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ROCKDALE BIODIVERSITY SURVEY

ROCKDALE CITY COUNCIL

**OCTOBER 2006
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SECTION 1

INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

Conacher Travers Pty Ltd have been engaged by Rockdale City Council to prepare the initial biodiversity strategy for the LGA. The consultants' brief prepared for the Biodiversity Strategy required that the project be undertaken as two related phases as outlined below.

Phase 1

Identification of biodiversity values and threats.

Phase 2

Development of strategies, actions, procedures etc. relevant to the protection and enhancement of biodiversity within Rockdale LGA.

This report provides details in the work undertaken and results obtained for Phase 1 of the Biodiversity Study. It is anticipated that the contents of this report will comprise an appendix within the final report with the key findings and issues integrated into the main part of the final report.

During the completion of Phase 1, detailed flora and fauna surveys were undertaken in various locations within the LGA and also in areas which had not previously been surveyed. The aim of these localised surveys was to supplement the results of previous surveys completed for various parks and reserves within the LGA. Details on the methods used, locations surveyed and results obtained are provided in the relevant sections of this report.

In addition to the completion of ecological surveys, consultations and meetings were undertaken with a range of Council officers, community group representatives and representatives of various State Government Departments. Valuable information and insight was obtained from these persons which will be utilized during the completion of Phase 2 of the study.

This Phase 1 Report has been prepared as a 'stand alone' document. Some of the information contained within the text, tables, figures and appendices may be subject to change as a result of ongoing work and assessments being completed for Phase 2. As previously identified, this Phase 1 Report is intended to form part of the appendices of the Final Report and as such the format and information provided should be considered interim information only which is subject to further change and refinement.

The following format has been utilized for the Phase 1 Report.

Section 1 – Introduction and Background

This section provides introductory and background information providing relevant details on the biophysical characteristics of Rockdale LGA. Details of consultations and comments on the relevant literature reviewed for Phase 1 of the Study are also provided.

Section 2 – Flora Characteristics

Comprehensive details on the threatened flora species, Endangered Ecological Communities specific flora surveys completed and flora species recorded are provided in this section.

Section 3 – Fauna Characteristics

Details on the threatened fauna species of the locality and results of detailed fauna surveys are provided in this section.

Section 4 – Biodiversity Issues Relevant to Rockdale LGA

This section utilises the data collected during Phase 1 of the Study, including data and reports from previous studies to identify a range of threats and threatening processes to the biodiversity of the Rockdale LGA. Issues relating to connectivity of key habitat areas are also identified.

Figures and Maps

A range of figures and maps are included to supplement the information and data provided in the Phase 1 Report.

Appendices

The appendices provide detailed flora and fauna species lists and other data or information referred to in the main text of the report.

1.2 LOCATION

The Rockdale City Council area covers an area of 29.8 square kilometers and is situated within the southern Sydney region approximately 12 km from the Sydney CBD on the foreshore of Botany Bay. The city is defined by mostly natural boundaries such as the Cooks River and Wollie Creek in the north, Botany Bay in the east and the Georges River in the south.

At a regional level for biodiversity management, Rockdale LGA is referred to as falling within the Sydney Basin Bio-region. This region is an extensive area, which covers the majority of lands from Murrurundi and Nelson Bay in the north to Batemans Bay in the south, Newnes to the west and is bounded by the Pacific Ocean to the east. In terms of area, the study area comprises approximately 29.8km² of the 36,600km² of the bio-region. The LGA has been divided into three areas for simplicity in explaining flora and fauna descriptions and mapping the vegetation communities and survey method locations. Figure 1.1 shows where the LGA has been divided into three areas for descriptive purposes.

1.3 BIOPHYSICAL CHARACTERISTICS OF THE CITY OF ROCKDALE

1.3.1 Climate

Rockdale has a typical temperate climate shared with the Sydney region with warm wet weather prevailing in the autumn and summer while cool dry weather is most common during the winter and spring.

The City of Rockdale is located within the sub-tropical climatic zone. The climate within this zone is typically characterised by summer rainfall events coupled with warm to hot summers. Winter temperatures are mild, with daily minimum rarely reaching freezing point in July.

Comprehensive weather data has been recorded at Mascot Airport since 1929 and shows that there is an average of 26.3°C maximum in January and February, and an average of 6.9°C minimum in July. Mean annual rainfall is 1094.0mm, with a maximum average in March (119.5mm), and minimum average in September (60.5mm). The mean number of rainy days occurs in March (12.3) while the minimum number of rain days occurs in July (9.2) with an average annual number of rain days being 128 days per year. Winds are predominantly from the south and north-east in summer, and from the south and south-west in winter.

Humidity levels (mean 3pm readings) within the City of Rockdale remain relatively constant throughout the year, with levels ranging from 50% in August to 63% in February. The highest mean daily maximum temperature for the LGA is 26.3°C in January and February. Figure 1.2.1 depicts the average climatic measurements from Mascot Airport since 1929.

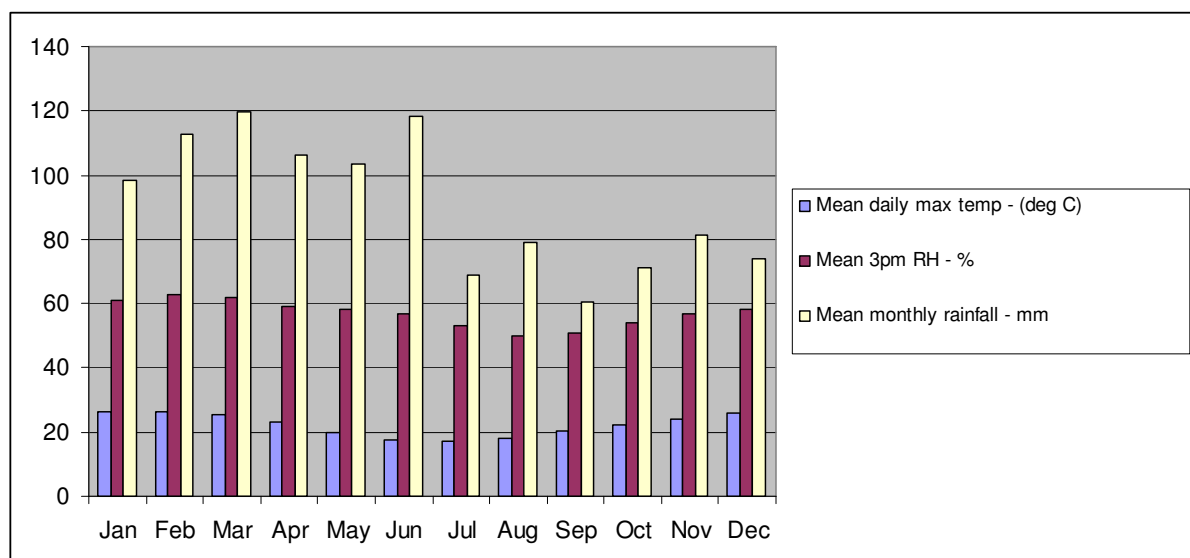


FIGURE 1.2.1
CLIMATIC RECORDS FROM MASCOT AIRPORT

Source: Bureau of Meteorology, 2006

1.3.2 Geology

The City of Rockdale is characterised by three geological types. There are Quaternary alluvium, sands, silts and clays in the eastern parts of the LGA with the Hawkesbury Sandstone geological sequence adjoining to the west. In the western-most parts of the LGA there are the Wianamatta Group Shales of the Liverpool sub-group present on the more elevated areas.

The Quaternary geology is characterised by sands and swamps formed by the deposition of sand by either aeolian (wind) or marine actions. This formation is characterised by massive sand sheets with low relief varying between dunes and swales containing swamps or lagoons.

The Hawkesbury Sandstone formation is characterised by medium to coarse-grained quartz sandstone with minor shale and laminite lenses.

The Wianamatta Group of sediments is divided into two formations, the Ashfield and the overlying Bringelly Shales. Areas of Wianamatta Group shales are restricted within the study area to the ridgetops in the western parts of the LGA. This formation is characterised by black to dark grey siltstone and laminite.

1.3.3 Soils and Soil Landscapes

The City of Rockdale is characterised by a number of various soil landscapes as defined by (Chapman and Murphy, 1989). Table 1.1 identifies the Soil Landscapes present within the study area and various details on their distribution, vegetation characteristics and local representation within the Rockdale LGA.

TABLE 1.1 SOIL LANDSCAPES OF THE ROCKDALE LGA				
SOIL LANDSCAPE	DESCRIPTION	LOCAL OCCURRENCE IN ROCKDALE LGA	VEGETATION	COMMENTS
Narrabeen (na)	Beaches and coastal foredunes on marine sands.	Restricted to Botany Bay foreshore.	Fore dune grasses and creepers, in sheltered areas open or closed scrub occurs.	Located on the foreshore of Botany Bay from Kyeemagh to Dolls Point.
Tuggerah (tg)	Gently undulating to rolling coastal dune fields.	Forms the low sand beds situated from Kyeemagh to Dolls Point.	Mostly cleared dry sclerophyll eucalypt and apple woodland with shrubby understorey.	Situated immediately west of the Narrabeen soils from Kyeemagh to Dolls Point.
Warriewood (wa)	Level to gently undulating swales, depressions and in-filled lagoons on quaternary sands.	Generally associated with Scarborough Park and ponds leading to Muddy Creek.	Sclerophyll scrub and woodland.	Situated in a drainage line to the landward side of the beach dunes.
Ettalong (et)	Level to very gently undulating coastal swamps.	Associated with Scarborough Park and a small area to the south near Ramsgate.	Complex swamp vegetation with high biodiversity, often arranged in concentric zones around the swamp.	Located near the headwaters of Scarborough Ponds.
Lambert (la)	Undulating to rolling low hills on Hawkesbury Sandstone.	Occurrences at Banksia, the eastern parts of Beverly Park and the western parts of Sans Souci.	Predominantly uncleared open-heath lands, closed heath lands & scrublands, with patches of low eucalypt woodland.	Occurs on the lower slopes of rises below but adjacent to the Newport soil landscape.

**TABLE 1.1 (Cont.)
SOIL LANDSCAPES OF THE ROCKDALE LGA**

SOIL LANDSCAPE	DESCRIPTION	LOCAL OCCURRENCE IN ROCKDALE LGA	VEGETATION	COMMENTS
Newport (np)	Gently undulating plains to rolling rises of Holocene Sands mantling other soil material or bedrock.	Known from the Kogarah and Rockdale areas.	Extensively cleared low open woodland, scrub and open heathland.	Occurs on the sideslopes of plateaus below but adjacent to the Hawkesbury sandstones and Wianamatta shales.
Hawkesbury (ha)	Rugged rolling to very steep hills on Hawkesbury Sandstone.	Known from the slopes of Bardwell Valley, Bexley and Bexley North.	Mostly uncleared woodlands (dry sclerophyll) and tall open forest (wet sclerophyll).	Restricted to the upper slopes where it has experienced extensive disturbance.
GyMEA (gy)	Undulating to rolling rises and low hills on Hawkesbury Sandstone.	Ridges & slopes near Bexley North and Beverly Hills.	Extensively cleared open forest and woodland (dry sclerophyll).	Restricted to ridges and upper slopes which are predominantly cleared of natural vegetation.
Birrong (bg)	Level to gently undulating alluvial floodplain draining Wianamatta Group Shales.	Located on the southern shore of Wolli Creek and Cooks river in Turrella and Arncliffe.	Extensively cleared forest and woodland.	Restricted to lower elevations, mostly cleared.
Blacktown (bt)	Gently undulating rises on Wianamatta shales and Hawkesbury shale.	Located at Bexley. Occupies a larger proportion of the LGA than other soil units.	Extensively cleared tall open forest (wet sclerophyll) and open woodland (dry sclerophyll).	Upper slopes and plateaus. Extensively cleared.
Lucas Heights (lh)	Gently undulating crests and ridges on plateau surfaces of the Mittagong formation.	Patchy areas on ridges.	Extensively cleared or completely cleared dry sclerophyll low forest and woodland.	Restricted to ridges which are predominantly cleared of natural vegetation.
Disturbed Terrain (xx)	Level plain to hummocky terrain, extensively disturbed by human activity, including complete disturbance, removal or burial of soil.	Brighton-le-Sands, Sans Souci and Kogarah Golf Club.	Completely cleared and/or extensive soil disturbance.	Affected by either soil removal, placement of fill, or extensive / high density development.

1.3.4 Topography

The Sydney Basin dips gently from the east and north to a central lowland area south-west of Parramatta. The centre of the basin is known as the Cumberland Lowlands consisting of plains and gently undulating to low hills. The basin rises to the north and south being transected by the Parramatta River, Georges River and Cooks River producing rugged to undulating valley sides on the Harbour Foreshores. The Rockdale LGA is located between the mouths of Georges River and Cooks River as they discharge into Botany Bay situated to the east.

The elevation of the City of Rockdale ranges from 0m to 120m Australian Height Datum (AHD). The LGA is characterised by low undulating areas in the south and east with slopes of less than 2% with a low plateau located in the north-western parts. This plateau is incised by several streams that have cut small valleys with some slopes up to 30% gradient in Bardwell Valley.

1.3.5 Drainage and Catchment Characteristics

Watercourses are a major element within the City of Rockdale. The LGA boundary in the north is delineated by the Cooks River, while the southern extent is delineated by the Georges River.

There are two broad catchments within Rockdale LGA all of which form part of the Botany Bay Catchment. These catchments are the Cooks River and Georges River catchments as well as direct flow into Botany Bay. These two catchments have been divided into ten smaller sub-catchment areas for management and reporting purposes as described within the State of the Environment: Comprehensive Report (Rockdale City Council 2003-04). The ten sub-catchments are described individually below.

Wolli Creek

This is one of the lower tributaries of the Cooks River with a sub-catchment area of 15.5km². It rises in Beverly Hills and extends approximately 8km before discharging into the Cooks River. The creek takes the form of a lined channel from Kingsgrove Road to Bexley Road then changes to a more 'natural' state forming a defined but winding watercourse. A small concrete weir at Turrella separates the estuarine part of Wolli Creek from the upper freshwater parts.

Bardwell Creek

This sub-catchment is the major tributary of Wolli Creek with a catchment area of 6.4km². The upper reaches of Bardwell Creek are within the adjoining Hurstville LGA and drain in a north-easterly direction through the suburbs of Hurstville, Bexley North, Bardwell Park and Turrella.

Bonnie Doon

This watercourse is the second last tributary of Cooks River before it discharges into Botany Bay. It is approximately 1.5km long and is generally inconspicuous due to extensive industrial development.

Spring Street

This watercourse takes the form of a canal for most of its 2km length. It discharges into the lower reaches of Muddy Creek and is surrounded by urban development.

Muddy Creek

Muddy Creek is the last tributary of Cooks River before it discharges into Botany Bay. This sub-catchment extends approximately 9.5km and runs north-east through the suburbs of Carlton, Kogarah, Rockdale, Banksia, Brighton Le Sands, and Kyeemagh. Muddy Creek takes the form of a concrete lined channel for the majority of its length.

Eve Street / Cahill Park

This catchment does not have a defined watercourse draining the whole of the catchment as it drains directly into Cooks River.

Scarborough Ponds

This watercourse is approximately 2.5km in length and comprises a series of ponds. It arises in Brighton Le Sands where it runs southward behind the sand dune formations to Ramsgate where it turns eastward and discharges directly into Botany Bay to the south of Ramsgate Beach.

Waradiel Creek

This creek runs approximately 0.5km southwards from Sandringham Street in Dolls Point. It is enclosed by an open space area in the southern parts of its length.

Bado-berong Creek

This creek extends approximately 1.8km south from Park Road in Sans Souci and discharges directly into Georges River. The majority of the length of this watercourse is within open space areas consisting of parks and reserves.

Goomun Creek

This watercourse is approximately 2km in length and runs roughly parallel to and between 150m and 350m east of Rocky Point Road. Goomun Creek runs along the north-western boundary of Kendall Street Reserve and is closely surrounded by urban development for most of its length.

1.4 CONSERVATION RESERVES

Rockdale LGA is near to Towra Point Aquatic Reserve and Nature Reserve (an internationally recognised Ramsar site). Together these reserves provide habitat for a number of marine species as well as several species listed under the Japanese Australian Migratory Bird Agreement (JAMBA) and Chinese Australian Migratory Bird Agreement (CAMBA).

There are also a large number of small reserves and open space areas within Rockdale LGA with the total area of remnant bushland being 20 hectares or 0.6% of the LGA. These reserves and open spaces are scattered along creeklines such as Wolli Creek, Bardwell Creek and Scarborough Ponds. There are also vegetated parks, reserves, golf courses and playing fields scattered throughout the urban landscape.

These reserves provide environments of varying quality and size for many flora and fauna species of regional and state significance as well as habitats for threatened ecological communities.

1.5 CONSULTATIONS

Throughout the production of Phase 1, consultation was made with a variety of people from various organisations. Their experience with the biodiversity in Rockdale is widespread and therefore several valuable issues and comments have been identified. These comments will be considered during the production of the final biodiversity strategy document. The issues identified during these consultations are listed in Table 1.2.

**TABLE 1.2
PERSONS CONTACTED AND THEIR IDENTIFIED ISSUES**

Representative	Organisation	Issues Identified
Ms Kath Wade	Bardwell Valley Volunteers	<ul style="list-style-type: none"> - Require trained regenerators employed by council as weeds were so prolific in some areas particularly south of Bexley Road that removal is beyond their resources. - More efficient sedimentation control and the wider use of more effective trash gates to reduce sedimentation and rubbish entering the creek. - The instigation of a Council organised public awareness program highlighting the problems with littering and the need to control garden weeds etc. - Bush Rat (<i>rattus fuscipes</i>) are still known to occur in the parkland however numbers are low due to the problem of predation by foxes, cats and dogs. - A plant list of the area was provided.
Dr Arthur White	Long time Rockdale Resident – Amphibian Specialist	<ul style="list-style-type: none"> - Mentioned Prof Allen Keast, a previous resident of Rockdale, who has maintained a historical record of avian fauna within the LGA which shows the decline of native species within the area as a result of urbanisation. - Expressed concern that the proposed new north-south highway proposed for the wetland corridor is likely to displace many flora and fauna species. - Is actively involved in the re-establishment of local habitat for the threatened Green and Golden Bell Frog and manages a Green and Golden Bell Frog breeding program
Mr Peter Stevens	Wolli Creek Preservation Society	<ul style="list-style-type: none"> - Main interest is the restoration and preservation of the Wolli Creek natural area. - Concerned that neither Canterbury nor Rockdale Councils take a leading role in the restoration and preservation of the creekline itself which forms the border, generally leaving responsibility to the other council. As a result the nutrient levels and general pollution are high. - Concerned that native fauna is in decline as a result of removal of habitat and high levels of predation from foxes, cats and dogs.

**TABLE 1.2 (Cont.)
PERSONS CONTACTED AND THEIR IDENTIFIED ISSUES**

Representative	Organisation	Issues Identified
Mr Ron Rayner	President of the Rockdale Wetlands Preservation Society	<ul style="list-style-type: none"> - Interested in wetland preservation and wading bird observation and conservation. - Highlighted that the migratory waders seen foraging at Sandringham are from the Taren Point Endangered Ecological Community, and that the migratory waders observed foraging at the mouth of the Cooks River and the adjoining beaches are from the flocks of Port Botany. - Awaiting a written submission from Ron concerning other issues.
Ms Marion Traynor	Department of environment & Conservation	<ul style="list-style-type: none"> - Updated biodiversity strategy is in draft form with plans to be finished by the year. - Structure and content is in progress but will remain similar to the old document. - Comments on urban and coastal environments will remain reasonably unchanged. - The current document is acceptable to use.
Mr Alan Madden	Sydney Metro Lands Council	<ul style="list-style-type: none"> - Wishes to be contacted for any land restoration projects near Dolls Point as possible midden sites exist. - Interested in further consultation during Phase 2.
Mr Phillip Gibbs	NSW Fisheries	<ul style="list-style-type: none"> - Inquiring into work conducted in Scarborough Ponds in the Rockdale Wetland Corridor. Provided relevant reference material. - Further contacts were given on other NSW Fisheries representatives in case of future inquiries.
Professor Paul Adam	University of New South Wales	<ul style="list-style-type: none"> - Willing to review bibliography.

1.6 LITERATURE REVIEW

A comprehensive literature review on studies within the LGA and surrounding areas that address flora and fauna was undertaken. Details of the most relevant documents are provided below:

Flora and Fauna Study 1999-2000 was completed for Rockdale LGA by Biosphere Environmental Consultants. The results within this document have been heavily utilised throughout the preparation and writing of this report.

The Rockdale Bushland Survey was produced by the National Trust of Australia (NSW) in 1988 and was utilised for the flora component of this report, with comparisons and contrasts made between community descriptions and threatened species occurrence

Rockdale Wetlands Corridor Management Strategy was completed by CLOUSTON in 2000 and offered information on the background of the wetland corridor and its significance to the LGA.

Rockdale Water Quality Monitoring Report produced by Rockdale City Council in 1999 was used during the technical assessment of this report, particularly for the assessment of aquatic habitats.

Rockdale City Council State of Environment Report was predominantly used for the introduction and background section.

Several database searches have also been undertaken to obtain detailed information on the flora and fauna species within the LGA. The following database systems have been investigated:

Atlas of NSW Wildlife (Department of Environment and Conservation 2006) – NSW state legislation list of flora and fauna sightings recorded by general public, interest groups and scientific licence holders. The date, location (eastings and northings), number of sightings and reliability factor are given when a search is completed.

Environmental Protection and Biodiversity Conservation (EPBC) list of threatened Flora and Fauna Species – This is a list of species that are federally listed as significant under the EPBC Act where significant refers to Vulnerable, Endangered, Migratory or Regionally Significant. The search option can be accessed on the web, the address is: www.deh.gov.au/erin/ert/epbc/index.html

BioNet – Enables a search of the map collections of the Australian Museum, NSW Department of Environment and Conservation and NSW Department of Primary Industries database systems. The search engine is found at the web address: www.bionet.nsw.gov.au

Rare or Threatened Australian Plants (RoTap) – is a list developed and maintained by the CSIRO and lists taxa that are presumed, Extinct, Endangered, Vulnerable, Rare or poorly known at a national level. State and Territory lists provides additional guide allocating a national conservation codes. The web address to search for RoTap codes is: <http://plantnet.rbgsyd.nsw.gov.au/search/index.html>

Birds Australia – A bird species list compiled by members of Birds Australia who are participating in the Birds Australia Atlas program.

SECTION 2

FLORA CHARACTERISTICS

2.1 INTRODUCTION

To determine the likely and actual occurrence of flora species and plant communities within the Rockdale Local Government Area field survey work was undertaken to supplement literature reviews and previous flora surveys of the area. The principle aims of the flora survey were to:

- Supplement previous detailed flora surveys completed in the LGA (Benson *et al.* (1999), Biosphere Environmental Consultants (2000) and National Trust (1988)), however, particular focus will be placed on areas not targeted in past surveys.
- Conduct additional targeted threatened flora surveys in areas of potential habitat.
- Identify the distribution and extent of Endangered Ecological Communities currently listed under the TSC Act (1995) within the study area.
- Provide consistent vegetation mapping for the study area that corresponds and is directly comparable with recent NPWS (2002) mapping in the western portion of Rockdale LGA.

The methods utilised for the flora survey are outlined below:

2.2 VEGETATION SURVEY METHODOLOGY

Literature Review

- A review of available literature for the area was undertaken to obtain reference material and background information for this study. These documents are listed in the References section of this Report.
- A search of the Atlas of NSW Wildlife (DEC 2006) was undertaken to identify records of threatened flora species located within 10km of the site. This enabled the preparation of a predictive list of threatened flora species that could possibly occur within the habitats found on the site.

Aerial Photograph Interpretation

- Aerial photographs at 1:25,000 scale were utilised to identify the extent of vegetation with respect to the Rockdale LGA.

Field Survey

- A field survey which consisted of foot traverses within areas which contained native vegetation was conducted according to Cropper (1993) to identify the occurrence of flora species and the extent and location of vegetation communities present across the Rockdale LGA. The initial flora survey was undertaken on the 2nd March 2006, with additional surveys conducted between the 7th and 9th March and the 18th and 19th April 2006.

- 20 X 20 metre vegetation sample quadrats were surveyed within areas identified as potential Endangered Ecological Communities and other remnant native vegetation communities. All vascular flora species observed within the quadrats were recorded and given a percentage cover abundance value according to a modified Braun - Blanquet classification system. Quadrats were not completed in areas of highly disturbed vegetation.
- Targeted threatened flora surveys consisting of parallel spaced transects were completed in Frys Reserve, Hawthorne Street Reserve and parts of Bardwell Valley Parklands and Stotts reserve.
- A recording and analysis of the population and age structure of the previously identified threatened species, *Acacia terminalis ssp terminalis* within Frys Reserve.
- Specimens of plants not readily identified in the field were collected for identification, while specimens of potential threatened species were sent to the Sydney Royal Botanic Gardens for confirmation of their identification.
- Determination of species composition as well as structural descriptions of the vegetation on the site according to Specht *et. al.* (1995) was also carried out.

2.3 THREATENED FLORA SPECIES

Combined searches of the Atlas of NSW Wildlife (DEC 2006) and Bionet (2006) were undertaken to identify records of threatened flora species located within 10km of the geographical centre of the Rockdale LGA. This enabled the preparation of a list of threatened flora species that could possibly occur within the habitats found within Rockdale LGA. Details on the threatened plant species, as listed in Schedule 1 and 2 of the *TSC Act* (1995) and Bionet (2006) with a known distribution in the local area are provided in Table 2.1.

**TABLE 2.1
THREATENED FLORA SPECIES RECORDED LOCALLY**

Scientific Name Common name	Growth form, habitat requirements and distribution within NSW	Date and Location of most recent record in Rockdale LGA	Legislation listing		
			TSC Act	EPBC Act	RoTAP
<i>Acacia pubescens</i> Downy Wattle	Spreading shrub 1-4 m high open sclerophyll growing in open forest and woodlands on clay soils. Distribution limits N-Bilpin S-Georges River.	Last recorded in Bardwell Creek in 1999 (Biosphere Environmental Consultants 2000, DEC 2006)	V	V	3VCa
<i>Acacia terminalis ssp terminalis</i> Sunshine Wattle	Erect or spreading shrub, 1.5 m high. Grows in a variety of habitats but usually in dry sclerophyll forest on sandstone, south from Tenterfield, chiefly on coasts and tablelands	Last recorded near Robertson Street Kogarah in 2000 (DEC 2006) and Frys Reserve (Biosphere Environmental Consultants 2000)	E1	E	-
<i>Melaleuca deanei</i>	Shrub to 3 m high. Grows in heath on sandstone. Distribution limits N - Gosford S - Nowra.	Last recorded near Wollie Creek 1897 (DEC 2006). This species is likely to be extinct.	V		3RC-
<i>Syzygium paniculatum</i> Magenta Lilly Pilly	Small tree. Subtropical and littoral rainforest on sandy soil. Distribution limits N - Forster S - Jervis Bay.	Last recorded in Wollie Creek (near Hartill Law Avenue) in 1987 (DEC 2006) and in Hawthorne Street Reserve in 1988 (National Trust 1988, Conacher Travers 2006)	V	V	3VCi
<i>Tetratheca juncea</i>	Prostrate shrub to 1 m high. Dry sclerophyll forest and heath. Distribution limits N - Bulahdelah S - Port Jackson.	Last recorded near Bonar Street, Turella 1886 and near Kenyon Road, Bexley (DEC 2006). This species is likely to be extinct.	V		3VCa

**TABLE 2.1 (Cont.)
THREATENED FLORA SPECIES RECORDED LOCALLY**

KEY:	<p>E = Endangered</p> <p>V = Vulnerable</p> <p>Rotap Code:</p> <p>3 = Geographic range in Australia less than 100km</p> <p>V = Vulnerable – taxon not presently endangered, but at low risk over a long period (20-50yr) of disappearing from the wild through continued depletion, or which occurs on land whose future use is likely to change and threaten its survival</p> <p>C = Reserved – indicated taxon has at least one population within a national park, other proclaimed conservation reserve or in any area otherwise dedicated for the protection of flora.</p>	<p>The taxon may or may not be considered adequately conserved within the reserve, as reflected by the conservation status assigned to it.</p> <p>R = Rare – taxon which is rare in Australia but which currently does not have any identifiable threat. Such species may be represented by a relatively large population in a very restricted area or by smaller populations spread over a wide range or some intermediate combination of distribution pattern.</p> <p>a = 1000 plants or more are known to occur within a conservation reserve</p> <p>i = less than 1000 plants are known to occur within a conservation reserve</p> <p>– = reserved population size is not currently known</p>
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There is suitable and/or sub-optimal habitat for *Acacia pubescens*, *Acacia terminalis* subsp. *terminalis*, *Caladenia tessellata*, *Melaleuca deanei*, *Syzygium paniculatum*, *Tetratheca juncea* and *Thesium australe* within the subject site. One additional threatened species, *Dillwynia tenuifolia* has been recorded within the local area by the National Trust (1988).

Acacia pubescens – A spreading shrub to 5 metres high, but usually 1-2 metres which occurs in dry sclerophyll forest and woodland on clay soils in the area between Bilpin and Georges River. Its principal occurrence is in the western section of the Cumberland Plain where it can occur in highly disturbed sites. This species has been recorded from the Bardwell Valley Parklands (Biosphere Environmental Consultants 2000), however was not observed by *Conacher Travers* (2006).

Acacia terminalis ssp. *terminalis* - Erect or spreading shrub, 1.5 m high. Grows in a variety of habitats but usually in dry sclerophyll forest on sandstone, south from Tenterfield, chiefly on coasts and tablelands. Numerous specimens of *Acacia terminalis* were observed throughout the sandstone vegetation within the Bardwell Valley Parklands, Stotts Reserve and Frys Reserve. Many of these specimens contain characteristics of *Acacia terminalis* ssp. *angustifolia* and not the threatened sub-species *Acacia terminalis* ssp. *terminalis*. Specimens from each of the observed locations were sent to the Sydney Royal Botanic Gardens for confirmation of their identification. None of the samples were subsequently identified as threatened flora species, *Acacia terminalis* ssp. *terminalis*.

The previously recorded population of the threatened flora species *Acacia terminalis* ssp. *terminalis* within Frys Reserve (Biosphere Environmental Consultants 2000) was surveyed in detail during this study. Results of this survey identified three main sub-populations within the reserve containing a total of 16 plants, comprising 8 juveniles, 7 mature plants and a single dead specimen. A sample from this population was identified by the Sydney Royal Botanic Gardens as a hybrid between the threatened *Acacia terminalis* ssp. *terminalis* and non-threatened *A. terminalis* ssp. *angustifolia*. It is recommended that a detailed sampling survey within the reserve be completed and identification from the Royal Botanical Gardens sort for all specimens observed. These additional works should be completed under the appropriate Biodiversity/Management Strategy for Frys Reserve.

Caladenia tessellata – Because so few specimens of this orchid have been observed in so many different environments, it has been impossible to determine a preferred habitat, thus its presence within the subject site prior to settlement cannot be ruled out. In *Orchids of New South Wales and Victoria* (Bishop 1996) which looks at its habitat throughout NSW and Victoria, its habitat is described only as “Favours low open forest with a heathy or sometimes grassy understorey”. It is highly unlikely that this species exists in Rockdale LGA, however it would favour the sandstone vegetation of the Bardwell Valley parklands and Coastal Sand vegetation remnants in the Hawthorne Street Reserve.

Melaleuca deanei – A shrub to 3m which generally occurs in two distinct areas, Ku-ring-gai Chase / Berowra and Holsworthy / Wedderburn. Disjunct populations occur in Blue Mountains, Nowra and Central Coast. It grows in heath on sandstone. This species has not been recorded in the Rockdale LGA since 1897 and is presumed to be extinct. Habitat for this species occurs in the sandstone escarpments and ridges around the Bardwell Valley parklands.

Syzygium paniculatum – A rainforest tree which occurs in littoral rainforest and in subtropical or gallery rainforest on sandy alluvium. There is habitat for this species within the Coastal Sand vegetation remnants in the Hawthorne Street Reserve. National Trust surveys (1988) have previously identified this species as occurring within this reserve. *Conacher Travers* identified *Syzygium paniculatum* in this area. Sydney Royal Botanic Gardens is likely to require a fruiting sample to confirm identification of this species.

Tetratheca juncea – This species is common and widespread in the Lake Macquarie district, especially in porous soil near Red Bloodwoods, but is difficult to detect when not flowering. The subject site must be classed as suitable habitat, but the understorey is so seriously disturbed, it is considered unlikely that it does now occur. This species has not been recorded in the Rockdale LGA since 1886 and is presumed to be extinct.

Thesium australe – An erect perennial herb to 40 cm which is a root parasite associated with Kangaroo Grass, often growing on wet sites. It is known from a few widely scattered sites on the coast, tablelands and slopes of NSW.

2.4 ENDANGERED POPULATIONS AND ENDANGERED ECOLOGICAL COMMUNITIES

Endangered Flora Populations

There are no Endangered Flora Populations known to occur within the Rockdale Local Government Area (DEC 2006).

Endangered Ecological Communities

There are seven (7) Endangered Ecological Communities listed on Schedule 1, Part 3 of the *Threatened Species Conservation Act (1995)* that are known in the Rockdale Local Government Area. Details on these ecological communities are provided below and locations of these communities are shown in Figures 2.1, 2.2 and 2.3.

1. BANGALAY SAND FOREST

General Description

Bangalay Sand Forest occurs in the Sydney Basin and South East Corner bioregions. This ecological community occurs on flat to moderate slopes within a few kilometres of the sea, at altitudes below 100 m.

Habitat Requirements

- Geology / Soils: Deep free draining to damp sandy soils.
- Topography: Coastal sand plains on flat to moderate slopes within a few kilometres of the sea, occurs at altitudes below 100m.
- Characteristic Canopy Species: *Eucalyptus botryoides*, *Eucalyptus pilularis*, *Casuarina glauca*, *Acmena smithii*, *Banksia integrifolia* subsp. *integrifolia*, *Banksia serrata*, *Leptospermum laevigatum*, *Monotoca elliptica* and *Breynia oblongifolia*

Conservation Status and Distribution

This community occurs in the Sydney Basin and South East Corner bioregions. Bangalay Sand Forest is conserved in Royal, Seven Mile Beach, Conjola, Meroo, Murramarang, Eurobodalla and Biamanga National Parks.

Key Threatening Processes

Clearing of native vegetation, invasion of native plant communities by exotic perennial grasses, anthropogenic pressures from camping areas, and high frequency fire regimes.

Occurrence on Site

The habitat requirements and species that characterise this community are present within the Rockdale LGA and correspond to the vegetation community Coastal Sands Swamp Forest as described elsewhere in this document.

2. COASTAL SALTMARSH

General Description

Coastal Saltmarsh occurs in the NSW North Coast, Sydney Basin and South East Corner bioregions. This ecological community occurs in the intertidal zone on the shores of estuaries and lagoons including when they are intermittently closed along the NSW coast.

Habitat Requirements

- Geology / Soils: deep, fine grained depositional mud.
- Topography: Coastal sand or mud flats usually as a zone landward of mangrove stands, occurs at altitudes below 1.5m.
- Characteristic Species: *Juncus krausii* (Sea Rush), *Baumea juncea*, *Sarcocornia quinqueflora*, *Sporobolus virginicus*, *Samolus repens* and *Suaeda australis*.

Conservation Status and Distribution

This community occurs in the Ramsar listed sites at Towra Point and Kooragang Island Nature Reserves.

Key Threatening Processes

Infilling, modified tidal flows, weed invasion, damage by domestic and feral animals, human disturbance, recreational disturbance, altered fire regimes and climate change.

Occurrence on Site

The habitat requirements and species that characterise this community are present within the Rockdale LGA and correspond to the vegetation community Saltmarsh, as described elsewhere in this document.

3. KURNELL DUNE FOREST

General Description

Kurnell Dune Forest is a low open sclerophyll forest community with a distinct mesophyll element found on sand, often with areas of sclerophyll heath and scrub. It occurs in the Sutherland Shire and the City of Rockdale. Within Sutherland Shire this ecological community occurs on the Kurnell Peninsula, with other stands near Bundeena, while in Rockdale it is known to occur within the Leo Smith Reserve.

Habitat Requirements

- Geology / Soils: Deep free draining to damp sandy soils.
- Topography: Coastal sand plains on flat to moderate slopes within a few kilometers of the sea.
- Characteristic Canopy Species: *Eucalyptus botryoides* (Bangalay), *Eucalyptus robusta* (Swamp Mahogany), *Banksia serrata* (Old Man Banksia), *Angophora costata* (Smooth-barked Apple), *Banksia ericifolia* (Heath Banksia), *Cupaniopsis anacardioides*, *Einandra sieberi* and *Glochidion ferdinandii* (Cheese Tree).

Conservation Status and Distribution

This community is known in at least two Council reserves, however it is not known from any NPWS estates.

Key Threatening Processes

Clearing and development of surrounding lands, remaining stands are disjunct, large edge to area ratios, invasion of the community by weeds and altered fire regimes.

Occurrence on Site

The habitat requirements and species that characterise this community are present within the Rockdale LGA and correspond to Coastal Sands Open Forest as described elsewhere in this document.

4. SWAMP OAK FLOODPLAIN FOREST

General Description

Forest associated with grey-black clay-loams and sandy loams, where the groundwater is saline or sub-saline, on waterlogged or periodically inundated flats, drainage lines, lake margins and estuarine fringes associated with coastal floodplains. Characteristic species are *Casuarina glauca*, *Glochidion* spp. and *Melaleuca* spp.

Habitat Requirements

- **Geology / Soils:** Generally on grey-black clay-loams and sandy loams, where the groundwater is saline or sub-saline, on waterlogged or periodically inundated flats, drainage lines, lake margins and estuarine fringes associated with coastal floodplains.
- **Topography:** Coastal floodplains very low elevation slopes less than 1%.
- **Characteristic Species:** *Casuarina glauca*, *Glochidion* spp. and *Melaleuca* spp.

Conservation Status and Distribution

Known to occur in Stotts Island, Ukerebagh, Tuckean, Pambalong, Wamberal, Towra Point and Cullendulla Creek Nature Reserves and Bongil Bongil, Myall Lakes and Conjola National Parks.

Key Threatening Processes

Further clearing, grazing, weed invasion, and physical damage from recreational activities.

Occurrence in Subject Site:

The habitat requirements and species that characterise this community are present within the Rockdale LGA and correspond to the Swamp Oak Woodland vegetation community as described elsewhere in this document.

5. SWAMP SCLEROPHYLL FOREST ON COASTAL FLOODPLAINS

General Description

The structure of the community is typically open forest, although partial clearing may have reduced the canopy to scattered trees. In some areas the tree canopy is low and dense, so that the community takes on the structure of scrub. The community also includes some areas of fernland and tall reedland or sedgeland, where trees are very sparse or absent. The dominant trees include *Eucalyptus robusta* (Swamp Mahogany), *Melaleuca quinquenervia* (Broad-leaf Paperbark), *Eucalyptus botryoides* (Bangalay) and south of Sydney, *Eucalyptus longifolia* (Woollybutt).

Habitat Requirements

- **Geology / Soils:** Humic clay loams and sandy loams.
- **Topography:** Waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. Generally occurs below 20m (though sometimes up to 50m) elevation.
- **Characteristic Species:** *Eucalyptus robusta* (Swamp Mahogany) *Melaleuca quinquenervia* (Broad-leaf Paperbark), *Eucalyptus botryoides* (Bangalay) and south of Sydney *Eucalyptus longifolia* (Woollybutt). Other species include *Callistemon salignus* (Willow Bottlebrush), *Casuarina glauca* (Swamp Oak), *Eucalyptus resinifera* ssp. *hemilampra* (Red Mahogany), *Livistona australis* (Cabbage Palm), and *Lophostemon suaveolens* (Swamp Turpentine). Small trees may be present such as *Acacia irrorata* (Green Wattle), *Acmena smithii* (Lillypilly), *Elaeocarpus reticulatus* (Blueberry Ash), *Glochidion ferdinandi* (Cheese Tree), *Melaleuca linariifolia* and *M. stypheloides*.

Conservation Status and Distribution

Occurs in NSW North Coast, Sydney Basin and South-east Corner Bioregions. Small areas are known to be reserved in Bungawalbin, Tuckean and Moonee Beach Nature Reserves, and Hat Head, Crowdy Bay, Wallingat, Myall Lakes, and Garigal National Parks.

Key Threatening Processes

Land clearing, continuing fragmentation, degradation, flood mitigation and drainage works, land filling and earthworks associated with urban and industrial development, pollution from urban and agricultural runoff, weed invasion, overgrazing, trampling and other soil disturbance by domestic livestock, feral animals including pigs, activation of 'acid sulphate soils', removal of dead wood and rubbish dumping.

Occurrence on Site

The habitat requirements and species that characterise this community are present within the Rockdale LGA and correspond to the vegetation community Floodplain Open Forest as described elsewhere in this document.

6. FRESHWATER WETLANDS ON COASTAL FLOODPLAINS (FWoCF)

General Description:

Freshwater wetlands are typically associated with periodic or semi-permanent inundation by freshwater, although there may be minor saline influences in some wetlands. This community has a structure that may vary from sedgeland and reedlands to herbfields with woody species of plants generally scarce.

Habitat Requirements:

- **Geology / Soils:** silts, muds or humic loams.
- **Topography:** depressions, flats, drainage lines, backswamps, lagoons and lakes associated with coastal floodplains below the 1:100 year flood line and below 20m elevation.
- **Characteristic Species:** *Eleocharis sphacelata*, *Baumea articulata*, *B. rubignosa*, *Ludwigia peploides* subsp. *Montevidensis*, *Phragmites australis* and *Persicaria sp.*

Conservation Status and Distribution:

Known to occur from NSW/Qld border to the NSW/Vic border. This community has been reported in Hexam Swamp and Pitt Town Nature Reserves, and Bungawalbin, Scheyville and Seven Mile Beach National Parks.

Key Threatening Processes:

Clearing, disturbance, changing hydrological regimes, filling, rubbish dumping, pollution, nutrient runoff, grazing, trampling, activation of 'acid sulphate soils' and degradation.

Occurrence in Subject Site:

The habitat requirements and species that characterise this community are present within the Rockdale LGA and corresponds to portions of the Aquatic Herbfield / Sedgeland vegetation community as described elsewhere in this document.

7. SYDNEY FRESHWATER WETLANDS (SFW)

General Description

Restricted to freshwater swamps in swales and depressions on sand dunes and low nutrient sandplain sites in coastal areas. Characterised by sedges and aquatic flora such as *Eleocharis sphacelata*, *Baumea juncea*, *B. rubignosa*, *B. articulata*, *Gahnia sieberiana*, *Ludwigia peploides* and *Persicaria sp.*

Habitat Requirements

- **Geology / Soils:** Generally on the Warriewood and Tuggerah Soil Landscapes (Chapman and Murphy 1989).
- **Topography:** swales and depressions on sand dunes and sandplain sites.
- **Characteristic Species:** *Eleocharis sphacelata*, *Baumea juncea*, *B. rubignosa*, *B. articulata*, *Gahnia sieberiana*, *Ludwigia peploides* and *Persicaria sp.*

Conservation Status and Distribution

Known to occur from the Lake Macquarie Local Government Area in the north to the Wollongong Local Government Area in the south, but may occur outside this area. Small areas of this complex have been reported in Wyrabalong, Royal and Botany Bay National Parks.

Key Threatening Processes

Small size, clearing disturbance and degradation.

Occurrence in Subject Site:

The habitat requirements and species that characterise this community are present within the Rockdale LGA and corresponds to portions of the Aquatic Herbfield / Sedgeland vegetation community as described elsewhere in this document.

It is considered that there is suitable habitat for, and that several Endangered Ecological Communities (EECs) were observed during the field surveys for this report. These EECs were Bangalay Sand Forest, Coastal Saltmarsh, Kurnell Dune Forest, Swamp Oak Floodplain Forest, Swamp Sclerophyll Forest on Coastal Floodplains, Sydney Freshwater Wetlands and Freshwater wetlands on Coastal Floodplains. No occurrences of Sydney Turpentine / Ironbark Forest were observed during surveys, however, there were a number of instances where the correct habitat attributes were present with some specimens of characteristic or indicative trees were found but these were considered to be relics of this EEC. The correlation between the EECs and the vegetation communities described elsewhere in this report are shown in Table 2.2 below.

2.5 FLORA SURVEY RESULTS

Observations

A total of two hundred and fifty-six (256) species of plants were observed within the Rockdale LGA by *Conacher Travers* (2006). The species observed within this survey should not be considered a comprehensive list of the flora within the Rockdale Local Government Area, rather should be used to supplement the two previous detailed surveys (Biosphere Environmental Consultants (2000) and National Trust (1988) within the major bushland remnants.

A further one hundred and eleven (111) species were recorded in the detailed surveys completed by National Trust (1988) and Biosphere Environment Consultants (2000), giving a total of three hundred and sixty-seven (367) recorded by all three field surveys. Of the total of three hundred and sixty-seven, two hundred and sixty-three (263) species were native plants and one hundred and four (104) species were exotic. The native species observed consisted of 42 trees, 94 shrubs, 106 groundcovers, 15 vines, 4 waterplants and 2 epiphytes.

A flora species list is provided in Appendix 1 while a general description of the vegetation communities is provided below. Figures 2.4, 2.5 and 2.6 show the distribution of the vegetation communities within the study area.

2.6 VEGETATION COMMUNITIES

Vegetation community descriptions were adopted from NPWS (2002) and from native vegetation mapping of the Cumberland Plain and Western Sydney. Vegetation communities observed within the study area that were not described in the NPWS (2002) have been described using a modified (Walker and Hopkins 1990) method, and provide reference to both structural and species characteristics. A total of thirteen (13) vegetation communities have been identified within the study area. These communities and their corresponding map units in previous studies are provided below in Table 2.2.

**TABLE 2.2
VEGETATION COMMUNITY NAMES**

ID Number	(Conacher Travers 2006)	NPWS (2002) Native Vegetation Maps of the Cumberland Plain	Benson (1994)	TSC Act (1995) Endangered Ecological Communities
1.	Eastern Sandstone Gully Forest;	MU-61 Eastern Sandstone Gully Forest	10ag – Sydney Sandstone Gully Forest	-
2.	Sandstone Open Forest;	MU-31 Sandstone Ridgetop Woodland	10ar- Sydney Sandstone Ridgetop Woodland	-
3.	Coastal Sands Open Forest	-	9t – Coastal Dune Forest	Kurnell Dune Forest
4.	Coastal Sands Swamp Forest;	-	27a – Coastal Swamp Forest Complex	Bangalay Sand Forest
5.	Floodplain Open Forest;	-	27a – Coastal Swamp Forest Complex	Swamp Sclerophyll Forest on Coastal Floodplains
6.	Swamp Oak Woodland	-	-	Swamp Oak Forest on Coastal Floodplains
7.	Melaleuca Scrub;	-	27a – Coastal Swamp Forest Complex	Swamp Sclerophyll Forest on Coastal Floodplains or Bangalay Sand Forest
8.	Mangrove Scrub;	-	4a – Estuarine complex	-
9.	Sandstone Heath;	MU-62 Woodland / Heath Complex	10ar- Sydney Sandstone Ridgetop Woodland	-
10.	Coastal Heath;	-	MU-21b Coastal Dune Heath	-
11.	Coastal Strandline Grassland;	-	4a – Estuarine complex	-
12.	Aquatic Herbfield / Sedgeland	-	28c – Coastal Freshwater Swamp	Sydney Freshwater Wetlands or Freshwater Wetlands on Coastal Floodplains
13.	Saltmarsh	MU-34 Mangrove / Saltmarsh Complex	4a – Estuarine complex	Coastal Saltmarsh

A general description of the vegetation communities is provided below while Figures 2.4, 2.5 and 2.6 show the distribution of the vegetation communities on the site.

1. EASTERN SANDSTONE GULLY FOREST

Structure: Open Forest to Closed Forest

Trees: To 25m in height with 35-75% Projected Foliage Cover (PFC)

Shrubs: To 3m in height with 25-60% PFC

Groundlayer: To 1.5m in height with 50- 65% PFC

Floristics:

(Main species present)

Trees: *Angophora costata* (Smooth-barked Apple), *Eucalyptus pilularis* (Blackbutt), *Eucalyptus saligna* (Blue Gum) and *Syncarpia glomulifera* (Turpentine)

Shrubs: *Acmena smithii* (Lillypilly), *Glochidion ferdinandii* (Cheese Tree), *Pittosporum undulatum* (Sweet Pittosporum) and *Leptospermum polygalifolium* (Lemon Scented Tea-tree).

Groundlayer: *Lomandra longifolia*, *Dianella careula*, *Pteridium esculatum* and *Aristida vagans*.

Variation:

There are two distinct variations of this community within the LGA. A *Eucalyptus saligna* (Blue Gum) dominated variation is present within Stotts Reserve, while a *Syncarpia glomulifera* (Turpentine) dominated community is present within the Bardwell Valley. Other variations also exist within this community in relation to the community structure and composition of mesophilic species.

Disturbance:

This community has been disturbed by logging, clearing, invasion by exotic weed species and the formation of walking tracks.

Weeds:

Weed invasion is moderate and generally restricted to the edges of the vegetation community where it adjoins pasture.

Location and Distribution:

This vegetation community occurs within the Bardwell Valley Parklands and along the edge of Bardwell Valley Golf Course. Remnant trees of this vegetation community occur throughout the Rockdale LGA.

2. SANDSTONE OPEN FOREST

Structure: Open Forest

Trees: 10-15m in height with 35-45% Projected Foliage Cover (PFC)

Shrubs: 1.5 to 2m in height with 25-60% PFC

Groundlayer: 1m in height with 50- 65% PFC

Floristics:

(Main species present)

Trees: *Angophora costata* (Smooth-barked Apple), *Corymbia gummifera* (Red Bloodwood) and *Eucalyptus sclerophylla* (Scribbly Gum).

Shrubs: *Acacia terminalis* (Sunshine Wattle), *Acacia ulicifolia* (Prickly Moses), *Leucopogon juniperinus* (Prickly Beard-heath) and *Ozothamnus diosmilfolium* (Ball Everlasting).

Groundlayer: *Lomandra longifolia* (Spiky-headed Mat-rush), *Dianella caerulea* (Flax Lily) and *Pteridium esculatum* (Bracken Fern).

Variation:

Several patches of remnant canopy trees of this vegetation community occur along the northern and south eastern edges of Bardwell Valley Golf Course. Another two remnants occur within Broadford Street Reserve with an additional area occurring to the east of Dowling Street.

Disturbance:

This community has been disturbed by extensive clearing, logging, invasion by exotic weed species and the formation of walking tracks.

Weeds:

Weed invasion is moderate and generally restricted to the groundlayer throughout the whole of this community.

Location and Distribution:

This vegetation community occurs within the Bardwell Valley Parklands and along the edge of Bardwell Valley Golf Course. Remnant trees of this vegetation community occur throughout the sandstone ridges in the central north and north east of Rockdale LGA.

3. COASTAL SANDS OPEN FOREST (EEC)

This community corresponds with the listed Endangered Ecological Community, Kurnell Dune Forest (NSW Scientific Committee 1998). The Scientific Committee describes this ecological community as a low open sclerophyll forest community with a distinct mesophyll element occurring on sand with the major occurrences occurring on the Kurnell Peninsula. This community includes the characteristic canopy species of *Eucalyptus botryoides* and *Eucalyptus robusta* (NSW Scientific Committee 1998).

Structure: Open Forest to Closed Forest

Trees: To 25m in height with 35-75% Projected Foliage Cover (PFC)

Shrubs: To 3m in height with 25-60% PFC

Groundlayer: To 2m in height with 50- 65% PFC

Floristics:

(Main species present)

Trees: *Angophora costata* (Smooth-barked Apple), *Banksia serrata* (Old Man Banksia), *Eucalyptus botryoides* (Bangalay).

Shrubs: *Alphitonia excelsa* (Red Ash), *Breynia oblongifolia* (Coffee Bush), *Banksia integrifolia* subsp. *integrifolia* (Coastal Banksia), *Glochidion ferdinandii* (Cheese Tree), *Leptospermum trinervium* (Flaky Barked Tea-tree), *Omalanthus populifolius* (Bleeding Hearts), *Pittosporum undulatum* (Sweet Pittosporum).

Groundlayer: *Lomandra longifolia*, *Imperata cylindrica* var. *major* (Blady grass), *Pomax umbellate* (Pomax), *Pteridium esculatum* (Bracken) and *Themeda australis* (Kangaroo grass).

Variation:

This community varies in the density of mesophilic and littoral rainforest species present in the sub-canopies and shrub layers. There is also a very broad transition between this community and the coastal sands swamp forest community identified along the drainage line to the west of this community.

Disturbance:

This community has been disturbed by past clearing, invasion by exotic weed species and the formation of access tracks.

Weeds:

Weed invasion is moderate to low and generally restricted to the ground and shrub-layers adjoining disturbed areas.

Location and Distribution:

This vegetation community occurs within the eastern section of Hawthorne Street Reserve.

4. COASTAL SANDS SWAMP FOREST (EEC)

This community corresponds with the listed Endangered Ecological Community, Bangalay Sand Forest (NSW Scientific Committee 2005). The Scientific Committee describes this ecological community as occurring on deep free draining to damp sandy soils, with a topography of coastal sand plains on flat to moderate slopes within a few kilometres of the sea, occurs at altitudes below 100m. The characteristic canopy species include *Eucalyptus botryoides*, *Eucalyptus pilularis* and *Casuarina glauca*.

Structure: Open Forest

Trees: To 20 m in height with 35-50% Projected Foliage Cover (PFC)

Shrubs: To 3m in height with 25-30% PFC

Groundlayer: To 1m in height with 50- 65% PFC

Floristics:

(Main species present)

Trees: *Eucalyptus botryoides* (Bangalay) and *Casuarina glauca* (Swamp Oak)

Shrubs: *Melaleuca quinquenervia* (Broad-leaved Paperbark), *Melaleuca stypheloides* (Prickly-leaved Tea Tree), *Pittosporum undulatum* (Sweet Pittosporum), *Lantana camara* (Lantana) and *Leptospermum polygalifolium* (Lemon Scented Tea-tree).

Groundlayer: *Blechnum cartilagineum* (Gristle Fern), *Commelina cyanea* (Scurvy Weed), *Gahnia clarkei* (Tall Saw-sedge), *Microlaena stipoides* var. *stipoides* (Weeping Rice Grass), *Restio tetraphyllus* subsp. *meiostachyos* (Tassel Cord-rush) and *Cynodon dactylon* (Couch).

Variation:

Remnants of this community contain the canopy cover dominant to this community but the understorey is highly disturbed by weed infestations or contains no shrub layer with lawn as the understorey. Portions of this community within the Hawthorne Street Reserve contain a broad transition zone with the Coastal Sands Open Forest.

Disturbance:

This community has been disturbed by extensive clearing, fill, invasion by exotic weed species and the formation of access tracks.

Weeds:

Weed invasion is moderate to high throughout this community.

Location and Distribution:

This vegetation community occurs within the eastern section of Eve Street, in Riverine Park Reserve and within the north east section of Bicentennial Park.

5. FLOODPLAIN OPEN FOREST (EEC)

This community corresponds with the listed Endangered Ecological Community, Swamp Sclerophyll Forest on Coastal Floodplains (NSW Scientific Committee 2004). The Scientific Committee describes this community as occurring on alluvial soils of fluvial origin within flood plains and associated flats and terraces.

Structure: Open Forest

Trees: To 20 m in height with 35-50% Projected Foliage Cover (PFC)

Shrubs: To 3m in height with 30-40% PFC

Groundlayer: To 1m in height with 50- 65% PFC

Floristics:

(Main species present)

Trees: *Angophora floribunda* (Rough-barked Apple), *Eucalyptus saligna* (Sydney blue Gum), *Eucalyptus botryoides* (Bangalay), *Erythrina X sykesii* (Coral Tree), *Salix babylonica* (Willow Tree) and *Casuarina glauca*.

Shrubs: *Pittosporum undulatum* (Sweet Pittosporum), *Lantana camara* (Lantana), *Ligustrum sinense* (Small-leaved Privet), *Ricinus communis* (Castor Oil) and *Senna pendula* var. *glabrata* (Senna).

Groundlayer: *Pennisetum clandestinum* (Kikuyu), *Cynodon dactylon* (Couch), *Lomandra longifolia*, *Commelina cyanea* (Scurvy Weed), *Gahnia clarkei* (Tall Saw-sedge) and *Microlaena stipoides* var. *stipoides* (Weeping Rice Grass)

Variation:

There is considerable variation in regards to the composition of the canopy species and degree of weed infestation within this vegetation community.

Disturbance:

This community has been disturbed by extensive weed invasion throughout the vegetation community.

Weeds:

Weed invasion ranges from moderate to severe within the canopy, shrub and groundlayers, with some areas heavily infested with *Salix babylonica* (Willow Tree) and *Lantana camara* (Lantana).

Location and Distribution:

A remnant of this vegetation community occurs along the banks of Bardwell Creek within the Bardwell Valley Golf Course.

6. SWAMP OAK WOODLAND (EEC)

This community corresponds with the listed Endangered Ecological Community, Swamp Oak Floodplain Forest of the NSW Coast (NSW Scientific Committee 2005). The Scientific Committee (2005) describes this community as occurring on alluvial soils of fluvial or estuarine origin, with significant salinity. The topography consists of Floodplains in areas with saline soils and flats adjoining estuaries (NSW Scientific Committee 2005). The most dominant canopy species of Swamp Oak Floodplain Forest is *Casuarina glauca* (NSW Scientific Committee 2005).

Structure: Open Woodland – Open Forest

Trees: 10-15m in height with 15-35% Projected Foliage Cover (PFC)

Shrubs: 1.5 to 3m in height with less than 5% PFC

Groundlayer: 1m in height with 80 - 95% PFC

Floristics:

(Main species present)

Trees: *Casuarina glauca* (Swamp Oak)

Shrubs: *Aegiceras corniculatum* (River Mangrove), *Acacia salinga*, *Acacia parramattensis* (Sydney Green Wattle) and *Lantana camara*.

Groundlayer: *Cynodon dactylon* (Couch), *Conyza albida* (Fleabane), *Pennisetum clandestinum* (Kikuyu), *Plantago lanceolata* (Ribwort), *Sida rhombifolia* (Paddy's Lucerne) and *Verbena rigida* (Veined Verbena).

Variation:

Urban remnant trees of this community are dominated by *Casuarina glauca* with no shrub layer and a groundcover of lawn with high incursions of pasture weeds.

Disturbance:

This community has been disturbed by incursions of pasture weeds, underscrubbing and extensive clearing.

Weeds:

Weed invasion is moderate to severe, with some areas the dominant understorey species being *Lantana camara*.

Location and Distribution:

This vegetation community occurs along the floodplains at Bicentennial Park, the floodplains within Coolabah Reserve. The shrub layer has often been removed in the remnant communities within the Rockdale LGA. The groundcover varies from sparse to moderate and contains significant incursions of pasture weeds in the majority of the communities.

7. MELALEUCA SCRUB**Structure: Open Scrub – Closed Scrub**

Shrubs: To 10m in height with 60-80% Projected Foliage Cover (PFC)

Groundlayer: 1m in height with 30-40% PFC

Floristics:

(Main species present)

Shrubs: *Melaleuca ericifolia* (Swamp Paperbark).

Groundlayer: *Muehlenbeckia gracillima* (Slender Lignum), *Histiopteris incisa* (Batswing Fern), *Oxalis latifolia* (Pink Fishtail), *Tradescantia albiflora* (Wandering Dew), *Ageratina adenophorum* (Crofton Weed) and *Paspalum dilatatum* (Paspalum).

Variation:

This vegetation community contains little variation.

Disturbance:

The main disturbance within this vegetation community is significant weed incursions.

Weeds:

Weed invasion occurs along the edges of this community where it adjoins the sedgeland and exotic grassland areas.

Location and Distribution:

This vegetation community occurs in three small areas within the wetlands to the south of President Avenue, within Scarborough Park.

8. MANGROVE SCRUB**Structure: Open Scrub – Closed Scrub**

Shrubs: To 10m in height with 60-80% Projected Foliage Cover (PFC)

Groundlayer: 1m in height with 10-20% PFC

Floristics:

(Main species present)

Shrubs: *Avicennia marina* (Grey Mangrove) and *Casuarina glauca* (Swamp Oak).

Groundlayer: *Commelina cyanea* (Wandering Dew), *Phragmites australis* (Common Reed) and *Einharta hastata* (Berry Saltbush).

Variation:

This vegetation community contains mosaic patches of the saltmarsh community, particularly along the tidal flats along the lower reaches of Wolli Creek.

Disturbance:

This community has been disturbed by incursions of exotic weeds.

Weeds:

Weed invasion occurs along the edges of this community where it adjoins pasture areas.

Location and Distribution:

This vegetation community occurs along the edges of Muddy Creek, adjoining the Coastal Sands Swamp Forest within Barton Park. In addition, this vegetation community occurs to the west of St George Soccer Stadium within Barton Park where it adjoins the Saltmarsh.

9. SANDSTONE HEATH

Structure: Open to Closed Heath

Shrubs: 1.5 to 2m in height with 35-60% Projected Foliage Cover (PFC)

Groundlayer: 1m in height with 50- 65% PFC

Floristics:

(Main species present)

Shrubs: *Acacia terminalis* (Sunshine Wattle), *Acacia ulicifolia* (Prickly Moses), *Dillwynia retorta* (Heathy Parrot Pea), *Epacris longiflora* (Native Fuschia), *Epacris pulchella* (NSW Coral Heath), *Leucopogon juniperinus* (Prickly Beard-heath), *Kunzea ambigua* (Tick Bush), *Pimelea linifolia* subsp. *linifolia* (Slender Rice Flower) and *Leptospermum polygalifolium* (Lemon Scented Tea-tree).

Groundlayer: *Entolasia stricta* (Wiry Panic), *Lepidosperma laterale*, *Lomandra longifolia*, *Dianella careula* and *Pteridium esculatum* (Bracken).

Variation:

The community varies considerably in the dominant species due to differences in soil depth and type and the moisture levels.

Disturbance:

This community has been disturbed by extensive clearing, quarrying and invasion by exotic weed species.

Weeds:

Weed invasion is low and generally restricted to the groundlayer throughout the whole of this community.

Location and Distribution:

This vegetation community occurs within the northern section of the Bardwell Valley Parklands and within Frys Reserve.

10. COASTAL HEATH**Structure: Open Heath/Scrub to Low Shrubland**

Shrubs: 1 to 3m in height with 35-60%. Projected Foliage Cover (PFC)

Groundlayer: 0.5m in height with 15- 35% PFC.

Floristics:

(Main species present)

Shrubs: *Acacia longifolia* var. *sophorae*, *Banksia integrifolia* subsp. *integrifolia* (Coast Banksia), *Chrysanthemoides monilifera* subsp. *monilifera* (Bitou Bush), *Lantana camara* (Lantana), *Leptospermum laevigatum* (Coastal Tea-tree), *Westringia fruticosa* (Coast Westringia).

Groundlayer: *Carpobrotus glaucescens* (Pigface), *Cynodon dactylon* (Common Couch), *Gazania rigens** *Lomandra longifolia* and *Spinifex sericeus*.

Variation:

This community contains two key variations; a Low Shrubland community dominated by *Acacia longifolia* var. *sophorae* and *Carpobrotus glaucescens* (Pigface), located on the fore-dunes closest to the beach strandline, and an Open Heath/Scrub dominated by *Banksia integrifolia* subsp. *integrifolia* (Coast Banksia) and *Leptospermum laevigatum* (Coastal Tea-tree) located landwards from the beach. Both of these variations are supplemented by numerous native plantings typically associated with coastal dune vegetation.

Disturbance:

This community has been disturbed by extensive alterations to the natural coastline, clearing and invasion by exotic weed species.

Weeds:

Weed invasion is low to moderate throughout the community.

Location and Distribution:

This vegetation community occurs within the eastern coastal portions of Rockdale LGA.

11. COASTAL STRANDLINE GRASSLAND**Structure: Open Tussock Grassland**

Groundlayer: 0.5m in height with 30% Projected Foliage Cover (PFC)

Floristics:

(Main species present)

Groundlayer: *Cakile maritima** (Sea Rocket), *Carpobrotus glaucescens* (Pigface), *Gazania rigens**, *Sporobolus virginicus* (Sand Couch), *Spinifex sericeus* and *Stenotaphrum secundatum** (Buffalo Grass).

Variation:

The dominance of individual species within this community varies in association with the distance from the water line and level of disturbance.

Disturbance:

This community has been disturbed by extensive alterations to the natural coastline and minor to moderate weed invasion.

Weeds:

Weed invasion varies from minor to moderate with the worst infestations occupying the transitions zones with exotic dominated coastal parklands.

Location and Distribution:

This vegetation community occurs along the coastal strandline of Lady Robinsons Beach and Sandringham Bay.

12. AQUATIC HERBFIELD/SEDGELAND

Portions of this community located on deep coastal sands, primarily along the Rockdale Wetlands Corridor, correspond with the listed Endangered Ecological Community, Sydney Freshwater Wetlands (NSW Scientific Committee 2000). The Scientific Committee describes this vegetation community as occurring on Sand dunes and low nutrient sandplains. The topography is restricted to swales and depressions in the above geology in coastal areas and the characteristic canopy species includes species such as *Eleocharis sphacelata*, *Baumea juncea*, *Baumea rubiginosa*, *Gahnia sieberiana*, *Ludwigia peploides* and *Persicaria sp.* (NSW Scientific Committee 2000).

Highly disturbed areas of this community located on deep alluvial floodplains, particularly along Wollie Creek and Bardwell creek correspond with the listed Endangered Ecological Community, Freshwater Wetlands on Coastal Floodplains (NSW Scientific Committee 2000).

Structure: Sedgeland

Groundlayer: 1.5m in height with 50- 65% Projected Foliage Cover (PFC)

Floristics:

(Main species present)

Groundlayer: *Phragmites australis* (Common Reed), *Ludwigia peploides*, *Typha orientalis* (Cumbungi) and *Persicaria sp.*

Variation:

There are a number of variations within this community, particularly in regards to the dominant species. These variations are associated with the level of estuarine influence and the underlying geology being either coastal sands or alluvial floodplain deposits.

Disturbance:

This community has been disturbed by extensive previous clearing, mowing for tracks, dumping of rubbish, and invasion by exotic weed species.

Weeds:

Severe weed incursions of a variety of weed species in all layers of the stratum occur within the edges of this community where it adjoins nearby parklands. The centre where this community adjoins the water is dominated by *Phragmites australis* with small incursions of pasture weeds where mowing has occurred.

Location and Distribution:

This vegetation community occurs as scattered pockets throughout the Rockdale Wetlands Corridor, Bardwell Valley Parklands and Wolli Creek system.

13. SALTMARSH (EEC)

This community corresponds with the listed Endangered Ecological Community, Coastal Saltmarsh (NSW Scientific Committee 2004). The Scientific committee describes this community as occurring within the low lying intertidal zone on the shores of coastal estuaries and lagoons. The dominant plant species characterising this vegetation community are: *Baumea juncea*, *Isolepis nodosa*, *Juncus kraussii*, *Samolus repens*, *Sarcocornia quinqueflora*, *Selliera radicans*, *Sporobolus virginicus*, *Suaeda australis*, *Triglochin striata* and *Zoysia micrantha* (NSW Scientific Committee 2004).

Structure:

Shrubs: To 15 m in height with 10% Projected Foliage Cover (PFC)

Groundlayer: To 1m in height with 80-90% PFC

Floristics:

(Main species present)

Shrubs: *Casuarina glauca* (Swamp Oak) and *Avicenna marina* (Grey Mangrove).

Groundlayer: *Sarcocornia quinqueflora*, *Einadia hastata* (Berry Saltbush), *Isolepis nodosa*, *Juncus kraussii*, *Juncus acutus*, *Suaeda australis*, *Sporobolus virginicus*, *Hydrocotyle bonariensis* (Pennywort).

Variation:

There is little variation within this vegetation community.

Disturbance:

Minor weed incursions are present along the edges of this vegetation community.

Weeds:

Weed invasion is moderate and is generally restricted to the edges of the vegetation community where it adjoins pasture and disturbed ground.

Location and Distribution:

This vegetation community occurs on the tidal flats to the west of St George Soccer Stadium, within Barton Park, along the lower reaches of Wolli Creek, Scotts Park and within the north-western section of Riverine Park.

2.7 PRINCIPAL AREAS OF NATURAL VEGETATION

Rockdale LGA is dominated by a highly disturbed urban landscape, however a small number of principal bushland remnants remain. These principal areas of natural vegetation provide a number of high quality fauna habitat attributes; contain the majority of the native plant diversity; and refuge for a number of threatened species.

A brief discussion is provided below on each of the following principal areas of native vegetation:

- Stotts Reserve
- Bardwell Valley Parklands
- Eve Street/Marsh Street Wetlands
- Spring Creek/Landing Lights Wetlands
- Kings Road Wetland
- Patmore Swamp and Central Scarborough Park
- Hawthornee Street Natural Area
- Russell Avenue
- Frys Reserve

Stotts Reserve

The vegetation within Stotts Reserve is one of the largest relatively undisturbed patches of sandstone vegetation within Rockdale LGA containing two distinct assemblages of species, Sandstone Open Forest and Eastern Sandstone Gully Forest. The reserves upper slopes and ridges are occupied by a Sandstone Open Forest dominated by the canopy species *Angophora costata* (Smooth-barked Apple), *Eucalyptus piperita subsp. piperita* (Peppermint) and *Corymbia gummifera* (Red Bloodwood) with small patches of *Eucalyptus sclerophylla* (Scribbly Gum). The south eastern portion of the reserve contains a slight variation to the Sandstone Open Forest observed elsewhere within the LGA as the canopy is co-dominated by the species, *Eucalyptus punctata* (Grey Gum) and *Eucalyptus resinifera subsp. resinifera* (Red Mahogany), typically associated with a slight shale influence. While the understorey within this area is largely representative of a typical sandstone community the presence of these species within the canopy indicates the start of a transition in vegetation to the Endangered Ecological Community, Sydney Turpentine Ironbark Forest which once dominated the surrounding ridges and majority of the western portion of Rockdale LGA (Benson *et al.* 1999).

The centre of Stotts Reserve and its sheltered gullies are occupied by a second sandstone assemblage representative of Eastern Sandstone Gully Forest. This community is dominated by the canopy species *Eucalyptus saligna* (Blue Gum) and *Syncarpia glomulifera* (Turpentine), and contains areas with a developed sub-canopy dominated by *Glochidion ferdinandii* (Cheese Tree), *Pittosporum undulatum* (Sweet Pittosporum) and *Leptospermum polygalifolium* (Lemon Scented Tea-tree). While the stand of *Eucalyptus saligna* (Blue Gum) is not representative of the Endangered Ecological Community, Blue Gum High Forest, its presence has previously been identified as unusual (Biosphere Environmental Consultants 2000) and should be considered as locally significant.

Bardwell Valley Parklands

The Bardwell Valley Parklands contain a variety of different vegetation communities associated with two general vegetation associations, Sandstone and Alluvial Floodplain.

The floodplain communities are restricted to highly disturbed remnants including: Swamp Oak Woodland, Aquatic Herbfield/Sedgeland and remnant trees of Floodplain Open Forest, along Bardwell Creek north of Bexley Road. These communities correspond to highly disturbed examples of the Endangered Ecological Communities, Swamp Oak Woodland on Coastal Floodplains, Freshwater Wetlands on Coastal Floodplains and Swamp Sclerophyll Forest on Coastal Floodplains respectively.

The sandstone communities within Bardwell Valley Parklands contain examples of Eastern Sandstone Gully Forest, Sandstone Open Forest and Sandstone Heath. The Heath areas are generally restricted to the western slopes and plateaus of the valley, including old sandstone quarry and contain a diverse array of native species. These heath patches also contain records of two threatened species, *Dillwynia tenuifolia* (National Trust 1988) and *Acacia pubescens* (Biosphere Environmental Consultants 2000). The Eastern Sandstone Gully Forest community occupies the sheltered lower slopes and banks of the upper reaches of Bardwell Creek in the southern portion of the Bardwell Valley Parklands. This community is dominated in the canopy by *Syncarpia glomulifera* (Turpentine) and *Eucalyptus pilularis* (Blackbutt) and contains a variety of sub-canopy mesophilic species, including *Acmena smithii* (Lillypilly). The Sandstone Open Forest community is largely restricted to small highly disturbed remnants on the steeper slopes within the Bardwell Valley Golf Course and thin linear strips around the perimeter of the Bardwell Valley Parklands. The canopy of this community is dominated by the species *Angophora costata* (Smooth-barked Apple), *Eucalyptus piperita subsp. piperita* (Peppermint) and *Corymbia gummifera* (Red Bloodwood), however, as identified within Stotts reserve there is potential for portions of this community along the ridge tops in the southeast and west to contain the species, typically associated with shale-sandstone transition zones and shale lenses.

Eve Street/Marsh Street Wetlands

The vegetation within the Eve Street wetlands is a mixture of estuarine and coastal sand vegetation.

There are four small areas of saltmarsh surrounded by Aquatic Herbfield/Sedgeland. The saltmarsh areas are dominated by *Sarcocroton quinqueflora*, *Suaeda australis* and *Juncus acutus*. This vegetation community is representative of the Endangered Ecological Community of Coastal Saltmarsh as listed on the Threatened Species Conservation Act (TSC) (1995).

The Aquatic Herbfield/Sedgeland vegetation community is dominated by *Phragmites australis*. This vegetation community is representative of the Endangered Ecological Community of Sydney Freshwater Wetlands as listed on the TSC Act (1995).

Adjoining the southern boundary of the Aquatic Herbfield/Sedgeland vegetation community is Coastal Sand Swamp Forest, dominated by *Eucalyptus botryooides*, *Casuarina glauca* (Swamp Oak), *Melaleuca linariifolia* and *M. stypheloides*. This remnant contains relatively low exotic weed infestations and provides a valuable example of the mosaic nature of estuarine communities.

Spring Creek/Landing Lights Wetlands

The vegetation within the Spring Creek/Landing Lights Wetlands area is subject to periodical tidal inundation, resulting in the three estuarine vegetation communities, Saltmarsh, Aquatic Herbfield/Sedgeland and Mangrove Scrub occurring within this area. The vegetation located within the eastern section of the wetland reserve is Aquatic Herbfield/Sedgeland and is a

mixture of weed species (*Juncus acutus*, *Pennisetum clandestinum*) and *Phragmites australis*. To the west and south are three distinct areas of Saltmarsh vegetation communities. The first area surrounds the western side of the lagoon which is dominated by a dense groundlayer of *Sarcocornia quinqueflora*, *Suaeda australis* and *Juncus acutus* with the occasional *Casuarina glauca* tree. The second area of saltmarsh vegetation has similar composition to the one described above with the exception of weed incursions along a vehicle track used to facilitate maintenance to the control shed for the Landing Lights located on the southern edge of the lagoon. This area continues to the south of the lagoon for approximately 150 metres in a thin strip. Adjoining this saltmarsh to the west is an area of Mangrove Scrub which is dominated by *Avicenna marina* (Grey Mangrove) with a sparse groundlayer. The third area of saltmarsh adjoins the market gardens to the west of the boardwalk and is of similar species composition to the remaining areas. The saltmarsh vegetation community is representative of the Endangered Ecological Community of Coastal Saltmarsh which is listed on the TSC Act (1995).

Kings Road Wetland

The Kings Road Wetland contains alluvial floodplain and coastal sands vegetation represented by remnant Swamp Oak Woodland and Coastal Sands Swamp Forest communities.

Swamp Oak Woodland is present along the western side of the wetland adjoining Bicentennial Park, this vegetation is dominated by *Casuarina glauca* and the majority of the shrub layer has been removed, with lawn as the understorey. Occasional native shrubs such as *Acacia parramattensis* occur throughout this community. This vegetation community is a disturbed remnant of the Endangered Ecological Community of Swamp Oak Forest on Coastal Floodplains listed on the TSC Act (1995).

The area along the eastern and northern sides of the wetland is Coastal Sands Swamp Forest. This vegetation community is crossed by tracks and is subject to mowing and rubbish dumping. The dominant tree species are *Eucalyptus botryoides* with the occasional *Melaleuca quinquenervia* with the understorey containing some patches of dense *Lantana camara*. The remaining areas contain some remnant native shrubs with the groundcover being dominated by pasture weeds. This vegetation community is a remnant of the Endangered Ecological Community of Bangalay Sand Forest as listed on the TSC Act (1995).

Central Scarborough Park

Several wetlands occur throughout the Scarborough Park area. This area has previously been dredged and filled, resulting in the fragmentation and subsequent creation of new isolated wetland areas (Biosphere Environmental Consultants 2000). Two vegetation communities of alluvial floodplain and coastal sands origin have been identified within this area. These are Melaleuca Scrub and Aquatic Herbfields/Sedgeland.

The Aquatic Herbfields/Sedgeland are dominated principally by *Phragmites australis* with incursions of severe pasture weeds present throughout the community. There are occasional stands of *Casuarina glauca* and *Melaleuca quinquenervia* scattered throughout this vegetation community.

There are three areas of Melaleuca Scrub located in the northwestern, western and south western portion of Scarborough Park. The Melaleuca Scrub is dominated by *Melaleuca ericifolia* and contains a sparse layer of ferns, vines and grasses as the understorey.

Hawthornee Street Natural Area

This area has two vegetation communities which are of coastal sands origin. The Coastal Sands Swamp Forest is located along the western section of this remnant vegetation and is representative of Bangalay Sand Forest as listed in the TSC Act (1995). This vegetation is dominated by *Eucalyptus botryoides* and is relatively undisturbed.

The Coastal Sands Open Forest located within the eastern portion of this remnant vegetation is dominated by *Angophora costata* and has a high diversity of native species with relatively low exotic weed incursions. The main weed incursions occur along the eastern boundary where it adjoins urban development. This vegetation community is representative of Kurnell Dune Forest as listed in the TSC Act (1995) and subsequently is considered to be of high conservation value due to the small areas of this vegetation community left within the Sydney Bioregion. This community also contains a record of the threatened flora species *Syzygium paniculatum* (Magenta Lilly Pilly) (National Trust 1988).

Russell Avenue

The vegetation within this area contains a mixture of alluvial floodplain and estuarine vegetation communities. To the north of Russell Ave there are two areas of the Swamp Oak Woodland vegetation community. The dominant canopy cover species is *Casuarina glauca* while the understorey contains either no shrubs or incursions of weeds.

To the south of Russell Avenue, species such as *Avicenna marina* are interspersed with the *Casuarina glauca*, representing an increased estuarine influence. To the north of Ida Street these influences become more prominent as *Avicenna marina* becomes the dominant canopy species with Coral trees and other *Eucalypts*.

There are also two small remnant stands of *Eucalyptus botryoides* trees located within Clareville Reserve to the south of Ida Street and within Scott Park adjoining Riverside Drive to the south.

Located within Stan Moses Reserve is a small area of saltmarsh, which was similar in species composition to the saltmarsh at the Landing Lights and Eve Street Wetlands. This vegetation community is also considered to be representative of the Endangered Ecological Community of Coastal Saltmarsh listed in the TSC Act (1995).

Frys Reserve

The vegetation within this reserve contains examples of the two sandstone communities, Sandstone Heath and Eastern Sandstone Gully Forest. As is often the case for small linear remnants, both of these communities are disturbed from past clearing and high levels of exotic weed invasion.

This vegetation remnant is of particular importance as it is the eastern most remnant of any of the sandstone communities. The Sandstone Heath community within this reserve has a recorded population of the threatened flora species, *Acacia terminalis ssp. terminalis* (Biosphere Environmental Consultants 2000). Detailed field surveys conducted by Conacher Travers for this report identified sixteen individual specimens of *Acacia terminalis* within the reserve. However, the collected samples were identified as containing characteristics of different sub-species of *Acacia terminalis*. The three samples collected for identification were confirmed by the Sydney Royal Botanic Gardens as hybrids between the threatened *Acacia terminalis ssp. terminalis* and non-threatened *A. terminalis ssp. angustifolia*. It is recommended that a detailed sampling survey within the reserve be completed and identification from the Royal Botanical Gardens sort for each specimen collected. These additional works should be completed under the appropriate Biodiversity/Management Strategy for Frys Reserve .

SECTION 3

FAUNA CHARACTERISTICS

3.1 LITERATURE REVIEW

- A review of available literature for the area was undertaken to obtain reference material and background information for this study. These documents are listed in section 1.6 of this Report and in the Reference section.
- A search of the Atlas of NSW Wildlife (DEC 2006), Environmental Protection and Biodiversity Conservation Act (EPBC) list of Threatened Fauna Species (2006), Birds Australia (2006) and BioNet (2006) was undertaken to identify records of threatened fauna species located within the site. This enabled the preparation of a predictive list of threatened fauna species that could possibly occur within the habitats found on the site. The results of these database searches are shown in Table 3.2.

3.2 FAUNA SURVEY METHODOLOGY

In order to detect the occurrence of fauna species, specific survey methods were employed to detect nocturnal and diurnal species.

The methods used for the fauna survey, as detailed in Appendix III are as follows:

- Nocturnal spotlighting
- Bat echolocation call detection
- Arboreal and terrestrial mammal trapping using Elliott Type A traps
- Arboreal and terrestrial mammal habitat searches
- Arboreal and terrestrial mammal hair tubing
- Hollow tree density assessment and habitat assessment
- Amphibian searches
- Habitat searches
- Playback of recorded owl calls
- Diurnal and nocturnal bird surveys

Details of the above surveys and weather conditions experienced during the surveys are provided in Table 3.1. The survey method utilised and the location of surveys is shown in Figures 3.1, 3.2 and 3.3 with a number representing each park that corresponds to Tables 3.3 and 3.4. A comprehensive species list compiled by *Conacher Travers* is shown in Table A2 and a species list of all previous fauna surveys is shown in Table A3 of Appendix II. Additional information regarding specific survey methodology is provided in Appendix III.

Field surveys were conducted between the 28th Feb to 3rd March, 7th to the 10th March, the 21st March and the 11th to the 12th April 2006.

**TABLE 3.1
FAUNA SURVEY DETAILS**

Fauna Group	Date	Location	Weather Conditions	Survey Method	Survey Effort / Time per day
Diurnal Birds	28/2/06	29	2/8 cloud, light SE wind, no rain, 30°C	Bird census, Opportunistic observation	2hr 1520-1720
	28/2/06	26	3/8 cloud, mod SE wind, no rain, 25°C	Bird census, Opportunistic observation	1hr 1730 – 1800
	1/3/06	2	4/8 cloud, SE wind, 28°C	Bird census, Opportunistic observation	1hr 0900-1000
	1/3/06	10	4/8 cloud, mod SE wind, 25°C	Bird census, Opportunistic observation	1hr 1100-1200
	1/3/06	1	4/8 cloud, mod SE wind, 20°C	Wading bird census, Opportunistic observation	1.5hrs 0730-0900
	2/3/06	26	6/8 cloud, no wind, no rain, 25°C	Bird census, Opportunistic observation	1hr 0730 – 0830
	2/3/06	7	4/8 cloud, light SE wind, no rain, 22°C	Bird census, Opportunistic observation	1hr 0830-0930
	2/3/06	8	6/8 cloud, light SE wind, no rain, 25°C	Bird census, Opportunistic observation	30min 1100-1130
	2/3/06	2	3/8 cloud, light SE wind, no rain, 25°C	Bird census, Opportunistic observation	3hrs 1200-1300
	2/3/06	K	4/8 cloud, mod SE wind, no rain, 26°C	Bird census, Opportunistic observation	5hr 1400-1900
	3/3/06	K	8/8 cloud, light SE wind, previous rain, 22°C	Bird census, Opportunistic observation	3hr 0700-1000
	8/3/06	10	6/8 cloud, no wind, no rain, 20°C	Bird census, Opportunistic observation	20min 0650-0710
	8/3/06	8	6/8 cloud, no wind, no rain, 20°C	Bird census, Opportunistic observation	1hr 0730-0830
	8/3/06	9	0/8 cloud , light E wind, no rain, 30°C	Bird census, Opportunistic observation	2hrs 1100-1300
	9/3/06	25, 27	0/8 cloud , light NE wind, no rain, 24°C	Bird census, Opportunistic observation	1hr 0930-1030
	9/3/06	11	0/8 cloud , light / mod NE wind, no rain, 30°C	Bird census, Opportunistic observation	45min 1415-1530
	21/3/06	26	0/8 cloud , light SE wind, no rain, 25°C	Bird census, Opportunistic observation	30min 1000-1030
21/3/06	1	0/8 cloud , light SE wind, no rain, 28°C	Wading bird census, Opportunistic observation	30min 1100-1130	
11/4/06	1	0/8 cloud , light W wind, no rain, 27°C	Wading bird census, Opportunistic observation	30min 1015-1045	
11/4/06	2	0/8 cloud , mod NE wind, no rain, 24°C	Bird census, Opportunistic observation	3.5hrs 1330-1700	
Nocturnal Birds	28/2/06	26	8/8 cloud, mod SE wind, light rain, no moon 20°C	Call playback & spotlighting	1hr 10m 1950-2100
	2/3/06	10	3/8 cloud, light SE wind, no moon, 23°C	Call playback & spotlighting	1hr 2015 – 2115
	7/3/06	26	7/8 cloud, mod SE wind, no rain, 19°C, no moon	Call playback & spotlighting	1hr 2030- 2130
	11/4/06	25, 27	0/8 cloud, mod NE wind, no rain, 20°C, ¾ moon	Call playback & spotlighting	1.5hrs 1830-2000
	12/4/06	9	0/8 cloud, light NE wind, no rain, 22°C, 4/4 moon	Call playback & spotlighting	1.5hrs 1820-1950

**TABLE 3.1 (Cont.)
FAUNA SURVEY DETAILS**

Fauna Group	Date	Location	Weather Conditions	Survey Method	Survey Effort / Time per day
Arboreal Mammals	28/2/06	29, 26	7/8 cloud, mod SE wind, no rain, no moon, 19°C	Spotlighting (2 sites)	1hrs 2030-2130
	1/3/06	26 9, 29	8/8 cloud, light SE wind, no rain, no moon, 18°C	5 x Type A Elliott Traps (1 transects) Spotlighting (2 sites)	5 trap nights 30min 2030-2100 15min 2130-2145
	2/3/06	26, 10 10	8/8 cloud, light SE wind, light rain, no moon 20°C	5 x Type A Elliott Traps (3 transects) Spotlighting x 2 persons	15 trap nights 3hrs 2000-2130
	3/3/06	26, 10		5 x Type A Elliott Traps (3 transects)	15 trap nights Total 35 Trap nights
	7/3/06	8, 10 26	8/8 cloud, light SE wind, light rain, ½ moon 20°C	3 & 4 type A Elliott Traps (2 Transects) Spotlighting	7 trap nights 30min 2015-2045
	8/3/06	8, 10	0/8 cloud, light SE wind, no rain, ½ moon 20°C	3 & 4 type A Elliott Traps (2 Transects)	7 trap nights
	9/3/06	8,10 8	0/8 cloud, light E wind, ½ moon 25°C	3 & 4 type A Elliott Traps (2 Transects) Spotlighting	7 trap nights 1hr 2000-2100 Total 21 trap nights
	11/4/06 12/4/06 2-20/3/06	25, 27 9	0/8 cloud, mod NE wind, no rain, ¾ moon 20°C 0/8 cloud, mod NE wind, no rain, ¾ moon 20°C Mostly fine variable	Spotlighting Spotlighting Hair tubing 10 within 1 Transect	1.5hrs 1830-2000 1.5hrs 1830-2000 190 tube nights
Terrestrial Mammals	28/2/06	29, 26	7/8 cloud, mod SE wind, no rain, no moon, 19°C	Spotlighting (2 sites)	2hrs 2100-2130
	1/3/06	26 9, 29	8/8 cloud, light SE wind, no rain, no moon, 18°C	5 x Type A Elliott Traps (1 transects) Spotlighting	5 trap nights 1.25hrs 2030-2115
	2/3/06	26, 10 10	8/8 cloud, light SE wind, light rain, no moon 20°C	5 x Type A Elliott Traps (3 transects) Spotlighting	15 trap nights 1.5hrs 2000-2130
	3/3/06	26, 10		5 x Type A Elliott Traps (3 transects)	15 trap nights Total 35 trap nights
	7/3/06	8, 10 26	8/8 cloud, light SE wind, light rain, ½ moon 20°C	3 & 4 type A Elliott Traps (2 Transects) Spotlighting	7 trap nights 30min 2015-2045
	8/3/06	8, 10	0/8 cloud, light SE wind, no rain, ½ moon 20°C	3 & 4 type A Elliott Traps (2 Transects)	7 trap nights
	9/3/06	8,10 8	0/8 cloud, light E wind, ½ moon 25°C	3 & 4 type A Elliott Traps (2 Transects) Spotlighting	7 trap nights 1hr 2000-2100 Total 21 trap nights
	11/4/06 12/4/06 2-20/3/06	25, 27 9	0/8 cloud, mod NE wind, no rain, ¾ moon 20°C 0/8 cloud, mod NE wind, no rain, ¾ moon 20°C Mostly fine variable	Spotlighting Spotlighting Hair tubing 45 within 4 Transects	1.5hrs 1830-2000 1.5hrs 1830-2000 855 tube nights

**TABLE 3.1 (Cont.)
FAUNA SURVEY DETAILS**

Fauna Group	Date	Location	Weather Conditions	Survey Method	Survey Effort / Time per day
Bats	28/2/06	26	8/8 cloud, mod SE wind, light rain, no moon 20°C	Anabat / spotlight	1.25hrs 1945-2100
	1/3/06	29	6/8 cloud, mod SE wind, light rain, no moon 20°C	Anabat / spotlight	1.25hrs 1945-2100
	2/3/06	10, 10	3/8 cloud, light SE wind, no moon, 23°C	Anabat x 2/ spotlight	2.5hrs 1945-2100
	7/3/06	26	7/8 cloud, mod SE wind, no rain, 19°C, no moon	Anabat / spotlight	50m 2010-2100
	9/3/06	8	0/8 cloud, light E wind, ½ moon 25°C	Anabat / spotlight	1.25hrs 1945-2100
	11/4/06	25, 25, 27	0/8 cloud, mod NE wind, no rain, 20°C, ¾ moon	Anabat x 3/ spotlight	6hrs 1800-2000
	12/4/06	9, 9	0/8 cloud, light NE wind, no rain, 22°C, 4/4 moon	Anabat x 2/ spotlight	4hrs 1800-2000
Reptiles	28/2/06	26	2/8 cloud, light SE wind, no rain, 30°C	Habitat search/Oppportunistic observation	2hr 1520-1720
	28/2/06	29	3/8 cloud, mod SE wind, no rain, 25°C	Habitat search/Oppportunistic observation	1hr 1730 – 1800
	1/3/06	2	4/8 cloud, SE wind, 28°C	Habitat search/Oppportunistic observation	1hr 0900-1000
	1/3/06	10	4/8 cloud, mod SE wind, 25°C	Habitat search/Oppportunistic observation	1hr 1100-1200
	1/3/06	1	4/8 cloud, mod SE wind, 20°C	Habitat search/Oppportunistic observation	1.5hrs 0730-0900
	2/3/06	8	6/8 cloud, no wind, no rain, 25°C	Habitat search/Oppportunistic observation	1hr 0730 – 0830
	2/3/06	7	4/8 cloud, light SE wind, no rain, 22°C	Habitat search/Oppportunistic observation	1hr 0830-0930
	2/3/06	2	3/8 cloud, light SE wind, no rain, 25°C	Habitat search/Oppportunistic observation	3hrs 1200-1300
	8/3/06	10	6/8 cloud, no wind, no rain, 20°C	Habitat search/Oppportunistic observation	20min 0650-0710
	8/3/06	8	6/8 cloud, no wind, no rain, 20°C	Habitat search/Oppportunistic observation	1hr 0730-0830
	8/3/06	9	0/8 cloud, light E wind, no rain, 30°C	Habitat search/Oppportunistic observation	2hrs 1100-1300
	9/3/06	25, 27	0/8 cloud, light NE wind, no rain, 24°C	Habitat search/Oppportunistic observation	1hr 0930-1030
	9/3/06	11	0/8 cloud, light / mod NE wind, no rain, 30°C	Habitat search/Oppportunistic observation	45min 1415-1530
	21/3/06	26	0/8 cloud, light SE wind, no rain, 25°C	Habitat search/Oppportunistic observation	30min 1000-1030
	21/3/06	1	0/8 cloud, light SE wind, no rain, 28°C	Habitat search/Oppportunistic observation	30min 1100-1130
11/4/06	1	0/8 cloud, light W wind, no rain, 27°C	Habitat search/Oppportunistic observation	30min 1015-1045	
11/4/06	25, 27	0/8 cloud, mod NE wind, no rain, 24°C	Habitat search/Oppportunistic observation	3.5hrs 1330-1700	
Amphibians	28/2/06	25, 27	8/8 cloud, mod SE wind, light rain, no moon 20°C	Spotlight / Habitat search	1hrs 2030-2130
	1/3/06	9, 29	6/8 cloud, mod SE wind, light rain, no moon 20°C	Spotlight / Habitat search	1.25hrs 2030-2115
	2/3/06	10	3/8 cloud, light SE wind, no moon, 23°C	Spotlight / Habitat search	1.5hrs 2000-2130
	7/3/06	26	7/8 cloud, mod SE wind, no rain, 19°C, no moon	Spotlight / Habitat search	30min 2015-2045
	9/3/06	8	0/8 cloud, light E wind, ½ moon 25°C	Spotlight / Habitat search	1hr 2000-2100
	11/4/06	25, 27	0/8 cloud, mod NE wind, no rain, 20°C, ¾ moon	Spotlight / Habitat search	1.5hrs 1830-2000
	12/4/06	9	0/8 cloud, light NE wind, no rain, 22°C, 4/4 moon	Spotlight / Habitat search	1.5hrs 1830-2000

3.3 ENDANGERED ECOLOGICAL COMMUNITIES

Throughout the period of the fauna survey no Endangered Ecological Communities were recorded. However, adjoining the southern boundary of the LGA at Taren Point, a listed shorebird community exists. This Endangered Ecological Community is known as the Taren Point Endangered Ecological Community. Species that make up this community have been observed to be utilising the habitat present within the Rockdale LGA during the surveys.

SHOREBIRD COMMUNITY

General Description

The Shorebird Community is the community of shorebirds (also known as waders) that uniquely occurs on the relict marginal shoal of the Georges River that occurs between Taren Point and Shell Point in Botany Bay, Sydney.

Habitat Requirements

- Geology / Soils: rich coastal mudflats.
- Topography: Coastal mud flats, occurs at altitudes below 1.5m.
- Characteristic Species: Latham's Snipe, Bar-tailed Godwit, Whimbrel, Eastern Curlew, Marsh Sandpiper, Common Greenshank, Terek Sandpiper, Grey-tailed Tattler, Ruddy Turnstone, Great Knot, Red Knot, Pied Oystercatcher, Sooty Oystercatcher, Pacific Golden Plover, and the Masked Lapwing.

Conservation Status and Distribution

This community occurs adjacent to, but is not included in the Towra Point Reserve which is of different geomorphological origin and does not provide alternative habitat for the Taren Point Shorebird Community. Therefore the area containing the Shorebird Community is not within a conservation reserve.

Key Threatening Processes

Intensification or alteration of uses of the area, changes to the extent and distribution of the fringing mangrove community.

Occurrence on Site

The habitat requirements and species that characterise this community are absent from the study area as this community is wholly marine.

3.4 THREATENED FAUNA SPECIES

At the completion of the literature and database search, a total of 67 threatened fauna species were recorded to have occurred locally (Table 3.2). The majority of these species are birds, with a representation of 47 species out of the total 61 species. Many of these species are classified under the international migratory bird treaties between Australia and China and Japan (CAMBA and JAMBA). The high diversity of threatened bird species is due to Rockdale's eastern boundary bordering Botany Bay which offers suitable habitat for shorebird foraging and nesting. The location of threatened fauna species, recorded by DEC, is shown in Figure 3.4. The EPBC Act (2006) database generates information that will help determine whether matters of national environmental significance or other matters protected by the EPBC Act are likely to occur in that area of interest. Any information provided through this facility is indicative only, and local knowledge and information should also be sought where possible. The results therefore do not give an exact coordinate location or date of threatened species recorded. The search results instead, give a recording of presence of species or species habitat likely or known to occur within the area. The results to this search are therefore based on habitat availability and should be interpreted with caution.

**TABLE 3.2
THREATENED FAUNA SPECIES RECORDED LOCALLY**

Scientific Name	Habitat and distribution within NSW	Legislation listing			
		TSC	EPBC	JAMBA	CAMBA
Broad-headed Snake <i>Hoplocephalus bungaroides</i>	Sandstone outcrops, exfoliated rock slabs and tree hollows in coastal and near coastal areas. Distribution Limit – N-Mudgee Park. S-Nowra	E	V*	-	-
Green Turtle <i>Chelonia mydas</i>	Oceans, bays and estuaries Distribution Limit – temperate waters of east coast	V	V	-	-
Leathery Turtle <i>Dermochelys coriacea</i>	Oceans, bays and estuaries Distribution Limit – temperate waters of east coast	V	V*	-	-
Wallum Froglet <i>Crinia tinnula</i>	Found in acidic paperbark swamps and wallum country with dense groundcover. Breeds in temporary and permanent pools and ponds of high acidity. Distribution Limit- N-Tweed Heads S-Kurnell.	V	-	-	-
Giant Burrowing Frog <i>Heleioporus australiacus</i>	Inhabits open forests and riparian forests along non-perennial streams, digging burrows into sandy creek banks. Distribution Limit- N-Near Singleton. S-South of Eden	V	V*	-	-
Green and Golden Bell Frog <i>Litoria aurea</i>	Prefers the edges of permanent water, streams, swamps, creeks, lagoons, farm dams and ornamental ponds. Often found under debris. Distribution Limit – N-Byron Bay. S-South of Eden	E	V	-	-
Flesh-footed Shearwater <i>Puffinus carneipes</i>	A migratory bird that inhabits temperate and subtropical seas. Nests on level sites close to the sea. Distribution Limit - N-Tweed Heads. S-South of Eden.	V	-	X*	
Southern Giant-petrel <i>Macronectes giganteus</i>	Oceanic species occurring off the NSW coast from S- Green Cape to N-Newcastle.	E	E*	-	-
Northern Giant-petrel <i>Macronectes halli</i>	Oceanic species occurring off the NSW coast from S-Green Cape to N- Newcastle.	V	V*	-	-
Kermadec Petrel <i>Pterodroma neglecta neglecta</i>	Oceanic species occurring off the NSW coast.	V	V*	-	-

**TABLE 3.2 (Cont.)
THREATENED FAUNA SPECIES RECORDED WITHIN ROCKDALE LGA**

Scientific Name	Habitat and distribution within NSW	Legislation listing			
		TSC	EPBC	JAMBA	CAMBA
Antipodean Albatross <i>Diomedea antipodensis</i>	Oceanic species occurring off the NSW coast from S-Green Cape to N-Newcastle.	V	V*	-	-
Gibson's Albatross <i>Diomedea gibsoni</i>	Oceanic species occurring off the NSW coast from S-Green Cape to N-Newcastle	V	V*	-	-
Buller's Albatross <i>Diomedea bulleri</i>	Oceanic species occurring off the NSW coast.	-	V*	-	-
Shy Albatross <i>Thalassarche cauta</i>	Oceanic species occurring off the NSW coast.	V	V*	-	-
Campbell Albatross <i>Thalassarche impavida</i>	Oceanic species occurring off the NSW coast.	-	V*	-	-
Salvins Albatross <i>Thalassarche salvini</i>	Oceanic species occurring off the NSW coast.	-	V*	-	-
White-capped Albatross <i>Thalassarche steadi</i>	Oceanic species occurring off the NSW coast.	-	V*	-	-
Australasian Bittern <i>Botaurus poiciloptilus</i>	Inhabits shallow freshwater or brackish wetlands with tall dense beds of reeds, sedges or rush species and swamp edges. Distribution Limit - N-North of Lismore. S- Eden.	V	-	-	-
Great Egret <i>Ardea alba</i>	Inhabits wetlands, flooded paddocks, and estuarine mudflats. Distribution throughout NSW where habitat is suitable.	-	-	X	X
Cattle Egret <i>Ardea ibis</i>	Inhabits grasslands, pastures, shallow open wetlands. Distribution throughout NSW where habitat is suitable.	-	-	X	X
White-bellied Sea Eagle <i>Haliaeetus leucogaster</i>	Inhabits coastal estuaries, bays, rivers also inland water courses and large freshwater lakes and dams. Distribution throughout NSW where habitat is suitable.	-	-	-	X*
Painted Snipe <i>Rostratula benghalensis</i>	Most numerous within the Murray-Darling basin and inland Australia within marshes and freshwater wetlands with swampy vegetation. Distribution Limit- N-Tweed Heads S-South of Eden.	E	V*	-	-
Latham's Snipe <i>Gallinago hardwickii</i>	Inhabits low vegetation around wetlands, salt marshes, fresh water wetlands. Distribution throughout NSW where habitat is suitable.	-	-	X*	X

**TABLE 3.2 (Cont.)
THREATENED FAUNA SPECIES RECORDED WITHIN ROCKDALE LGA**

Scientific Name	Habitat and distribution within NSW	Legislation listing			
		TSC	EPBC	JAMBA	CAMBA
Sanderling <i>Calidris alba</i>	Inhabits open sandy beaches. Distribution N - Tweed Heads S - South of Eden.	V	-	X	X
Great Knot <i>Calidris tenuirostris</i>	Summer migrant to Australian coastal regions. Forages on tidal mudflats, and sandy ocean shores. Distribution N - Tweed Heads S - South of Eden.	V	-	X*	X
Broad-billed Sandpiper <i>Limicola falcinellus</i>	Almost exclusively coastal feeding along estuaries, mudflats, salt marshes and occasionally shallow freshwater lagoons. Distribution Limit - N-Tweed Heads. S-South of Eden.	V	-	X	X
Black-tailed Godwit <i>Limosa limosa</i>	A mainly coastal species feeding along estuarine mudflats, beaches, mangroves and lagoons. Distribution Limit - N-Tweed Heads. S-South of Eden.	V	-	X	X
Bar-tailed Godwit <i>Limosa lapponica</i>	A mainly coastal species feeding along estuarine mudflats, beaches, mangroves and lagoons. Distribution Limit - N-Tweed Heads. S-South of Eden.	-	-	X	X
Eastern Curlew <i>Numenius Madagascariensis</i>	A mainly coastal species feeding along estuarine mudflats, beaches, mangroves and lagoons. Distribution Limit - N-Tweed Heads. S-South of Eden.	-	-	X	X
Terek Sandpiper <i>Xenus cinereus</i>	Almost exclusively coastal species feeding along estuarine mudflats, coral reefs, mangrove swamps and beaches. Distribution Limit - N-Tweed Heads. S-South of Eden.	V	-	X	X
Grey-tailed Tattler <i>Heteroscelus brevipes</i>	A mainly coastal species feeding along estuarine mudflats, beaches, mangroves and lagoons. Distribution Limit - N-Tweed Heads. S-South of Eden.	-	-	X*	X
Red Knot <i>Calidris canutus</i>	Almost exclusively coastal species feeding along sheltered estuarine mudflats, mangrove swamps and occasionally beaches. Distribution Limit - N-Tweed Heads. S-South of Eden.	-	-	X	X
Red-necked Stint <i>Calidris ruficollis</i>	Inhabits coastal tidal and inland mudflats, salt marshes and beaches. Distribution throughout NSW where habitat is suitable.	-	-	X	X

**TABLE 3.2 (Cont.)
THREATENED FAUNA SPECIES RECORDED LOCALLY**

Scientific Name	Habitat and distribution within NSW	Legislation listing			
		TSC	EPBC	JAMBA	CAMBA
Sharp-tailed Sandpiper <i>Calidris acuminata</i>	Inhabits coastal tidal and inland mudflats, salt marshes and beaches. Distribution throughout NSW where habitat is suitable.	-	-	X	X
Curlew Sandpiper <i>Calidris ferruginea</i>	Inhabits coastal tidal and inland mudflats, salt marshes and beaches. Distribution throughout NSW where habitat is suitable.	-	-	X	X
Pied Oystercatcher <i>Haematopus longirostris</i>	Inhabits coastal beaches and estuarine flats. Distribution Limit N-Tweed Heads S-South of Eden.	V	-	-	-
Sooty Oystercatcher <i>Haematopus fuliginosus</i>	Exclusively coastal in distribution foraging along rocky coastlines and estuaries. Distribution Limit- N-Tweed Heads S-South of Eden.	V	-	-	-
Pacific Golden Plover <i>Pluvialis fulva</i>	Inhabits coastal tidal and inland mudflats, salt marshes and beaches. Distribution throughout NSW where habitat is suitable.	-	-	X*	X
Grey Plover <i>Pluvialis squatarola</i>	Inhabits coastal tidal and inland mudflats, salt marshes and beaches. Distribution throughout NSW where habitat is suitable.	-	-	X*	X
Lesser Sand-plover <i>Charadrius mongolus</i>	A migratory coastal species found along coastal beaches, mangroves and mudflats. Distribution Limit - N-Tweed Heads. S-South of Eden	V [#]	-		
Greater Sand-plover <i>Charadrius leschenaulti</i>	An almost exclusively coastal species favouring extensive mudflats and marshes. Distribution Limit - N-Tweed Heads. S-South of Eden.	V [#]	-		
Cattle Egret <i>Ardea ibis</i>	Moist pastures with tall grass, shallow wetlands and mudflats, Distribution – north, east and south coast of Australia, less common in west.	-	-	X*	X
Great Egret <i>Ardea alba</i>	Wetlands, flooded pastures, mangroves, reeds and mudflats. Distribution – Widespread throughout Australia except central west	-	-	X*	X

**TABLE 3.2 (Cont.)
THREATENED FAUNA SPECIES RECORDED LOCALLY**

Scientific Name	Habitat and distribution within NSW	Legislation listing			
		TSC	EPBC	JAMBA	CAMBA
Caspian Tern <i>Sterna caspia</i>	Inhabits ocean beaches and off shore islands, sheltered areas. Distribution Limit - N-Tweed Heads. S-South of Eden.	-	-	X	X
Crested Tern <i>Sterna bergii</i>	Inhabits ocean beaches and off shore islands. Distribution Limit - N-Tweed Heads. S-South of Eden.	-	-	X	X
Common Tern <i>Sterna hirundo</i>	Inhabits ocean beaches usually more sheltered, bays and estuaries. Distribution Limit - N-Tweed Heads. S-South of Eden.	-	-	X*	X
Little Tern <i>Sterna albifrons</i>	An almost exclusively coastal species inhabiting open beaches, sheltered inlets, estuaries and occasionally lakes. Distribution Limit- N-North of Tweed Heads. S-South of Eden.	E	-	X	X
Superb Fruit-dove <i>Ptilinopus superbus</i>	Rainforests, adjacent mangroves, eucalypt forests, scrubland with native fruits. Distribution Limit - N-Border Ranges National Park. S-Bateman's Bay.	V [#]	-	-	-
Gang-gang Cockatoo <i>Callocephalon fimbriatum</i>	Prefers wetter forests and woodlands from sea level to > 2000m on Divide, timbered foothills and valleys, timbered watercourses, coastal scrubs, farmlands and suburban gardens. Distribution Limit –mid north coast of NSW to western Victoria	V [#]	-	-	-
Major Mitchell's Cockatoo <i>Cacatua leadbeateri</i>	Commonly found within the arid interior of Australia within desert scrubs, open woodland, mallee, mulga, and callitris woodlands. Distribution Limit - N-Goodooga. S-Albury	V [#]	-	-	-
Glossy Black-Cockatoo <i>Calyptorhynchus lathami</i>	Open forests with <i>Allocasuarina</i> species and hollows for nesting. Distribution Limit - N-Tweed Heads. S-South of Eden.	V [#]	-	-	-
Swift Parrot <i>Lathamus discolor</i>	Inhabits eucalypt forests and woodlands with winter flowering eucalypts. Distribution Limit - N-Border Ranges National Park. S-South of Eden.	E	E*	-	-
Regent Honeyeater <i>Xanthomyza phrygia</i>	Found in temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts. Distribution Limit - N-Urbanville. S-Eden.	E	E	-	-

**TABLE 3.2 (Cont.)
THREATENED FAUNA SPECIES RECORDED WITHIN ROCKDALE LGA**

Scientific Name	Habitat and distribution within NSW	Legislation listing			
		TSC	EPBC	JAMBA	CAMBA
Spotted-tailed Quoll <i>Dasyurus maculatus</i>	Dry and moist open forests containing rock caves, hollow logs or trees. Distribution Limit- N-Mt Warning National Park S-South of Eden.	V	E*	-	-
Long-nosed Potoroo <i>Potorous tridactylus</i>	Coastal heath and dry and wet sclerophyll forests with a dense understorey. Distribution Limit - N-Mt Warning National Park. S-South of Eden.	V	V*	-	-
Brush-tailed Rock-wallaby <i>Petrogale penicillata</i>	Found in rocky gorges with a vegetation of rainforest or open forests to isolated rocky outcrops in semi-arid woodland country. Distribution Limit - N-North of Tenterfield. S-Bombala.	V	V*	-	-
Grey-headed Flying-fox <i>Pteropus poliocephalus</i>	Found in a variety of habitats including rainforest, mangroves, paperbark swamp, wet and dry open forest and cultivated areas. Forms camps commonly found in gullies and in vegetation with a dense canopy. Distribution Limit – N – Tweed Heads S – Eden.	V	V	-	-
Large-footed Myotis <i>Myotis adversus</i>	Roosts in caves, mines, tunnels, buildings, tree hollows and under bridges. Forages over open water. Distribution limits - N - Border Ranges National Park, S - South of Eden.	V	-	-	-
Large-eared Pied Bat <i>Chalinolobus dwyeri</i>	Warm-temperate to subtropical dry sclerophyll forest and woodland. Roosts in caves, tunnels and tree hollows in colonies of up to 30 animals. Distribution Limit - N-Border Ranges National Park. S-Wollongong.	V	V*	-	-
Greater Broad-nosed Bat <i>Scoteanax rueppellii</i>	Inhabits areas containing moist river & creek systems especially tree lined creeks. Distribution Limit - N-Border Ranges National Park. S-Pambula.	V [#]	-	-	-
Southern Right Whale <i>Eubabaena australis</i>	Oceanic species occurring off the coast of NSW occasionally sheltering in deep bays and harbours.	V	E*	-	-
Humpback Whale <i>Megaptera novaeangliae</i>	Oceanic species occurring off the coast of NSW occasionally sheltering in deep bays and harbours.	V	V*	-	-

**TABLE 3.2 (Cont.)
THREATENED FAUNA SPECIES RECORDED WITHIN ROCKDALE LGA**

Scientific Name	Habitat and distribution within NSW	Legislation listing			
		TSC	EPBC	JAMBA	CAMBA
Australian Fur-seal <i>Arctocephalus pusillus</i>	Oceanic species occurring off the coast of NSW occasionally sheltering in deep bays and harbours.	V [#]	-	-	-
Dugong <i>Dugong dugon</i>	Oceanic species occurring off the coast of NSW often sheltering in bays and harbours where sea grasses occur.	V [#]	-	-	-
Grey Nurse Shark <i>Carcharias taurus</i>	Inhabits oceanic exposed reef areas. All coastal areas of NSW.	-	E*	-	-
Great White Shark <i>Carcharodon carcharias</i>	Oceanic species occurring off the coast of NSW within the open sea. All coastal areas of NSW.	-	V*	-	-
Whale Shark <i>Rhincodon typus</i>	Oceanic species occurring off the coast of NSW within the open sea. All coastal areas of NSW.	-	V*	-	-
* Denotes species listed in EPBC Act search, but not recorded within the LGA boundary under the Atlas of NSW Wildlife database search # Denotes species that appeared on the Atlas of NSW Wildlife database search but the individual recordings are outside the LGA boundary					

3.5 FAUNA SURVEY RESULTS

At the conclusion of the fauna survey period a fauna species list was compiled, (Table A2 of Appendix II). Similar to the threatened fauna species list, the list is dominated by bird species. A total of five threatened species or species of significance were recorded during the survey period with the location of these shown in Figure 3.5. These species are:

- Grey-Headed Flying-Fox (V)
- Pied Oystercatcher (V)
- Eastern Curlew (JAMBA/CAMBA)
- Sharp-tailed Sandpiper (JAMBA/CAMBA)
- Bar-tailed Godwit (JAMBA/CAMBA)

3.6 HABITAT ASSESSMENTS

There are a variety of habitats present in Rockdale LGA, with the majority being < 10ha in size and consisting of exotic vegetation and mown lawns. Table 3.3 represents the habitat assessment of each park and reserve surveyed and describes the vegetation and the available fauna habitat in each. Fauna survey details for each location were also recorded. Table 3.4 represents the date each park/reserve was surveyed and what methods were carried out. The Park/Reserve Number in both of these tables corresponds to Figures 3.1, 3.2 and 3.3 which identify the location of each park/reserve and what survey methods were performed at each. The purpose of this connection between Table 3.3 and 3.4 and the three figures is to record what parks have been surveyed, on what date and by which survey method.

Assessing habitat significance results in evaluating biodiversity value and producing maps that demonstrate habitat ranking. A key assumption for this is that vegetation is an important surrogate for biodiversity value such as habitat, food and breeding resources for fauna as well as other habitat for flora species. The grading of environments into categories requires a largely subjective judgement on the part of the assessor, based on experience in the management and restoration of native ecosystems. Below are the definitions that were used to class these open space areas within the LGA as high, medium or low biodiversity value.

Habitats of High Biodiversity Value:

Remnant native vegetation with complex structure (Canopy/understorey/groundlayer) and/or the occurrence of multiple hollows. A high diversity of native foraging resources with breeding, foraging and shelter habitat for small mammals, reptiles, amphibians and small and large bird species. Generally >1 hectare in size.

And/or

A high level of aquatic habitat with permanently flowing watercourses. Marine or freshwater vegetation present with known/observed breeding, foraging and shelter habitat for aquatic vertebrates and invertebrates.

Habitats of Medium Biodiversity Value:

Native remnant trees and/or the occurrence of some hollows. Moderate diversity of native and/or exotic foraging resources. Possible breeding, foraging and shelter habitat for small mammals, reptiles, amphibians and small and large bird species. Generally >0.5 hectares in size.

And/or

A moderate level of aquatic habitat with permanent or intermittent flowing watercourse, semi-permanent/permanent pools or connected wetland areas. Marine or freshwater vegetation is present with evidence of some aquatic vertebrate and invertebrate habitat present.

Habitats of Low Biodiversity Value:

Habitat dominated by planted exotics and no hollows present. A low diversity of foraging resources. Habitat available is limited to roosting and foraging. Principally foraging habitat for birds. Minimal habitat available for small mammals, reptiles and amphibians. Minimal linkages with the habitat in surrounding areas.

And/or

Aquatic habitat in the form of semi-permanent pools or ponds. Low occurrence of aquatic vegetation with minimal occurrence of aquatic vertebrates. Habitat for aquatic invertebrates present.

Refer to Figures 3.6, 3.7 and 3.8 for the location of high, medium and low biodiversity value areas within the LGA.

**TABLE 3.3
HABITAT ASSESSMENT OF PARKS AND RESERVES IN ROCKDALE LGA**

Park/ Reserve No. & Name	Date	Time	Area ha	Vegetation / disturbances	Available fauna habitats	Biodiversity Value
1 Cook Park Dolls Point	1/3/06	0730-0800	38.5	Exotic pines, mowed understorey.	Roosting and foraging for birds. No tree hollows.	Low
2 Scott Park, Stan Moses Reserve, Clareville Reserve Sandringham	1/3/06	0800-0900	3.34	Mostly exotic plantings some remnant and planted native trees, mown understorey, tidal drainage line, large cleared areas and saltmarsh at Scott park.	Roosting and foraging for birds. Water bird habitat & fish habitat within drainage line. Tree hollows within remnant trees of Clareville Res.	Medium
3 Bexley Park Bexley	1/3/06	0930-0945	4.045	Mostly exotic plantings some native trees, mown understorey, large cleared areas. Cricket ground and children's play ground.	Roosting and foraging for birds. No tree hollows.	Low
4 Evatt Park Bexley	1/3/06	0950-1010	1.83	Mostly exotic plantings some native trees, mown understorey, large cleared areas. Children's play ground.	Roosting and foraging for birds. No tree hollows.	Low
5 Rockdale Park	8/3/06	0900-0915	3.2	Mostly exotic plantings some native trees, mown understorey, planted exotic garden beds, large cleared areas.	Roosting and foraging for birds. No tree hollows.	Low
6 Ron Gosling Reserve Bardwell Park	8/3/06	0930-0945	0.88	Mostly exotic plantings some native trees along boundary, mown understorey, large cleared areas.	Roosting and foraging for birds. No tree hollows.	Low

**TABLE 3.3 (Cont.)
HABITAT ASSESSMENT OF PARKS AND RESERVES IN ROCKDALE LGA**

Park/ Reserve No. & name	Date	Time	Area ha	Vegetation / disturbances	Available fauna habitats	Biodiversity Value
7 Cooilbah Reserve Bardwell Valley	8/3/06	0945- 1030	3.69	Mostly native plantings, creekline reed beds associated with pond, disturbed riparian vegetation, mostly weeds, large cleared mown areas, limited shrub layer.	Roosting and foraging for birds. No visible tree hollows. Aquatic habitats for birds, amphibians, reptiles, fish and terrestrial mammals.	Medium
8 Stotts Reserve Bexley North	8/3/06	1400- 1500	3.74	Remnant native open forest vegetation, clearing to perimeters. Moderate to dense shrub layer mostly endemic, drainage line, and weedy riparian areas.	Roosting and foraging for birds. Low numbers of tree hollows, no large hollows. High levels of leaf litter and fallen timber, rock outcropping. Aquatic habitats for birds, amphibians, reptiles, fish and terrestrial mammals.	High
9 Bardwell Valley Parklands north of Bexley Road and Bardwell Valley Golf Course	8/3/06	0830- 1300	Part of 38.7	Remnant native open forest vegetation to perimeters of golf course and parklands with high levels of weed invasion. Heath with dense shrubby understorey. Weedy riparian areas along Bardwell Creek. Large areas of clearing associated with golfing activities.	Roosting and foraging for birds. Low numbers of tree hollows, no large hollows. Suitable shelter and foraging habitat for terrestrial and arboreal mammals, high levels of leaf litter and fallen timber within undisturbed areas, rock outcropping. Aquatic habitats for birds, amphibians, reptiles, fish and terrestrial mammals.	Medium and High (Refer to Figure 3.6 for specific areas)

**TABLE 3.3 (Cont.)
HABITAT ASSESSMENT OF PARKS AND RESERVES IN ROCKDALE LGA**

Park/ Reserve No. & Name	Date	Time	Area ha	Vegetation / disturbances	Available fauna habitats	Biodiversity Value
10 Bardwell Valley Parklands south of Bexley Road	9/3/06	0730-0915	Part of 38.7	Remnant native open forest vegetation, clearing to perimeters. Moderate to dense shrub layer mostly endemic, drainage line, and weedy riparian areas.	Roosting and foraging for birds. Low numbers of tree hollows, no large hollows. Suitable shelter and foraging habitat for terrestrial and arboreal mammals, high levels of leaf litter and fallen timber within undisturbed areas, rock outcropping. Aquatic habitats for birds, amphibians, reptiles, fish and terrestrial mammals.	High
11 Kogarah Golf Course	9/3/06	1415-1530	41.84	Sparse mostly planted tree and shrub vegetation. Dams and canals with some low levels of weedy shoreline vegetation. Large areas of clearing associated with golfing activities. Small areas of estuarine wetland.	Roosting and foraging for birds. Low numbers of tree hollows, no large hollows. Aquatic habitats for birds, amphibians, reptiles, fish and terrestrial mammals.	Medium
12 Bexley Golf Course Bexley North	10/3/06	0903-1100	21.8	Sparse mostly planted tree and shrub vegetation. Some remnant endemic trees. Dams and canals with some low levels of weedy shoreline vegetation. Large areas of clearing associated with golfing activities.	Roosting and foraging for birds. Low numbers of tree hollows, one large hollow. Aquatic habitats for birds, amphibians, reptiles, fish and terrestrial mammals.	Medium

**TABLE 3.3 (Cont.)
HABITAT ASSESSMENT OF PARKS AND RESERVES IN ROCKDALE LGA**

Park/ Reserve No. & Name	Date	Time	Area ha	Vegetation / disturbances	Available fauna habitats	Biodiversity Value
13 Kingsgrove Ave Reserve Bexley North	11/4/06	0800-0830	4.9	Sparse mostly planted open forest tree and shrub vegetation. Playing fields. Concrete stormwater canal.	Roosting and foraging for birds within native trees and shrubs. No tree hollows.	Low
14 Flynn's Reserve Bexley North	11/4/06	0900-0920	1.83	Sparse mostly planted tree and shrub vegetation. Open space areas. Some remnant trees.	Roosting and foraging for birds within native tree and shrubs. Small tree hollows.	Medium
15 Cahill Park Arncliffe	12/4/06	0800-0830	7.26	Scattered trees mostly planted. Large mature <i>Ficus</i> trees. Planted gardens of native and exotic shrubs. Playing fields, tidal flats to Cooks River.	Roosting and foraging for birds within native tree and shrubs. Small tree hollows within <i>Ficus</i> trees. Small mammal foraging along shoreline. Sand flats suitable for aquatic bird foraging.	Medium
16 Gilchrist Park Bexley North	12/4/06	0845-0900	2.9	Sparse mostly planted tree and shrub vegetation. Open space areas. Some remnant trees (<i>Casuarina</i>). Playing fields, playground.	Roosting and foraging for birds within trees and shrubs. No tree hollows.	Low
17 Arncliffe Park Arncliffe	12/4/06	0930-0920	3.79	Planted native and exotic trees now mature. Mown cleared areas and understorey. Playground.	Roosting and foraging for birds within native tree and shrubs. No tree hollows.	Low
18 Gardiner Park Rockdale	12/4/06	0945-1000	4.26	Planted native and exotic trees now mature. Mown cleared areas and understorey. Playground.	Roosting and foraging for birds within trees and shrubs. No tree hollows.	Low

**TABLE 3.3 (Cont.)
HABITAT ASSESSMENT OF PARKS AND RESERVES IN ROCKDALE LGA**

Park/ Reserve No. & Name	Date	Time	Area ha	Vegetation / disturbances	Available fauna habitats	Biodiversity Value
19 Yambawoora Reserve Arncliffe	12/4/06	1030-1045		Large mature exotic trees with some regrowth.	Roosting and foraging for birds within trees and shrubs. No tree hollows.	Low
20 A.E. Watson Reserve Bexley	12/4/06	1100-1115	.747	Mostly planted native trees and shrubs. Cleared open mown areas. Playground.	Roosting and foraging for birds within trees and shrubs. No tree hollows.	Low
21 Seaforth Park Bexley	12/4/06	1120-1130	1.61	Mature planted exotic and native tree species. Cleared open mown areas.	Roosting and foraging for birds within trees and shrubs. No tree hollows.	Low
22 Dominey Res. Bexley	12/4/06	1140-1150	.58	Mature planted exotic and native tree species. Cleared open mown areas. One remnant eucalypt. New gardens of native shrubs. Playground.	Roosting and foraging for birds within trees and shrubs. No tree hollows.	Low
23 Bardwell Park	12/4/06	1200-1230	.58	Formal gardens of exotic plantings. Exotic mature tree species. Playground. Open cleared mown areas.	Roosting and foraging for birds within trees and shrubs. No tree hollows.	Low
24 Fry's Reserve Bexley	11/4/06	1100-1200	2.24	Remnant native vegetation, mostly heath adjoining railway line. Cleared mown open space, playground. Planted trees and shrubs. Concrete water canal.	Roosting and foraging for birds within trees and shrubs. No tree hollows. Some rock outcropping.	High

**TABLE 3.3 (Cont.)
HABITAT ASSESSMENT OF PARKS AND RESERVES IN ROCKDALE LGA**

Park/ Reserve No. & Name	Date	Time	Area ha	Vegetation / disturbances	Available fauna habitats	Biodiversity Value
25 Riverine Park Arncliffe (Eve St wetlands)	11/4/06	1330- 1430	33.41	Mostly cleared grassland, planted open forest of native trees and shrubs, fresh- saltwater wetland and reed beds, mangroves, playing fields etc.	Roosting and foraging for birds within trees and shrubs. No tree hollows. Important wetland area providing foraging and roosting sites for migratory wading birds. Area of high conservation value.	Medium and High (Refer to Figure 3.7 for specific areas)
26 Scarborough Park Monterey	21/3/06	1030- 1100	31.596	Mostly cleared grasslands unmown and playing fields. Brackish to salt water channel and wetland area. High level of pasture weeds. Scattered planted trees mostly native.	Highly disturbed area providing aquatic habitats for amphibians and water birds. Reed beds and tall grasses areas provide shelter and foraging for terrestrial mammals and small ground birds. Important breeding habitat for aquatic species is also available.	Low, Medium and High (Refer to Figure 3.8 for specific areas)
27 Barton Park (Landing Lights Wetland)	9/3/06	0930- 1030	19.56	Mostly cleared grassland, planted open forest of native trees and shrubs, freshwater wetland and reed beds, mangroves, playing fields etc.	Roosting and foraging for birds within trees and shrubs. No tree hollows. Important wetland area providing foraging and roosting sites for migratory wading birds. Area of high conservation value.	Medium and High (Refer to Figure 3.7 for specific areas)
28 Equestrian Park / Noel Seiffert Reserve	2/3/06	1200- 1300	3.3	Mostly cleared mown grassland, remnant native trees, established mature exotic trees, saltwater wetland and reed beds, mangroves associated with tidal channel.	Roosting and foraging for birds within native and exotic trees and shrubs. Small mammal foraging along shoreline. Waterbird roosting and foraging within channel. Important aquatic habitat.	High

**TABLE 3.3 (Cont.)
HABITAT ASSESSMENT OF PARKS AND RESERVES IN ROCKDALE LGA**

Park/ Reserve No. & Name	Date	Time	Area ha	Vegetation / disturbances	Available fauna habitats	Biodiversity Value
29 Bicentennial Park Rockdale	28/2/06	1520- 1720	12.5	Mostly cleared mown grassland and playfields, established mature exotic and native trees, tall exotic grasslands brackish water channel.	Roosting and foraging for birds within native and exotic trees and shrubs. Small mammal foraging along shoreline. Waterbird roosting and foraging within channel.	Low and High (Refer to Figure 3.8 for specific areas)
30 Turrella open space	2/3/06	0830- 0900	2.49	Remnant disturbed area of mostly exotic weed trees and shrubs. Wolli creekline and disturbed remnant riparian vegetation.	Roosting and foraging for birds within native and exotic trees and shrubs. Small mammal foraging along shoreline. Waterbird roosting and foraging within Wolli Creek. Important aquatic habitat is also available.	Medium
31 Wolli Creek open space	2/3/06	0900- 0930	2.49	Remnant disturbed area of mostly native trees and shrubs. Wolli creekline and disturbed remnant riparian vegetation.	Roosting and foraging for birds within native and exotic trees and shrubs. Small mammal foraging along shoreline. Waterbird roosting and foraging within Wolli Creek.	Medium
32 Slade Rd Reserve	8/3/06	1040- 1050	0.75	Planted native and exotic trees. Mown cleared areas and understorey. Playground.	Roosting and foraging for birds within trees and shrubs. No tree hollows.	Low

**TABLE 3.4
FAUNA SURVEY DETAILS FOR EACH LOCATION**

Park/Reserve No. & Name	Date of survey	Survey Detail
1 Cook Park Dolls Point	1/3/04 1/3/06; 21/3/06; 11/4/06 1/3/06; 21/3/06; 11/4/06	Habitat assessment Wading bird census, Opportunistic observation Reptile; Habitat search/Opportunistic observation
2 Scotts Park, Stan Moses Reserve, Clareville Reserve Sandringham	1/3/04 1/3/06; 2/3/06; 11/4/06 1/3/06; 2/3/06	Habitat assessment Bird census, Opportunistic observation Reptile habitat search/Opportunistic observation
3 Bexley Park Bexley	1/3/06	Habitat assessment
4 Evatt Park Bexley	1/3/06	Habitat assessment
5 Rockdale Park Rockdale	8/3/06	Habitat assessment
6 Ron Gosling Reserve Bardwell Park	8/3/06	Habitat assessment
7 Coolibah Reserve Bardwell Valley	2/3/06 2/3/06	Bird census, Opportunistic observation Habitat assessment
8 Stott's Reserve Bexley North	7-9/3/06 2/3/06 2/3/06 8/3/06 8/3/06 8/3/06 9/3/06 9/3/06 9/3/06	Terrestrial & arboreal mammal trapping (Elliott) Reptile habitat search/Opportunistic observation Bird census, Opportunistic observation Bird census, Opportunistic observation Reptile habitat search/Opportunistic observation Habitat assessment Recorded owl call playback Micro bat detection (Anabat II) Spotlighting/ amphibian searches
9 Bardwell Valley Parklands north of Bexley Road and Bardwell Valley Golf Course	1/3/06 8/3/06 8/3/06 8/3/06 12/4/06 12/4/06 12/4/06 12/4/06	Spotlighting/ amphibian searches Habitat assessment Bird census, Opportunistic observation Reptile habitat search/Opportunistic observation Recorded owl call playback (Golf Course) Micro bat detection (Anabat II) (Golf Course) Spotlighting/ amphibian searches (Golf Course) Spotlighting/ amphibian searches (Golf Course)

TABLE 3.4 (Cont.) FAUNA SURVEY DETAILS FOR EACH LOCATION		
Park/Reserve No. & Name	Date of survey	Survey Detail
10 Bardwell Valley Parklands south of Bexley Road	1/3/06	Bird census, Opportunistic observation
	1/3/06	Reptile habitat search/Opportunistic observation
	1-3/3/06	Terrestrial & arboreal mammal trapping (Elliott)
	2/3/06	Spotlighting/ amphibian searches
	2/3/06	Recorded owl call playback
	2/3/06	Micro bat detection (Anabat II)
	7-9/3/06	Terrestrial & arboreal mammal trapping (Elliott)
	8/3/06	Bird census, Opportunistic observation
11 Kogarah Golf Course	8/3/06	Reptile habitat search/Opportunistic observation
	9/3/06	Habitat assessment
	9/3/06	Bird census, Opportunistic observation
12 Bexley Golf Course Bexley North	9/3/06	Reptile habitat search/Opportunistic observation
	10/3/06	Habitat assessment
	10/3/06	Bird census, Opportunistic observation
13 Kingsgrove Ave Reserve Bexley North	10/3/06	Reptile habitat search/Opportunistic observation
	11/4/06	Habitat assessment
	11/4/06	Habitat assessment
14 Flynn's Reserve Bexley North	11/4/06	Habitat assessment
15 Cahill Park Arncliffe	12/4/06	Habitat assessment
16 Gilchrist Park Bexley North	12/4/06	Habitat assessment
17 Arncliffe Park Arncliffe	12/4/06	Habitat assessment
18 Gardiner Park Rockdale	12/4/06	Habitat assessment
19 Yambawoora Reserve Arncliffe	12/4/06	Habitat assessment
20 A.E.Watson Reserve Bexley	12/4/06	Habitat assessment
21 Seaforth Park Bexley	12/4/06	Habitat assessment
22 Dominey Reserve Bexley	12/4/06	Habitat assessment
23 Barwell Park	12/4/06	Habitat assessment
24 Fry's Reserve Bexley	12/4/06	Habitat assessment
25 Riverine Park Arncliffe (Eve St wetlands)	9/3/06	Bird census, Opportunistic observation
	9/3/06	Reptile habitat search/Opportunistic observation
	11/4/06	Spotlighting/ amphibian searches
	11/4/06	Recorded owl call playback
	11/4/06	Micro bat detection (Anabat II)

**TABLE 3.4 (Cont.)
FAUNA SURVEY DETAILS FOR EACH LOCATION**

Park/Reserve No. & Name	Date of survey	Survey Detail
26 Scarborough Park (including the Hawthorne St Reserve)	28/2/06	Bird census, Opportunistic observation
	28/2/06	Reptile habitat search/Opportunistic observation
	28/2/06	Spotlighting/ amphibian searches
	28/2/06	Recorded owl call playback
	28/2/06	Micro bat detection (Anabat II)
	2/3/06	Bird census, Opportunistic observation
	7/3/06	Spotlighting/ amphibian searches
	7/3/06	Recorded owl call playback
	7/3/06	Micro bat detection (Anabat II)
	21/3/06	Bird census, Opportunistic observation
21/3/06	Reptile habitat search/Opportunistic observation	
27 Barton Park (Landing Lights Wetland)	9/3/06	Bird census, Opportunistic observation
	9/3/06	Reptile habitat search/Opportunistic observation
	11/4/06	Spotlighting/ amphibian searches
	11/4/06	Recorded owl call playback
	11/4/06	Micro bat detection (Anabat II)
28 Equestrian Park / Noel Seiffert Res.	2/3/06	Habitat assessment
29 Bicentennial Park Rockdale	28/2/06	Habitat assessment
	28/2/06	Bird census, Opportunistic observation
	28/2/06	Reptile habitat search/Opportunistic observation
	28/2/06	Spotlighting/ amphibian searches
	28/2/06	Micro bat detection (Anabat II)
30 Turrella open space	2/3/06	Habitat assessment
31 Wolli Creek open space	2/3/06	Habitat assessment
32 Slade Rd Reserve	12/4/06	Habitat assessment

3.7 AQUATIC HABITATS AND SPECIES

Aquatic habitats in relation to fish habitat were assessed according to NSW Fisheries (1999), guidelines for fish habitat types. The NSW Fisheries Fish Habitat Assessment Guidelines classify fish habitat into four classes depending on the characteristics and features of the watercourse being assessed. The following descriptions are provided for each class:

Class 1 - Major Fish Habitat – Large named permanently flowing stream, creek or river. Threatened species habitat or area of declared “critical habitat” under the threatened species provisions of the Act. Marine or freshwater vegetation is present. Known fish habitat and/or fish observed inhabiting the area.

Class 2 - Moderate Fish Habitat – Smaller named permanent or intermittent stream, creek or watercourse. Clearly defined drainage channels with semi-permanent to permanent waters in pools or in connected wetland areas. Marine or freshwater aquatic vegetation is present. Known fish habitat and/or fish observed inhabiting the area.

Class 3 - Minimal Fish Habitat – Named or unnamed watercourse with intermittent flow but has potential refuge, breeding or feeding areas for some aquatic fauna (e.g. fish yabbies). None to minimal defined drainage channel. Semi-permanent pools, ponds, farm dams or wetlands nearby, or form in the watercourse after a rain event. Watercourse interconnects wetlands or stream habitat.

Class 4 - Unlikely Fish Habitat – Named or unnamed watercourse with intermittent flow during rain events only, little or no defined drainage channel, little or no free standing water or pools after rain event finishes (e.g. dry gully, shallow floodplain depression with no permanent wetland aquatic flora present). No aquatic or wetland vegetation present.

The upper reaches of the Cooks River are freshwater, the mid to lower reaches experience saline water and the discharge point into Botany Bay is influenced by tidal flows. The Cooks River also drains several stormwater drains and sewage overflow points (Saintilan et al. 2005). Aquatic vegetation is present within the watercourse and riparian vegetation occurs along the major tributaries to the River. The Cooks River is therefore classified as Class 1 – Major fish habitat under NSW Fisheries (1999).

Wolli Creek is a major tributary to the lower reaches of the Cooks River and covers a sub-catchment of 15.5km². It consists of freshwater in its upper reaches and grades into estuarine as it nears its connection with the Cooks River. The upper reaches of the creek takes the form of a lined channel with the mid to lower reaches of Wolli Creek being bordered by Wolli Creek Nature Reserve which protects riparian vegetation and several fish species (Rockdale City council 2003-04). Wolli Creek is therefore classified as Class 1 – Major fish habitat.

Bardwell Creek is the major tributary of Wolli Creek and has a sub-catchment of 6.4km². The substrate and banks interchange between concrete drains and natural substrate throughout the length of the creek. Freshwater riparian and aquatic vegetation is evident in Bardwell Creek and known fish habitat exists giving this creek a Class 2 – Moderate fish habitat classification.

Muddy Creek is the final tributary into Cooks River before it drains into Botany Bay. Muddy Creek is an estuarine environment in its natural state with the upper area of the creek being a concrete channel. However it drains the stormwater from six surrounding suburbs and Spring Street Canal which may influence the condition of the water. There is known fish habitat and Muddy Creek can be classified as Class 2 – Moderate fish habitat under NSW Fisheries (1999).

The wetland area that runs from Marsh Street Wetlands, near the Cooks River, south to Bona Park is divided into three drainage catchments. The northern section includes Marsh and Eve Street wetlands, Spring Creek wetlands and Landing Lights wetlands which drain into Cooks River; the central section includes Kings wetland, Patmore swamp, Scarborough Ponds and Hawthorne Street Natural Area which drains into Botany Bay; and the southern section consists of Bona park and Bado-berong Creek which drain into the Georges River. These wetland areas have been extensively modified due to urban development and they vary in riparian vegetation and aquatic vegetation cover and protect several species of fish and fish habitat. The Hawthorne Street Natural Area protects an important natural aquatic habitat. There are dense fish populations inhabiting this area and a good tidal flow and rock substrate for fish habitat. The Scarborough Ponds wetland area, which is upstream from the Hawthorne Street Natural Area, also plays a key role in providing significant habitat for fish breeding and foraging. These areas can be classified as Class 1 – Major fish habitat and the remaining wetland areas are classified as Class 2 – Moderate fish habitat.

The Georges River has a catchment area of 920km² and is divided into three sections, the upper, middle and lower. The Lower section covers from Salt Pan Creek to Botany Bay and Rockdale LGA falls within this section. This river is classified as a Class 1 – Major fish habitat due to its size, flow regime and habitat availability for threatened species.

Botany Bay is the eastern boundary of Rockdale LGA. This area is a continuous stretch of coastal shoreline that maintains extensive habitat for fish species, aquatic vegetation and threatened species. It is therefore classified as Class 1 – Major fish habitat.

A study undertaken by NSW Fisheries into the use of an estuarine wetland by fish in an urban environment compared to a less disturbed environment was conducted in the Rockdale Wetlands Corridor, Scarborough Park. Table 3.5 represents the species list from this study in which 22 fish species inhabit the area with the dominant species being Yellowfin Bream, Mullet and Gobies (Gibbs, P. 1999 cited in Lunney & Burgin 2004).

TABLE 3.5 SCARBOROUGH PARK ESTUARINE FISH SPECIES LIST (from Gibb 1999)	
Scientific Name	Common Name
<i>Philypnodon grandiceps</i>	Flathead gudgeon
<i>Acanthopagrus australis</i>	Yellowfin bream
<i>Myxus elongates</i>	Sand mullet
<i>Mugil cephalus</i>	Sea mullet
<i>Pseudogobius sp.</i>	Blue-spot goby
<i>Liza orgentea</i>	Flat-tail mullet
<i>Gambusia holbrooki</i>	Mosquitofish
<i>Philypnodon sp.</i>	Dwarf flathead gudgeon
<i>Ambassis jacksoniensis</i>	Port Jackson glassfish
<i>Favonigobius tamerensis</i>	Tamar river goby
<i>Arenigobius bifrenatus</i>	Briclled goby
<i>Centropogon australis</i>	Fortescue
<i>Favanigobius lateralis</i>	Long finned goby
<i>Ambassis marianus</i>	Rarnsey's glassfish
<i>Galaxias maculalus</i>	Common jollytail
<i>Anguilla reinhardlii</i>	Long-fin eel
<i>Gobiopterus semivestitus</i>	Glass goby
<i>Terapon jarbua</i>	Crescent perch
<i>Anguilla australis</i>	Short-fin eel
<i>Redigobius macrostoma</i>	Largemouth goby
<i>Torquigener squamicacla</i>	Brush-tail toadfish
<i>Hyperlophus vittatus</i>	Sandy sprat

SECTION 4

BIODIVERSITY ISSUES RELEVANT TO ROCKDALE LGA

This section utilizes the data collected during Phase 1 of the Study, including data and reports from previous studies to identify a range of threats and threatening processes to the biodiversity of the Rockdale LGA. This section also outlines the issues relating to the connectivity of key habitat areas.

There are a variety of threats to the biodiversity of Rockdale LGA and these can be divided into threats that are listed under legislation, known as Key Threatening Processes and fundamental threats that occur throughout the LGA. Key Threatening Processes are determined by the NSW Scientific Committee and listed under Schedule 2 of the Threatened Species Conservation Act (1995). A list of Key Threatening Processes appropriate to Rockdale LGA is presented in Table 4.1.

TABLE 4.1 KEY THREATENING PROCESSES IN ROCKDALE	
Key Threatening Process	Description and Justification for Rockdale
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands	<i>Description:</i> This process contributes to the loss of biodiversity and ecological functions in aquatic ecosystems. <i>Justification:</i> The aquatic and marine areas within Rockdale LGA have been severely altered making the biodiversity vulnerable to this threat.
Anthropogenic Climate Change	<i>Description:</i> Modification of the environment by humans may change climate conditions and frequency of occurrence of extreme events. Species at risk include those with narrow ranges, poor mobility and isolate species. <i>Justification:</i> Species in Rockdale are reasonably isolated, have narrow ranges and poor mobility. Rockdale is also on the coast which makes it susceptible to rising sea levels.
Clearing of native vegetation	<i>Description:</i> Clearing of native vegetation, including areas less than 2 hectares in extent, may have significant effects on biological diversity. <i>Justification:</i> Several areas of vegetation in Rockdale are smaller than 2 ha and are extremely vulnerable to clearing for the demand of development.
Death or injury of marine species following capture in shark control programs on ocean beaches	<i>Description:</i> A wide variety of non-target species particularly Dugong, Green Turtle and Australian Fur-seal occur within Botany Bay <i>Justification:</i> These species are recorded in Botany Bay which borders the LGA at Lady Robinsons Beach and these species may still possibly visit the area.
Entanglement in or ingestion of anthropogenic debris in marine and estuarine environments	<i>Description:</i> Pollution by human-generated objects from ship waste, recreational activities, aquaculture industry, and urban and rural discharge. <i>Justification:</i> The aquatic and marine environments in urban Rockdale are highly susceptible to these human generated objects.

**TABLE 4.1
KEY THREATENING PROCESSES IN ROCKDALE**

Key Threatening Process	Description and Justification for Rockdale
Infection by Psittacine Circoviral Disease	<i>Description:</i> The beak and feather disease affects parrots and their allies (psittacines) and is often fatal. It does not represent a major threat unless populations have dramatically reduced numbers. <i>Justification:</i> Most bird populations in Rockdale LGA are dramatically reduced.
Infection of frogs by amphibian Chytrid causing the disease chytridiomycosis	<i>Description:</i> Is a fatal disease and the transfer of the disease is related to international and domestic trade and collection and handling of frogs. The Green and Golden Bell Frog has been reported with the disease. <i>Justification:</i> The LGA is extremely close to international and domestic trading points and has a protected population of Green and Golden Bell Frogs in the east section of the LGA closest to these trade areas in Botany Bay.
Infection of native plants by <i>Phytopthera cinnamomi</i>	<i>Description:</i> It is a soil borne pathogen that colonises on plants roots and in soil. It is widespread in coastal forests. <i>Justification:</i> Any remnant vegetation surrounded by urban development in the Sydney basin is susceptible.
Invasion of Native plant communities by <i>Chrysanthemoides monilifera</i>	<i>Description:</i> These are boneseed and bitou bush species that invade dune systems and have vigorous growth, prolific seed production and effective seed dispersal. <i>Justification:</i> Threatens <i>Acacia terminalis</i> and dune systems which are recorded in the LGA.
Invasion of native plant communities by exotic perennial grasses	<i>Description:</i> These species have been deliberately spread in NSW and spread is aided by slashing, addition of fertilisers and nutrients and changes in drainage regimes. <i>Justification:</i> Vegetated areas in the LGA are heavily slashed, with some areas being susceptible to nutrient input which contaminates the waterways encouraging grasses.
Invasion, establishment and spread of <i>Lantana camara</i>	<i>Description:</i> This vigorous growing weed has potential for much denser infestations on the coastal ranges of eastern NSW. It readily invades disturbed sites and may adversely affect the soil microhabitat. <i>Justification:</i> Rockdale is located in a coastal area and has many disturbed sites susceptible to invasion
Predation by <i>Gambusia holbrooki</i>	<i>Description:</i> This small freshwater fish preys on eggs and tadpoles of the Green and Golden Bell Frog and breeding of these frogs is almost restricted to water bodies without <i>Gambusia</i> . <i>Justification:</i> Rockdale LGA protects an isolated population of Green and Golden Bell Frogs which makes it essential to keep out <i>Gambusia</i> from this wetland.
Removal of dead wood and dead trees	<i>Description:</i> Removal of standing dead trees and woody debris on ground is contributing to the loss of biological diversity. <i>Justification:</i> Dead wood provides habitat for a suite of birds, amphibians, reptiles and mammal species and may encourage re-colonisation of species. Clearing of dead wood in urban areas for safety issues may reduce habitat availability.

**TABLE 4.1
KEY THREATENING PROCESSES IN ROCKDALE**

Key Threatening Process	Description and Justification for Rockdale
Bushrock Removal	<i>Description:</i> Bushrock provides habitat for reptile and amphibian species. <i>Justification:</i> Species recorded in the LGA inhabit these rock outcrops and are susceptible to its removal.
Predation by European red fox (<i>Vulpes vulpes</i>)	<i>Description:</i> The fox has a wide selection of prey and is largely opportunistic. It also causes habitat limitations on other terrestrial species and is the main contributor to the disappearance of ground-dwelling mammals. <i>Justification:</i> Rockdale has a very low number of ground dwelling mammal species and foxes and their traces are readily sighted.
Predation by the feral cat (<i>Felis catus</i>)	<i>Description:</i> They occur in all terrestrial habitats and they show preference in prey for mammals under 220g and birds less than 200g. Many native species are at high risk of becoming threatened as a result of feral cat predation. <i>Justification:</i> Rockdale is highly urbanised which causes a high density of domestic and feral cats preying on native species.
Predation by European red fox (<i>Vulpes vulpes</i>)	<i>Description:</i> The fox has a wide selection of prey and is largely opportunistic. It also causes habitat limitations on other terrestrial species and is the main contribution to the disappearance of ground-dwelling mammals. <i>Justification:</i> Rockdale has a very low number of ground dwelling mammal species and foxes and their traces are readily sighted.
Predation by the feral cat (<i>Felis catus</i>)	<i>Description:</i> They occur in all terrestrial habitats and they show preference in prey for mammals under 220g and birds less than 200g. Many native species are at high risk of becoming threatened as a result of feral cat predation. <i>Justification:</i> Rockdale is highly urbanised which causes a high density of domestic and feral cats preying on native species.
Competition and grazing by the feral European Rabbit (<i>Oryctolagus cuniculus</i>)	<i>Description:</i> Feral rabbits impact negatively on indigenous species via competition, alteration of structure and composition of vegetation and land degradation. <i>Justification:</i> The management of European Red Fox in Rockdale should incorporate the rabbit threat abatement plan to minimise the explosion of rabbit populations in conjunction with reduced fox numbers.

Threats to Biodiversity in Rockdale

Rockdale LGA supports a high population and has several pockets of remnant vegetation that support locally important fauna. A combination of industrial, domestic, recreational and urban activities create an extensive amount of pressure on the biodiversity within the LGA. These threats can be divided into locations within the LGA as different threats occur in different areas. Therefore, Table 4.2 identifies the threats to specific areas of Rockdale LGA and gives descriptions on the impact of each threat.

**TABLE 4.2
THREATS TO BIODIVERSITY IN ROCKDALE**

Urban Recreational Parklands	
Threat	Description of Threat
Clearing of native vegetation	The removal of native vegetation regrowth through mowing and removal of understorey.
Soil erosion and compaction	Erosion to areas subjected to high levels of human activity removing topsoil and exposing plant root systems leading to plant stress. Compaction of soils within areas subjected to high levels of human activity altering the absorption rate of water to plant root systems.
Waste disposal and rubbish dumping	The dumping of garden rubbish within parklands introducing exotic weeds. Overflowing solid waste bins, causing wind borne litter to pollute adjoining waterways and natural areas and illegal waste dumping.
Future development	The establishment of large scale developments interrupting ecological processes and movement of species. Particularly along Lady Robinsons Beach, the proposed development of a marina will severely impact on the movement of sand and invertebrate food sources for birds.
Introduction of exotic species	The planting of exotic and non endemic native plant species reducing availability of pollen dispersal for endemic native flora species and reduction in available foraging resource for endemic native fauna species. Invasion of exotic species into bushland areas Unrestrained domestic dogs and cats hunting within parkland areas reducing fauna populations. Predation by foxes (<i>Vulpes vulpes</i>) on native fauna.
Golf Courses	
Threat	Description of Threat
Alteration of hydrological systems, increased nutrients to waterways.	The filling and draining of previous wetland areas altering hydrological flows and aquatic, flora and fauna habitats. The use of fertilisers causing high nutrient runoff into drainage lines and creeks increasing algae and weed growth.
Introduction of exotic species	The planting of exotic and non endemic flora species reducing availability of pollen dispersal for endemic native flora species and the reduction in available foraging resource for endemic native fauna species. The invasion of exotic trees, shrubs and grasses within natural areas surrounding the courses.

**TABLE 4.2 (Cont.)
THREATS TO BIODIVERSITY IN ROCKDALE**

Golf Courses (Cont.)	
Threat	Description of Threat
Soil erosion and compaction	<p>Erosion to areas subjected to high levels of human activity removing topsoil and exposing plant root systems leading to plant stress.</p> <p>Compaction of soils within areas subjected to high levels of human activity altering the absorption rate of water to plant root systems.</p>
Clearing of native vegetation	The removal of native vegetation regrowth through mowing and underscrubbing.
Bardwell Valley Parklands (north and south of Bexley Road) and Coolibah Reserve	
Threat	Description of Threat
Bushfire management	<p>Clearing of vegetation to reduce fire hazard to surrounding residences.</p> <p>Alteration to fire regimes likely to cause changed flora and fauna life cycle patterns.</p>
Clearing of vegetation	<p>The mowing of areas, particularly riparian zones, within the parkland inhibiting the regeneration of native flora species.</p> <p>The reduction of native flora and fauna habitats within the parkland caused through creation and maintenance of walking tracks.</p>
Roads and traffic	<p>Death by vehicle impact on native fauna species at road crossings and cutting of fauna pathways.</p> <p>Stormwater runoff from roadways containing pollutants which drains into Bardwell Creek reducing the water quality of Bardwell Creek.</p> <p>Wind blown solid wastes from passing traffic polluting natural areas.</p>
Introduction of exotic species	<p>Hollow dependant exotic fauna species (feral honey bee, Common Myna) occupying available tree hollows within natural areas depriving hollow dependant native fauna species suitable breeding and roosting sites.</p> <p>Predation by foxes (<i>Vulpes vulpes</i>) upon native terrestrial fauna species.</p> <p>Unrestrained domestic dogs and cats hunting within natural areas preying particularly on terrestrial fauna species.</p> <p>The dumping of garden rubbish within natural areas introducing exotic weed species.</p>

**TABLE 4.2 (Cont.)
THREATS TO BIODIVERSITY IN ROCKDALE**

Bardwell Valley Parklands (north and south of Bexley Road) and Coolibah Reserve (Cont.)

Threat	Description of Threat
Waste disposal and rubbish dumping	<p>The dumping of garden rubbish within natural areas introducing exotic weeds.</p> <p>Overflowing solid waste bins, causing wind borne litter to pollute natural areas.</p> <p>Illegal dumping of domestic waste within natural areas.</p>
Displacement of native flora and fauna species by exotic flora and fauna species	<p>The choking of native shrubs and trees by invasive viny weed species.</p> <p>The invasion of exotic tree and shrub species with higher reproduction rates causing the demise of native species via increased competition.</p> <p>Competition from exotic <i>rattus</i> species with higher levels of fecundity resulting in increased competition and predation causing a decline in native terrestrial fauna.</p>
Residential and industrial development	<p>The encroachment into natural areas for further development increasing the <i>edge effect</i> on native flora and fauna species.</p> <p>The improper management of waste associated with such developments, in particular stormwater pollutants entering the creeks, wetlands and the bay.</p>

Barton Park and Wetland Area

Threat	Description of Threat
Trespassing and vandalism	Habitat destruction and interruption of foraging migratory waders from motorbikes riding through the saltmarsh, lighting fires and fireworks, picking the saltmarsh plants for bait and making noise around nesting birds.
Future Development	Clearing of habitat and increased pressure on stormwater system, increased runoff into Cooks River and increased risk of water contamination. Increase pressure on all infrastructure from more employees. Increase interruption of migratory species from human disturbance, a decrease in the available area of breeding, roosting and foraging sites for species.
Aircraft traffic disturbance	The interruption to bird flight movements reducing time spent foraging.

**TABLE 4.2 (Cont.)
THREATS TO BIODIVERSITY IN ROCKDALE**

Barton Park and Wetland Area (Cont.)	
Threat	Description of Threat
Introduction of exotic species	<p>Predation by foxes (<i>Vulpes vulpes</i>) upon native terrestrial fauna species.</p> <p>Unrestrained domestic dogs and cats hunting within natural areas preying particularly on terrestrial fauna species.</p> <p>The dumping of garden rubbish within natural areas introducing exotic weed species.</p>
Waste disposal and rubbish dumping	<p>The dumping of garden rubbish within natural areas introducing exotic weeds.</p> <p>Overflowing solid waste bins, causing wind borne litter to pollute natural areas.</p> <p>Illegal dumping of domestic waste within natural areas.</p>
Clearing of vegetation	<p>The mowing of areas within the parkland inhibiting the regeneration of native flora species.</p> <p>The reduction of native flora and fauna habitats within the parkland caused through creation and maintenance of walking tracks.</p>
Displacement of native flora and fauna species by exotic flora and fauna species	<p>The choking of native shrubs and trees by invasive viny weed species.</p> <p>The invasion of exotic tree and shrub species with higher reproduction rates causing the demise of native species via increased competition.</p> <p>Competition from exotic <i>rattus</i> species with higher levels of fecundity resulting in increased competition and predation causing a decline in native terrestrial fauna.</p>
Riverine Park and Wetland Area	
Threat	Description of Threat
Alteration of hydrological systems, increased nutrients to waterways	Nutrient runoff from agricultural production systems that will affect the nearby water quality
Aircraft traffic disturbance	The interruption to bird flight movements reducing time spent foraging
Introduction of exotic species	<p>Predation by foxes (<i>Vulpes vulpes</i>) upon native terrestrial fauna species.</p> <p>Unrestrained domestic dogs and cats hunting within natural areas preying particularly on terrestrial fauna species.</p> <p>The dumping of garden rubbish within natural areas introducing exotic weed species.</p>

**TABLE 4.2 (Cont.)
THREATS TO BIODIVERSITY IN ROCKDALE**

Riverine Park and Wetland Area (Cont.)	
Threat	Description of Threat
Waste disposal and rubbish dumping	<p>The dumping of garden rubbish within natural areas introducing exotic weeds.</p> <p>Overflowing solid waste bins, causing wind borne litter to pollute natural areas.</p> <p>Illegal dumping of domestic waste within natural areas.</p>
Clearing of vegetation	<p>The mowing of areas within the parkland inhibiting the regeneration of native flora species.</p> <p>The reduction of native flora and fauna habitats within the parkland caused through the creation and maintenance of walking tracks.</p>
Displacement of native flora and fauna species by exotic flora and fauna species	<p>The choking of native shrubs and trees by invasive viny weed species.</p> <p>The invasion of exotic tree and shrub species with higher reproduction rates causing the demise of native species via increased competition.</p> <p>Competition from exotic <i>rattus</i> species with higher levels of fecundity resulting in increased competition and predation causing declines within native terrestrial fauna.</p>
Scarborough Park, Bicentennial Park and Wetland Area	
Threat	Description of Threat
Introduction of exotic species	<p>Predation by foxes (<i>Vulpes vulpes</i>) upon native terrestrial fauna species.</p> <p>Unrestrained domestic dogs and cats hunting within natural areas preying particularly on terrestrial fauna species.</p> <p>The dumping of garden rubbish within natural areas introducing exotic weed species.</p>
Waste disposal and rubbish dumping	<p>The dumping of garden rubbish within natural areas introducing exotic weeds.</p> <p>Overflowing solid waste bins, causing wind borne litter to pollute natural areas.</p> <p>Illegal dumping of domestic waste within natural areas.</p>
Clearing of vegetation	<p>The mowing of areas within the parkland inhibiting the regeneration of native flora species.</p> <p>The reduction of native flora and fauna habitats within the parkland caused through creation and maintenance of walking tracks.</p>

TABLE 4.2 (Cont.) THREATS TO BIODIVERSITY IN ROCKDALE	
Scarborough Park, Bicentennial Park and Wetland Area (Cont.)	
Threat	Description of Threat
Displacement of native flora and fauna species by exotic flora and fauna species	<p>The choking of native shrubs and trees by invasive viny weed species.</p> <p>The invasion of exotic tree and shrub species with higher reproduction rates causing the demise of native species via increased competition.</p> <p>Competition from exotic <i>rattus</i> species with higher levels of fecundity resulting in an overpopulation causing declines within native terrestrial fauna. Common myna exploitation with competition for hollows.</p>
Stotts Reserve	
Threat	Description of Threat
Introduction of exotic species	<p>Predation by foxes (<i>Vulpes vulpes</i>) upon native terrestrial fauna species.</p> <p>Unrestrained domestic dogs and cats hunting within natural areas preying particularly on terrestrial fauna species.</p> <p>The dumping of garden rubbish within natural areas introducing exotic weeds species.</p>
Waste disposal and rubbish dumping	<p>The dumping of garden rubbish within natural areas introducing exotic weeds.</p> <p>Overflowing solid waste bins, causing wind borne litter to pollute natural areas.</p> <p>Illegal dumping of domestic waste within natural areas.</p>
Displacement of native flora and fauna species by exotic flora and fauna species.	<p>The choking of native shrubs and trees by invasive viny weed species.</p> <p>The invasion of exotic tree and shrub species with higher reproduction rates causing the demise of native species via increased competition.</p> <p>Competition from exotic <i>rattus</i> species with higher levels of fecundity resulting in increased competition and predation causing declines within native terrestrial fauna.</p>

Core Habitat Linkages

The linkages within the LGA can be divided into two classifications, the core habitat areas and the surrounding habitat areas. The identification of linkages will require identifying the core habitat areas then aiming to link any surrounding habitat areas. For instance street trees or aquatic underpasses may be improved to achieve these linkages. The core habitat areas within the LGA and possible surrounding habitat linkages include:

Bardwell Valley Parklands is the core habitat area that links with another core habitat area outside the LGA known as Wolli Creek. These two areas are linked by surrounding habitat in Coolibah Reserve and Stotts Reserve. Possible surrounding linkages to these core areas are Bexley North Public School, Broadford Street Reserve, Bexley Park and several vegetation clumps on privately owned land.

Rockdale Wetlands Corridor is the core habitat area with Kogarah Golf Course, Cahill Park and Rockdale Park being the surrounding habitat areas that potentially link into the north section. Florence Street and Ramsgate Public school are potential surrounding habitat areas that could link Lady Robinsons Beach with Rockdale Wetlands Corridor. The streets to the south and running parallel with Russell Avenue in the southern section of the Rockdale Wetlands Corridor are a potential surrounding linkage area due to the occurrence of street trees.

Lady Robinsons Beach is the core habitat area with Alice Street and Florence Street linking it to the Rockdale Wetlands Corridor. Cook Park and the foredune system are surrounding linkages to this core area throughout the entire stretch of the coastline. Lady Robinsons Beach is particularly important as a terrestrial and aquatic linkage as it falls into the LGA and can be protected under one management plan.

Aquatic and terrestrial linkages vary regularly on a spatial and temporal scale due to impacts such as urban and industrial development. Developing and creating a boundary for a biodiversity linkage is a procedure that requires detailed decision making, the concepts involved with identifying the linkages needs to be carefully planned and assessed. The boundaries identified in Figures 4.1, 4.2 and 4.3 are interpreted predominantly from the assessment of vegetation cover from aerial photographs, hence these boundaries are ambiguous and subject to change.

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