearby forest floors. Eggs are deposited in leaf litter on the banks of streams and are washed into the water during heavy rains (Barker *et al.* 1995).	No
Myobatrachidae	*Mixophyes iterates* Giant Barred Frog	E	E1	Occurs along coast and ranges from south-eastern Queensland to the Hawkesbury River in NSW. Found in rainforests, moist eucalypt forest and nearby dry eucalypt forest, at elevations below 1000 m, often hiding in leaf litter near permanent fast-flowing streams. Females lay eggs onto moist creek banks or rocks above water level, from where tadpoles drop into the water when hatched. When not breeding the frogs disperse hundreds of metres away from streams (DEC 2005i).	No
Myobatrachidae	*Pseudophryne australis* Red-crowned Toadlet	-	V	Occurs on wetter ridge tops and upper slopes of sandstone formations on which the predominant vegetation is dry open forests and heaths. This species typically breeds within small ephemeral creeks characterised by a series of shallow pools that feed into larger semi-perennial streams (Thumm and Mahony 1997). Breeds all year round (Thumm and Mahoney 2002).	No
Birds					

Family Name	Latin Name Common Name	EPBC Act[1]	TSC Act [2]	Habitat	Potential Habitat?
Accipitridae	*Haliaeetus leucogaster* White-bellied Sea-eagle	M	-	A migratory species that is generally sedentary in Australia, although immature individuals and some adults are dispersive (Marchant and Higgins 1993). Found in terrestrial and coastal wetlands; favouring deep freshwater swamps, lakes and reservoirs; shallow coastal lagoons and saltmarshes. It hunts over open terrestrial habitats. Feeds on birds, reptiles, fish, mammals, crustaceans and carrion. Roosts and makes nest in trees (Marchant and Higgins 1993).	No, but may fly over site.
Accipitridae	*Pandion haliaetus* Osprey	M	V	Found in coastal waters, inlets, estuaries and offshore islands. Occasionally found 100 km inland along larger rivers (Pizzey and Knight 1997). It is water-dependent, hunting for fish in clear, open water. The Osprey occurs in terrestrial wetlands, coastal lands and offshore islands. It is a predominantly coastal species, generally using marine cliffs as nesting and roosting sites. Nests can also be made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea (Marchant and Higgins 1993).	No, but may fly over site.
Anatidae	*Stictonetta naevosa* Freckled Duck	-	V	The freckled duck breeds in permanent fresh swamps that are heavily vegetated. Found in fresh or salty permanent open lakes, especially during drought. Often seen in groups on fallen trees and sand spits (Simpson and Day 1996).	No

Family Name	Latin Name Common Name	EPBC Act[1]	TSC Act [2]	Habitat	Potential Habitat?
Apodidae	*Apus pacificus* Fork-tailed Swift	M	-	The fork-tailed swift breeds in Asia but migrates to Australia from September to April (Higgins 1999). Individuals or flocks can be observed hawking for insects at varying heights from only a few metres from the ground and up to 300 metres high (Boehm 1944).	No
Apodidae	*Hirundapus caudacutus* White-throated Needletail	M	-	An aerial species found in feeding concentrations over cities, hilltops and timbered ranges. Breeds in Asia (Pizzey and Knight 1997).	No
Ardeidae	*Ardea alba* Great Egret	M	-	Terrestrial wetlands, estuarine and littoral habitats and moist grasslands. Inland, prefer permanent waterbodies on floodplains; shallows of deep permanent lakes (either open or vegetated), semi-permanent swamps with tall emergent vegetation and herb dominated seasonal swamps with abundant aquatic flora. Also regularly use saline habitats including mangrove forests, estuarine mudflats, saltmarshes, bare saltpans, shallows of salt lakes, salt fields and offshore reefs. Breeding requires wetlands with fringing trees in which to build nests including mangrove forest, freshwater lakes or swamps and rivers (Marchant and Higgins 1990).	No
Ardeidae	*Ardea ibis* Cattle Egret	M	-	Occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands (Marchant and Higgins 1990).	No

Family Name	Latin Name Common Name	EPBC Act[1]	TSC Act [2]	Habitat	Potential Habitat?
Ardeidae	*Botaurus poiciloptilus* Australasian Bittern	-	V	The Australasian Bittern is distributed across south-eastern Australia. Often found in terrestrial and estuarine wetlands, generally where there is permanent water with tall, dense vegetation including *Typha* spp. and *Eleocharis* spp. (DECC 2005; NPWS 1999a). Typically this bird forages at night on frogs, fish and invertebrates, and remains inconspicuous during the day. The breeding season extends from October to January with nests being built amongst dense vegetation on a flattened platform of reeds (DECC 2005).	No
Ardeidae	*Ixobrychus flavicollis* Black Bittern	-	V	The Black Bittern is found along the coastal plains within NSW, although individuals have rarely being recorded south of Sydney or inland. It inhabits terrestrial and estuarine wetlands such as flooded grasslands, forests, woodlands, rainforests and mangroves with permanent water and dense waterside vegetation (DEC 2005c; NPWS 1999b). The Black Bittern typically roosts on the ground or in trees during the day and forages at night on frogs, reptiles, fish and invertebrates (DEC 2005c). The breeding season extends from December to March. Nests are constructed of reeds and sticks in branches overhanging the water.	No

Family Name	Latin Name Common Name	EPBC Act[1]	TSC Act [2]	Habitat	Potential Habitat?
Artamidae	*Artamus superciliosus* White-browed Woodswallow	-	PD (V)	Mainly inhabits open eucalypt, sheoak and Acacia woodland; forest; riparian zones; and, grasslands with few or no trees and sparsely scattered shrubs (including farmland) (Higgins *et al.* 2006). In NSW the species is widespread on the inland slopes of the Great Divide and western plains; occurs more sparsely east of the Great Divide (Higgins *et al.* 2006). The species eats arthropods, including insects that swarm above vegetation, plus some nectar and small native fruits (NSW Scientific Committee 2009c). Will nest in a tree fork, tree crevice, foliage, vine, stump or artificial structure (NSW Scientific Committee 2009c).	No
Cacatuidae	*Callocephalon fimbriatum* Gang-gang Cockatoo	-	V	In summer, occupies tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests (Higgins 1999). Also occur in subalpine Snow Gum woodland and occasionally in temperate or regenerating forest (Forshaw and Cooper 1981). In winter, occurs at lower altitudes in drier, more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas (Shields and Crome 1992). It requires tree hollows in which to breed (Gibbons and Lindenmayer 1997).	No

Family Name	Latin Name Common Name	EPBC Act[1]	TSC Act [2]	Habitat	Potential Habitat?
Cacatuidae	*Calyptorhynchus lathami* Glossy Black-cockatoo	-	V	Inhabits forest with low nutrients, characteristically with key Allocasuarina species. Tends to prefer drier forest types (NPWS 1999d). Often confined to remnant patches in hills and gullies. Breed in hollows stumps or limbs, either living or dead (Higgins 1999).	No
Charadriidae	*Charadrius bicinctus* Double-banded Plover	M	-	Tidal mudflats, beaches, exposed reefs, salt marshes, freshwater wetlands, inland salt lakes, short grass on golf courses, airfields (Morcombe 2006).	No
Charadriidae	*Charadrius leschenaultia* Greater Sand Plover	M	V	Entirely coastal in NSW, foraging on intertidal sand and mudflats in estuaries and roosting during high tide on sandy beaches or rocky shores. Individuals have been recorded on inshore reefs, rock platforms, small rocky islands and sand cays on coral reefs, within Australia. Occasional sightings have also occurred on near-coast saltlakes, brackish swamps, shallow freshwater wetlands and grassed paddocks (NPWS 1999e).	No
Charadriidae	*Charadrius mongolus* Lesser Sand Plover	M	V	In Australia, the species is known to favour coastal environs including beaches, mudflats and mangroves. Within NSW, individuals have been observed on intertidal sand and mudflats in estuaries or roosting on sandy beaches or rocky shores at high tide (NPWS 1999g).	No
Charadriidae	*Pluvialis fulva* Pacific Golden Plover	M	-	Migratory species that visits estuaries mudflats, saltmarshes and ocean shores as well as paddocks, grasslands and swamps near the coast (Pizzey and Knight 1997).	No

Family Name	Latin Name Common Name	EPBC Act[1]	TSC Act [2]	Habitat	Potential Habitat?
Charadriidae	*Pluvialis squatarola* Grey Plover	M	-	Almost entirely coastal, but occasionally recorded on inland wetlands. Mainly on marine shores, inlets, estuaries and lagoons where there are nearby large tidal mudflats or sandflats for feeding and sandy beaches for roosting (Marchant and Higgins 1993).	No
Columbidae	*Ptilinopus superbus* Superb Fruit-Dove	-	V	The Superb Fruit Dove's NSW distribution ranges from northern NSW to as far south as Moruya (DEC 2005s). It is found in rainforests, closed forests (including mesophyll vine forests) and sometimes in eucalypt and acacia woodlands where there are fruit-bearing trees (Higgins and Davies 1996). It forages in the canopy of fruiting trees such as figs and palms. Nests are constructed high in the canopy throughout September to January (DEC 2005s).	No
Cuculidae	*Cuculus saturatus* Oriental Cuckoo	M	-	Canopy or shrub layer of monsoon rainforest, vine thickets, wet sclerophyll forest, or open casuarina, Acacia or Eucalyptus woodland (Higgins 1999).	No
Dicruridae	*Monarcha melanopsis* Black-faced Monarch	M	-	A migratory species found during the breeding season in damp gullies in temperate rainforests. Disperses after breeding into more open woodland (Pizzey and Knight 1997).	No
Dicruridae	*Myiagra cyanoleuca* Satin Flycatcher	M	-	Migratory species that occurs in coastal forests, woodlands and scrubs during migration. Breeds in heavily vegetated gullies (Pizzey and Knight 1997).	No
Dicruridae	*Rhipidura rufifrons* Rufous Fantail	M	-	Migratory species that prefers dense, moist undergrowth of tropical rainforests and scrubs. During migration it can stray into gardens and more open areas (Pizzey and Knight 1997).	No

Family Name	Latin Name Common Name	EPBC Act[1]	TSC Act [2]	Habitat	Potential Habitat?
Laridae	*Sterna albifrons* Little Tern	M	E1	The Little Tern favours sheltered coasts, harbours, bays, lakes, inlets, estuaries, coastal lagoons and ocean beaches especially with sand-spits and sand islets (Higgins and Davies 1996; Morcombe 2006).It forages over shallow waters close inshore or over sandbars and reefs (Morcombe 2006).	No
Laridae	*Sterna hirundo* Common Tern	M	-	Marine, typically well offshore, but also in coastal waters, sheltered bays, estuaries, and on ocean beaches (Morcombe 2006).	No

Family Name	Latin Name Common Name	EPBC Act[1]	TSC Act [2]	Habitat	Potential Habitat?
Meliphagidae	*Anthochaera Phrygia* Regent Honeyeater	E	E1	A semi-nomadic species occurring in temperate eucalypt woodlands and open forests. Most records are from box-ironbark eucalypt forest associations and wet lowland coastal forests (NPWS 1999h; Pizzey and Knight 1997). Key eucalypt species include Mugga Ironbark, Yellow Box, Blakely's Red Gum, White Box and Swamp Mahogany. Also utilises: *Eucalyptus microcarpa, E. punctata, E. polyanthemos, E. moluccana, E. robusta, E. crebra, E. caleyi, Corymbia maculata, E. mckieana, E. macrorhyncha, E. laevopinea*, and *Angophora floribunda*. Nectar and fruit from the mistletoes *Amyema miquelii, A. pendula, A. cambagei* are also eaten during the breeding season (DEC 2005q). Regent Honeyeaters usually nest in horizontal branches or forks in tall mature eucalypts and sheoaks. Also nest in mistletoe haustoria. An open cup-shaped nest is constructed of bark, grass, twigs and wool by the female (DEC 2005q).	No
Meropidae	*Merops ornatus* Rainbow Bee-eater	M	-	Usually occurs in open or lightly timbered areas, often near water. Nest in embankments, including banks of creeks and rivers, in sand dunes, in quarries and in roadside cuttings. Breeding occurs from November to January. It has complex migratory movements in Australia. NSW populations migrate north for winter (Higgins 1999).	No

Family Name	Latin Name Common Name	EPBC Act[1]	TSC Act [2]	Habitat	Potential Habitat?
Neosittidae	*Daphoenositta chrysoptera* Varied Sittella	-	V	The Varied Sittella is a sedentary species which inhabits a wide variety of dry eucalypt forests and woodlands, usually with either shrubby understorey or grassy ground cover or both, in all climatic zones of Australia. Usually inhabit areas with rough-barked trees, such as stringybarks or ironbarks, but also in mallee and acacia woodlands, paperbarks or mature Eucalypts (Higgins and Peter 2002; NSW Scientific Committee 2010). The Varied Sittella feeds on arthropods gleaned from bark, small branches and twigs. It builds a cup-shaped nest of plant fibres and cobweb in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years (NSW Scientific Committee 2010).	No
Petroicidae	*Petroica boodang* Scarlet Robin	-	V	During the breeding season the Scarlet Robin is found in eucalypt forests and temperate woodlands, often on ridges and slopes. During autumn and winter it moves to more open and cleared areas. It has dispersive or locally migratory seasonal movements. The Scarlet Robin forages amongst logs and woody debris for insects which make up the majority of its diet (NSW Scientific Committee 2009b). The nest is an open cup of plant fibres and cobwebs, sited in the fork of a tree (often a dead branch in a live tree, or in a dead tree or shrub) which is usually more than 2 m above the ground (NSW Scientific Committee 2009b). It is conspicuous in open and suburban habitats (Morcombe 2006).	No

Family Name	Latin Name Common Name	EPBC Act[1]	TSC Act [2]	Habitat	Potential Habitat?
Petroicidae	*Petroica phoenicea* Flame Robin	-	V	Flame Robins are found in a broad coastal band from southern Queensland to just west of the South Australian border (Australian Museum 2009). The species is also found in Tasmania. The preferred habitat in summer includes moist eucalyptus forests and open woodlands, whilst in winter prefers open woodlands and farmlands (NSW Scientific Committee 2009a). It is considered migratory. The Flame Robin breeds from about August to January (Morcombe 2006).	No
Petroicidae	*Petroica rodinogaster* Pink Robin	-	V	The Pink Robin is found in dense, dank forests and tree fern gullies (Pizzey and Knight 1997). During the winter months the Pink Robin disperses north (as far up as the central coast of NSW) and west (as far as the ACT area) into more open forests, woodlands and scrublands (DECCW 2005).	No
Psittacidae	*Glossopsitta pusilla* Little Lorikeet	-	V1	Distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range in NSW, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. Mostly occur in dry, open eucalypt forests and woodlands. They feed primarily on nectar and pollen in the tree canopy. Nest hollows are located at heights of between 2 m and 15 m, mostly in living, smooth-barked eucalypts. Most breeding records come from the western slopes (NSW Scientific Committee 2008).	No

Family Name	Latin Name Common Name	EPBC Act[1]	TSC Act [2]	Habitat	Potential Habitat?
Psittacidae	*Lathamus discolour* Swift Parrot	E	E1	The Swift Parrot occurs in woodlands and forests of NSW from May to August, where it feeds on eucalypt nectar, pollen and associated insects (Forshaw and Cooper 1981). The Swift Parrot is dependent on flowering resources across a wide range of habitats in its wintering grounds in NSW (Shields and Crome 1992). Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta,* Spotted Gum *Corymbia maculata*, Red Bloodwood *C. gummifera,* Mugga Ironbark *E. sideroxylon*, and White Box *E. albens*. Commonly used lerp infested trees include Grey Box *E. microcarpa,* Grey Box *E. moluccana* and Blackbutt *E. pilularis* (DEC 2005t). This species is migratory, breeding in Tasmania and also nomadic, moving about in response to changing food availability (Pizzey and Knight 1997).	No
Psittacidae	*Polytelis swainsonii* Superb Parrot	V	V	Found mainly in open, tall riparian River Red Gum forest or woodland. Often found in farmland including grazing land with patches of remnant vegetation. Breeds in hollow branches of tall Eucalypt trees within 9 km of feeding areas (Higgins 1999).	No
Rostratulidae	*Rostratula australis* Australian Painted Snipe	VM	E1	Usually found in shallow inland wetlands including farm dams, lakes, rice crops, swamps and waterlogged grassland. They prefer freshwater wetlands, ephemeral or permanent, although they have been recorded in brackish waters (Marchant and Higgins 1993).	No

Family Name	Latin Name Common Name	EPBC Act[1]	TSC Act [2]	Habitat	Potential Habitat?
Scolopacidae	*Actitis hypoleucos* Common Sandpiper	M	-	Inhabits a wide range of coastal and inland wetlands, often with muddy or rocky margins. Also known to occur at estuaries, billabongs, dams, pools and lakes, often associated with mangroves (Higgins and Davies 1996).	Yes
Scolopacidae	*Arenaria interpres* Ruddy Turnstone	M	-	Inhabits tidal reefs, sandy beaches mudflats and exposed or shallow seaweed beds (Pizzey and Knight 1997).	No
Scolopacidae	*Calidris acuminate* Sharp-tailed Sandpiper	M	-	Inland waters, coastal (Simpson and Day 1996).	No
Scolopacidae	*Calidris canutus* Red Knot	M	-	Typically located within intertidal mudflats, sandflats and sandy beaches of sheltered coasts. Occasionally found on sandy open beaches or shallow pools, or in saline wetlands close to the coast (Higgins and Davies 1996).	No
Scolopacidae	*Calidris ferruginea* Curlew Sandpiper	M	-	Inhabits sheltered intertidal mudflats. Also non-tidal swamps, lagoons and lakes near the coast. Infrequently recorded inland (Higgins and Davies 1996).	No
Scolopacidae	*Calidris mauri* Western Sandpiper	M	-	Found in tidal mudflats, and tidal wetlands (Pizzey and Knight 2007).	No
Scolopacidae	*Calidris melanotos* Pectoral Sandpiper	M	-	Scarce, but regular visitor, usually recorded in summer from November to March (Slater *et al.* 2003). Widespread but scattered records in Australia. Usually found in fresh to saline wetlands, floodplains, swamps, estuaries and lagoons, sometimes with emergent or fringing vegetation such as grass (Higgins and Davies 1996).	No
Scolopacidae	*Calidris ruficollis* Red-necked Stint	M	-	Inhabits mainly coastal environments; saltmarshes, tidal mudflats, saline and freshwater wetlands, sandy or shelly beaches and sewage ponds (Higgins and Davies 1996).	No

Family Name	Latin Name Common Name	EPBC Act[1]	TSC Act [2]	Habitat	Potential Habitat?
Scolopacidae	*Calidris tenuirostris* Great Knot	M	V	Mainly found on intertidal mudflats, sandflats and sandy beaches (Higgins and Davies 1996).	No
Scolopacidae	*Gallinago hardwickii* Latham's Snipe	M	-	Typically found on wet soft ground or shallow water with good cover of tussocks. Often found in wet paddocks, seepage areas below dams (Pizzey and Knight 1997).	No
Scolopacidae	*Gallinago megala* Swinhoe's Snipe	M	-	A vagrant visitor to northern and north-western Australia. A rare visitor to southern Australia (Morcombe 2006).	No
Scolopacidae	*Heteroscelis brevipes* Grey-tailed Tattler	M	-	Found in estuaries, sand beaches and tidal mudflats. Also in shallow river margins, both coastal and inland (Pizzey and Knight 1997).	No
Scolopacidae	*Limicola falcinellus* Broad-billed Sandpiper	M	V	Occurs in sheltered parts of coasts, such as estuaries, harbours, embayments and lagoons, which have shell or sandbanks nearby (Higgins and Davies 1996).	No
Scolopacidae	*Limosa lapponica* Bar-tailed Godwit	M	-	Coastal species, usually inhabiting intertidal sandflats, spits and banks. Less frequently found in mudflats, estuaries, coastal lagoons and harbours (Higgins and Davies 1996).	No
Scolopacidae	*Limosa limosa* Black-tailed Godwit	M	V	Mainly coastal, usually in sheltered bays, estuaries and lagoons with large intertidal mudflats or sandflats (Higgins and Davies 1996).	No
Scolopacidae	*Numenius madagascariensis* Eastern Curlew	M	-	Occurs in sheltered coasts, especially estuaries, embayments, harbours, inlets and coastal lagoons with large intertidal mudflats or sandflats often with beds of seagrass (Higgins and Davies 1996).	No

Family Name	Latin Name Common Name	EPBC Act[1]	TSC Act [2]	Habitat	Potential Habitat?
Scolopacidae	*Numenius minutus* Little Curlew	M	-	Short, dry grasslands and sedgelands, including dry floodplains and blacksoil plains, which have scattered, shallow freshwater pools. Mostly feed in dry grassland or sedgeland, either natural or artificial. Foraging sites usually occur within 5km of daytime roosting sites (Higgins and Davies 1996).	No
Scolopacidae	*Numenius phaeopus* Whimbrel	M	-	Occurs in intertidal mudflats of sheltered coasts (Higgins and Davies 1996). Also in estuaries, mangroves, coral clays and exposed reefs. Roosts in trees and mangroves (Pizzey and Knight 1997).	Yes
Scolopacidae	*Philomachus pugnax* Ruff	M	-	Rare migrant from northern Eurasia (Slater *et al.* 2003) regularly visits fresh, brackish or saline wetlands with exposed mudflats at edges, usually terrestrial but sometimes found in sheltered coast habitats (Higgins and Davies 1996).	No
Scolopacidae	*Tringa glareola* Wood Sandpiper	M	-	Freshwater swamps, lakes, flooded pasture; less frequently on brackish waters, occasionally in mangroves (Morcombe 2006).	No
Scolopacidae	*Tringa nebularia* Common Greenshank	M	-	Widely distributed throughout a range of inland wetlands and sheltered coastal habitats. Occurs in habitats with varying salinity (Higgins and Davies 1996).	No
Scolopacidae	*Tringa stagnatilis* Marsh Sandpiper	M	-	Inhabits permanent or ephemeral wetlands, including swamps, billabongs, lagoons, saltmarshes and estuaries. Forages at the edge of wetlands in shallow water (Higgins and Davies 1996).	Yes

Family Name	Latin Name Common Name	EPBC Act[1]	TSC Act [2]	Habitat	Potential Habitat?
Strigidae	*Ninox connivens* Barking Owl	-	V	Generally found in open forests, woodlands, swamp woodlands and dense scrub. Can also be found in the foothills and timber along watercourses in otherwise open country (Pizzey and Knight 1997). Territories are typically 2000 ha in NSW habitats (DEC 2005b).	No
Strigidae	*Ninox strenua* Powerful Owl	-	V	The Powerful Owl occupies wet and dry eucalypt forests and rainforests. It may inhabit both un-logged and lightly logged forests as well as undisturbed forests where it usually roosts on the limbs of dense trees in gully areas (Debus and Chafer 1994b; Debus and Chafer 1994a). Large mature trees with hollows at least 0.5 m deep are required for nesting (Garnett 1992). Tree hollows are particularly important for the Powerful Owl because a large proportion of the diet is made up of hollow-dependent arboreal marsupials (Gibbons and Lindenmayer 1997). Nest trees for this species are usually emergent with a diameter at breast height of at least 100 cm (Gibbons and Lindenmayer 1997). It has a large home range of between 450 and 1450 ha (DEC 2005p).	No
Threskiornithidae	*Plegadis falcinellus* Glossy Ibis	M	-	Terrestrial wetlands, and occasionally wet grasslands and sheltered marine habitats. Forage in shallow water over soft substrate or on grassy or muddy verges of wetlands, preferring those providing variety of water depths; avoid dry ground (Marchant and Higgins 1990).	No

Family Name	Latin Name Common Name	EPBC Act[1]	TSC Act [2]	Habitat	Potential Habitat?
Tytonidae	*Tyto capensis* Grass Owl	-	V	Occurs mainly in open tussock grassland, usually in treeless areas. Can also occur in marshy areas with tall dense tussocks of grass. Occasionally occurs in densely vegetated agricultural lands such as sugarcane fields (Higgins 1999).	No
Invertebrates					
Camaenidae	*Meridolum corneovirens* Cumberland Plain Land Snail	-	E1	Most likely restricted to Cumberland Plain, Castlereagh Woodlands and boundaries between River-flat Forest and Cumberland Plain Woodland. It is normally found beneath logs, debris and amongst accumulated leaf and bark particularly at the base of trees. May also use soil cracks for refuge (NPWS 1999c).	No
Mammals					

Family Name	Latin Name Common Name	EPBC Act[1]	TSC Act [2]	Habitat	Potential Habitat?
Burramyidae	*Cercartetus nanus* Eastern Pygmy-possum	-	V	Patchily distributed from the coast to the Great Dividing, and as far as Pilliga, Dubbo, Parkes and Wagga Wagga on the western slopes. Inhabits rainforest through to sclerophyll forest and tree heath. Banksias and myrtaceous shrubs and trees are a favoured food source. Soft fruits are eaten when flowers are unavailable and it also feeds on insects (DEC 2005g; Ward and Turner 2008). Will often nest in tree hollows, but can also construct its own nest (Turner and Ward 1995). Because of its small size it is able to utilise a range of hollow sizes including very small hollows (Gibbons and Lindenmayer 1997). Individuals will use a number of different hollows and an individual has been recorded using up to 9 nest sites within a 0.5 ha area over a 5 month period (Ward 1990). It is mainly solitary, and each individual uses several nests. Home ranges of males are generally less than 0.75 ha, and those of females are smaller (Ward and Turner 2008).	No

Family Name	Latin Name Common Name	EPBC Act[1]	TSC Act [2]	Habitat	Potential Habitat?
Dasyuridae	*Dasyurus maculatus maculatus* Spotted-tailed Quoll (southeastern mainland)	E	V	Occurs along the east coast of Australia and the Great Dividing Range (Belcher *et al.* 2008). Uses a range of habitats including sclerophyll forests and woodlands, coastal heathlands and rainforests (Dickman and Read 1992). Occasional sightings have been made in open country, grazing lands, rocky outcrops and other treeless areas (NPWS 1999k). Habitat requirements include suitable den sites, including hollow logs, rock crevices and caves, an abundance of food and an area of intact vegetation in which to forage (Edgar and Belcher 1995). 70% of the diet is medium-sized mammals, and also feeds on invertebrates, reptiles and birds. Individuals require large areas of relatively intact vegetation through which to forage (NPWS 1999i). The home range of a female is between 180 – 1000 ha, while males have larger home ranges of between 2000 – 5000 ha. Breeding occurs from May to August (Belcher *et al.* 2008).	No
Macropodidae	*Petrogale penicillata* Brush-tailed Rock-wallaby	V	E1	Occurs along the Great Dividing Range south to the Shoalhaven, and also occurs in the Warrumbungles and Mt Kaputar. Habitats range from rainforest to open woodland. It is found in areas with numerous ledges, caves and crevices, particularly where these have a northerly aspect. Individuals defend a specific rock shelter, emerging in the evening to forage on grasses and forbs, as well as browse in drier months. Home sizes range from 2-30 ha (Eldridge and Close 1995).	No

Family Name	Latin Name Common Name	EPBC Act[1]	TSC Act [2]	Habitat	Potential Habitat?
Molossidae	*Mormopterus norfolkensis* Eastern Freetail Bat	-	V	Distribution extends east of the Great Dividing Range from southern Queensland to south of Sydney (Churchill 1998). Most records are from dry eucalypt forests and woodland. Individuals tend to forage in natural and artificial openings in forests, although it has also been caught foraging low over a rocky river within rainforest and wet sclerophyll forest habitats. The species generally roosts in hollow spouts of large mature eucalypts (including paddock trees), although individuals have been recorded roosting in the roof of a hut, in wall cavities, and under metal caps of telegraph poles. Foraging generally occurs within a few kilometres of roosting sites (Churchill 2008; Hoye *et al.* 2008).	No
Potoroidae	*Potorous tridactylus* Long-nosed Potoroo	V	V	Occurs from Queensland to Victoria, normally within 50 km of the coast (Claridge *et al.* 2007). Inhabits coastal heath and wet and dry sclerophyll forests. Generally found in areas with rainfall greater than 760 mm. Requires relatively thick ground cover where the soil is light and sandy. Known to eat fungi, arthropods, fleshy fruit, seeds and plant tissue. It is solitary and sedentary, buts tends to aggregate in small groups. It has two breeding seasons, one in late winter-early spring and the other in late summer (Johnston 2008). This species appears to benefit from a lack of recent disturbance (Claridge *et al.* 2007).	No

Family Name	Latin Name Common Name	EPBC Act[1]	TSC Act [2]	Habitat	Potential Habitat?
Pteropodidae	*Pteropus poliocephalus* Grey-headed Flying-fox	V	V	Occurs along the NSW coast, extending further inland in the north. This species is a canopy-feeding frugivore and nectarivore of rainforests, open forests, woodlands, melaleuca swamps and banksia woodlands. Roosts in large colonies (camps), commonly in dense riparian vegetation. Bats commute daily to foraging areas, usually within 15 km of the day roost (Tidemann 1995) although some individuals may travel up to 70 km (Augee and Ford 1999).	Yes
Vespertilionidae	*Chalinolobus dwyeri* Large-eared Pied Bat	V	V	Occurs from the Queensland border to Ulladulla, with largest numbers from the sandstone escarpment country in the Sydney Basin and Hunter Valley (van dyck and Strahan 2008). Primarily found in dry sclerophyll forests and woodlands, but also found in rainforest fringes and subalpine woodlands (Churchill 2008; Hoye and Schulz 2008). Forages on small, flying insects below the forest canopy. Roosts in colonies of between three and 80 in caves, Fairy Martin nests and mines, and beneath rock overhangs, but usually less than 10 individuals. Likely that it hibernates during the cooler months (Churchill 2008). The only known existing maternity roost is in a sandstone cave near Coonabarabran (Pennay 2008).	No

Family Name	Latin Name Common Name	EPBC Act[1]	TSC Act [2]	Habitat	Potential Habitat?
Vespertilionidae	*Falsistrellus tasmaniensis* Eastern False Pipistrelle	-	V	Distribution extending east of the Great Dividing Range throughout the coastal regions of NSW, from the Queensland border to the Victorian border. Prefers wet high-altitude sclerophyll and coastal mallee habitat, preferring wet forests with a dense understorey but being found in open forests at lower altitudes (Churchill 2008). Apparently hibernates in winter. Roosts in tree hollows and sometimes in buildings in colonies of between 3 and 80 individuals. Often change roosts every night. Forages for beetles, bugs and moths below or near the canopy in forests with an open structure, or along trails (Law *et al.* 2008). Has a large foraging range, up to 136 ha (Churchill 2008; Law *et al.* 2008). Records show movements of up to 12 km between roosting and foraging sites (Menkhorst and Lumsden 1995).	No
Vespertilionidae	*Miniopterus schreibersii oceanensis* Eastern Bentwing Bat	-	V	Occurs from Victoria to Queensland, on both sides of the Great Dividing Range. Forms large maternity roosts (up to 100,000 individuals) in caves and mines in spring and summer. Individuals may fly several hundred kilometres to their wintering sites, where they roost in caves, culverts, buildings, and bridges. They occur in a broad range of habitats including rainforest, wet and dry sclerophyll forest, paperbark forest and open grasslands. Has a fast, direct flight and forages for flying insects (particularly moths) above the tree canopy and along waterways (Churchill 2008; Hoye and Hall 2008).	Yes

Family Name	Latin Name Common Name	EPBC Act[1]	TSC Act [2]	Habitat	Potential Habitat?
Vespertilionidae	*Myotis macropus* Large-footed Myotis	-	V	Scattered, mainly coastal distribution extending to South Australia along the Murray River. Roosts in caves, mines or tunnels, under bridges, in buildings, tree hollows, and even in dense foliage. Colonies occur close to water bodies, ranging from rainforest streams to large lakes and reservoirs. They catch aquatic insects and small fish with their large hind claws, and also catch flying insects ((Richards *et al.* 2008)).	Yes
Vespertilionidae	*Scoteanax rueppellii* Greater Broad-nosed Bat	-	V	Occurs along the Great Dividing Range, generally at 500 m but up to 1200 m, and in coastal areas. Occurs in woodland and rainforest, but prefers open habitats or natural or human-made openings in wetter forests. Often hunts along creeks or river corridors. Flies slowly and directly at a height of 30 m or so to catch beetles and other large, flying insects. Also known to eat other bats and spiders. Roosts in hollow tree trunks and branches (Churchill 2008; Richards *et al.* 2008).	No
Reptiles					
Elapidae	*Hoplocephalus bungaroides* Broad-headed Snake	V	E1	Mainly occurs in association with communities occurring on Triassic sandstone within the Sydney Basin. Typically found among exposed sandstone outcrops with vegetation types ranging from woodland to heath. Within these habitats they generally use rock crevices and exfoliating rock during the cooler months and tree hollows during summer (Webb 1996; Webb and Shine 1998).	No

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