ST MARYS PROPERTY - CENTRAL PRECINCT

Biodiversity Assessment

For:

MARYLAND DEVELOPMENT COMPANY

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Final Report

Cumberland Ecology
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Report No. 7070RP4

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PURPOSE AND OBJECTIVES

This Biodiversity Assessment describes the flora and fauna that occur within and adjacent to the Central Precinct of the St Marys Property (SMP) in Western Sydney, predicts impacts from proposed developments within the precinct and provides measures to mitigate those impacts. It has been undertaken as part of the preparation of the Central Precinct Plan.

BACKGROUND

The SMP is a 1545 hectare property that incorporates areas of cleared land currently under pasture, developed areas and areas of native vegetation. The native vegetation within the SMP has persisted after decades of a variety of different uses and clearing since European settlement. The entire property experienced tree clearance and pastoral activities prior to the 1940s, therefore the native vegetation is regenerating from these earlier episodes of clearing.

The Central Precinct has an area of 133ha and and is zoned for development under SREP 30. 900 ha of vegetation within the SMP is zoned Regional Park and will be owned and managed by Department of Environment and Climate Change (DECC).

Key Planning Instruments for the development of the Western Precinct include:

- Sydney Regional Environmental Plan 30 (SREP 30); and
- St Marys Environmental Planning Strategy 2000 (St Marys EPS).

SREP 30 addresses proposals for a regional park, regional open space, urban and employment lands and establishes town planning, urban design and environmental conservation principles to guide the long-term development and conservation of the SMP.

The *St Marys Environmental Planning Strategy 2000* supports the SREP, which provides a framework for sustainable development and management of land to which the SREP 30 applies, including the Western Precinct.

As a result of SREP 30, approximately 900 ha of the property will be dedicated as a Regional Park and managed by the DECC. This will protect substantial areas of endangered ecological communities including Cumberland Plain Woodland, River-flat

Eucalypt Forest, Shale-gravel Transition Forest and Cooks River/Castlereagh Ironbark Forest. It also supports habitats for a range of threatened flora and fauna species.

In addition to SREP 30 and the Environmental Planning Strategy, another key guiding document for the development of the Western Precinct is Penrith City Council's *Sustainability Blueprint for Urban Release Areas*. This document provides a framework for delivering quality urban development and sustainable outcomes in new release areas in the Penrith LGA.

SOURCES OF INFORMATION

A number of studies have been conducted on the flora and fauna of the SMP. Previous flora and fauna surveys at the SMP have been reviewed to provide background information for this report.

Three key processes have been instrumental in generating the flora and fauna data that is available about the SMP today:

- the Regional Environmental Study by Kinhill;
- the section 22 process undertaken under the *Environmental Planning and Assessment Act, 1979;* and
- the listing of part of the SMP on the Register of National Estate by the Australian Heritage Commission under the terms of the *Australian Heritage Commission Act 1975.*

A number of studies have also been conducted since for various precinct plans and development applications that have already been submitted including:

- The Eastern Precinct, Dunheved Precincts and Ropes Creek Precinct Biodiversity Assessments; and
- Flora and Fauna Assessments for development applications within the Eastern and Ropes Creek Precincts.

FLORA AND FAUNA HABITATS OF THE STUDY AREA

Habitats of value to native fauna are generally associated with the regrowth woodland that occurs in parts of the Central Precinct and adjacent areas which have the potential to be impacted by the proposed development, referred to as the 'study area'. Similar and higher conservation value habitats will be conserved within the Regional Park. Disturbed habitats such as those found in the Central Precinct generally support populations of native and exotic species that are common in urban/rural environments.

Small areas of vegetation, including five endangered ecological communities, Cumberland Plain Woodland (CPW), Shale-gravel Transition Forest, River-flat Eucalypt Forest, Swamp Oak Floodplain Forest and Freshwater Wetlands occur in the Central Precinct. Cumberland Plain Woodland has also been nominated as a critically endangered ecological community. The threatened flora species, *Grevillea juniperina* subsp. *juniperina* occurs within the Central Precinct and the endangered flora population *Marsdenia viridiflora* subsp. *viridiflora* occurs adjacent to the Central Precinct. However, the vegetation in this area is highly degraded and the majority of the ecological communities are represented by scattered regrowth indigenous tree cover.

Fauna habitat is generally limited to grassland and woodland in the Central Precinct. Aquatic habitat exists in the form of wetland areas towards the centre of the precinct.

A mixture of native and exotic fauna occurs including Eastern Grey Kangaroos, Red Kangaroos and Emus, which commonly occur at the SMP. Many other native animals including mammals, birds and reptiles also occur. Exotic species including foxes, feral cats, rabbits and hares are known to occur throughout SMP and impact on the long term survival of native species. However, the adjoining Regional Park areas provide the most valuable habitat for fauna as these areas support the greatest vegetation cover and quality, as well as the majority of water bodies across the SMP.

A number of threatened fauna species are also known to occur at or periodically visit the SMP and therefore are likely to forage in the Central Precinct. These species include the Greater Broad-nosed Bat, the Eastern Bent-wing Bat, Eastern Freetail Bat, Large-footed Myotis, Grey-headed Flying-fox, Speckled Warbler, Diamond Firetail and the Cumberland Land Snail. Latham's Snipe, a migratory species, was also recorded using a wetland area in the precinct. Substantial and intact areas of habitat for all of these species occur within the Regional Park.

IMPACT ASSESSMENT

The majority of the Central Precinct has been cleared as a result of past site activities and has undergone earth works, leaving large areas of grassland with scattered patches of regenerating woodland and wetland. The main impacts have arisen from extensive clearing, grazing, and construction and demolition of facilities used by Australian Defence Industries. Development within the Central Precinct is likely to remove disparate remnant patches of native vegetation. Macrofauna, including kangaroos and emus, will be excluded from the development areas for safety reasons. The long-term management of such fauna over the entire SMP is discussed in detail within the endorsed Macrofauna Management Plan.

The impacts of vegetation clearance will be counterbalanced by the maintenance of the 900 ha Regional Park, in which habitats for all threatened (and regionally significant) flora and fauna are known to occur. The Regional Park will be managed for conservation purposes to ensure the long-term persistence of threatened communities and species that

occur on the SMP. Therefore the proposed development is not predicted to have a significant effect upon any threatened flora or fauna species in the long-term.

The CPW in the Central Precinct is under threat from edge effects whereas the COW in the Regional Park is more secure and will be adequately managed to reduce such threats, particularly where the CPW is contained in large blocks with a small edge to area ratio. Therefore the loss of low quality CPW from the precinct is not considered to significantly impact on the local occurrence of the community because high quality CPW is conserved in the Regional Park. If a final determination was made to list CPW as a CEEC, the further field studies that are to be undertaken for the flora and fauna assessments for each development application in the Central Precinct would ensure ongoing assessment of the critically endangered ecological community in terms of the seven part test.

MITIGATION MEASURES

The development of the Central Precinct is to proceed as contemplated by SREP 30 and the EPS. The foremost mitigation measure for the proposed development of the Central Precinct is the establishment of the 900 hectare Regional Park, which will conserve extensive, viable tracts of forest and woodland. The Regional Park will also conserve habitats of threatened and regionally significant species.

A range of other mitigation measures to minimise and control the predicted indirect impacts of urban development are discussed within this report. Mitigation measures have been designed following the principles of ecologically sustainable development to ensure that species, communities or habitats of conservation significance are not compromised in the long term. Such mitigation measures are also discussed in detail within the following reports for the Central Precinct that have been prepared in conjunction with this Biodiversity Assessment:

- Feral and Domestic Animal Management Strategy;
- Weed Management Plan; and
- Fire Management Strategy.

Chapter 1

Introduction

1.1 Purpose

This Biodiversity Assessment forms part of the Central Precinct Plan, and has been prepared to provide a description of the flora and fauna that occur within and adjacent to the Central Precinct of the St Marys Property (SMP), to predict impacts from proposed development within this precinct and to recommend measures to mitigate those impacts.

1.2 Background

The SMP is a 1,545 hectare area of land which is situated north of St Marys and east of Penrith in Western Sydney. The site is bounded by Ninth Avenue, Palmyra Avenue, Forrester Road, Dunheved Golf Course, The Northern Road and the suburbs of Cambridge Gardens and Werrington County. The SMP is located within both the Blacktown and Penrith Local Government Areas (LGAs). It incorporates areas of cleared agricultural land, developed areas and areas of regenerating Western Sydney woodland vegetation.

The SMP was originally used for grazing, and a butchery and saleyard were located on the land. Following the outbreak of World War II, the Australian Government established an explosives and munitions filling factory on these lands. Extensive works were undertaken on the site involving the construction of more than 800 buildings, a transport network including roads and railway lines, as well as major services infrastructure and telecommunications facilities. This complex of munitions factories operated until production ceased in 1994. The site has subsequently been decontaminated, and the great majority of the buildings and other infrastructure removed.

In 1993 the State Government included the SMP in its Urban Development Program for future urban development, in recognition of its ability to meet future regional housing needs. The site is currently owned by St Marys Land Limited and is being jointly developed by ComLand Limited and Lend Lease Development Pty Ltd through the joint venture company, Maryland Development Company.

The SMP was rezoned in January 2001 by *St Marys Regional Environmental Plan No 30* (SREP 30) to permit its development for a combination of urban, employment, regional

open space and regional park purposes. The SMP comprises six future development precincts, namely the Western Precinct, Central Precinct, North and South Dunheved Precincts, Ropes Creek Precinct and Eastern Precinct, identified by SREP 30 (Figure 1.1).

In accordance with SREP 30, St Marys Land Limited signed a Deed of Agreement with the NSW State Government in December 2002 which in part details the methodology for the establishment, funding and management of the Regional Park. This is an area approximately 900 ha in size that will be retained for conservation, as a mitigation measure for the development of the six future development precincts.

In 2003, the Eastern, North Dunheved and South Dunheved Precincts were released, and Precinct Plans have since been submitted and adopted by Blacktown City Council and Penrith City Council for these areas. The Eastern Precinct is currently under development and development of the Dunheved Precincts is expected to commence in 2008.

In 2006 the Central, Western, and Ropes Creek Precincts were released, allowing the planning process to proceed to the preparation of the Central Precinct Plan. The Central Precinct is located in the central part of the SMP and comprises land zoned for urban and employment uses. SREP 30 is currently being amended to consolidate the employment zones from the Western and Ropes Creek Precincts into the Central Precinct. This will increase the area of land zoned for employment uses in the Central Precinct from 3.4 ha to 38.4 ha.

1.3 Objectives

This report has been prepared to support Precinct Plan for the Central Precinct. This report provides a Biodiversity Assessment of the Central Precinct and its objectives are to:

- Provide a description of the flora and fauna that occur within and adjacent to the Central Precinct;
- Identify the flora and fauna that has the potential to occur within the Western Precinct;
- Identify and map the occurrences of threatened or migratory species, endangered populations or endangered ecological communities as listed within Schedules of the NSW *Threatened Species Conservation Act 1995* (TSC Act), NSW *Fisheries Management Act 1994* (FM Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);
- Locate and map vegetation communities and fauna habitats within the study area;
- Predict the likely impacts from the proposed development of the Central Precinct;
- Provide recommendations on measures to manage and mitigate development impacts on the physical and environmental characteristics of the land;

- Outline strategies to ensure that the conservation objectives outlined in Sydney Regional Environmental Plan 30 (SREP 30) and *St Marys Environmental Planning Strategy 2000* (EPS) are met;
- Outline strategies to ensure that the relevant principles of the *Sustainability Blueprint for Urban Release Areas* are met;
- Provide information about the impact on adjoining land that is zoned Regional Park; and
- Outline strategies to ensure that there will be no significant impact on threatened and migratory species listed under NSW and Commonwealth legislation.

This Biodiversity Assessment was prepared as part of a series of reports that address the flora and fauna of the Central Precinct. For additional information regarding flora and fauna of this precinct, refer to the Weed Management Plan, Feral and Domestic Animal Management Strategy and Fire Management Strategy for this precinct and the Macrofauna Management Plan[1].

1.4 Glossary of Terms and Abbreviations

This report uses the following terminology:

Central Precinct: encompassing the land identified as such in Figure 1.1.

Cumberland Plain: the Cumberland Plain extends from near Parramatta west to the eastern margins of the lower Blue Mountains. It spans from Richmond in the north to Campbelltown and Camden in the south;

EPBC Act: *Environment Protection and Biodiversity Conservation Act 1999*;

Locality: the area within a 5 km radius of the Central Precinct;

PLGA: Penrith Local Government Area;

Region: area encompassing the Sydney Basin Bioregion;

SREP 30: Sydney Regional Environment Plan 30;

St Marys EPS: St Marys Environmental Planning Strategy 2000;

St Marys Property (SMP): encompassing land marked in Figure 1.1;

Study Area: the Central Precinct and any adjacent land with potential to be impacted by development within the Central Precinct; and

Sustainability Blueprint: Sustainability Blueprint for Urban Release Areas, Penrith City Council, June 2005.

TSC Act: *Threatened Species Conservation Act 1995*.

1.5 Report Structure

The report is set out as follows:

- Chapter 2 provides an overview of relevant legislation and an overview of the regional and local flora and fauna;
- Chapter 3 provides the methodology for flora and fauna surveys that were undertaken for this Biodiversity Assessment;
- Chapter 4 describes the flora of the Central Precinct and surrounding area;
- Chapter 5 describes the fauna habitats and fauna of the Central Precinct and surrounding area;
- Chapter 6 is an assessment of the likely impacts of the proposed development on native flora and fauna;
- Chapter 7 describes impact mitigation measures; and
- Chapter 8 details the conclusions of the assessment.

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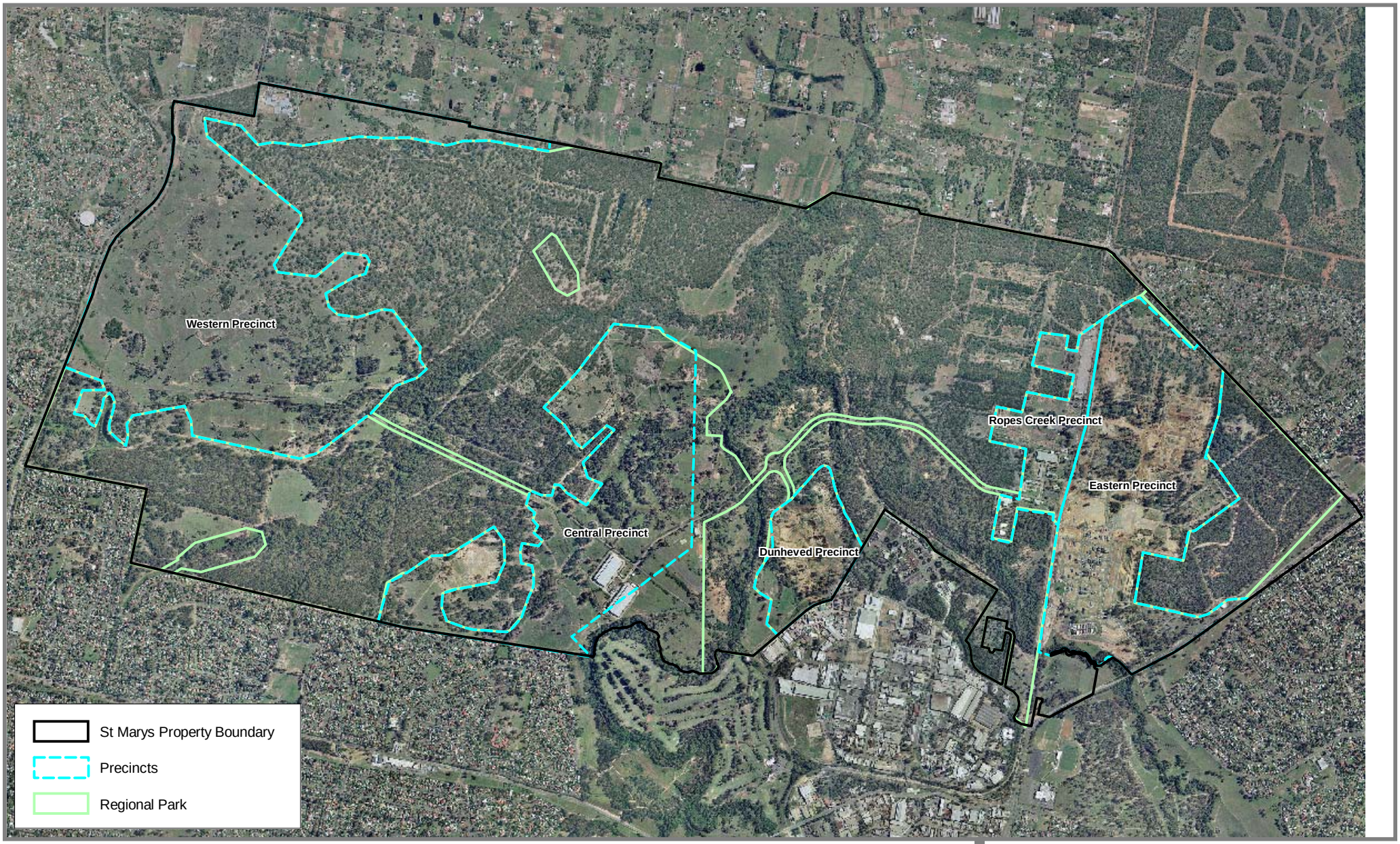

Figure 1.1 Aerial Photograph of the St Marys Property

Chapter 2

Contextual Information

2.1 Legislation and Policy Context

The following sections outline legislation and policy objectives relevant to the assessment of flora and fauna in the Central Precinct.

2.1.1 Environment Protection and Biodiversity Conservation Act (1999)

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the key piece of national legislation for protection of the environment, particularly Matters of National Environmental Significance (MNES). It provides a framework for environmental assessment and approval that is designed to protect Australian biodiversity and provide management of important natural and cultural places.

The following MNES are defined by the EPBC Act and consideration was given to those MNES relating to flora and fauna:

- World Heritage Properties;
- National Heritage places;
- Wetlands of international importance (Ramsar wetlands);
- Threatened species and ecological communities;
- Migratory species;
- Commonwealth marine areas; and
- Nuclear actions (including uranium mining).

The matters of relevance to this report are threatened species and ecological communities, migratory species, and National Heritage places. The other items are not relevant as they do not occur in the vicinity of the Central Precinct.

i. Threatened Species and Ecological Communities

One of the vegetation communities that occurs in the Central Precinct is Cumberland Plain Woodland, an endangered ecological community (EEC) listed under the EPBC Act.

ii. Migratory Species

One migratory bird species has been recorded from wetlands within the Central Precinct, Latham's Snipe (*Gallinago hardwickii*).

2.1.2 Threatened Species Conservation Act (1995)

The *Threatened Species Conservation Act 1995* (TSC Act) outlines the protection of threatened species, communities and critical habitat in New South Wales. An independent Scientific Committee has been set up under the Act to determine which species, populations and ecological communities should be listed as endangered, vulnerable or extinct under the act, and also to determine key threatening processes.

The proposed development of the Western Precinct requires approval under the *Environmental Planning and Assessment Act 1979* (EP&A Act). This Act, as amended by the TSC Act, requires that a project be assessed to determine any impacts on threatened species, populations, ecological communities, or their habitats. Threatened species, populations and ecological communities are those described in Schedules 1, 2 and 3 of the TSC Act.

2.1.3 St Marys Development Agreement (2002)

A formal Development Agreement has been entered into by Lend Lease Development Pty Limited, ComLand Limited,, the NSW Government Blacktown and Penrith City Councils. St Marys Land Limited owns the SMP and is a subsidiary of ComLand Limited. Maryland Development Company is the joint venture company that was established by ComLand and Lend Lease Development to develop the site. Under the terms of the development agreement, land within the SMP will be transferred to State Government ownership and established as a Regional Park managed by the National Parks Division of the Department of Environment and Climate Change (DECC), formerly known as the National Parks and Wildlife Service (NPWS). Under the agreement, the proponent will also provide funds for the preparation of a plan of management for the park and the establishment of the Park.

The establishment of the Regional Park is the foremost mitigation measure for the proposed developments that are to occur on the SMP. The area of approximately 900 hectares will conserve the major occurrences of endangered woodland and forest communities as well as the habitats of threatened and regionally significant species.

2.1.4 State Government Instruments

Planning instruments that relate to the development of the Central Precinct include:

- *Sydney Regional Environmental Plan* 30 (*Amendment No 1*)(SREP 30) [2]; and
- *St Marys Environmental Planning Strategy 2000*[3].

i. SREP 30

Sydney Regional Environmental Plan No. 30 – St Marys provides a framework for sustainable development and management of land to which SREP 30 applies, including the Central Precinct. SREP 30 addresses proposals for a regional park, regional open space, urban and employment lands and establishes town planning, urban design and environmental conservation principles to guide the long-term development and conservation of the SMP.

Under SREP 30, a draft Precinct Plan is to include proposals for and information about:

"*management of the potential impacts of development on the existing physical and environmental characteristics of the land, including significant native flora and fauna habitat and soil characteristics. The information is to include specific details of those characteristics and to explain how development should be planned and configured to minimise adverse impacts on areas of significance for biodiversity.*"

Part 5 of SREP 30 outlines performance objectives for the development of the SMP. Those outlined for conservation are:

(1) *A representative and significant proportion of the natural values of the land are to be conserved within a regional park in order to protect the variety of Western Sydney vegetation communities, native flora and fauna species and fauna habitat;*

(2) *Urban design and site planning in the Employment and Urban zones are to have regard to significant stands of trees and, where practicable, retain those trees;*

(3) *Adverse impacts on the vegetation and fauna habitats within the Regional Park and Regional Open Space zones resulting from the development of areas zoned Employment or Urban are to be minimised;*

(4) *Infrastructure is to be designed and located to minimise potential adverse impacts on the conservation values of the land; and*

(5) *Infrastructure and recreational facilities within the regional park are to be sited and constructed to minimise adverse impacts on the park's natural values.*

ii. EPS 2000

The EPS 2000[3] supports SREP 30 and outlines the strategies required to achieve the objectives outlined in SREP 30.

2.1.5 Local Government Policies

The Central Precinct is located within the Penrith LGA. Penrith City Council (PCC) has produced a document entitled *Sustainability Blueprint for Urban Release Areas*[4]. Whilst not an environmental planning instrument, this document outlines the key aims of the PCC in relation to ensuring the sustainability of future urban development. The objective of this document as it relates to biodiversity is "*to retain and conserve indigenous vegetation and wildlife habitat and corridors*"[4]. This requires areas of high conservation value to be identified within urban development areas and to be excluded from development; biodiversity corridors to be established that link corridors of regional significance; and requires the submission of a Flora and Fauna Strategy which retains and conserves indigenous vegetation and wildlife habitat.

2.1.6 Australian Heritage Commission Register of National Estate

The majority of the Regional Park is listed on the Australian Heritage Commission Register of National Estate. The vegetation within this area is referred to in the National Estate as an important remnant of the vegetation communities that were once widespread on the Cumberland Plain and include Cumberland Plain Woodland and Castlereagh Woodland. The Register of National Estate place description also makes reference to significant flora and fauna, including threatened plants and examples of the Cumberland Plain Woodland bird assemblage. The developments proposed for the Central Precinct will adjoin Regional Park land.

2.2 Biodiversity Overview

2.2.1 The Cumberland Plain

The SMP is located within a distinctive portion of the Sydney bioregion known as the Cumberland Plain, a gently undulating area within the Hawkesbury-Nepean Catchment in Western Sydney. The Cumberland Plain extends from near Parramatta west to the eastern margins of the lower Blue Mountains. It spans from Richmond in the north to Campbelltown and Camden in the south[5].

i. Soils and Topography

The Cumberland Plain broadly consists of a series of undulating low hills and swampy depressions extending from Western Sydney to the lower Blue Mountains. Geologically, the landform is a subsidence basin that remained after the surrounding areas were raised into plateaus. The soils of the plain are formed from weathered clays derived from Wianamatta Shale. Ancient and recent pathways of the Hawkesbury-Nepean River system have left Tertiary and Quaternary alluvial deposits of sand, silt and gravel.

Hawkesbury sandstones of the Blue Mountains, Woronora and Hornsby Plateaus encroach on the western, southern and northern boundaries of the Cumberland Plain [5].

ii. Climate

The Cumberland Plain is relatively dry as most rainfall in the Sydney region occurs near the coast or in the mountains. Temperatures are consequently more extreme than in coastal Sydney. Local climate variation on the Cumberland Plain is a result of local topography, with higher areas generally receiving greater rainfall and lower areas experiencing more severe frosts[5].

iii. Drainage

The Hawkesbury-Nepean River and a number of smaller tributaries dissect the Cumberland Plain. Two of these tributaries flow through the SMP, Ropes and South Creeks, which are meandering lowland creeks that have their origins within the Cumberland Plain itself. The river and creeks that dissect the plain originally formed a network of wetland areas. The present day streams and wetlands in the region are encompassed in the Lowlands Formation, Cranebrook Formation, Clarendon Formation, Agnes Banks Sand and Pitt Town Sand.

iv. Flora

The Cumberland Plain was once entirely covered by a mosaic of eucalypt forest, woodland and wetlands that supported a rich array of flora and fauna[6]. It also included numerous freshwater habitats including the Hawkesbury-Nepean River, smaller lowland creeks, billabongs and other wetlands. In areas where the original vegetation still occurs, there remains considerable biological diversity[5].

A high proportion of the original vegetation cover has been completely removed and the fragmented patches that remain are not pristine. Land clearance, combined with changes to hydrology and fire regimes and the introduction of new plant and animal species, has dramatically altered the biota of the Cumberland Plain. Remaining forest and woodland patches are typically highly disturbed, consisting of relatively young regrowth trees with few ground dwelling and arboreal mammals remaining[5].

In the medium to long term, the viability of the Cumberland Plain flora and fauna is dependent upon the reinstatement or enhancement of linkages between remaining blocks of habitat. The formation of strategic linkages has been recommended by several recent investigations of vegetation in western Sydney, including the Urban Bushland Biodiversity Survey[5] and the Green Web – a vegetation management plan for the Sydney Region[7].

v. Fauna

Fauna surveys of the Cumberland Plain have recorded considerable diversity of native bird, reptile, amphibian and mammal species. Fauna habitats include rainforests, sclerophyll forests and woodlands, shrublands, heath and wetlands. Disturbed habitats include farmland and urban environments. Forests and woodlands provide habitat for many birds, frogs and mammals including common and threatened species.

vi. Past and Present Land Uses

Some of the earliest European agricultural settlements in Australia occurred on the fertile land of the Cumberland Plain and, therefore historically, the Cumberland Plain locality has had extensive clearance of the original native vegetation. These cleared areas were initially used for agriculture and have more recently been developed for residential, commercial and industrial purposes[8].

2.2.2 The St Marys Property

The SMP is a 1545 hectare area of land which is situated north of St Marys and east of Penrith in Western Sydney. It incorporates areas of cleared agricultural land, developed areas and areas of regenerating Western Sydney woodland vegetation[9]. Past land uses have resulted in highly disturbed areas, where natural regeneration of the woodland communities has been restricted. This has lead to segregation of patches of these communities, and weed invasion in areas of the SMP. The site is bounded by Ninth Avenue, Palmyra Avenue, Forrester Road, Dunheved Golf Course, The Northern Road and the suburbs of Cambridge Gardens and Werrington County. The SMP is located within both the Blacktown and Penrith LGAs[10].

Historically, there is evidence that the site was occupied continuously by Aborigines prior to European settlement. From 1803 the site was surveyed, settled and used for farming purposes by Governor King's family.

Generally, farming in the St Marys area centred on cattle with the nearby St Marys saleyards being the second largest in rural New South Wales during the 60 years of its operation from the 1880's. Within the SMP, the ruins of the former Beecroft Butchery and slaughter yard are to be found.

In 1924, the lands generally comprising the SMP were consolidated into one parcel by a grazier, Mr J W Fisher. Following the outbreak of World War II, the Australian Government established an explosives and munitions filling factory on these lands, which had by then been resumed from various farmers, including J W Fisher. These manufacturing operations were established in two major waves during World War II and later during the 1950's. Extensive works were undertaken on the site involving the construction of more than 800 buildings, a transport network including roads and railway lines, as well as major services infrastructure and telecommunications facilities. The site was segregated into small areas by security fencing for both safety and security reasons.

This complex of munitions factories operated until production ceased in 1994. The site has subsequently been decontaminated, and the great majority of the buildings and other infrastructure removed.

In 1993 the State Government included the SMP in its Urban Development Program for future urban development, in recognition of its ability to meet future regional housing needs. SREP 30 rezoned the SMP in January 2001 to permit its development for a range of uses, including urban, regional park and employment purposes. The landowner and the proponents of the landowner, signed a Deed of Agreement with the NSW State Government in December 2002 which in part details the methodology for the establishment, funding and management of the Regional Park.

In 2003 the Minister for Infrastructure, Planning and Natural Resources announced the "release" of Eastern, North Dunheved and South Dunheved Precincts. In 2006 the Western, Central, and Ropes Creek Precincts were released, allowing the planning process to proceed to the preparation of the Central Precinct Plan.

i. Biodiversity of the SMP

The native vegetation within the SMP has been substantially altered since European settlement, and much of the site was cleared for pastoral activities prior to the 1940s[11]. Most of the native vegetation that currently occurs on the site is regenerating from earlier episodes of clearing [12,13]. An estimated total of 800 hectares of native vegetation currently occurs on the SMP, consisting of 6 broad vegetation communities[14]. Within the Central Precinct, Alluvial Woodland, Shale Plains Woodland and Shale Gravel Transition forest have been mapped as occurring by NSW NPWS[14].

Most trees that remain on the SMP are regrowth and there are few remaining old growth trees with hollows[13]. Regeneration of understorey species has taken place in some areas that have not been subject to slashing. Disturbance to understorey vegetation in the 1990s has occurred in some areas due to the removal of buildings and the decontamination process. Weeds occur in varying densities throughout the site.

Within the SMP, native fauna populations remain predominantly within the larger patches of woodland. A diverse array of bird species has been recorded at the property, particularly within the woodland habitats.

The SMP is characterised by its introduced and conspicuous Eastern Grey Kangaroo, Red Kangaroo and Emu populations. The SMP also hosts populations of feral Black Rats, House Mice, Foxes and Cats. Common species of reptiles and amphibians also occur.

Several endangered ecological communities and threatened flora species occur within the SMP. Threatened fauna species also occur throughout the SMP, including several species of microchiropteran bats, birds and one invertebrate. All species recorded at the SMP or that potentially occur within the study area discussed in more detail in Chapters 4 and 5.

2.2.3 The Central Precinct

The Central Precinct is located in the middle of the SMP, and is surrounded for the most part by the Regional Park, except for to the south where residential development and section of South Creek occurs. A golf course is located on the southern side of South Creek. The precinct contains a network of tracks and roads, some of them sealed, that are a legacy of past land uses. Several buildings are present on the precinct, including sheds being used for ongoing macrofauna management activities and two large warehouses. Extensive areas of tall mesh fencing are present throughout the precinct due to ongoing macrofauna management activities. A large concrete stockpile is present in the precinct that has been formed by the stockpiling of concrete from building demolitions in the precinct and other parts of the SMP.

The Central Precinct consists primarily of grassland, with scattered trees and some areas of regrowth canopy vegetation. Wooded communities in the precinct are limited, and are restricted to remnants occurring along the common border with the Regional Park and patches of regrowth in the middle of the precinct. Some areas of the precinct are mown on a regular basis for bushfire management purposes. These areas are limited to around the warehouses and the boundary with urban areas to the south. A large area of bare earth occurs in the south-west of the precinct. This area is eroded and supports little plant life.

The woodlands within the Central Precinct consist of predominantly regrowth vegetation and therefore are relatively immature. Few trees are older than approximately 50 years, and as such, show few signs of senescence and generally lack hollows. A man-made drainage line runs through the precinct and drains into patches of wetland covering a total of 2.4ha in the centre of the Precinct that have been created since clearing of canopy species in depressions. These patches are likely to provide water sources for native species, and are likely to provide habitat for native fauna species.

Chapter 3

Flora and Fauna Survey Methods

Prior to the preparation of this Biodiversity Assessment, more than twenty flora and fauna investigations had been undertaken for all or part of the SMP since the early 1990s. The Biodiversity Assessment for the Central Precinct has made extensive use of such earlier work[13,15-22] and vegetation mapping by National Parks and Wildlife Service[14]. Extensive survey of the Eastern Precinct, parts of the Regional Park, Ropes Creek Precinct and Dunheved Precinct has previously been undertaken by Cumberland Ecology. Appendix A provides a summary of previous flora and fauna investigations that were used for this Biodiversity Assessment.

The purpose of the field assessments undertaken for this Biodiversity Assessment were to supplement previous surveys and update information about the flora and fauna of the Central Precinct and surrounding lands (i.e. study area), particularly regarding threatened and regionally significant species and endangered ecological communities.

3.1 Flora Survey

3.1.1 Vegetation Community Mapping

The vegetation of the SMP has been mapped by NSW NPWS[14] at a regional scale from aerial photographs, with minimal ground survey. For the purposes of this report, this mapping was ground-truthed by field survey by Cumberland Ecology on 19 October 2007 and 26 May 2008. The mapping provided by NSW NPWS is at a regional scale and therefore it was desirable for the purposes of this report to refine the scale of the mapping through ground-truthing.

The entire precinct was traversed using meandering transects (see Figure 3.1 for locations of transects) and the vegetation communities occurring were identified on the basis of species composition, position in the landscape and underlying soil structure. Plant communities were described based on the dominant canopy species and community structure, according to Specht[23]. Identification of Endangered Ecological Communities (EEC) was conducted with reference to the Final Determination of each ecological community, published by the NSW Scientific Committee, TSC Act Schedules, the EPBC Act, RoTAP[24] and the NSW NPWS[14]. Plant species nomenclature conforms to Harden[25-28].

Notes were made regarding details of plant communities and species present, vegetation structure, existing impacts and other relevant details. During the survey significant stands of trees were identified and mapped using recent, high resolution aerial photography.

3.1.2 Limitations of Survey

The transect survey was conducted during one site visit in October 2007. Prior to the time of the survey the weather conditions had been unfavourable for plant growth and production of features required for identification of most plants to species level. Although the majority of plants could be identified, some were identifiable to genus level only.

Owing to the survey relying on a single inspection of any one location within this study area, it was impossible to record all species present. Despite this, it is probable that issues including conservation significance of the flora, condition and viability of bushland and likely impact on native vegetation have been able to be satisfactorily assessed.

3.1.3 Targeted Threatened Flora Search

A targeted threatened flora survey was conducted within the precinct during the field survey for threatened flora recorded from the SMP and with potential to occur. This includes the following species:

- *Grevillea juniperina ssp juniperina*;
- *Pimelea spicata*;
- *Dillwynia tenuifolia;*
- *Micromyrtus minutiflora;*
- *Marsdenia viridiflora* ssp *viridiflora;*
- *Persoonia nutans;* and
- *Pultenaea parviflora*

Notes were made on the relative distribution of threatened flora species found to be present and estimates were made of their approximate abundance using the quadrat census method. This involved counting the numbers of plants present in quadrats, and this figure was extrapolated over the area of occurrence to estimate total population numbers for the Central Precinct.

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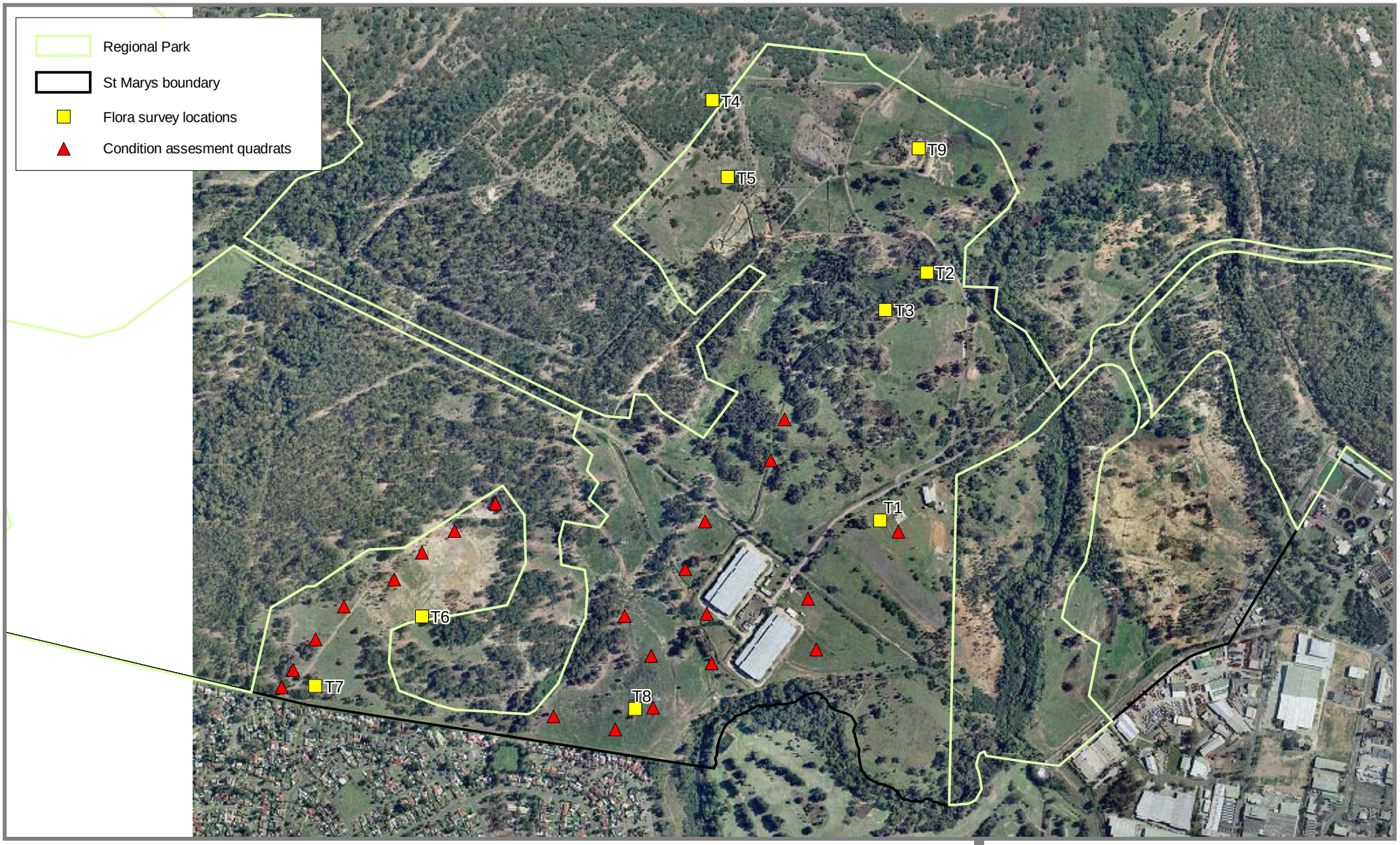

Figure 3.1 Vegetation survey locations

Cumberland Ecology

3.1.4 Vegetation Condition Assessment

Twenty-three quadrats each 5x5m were surveyed across the Central Precinct to assess the condition of vegetation. Quadrats were located in transects throughout grassland and regenerating woodland areas within the precinct, with the number of quadrats in each area proportionate to the area covered by that vegetation community (Figure 3.1).

The dominant and common species were recorded from each quadrat and the percentage cover of exotics in each stratum also noted. Other notes were made on the area surrounding the quadrat.

3.2 Fauna Surveys

There is substantial knowledge of the fauna species that occur at the SMP from studies by Kinhill[16] and Gunninah[12,13,15,29,30]. Cumberland Ecology has conducted surveys previously in the Central Precinct for development applications for the demolition of buildings. Owing to the availability of data from previous surveys and in the knowledge of the highly disturbed nature of habitats within the Central Precinct, the fauna surveys for the Biodiversity Assessment were of a relatively small scale. They were designed to verify pre-existing data and to address minor gaps in existing information. Bird surveys were carried out in the Central Precinct, as were fauna habitat assessments. No targeted threatened fauna surveys were conducted for this Biodiversity Assessment.

Numerous bat surveys have been completed on the SMP and in the Central Precinct, and therefore the bat species that utilise the site are well documented. In 2001, Anabat surveys were conducted in riparian, grassland, woodland and forest habitats in the Western Precinct. An Anabat survey was conducted for the Dunheved Biodiversity Assessment in 2004 and also included surveys of Ropes Creeks in the Eastern Precinct. Further surveys including Anabat and harp trapping were conducted in 2006 in the Eastern and Ropes Creek Precincts.

Bird surveys were conducted in the Central Precinct on 23rd and 24th September 2007`by an ornithologist, Dr Tony Saunders. This involved the use of an area search method, with a more concentrated effort being undertaken within likely habitat areas. All birds identified either by call or sight, were listed and the breeding status recorded. Records were also kept of birds observed or heard while conducting flora surveys in the Central Precinct. GPS readings were taken for localities where vulnerable species or other species of concern were recorded.

3.2.1 Fauna Habitat Assessment

Information gained from past and current flora surveys and inspections of the site for this survey was used to identify and assess the distribution of habitat types on the subject site

and within the study area. The diversity of microhabitats used by native fauna was also assessed in the subject site and study area.

A detailed habitat assessment was conducted across the Central Precinct that included an assessment of the nature and extent of fauna habitats and an identification of areas where fauna species could reside or forage. Consideration was made of important indicators of habitat condition and complexity including the occurrence of microhabitats such as tree hollows, fallen logs, bush rock and aquatic areas such as creeks and wetlands. The presence of nesting/shelter sites such as tree hollows, hollows logs, decorticating bark and rocks was noted and the presence of rocks and basking sites for reptiles was recorded.

An assessment of the structural complexity of the vegetation, the age structure of the forest and the nature and extent of human disturbance throughout the Central Precinct was undertaken and considered. Tree hollows were used as a general indication of habitat quality for arboreal fauna, and hollow-dwelling birds and bats. Hollows observed during the survey were recorded and the general vegetation condition and tree maturity used to predict whether trees were likely to contain hollows.

Habitat usage by fauna was documented through analysis of tracks, scats, diggings and other traces. Surveys were conducted opportunistically throughout the entire Central Precinct and included: searches for indicators such as scratches on trees and runways; searches for owl and koala pellets and other scats; searches for raptor nests; searches for tracks and diggings and inspection of road kills.

Chapter 4

Flora of the Central Precinct

This chapter describes the flora of the Central Precinct, taking into account information obtained from previous surveys and surveys undertaken specifically for this Central Precinct Biodiversity Assessment. Particular emphasis has been placed on threatened flora and vegetation communities recorded from the SMP, the Central Precinct or with potential to occur.

Most of the Central Precinct contained grassland created by previous clearing of natural woodland and open forest. Subsequent pasture improvement and weed invasion had resulted in the establishment of variable amounts of introduced species. Highly degraded regrowth woodland and forest is estimated to cover 38% of the precinct with the majority of vegetation occurring in small fragments of scattered tree cover with a high proportion of introduced species in the understorey or narrow sections of regrowth woodland or forest with a high edge to area ratio.

4.1 Vegetation Communities

The vegetation communities on the SMP have been mapped by the NSW NPWS [14] at a regional scale and identified four communities in the Central Precinct: Shale Plains Woodland, Alluvial Woodland, Shale-gravel Transition Forest and Freshwater Wetlands. Such maps have been refined by field survey for the purposes of this report (see Figure 4.1). A species list for the Central Precinct is provided in Appendix B.

Five plant communities were recorded in the precinct:

- Swamp Oak Floodplain Forest/River-flat Eucalypt Forest;
- Cumberland Plain Woodland;
- Native Grassland;
- Exotic Grassland; and
- Freshwater Wetlands.

4.1.1 Swamp Oak Floodplain Forest/River-flat Eucalypt Forest

Swamp Oak Floodplain Forest and River-flat Eucalypt Forest are both forms of Alluvial Woodland and occur in the low-lying areas in the middle section of the Precinct. Areas of each community have been ground-truthed within the precinct but both are included in areas mapped as Alluvial Woodland across other parts of the SMP (Figure 4.1). Much of these communities have been cleared many years previously, presumably for grazing (Photograph 4.1). In some of these cleared areas, the vegetation has regenerated as Freshwater Wetlands as the soil is waterlogged and ephemerally inundated. The current vegetation was a mixture of scattered old trees with extensive regeneration of an estimated 1-20 years age. Stands of forest and woodland were generally separated by native grassland. Some stands adjoined or were separated by exotic grassland and wetlands. Both grassland types formed a mosaic that varied from mixtures to predominantly native or exotic vegetation.

Swamp Oak Floodplain Forest and River-flat Eucalypt Forest are similar communities on the SMP that intergrade with each other. They may be separated into separate communities based on the dominance of *Casuarina glauca* (Swamp Oak) or eucalypts. Swamp Oak Floodplain Forest typically comprised a canopy of *Casuarina glauca* (Swamp Oak) and River-flat Eucalypt Forest comprised *Angophora floribunda* (Rough-barked Apple) with scattered *Eucalyptus tereticornis* (Forest Red Gum) and *E. amplifolia* (Cabbage Gum). *Eucalyptus moluccana* occurred in some localised concentrations.

Some areas of River-flat Eucalypt forest contained a dense small tree layer of *Acacia parramattensis* (Parramatta Wattle), particularly where canopy trees were absent. Generally, the small tree stratum was limited to juvenile canopy species however *Melaleuca styphelioides* (Prickly Paperbark) occurred in some locations.

Shrubs were generally absent however *Bursaria spinosa* (Blackthorn) occurred in some areas and the prostrate *Hibbertia diffusa* was common and widespread. *Trema aspera* (Poison Peach) was recorded in one location.

Ground covers were typically grassy and varied from single species dominance, especially *Microlaena stipoides* (Weeping Meadow-grass), *Themeda australis* (Kangaroo Grass), or the exotic *Cynodon dactylon* (Couch Grass) or *Briza subaristata*. Other common species included: *Conyza* sp (a Fleabane) and *Angophora floribunda* seedlings. *Imperata cylindrica* var *major* (Blady Grass) was dominant in some localised patches.

The condition of this community varied. Exotics were absent from the canopy, small tree and shrub strata, but exotics in the ground cover ranged from locally dominant to sparse. Exotics tended to be dominant under dense, mature canopy but occurred in small proportions under regrowth canopy and at margins with grassland. The percentage of exotic species was between 10 and 80% of the total ground cover projective foliage cover in this community. The high proportions of introduced ground cover species in mature forest were unlikely to significantly affect the viability of the forest unless significant areas of canopy were removed by natural or other means.

Woody weeds, mainly *Ligustrum sinense* (Narrow-leaved Privet) were noted in several locations, generally as individuals or in small populations. *Lantana camara* (Lantana) was also recorded in a couple of locations but was severely affected by drought conditions at the time of the survey.

An excavated channel passed through the low-lying area north of the main east-west road. Its cross-section was approximately three metres in width and one to two metres deep. The channel margins were generally lined with *Angophora floribunda* and *Casuarina glauca*. Shrubs were absent apart from thickets of, and scattered *Rubus fruticosus* (Blackberry) and *Ligustrum sinense* (Narrow-leaved Privet). The ground cover was mainly *Cynodon dactylon* with other species, especially *Carex appressa*, *Pratia purpurascens*, *Juncus* sp., *Conyza* sp., *Microlaena stipoides* and *Asparagus asparagoides* (Bridal Creeper) occurring in small proportions.

Photograph 4.1 Swamp Oak Forest and Clearing

i. Conservation Significance

These communities are variants of the EECs listed under the TSC Act; *Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions* and *River-flat eucalypt forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions*.

These communities consisted predominantly of varying stages of regrowth. The communities were highly fragmented and some sections contained high concentrations of exotic ground cover species. It is likely to be viable in the long-term even though the presence of exotics diminish its conservation significance.

4.1.2 Cumberland Plain Woodland

Cumberland Plain Woodland was the most common community in the Central Precinct with *Eucalyptus moluccana* (Grey Box) and *E. tereticornis* (Forest Red Gum) being the dominant tree species. Cumberland Plain Woodland is mapped as Shale Plains Woodland in Figure 4.1. *Angophora floribunda* was also common in the northern section of the precinct. The dominant tree species occurred in remnant and regrowth open forest and woodland and as scattered individuals in grassland communities (Photograph 4.2). *Eucalyptus fibrosa* (Broad-leaved Ironbark), *E. crebra* (Narrow-leaved Ironbark) and *E. globoidea* (White Stringybark) were the only other eucalypts recorded. The first and last of these tended to be associated with lateritic gravel however gravel also occurred extensively in variable amounts in areas where they were absent.

Small trees and shrubs were generally rare in this community apart from juvenile canopy trees. *Bursaria spinosa* (Blackthorn) was locally dominant in some locations, especially in the southern section where it in the process of invading adjoining grassland areas. *Grevillea juniperina* subsp. *juniperina* (Prickly Spider Flower) was widespread and an often common shrub in and adjacent to eucalypt woodland, particularly in the northern section. Local population sizes varied locally from individuals to an estimated 380 plants (Table 4.1). *Dillwynia juniperina* (Prickly Parrot Pea) and *Hibbertia diffusa* were common in many areas. Other shrubs occurred in small numbers, including: *Acacia falcata* (Sickle Wattle), *Astroloma humifusum* (Cranberry Heath), *Dodonaea viscosa* ssp *cuneata* and the exotic *Senecio pterophora*.

The ground cover in this community frequently contained *Bothriochloa* sp. (*decipiens* and/or *macra*), *Aristida vagans*, *Microlaena stipoides*, *Sporobolus* sp. (*creber* and/or *elongata*), *Lomandra filiformis*, *Dichondra repens* and *Brunoniella australis*. Exotic ground covers often included: *Cynodon dactylon*, various Asteraceae, *Richardia stellaris*, *Conyza* sp., *Sida rhombifolia* (Paddys Lucerne) and *Anagallis arvensis* (Scarlet Pimpernel).

This community had been highly modified from its pre-European condition but most was likely to be in viable condition and was in various stages of regeneration. Scattered trees in exotic grassland were unlikely to be viable as bushland. The concentration of exotic species varied but was typically limited to the ground cover, ranging between 1-50% of the projective foliage cover of the stratum.

Photograph 4.2 Woodland in the Central Precinct

i. Conservation Significance

Cumberland Plain Woodland is an EEC listed under the TSC Act and the EPBC Act. There is also a preliminary determination to list Cumberland Plain Woodland as a critically endangered ecological community under the TSC Act. One occurrence in the north of the study area could possibly be described as Shale-gravel Transition Forest (high shale influence). Its understorey had been cleared many years previously. Much of the CPW contained elements of the gravel community, especially *Grevillea juniperina* subsp *juniperina*. Other, more localised species included: *Eucalyptus fibrosa*, *E. globoidea* and, just outside the study area: *Marsdenia viridiflora* subsp. *viridiflora*. Pea-sized lateritic gravel was common and widespread through the study area.

Most of this community had been heavily cleared and was in various stages of regeneration. Some sections were almost weed-free and were in viable condition. Other, small occurrences comprised local concentrations of canopy trees amongst largely exotic grassland, and would be unlikely to regenerate naturally to re-establish a representative and viable community.

4.1.3 Grassland

The majority of the precinct contained grassland. The grasslands had been created many decades previously, probably initially for grazing and were subsequently maintained during use of the property by Australian Defence Industries. The grassland in the Central Precinct comprised a mixture and mosaic of indigenous and introduced species (Photograph 4.3). The native and exotic-dominated grassland communities have been mapped as cleared land in Figure 4.1 and have not been distinguished from each other in the mapping due to the fine mosaic in which they occur.

i. Native grassland

Native grassland occurred extensively near the southern boundary of the study area and sporadically north of the main east-west road. In most areas it contained relatively high proportions of introduced species that formed a low ground cover between tussocks. Exotic species concentrations were commonly in the order of 50% of the projective foliage cover of the ground cover.

The community south of the main east-west road mainly comprised *Cymbopogon refractus* (Barb-wire Grass) with smaller proportions of *Aristida vagans* (Three-awned Grass), *Themeda australis* and *Eragrostis leptostachya* (Paddock Love-grass). *Eragrostis curvula*, *Cynodon dactylon*, *Lolium perenne* (Perennial Rye), *Briza subaristata* and *Conyza* sp. (a Fleabane) were also present in small proportions in some locations. The low ground cover typically contained *Hypochaeris radicata*, *Senecio madagascariensis*, *Ciclosperma leptophylla* (Slender Celery), *Brunoniella australis* (Purple Trumpet) and *Asperula conferta* (Common Bedstraw).

This community complex north of the main east-west road tended to occur as part of a mosaic, with similar combinations of species to those to the south of the east-west road. *Microlaena stipoides* was generally dominant under dense canopy. In addition, *Imperata cylindrica* (Blady Grass) was dominant in several patches, generally in moister locations.

The main species comprised *Themeda australis*, *Microlaena stipoides*, *Cymbopogon refractus* and the exotic *Eragrostis curvula* and *Cynodon dactylon*. Other widespread species included: *Paspalum dilatatum*, *Briza subaristata*, *Axonopus affinis*, introduced Asteraceae, *Richardia stellaris* and *Plantago lanceolata* (Lambs Tongue). Native species included: *Aristida vagans*, *Dichondra repens* (Kidney Plant), *Pratia purpurascens* (Whiteroot) and *Asperula conferta*.

Photograph 4.3 Grassland in the Central Precinct

ii. Exotic grassland

The most common exotic grassland was dominated by one or more of *Eragrostis curvula* (African Love-grass), *Cynodon dactylon* and *Briza subaristata*. Other common species included: *Axonopus affinis* (Carpet Grass), *Paspalum dilatatum*, *Richardia stellaris*, *Senecio madagascariensis* (Fireweed) and *Hypochaeris radicata* (Flatweed). *Verbena* spp., (Purpletop) was locally common.

This community complex occurred through much of the southern section of the precinct (in the vicinity of the old radio frequency tower and south of the main east-west road. Localised relatively small patches of *Themeda australis* (Kangaroo Grass) were observed in several locations within this community. Exotics comprised an estimated 60 to 99% of the projective foliage cover in these two areas.

North of the main east-west road this community generally formed a mosaic with indigenous grassland although exotic species were dominant near the north-south and east-west roads. The percentage of exotics ranged from about 10 to 90% in the northern zone.

The noxious plant *Ailanthus altissima* (Tree of Heaven) was recorded next to an existing track.

iii. Conservation Significance

The areas of native grassland in the Central Precinct are a highly modified variant of Cumberland Plain Woodland. Most areas contained relatively high proportions of exotic ground cover species that are likely to threaten its long-term viability and usefulness for conservation purposes. It is possible that the taller indigenous grass species could survive with the lowest stratum being dominated by exotics. The two-level mixed grassland would be similar in structure to native communities dominated by tufting species, however the floristics are and would remain compromised by the entrenched introduced species.

Areas containing exotic grassland were considered to have no conservation significance for native flora. However, as discussed above, this community is generally mixed with native grassland, much of which is regenerating to native woodland, and therefore has some conservation significance.

4.1.4 Freshwater Wetlands

Several patches of Freshwater Wetlands occur in the precinct (Figure 4.1, Photograph 4.4). The largest area is located within and adjacent to the transmission line easement and a smaller area is also contained within this easement. Some other small patches of wetlands form a mosaic with Swamp Oak Floodplain Forest and River-flat Eucalypt Forest. These are likely to have been created when the original forest vegetation was removed and the soil was disturbed, creating depressions that are ephemerally inundated and allowing wetland species to colonise.

The drier sections are dominated by *Carex appressa*. *Typha orientalis* occurred in the western section and as small clumps in other locations. Wetter sections mainly contained *Hemarthria uncinata* and *Triglochin procerum*. Small proportions of *Ludwigia peploides* and *Typha orientalis* (Cumbungi) were present. The margins of the wetlands typically contained *Juncus* sp., *Centella asiatica* (Pennywort), *Ranunculus inundata*, with an outer margin of exotic *Cynodon dactylon* and *Briza subaristata* or Swamp Oak Floodplain Forest, as described above.

Photograph 4.4 Wetland in the Central Precinct

i. Conservation Significance

The sedgeland in the Central Precinct is considered to be a variant of the EEC listed under the TSC Act; *Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions*. This kind of wetland is uncommon in and around the SMP and is considered to have moderate to high conservation significance. Where wetland species have colonised artificially created habitats, the area is still considered to be a degraded variant of the EEC. Degraded wetlands have conservation value if they form part of a habitat corridor, provide habitat for aquatic species and resources for birds and mammals, provide habitat for threatened aquatic plants or maintain a seed bank of local provenance plants. The smaller areas of sedgeland in the Central Precinct formed in scrapes in the soil have minimal conservation value. They provide small areas of habitat to common frog species and water resources for other animals, as well as local provenance plants. The larger area of wetland towards the western side of the Central Precinct has a slightly higher conservation value as it is currently connected to larger areas of habitat in the Regional Park and contains habitat for Latham's Snipe.

4.2 Vegetation Condition

The vegetation within the Central Precinct has been assessed in terms of its condition (proportion of exotic species) as an indication of its recovery capacity to regenerate to a native vegetation community. Quadrat condition is shown in Appendix C.

The Central Precinct varies from low to high condition. The grassland areas are a mosaic of exotic and native grassland with species composition varying often so that patches dominated by either native or exotic species may only be several square metres in area. Common dominant exotic grass species are *Axonopus affinis, Eragrostis curvula, Cynodon dactylon* and *Setaria gracilis* with *Briza subaristata* occurring occasionally. Common dominant native grass species are *Aristida vagans, Bothriochloa decipiens, Sporobolus creber, Chloris ventricosa, A. ramosa, Austrodanthonia* sp. *Eragrostis brownii, Cymbopogon refractus, Microlaena stipoides* and *Themeda australis*. Most quadrats contained a mixture of native and exotic species in varying proportions. In general, grassland had higher condition towards the south of the precinct but towards the centre and north, native grassland still in places had 50% exotic cover.

Areas of regenerating woodland and forest were in moderate condition overall but varied from low to high, depending on variation in the ground cover. Patches of forest within the centre of the precinct are highly fragmented and more susceptible to weed invasion. Areas of remnant canopy trees growing amongst exotic grassland represent remnant CPW and RFEF but are not viable in the long term as exotic species are so well-established there.

The high level of establishment of exotic species in the precinct has reduced the likelihood that the native soil seed bank is intact, especially in grassland areas, and native communities are unlikely to regenerate. If native species did regenerate, there would be a low diversity of species and exotics would persist. Any regeneration that would occur in the precinct would be from recolonisation from adjacent communities, for example, on the edge of the Regional Park.

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St Marys Property Boundary

Regional Park

NPWS Vegetation Communities

- 3 - Cooks River Castlereagh Ironbark Forest
- 4 - Castlereagh Swamp Woodland
- 6 - Castlereagh Scribbly Gum Woodland
- 9 - Shale Hills Woodland
- 10 - Shale Plains Woodland
- 11 - Alluvial Woodland
- River-flat Eucalypt Forest
- Swamp Oak Floodplain Forest
- 36 - Freshwater Wetlands
- 103 - Shale/Gravel Transition Forest

Disturbance

- A Canopy intact
- B Canopy gaps
- C Even canopy gaps
- Cmi
- TX Scattered indigenous tree cover
- TXR Scattered indigenous tree cover (Rural/ residential)
- TXU Scattered indigenous tree cover (Urban)
- Cleared

0 500 1000

Metres

Figure 4.1 Vegetation communities of the St Marys Property

4.3 Plant Species

Numerous flora surveys have recorded a wide diversity of plants from the SMP, including several threatened species. These include *Grevillea juniperina ssp juniperina, Pultenaea parviflora, Pimelea spicata, Dillwynia tenuifolia, Micromyrtus minutiflora, Marsdenia viridiflora* ssp *viridiflora* (endangered population), and *Persoonia nutans*. The majority of these species are found in Shale-gravel Transition Forest (SGTF) to the east of the SMP, where the soil is characterised by large amounts of lateritic gravel. The soil type in the Central Precinct is different however, and contains less lateritic gravel, although localised areas contain high proportions of gravel also. Consequently, there is limited habitat for most of the threatened species recorded from the east, except in pockets of similar soil type.

One threatened plant species; *Grevillea juniperina* ssp *juniperina* was recorded in the Central Precinct, as shown in Figure 4.2. No other species recorded from the precinct are of conservation significance.

Other threatened species that have been recorded from the locality, but have not been recorded on the SMP include *Acacia bynoeana* (Bynoes Wattle) and *Allocasuarina glareicola* (Figure 4.3).

A species list for the Central Precinct is provided in Appendix B.

4.3.1 Grevillea juniperina subsp. juniperina

Grevillea juniperina subsp. *juniperina* is listed as Vulnerable under the TSC Act. It is a dense shrub, 0.5-1.5m tall, found only in Western Sydney, between St Mary's, Londonderry and Prospect[31]. *Grevillea juniperina* subsp. *juniperina* is a broadly spreading bush with spider-like flowers 2.5-3.5 cm long ranging in colour from red to pinkish, pale orange to greenish[32]. The leaves are narrow and prickly to 22mm long, clustered along short lateral branches and often bright green[32]. It occurs in localised and small populations on red sandy to clay soils in Cumberland Plain Woodland and Castlereagh Woodland. Threats to *Grevillea juniperina* subsp. *juniperina* include habitat clearance, altered fire regimes, weed invasion, rubbish dumping, trampling, vehicular damage[33] and degradation and reduction of habitat following clearing and fragmentation of native vegetation[32].

It is estimated that approximately 530 individuals occur within the precinct (Photograph 4.5). Large areas of habitat for this species will remain in the Regional Park, where over 250,000 *Grevillea juniperina* subsp *juniperina* specimens are located[18].

Table 4.1 Populations of *Grevillea juniperina* ssp *juniperina* in the Central Precinct

Location – WGS 84	Number of plants (estimated)
56 291888 6265653	150
56 291961 6265646	380
56 291043 6264788	2

Photograph 4.5 *Grevillea juniperina* subsp*. juniperina*

4.3.2 Weeds

Much of the Central Precinct contained introduced species, mainly herbaceous types associated with disturbed areas and farms. The proportions of introduced species were generally lower in areas where native trees were regenerating in large numbers in grassland. This may be a result of shading and root competition of regenerating trees that modifies the environment to favour indigenous ground cover species and disadvantages many of the exotic species.

Several species recorded from the Central Precinct are required to be controlled according to weed control legislation. This includes species declared Class 3 Noxious (*Cortaderia selloana* and *Alternanthera philpxeroides*), Class 4 Noxious (*Eragrostis curvula*, *Rubus*

fruticosus and *Ligustrum sinense*) and Class 5 Noxious (*Lantana camara*). Three of these species are declared as Weeds of National Significance (WONS) (*Alternanthera philpxeroides*, *Rubus fruticosus* and *Lantana camara*).

A Weed Management Plan has been prepared to specifically deal with the weeds that occur in this precinct.

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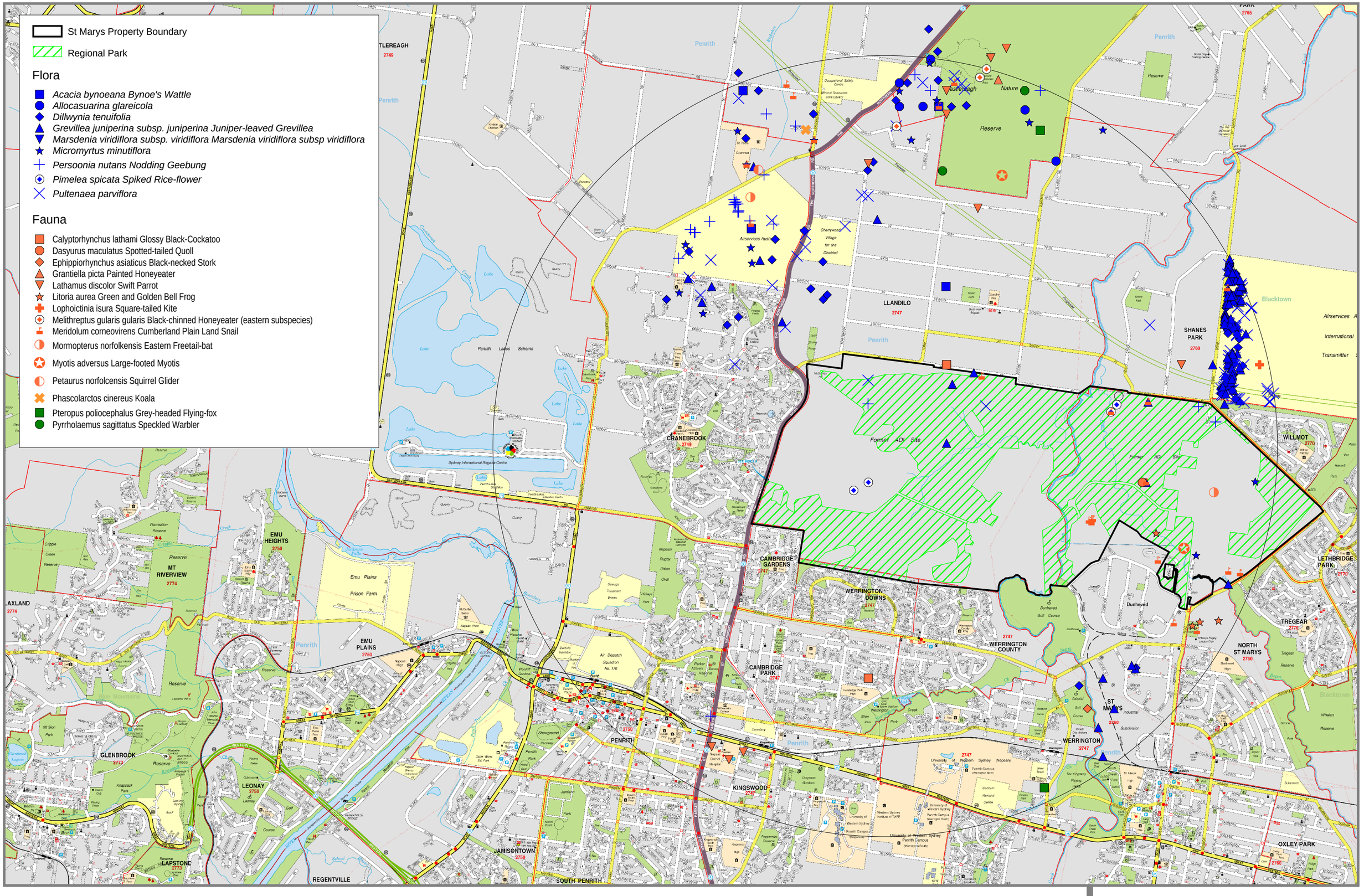

Figure 4.2 DECC Threatened Flora and Fauna Records

Chapter 5

Fauna of the Central Precinct

This chapter describes the fauna of the Central Precinct, taking into account information obtained from previous surveys and surveys undertaken specifically for this Central Precinct Biodiversity Assessment. Particular emphasis has been placed on threatened fauna recorded from the SMP, the Central Precinct or with potential to occur.

5.1 Fauna Habitat Assessment

Habitats of value to native fauna in the Central Precinct are generally associated with the largely regrowth woodland that occurs in clumps throughout the precinct and with the area of wetland habitat near the concrete stockpile. However, the value of this vegetation to hollow-dwelling native fauna is limited as the trees are mostly immature and offer limited roosting or nesting habitat. The majority of the woodland habitat that occurs on the SMP will be conserved within the Regional Park.

The extent of disturbance and land management activities has significantly limited the suitability of this area to provide habitat for native species. Disturbed habitats generally support populations of native and exotic species that are common in urban/rural environments. Therefore the patches of remnant vegetation in the Central Precinct are not likely to support a wide range of species compared with the Regional Park which contains larger areas not subject to ongoing disturbance.

5.1.1 Grassland Habitats

The dominant fauna habitat in the Central Precinct is grassland, and these occur throughout most of the Central Precinct. Grassland areas are of little value to native fauna, as there is little structural complexity that is necessary to provide roosting or nesting habitat for most species. Species that commonly occur in these habitats are those that are generally abundant in agricultural areas where the native vegetation has been significantly modified or removed, or they are species that typically favour foraging in grassland. Such species include the Australian Raven (*Corvus coronoides*), Crested Pigeon (*Geophaps lophotes*), Galah (*Cacatua roseicapilla*) and Eastern Grey Kangaroo (*Macropus giganteus*).

5.1.2 Woodland Habitats

The woodland communities in the Western Precinct are very limited, and are restricted to remnants occurring along the common border with the Regional Park and patches of regrowth in the middle of the precinct. These areas typically have very little understorey vegetation remaining, and consist mostly of juvenile canopy species. Despite this, flowering eucalypts, paperbarks and smaller shrubs on the subject site are likely to provide some foraging resources for nectivorous mammals and birds. The Sugar Glider (*Petaurus breviceps*) will feed on nectar and pollen when available[34] and the Common Ring-tail Possum (*Pseudocheirus peregrinus*) will also feed on flowers[35]. Birds such as honeyeaters, would also feed on the nectar resources and several bat species may also forage over the canopy[36].

The woodlands within the Central Precinct consist of predominantly regrowth vegetation and therefore are relatively immature. Few trees are older than approximately 50 years, and as such, show little signs of senescence and generally lack hollows. This significantly limits the nesting habitat available for hollow-dependent fauna such as Sulphur-crested Cockatoos, Galahs and Brushtail Possums. The majority of trees with potential to support hollows are located outside of the Central Precinct in the Regional Park.

Extensive areas of woodland habitat occur throughout most of the Regional Park and provide sheltering, foraging, nesting and breeding habitat for most fauna that may occur within the Central Precinct. These habitats are extensive within the SMP and facilitate fauna movement within the property and between external areas of habitat. These habitats will be protected in the long term within the Regional Park.

5.1.3 Wetland Habitats

Several patches of wetlands occur in the Central Precinct, the largest and most significant being within and adjacent to the transmission line easement. A man-made drainage line also runs through the precinct.

The wetland patches contained water at the time of the survey and numerous birds were observed foraging in this area. The largest wetland is likely to provide breeding and foraging habitat for a wide variety of aquatic animals, particularly birds including ducks, ibis, herons and one migratory species; Lathams Snipe (*Gallinago hardwickii*). The Large-footed Myotis may forage in this wetland, and other bat species are likely to congregate in this area to forage on insects that are attracted to the wetland. Amphibians are likely to occur in the wetland, and the Common Eastern Froglet (*Crinia signifera*) was recorded calling from there. There is potential habitat for the Green and Golden Bell Frog (*Litoria aurea*) in this area, although the presence of Mosquito Fish (*Gambusia holbrooki*) may limit the ability of this area to support these frogs.

The drainage line contains some water at most times of the year and provides a water source for native fauna. It is likely to provide habitat for aquatic species and contains aquatic and fringing vegetation in parts that is a prerequisite for most aquatic species. It is

likely to provide significant habitat for native species as it is a semi-permanent source of water and contains significant amounts of vegetation on the edges that provides habitat for wading birds and amphibians.

5.1.4 Fauna Habitat Corridors

The Central Precinct has limited ability to function as a corridor for native wildlife due to the low level of native vegetation that is present on the site. However, the Central Precinct is located between large areas of Regional Park to the east and west of the precinct, and therefore has some potential to facilitate the movement of native fauna between the two sections of Regional Park. There is connectivity between these two areas via a broad band of vegetation to the north, however, remnant vegetation within the precinct could enhance the existing connectivity. If retained, the remnants of vegetation in the middle of the precinct may be able serve as corridors or "stepping stones" for wildlife between the two sections of the Regional Park.

5.2 Fauna Species

A wide variety of fauna species have been recorded from the SMP, and the Central Precinct, including several threatened species. A complete fauna species list for the study area is provided in Appendix D.

5.2.1 Non-Flying Mammals

The most common and visible mammals across the SMP, are the Eastern Grey Kangaroo (*Macropus giganteus*) and Red Kangaroo (*Macropus rufus)*. The animals within the SMP are not part of a natural population, as they have been introduced into the area by humans. Population numbers are dynamic but were estimated to be 2,185 animals in May 2007[37]. Some kangaroos are contained within the Central Precinct. These animals are subject to a Macrofauna Management Plan[38], which is being implemented across the SMP.

Three arboreal mammals have been recorded from the SMP; the Common Brush-tail Possum (*Trichosurus vulpecula*), the Common Ring-tail Possum (*Pseudocheirus peregrinus*), and the Sugar Glider (*Petaurus breviceps*). The Common Brush-tail Possum and Sugar Glider generally occur in low numbers on the SMP which is likely to be a reflection of the lack of hollow-bearing trees. The Common Ring-tail Possum is more abundant, which is most likely due to its ability to build nests in tree foliage. One native terrestrial mammal has been recorded from the SMP; the Echidna (*Tachyglossus aculeatus*). These species are likely to be found predominantly in the Regional Park where large areas of intact woodland are present.

Several threatened mammals have been recorded within the locality or have potential habitat within the locality including the Spotted-tailed Quoll *(Dasyurus maculatus*

maculatus), Koala (*Phascolartctos cinereus*) and Squirrel Glider (*Petaurus norfolkensis*). No recent, confirmed records for these species have been obtained for the SMP, and it is unlikely that these species occur in the Central Precinct due to the limited availability of habitat.

There are a small number of unverified anecdotal records of koalas from the SMP and surrounds from 1985 until the present (Ray Giddins pers comm.). No koalas were detected in the Central Precinct during recent field investigations, nor were any traces of koalas found such as scats or scratches on trees. According to members of staff who have worked on the site for many years, including Graham Duncan and Bill Mitchell, there have been no formal or verified reports of koalas made within the site. This is consistent with the findings of earlier fauna surveys by Gunninah Consultants and ERM[15,17].

Several introduced species have been recorded from the SMP including the European fox (*Vulpes vulpes*), cat (*Felis catus*), dog (*Canis familiaris*), rabbit (*Oryctolagus cuniculus*), Brown hare (*Lepus capensis*), Black rat (*Rattus rattus*) and House mouse (*Mus musculus*). The introduced species are the subject of a Feral and Domestic Animal Management Strategy for the Central Precinct, which includes recommendations for their control.

5.2.2 Bats

Numerous bat surveys have been conducted on the SMP and the species detected during these surveys are indicated in Table 5.1. Of the species recorded, several are listed as threatened under the TSC Act and/or the EPBC Act including; the Grey-headed Flying-fox (*Pteropus poliocephalus*), Large Footed Myotis (*Myotis adverus*), Eastern Bentwing Bat (*Miniopterus schriebersii oceanensis*), Greater Broad-nosed Bat (*Scoteanax rueppellii*) and Eastern Freetail Bat (*Mormopterus norfolkensis*).

The Central Precinct may provide suitable habitat for the Large Footed Myotis, as this species forages over open water for fish and insects, using its feet[39]. The largest wetland in the precinct may provide suitable habitat for this species as it contains a relatively large area of open water at times when it is flooded, where the species may forage.

The Eastern Bentwing Bat, Greater Broad-nosed Bat and Eastern Freetail Bat may have some limited potential roosting habitat on the Central Precinct as they are known to roost in tree hollows[40-42]. This kind of habitat is limited in the Central Precinct however, as the vegetation is predominantly immature regrowth. The Greater Broad-nosed Bat has also been known to roost in buildings[41], and any derelict buildings within the precinct may provide habitat for this species. These species may forage across the Central Precinct but are not expected to rely upon the vegetation in the precinct for roosting habitat.

The Grey-headed Flying-fox (*Pteropus poliocephalus*) is listed as Vulnerable under both the TSC Act and the EPBC Act. This species is the largest Australian bat, and forages on the nectar, fruits and pollen of native trees, and roosts in large aggregations[43]. The Grey-headed Flying-fox has been recorded from the locality and has the potential to forage on the SMP; however no roosting camps are present on the site. There is limited habitat

present in the Central Precinct for this species due to the relatively low amounts of native vegetation that is present.

Table 5.1 BAT SPECIES DETECTED ON THE SMP

Species	Common Name	Western Precinct 2001	Dunheved B.A. 2004	Demolition Surveys 2006
Chalinolobus gouldii	Gould's Wattled Bat	41 records	4 records	26 records
Chalinolobus morio	Chocolate Wattled Bat	5 records		2 records
Miniopterus schreibersii	Eastern Bentwing-bat	15 records	13 records[2]	
Mormopterus norfolkensis	Eastern Freetail-bat	28 records		3 records
Mormopterus planiceps	Little Mastiff-bat	70 records		
Mormopterus sp.	mastiff-bat		2 records	
Myotis adversus	Large-footed Myotis		43 records[1]	
Nyctophilus geoffroyi	Lesser Long-eared Bat			2 records
Nyctophilus sp.	long-eared bat	4 records	43 records[1]	
Scoteanax rueppellii	Greater Broad-nosed Bat	2 records		
Scotorepens orion	Eastern Broad-nosed Bat	9 records		
Tadarida australis	White-striped Freetail-bat	16 records		
Vespadelus darlingtoni	Large Forest Bat	30 records		
Vespadelus regulus	Southern Forest Bat	6 records	13 records[2]	
Vespadelus vulturnus	Little Forest Bat	2 records		

Notes: 1.Calls not identified to species but could either be Nyctophilus sp. or Myotis adversus[1], or Miniopterus schreibersil or Vespadelus regulus[2].

5.2.3 Birds

Within the Central Precinct, the main habitats for birds are those associated with remnant and regrowth vegetation. However, these areas of regrowth are generally immature and structural diversity is low, thereby limiting the diversity of birds. These kinds of habitats are rare in the precinct, and the main habitat type is open grassland which supports a low diversity of bird species. Within the disturbed grasslands and open woodland, common bird species include the Australian Magpie-lark (*Grallina cyanoleuca*), Australian Raven (*Corvus coronoides*), Pied Currawong (*Strepera graculina*), Eastern Rosella (*Platycercus eximius*), Rainbow Lorikeet (*Trichoglossus naematodus*) and the Noisy Miner (*Manorina melanocephala*). These species are common in urban and rural environments and often out-compete smaller forest birds at the interface with woodland habitats. Emus (*Dromaius novaehollandeae*) are also present in the precinct within the grassland and open woodland

areas. Although there are limited habitat areas for small birds, several common birds were recorded in woodland areas including the Weebill (*Smicrornis brevirostris*), Superb Fairy Wren (*Malurus cyaneus*), and the Spotted Pardalote (*Pardalotus punctatus*).

A number of bird species listed under the TSC Act and/or the EPBC Act, including migratory and non-migratory species, have been recorded from the SMP and may utilise habitats within the Central Precinct.

Migratory species that may visit the site to forage include the Lathams Snipe (*Gallinago hardwickii*), and Swift Parrot (*Lathamus discolour*). The Swift Parrot is listed under both the TSC Act and the EPBC Act as Endangered and has been recorded from within the locality, although it has not been recorded from the SMP or the Central Precinct.

Lathams Snipe is listed as Migratory under the EPBC Act and was recorded during the most recent field survey in an area of wetland in the Central Precinct in the transmission line easement.

The Speckled Warbler (*Pyrrholaemus sagittata*) is listed as Vulnerable under the TSC Act and has been recorded at the SMP in 1991[15], and most recently in 2006 by Cumberland Ecology when it was recorded in the western area of the Regional Park. This species forages on the ground in grassy woodlands, and requires large undisturbed remnants in order to persist[44]. The Central Precinct consists predominantly of degraded regrowth woodland that has been highly disturbed. The precinct may constitute some limited potential habitat for this species, although this species is most likely to occur within parts of the Regional Park where there is sufficient shelter in the grass/shrub layers.

The Diamond Firetail (*Emblema guttata*) is listed as Vulnerable under the TSC Act and was recorded on the SMP in 1991[15], however no subsequent records have been documented. The Diamond Firetail inhabits grassy eucalypt-dominated woodlands, nests in trees and bushes, and forages on the ground. The Central Precinct consists predominantly of degraded regrowth woodland with few areas of shrubs and provides little habitat for this species. Consequently it is considered unlikely that the Diamond Firetail is present in the Central Precinct.

The Black Bittern is listed as Vulnerable under the TSC Act has been recorded on the SMP in 1985 in South Creek near the southern boundary of the SMP. The Black Bittern is found in wetland areas with permanent water and dense vegetation. It has not been recorded in the Central Precinct but marginal potential habitat occurs there in the form of the wetlands although these are not permanently wet areas.

Other threatened bird species recorded from the locality but not the SMP include: the Regent Honeyeater (*Xanthomyza phrygia*), listed as Endangered under both the EPBC Act and the TSC Act; Black-necked Stork (*Ephippiorhynchus asiaticus*), listed as Endangered under the TSC Act, and Painted Honeyeater (*Grantiella picta*), Square-tailed Kite (*Lophoictinia isura*) and the Glossy Black Cockatoo (*Calyptorhynchus lathami*), all listed as Vulnerable under the TSC Act.

These species are considered unlikely to occur on the Central Precinct due to the lack of suitable habitat. If these species occur on the SMP, they are considered likely to occur within the Regional Park as large areas of intact native vegetation are being preserved.

5.2.4 Reptiles and Amphibians

Reptiles that have been recorded at the SMP and may occur within the Central Precinct include the Red-bellied Black-snake (*Pseudechis porphyriacus*), Eastern Brown Snake (*Pseudonaja textilis*), Bearded Dragon (*Amphibolurus barbatus*) and the Delicate Garden Skink (*Lampropholis delicata*). These species are generally common in open grassland/open woodland habitats.

No threatened reptiles have been recorded on the SMP. The Broad-headed Snake (*Hoplocephalus bungaroides*), listed as Endangered under the TSC Act and Vulnerable under the EPBC Act has been recorded from the locality, however it has not been recorded on the SMP, and is unlikely to occur due to lack of suitable habitat. This species inhabits sandstone escarpments and none are present on the SMP.

The Central Precinct contains potential habitat for amphibians in the patches of wetland in the precinct. The largest wetland is likely to provide potential habitat for the Green and Golden Bell Frog (*Litoria aurea*), a species listed as Endangered under the TSC Act and Vulnerable under the EPBC Act, in parts that may be permanently inundated. However, established populations of Mosquito Fish (*Gambusia holbrooki*) are also present in the wetlands of the Central Precinct, which are a known predator of Green and Golden Bell Frog eggs and tadpoles. Mosquito Fish have been linked to declines in Green and Golden Bell Frog distribution and are likely to limit the suitability of the wetlands to provide habitat for this species[45].

5.2.5 Invertebrates

One invertebrate species listed as Endangered under the TSC Act has been recorded on the SMP, the Cumberland Land Snail (*Meridolum corneovirens*). The Cumberland Land Snail has been found in many areas of Cumberland Plain Woodland on the SMP and many records of the species exist in the surrounding locality. The Cumberland Land Snail was not recorded in the Central Precinct; however there is some potential for the species to occur in woodland patches in the precinct, particularly those adjacent to the Regional Park. The vegetation on the Central Precinct is highly disturbed and there is little leaf litter present for this species to shelter within and it is considered that it provides potential, although not likely, habitat for this species.

Chapter 6

Impact Assessment

6.1 Introduction

This chapter provides a detailed analysis of the known and potential impacts of the development of the Central Precinct on the ecological values of the precinct, in particular, threatened species and communities. This analysis includes a discussion of indirect impacts of the development including weed invasion and stormwater runoff.

The primary impact mitigation measure for ecological impacts on the SMP is the protection and conservation of approximately 900 ha of the highest quality native vegetation on the SMP, within the Regional Park. Impacts resulting from the development of the Central Precinct will be offset by the major conservation outcome of the Regional Park and by a series of management strategies to be implemented for management of weeds, feral animals, macrofauna and bushfire in the Central Precinct. In addition, a suite of mitigation measures will be implemented to reduce impacts from the proposed development within the Central Precinct and adjoining Regional Park including comprehensive drainage and waste management strategies. There is potential for additional mitigation measures to be implemented including the retention and incorporation of patches of regenerating trees into the site plan.

6.2 Impacts on Endangered Ecological Communities

Development within the Central Precinct may result in the removal or disturbance of approximately 25.6ha of Cumberland Plain Woodland, 11.3ha of Swamp Oak Floodplain Forest, 7.4ha of River-flat Eucalypt Forest, 1.6ha of Shale-gravel Transition Forest and removal or modification of 2.4ha of Freshwater Wetlands.

The examples of these communities that occur in the Central Precinct are highly degraded and consist mainly of sparse native tree regrowth with a slashed understorey. Based on their highly modified condition, the conservation value of these remnants has been seriously compromised and the loss of this vegetation would not be considered significant in terms of conservation of this ecological community. There are variable but generally high proportions of exotic species in the Central Precinct, which further detract from their ecological significance. Large areas of these communities are conserved within the Regional Park that are in good condition and will be conserved in the long term.

The preliminary determination for CPW as a critically endangered ecological community (CEEC) expands the current definition of the community to include derived grasslands (areas from which trees and shrubs have been cleared) and requires further consideration as to the adequacy of conservation of the community. The area of CPW in the Central Precinct would not increase. The soil profile in this precinct is highly disturbed where large areas have had soil stockpiled or stripped. Grassland areas are a mosaic of exotic or native dominated grasses that vary frequently. There areas are not considered to have the ability to recover to CPW.

Large areas of all communities represented in the Western Precinct are present within the Regional Park that will be conserved in the long term. Approximately 411.5ha of Cumberland Plain Woodland, 202.8ha of Alluvial Woodland (including River-flat Eucalypt Forest and Swamp Oak Floodplain Forest forms), 2.8ha of Freshwater Wetlands and 55.8ha of Shale Gravel Transition Forest are present within the Regional Park.

The areas of each community within the precinct are compared to the areas of each community within the Regional Park in Table 6.1.

Table 6.1 AREAS OF VEGETATION COMMUNITIES WITHIN THE CENTRAL PRECINCT AND THE REGIONAL PARK

Community	Central Precinct (ha)	Regional Park (ha)
Swamp Oak Floodplain Forest	11.3	202.8 (Alluvial Woodland)
River-flat Eucalypt Forest	7.4	
Cumberland Plain Woodland	25.6	411.5
Shale-gravel Transition Forest	1.6	55.8
Freshwater Wetlands	2.4	2.8

The final areas to be cleared will be identified at the Development Application stage. Some areas of native vegetation are likely to be retained within the precinct and where possible, mature trees will also be protected and retained. Areas of riparian and wetland communities will be regenerated along riparian corridors that will be created or possibly retained along existing drainage lines in the precinct. Wetland vegetation will also be planted around detention basins within the precinct.

The DECC is currently preparing a draft recovery plan for the endangered ecological communities within the Cumberland Plain[46]. Although the plan is only in the development stage, it will cover the following issues:

- Reservation and acquisition of open space;
- Land use planning;
- Land Management;

- Promoting community involvement; and
- Research.

Development within the Central Precinct is not considered likely to have a serious impact on these vegetation communities. Assessments of Significance have been prepared for these communities and are presented in Appendix E. These indicate that no significant impact is expected to occur.

6.3 Impacts to Flora Species

One threatened plant species has been recorded from within the Central Precinct; *Grevillea juniperina* spp. *juniperina*.

6.3.1 Grevillea juniperina spp. *juniperina*

Approximately 530 specimens of *Grevillea juniperina spp. juniperina* were recorded from the Central Precinct during the field survey. These are located at the northern and western margins of the precinct.

This is not considered to represent an important number of specimens for the persistence of the local occurrence of this species. It has been estimated that at least 249,000 (minimum) specimens of *Grevillea juniperina* subsp *juniperina* occur within the Regional Park, where extensive habitat has been conserved[17]. These specimens will not be affected by development within the Central Precinct and will be protected in perpetuity. An assessment of significance has been prepared for this species and is presented in Appendix E. This assessment found that no significant impact is expected to occur to this species as a result of development within the Central Precinct.

6.4 Impacts to Fauna

The main impacts to native fauna from the development of the Central Precinct will be the removal and reduction of woodland and forest habitat.

The vegetation within the Central Precinct is highly fragmented and degraded, and therefore its value as habitat for native fauna has been significantly reduced. This habitat is not likely to be significant breeding habitat for any threatened species of fauna, however it is likely that some more mobile species, such as bats and birds, may utilise habitat within the precinct to forage.

6.4.1 Bats

The Central Precinct is likely to provide some foraging habitat for the bats recorded from the SMP; however, roosting habitat in the form of hollow trees for the microchiropteran bats is largely absent. Therefore hollow dwelling threatened bat species; Eastern Bentwing Bat (*Miniopterus schriebersii oceanensis*), Greater Broad-nosed Bat (*Scoteanax rueppellii*) and Eastern Freetail Bat (*Mormopterus norfolkensis*) are unlikely to have roosting habitat on the precinct. No camps of the Grey-headed Flying-fox (*Pteropus poliocephalus*) occur on the SMP.

Some limited foraging habitat is likely to be present however. Insectivorous microchiropteran bat species are likely to forage over the grasslands and regrowth woodlands for insects and the Grey-headed Flying-fox may forage for nectar and pollen in the woodlands.

The large wetland in the Central Precinct provides potential habitat for the Large-footed Myotis. This wetland may be negatively affected by the close proximity of urban development including the potential for domestic animals to enter the wetland, noise pollution, light pollution, and disturbance impacts from human impacts so close to the wetland and parts of the wetland may be destroyed. These impacts can be mitigated however, such as the through the rehabilitation of a riparian corridor and creation of a detention basin. Chapter 7 outlines a range of measures that are recommended to be implemented to reduce the impacts in this area.

The bat species recorded from the SMP are not considered likely to be dependent upon habitat resources within the Central Precinct for their survival. The adjoining Regional Park provides extensive foraging and roosting habitat, and these highly mobile species are able to fly over developed areas without restriction.

An assessment of significance (7 part test) has been prepared to assess the impacts of the proposed development on bats and is presented in Appendix E. This assessment indicates that no significant impact is expected to occur to threatened bat species as a result of the proposed development.

6.4.2 Birds

A wide range of birds have been recorded from the locality, including several threatened bird species (see Chapter 5). However, few threatened species have been recorded from the SMP, and those have been predominantly from the Regional Park where large areas of woodland habitat are being protected.

The Central Precinct is considered to offer poor habitat for threatened bird species as it lacks a diverse and complex understorey to provide food resources for smaller birds and protection from predators, and these bird species are not considered likely to occur on the site. The majority of the Central Precinct is open grassland with few areas that contain trees, and the trees that are present are largely immature, and lack hollows to provide

nesting habitat. The majority of the treed vegetation within the SMP will be conserved within the 900 ha Regional Park and will continue to provide high quality habitat for a wide range of species.

Latham's Snipe has been recorded from the wetland within the transmission line easement in the Central Precinct. This wetland may be negatively affected by the close proximity of urban development and the removal of some wetland areas for development. This includes the potential for domestic animals to enter the wetland, noise pollution, light pollution, and disturbance impacts from human impacts so close to the wetland. These impacts can be mitigated however, and Chapter 7 outlines a range of measures that are recommended to be implemented to reduce the impacts in this area.

Assessments of significance (7 part test) have been prepared to assess the potential impacts of the proposed development on threatened bird species and are presented in Appendix E. These assessments indicate that no significant impact is expected to occur to these species as a result of the proposed development.

6.4.3 Reptiles and Amphibians

No threatened reptile has been recorded from the SMP, and no significant impact will occur to any reptile species as a result of development within the Central Precinct.

The largest wetland area provides potential habitat for the Green and Golden Bell Frog (*Litoria aurea*). Part of this wetland will be protected from development, however it may be negatively affected by the close proximity of urban development with the impacts outlined previously. These impacts can be mitigated however, such as the through the rehabilitation of a riparian corridor and creation of a detention basin. Chapter 7 outlines a range of measures that are recommended to be implemented to reduce the impacts in this area.

6.4.4 Invertebrates

Traces of the Cumberland Land Snail (*Meridolum corneovirens*) have been found within the SMP in patches of Cumberland Plain Woodland but it has not been detected in the Western Precinct. Although potential habitat is present in the form of Cumberland Plain Woodland, extensive historical disturbance including vegetation clearance and substantial earth works has reduced the likelihood of the species occurring in the precinct. There is little leaf litter present for this species to shelter within and it is considered unlikely that this species occurs. The Regional Park provides extensive areas of habitat for this species, which will be maintained and enhanced in the long-term.

6.4.5 Summary of Impact Assessment

Table 6.2 lists the threatened fauna species that occur or potentially occur in the Central Precinct and the habitat for these species that is present within the Central Precinct, and whether or not they should to be considered in a seven part test.

Table 6.2 SUMMARY OF POTENTIAL IMPACTS TO HABITAT FOR THREATENED FAUNA

Species	Habitat within the Central Precinct	Potential Impact to Habitat	Seven-part Test?
Greater Broad-nosed Bat	Foraging habitat over vegetation remnant and forest edge.	Modification to foraging habitat	Yes
Large-footed Myotis	Foraging habitat over wetland.	Some indirect impact from close urban development	Yes
Eastern Freetail Bat	Foraging habitat over vegetation remnant and forest edge.	Modification to foraging habitat	Yes
Eastern Bentwing Bat	Foraging habitat over vegetation remnant and forest edge.	Modification to foraging habitat	Yes
Koala	Feed trees present in the precinct but the species is not known to occur.	Modification to potential habitat	No
Grey-headed Flying Fox	Limited foraging habitat on trees on the precinct. No camps known to occur on SMP.	Modification to foraging habitat	Yes
Speckled Warbler	Preferred habitat includes a combination of open grassy patches, leaf litter and shrub cover. Potentially uses open grassy habitats within Central Precinct but most likely to be restricted to the woodlands within the Regional Park.	Modification to foraging habitat	Yes
Black Bittern	No habitat present	None	No
Black-chinned Honeyeater	Potential habitat present in the precinct but not known to occur	Modification to potential habitat	No
Diamond Firetail	Most likely to occur within the Regional Park where it is less likely to be predated upon by	Modification to foraging habitat.	Yes

Table 6.2 SUMMARY OF POTENTIAL IMPACTS TO HABITAT FOR THREATENED FAUNA

Species	Habitat within the Central Precinct	Potential Impact to Habitat	Seven-part Test?
	feral animals and native pest species such as the Pied Currawong. Potentially occurs within the Central Precinct along the Regional Park edges.		
Painted Honeyeater	Specialist feeder on mistletoe. Unlikely to be sufficient mistletoes in the precinct to support this species	None	No
Cumberland Land Snail	Central Precinct provides degraded potential habitat in areas of Cumberland Plain Woodland.	Modification of habitat	Yes
Green and Golden Bell Frog	Potential habitat present in the form of Freshwater Wetlands, may be impacted by proximity to urban development.	None	No
Squirrel Glider	Few hollows present in Central Precinct, not known to occur.	None.	No

6.5 Indirect Impacts

There are a range of potential indirect impacts of the proposed development on native flora and fauna. The majority of these impacts can be avoided or mitigated. The potential indirect impacts are described below.

6.5.1 Stormwater Run-off and Erosion

Development within the Central Precinct will increase the level of impermeable surfaces and thereby reduce infiltration of rainwater into the soil and increase levels of stormwater runoff. This has the potential to increase rates of erosion and deliver increased pollution and sediment loads to water bodies in the SMP, as well as litter and nutrients. It is a requirement of SREP 30 that stormwater measures be incorporated into the development to ensure that there is no net adverse impact upon the water quality in South Creek, and to ensure that post-development peak runoff rates do not exceed the existing conditions.

To comply with these requirements within the Central Precinct area, a range of measures are proposed to be incorporated into the development:

- Major above-ground drainage lines are to be constructed and vegetated so they approximate as natural a state as possible and conserve indigenous flora wherever possible;
- Water detention areas are to be provided within the development area, and where appropriate designed to provide habitat for water birds and frogs;
- An erosion and sediment control plan is to be prepared for the subdivision development and construction phase. This plan is to be formulated in accordance with acceptable standards and is to ensure that the development does not contribute to environmental degradation; and
- Fill contamination has the potential to carry weeds and contaminants which can potentially harm the flora and fauna in the area. All fill used for on site construction will be validated before use in the Central Precinct.

6.5.2 Weeds

Development of the Central Precinct has potential to create conditions favourable to the increased dispersal and establishment of weeds. Particular hazards include:

- soil disturbance and stock piling during construction;
- introduction and dispersal of weed propagules from vehicles and machinery during construction;
- spread of invasive species in conservation areas/Regional Park if used in landscaping/gardens;
- increased run-off into the Regional Park; and
- nutrient laden run-off into the Regional Park.

The control and management of weeds has been addressed within the Weed Management Plan prepared for the Central Precinct. This plan addresses weed control measures for noxious and environmental weeds that currently exist in the Central Precinct, strategies to avoid and minimise the potential for weed spread and establishment during construction, and controls to prevent weed invasion into the Regional Park after the construction phase.

6.5.3 Feral, Pest and Domestic Animals

Feral and domestic/stray animals currently occur throughout the SMP. These include foxes, dogs, cats, rabbits, hares, Black rats, House mice and Mosquito fish. Feral and

domestic animals can impact on native flora and fauna through predation, competition, soil degradation and by disturbing foraging and nesting patterns.

Development of the Central Precinct has potential to enhance feral and pest animal populations by:

- Encouraging feral animals by providing foraging/scavenging opportunities such as rubbish piles;
- Encouraging pest species such as the Noisy Miner by creating open areas and less structurally complex habitat; and
- Encouraging feral animals by providing sheltering/nesting habitat such as stock piles of building materials and cleared vegetation.

Management of feral and domestic animals within the Central Precinct has been addressed within the Feral and Domestic Animals Management Strategy. This strategy includes control measures during and post construction to minimise habitats for feral animals and to restrict and control domestic cats and dogs.

6.5.4 Macrofauna

The SMP supports sizeable populations of macrofauna including Eastern Grey Kangaroos (*Macropus giganteus*), Red Kangaroos (*Macropus rufus*) and Emus (*Dromaius novaehollandiae*). These populations have been introduced to the SMP, even though Eastern Grey Kangaroos and emus are species that would have originally occurred naturally on the Cumberland Plain at the time of European settlement.

The major feeding areas for macrofauna are grasslands as forest vegetation does not provide much grass and is unable to support high densities of macrofauna. Development is occurring predominantly in grassland areas and the majority of the forest vegetation on the SMP being reserved in the Regional Park. Therefore, as development takes place across the site, major reductions in the feeding areas for kangaroos and emus will occur. This has the potential to significantly degrade vegetation in the Regional Park, as large numbers of macrofauna will be competing for limited resources which may result in overgrazing of sensitive ecological communities. To address this issue, a Macrofauna Management Plan for the entire SMP has been prepared with the endorsement of the DECC and has been implemented for approximately 4 years. Implementation of the MMP will result in population reduction and a decrease in grazing pressure and exclusion of animals from the Western Precinct. Further information concerning the development and implementation of the management plan are detailed in the St Marys Macrofauna Management Plan[1].

6.5.5 Key Threatening Processes

The following Key Threatening Processes (KTP), listed under the TSC Act, have been considered with respect to native species and ecological communities that occur in the Central Precinct:

i. Clearing of Native Vegetation

Native vegetation will be cleared for the development of the Central Precinct and the most direct impacts on native species and communities will arise from vegetation clearance. This vegetation is regenerating after disturbance and contains agricultural weeds. It is not considered to be good quality compared with vegetation within the Regional Park.

ii. Invasion of Native Plant Communities by Exotic Perennial Grasses

Exotic grasses occur across most of the Central Precinct. There is potential for exotic perennial grasses to invade bushland in the Regional Park, particularly if there is runoff from the precinct to the Regional Park, or dumping of grass propagules in the Regional Park by future residents. Active management of the Regional Park according to the Regional Park Plan of Management, and implementation of the Weed Management Plan will reduce the effect of exotic grasses and minimise invasion into the Regional Park.

iii. Competition from Feral Honeybees

Honeybees are currently established in the vegetation of the SMP and present an ongoing threat to native species. Honeybees can compete with native arboreal fauna and native bees for tree hollows, and can also compete with native pollinators for floral resources[47]. However, development within this precinct will not exacerbate these impacts as there are no tree hollows in this area to provide habitat for bees, and development will not increase the level of competition by honeybees.

iv. Infection of Native Plants by Phytophthora cinnamomi

Phytophthora cinnamomi is a fungus causing root rot in plants and presents a potential threat to the vegetation to be conserved within the Regional Park. However, during vegetation surveys no significant dieback from any source has been observed within the SMP, suggesting there are no aggressive pathogens active on the site. Moreover in the future there is unlikely to be any gross disturbance within the Regional Park that may stimulate any dormant pathogens that may potentially exist within the soil. The NSW Scientific Committee does not generally regard *Phytophthora cinnamomi* as a threat within Western Sydney vegetation. Development of the Central Precinct will not increase the effect of this KTP.

v. Importation of Red Imported Fire Ants into NSW

Fire ants, if established would be a major threat to terrestrial ecosystems. These ants have not been recorded from the SMP and development of the Central Precinct is not likely to increase the risk of establishment of these ants.

vi. Introduction of the Large Earth Bumblebee Bombus terrestris

The large earth bumblebee, if established would be a major threat to terrestrial ecosystems. This species has not been recorded from the SMP and development of the Central Precinct is not likely to increase the risk of establishment of this species.

vii. Removal of Dead Wood and Dead Trees

The proposed development will remove some dead wood and a small number of dead trees from the Central Precinct. However, most of the vegetation in the precinct is regrowth and so contains little dead wood and has been managed so that ground litter is reduced. Future urban development of the Central Precinct may create the potential for new residents to collect wood from the Regional Park for fire wood. This threat has been addressed by the DECC via the management plan for the Regional Park[48].

viii. Competition and Grazing by the Feral European Rabbit

Rabbits are well established across the SMP including the Central Precinct. The proposal will not increase the impact of rabbits, rather the precinct will benefit from the implementation of a Feral and Domestic Animal Management Strategy that includes rabbit control measures. Such measures are currently being implemented elsewhere in the SMP.

ix. Predation by the European Red Fox

Foxes are known to occur on the SMP and have been targeted in a control program as part of the implementation of the MMP. The proposal is not likely to increase the impacts of foxes but will benefit from the implementation of the Feral and Domestic Animal Management Strategy.

x. Predation by Feral Cats

Cats are known to occur on the SMP. Pet ownership will be restricted as part of the development proposal through the implementation of the Feral and Domestic Animal Management Strategy to ensure the number of feral cats on the SMP does not increase as a result of the proposed development.

xi. Ecological Consequences of High Frequency Fires

The SMP has had a relatively high fire frequency in the past due to arson. This has been addressed in the Regional Park Plan of Management. The proposed development of the Central Precinct is unlikely to significantly increase the frequency of fire, but fire frequencies will have to be monitored.

xii. Predation by Plague Minnow (Gambusia holbrooki)

The Plague Minnow preys upon tadpoles and is a threat to a number of frog species. It occurs within Ropes Creek and probably South Creek. It also occurs in wetland areas within the Central Precinct. If detention basins are constructed within the precinct, care should be taken to ensure the Plague Minnow is not introduced into these artificial habitats.

Chapter 7

Mitigation Measures

7.1 Introduction

Measures to minimise the impacts of the proposed development of the Central Precinct have been developed during the precinct planning process. These mitigation measures have been designed to ensure that species, communities or habitats of conservation significance are not compromised and will not be significantly affected by the proposed development. The key impact mitigation measure for development within the SMP, including the Central Precinct is the conservation of 900 ha of high quality bushland within the Regional Park. Other mitigation measures include the implementation of several management plans including a Weed Management Plan, a Feral and Domestic Animal Management Strategy and a Bushfire Management Plan. These plans outline objectives and measures that will be implemented to avoid impacts associated with these topics. The following sections describe these mitigation measures as well as additional impact mitigation measures that will be implemented within the Western Precinct.

7.2 Establishment of the Regional Park

The foremost mitigation measure for threatened species and ecological communities is the establishment of the 900ha Regional Park, to be managed by DECC. The Regional Park will conserve extensive, viable tracts of forest, woodland and wetland, and habitats of threatened and regionally significant species.

In addition to the reservation of this land, regeneration (assisted if required) of endangered ecological communities and threatened flora will occur within degraded parts of the Regional Park using local seed stock (this has been addressed within the Regional Park Plan of Management).

7.2.1 Regional Park Plan of Management

A Draft Plan of Management for the Regional Park[48] has been prepared by DEC in 2007. The Regional Park will be managed to maintain the remnant vegetation communities and associated biodiversity and will include the protection of significant cultural and scenic values. Visitor and research opportunities will be provided that are consistent with the conservation values of the Park. The key objectives of this plan include:

- Protection and enhancement of the natural heritage of the Park, particularly the endangered ecological communities and the threatened flora and fauna species through the management of fire, disturbed areas, drainage, introduced species, access and visitor use;
- Protection of the catchment values of South and Ropes Creeks through managing any disturbances, particularly those associated with fire, access and drainage;
- Provision of recreational facilities that are appropriate in a regional context and are designed, located and managed to protect the natural and cultural heritage and visual values of the Park;
- Provision of interpretive and educational opportunities through signage, park brochures and activities to assist visitor understanding and enjoyment of the Park; and
- Improving knowledge of natural and cultural heritage, corresponding threats and the evaluation of management programs through research and monitoring. Working with local government, other agencies and authorities, the community and commercial interests to maximise community interest and involvement in the conservation of the Park, and the implementation of sympathetic conservation measures in the neighbouring environment.

7.3 Weed Management Plan

A Weed Management Plan has been developed for the Central Precinct in order to provide for the following objectives:

- Identification and management of weeds during and after construction on the Central Precinct to prevent the spread of weeds into the Regional Park;
- Specify control measures for noxious weeds of significance in the St Marys Property specifically identified in the EPS, *Noxious Weeds Act 1993* and Weeds of National Significance;
- Set out requirements for revegetation after disturbance or construction to reduce the potential spread and establishment of weeds;
- Prepare prescriptions for the control of significant weed species within the Central Precinct development area during and after construction;
- Detail a weed control program for the Central Precinct development area;
- Make provision for weed control guidelines for building and landscaping and education material for future residents; and

- Outline strategies to ensure that the relevant objectives outlined in SREP 30 and St Marys Environmental Planning Strategy are met.

7.4 Feral and Domestic Animal Management Strategy

A Feral and Domestic Animal Management Strategy has been developed for the Central Precinct in order to provide for the following objectives:

- To ensure that development of the Central Precinct does not directly increase populations of, or improve habitats for, feral/exotic pest animals and over-abundant native species;
- To ensure that development of Central Precinct does not indirectly increase populations of feral animals such as European Red Foxes and Feral Cats by creating abundant prey;
- To ensure that development of Central Precinct does not exacerbate any Key Threatening Process;
- To minimise the potential for domestic animals within Central Precinct to impact on native flora and fauna values at the SMP; and
- To minimise the potential for feral/exotic pest, over-abundant native and domestic animals to impinge on the conservation values of the adjoining Regional Park.

7.5 Bushfire Management Plan

A Bushfire Management Plan will be implemented in the Central Precinct to reduce the bushfire hazard to life and property within the precinct and reduce the adverse effects of frequent bushfires on the Regional Park.

7.6 Macrofauna Management Plan

The St Marys Macrofauna Management Plan for the entire SMP has been endorsed and is now being implemented, which will ultimately result in a decrease in grazing pressure and exclusion of macrofauna from the Central Precinct[1].

The key objectives of the MMP include:

- Minimisation of risks to macrofauna from human activities and from macrofauna to humans on the SMP;
- Provision of a protocol for the treatment of sick or injured macrofauna on the SMP;

- Justification of management options for the macrofauna population;
- Provision of short term prescriptions for management of macrofauna in relation to proposed developments within the development precincts of the SMP;
- Provision of medium term and long term prescriptions for management of macrofauna within the Regional Park and open space areas of the SMP; and
- Provision of appropriate mechanisms for monitoring, review and revision of the MMP as required for adaptive management of the macrofauna populations.

7.7 Mitigation within Development Area

Some existing trees within the Central Precinct will be retained and incorporated into the landscape design of the precinct plan. These may be retained around future dwellings or in proposed riparian corridors and areas of open space.

Some areas of Freshwater Wetlands may be retained within the precinct such as the area within the transmission line corridor. Riparian areas in the precinct will be rehabilitated or relocated and planted with locally native wetland vegetation. Other wetlands will be created as part of detention basins and will also be planted with local provenance species. Seed will be collected from the precinct to propagate local provenance specimens for planting in wetlands.

Patches of retained native vegetation are recommended to be regenerated as required to remove exotic species and enhance native shrub and ground covers. Maintenance of structural complexity of retained habitat will encourage native fauna species to utilise these areas.

Pre-clearance surveys will be undertaken in buildings to be demolished within the precinct to relocate any native animals that may be living within them.

Chapter 8

Conclusions and Recommendations

Development of the Central Precinct will occur within a landscape that has been extensively altered since European settlement took place. The precinct is predominantly vegetated by mixed exotic and native grassland, and sparse remnants of regenerating woodland. The Regional Park surrounds the precinct on the eastern, northern and western boundaries, and contains higher quality vegetation communities and habitats than the precinct.

Development within the Central Precinct is likely to result in the removal of patches of disturbed and degraded native vegetation representative of five endangered ecological communities. Approximately 25.6ha of Cumberland Plain Woodland, 1.6ha of Shale Gravel Transition Forest, 11.3ha of Swamp Oak Floodplain Forest, 7.4ha of River-flat Eucalypt Forest and 2.4ha of Freshwater Wetlands will be removed or modified. However, the Regional Park contains extensive areas of these vegetation communities that are in excellent ecological condition and will be conserved in the long term.

Development within the Central Precinct will also entail the removal of some threatened plants (*Grevillea juniperina* subsp. *juniperina*). Over 249,000 specimens of *Grevillea juniperina* subsp. *juniperina* occur in the Regional Park and the relatively small numbers to be removed in the Central Precinct are not important for the survival of this species in the locality.

No threatened fauna species have been recorded from the Central Precinct and no impact is expected to occur to native fauna. The Central Precinct may offer some limited foraging habitat for mobile species such as bats, however little nesting habitat is present which limits the value of this habitat. Large numbers of kangaroos are present on the precinct, however, kangaroos and emus are being managed throughout the development areas in accordance with the endorsed Macrofauna Management Plan.

The development of the Central Precinct is considered to be compliant with the objectives and strategies contained within SREP 30 and the EPS. The foremost mitigation measure for the proposed development of the Central Precinct and the broader SMP is the establishment of the 900 hectare Regional Park, which will conserve extensive, viable tracts of forest and woodland. The impacts of vegetation clearance will be mitigated by the creation and maintenance of this park, in which habitats for all threatened flora and fauna recorded from the SMP are known to occur.

The development of the Central Precinct may have a range of indirect impacts including increased levels of weed invasion and colonisation by feral animals. These impacts are

unlikely to significantly affect threatened species or adjacent areas of native vegetation within the Regional Park. Nevertheless, strategies and plans have been prepared to mitigate these impacts; the Central Precinct Weed Management Plan, Bushfire Management Plan and Feral and Domestic Animal Management Strategy.

Potential impacts are expected to be substantially mitigated by the measures proposed as part of the development of the Central Precinct including:

- Retention where possible of stands of trees and vegetation within proposed riparian corridors and open space areas;
- Weed control;
- Use of clean fill;
- Habitat regeneration where possible;
- Control of feral and over-abundant native animals through planning during construction phase; and
- Control of domestic animal access

The development of the Central Precinct is not expected to have a significant impact upon any threatened flora or fauna species known to occur within the SMP, study area and the Regional Park in the long-term. If a final determination was made to list CPW as a critically endangered ecological community, the further field studies that are to be undertaken for the flora and fauna assessments for each development application in the Central Precinct would ensure ongoing assessment of this community as a critically endangered ecological community in terms of the seven part test.

The proposed development is considered to be in accordance with the objectives of SREP 30 and the St Marys EPS.

8.1 Recommendations

It is recommended that, in accordance with the EPS, local native plant species and species of conservation significance are included in the landscape design of the precinct. This may include using locally endemic species as road trees or in landscaping of public places. Threatened species could also be propagated and used in this manner.

Significant stands of trees and vegetation, particularly the Freshwater Wetlands, where practicable, should be retained in the development areas, and opportunities created for their inclusion into public space. This would additionally provide habitat for native fauna species. Where impacts to Freshwater Wetlands cannot be avoided, new habitat should be created through riparian corridor rehabilitation and habitat creation around detention

basins. Local provenance of plants should be maintained by using seed collected from wetland areas to be removed to propagate tube stock for planting in created habitats.

It is recommended that buffers around sensitive conservation areas and around the Regional Park be established. This is particularly relevant with consideration of wetlands that may be retained within the precinct. The wetland under the transmission lines provides foraging habitat for the Latham's Snipe, in particular the reeds and sedges on the edge of the wetland. However, land proposed for development is in close proximity to this wetland and this has significant potential to impact on the amenity of this area for this species. So that the wetland may continue to provide habitat for Latham's Snipe and other wetland species, it is recommended that appropriate buffer areas are established where possible and maintained, where practicable between the wetland and the future urban development.

References

1. Cumberland Ecology (2004) **St Marys Macrofauna Management Plan: A Plan of Management for Eastern Grey Kangaroos, Red Kangaroos and Emus** Cumberland Ecology, Sydney.

2. DUAP (2001) **Sydney Regional Environmental Plan No. 30: St Marys** Department of Urban Affairs and Planning, Sydney.

3. DUAP (2001) **St Marys Environmental Planning Strategy 2000** Department of Urban Affairs and Planning, Sydney.

4. PCC (2005) **Sustainability Blueprint for Urban Release Areas** Penrith City Council, Penrith.

5. NSW NPWS (1997) **Flora Appendices 1 of Western Sydney, Urban Bushland Biodiversity Survey** NSW National Parks and Wildlife Service, Hurstville.

6. Benson, D. and Howell, J. (1990) **Taken for Granted - The Bushland of Sydney and its Suburbs** Kangaroo Press, NSW.

7. Seidlich, B. (1997) **Green Web - Sydney: A Vegetation Management Plan for the Sydney Region** The Sydney Regional Organisations of Councils, Sydney.

8. NSW NPWS (2000) **The Native Vegetation of the Cumberland Plain, Western Sydney: Technical Report** NSW National Parks and Wildlife Service, Hurstville.

9. Gunninah (1997) **ADI Site St Marys. Biological Assessment Report. Volume 1-3: Responses to Issues Raised by the Section 22 Committee** Gunninah Environmental Consultants, Sydney.

10. NSW NPWS (1997) **Flora Appendices 3 of Western Sydney, Urban Bushland Biodiversity Survey** NSW National Parks and Wildlife Service, Hurstville.

11. ERM (2000) **Assessment of the Implications of Development for Land Registered on the National Estate at St Marys NSW** Report to ComLand Limited Environmental Resources Management Australia, Sydney.

12. Gunninah (1995) **Australian Defence Industries St Marys Planning Study: Flora and Fauna Issues** Gunninah Environmental Consultants, Sydney.

13. Gunninah (1997) **ADI Site St Marys. Biological Assessment Report. Volume 1-3: Responses to Issues Raised by the Section 22 Committee** Gunninah Environmental Consultants, Sydney.

14. NSW NPWS (2002) **Native Vegetation Maps of the Cumberland Plain Western Sydney** NSW National Parks and Wildlife Service, Sydney.

15. Gunninah (1991) **Australian Defence Industries (ADI) Site, St Marys, Fauna Survey** Gunninah Environmental Consultants, Sydney.

16. Kinhill (1995) **Australian Defence Industries Site - St Marys, Regional Environment Study Technical report Number 4: Characteristics of the Site** Kinhill Engineers Pty Ltd, Sydney.

17. ERM (2003) **St Marys Eastern Precinct Plan: Biodiversity Assessment** Environmental Resources Management Australia, Sydney.

18. Cumberland Ecology (2004) **Stage 1 Subdivision, St Mary's Eastern Precinct: Part Lot 2 DP 1038166 Species Impact Statement** Cumberland Ecology, Sydney.

19. Cumberland Ecology (2005) **St Marys North and South Dunheved Precincts Plan: Biodiversity Assessment** Cumberland Ecology, Sydney.

20. Cumberland Ecology (2005) **St Marys Property - Eastern Sector Blacktown LGA: Eight Part Test of the Impacts of Long Term Macrofauna Fencing Upon Threatened Flora and Fauna** For Maryland Development Company Cumberland Ecology, Epping.

21. Cumberland Ecology (2007) **Ropes Creek Precinct: Biodiversity Assessment** Report for Delfin Lend Lease Cumberland Ecology, Epping.

22. Cumberland Ecology (2007) **Ropes Creek Precint: Feral and Domestic Animal Management Strategy** Report for Delfin Lend Lease Cumberland Ecology, Epping.

23. Specht, R. L. (1970) **Vegetation** The Australian Environment 4th edition CSIRO Melbourne University Press, Melbourne.

24. Briggs, J. D. and Leigh, J. H. (1995) **Rare or Threatened Australian Plants** CSIRO, Canberra.

25. Harden, G. J. (1990) **Flora of New South Wales Volume 1** New South Wales University Press, Kensington.

26. Harden, G. J. (1991) **Flora of New South Wales Volume 2** New South Wales University Press, Kensington.

27. Harden, G. J. (1992) **Flora of New South Wales Volume 3** New South Wales University Press, Kensington.

28. Harden, G. J. (1993) **Flora of New South Wales Volume 4** New South Wales

University Press, Kensington.

29. Gunninah (1994) **Australian Defence Industries St Marys Facility Western Sydney Environmental Review** Gunninah Environmental Consultants, Sydney.

30. Gunninah (1996) **Australian Defence Industries St Marys Facility - Vegetation Communities** Gunninah Environmental Consultants, Sydney.

31. Robinson, L. (1991) **Field Guide to the Native Plants of Sydney** Kangaroo Press, Roseville, Sydney.

32. DEC (NSW) (2005) **Juniper-leaved Grevillea - profile** Department of Environmental and Conservation (NSW), Hurstville.

33. NSW Scientific Committee (2000) ***Grevillea juniperina* R. BR. subsp*. juniperina* (a shrub) - vulnerable species listing** NSW National Parks and Wildlife Service, Hurstville.

34. Suckling, G. C. (1995) **Sugar Glider *Petaurus breviceps*** in *The Australian Museum Complete Book of Australian Mammals* ed. Strahan, R. Reed Books, Sydney.

35. McKay, G. M. and Ong, P. (1995) **Common Ringtail Possum *Pseudocheirus peregrinus*** in *The Australian Museum Complete Book of Australian Mammals* ed. Strahan, R. Reed Books, Sydney.

36. Churchill, S. (1998) **Australian Bats** Reed New Holland, Sydney.

37. Cumberland Ecology (2007) **Macrofauna Management on St Marys Property - Annual Report on the Macrofauna Management Plan** For Maryland Development Company Cumberland Ecology, Epping.

38. Cumberland Ecology (2006) **St Marys Macrofauna Management Plan 2006/2007** For Maryland Development Company Cumberland Ecology, Epping.

39. DEC (NSW) (2005) **Large-footed Myotis - profile** Department of Environment and Conservation (NSW), Hurstville.

40. DEC (NSW) (2005) **Eastern Bentwing-bat - profile** Department of Environment and Conservation (NSW), Hurstville.

41. DEC (NSW) (2005) **Greater Broad-nosed Bat - profile** Department of Environment and Conservation (NSW), Hurstville.

42. DEC (NSW) (2005) **Eastern Freetail-bat - profile** Department of Environment and Conservation (NSW), Hurstville.

43. DEC (NSW) (2005) **Grey-headed Flying-fox - profile** Department of Environment

and Conservation (NSW), Hurstville, NSW .

44. DEC (NSW) (2006) **Speckled Warbler - profile** Department of Environment and Conservation (NSW), Hurstville.

45. DEC (NSW) (2005) **Draft Green and Golden Bell Frog *Litoria aurea* (Lesson 1829) Recovery Plan** Department of Environment and Conservation (NSW), Hurstville.

46. NSW NPWS (2004) **Recovery planning for the Cumberland Plain's endangered ecological communities** http://www.nationalparks.nsw.gov.au/npws.nsf/Content/Recovery+planning+for+the+Cumberland+Plains+endangered+ecological+communities *last accessed* 4/7/1928

47. NSW Scientific Committee (2004) **Competition from feral honeybees - key threatening process declaration** Department of Environment & Conservation (NSW), Hurstville.

48. DEC (NSW) (2007) **Wianamatta Regional Park Draft Plan of Management** Department of Environment and Conservation (NSW), Hurstville.

49. Australian Heritage Commission (1999) **Register of the National Estate: Western Sydney Shale Woodland St Marys, Forrester Road, St Marys, NSW** Department of the Environment and Heritage

50. Cumberland Ecology (2007) **Ropes Creek Precinct: Weed Management Strategy** Report for Delfin Lend Lease Cumberland Ecology, Epping.

51. Cumberland Ecology (2004) **St Mary's Eastern Precinct: Fauna and Fauna Assessment for Proposed Lot 2 and Lot 5 Development Applications** Cumberland Ecology, Sydney.

52. Cumberland Ecology (2005) **St Marys Eastern Precinct: Flora and Fauna Assessment for Part Lot 2 DP1038166, (Residue Lot 1170) for a Residential Subdivision, Open Space, Drainage and Associated Infrastructure** Prepared for Maryland Development Company Cumberland Ecology, Epping.

53. Cumberland Ecology (2005) **St Marys Property - Eastern Precinct: Flora and Fauna Risk Assessment for the Demolition of Buildings, Removal of Existing Roads and Stockpiling of Materials** For Delfin Lend Lease Cumberland Ecology, Epping.

54. Cumberland Ecology (2005) **Eastern Precinct St Marys Project Site: Flora and Fauna Assessment of proposed subdivision and construction works for a northern village centre** For Maryland Development Company Cumberland Ecology, Epping.

55. Perkins, I. (1999) **Flora Assessment of the Disputed Areas of Western Sydney Shale Woodlands** Ian Perkins Consultancy Services, Sydney.

56. Benson, D. (1992) **The natural vegetation of the Penrith 1:100,000 sheet** *Cunninghamia* 2:503-662

57. NSW NPWS (1997) **Native Flora of Western Sydney, Urban Bushland Biodiversity Survey** NSW National Parks and Wildlife Service, Hurstville.

58. NSW NPWS (1997) **Native Fauna of Western Sydney, Urban Bushland Biodiversity Survey** NSW National Parks and Wildlife Service, Hurstville.

59. Reid, J. R. W. (2000) **Threatened and declining birds in the New South Wales sheep-wheat belt: II Landscaping relationships - modelling bird atlas data against vegetation cover** CSIRO Sustainable Ecosystems, Canberra.

60. NSW NPWS (2001) **Endangered Ecological Community Information: Cumberland Plain Woodland** NSW National Parks and Wildlife Service, Hurstville.

61. NSW Scientific Committee (2004) **Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and south east coast, Sydney Basin and south east corner bioregions - endangered ecological community listing** Department of Environment and Conservation (NSW), Hurstville.

62. NSW NPWS (2002) **Endangered Ecological Community Information: Shale-Gravel Transition Forest** NSW National Parks and Wildlife Service, Hurstville.

63. NSW Scientific Committee (2004) **Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions - endangered ecological community listing** Department of Environment and Conservation (NSW), Hurstville.

64. NSW Scientific Committee (2004) **Speckled Warbler - vulnerable species listing** Department of Environment and Conservation (NSW), Hurstville.

65. DEC (NSW) (2005) **Diamond Firetail - profile** Department of Environment and Conservation (NSW), Hurstville.

66. DEC (NSW) (2005) **Cumberland Land Snail - profile** Department of Environment and Conservation (NSW), Hurstville.

67. NSW Scientific Committee (1997) **Cumberland Plain Land Snail - Endangered Species Listing** NSW National Parks and Wildlife Service, Hurstville.

68. NSW Scientific Committee (2004) **Eastern bentwing-bat - vulnerable species listing** Department of Environment and Conservation (NSW), Hurstville.

69. DEC (NSW) (2005) **Eastern False Pipistrelle - profile** Department of Environment and Conservation (NSW), Hurstville.

70. NSW Scientific Committee (2004) **Eastern false pipistrelle - vulnerable species listing** Department of Environment and Conservation (NSW), Hurstville.

71. NSW Scientific Committee (2004) **Eastern freetail-bat - vulnerable species listing** Department of Environment and Conservation (NSW), Hurstville.

72. DEC (NSW) (2005) **Large-eared Pied Bat - profile** Department of Environment and Conservation (NSW), Hurstville.

73. NSW Scientific Committee (2004) **Large-eared pied bat - vulnerable species listing** Department of Environment and Conservation (NSW), Hurstville.

74. NSW Scientific Committee (2004) **Large-footed myotis - vulnerable species listing** Department of Environment and Conservation (NSW), Hurstville.

75. NSW Scientific Committee (2004) **Greater broad-nosed bat - vulnerable species listing** Department of Environment and Conservation (NSW), Hurstville.

76. DEC (NSW) (2005) **Yellow-bellied Sheathtail-bat - profile** Department of Environment and Conservation (NSW), Hurstville.

77. NSW Scientific Committee (2004) **Yellow-bellied sheathtail bat - vulnerable species listing** Department of Environment and Conservation (NSW), Hurstville.

78. NSW Scientific Committee (2004) **Grey-headed Flying-fox - vulnerable species listing** Department of Environment and Conservation (NSW), Hurstville.

Appendix A

Previous Flora and Fauna Investigations on the SMP

The St Marys Property and surrounds have been subject to ongoing surveys and assessment over the last 10 years. These have provided a large amount of background information.

Three key processes have been important in generating the flora and fauna data that is available about the St Marys Property today:

- The Regional Environmental Study by Kinhill[16];
- The section 22 process undertaken under the *Environmental Planning and Assessment Act, 1979;* and
- The listing of the site on the Register of National Estate by the Australian Heritage Commission (AHC)[49] under the terms of the *Australian Heritage Act 1989*.

Additional studies have been conducted as part of the precinct planning and development application processes for the Eastern, Dunheved and Ropes Creek Precincts[17-19,21,22,50-54].

The relevant documents produced during these processes have been reviewed to obtain background information on the SMP. This Biodiversity Assessment has collated and added to such information by conducting additional field investigations where necessary to address gaps in information. The Biodiversity Assessment is therefore a compendium report that is intended for use as a resource during the development and management of the Central Precinct.

A.1 Assessments prior to Land Releases

A.1.1 Flora

Kinhill[16], Gunninah[12,13] and ERM[17] undertook intensive flora and fauna investigations on the SMP. Vegetation on site was mapped and targeted surveys were completed for plants and animals of conservation significance, especially those listed by the *Threatened Species Conservation Act 1995.* These studies, together with concurrent studies of archaeological and heritage sites, produced a detailed inventory of the natural heritage values of the SMP.

The biological data for the property was summarised in a detailed compilation report by Gunninah[13]. The report provided the background information necessary for the evaluation of relative biodiversity values. The Gunninah report included a vegetation map of the SMP based on a series of surveys conducted between 1995 and 1997. The veracity of methods and data contained in the Gunninah report was later reviewed by NPWS.

Since the original vegetation map was produced, additional flora surveys have been conducted to further elucidate the nature and extent of vegetation communities in selected areas. These additional surveys included work by ERM during February 1999 (Central Sector) and October 1999 (North-western Sector) and by Ian Perkins[55] during January and February 1999 (North-western Sector). The survey by Perkins was commissioned by the AHC to clarify the nature and extent of Grey Box Woodlands within the western portion of the St Marys Property.

Within the locality there is also a large amount of published information on the current distribution of native vegetation and discussion of original vegetation communities. This information includes:

- Benson[56] The Natural Vegetation of the Penrith 1:100,000 map sheet;
- Benson and Howell[6] Taken For Granted - The Bushland of Sydney and its Suburbs;
- NSW National Parks and Wildlife Service[14]. Native Vegetation Maps of the Cumberland Plain Western Sydney; and
- NSW National Parks and Wildlife Service[57,58] Urban Bushland Biodiversity Survey.

A.1.2 Fauna

From 1991 until 1998, there have been three fauna surveys undertaken throughout the SMP for an array of fauna groups. These surveys have been completed for a variety of different purposes and therefore employed a range of different methods. The three fauna surveys include:

- A trapping, spotlighting and observation study conducted in winter 1991 by Gunninah[15];
- A less intensive spotlighting and observational field survey in November 1994 and January/February 1995 by Kevin Mills and Associates[16]; and
- A survey for the threatened Cumberland Land Snail (*Meridolum corneovirens*) (ERM, unpublished).

Trapping surveys by Gunninah[13] were conducted in representative sites within the most significant habitats and vegetation communities on the site. Techniques involved the use of small mammal Elliott traps, small mammal and reptile pit traps and harp traps for capturing bats.

A total of 1,200 trap-nights were conducted using the Elliott traps, 26 trap nights using the bat traps and 60 trap nights using the pitfall traps. Spotlight transects were conducted by foot and from a slow moving vehicle through the sites containing traplines and representative samples of all significant vegetation types. Additional spotlighting was conducted along creeklines and disturbed areas.

Surveys by Kevin Mills and Associates in November and January/February 1995[16] were conducted in all parts of the study area and in all habitat types. This survey concentrated on birds, reptiles and frogs. Techniques included transect spotlighting, incidental sightings, listening for fauna calls and searching for amphibians.

Searches were also conducted in August 1998 for the threatened snail *Meridolum corneovirens* in Cumberland Plain Woodland across the SMP. These searches involved four hours of searching by two investigators with experience in identification of the snail. Additionally, searches were made for the snail along Ropes and South creeks in the south of the SMP (ERM unpublished).

A.2 Precinct Plans and Development Applications

The following summary of fauna species is derived from the Biodiversity Assessments for the Eastern Precinct[17], Dunheved Precinct[19] and Ropes Creek Precinct[21] but is supplemented by the results of targeted surveys and incidental records within the broader study area for Green and Golden Bell Frog, microchiropteran bats, Koala and Cumberland Land Snails.

A.2.1 Mammals

Both Eastern Grey and Red Kangaroos were present across the entire Eastern Precinct and Regional Park until November 2004. As required, they have been excluded from the sections of the Eastern Precinct and Regional Park, as part of the long term Macrofauna Management Plan[1]. A small number of animals are still present in the Eastern Precinct project site, although the large majority of the population have been moved out of this area.

Three arboreal mammals (excluding bats) have been recorded within the SMP and are likely to occur within the study area, namely the Common Brush-tail Possum (*Trichosurus vulpecula*), Common Ring-tail Possum (*Pseudocheirus peregrinus*) and Sugar Glider (*Petaurus breviceps*). The Common Brush-tail Possum and Sugar Glider generally occur in low numbers which is likely to be a reflection of the lack of hollow-bearing trees. The Common Ring-tail Possum is more abundant, which is most likely due to its ability to build nests in tree foliage.

Terrestrial mammals that occur on the SMP include the Echidna (*Tachyglossus aculeatus*) and introduced species such as the European Fox (*Vulpes vulpes*), Cat (*Felis catus*), Dog (*Canis familiaris*), Black Rat (*Rattus rattus*), House Mouse (*Mus musculus*), Rabbit (*Oryctolagus cuniculus*) and Brown Hare (*Lepus capensis*).

Koala searches

No Koalas were detected on the subject site, within the study area or within vegetation adjacent to Ropes Creek. No Koala scats or scratchings were found. There are a small number of unverified anecdotal records from the SMP and surrounds from 1985 until the present (Ray Giddins pers comm.). According to members of staff who have worked on the site for many years, including Graham Duncan and Bill Mitchell, there have been no reports of koalas made within the site. This is consistent with the findings of earlier fauna surveys by Gunninah Consultants and ERM[15,17].

A.2.2 Bats

In 2001, Anabat surveys were conducted in riparian, grassland, woodland and forest habitats in the Western Precinct. An Anabat survey was conducted for the Dunheved Biodiversity Assessment in 2004 and also included surveys of Ropes Creeks in the Eastern Precinct. Further surveys including Anabat and harp trap detection were conducted in 2006 the species detected during these surveys are summarised in Table 5.1. More detail is provided in Appendix E.

Table 8.1 MICROCHIROPTERAN BAT SPECIES RECORDED ON THE SMP

Species	Western Precinct 2001	Dunheved B.A. 2004	Demolition Surveys 2006
Chalinolobus gouldii	41 records	4 records	26 records
Chalinolobus morio	5 records		2 records
Miniopterus schreibersii	15 records	13 records[2]	
Mormopterus norfolkensis	28 records		3 records
Mormopterus planiceps	70 records		
Mormopterus sp.		2 records	
Myotis adverus		43 records[1]	
Nyctophilus geoffroyi			2 records
Nyctophilus sp.	4 records	43 records[1]	
Scoteanax rueppellii	2 records		
Scotorepens orion	9 records		
Tadarida australis	16 records		
Vespadelus darlingtoni	30 records		
Vespadelus regulus	6 records	13 records[2]	
Vespadelus vulturnus	2 records		

Notes: 1.Calls not identified to species but could either be Nyctophilus sp. or Myotis adversus[1], or Miniopterus schreibersil or Vespadelus regulus[2]..

A.2.3 Birds

Bird habitats in the study area include patches of regenerating woodland amid areas of open grassland, and a small number of old growth trees with small hollows. These support a considerable variety of bird species, but particularly those native birds of disturbed forest/woodland areas and "edge" areas.

Dryland bird habitats are highly disturbed, with patches of woodland in the study area fragmented by clearing and soil remediation (which has removed topsoil). Fallen logs and other similar habitat features that could add to the structural complexity of the habitats are largely absent.

Semi-aquatic habitat provided by the surface water which can be retained on the land of the study area is not likely to be suitable for wetland birds, as major resources are absent, including sedges which provide shelter for these ground dwelling species. Small wetland areas found in the study area are generally within the adjoining parts of the Regional Park, which may provide some potential habitat. The riparian zone along Ropes and South Creeks has limited potential habitat for wetland birds as the vegetation is very dense and there is an absence of bulrushes and sedges, which wetland species favour for shelter.

The open disturbed habitats in the study area favour birds of disturbed or edge habitats, especially species that commonly occur within suburban areas or disturbed rural areas. Among such species are birds that are thought to have increased since European settlement[59] including Australian Magpie, Australian Magpie-lark, Australian Raven, Pied Currawong, Noisy Minor, Galah, Eastern Rosella, Willie Wagtail, Welcome Swallow and Richard's Pipit. These species are known to persist in urban and rural environments and can out-compete smaller forest birds at the interface with woodland habitats.

Several regionally significant birds were detected during the 2004 surveys. These were Buff-rumped Thornbill, Double-barred Finch and White-winged Choughs. Habitat for these species is abundant within the Regional Park.

Emus are also present within the study area, within the disturbed grassland and open woodland areas. Like the kangaroos, emus were removed from the southern and central part of the Eastern Precinct and the Eastern Precinct Regional Park, into adjacent areas.

Forest bird species are generally absent from the open grassland and developed/disturbed parts of the study area, but have been observed in areas of the Regional Park. Such species include; Eastern Spinebill, Crested Shrike-tit, Superb Fairy-wren and Eastern Yellow Robin.

Targeted threatened birds survey

Targeted surveys for Speckled Warblers were completed over two days in August 2004 (5th and 10th) on the study area. Weather conditions for both surveys were fine and cool to cold in the mornings. The sky was clear with little cloud cover. August 5th was calm with no breeze whereas there was a light breeze on 10th August. These surveys entailed

traversing the study area at dawn and recording all birds seen or heard calling within the study area. The results of these surveys were added to those of Gunninah Consultants and ERM[15,17]. The ornithologist, Tony Saunders of Merops Services undertook this work together with Cumberland Ecology staff.

The bird assemblage in the study area is likely to contain representatives from species known to occur in disturbed woodland habitat and forest species. Forest birds were observed flying across the forest/woodland interface near Ropes Creek to forage in woodland of the study area. Species common to disturbed habitats were also observed. No threatened bird species were detected.

A.2.4 Reptiles and Amphibians

Reptiles that have been recorded at the SMP and are known to occur, or are likely to occur, within the study area include the Red-bellied Black-snake (*Pseudechis porphyriacus*), Eastern Brown Snake (*Pseudonaja textilis*), Bearded Dragon (*Amphibolurus barbatus*) and the Delicate Garden Skink (*Lampropholis delicata*). These species are generally common to open grassland/open woodland habitats[15].

A range of frogs have been recorded at the SMP, some of which are likely to occur within the study area. However, given the lack of suitable breeding habitat for most species of frogs, only populations of common and widespread frog species are expected to occur.

Previous surveys at the SMP have identified frog species that can often be found in disturbed or artificial environments such as farm dams. These species include the Common Eastern Froglet (*Crinia signifera*), Striped Marsh Frog (*Limnodynastes peroni*), Spotted Marsh Frog (*Limnodynastes tasmaniensis*), Keferstein's Tree Frog (*Litoria dentata*) and Verreaux's Tree Frog (*Litoria verreauxii*).[15]

Within the study area, only the Common Eastern Froglet was recorded during the 1991 surveys. Other common species are likely to occur within suitable habitat in the study area. These species may not have been detected because surveys were conducted during the winter months when some species are not calling.

During the frog survey in April 2004 conditions were generally dry and mild. No rain fell during the survey period and the last significant rain had fallen on the 5th of April. Although weather conditions at the time of survey were cool and not ideal for frog surveys. Ropes Creek and tributaries of South Creek were slowly flowing and ephemeral wetlands around the site contained water but were generally at low levels. Day air temperatures reached a maximum of 23 and 26 degrees respectively. At night, the temperature fell quickly reaching a minimum of 13 and 16 degrees respectively.

Targeted Green and Golden Bell Frog survey

No Green and Golden Bell Frogs were located in the study area or at other locations on the SMP during the latest targeted surveys for the species in April 2004[18], however, potential habitat within the study area does occur in the form of drainage lines and surface

water. These results are consistent with the findings of other surveys for the species by Gunninah[13].

A.2.5 Cumberland Land Snail

No targeted searches for this species were conducted within the current subject site, however they were conducted in the study area in 2004. The Cumberland Land Snail is mostly found to occur in CPW, River Flat Eucalypt Forest and SGTF with shale soils and has the potential to occur on the subject site.

The presence of Cumberland Land Snails was verified within the Cumberland Plain Woodland in the southern section of the Eastern Precinct. The species has also been found frequently within the locality in similar habitat.

Appendix B

Flora Species

Table B.1 FLORA SPECIES DETECTED IN THE CENTRAL PRECINCT

Family	Scientific Name	Common Name	T1	T2	T3	T4	T5	T6	T7	T8	T9
Trees											
Casuarinaceae	Casuarina glauca	Swamp Oak		o	v		o				
Fabaceae	Acacia parramattensis	Parramatta Wattle					o		r		r
Meliaceae	Melia azedarach	White Cedar			r						
Myrtaceae	Angophora floribunda	Rough-barked Apple		r	v		o				
	Eucalyptus amplifolia	Cabbage Gum			o						
	Eucalyptus crebra	Narrow-leaved Ironbark					r				o
	Eucalyptus fibrosa	Broad-leaved Ironbark				r	r				
	Eucalyptus globoidea	White Stringybark					r				
	Eucalyptus moloccana	Grey Box				v	o		v	r	c
	Eucalyptus tereticornis	Forest Red Gum		r	r		o		o		
Shrubs											
Asteraceae	*Senecio pterophorus						r	r			
Chenopodiaceae	Sclerolaena sp							c			
Dilleniaceae	Hibbertia diffusa				c	o	o				
Epacridaceae	Astroloma humifusum	Cranberry Heath				r					
Fabaceae	Dillwynia juniperina	Prickly Parrot Pea				o	c	o	c		
	*Acacia baileyana	Cootamundra Wattle							r		

Table B.1 FLORA SPECIES DETECTED IN THE CENTRAL PRECINCT

Family	Scientific Name	Common Name	T1	T2	T3	T4	T5	T6	T7	T8	T9
	Acacia falcata	Sickle Wattle						r			
	Acacia floribunda	Sally Wattle				r					
Malaceae	*Malus sp	Apple									r
Myrtaceae	Angophora floribunda	saplings			c						c
	Eucalyptus crebra	saplings					o				
	Eucalyptus moluccana	saplings						r			
Oleaceae	*Ligustrum sinense	Small-leaved Privet			o						
Pittosporaceae	Bursaria spinosa	Blackthorn			r		r		c	o	
Proteaceae	Grevillea juniperina spp juniperina	Prickly Spider Flower					o	r			
Sapindaceae	Dodonaea viscosa ssp cuneata	a Hopbush				r					
Ulmaceae	Trema aspera	Poison Peach			r						
Herbs - Ferns											
Marsilaceae	Marsilea hirsuta										r
Sinopteridaceae	Cheilanthes sieberi	Rock Fern			r		r			o	
Herbs - Dicots											
Acanthaceae	Brunoniella australis	Purple Trumpet				o			c	c	
Apiaceae	Centella asiatica	Pennywort		o			o		o	r	r
	*Ciclosperma leptophylla	Slender Celery					r			v	
Asteraceae	*Bidens pilosa	Farmers Friends									o

Table B.1 FLORA SPECIES DETECTED IN THE CENTRAL PRECINCT

Family	Scientific Name	Common Name	T1	T2	T3	T4	T5	T6	T7	T8	T9
	Calotis cuneifolia	Blue Burr-daisy					o	o	o		
	Calotis lappulacea	Yellow Burr-daisy				r		o			
	*Cirsium vulgare	Spear Thistle			r					o	
	*Conyza sp.	a Fleabane	o		c		v			v	c
	Empodisma minus							r			
	Glossogyne tannensis	Cobblers Ticks					r				
	*Gnaphalium sp	a Cudweed	c								
	*Hypochaeris radicata	Flatweed					c	c	o	v	c
	*Lactuca seriola										r
	*Senecio madagascariensis	Fireweed	r		o	o	c	c	c	v	c
	Senecio quadridentatus										c
	Sigesbeckia orientalis				r						
	Vittadinia sp.					r	r	o			
Boraginaceae	*Echium plantagineum	Patersons Curse									r
	*Heliotropium amplexicaule	Blue Heliotrope									r
Campanulaceae	Wahlenbergia sp	a Bluebell				r	o	r			
Chenopodiaceae	Einadia trigonos	Fishweed					r				
Clusiaceae	Hypericum gramineum					o	r				
Convolvulaceae	Dichondra repens	Kidney PLant			o	o			c		
Crassulaceae	Crassula sp								r		
Euphorbiaceae	Phyllanthus virgatus						r				

Table B.1 FLORA SPECIES DETECTED IN THE CENTRAL PRECINCT

Family	Scientific Name	Common Name	T1	T2	T3	T4	T5	T6	T7	T8	T9
	Poranthera microphylla						o				
Fabaceae	Chorizema parviflorum									o	
	Desmodium varians	Tick Trefoil							r	o	v
	*Trifolium spp	Clover						o			
Gentianaceae	*Centaurium sp		r								
Linaceae	*Linum monogynum						c	o			
Malvaceae	*Modiola caroliniana										o
	*Sida rhombifolia	Paddys Lucerne			o	o	o	o	o		c
Myoporaceae	Eremophila debile	Winter Apple							r		
Myrsinaceae	Myriophyllum variifolium									adj	
Myrtaceae	Angophora floribunda	seedlings			c						
Onagraceae	Ludwigia peploides ssp montevidensis			r							
	Oenothera sp		r								
Plantaginaceae	Plantago myosuros					o	o				
	*Plantago lanceolata	Scarlet Pimpernel	o				r				o
Primulaceae	*Anagallis arvensis	Buttercup				o	c	c			
Ranunculaceae	Ranunculus inundatus			o							
Rubiaceae	Asperula confertifolia	Common Bedstraw				o				c	
	Opercularia diphylla						o				
	*Richardia stellaria	Blackberry Nightshade	c			o	v	c	c		
Solanaceae	Solanum prinophyllum				o	o					

Table B.1 FLORA SPECIES DETECTED IN THE CENTRAL PRECINCT

Family	Scientific Name	Common Name	T1	T2	T3	T4	T5	T6	T7	T8	T9
	*Solanum pseudocapsicum	Jerusalem Cherry			c			r			
Stackhousiaceae	Stackhousia viminea						r			o	
	*Solanum nigrum	Small-flowered Purpletop									
Verbenaceae	*Verbena bonariensis	Purpletop									o
Herbs - Monocots											
Alliaceae	*Nothoscordum borbonicum	Onion Weed									r
Anthericaceae	Dichopogon strictus	Chocolate Lily					r			o	
Asparagaceae	*Asparagus densiflorus	Climbing Asparagus							r		
	*Asparagus plumosus	Fern Asparagus									r
Cyperaceae	Carex appressa			c							o
	Cyperus sp						o				
	Elaeocharis acuta										o
Iridaceae	*Romulea rosea	Nut Grass							o		
Juncaceae	Juncus sp			o							o
Juncaginaceae	Triglochin procerum										
Lomandraceae	Lomandra filiformis	Wattle Mat-rush				c			c		
	Lomandra multiflora	Many-flowered Mat-rush				r					
Phormiaceae	Dianella longifolia									o	r
Poaceae	Agrostis sp	Blown Grass					r				
	Aristida vagans	a Three-awned Grass					v	c	v	c	

Table B.1 FLORA SPECIES DETECTED IN THE CENTRAL PRECINCT

Family	Scientific Name	Common Name	T1	T2	T3	T4	T5	T6	T7	T8	T9
	*Axonopus affinis	Carpet Grass	o				v				
	Bothriochloa decipiens/macra	Pitted Bluegrass/Red Leg Grass	o			v	v	c			
	*Briza subaristata		o		o		o			o	c
	*Cortaderia selloana	Pampas Grass									r
	Cymbopogon refracta	Barb-wire Grass				c	c	o	v	v	v
	*Cynodon dactylon	Couch	o		o		o	v	o	o	c
	Dichelachne micrantha	Short-haired Plume Grass					r				r
	Eragrostis brownii	Browns Love-grass									
	*Eragrostis curvula	African Love-grass	v			r	c				c
	Eragrostis leptostachya	Paddock Love-grass				o	c			c	
	Imperata cylindrica var major	Blady Grass			o						
	*Lolium perenne	Perennial Rye								o	
	Microlaena stipoides	Weeping Meadow-grass			c	o					
	Oplismenus aemulus	Basket Grass			o						
	*Paspalum dilatatum	Paspalum	o	o						c	o
	Stipa sp	a Spear Grass									o
	Themeda australis	Kangaroo Grass			v					c	o
	Poaceae sp.			v							
Vines											
Apocynaceae	Parsonsia straminea	Common Silkpod			r						

Table B.1 FLORA SPECIES DETECTED IN THE CENTRAL PRECINCT

Family	Scientific Name	Common Name	T1	T2	T3	T4	T5	T6	T7	T8	T9
Asclepiadaceae	*Araujia sericifera	Moth Vine							o	o	
Fabaceae	Glycine tabacina	Love-creeper	r		o	o					
Pittosporaceae	Billardiera scandens	Common Appleberry									
Ranunculaceae	Clematis glycinoides	Travellers Joy									
Rosaceae	*Rubus fruticosus	Blackberry									
Asparagaceae	*Asparagus asparagoides	Bridal Veil Creeper			o						

KEY

* = introduced species

adj = occurs adjacent to transect

Indicative frequency of occurrence in transect: r = rare; o = occasional; c = common; v = very common.

Appendix C

Vegetation Condition Assessment Data

Table C.1 VEGETATION CONDITION ASSESSMENT PER QUADRAT

Quadrat	Common Species	Condition - % weeds			
		Canopy	Small tree layer	Understorey	Groundcover
1	*Eucalyptus moluccana* *Eucalyptus fibrosa* *Aristida ramosa* *Chloris ventricosa* *Marsdenia viridiflora*	0	A	A	5
2	*Eucalyptus moluccana* *Chloris ventricosa* *Austrodanthonia* sp. *Bursaria spinosa*	0	A	0	1
3	*Eucalyptus moluccana* *Austrodanthonia* sp. *Sporobolus creber* **Cynodon dactylon*	0	0	A	10
4	*Eucalyptus moluccana* *Sporobolus creber* **Setaria gracilis* **Eragrostis curvula* **Cynodon dactylon* **Sida rhombifolia*	A	0	0	40
5	*Dillwynia juniperina* *Eragrostis brownii* *Aristida vagans* *Sporobolus creber* *Cymbopogon refractus* **Cynodon dactylon*	A	0	0	5
6	*Cymbopogon refractus* **Setaria gracilis* *Aristida vagans* *Eragrostis brownii* *Bursaria spinosa*	A	A	0	5
7	*Eucalyptus tereticornis* *Aristida vagans*	0	0	0	2

Table C.1 VEGETATION CONDITION ASSESSMENT PER QUADRAT

Quadrat	Common Species	Condition - % weeds			
		Canopy	Small tree layer	Understorey	Groundcover
	Microlaena stipoides				
	Bursaria spinosa				
8	*Sporobolus creber*	A	A	0	10
	Bothriochloa sp.				
	**Sida rhombifolia*				
	Grevillea juniperina				
	Sclerolaena sp.				
9	*Microlaena stipoides*	A	A	A	20
	Cymbopogon refractus				
	**Senecio madagascariensis*				
	Sporobolus creber				
	**Ligustrum sinense*				
	**Setaria gracilis*				
10	*Sporobolus creber*	A	A	A	50
	**Setaria gracilis*				
	**Conyza* sp.				
	**Senecio madagascariensis*				
	Cymbopogon refractus				
	Centella asiatica				
11	**Setaria gracilis*	A	A	A	70
	Sporobolus creber				
	**Senecio madagascariensis*				
	**Eragrostis curvula*				
	**Conyza* sp.				
	Bothriochloa sp.				
	**Axonopus affinis*				
	**Cynodon dactylon*				
12	**Eragrostis curvula*	A	A	A	90
	**Senecio madagascariensis*				
	**Setaria gracilis*				
	Bothriochloa sp.				
	Sporobolus creber				
	**Cynodon dactylon*				
	Cymbopogon refractus				

Table C.1 VEGETATION CONDITION ASSESSMENT PER QUADRAT

Quadrat	Common Species	Condition - % weeds			
		Canopy	Small tree layer	Understorey	Groundcover
13	**Eragrostis curvula* *Cymbopogon refractus* **Axonopus affinis* **Hypochaeris radicata*	A	A	A	70
14	*Sporobolus creber* **Eragrostis curvula* **Setaria gracilis* **Briza subaristata*	A	A	A	9*0
15	*Bothriochloa* sp. **Setaria gracilis* *Sporobolus elongatus* *Aristida vagans* **Cynodon dactylon* **Verbena officinalis* *Cymbopogon refractus*	A	A	A	50
16	*Sporobolus elongatus* **Conyza* sp. *Aristida ramosa* **Setaria gracilis* **Cynodon dactylon* **Senecio madagascariensis* *Cymbopogon refractus* *Kunzea ambigua*	A	A	A	30
17	*Sporobolus elongatus* **Cynodon dactylon* *Cymbopogon refractus* *Aristida ramosa*	A	A	A	50
18	*Sporobolus elongatus* **Setaria gracilis* *Cymbopogon refractus* **Senecio madagascariensis* *Dichondra repens*	A	A	A	10
19	*Themeda australis* **Senecio madagascariensis*	A	A	A	10

Table C.1 VEGETATION CONDITION ASSESSMENT PER QUADRAT

Quadrat	Common Species	Condition - % weeds			
		Canopy	Small tree layer	Understorey	Groundcover
	**Conyza sp.* *Sporobolus creber* *Aristida vagans*				
20	*Sporobolus* sp. *Bothriochloa* sp. *Themeda australis* **Axonopus affinis* **Briza subaristata* **Cynodon dactylon*	A	A	A	60
21	*Casuarina glauca* *Microlaena stipoides* **Sida rhombifolia* *Solanum prinophyllum*	0	0	A	10
22	**Eragrostis curvula* **Axonopus affinis* *Fimbristylis dichotoma* *Sporobolus creber*	A	A	A	90
23	**Eragrostis curvula* **Axonopus affinis* *Eragrostis brownii* *Gnaphalium* sp.	A	A	A	95

Appendix D

Fauna Species

Table D.1 FAUNA SPECIES RECORDED ON THE SMP

Family	Scientific Name	Common Name	Legal Status	Count	ERM 2003	CE 2004-2006	CE 2007-2008*
Amphibia							
Hylidae	Litoria aurea	Green and Golden Bell Frog	E1	10			
	Litoria caerulea	Green Tree Frog	P	9			
	Litoria dentata	Bleating Tree Frog	P	2		X	
	Litoria fallax	Eastern Dwarf Tree Frog	P	8			
	Litoria peronii	Peron's Tree Frog	P	8	X		
	Litoria tyleri	Tyler's Tree Frog	P	1			
	Litoria verreauxii	Verreaux's Frog	P	8	X		
Myobatrachidae	Crinia signifera	Common Eastern Froglet	P	30	X	X	
	Limnodynastes dumerilii	Eastern Banjo Frog	P	1			
	Limnodynastes peronii	Brown-striped Frog	P	4		X	
	Limnodynastes tasmaniensis	Spotted Grass Frog	P	4		X	
	Uperoleia laevigata	Smooth Toadlet	P	3			
Aves							
Acanthizidae	Acanthiza chrysorrhoa	Yellow-rumped Thornbill	P	2		X	
	Acanthiza lineata	Striated Thornbill	P	15		X	
	Acanthiza nana	Yellow Thornbill	P	37	X	X	B
	Acanthiza pusilla	Brown Thornbill	P	5	X		
	Acanthiza reguloides	Buff-rumped Thornbill	P	15		X	

Table D.1 FAUNA SPECIES RECORDED ON THE SMP

Family	Scientific Name	Common Name	Legal Status	Count	ERM 2003	CE 2004-2006	CE 2007-2008*
	Gerygone olivacea	White-throated Gerygone	P	7			A
	Pyrrholaemus saggitatus	Speckled Warbler	V	2			
	Sericornis frontalis	White-browed Scrubwren	P			X	A
	Smicrornis brevirostris	Weebill	P	33		X	B
Accipitridae	Accipiter cirrocephalus	Collared Sparrowhawk	P	1		X	
	Accipiter fasciatus	Brown Goshawk	P	5		X	A
	Accipiter novaehollandiae	Grey Goshawk	P	2			
	Aquila audax	Wedge-tailed Eagle	P	1	X		
	Elanus axillaris	Black-shouldered Kite	P	3	X		
	Hieraaetus morphnoides	Little Eagle	P	3			
	Lophoictinia isura	Square-tailed Kite	V	1			
Aegothelidae	Aegotheles cristatus	Australian Owlet-nightjar	P	8			
Alaudidae	Mirafra javanica	Horsfield's Bushlark	P	1			
Alcedinidae	Dacelo novaeguineae	Laughing Kookaburra	P	23	X	X	A
	Todiramphus sanctus	Sacred Kingfisher	P	4			
Anatidae	Anas castanea	Chestnut Teal	P			X	
	Anas gracilis	Grey Teal	P	1		X	
	Anas superciliosa	Pacific Black Duck	P	12		X	
	Chenonetta jubata	Australian Wood Duck	P	8		X	A
Ardeidae	Ardea alba	Great Egret	P	2			

Table D.1 FAUNA SPECIES RECORDED ON THE SMP

Family	Scientific Name	Common Name	Legal Status	Count	ERM 2003	CE 2004-2006	CE 2007-2008*
	Bubulcus ibis	Cattle Egret	P	4			
	Egretta novaehollandiae	White-faced Heron	P	7		X	
Artamidae	Artamus cyanopterus	Dusky Woodswallow	P	9		X	
	Artamus personatus	Masked Woodswallow	P	1			
	Artamus superciliosus	White-browed Woodswallow	P	2			
	Cracticus torquatus	Grey Butcherbird	P	28	X	X	A
	Gymnorhina tibicen	Australian Magpie	P	27	X	X	A
	Strepera graculina	Pied Currawong	P	12	X	X	A
Cacatuidae	Cacatua galerita	Sulphur-crested Cockatoo	P	9	X	X	A
	Cacatua sanguinea	Little Corella	P	1		X	A
	Cacatua tenuirostris	Long-billed Corella	P	3			
	Calyptorhynchus funereus	Yellow-tailed Black-Cockatoo	P	6	X	X	
	Calyptorhynchus lathami	Glossy Black-Cockatoo	V	2			
	Eolophus roseicapillus	Galah	P	15	X	X	A
	Nymphicus hollandicus	Cockatiel	P	1			
Campephagidae	Coracina novaehollandiae	Black-faced Cuckoo-shrike	P	31	X	X	A
	Coracina tenuirostris	Cicadabird	P	1			
	Lalage tricolor	White-winged Triller	P	1			
Casuariidae	Dromaius novaehollandiae	Emu	P		X	X	A
Charadriidae	Vanellus miles	Masked Lapwing	P	15	X	X	

Table D.1 FAUNA SPECIES RECORDED ON THE SMP

Family	Scientific Name	Common Name	Legal Status	Count	ERM 2003	CE 2004-2006	CE 2007-2008*
	Vanellus tricolor	Banded Lapwing	P	3			
Ciconiidae	Ephippiorhynchus asiaticus	Black-necked Stork	E1	1			
Cisticolidae	Cisticola exilis	Golden-headed Cisticola	P	2			
Climacteridae	Cormobates leucophaea	White-throated Treecreeper	P	8		X	
Columbidae	Columba livia*	Rock Dove	U	6	X		
	Geopelia humeralis	Bar-shouldered Dove	P	1			
	Geopelia placida	Peaceful Dove	P	13			
	Leucosarcia melanoleuca	Wonga Pigeon	P	1			
	Ocyphaps lophotes	Crested Pigeon	P	10		X	A
	Phaps chalcoptera	Common Bronzewing	P	2		X	
	Streptopelia chinensis*	Spotted Turtle-Dove	U	16	X	X	
Coraciidae	Eurystomus orientalis	Dollarbird	P	2			
Corcoracidae	Corcorax melanorhamphos	White-winged Chough	P	10	X	X	B
Corvidae	Corvus coronoides	Australian Raven	P	53	X	X	B
Cuculidae	Cacomantis flabelliformis	Fan-tailed Cuckoo	P	5	X		
	Chalcites basalis	Horsfield's Bronze-Cuckoo	P	5			A
	Chalcites lucidus	Shining Bronze-Cuckoo	P	6		X	
	Cuculus pallidus	Pallid Cuckoo	P	6			A
Dicaeidae	Dicaeum hirundinaceum	Mistletoebird	P	9		X	A
Dicruridae	Grallina cyanoleuca	Magpie-lark	P	43	X	X	A

Table D.1 FAUNA SPECIES RECORDED ON THE SMP

Family	Scientific Name	Common Name	Legal Status	Count	ERM 2003	CE 2004-2006	CE 2007-2008*
	Myiagra inquieta	Restless Flycatcher	P	1		X	
	Rhipidura albiscapa	Grey Fantail	P	35	X	X	A
	Rhipidura leucophrys	Willie Wagtail	P	27	X	X	A
Estrildidae	Neochmia temporalis	Red-browed Finch	P	26	X	X	
	Taeniopygia bichenovii	Double-barred Finch	P	19		X	
	Taeniopygia guttata	Zebra Finch	P	1			
Eupetidae	Psophodes olivaceus	Eastern Whipbird	P	2			
Falconidae	Falco berigora	Brown Falcon	P	3			
	Falco cenchroides	Nankeen Kestrel	P	1			
	Falco longipennis	Australian Hobby	P	3		X	
Fringillidae	Carduelis carduelis*	European Goldfinch	U	1			
Hirundinidae	Hirundo neoxena	Welcome Swallow	P	14		X	B
	Petrochelidon nigricans	Tree Martin	P	5			
Maluridae	Malurus cyaneus	Superb Fairy-wren	P	41	X	X	B
Meliphagidae	Acanthorhynchus tenuirostris	Eastern Spinebill	P	20	X	X	A
	Anthochaera carunculata	Red Wattlebird	P	13		X	A
	Anthochaera chrysoptera	Little Wattlebird	P	2	X		
	Lichenostomus chrysops	Yellow-faced Honeyeater	P	24	X	X	B
	Lichenostomus fuscus	Fuscous Honeyeater	P	9			
	Lichenostomus leucotis	White-eared Honeyeater	P	15			

Table D.1 FAUNA SPECIES RECORDED ON THE SMP

Family	Scientific Name	Common Name	Legal Status	Count	ERM 2003	CE 2004-2006	CE 2007-2008*
	Lichenostomus penicillatus	White-plumed Honeyeater	P	9		X	
	Manorina melanocephala	Noisy Miner	P	52	X	X	B
	Manorina melanophrys	Bell Miner	P	5			
	Meliphaga lewinii	Lewin's Honeyeater	P	2			
	Melithreptus brevirostris	Brown-headed Honeyeater	P	7		X	B
	Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V	2			
	Melithreptus lunatus	White-naped Honeyeater	P	3		X	
	Myzomela sanguinolenta	Scarlet Honeyeater	P	2		X	
	Philemon corniculatus	Noisy Friarbird	P	7		X	B
	Phylidonyris niger	White-cheeked Honeyeater	P	10			
	Phylidonyris novaehollandiae	New Holland Honeyeater	P	2			
Meropidae	Merops ornatus	Rainbow Bee-eater	P	1			
Motacillidae	Anthus australis	Australian Pipit	P	3			
Neosittidae	Daphoenositta chrysoptera	Varied Sittella	P	11	X	X	
Oriolidae	Oriolus sagittatus	Olive-backed Oriole	P	8		X	
Pachycephalidae	Colluricincla harmonica	Grey Shrike-thrush	P	35	X	X	A
	Falcunculus frontatus	Eastern Shrike-tit	P	8	X	X	A
	Pachycephala pectoralis	Golden Whistler	P	20	X	X	A
	Pachycephala rufiventris	Rufous Whistler	P	20			A
Pardalotidae	Pardalotus punctatus	Spotted Pardalote	P	37	X	X	A

Table D.1 FAUNA SPECIES RECORDED ON THE SMP

Family	Scientific Name	Common Name	Legal Status	Count	ERM 2003	CE 2004-2006	CE 2007-2008*
	Pardalotus striatus	Striated Pardalote	P	17		X	B
Passeridae	Passer domesticus*	House Sparrow	U	9			
Pelecanidae	Pelecanus conspicillatus	Australian Pelican	P	1			
Petroicidae	Eopsaltria australis	Eastern Yellow Robin	P	19	X	X	A
	Microeca fascinans	Jacky Winter	P	2	X	X	A
	Petroica boodang	Scarlet Robin	P	2		X	
	Petroica goodenovii	Red-capped Robin	P	1			
	Petroica rosea	Rose Robin	P	9		X	
Phalacrocoracidae	Phalacrocorax carbo	Great Cormorant	P	1			
	Phalacrocorax melanoleucos	Little Pied Commerant	P			X	
	Phalacrocorax varius	Pied Cormorant	P	2			
Phasianidae	Coturnix pectoralis	Stubble Quail	P	1			
	Coturnix ypsilophora	Brown Quail	P	4			
Podargidae	Podargus strigoides	Tawny Frogmouth	P	4			
Podicipedidae	Podiceps cristatus	Great Crested Grebe	P	1			
	Poliocephalus poliocephalus	Hoary-headed Grebe	P	1			
	Tachybaptus novaehollandiae	Australasian Grebe	P	2		X	
Psittacidae	Alisterus scapularis	Australian King-Parrot	P	1			
	Glossopsitta pusilla	Little Lorikeet	P	2			
	Lathamus discolor	Swift Parrot	E1	7			

Table D.1 FAUNA SPECIES RECORDED ON THE SMP

Family	Scientific Name	Common Name	Legal Status	Count	ERM 2003	CE 2004-2006	CE 2007-2008*
	Platycercus adscitus eximius	Eastern Rosella	P	16	X	X	B
	Platycercus elegans	Crimson Rosella	P	2	X	X	
	Psephotus haematonotus	Red-rumped Parrot	P	14		X	
	Trichoglossus chlorolepidotus	Scaly-breasted Lorikeet	P	1			
	Trichoglossus haematodus	Rainbow Lorikeet	P	19		X	A
Pycnonotidae	Pycnonotus jocosus*	Red-whiskered Bulbul	U	7		X	
Rallidae	Fulica atra	Eurasian Coot	P	2		X	
	Gallinula tenebrosa	Dusky Moorhen	P	7		X	A
	Gallirallus philippensis	Buff-banded Rail	P	2			
	Porphyrio porphyrio	Purple Swamphen	P	7		X	A
	Porzana tabuensis	Spotless Crake	P	1			
Scolopacidae	Actitis hypoleucos	Common Sandpiper	P	1			
	Gallinago hardwickii	Latham's Snipe	P				A (2)
Strigidae	Ninox boobook	Southern Boobook	P	3			
Sturnidae	Acridotheres tristis*	Common Myna	U	33		X	B
	Sturnus vulgaris*	Common Starling	U	19		X	B
Sylviidae	Acrocephalus australis	Australian Reed-Warbler	P	1			
	Megalurus gramineus	Little Grassbird	P	2			
Threskiornithidae	Platalea flavipes	Yellow-billed Spoonbill	P			X	
	Threskiornis spinicollis	Straw-necked Ibis	P	1			

Table D.1 FAUNA SPECIES RECORDED ON THE SMP

Family	Scientific Name	Common Name	Legal Status	Count	ERM 2003	CE 2004-2006	CE 2007-2008*
Turnicidae	Turnix varia	Painted Button-quail	P	2			
Tytonidae	Tyto alba	Barn Owl	P	1			
Zosteropidae	Zosterops lateralis	Silvereye	P	21	X	X	B
Gastropoda							
Camaenidae	Meridolum corneovirens	Cumberland Plain Land Snail	E1	43		X	
Helicidae	Helix aspersa*	Brown gardensnail	U	2			
Mammalia							
Bovidae	Bos taurus*	European cattle	U	2			
	Capra hircus*	Goat	U	2			
Canidae	Canis lupus familiaris*	Dog	U	7	X		
	Canis lupus*	Dingo, domestic dog	U	5			
	Vulpes vulpes*	Fox	U	22	X		
Dasyuridae	Dasyurus maculatus	Spotted-tailed Quoll	V	4			
	Sminthopsis murina	Common Dunnart	P	1			
Equidae	Equus caballus*	Horse	U	3			
Felidae	Felis catus*	Cat	U	5		X	
Leporidae	Lepus capensis*	Brown Hare	U	4	X	X	
	Oryctolagus cuniculus*	Rabbit	U	17	X	X	

Table D.1 FAUNA SPECIES RECORDED ON THE SMP

Family	Scientific Name	Common Name	Legal Status	Count	ERM 2003	CE 2004-2006	CE 2007-2008*
Macropodidae	Macropus giganteus	Eastern Grey Kangaroo	P	30	X	X	
	Macropus rufus	Red Kangaroo	P		X	X	
	Wallabia bicolor	Swamp Wallaby	P	4			
Molossidae	Mormopterus "Species 2"	Undescribed Freetail Bat	P	8		X	
	Mormopterus norfolkensis	Eastern Freetail-bat	V	6	X		
	Mormopterus planiceps	Little Mastiff-bat	P		X		
	Tadarida australis	White-striped Freetail-bat	P	6	X		
Muridae	Mus musculus*	House Mouse	U	5			
	Rattus rattus*	Black Rat	U	3			
	Rattus sp.	rat	P	3			
Petauridae	Petaurus breviceps	Sugar Glider	P	7			
	Petaurus norfolcensis	Squirrel Glider	V	1			
Phalangeridae	Trichosurus sp.	brushtail possum	P	5			
	Trichosurus vulpecula	Common Brushtail Possum	P	11		X	
Phascolarctidae	Phascolarctos cinereus	Koala	V	1			
Pseudocheiridae	Pseudocheirus peregrinus	Common Ringtail Possum	P	4	X		
Pteropodidae	Pteropus poliocephalus	Grey-headed Flying-fox	V	5			
Suidae	Sus scrofa*	Pig	U	1			
Tachyglossidae	Tachyglossus aculeatus	Short-beaked Echidna	P	1			
Vespertilionidae	Chalinolobus gouldii	Gould's Wattled Bat	P	33	X	X	

Table D.1 FAUNA SPECIES RECORDED ON THE SMP

Family	Scientific Name	Common Name	Legal Status	Count	ERM 2003	CE 2004-2006	CE 2007-2008*
	Chalinolobus morio	Chocolate Wattled Bat	P	15	X	X	
	Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	35	X	X	
	Myotis adversus	Large-footed Myotis	V	6		X	
	Myotis macropus	Southern Large-footed Myotis				X	
	Nyctophilus geoffroyi	Lesser Long-eared Bat	P	27	X	X	
	Nyctophilus sp.	long-eared bat	P	2	X	X	
	Scoteanax rueppellii	Greater Broad-nosed Bat	V	1	X		
	Scotorepens orion	Eastern Broad-nosed Bat	P	21	X		
	Vespadelus darlingtoni	Large Forest Bat	P	1	X		
	Vespadelus regulus	Southern Forest Bat	P	3	X	X	
	Vespadelus vulturnus	Little Forest Bat	P	26	X		
Reptilia							
Agamidae	Amphibolurus muricatus	Jacky Lizard	P	6			
	Physignathus lesueurii	Eastern Water Dragon	P	1			
	Pogona barbata	Bearded Dragon	P	6	X		
Chelidae	Chelodina longicollis	Eastern Snake-necked Turtle	P	3			
Elapidae	Furina diadema	Red-naped Snake	P	4			
	Pseudechis porphyriacus	Red-bellied Black Snake	P	5	X		
	Pseudonaja textilis	Eastern Brown Snake	P	2	X		

Table D.1 FAUNA SPECIES RECORDED ON THE SMP

Family	Scientific Name	Common Name	Legal Status	Count	ERM 2003	CE 2004-2006	CE 2007-2008*
Gekkonidae	Diplodactylus vittatus	Wood Gecko	P	6			
Pygopodidae	Pygopus lepidopodus	Common Scaly-foot	P	4			
Scincidae	Cryptoblepharus virgatus	Cream-striped Shinning-skink	P	2			
	Ctenotus robustus	Robust Ctenotus	P	10			
	Ctenotus taeniolatus	Copper-tailed Skink	P	8			
	Egernia whitii	White's Skink	P	1			
	Eulamprus quoyii	Eastern Water-skink	P	8			
	Lampropholis delicata	Dark-flecked Garden Sunskink	P	21			
	Lampropholis guichenoti	Pale-flecked Garden Sunskink	P	16	X		
	Lampropholis sp.	unidentified grass skink	P	4			
	Lygisaurus foliorum	Tree-base Litter-skink	P	2			
	Tiliqua scincoides	Eastern Blue-tongue	P	5			
Varanidae	Varanus sp.	Unidentified Goanna	P	1			
	Varanus varius	Lace Monitor	P	2			

KEY
* records from the Central Precinct
X = recorded on the SMP
A = 1-5 individuals

B = 6-20 individuals
C = 21-50 individuals

Appendix E

Assessments of Significance

E.1 Ecological Communities

E.1.1 Cumberland Plain Woodland

Cumberland Plain Woodland (CPW) occurs in two forms; Shale Hills Woodland and Shale Plains Woodland. Shale Hills Woodland occurs in the south of the Cumberland Plain in more elevated areas. Shale Plains Woodland (SPW) is more widely distributed, occurring throughout the drier areas of the Cumberland Plain[60]. Dominant canopy species include Grey Box (*Eucalyptus moluccana*), Forest Red Gum (*E. tereticornis*), Narrow-leaved Ironbark (*E. creba*), Spotted Gum (*Corymbia maculata*) and Thin-leaved Stringybark (*E. eugenoides*). The shrub layer is dominated by Blackthorn (*Bursaria spinosa*). Grasses dominate the ground layer[6].

The community is well adapted to fire and drought but is now under threat from disturbance triggering weed invasion, increased soil nutrients, rubbish dumping and altered fire regimes[60].

Small patches of depauperate CPW occur in the Central Precinct as stands of scattered indigenous tree cover. Larger patches and tracts of CPW occur on the SMP. There are small patches of high quality CPW jutting into the precinct from the Regional Park and moderate condition patches of CPW in the centre of the precinct. The shape of these areas and their proximity to highly disturbed areas threatens their viability in the long term because they are susceptible to edge effects. The shape of these patches does not provide for viable management in the long term.

a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

The proposed development will remove small patches of degraded CPW. This will not have an adverse effect on the extent of the community such that its local occurrence is likely to be placed at risk of extinction because the community is well-represented within the adjacent Regional Park where it has a higher conservation value and is in better condition.

The composition may be modified in parts of the Central Precinct where representations of the community are retained such as significant trees or patches of understorey. Although patches of vegetation are not likely to be retained with structural complexity or composition resembling CPW, this will not adversely modify composition to place the local occurrence at risk of extinction because of the retention of CPW in the Regional Park.

d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

It is assumed that all CPW within the precinct will be removed or substantially modified for the proposed development, except for any portions of the community that may be retained along drainage lines as part of riparian zones.

Intact CPW will remain connected through the Regional Park around the western, northern and eastern sides of the precinct. Any significant trees or patches of understorey that are retained within the precinct will become isolated as a result of the proposed development.

The CPW to be removed, modified or isolated as a result of the proposed development is not important to the long-term survival of the community within the locality. Cumberland Plain Woodland of high conservation significance will be conserved within the Regional Park and managed for conservation. The vegetation within the Regional Park is considered to be more important than that within the Central Precinct as it is in better condition and is more intact.

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

No critical habitat for this endangered ecological community has currently been identified by the Director-General of the DECC.

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

The DECC is currently preparing a draft recovery plan for the endangered ecological communities of the Cumberland Plain, though it is yet to be finalised. There are no threat abatement plans relevant to CPW.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The proposed development will result in Clearing of native vegetation. However, the vegetation to be cleared consists of degraded CPW and higher quality examples of the community will be conserved within the Regional Park.

Other key threatening processes that may be increased as a result of the proposed development include:

- Competition and grazing by the feral European rabbit;
- Ecological consequence of high frequency fires; and
- Invasion of native plant communities by exotic perennial grasses.

The Feral and Domestic Animal Management Strategy will be implemented in the Central Precinct to ensure that the effects of rabbits are not exacerbated by the proposed development and to decrease the impacts from rabbits as they currently exist on the SMP.

The Bushfire Management Plan has been designed to mitigate factors that could lead to high frequency fires. The plan of management that will be developed for the Regional Park will also ensure that this process is not exacerbated.

The Weed Management Plan will be implemented to reduce the impacts of exotic perennial grasses.

Conclusion

The proposed development is not likely to have a significant impact on Cumberland Plain Woodland. No Species Impact Statement is required for this ecological community. The CPW in the Central Precinct is under threat from edge effects whereas the CPW in the Regional Park is more secure and will be adequately managed to reduce such threats, particularly where CPW is contained in large blocks with a small edge to area ratio. Therefore the loss of low quality CPW from the precinct is not considered to significantly

impact on the local occurrence of the community because high quality CPW is conserved in the Regional Park.

E.1.2 Swamp Oak Floodplain Forest and River-flat Eucalypt Forest

Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions (SOFF) and River-flat Eucalypt Forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions are both forms of Alluvial Woodland depending on whether Swamp Oak is the dominant tree species or eucalypts are dominant. The communities are very similar and have been assessed together here as they intergrade with each other throughout the occurrence of Alluvial Woodland that has been mapped on the SMP, including the Central Precinct.

Swamp Oak Floodplain Forest occurs where the groundwater is saline or subsaline, in areas that are waterlogged or periodically inundated flats, drainage lines, lake margins and estuarine fringes associated with coastal floodplains. Swamp Oak (*Casuarina glauca*) forms a dense to sparse canopy. The understorey has frequent vines, sparse shrubs and a continuous ground cover of forbs, sedges, grasses and leaf litter[61].

The community is threatened by land clearing, fragmentation, flood mitigation, land-filling, pollution from runoff, weed invasion, damage from livestock and feral animals, acid sulphate soils and rubbish dumping[61].

Small patches of depauperate SOFF occur in the Central Precinct as stands of scattered indigenous tree cover. Larger patches and tracts of SOFF occur on the SMP.

River-flat Eucalypt Forest (RFEF) is found on coastal floodplains and has a tall canopy of eucalypts. The most widespread canopy trees include *Eucalyptus tereticornis, E. amplifolia, Angophora floribunda* and *A. subvelutina*. It may have a layer of small trees and a scattering of shrubs. The ground cover consists of abundant forbs, scramblers and grasses. RFEF occurs on alluvial soils on river-flats of the NSW North Coast, Sydney Basin and South East Corner bioregions.

Small patches of RFEF in occur in the centre of the Central Precinct. Larger patches and tracts of RFEF occur in the Regional Park.

a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

c) *in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*

   (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

   (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

The proposed development will remove small patches of degraded SOFF and RFEF. This will not have an adverse effect on the extent of the communities such that their local occurrences are likely to be placed at risk of extinction because the communities are well-represented within the adjacent Regional Park where they have a higher conservation value and are in better condition.

The composition may be modified in parts of the Central Precinct where representations of the communities are retained such as significant trees or patches of understorey. Although patches of vegetation are not likely to be retained with structural complexity or composition resembling the communities, this will not adversely modify composition to place the local occurrence at risk of extinction because of the retention of the communities in the Regional Park.

d) *in relation to the habitat of a threatened species, population or ecological community:*

   (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

   (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

   (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

It is assumed that all SOFF and RFEF within the precinct will be removed or substantially modified for the proposed development, except for any portions of the community that may be retained along drainage lines as part of riparian zones.

Intact SOFF and RFEF will remain connected through the Regional Park around the western, northern and eastern sides of the precinct. Any significant trees or patches of understorey that are retained within the precinct will become isolated as a result of the proposed development.

The patches of SOFF and RFEF to be removed, modified or isolated as a result of the proposed development are not important to the long-term survival of the communities within the locality. Swamp Oak Floodplain Forest and RFEF of high conservation significance will be conserved within the Regional Park and managed for conservation. The vegetation within the Regional Park is considered to be more important than that within the Central Precinct as it is in better condition and is more intact.

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

No critical habitat for this endangered ecological community has currently been identified by the Director-General of the DECC.

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

The DECC is currently preparing a draft recovery plan for the endangered ecological communities of the Cumberland Plain, though it is yet to be finalised. There are no threat abatement plans relevant to SOFF or RFEF.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The proposed development will result in Clearing of native vegetation. However, the vegetation to be cleared consists of degraded SOFF and RFEF, and higher quality examples of the community will be conserved within the Regional Park.

Other key threatening processes that may be increased as a result of the proposed development include:

- Competition and grazing by the feral European rabbit;
- Ecological consequence of high frequency fires; and
- Invasion of native plant communities by exotic perennial grasses.

The Feral and Domestic Animal Management Strategy will be implemented in the Central Precinct to ensure that the effects of rabbits are not exacerbated by the proposed development and to decrease the impacts from rabbits as they currently exist on the SMP.

The Bushfire Management Plan has been designed to mitigate factors that could lead to high frequency fires. The plan of management that will be developed for the Regional Park will also ensure that this process is not exacerbated.

The Weed Management Plan will be implemented to reduce the impacts of exotic perennial grasses.

Conclusion

The proposed development is not likely to have a significant impact on Swamp Oak Floodplain Forest and River-flat Eucalypt Forest. No Species Impact Statement is required for these ecological communities.

E.1.3 Shale-gravel Transition Forest

Shale-gravel Transition Forest (SGTF) has a dominant canopy species of Broad-leaved Ironbark (*Eucalyptus fibrosa*) but Grey Box (*E. moluccana*) and Forest Red Gum (*E. tereticornis*) may also occur. Paperbark (*Melaleuca decora*) dominates the understorey, with *Bursaria spinosa, Daviesia ulicifolia* and *Lissanthe strigosa* occurring in the shrub layer. Grasses and herbs occur in the ground layer. SGTF occurs mainly in the north of the Cumberland Plain, on gravel deposits over shale soils. Threats to SGTF include clearing, mining for gravel and weed invasion[62].

A small patch of degraded SGTF occurs in the southern portion of the Central Precinct.

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Not applicable.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

Not applicable.

c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

The SGTF in the Central Precinct and surrounding areas of the Regional Park occurs in very small localised patches where the soil contains higher amounts of lateritic gravel. The proposed development will remove an area of degraded SGTF. This will not have an adverse effect on the extent of the community such that its local occurrence is likely to be

placed at risk of extinction because the community is well-represented within the adjacent Regional Park where it has a higher conservation value and is in better condition.

The composition may be modified where it occurs in the Central Precinct where representations of the community are retained such as significant trees or patches of understorey. Although patches of vegetation are not likely to be retained with structural complexity or composition resembling SGTF, this will not adversely modify composition to place the local occurrence at risk of extinction because of the retention of SGTF in the Regional Park.

d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

It is assumed that all SGTF within the precinct will be removed or substantially modified for the proposed development.

Intact SGTF will remain connected to other areas of native vegetation as the community intergrades with CPW, through the Regional Park around the southern and eastern sides of the precinct. Any significant trees or patches of understorey that are retained within the precinct will become isolated as a result of the proposed development.

The SGTF to be removed, modified or isolated as a result of the proposed development is not important to the long-term survival of the community within the locality. Shale-gravel Transition Forest of high conservation significance will be conserved within the Regional Park and managed for conservation. The vegetation within the Regional Park is considered to be more important than that within the Central Precinct as it is in better condition and is more intact.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

No critical habitat for this endangered ecological community has currently been identified by the Director-General of the DECC.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plans,

The DECC is currently preparing a draft recovery plan for the endangered ecological communities of the Cumberland Plain, though it is yet to be finalised. There are no threat abatement plans relevant to SGTF.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The proposed development will result in Clearing of native vegetation. However, the vegetation to be cleared consists of degraded SGTF and higher quality examples of the community will be conserved within the Regional Park. Other key threatening processes that may be increased as a result of the proposed development include:

- Competition and grazing by the feral European rabbit;
- Ecological consequence of high frequency fires; and
- Invasion of native plant communities by exotic perennial grasses.

The Feral and Domestic Animal Management Strategy will be implemented in the Central Precinct to ensure that the effects of rabbits are not exacerbated by the proposed development and to decrease the impacts from rabbits as they currently exist on the SMP.

The Bushfire Management Plan has been designed to mitigate factors that could lead to high frequency fires. The plan of management that will be developed for the Regional Park will also ensure that this process is not exacerbated.

The Weed Management Plan will be implemented to reduce the impacts of exotic perennial grasses.

Conclusion

The proposed development is not likely to have a significant impact on Shale-gravel Transition Forest. No Species Impact Statement is required for this ecological community.

E.1.4 Freshwater Wetlands

Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions occurs on low-lying parts of floodplains, alluvial flats, depressions, drainage lines, back swamps, lagoons and lakes. It is dominated by herbaceous plants including sedges, emergent plants, floating and submerged plants[63].

The community is threatened by land clearing, fragmentation, flood mitigation, land-filling, pollution from runoff, weed invasion, damage from livestock and feral animals, acid sulphate soils, rubbish dumping and climate change[63].

Small patches of Freshwater Wetlands occur in the Central Precinct in low-lying areas towards the centre of the precinct. Other areas of Freshwater Wetlands are conserved within the Regional Park.

a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

The proposed development will remove some patches of Freshwater Wetlands. It is also represented within the Regional Park where it has a higher conservation value and is in better condition so that its local occurrence is not likely to be placed at risk of extinction.

The composition may be modified in parts of the Central Precinct resulting from secondary impacts such as nutrient-enriched runoff from the proposed development; however, stormwater controls will be implemented to mitigate this effect. This is not likely to place this occurrence of the community at risk of extinction.

d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

Small areas of Freshwater Wetlands will be removed or modified as a result of the proposed development.

Any Freshwater Wetland areas that are maintained within the precinct will be connected to the Regional Park through riparian corridors. The community will not become isolated as a result of the proposed development.

The Freshwater Wetland areas that may be removed or modified as a result of the proposed development are not important to the long-term survival of the community within the locality. Freshwater Wetlands of high conservation significance will be conserved within the Regional Park and managed for conservation. The vegetation within the Regional Park is considered to be more important than that within the Central Precinct as it is in better condition and is more intact.

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

No critical habitat for this endangered ecological community has currently been identified by the Director-General of the DECC.

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

The DECC is currently preparing a draft recovery plan for the endangered ecological communities of the Cumberland Plain, though it is yet to be finalised. There are no threat abatement plans relevant to Freshwater Wetlands.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The proposed development will result in Clearing of native vegetation. Higher quality examples of the community will be conserved within the Regional Park.

Other key threatening processes that may be increased as a result of the proposed development include:

- Competition and grazing by the feral European rabbit;
- Ecological consequence of high frequency fires; and
- Invasion of native plant communities by exotic perennial grasses.

The Feral and Domestic Animal Management Strategy will be implemented in the Central Precinct to ensure that the effects of rabbits are not exacerbated by the proposed development and to decrease the impacts from rabbits as they currently exist on the SMP.

The Bushfire Management Plan has been designed to mitigate factors that could lead to high frequency fires. The plan of management that will be developed for the Regional Park will also ensure that this process is not exacerbated.

The Weed Management Plan will be implemented to reduce the impacts of exotic perennial grasses.

Conclusion

The proposed development is not likely to have a significant impact on Freshwater Wetlands. No Species Impact Statement is required for this ecological community.

E.2 Flora

E.2.1 Grevillea juniperina spp. juniperina

Grevillea juniperina subsp. *juniperina* is a dense shrub, 0.5-1.5m tall, found only in Western Sydney[31]. The distribution is bounded by St Mary's, Londonderry and Prospect. It occurs on red sandy to clay soils in Cumberland Plain Woodland and Castlereagh Woodland. It is found in localised and small populations. *Grevillea juniperina* subsp. *juniperina* is threatened by habitat clearance, altered fire regimes, weed invasion, rubbish dumping, trampling and vehicular damage[33]. In summary:

- The species occurs in the order of approximately 530 individuals in the precinct;
- Several hundred thousand individuals of the species occur within the Regional Park and throughout the study area; and
- The species is conserved within the nearby Castlereagh Nature Reserve.

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

It is estimated that approximately 530 individuals occur within the precinct and will be removed for the purpose of the proposed development. However this amount is very small when compared with the extensive habitat and hundreds of thousands of this species within the Regional Park. This species is also highly tolerant of disturbance and is expected to persist at the edges of development. Therefore the proposed development is not likely to have an impact on the life cycle of the species or compromise the viability of the population.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the

endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

There are no populations of this species listed as endangered under the TSC Act.

c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

All of the known and potential habitat for this species in the Central Precinct will be removed or substantially modified as a result of the proposed development.

Intact habitat for the species will remain connected to other areas of native vegetation through the Regional Park around the western, northern and eastern sides of the precinct. Any significant patches of understorey containing the species that are retained within the precinct will become isolated as a result of the proposed development.

The habitat to be removed, modified or isolated as a result of the proposed development is not important to the long-term survival of the species within the locality. Hundreds of thousands of *Grevillea juniperina* subsp. *juniperina* individuals occur within the Regional Park and habitat of high conservation significance will be conserved within the Regional Park and managed for conservation.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

No critical habitat for this species has currently been identified by the Director-General of the DECC.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

A recovery plan has not been prepared for this species. No threat abatement plans are relevant to this species.

g) Whether the action proposed constitutes or is part of a key threatening process or likely to result in the operation of, or increases the impact of, a key threatening process.

The proposed development will result in Clearing of native vegetation. However, only approximately 530 individuals will be cleared as a result of the proposed development compared with the hundreds of thousands that will be conserved within the Regional Park. Other key threatening processes that may be increased as a result of the proposed development include:

- Ecological consequence of high frequency fires; and
- Invasion of native plant communities by exotic perennial grasses.

The Bushfire Management Plan has been designed to mitigate factors that could lead to high frequency fires. The plan of management that will be developed for the Regional Park will also ensure that this process is not exacerbated.

The Weed Management Plan will be implemented to reduce the impacts of exotic perennial grasses.

Conclusion

The proposed development is not likely to have a significant impact on *Grevillea juniperina* subsp. *juniperina*. No Species Impact Statement is required for this species.

E.3 Fauna

E.3.1 Green and Golden Bell Frog

One threatened frog species is considered to have the potential to occur in the study area. The following Assessment of Significance demonstrates that no significant impacts will occur to the Green and Golden Bell Frog (*Litoria aurea*).

The Green and Golden Bell Frog have not been recorded on the SMP, although it is known to occur in the locality. Recent targeted searches for it in the study area did not detect it.

It is possible that this species uses Ropes Creek and South Creek to travel between habitat patches. Green and Golden Bell Frogs inhabit marshes, dams and stream sides, particularly water bodies containing bulrushes Typha spp. and spikerushes *Eleocharis* spp.

(a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

The Freshwater Wetlands of the Central Precinct contain potential habitat for this species, although it is not known to occur there. Areas of better quality habitat occur within the Regional Park. The proposed development is not likely to place a local population of the species at risk of extinction.

(b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*

There are no populations of this species that are listed as endangered under the TSC Act.

(c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

(d) *In relation to the habitat of a threatened species, population or ecological community:*

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

There is potential for this habitat to be removed or modified by the proposed development because of its proximity to development and associated edge effects.

The wetland that may be retained within the precinct will become isolated from South Creek through the relocation of the drainage line. The relocated drainage line will connect to South Creek.

The habitat to be removed, modified or isolated as a result of the proposed development is not important to the long-term survival of the species within the locality. Areas of high quality habitat occur within the Regional Park and will be conserved within the Regional Park and managed for conservation.

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

No critical habitat for this species has currently been identified by the Director-General of the DECC.

(f) *Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,*

The Plague Minnow threat abatement plan is relevant to this species. The broad objective of the plan is to ameliorate the impact of the species on frogs, particularly threatened frogs. A relevant specific objective is to minimise dispersal by humans. The Plague Minnow is already likely to be established in South Creek and probably invaded the Central Precinct wetlands from South Creek via the drainage channel. The proposed development is not inconsistent with the objectives of this threat abatement plan.

A recovery plan has been drafted for the Green and Golden Bell Frog. The overall objectives are to manage threats on currently known populations of the species and to prevent further decline of the species. A relevant specific objective is to prevent further habitat loss. With the retention of the wetland habitat within the precinct, the proposed development is not inconsistent with the objectives of this recovery plan.

(g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

The proposed development will result in Clearing of native vegetation. However, the potential habitat for this species will be retained. Larger areas of better quality habitat will be conserved within the Regional Park.

Other key threatening processes that may be increased as a result of the proposed development include:

- Predation by the Plague Minnow.

Conclusion

The proposed development is not likely to have a significant impact on Green and Golden Bell Frog. No Species Impact Statement is required for this species.

E.3.2 Speckled Warbler

The Speckled Warbler has a patchy distribution throughout south-eastern Queensland, the eastern half of NSW and into Victoria, as far west as the Grampians. The species is most frequently reported from the hills and tablelands of the Great Dividing Range, and rarely from the coast. The Speckled Warbler lives in a wide range of eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies[44]. The Speckled Warbler is listed as Vulnerable on Schedule 2 of the TSC Act[64].

(a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

Development of the Central Precinct may impact on some potential habitat for this species, although it is not known to occur in the Central Precinct and areas of better quality habitat occur within the Regional Park. The proposed development is not likely to place a local population of the species at risk of extinction.

(b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*

There are no populations of this species that are listed as endangered under the TSC Act.

(c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

(d) *In relation to the habitat of a threatened species, population or ecological community:*

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

All of the known and potential habitat for this species in the Central Precinct will be removed or substantially modified as a result of the proposed development.

Intact habitat for the species will remain connected to other areas of native vegetation through the Regional Park around the western, northern and eastern sides of the precinct. Any significant patches of vegetation that may be used by the species to be retained within the precinct will become isolated as a result of the proposed development.

The habitat to be removed, modified or isolated as a result of the proposed development is not important to the long-term survival of the species within the locality. Areas of high quality habitat occur within the Regional Park and will be conserved within the Regional Park and managed for conservation.

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

No critical habitat for this species has currently been identified by the Director-General of the DECC.

(f) *Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,*

The Red Fox threat abatement plan is relevant to this species, although the Speckled Warbler is not a priority species listed in the plan. The proposed development is consistent with the objectives of the plan.

No recovery plan has been prepared for this species.

(g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

The proposed development will result in Clearing of native vegetation. However, the vegetation to be cleared consists of degraded habitat for the species and potential habitat

may be removed, modified or partially retained. However, larger areas of better quality habitat will be conserved within the Regional Park.

Other key threatening processes that may be increased as a result of the proposed development include:

- Predation by the European Red Fox; and
- Predation by the Feral Cat.

The Feral and Domestic Animal Management Strategy will be implemented in the Central Precinct to ensure that the effects of foxes and cats are not exacerbated by the proposed development.

Conclusion

The proposed development is not likely to have a significant impact on Speckled Warbler. No Species Impact Statement is required for this species.

E.3.3 Black Bittern

The Black Bittern uses terrestrial and estuarine wetlands with permanenet water and dense vegetation. It may occur in flooded grassland, forest, woodland, rainforest and mangroves where permanent water is present. The Black Bittern is listed as vulnerable under the TSC Act.

(a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

Development of the Central Precinct may impact on some potential habitat for this species, although it is not known to occur in the Central Precinct and areas of better quality habitat occur within the Regional Park. The proposed development is not likely to place a local population of the species at risk of extinction.

(b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*

There are no populations of this species that are listed as endangered under the TSC Act.

(c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

(d) *In relation to the habitat of a threatened species, population or ecological community:*

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

A portion of potential habitat for this species in the Central Precinct will be retained as part of the proposed development. There is potential for this habitat to be modified by the proposed development because of its proximity to development and associated edge effects. Additional habitat will be created through the relocation of a drainage line.

The wetland that may be retained in the precinct will become isolated through the relocation of the drainage line. The relocated drainage line will connect to South Creek.

The habitat to be removed or modified as a result of the proposed development is not important to the long-term survival of the species within the locality. Areas of high quality habitat occur within the Regional Park and will be conserved within the Regional Park and managed for conservation.

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

No critical habitat for this species has currently been identified by the Director-General of the DECC.

(f) *Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,*

The Red Fox threat abatement plan is relevant to this species, although the Black bittern is not a priority species listed in the plan. The proposed development is consistent with the objectives of the plan.

No recovery plan has been prepared for this species.

(g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

The proposed development will result in Clearing of native vegetation. However, the vegetation to be cleared consists of degraded habitat for the species. Larger areas of better quality habitat will be conserved within the Regional Park and retained within the precinct.

Other key threatening processes that may be increased as a result of the proposed development include:

- Predation by the European Red Fox; and
- Predation by the Feral Cat.

The Feral and Domestic Animal Management Strategy will be implemented in the Central Precinct to ensure that the effects of foxes and cats are not exacerbated by the proposed development.

Conclusion

The proposed development is not likely to have a significant impact on Black Bittern. No Species Impact Statement is required for this species.

E.3.4 Diamond Firetail

The Diamond Firetail occurs in Eucalypt woodlands including Box-Gum and Snow Gum woodlands. It also occurs in open forest, mallee, natural temperate grasslands and derived grasslands, often in riparian areas. It is widely distributed across NSW. The Diamond Firetail is threatened by habitat loss through clearing, invasion of weeds and firewood collection, and predation of eggs and nestlings by the Pied Currawong[65]. The Diamond Firetail is listed as Vulnerable on Schedule 2 of the TSC Act[65].

(a) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

Development of the Central Precinct may impact on some potential habitat for this species, although it is not known to occur in the Central Precinct and areas of better quality habitat occur within the Regional Park. The proposed development is not likely to place a local population of the species at risk of extinction.

(b) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*

There are no populations of this species that are listed as endangered under the TSC Act.

(c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

(d) *In relation to the habitat of a threatened species, population or ecological community:*

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

All of the known and potential habitat for this species in the Central Precinct will be removed or substantially modified as a result of the proposed development.

Intact habitat for the species will remain connected to other areas of native vegetation through the Regional Park around the southern and eastern sides of the precinct. Any significant patches of vegetation that may be used by the species to be retained within the precinct will become isolated as a result of the proposed development.

The habitat to be removed, modified or isolated as a result of the proposed development is not important to the long-term survival of the species within the locality. Areas of high quality habitat occur within the Regional Park and will be conserved within the Regional Park and managed for conservation.

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

No critical habitat for this species has currently been identified by the Director-General of the DECC.

(f) *Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,*

The Red Fox threat abatement plan is relevant to this species, although the Diamond Firetail is not a priority species listed in the plan. The proposed development is consistent with the objectives of the plan.

No recovery plan has been prepared for this species.

(g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

The proposed development will result in Clearing of native vegetation. However, the vegetation to be cleared consists of degraded habitat for the species. Larger areas of better quality habitat will be conserved within the Regional Park.

Other key threatening processes that may be increased as a result of the proposed development include:

- Predation by the European Red Fox; and
- Predation by the Feral Cat.

The Feral and Domestic Animal Management Strategy will be implemented in the Central Precinct to ensure that the effects of foxes and cats are not exacerbated by the proposed development.

Conclusion

The proposed development is not likely to have a significant impact on Diamond Firetail. No Species Impact Statement is required for this species.

E.3.5 Cumberland Land Snail

The Cumberland Land Snail inhabits a very small area on the Cumberland Plain west of Sydney from Richmond and Windsor south to Picton and from Liverpool west to the Hawkesbury and Nepean Rivers at the base of the Blue Mountains[66]. It primarily occurs in Cumberland Plain Woodland, which is a grassy open woodland with occasional dense patches of shrubs[66]. It lives under litter or bark, leaves and logs or shelters in loose soil around grass clumps[66]. The Cumberland Land Snail is listed as Vulnerable on Schedule 2 of the TSC Act[67].

a) *In the case of a threatened species, whether the lifecycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.*

Little is known about the range of the Cumberland Land Snail and the area required for a viable population, but it is though the remaining total population on the Cumberland Plain consists of several disjunct populations[67]. The SMP is likely to support one large population or subpopulation of this species. The Cumberland Land Snail is present within most or all of the larger patches of CPW on the SMP and is represented within the Regional Park which contains more than 400ha potential habitat.

The proposed development of the precinct will clear a small amount of potential habitat for the species. However, this habitat is regenerating after past disturbances such as vegetation clearance and earth works, therefore it is not likely that the species occurs there and was not detected during recent surveys.

b) *In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised,*

There are no populations of this species listed as endangered under the TSC Act.

c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

d) *In relation to the habitat of a threatened species, population or ecological community:*

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

All of the known and potential habitat for this species in the Central Precinct will be removed or substantially modified as a result of the proposed development.

Intact habitat for the species will remain connected to other areas of native vegetation through the Regional Park around the northern, western and eastern sides of the precinct. Any significant patches of vegetation that may be used by the species to be retained within the precinct will become isolated as a result of the proposed development.

The habitat to be removed, modified or isolated as a result of the proposed development is not important to the long-term survival of the species within the locality. Areas of high quality habitat occur within the Regional Park and will be conserved within the Regional Park and managed for conservation.

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

No critical habitat for this species has currently been identified by the Director-General of the DECC.

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

A recovery plan has not been prepared for this species. No threat abatement plans are relevant to this species.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of a key threatening process.

Clearing of native vegetation resulting in the loss of habitat is a listed threatening process under the TSC Act. Small, degraded patches of potential habitat will be cleared for the development of the Central Precinct. However, over 400ha of potential habitat for the species will be contained within the Regional Park, which will be managed to improve fauna habitat on the SMP.

No other key threatening process that may be exacerbated by the proposed action will affect this species.

Conclusion

The proposed development is not likely to have a significant impact on the Cumberland Land Snail. No Species Impact Statement is required for this species.

E.3.6 Microchiropteran Bats

The following Assessments of Significance demonstrates apply to the following species of microchiropteran bats known to occur in the locality:

- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*);
- Eastern False Pipistrelle;
- Eastern Freetail-bat (*Mormopterus norfolkensis*);
- Greater Broad-nosed Bat (*Scoteanax rueppellii*);
- Large-eared Pied Bat (*Chalinolobus dwyeri*);
- Large-footed Myotis; and
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*).

The Eastern Bentwing Bat occurs along the east and north west coasts of Australia. It roosts in caves, derelict mines, stormwater tunnels, buildings and other man made structures. It forages above the canopy in forested areas. The Eastern Bentwing Bat forms maternity colonies in caves and populations usually centre on such caves[40]. The Eastern Bentwing Bat is listed as Vulnerable on Schedule 2 of the TSC Act[68].

The Eastern False Pipistrelle is found on the south eastern coast and ranges of Australia from southern Queensland to Victoria and Tasmania[69]. It prefers moist habitats and generally roosts in eucalypt hollows, but has been found under loose bark on trees or in buildings[69]. The Eastern False Pipistrelle is listed as Vulnerable on Schedule 2 of the TSC Act[70].

The Eastern Freetail Bat occurs from southern Queensland to southern NSW, in dry sclerophyll forest and woodland. It roosts in tree hollows and sometimes under bark or in man-made structures[42]. The Eastern Freetail Bat is listed as Vulnerable on Schedule 2 of the TSC Act[71].

The Large-eared Pied Bat is found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW[72]. This species roosts in caves, crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Hirundo ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features[72]. This species is found in well-timbered areas containing gullies. The Large-eared Pied Bat is listed as Vulnerable on Schedule 2 of the TSC Act[73] and Vulnerable under the EPBC Act.

The Large-footed Myotis occurs in coastal areas from north western Australia to south western Victoria[39]. It roots close to water in caves, mine shafts, tree hollows, stormwater channels, buildings, under bridges and in dense foliage. It forages over streams and pools by raking its feet across the surface for insects and small fish[39]. The Large-footed Myotis is listed as Vulnerable on Schedule 2 of the TSC Act[74].

The Greater Broad-nosed Bat occurs from the Atherton Tableland to north eastern Victoria in gullies and river systems that drain the Great Dividing Range. It roosts in tree hollows and sometimes in buildings. It occurs in woodland to moist and dry eucalypt forest and rainforest but is most common in tall wet forest[41]. The Greater Broad-nosed Bat is listed as Vulnerable on Schedule 2 of the TSC Act[75].

The Yellow-bellied Sheathtail Bat is a large species of microchiropteran bat that is characterised by rich shiny black fur on the back and contrasting bright white or yellow fur on the belly[36]. It occurs across northern and eastern Australia but it is a rare visitor in the southern parts of this range, including Victoria, south western NSW and eastern South Australia. It roosts in tree hollows and buildings and forages in most habitats[76]. The Yellow-bellied Sheathtail Bat is listed as Vulnerable on Schedule 2 of the TSC Act[77].

a) In the case of a threatened species, whether the lifecycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

There is very limited potential roosting habitat for the hollow-dwelling species of these microchiropteran bats in the Central Precinct. These species are likely to primarily utilise the precinct as foraging habitat as part of a larger range. Potential habitat will be retained in the Regional Park, where extensive areas of roosting and foraging habitat are located. As 900ha of potential roosting and foraging habitat will be conserved within the Regional Park, it is not likely that the proposal will affect the life cycle of these species such that a viable local population is placed at risk of extinction.

b) In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised,

There are no populations of these species listed as endangered under the TSC Act.

c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

d) *In relation to the habitat of a threatened species, population or ecological community:*

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

All of the known and potential habitat for these species in the Central Precinct will be removed or substantially modified as a result of the proposed development.

Intact habitat for the species will remain connected to other areas of native vegetation through the Regional Park around the northern, western and eastern sides of the precinct. Any significant patches of vegetation that may be used by the species to be retained within the precinct will become isolated as a result of the proposed development.

The habitat to be removed, modified or isolated as a result of the proposed development is not important to the long-term survival of the species within the locality. Areas of high quality habitat occur within the Regional Park and will be conserved within the Regional Park and managed for conservation.

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

No critical habitat for these species has currently been identified by the Director-General of the DECC.

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

No recovery plans have been prepared for these species. No threat abatement plans are relevant to these species.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of a key threatening process.

Clearing of native vegetation and Loss of hollow-bearing trees are listed key threatening processes under the TSC Act. A relatively small number of mature eucalypt trees occur on the subject site, which provide foraging and potential roosting habitat, may be removed for the proposed development. However 900 ha of vegetation, including hollow bearing trees, will be conserved within the Regional Park. Future management of the Regional Park will also be designed to protect fauna habitats. The extent of clearing proposed is therefore not considered to be a threat to microchiropteran bat species in the precinct.

No other key threatening process that may be exacerbated by the proposed action will affect these species.

Conclusion

The proposed development is not likely to have a significant impact on threatened microchiropteran bats. No Species Impact Statement is required for these species.

E.3.7 Grey-headed Flying-fox

The Grey-headed Flying-fox is found along the east coast of Australia from Bundaberg to Melbourne. It occurs in subtropical and temperate rainforests, tall sclerophyll forest and woodlands, heaths, swamps, gardens and orchards. The species roosts in camps with high site fidelity. The Grey-headed Flying-fox is threatened by loss of foraging habitat, disturbance to camps, unregulated shooting and electrocution on power lines[43]. It is listed as vulnerable under the TSC Act and the EPBC Act[78].

a) *In the case of a threatened species, whether the lifecycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.*

The Central Precinct consists only of potential foraging habitat for the Grey-headed Flying-fox as this species roosts in camps, the locations of which are well-known in the Sydney region. No camps occur on the SMP. The proposed development is unlikely to place a local population of the species at risk of extinction as it will result in the removal of a small area of low quality foraging habitat.

b) *In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised,*

There are no populations of this species listed as endangered under the TSC Act.

c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*

   (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

   (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

d) *In relation to the habitat of a threatened species, population or ecological community:*

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

All of the known and potential habitat for this species in the Central Precinct will be removed or substantially modified as a result of the proposed development.

Intact habitat for the species will remain connected to other areas of native vegetation through the Regional Park around the western, northern and eastern sides of the precinct. Any significant patches of vegetation that may be used by the species to be retained within the precinct will become isolated as a result of the proposed development although this is not likely to affect the Grey-headed Flying-fox as it is a highly mobile species.

The habitat to be removed, modified or isolated as a result of the proposed development is not important to the long-term survival of the species within the locality. Areas of high quality habitat occur within the Regional Park and will be conserved within the Regional Park and managed for conservation.

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

No critical habitat for this species has currently been identified by the Director-General of the DECC.

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

No recovery plan has been prepared for this species. No threat abatement plans are relevant to the species.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of a key threatening process.

Clearing of native vegetation is a listed key threatening process under the TSC Act. A relatively small number of mature eucalypt trees occur on the subject site, which provide potential foraging habitat, will be removed for the proposed development. However 900 ha of vegetation, will be conserved within the Regional Park. Future management of the

Regional Park will also be designed to protect fauna habitats. The extent of clearing proposed is therefore not considered to be a threat to the Grey-headed Flying-fox in the precinct.

No other key threatening process that may be exacerbated by the proposed action will affect this species.

Conclusion

The proposed development is not likely to have a significant impact on the Grey-headed Flying-fox. No Species Impact Statement is required for this species.