

## **FORESHORE MANAGEMENT PLAN CYGNIA COVE ESTATE, WATERFORD**

Prepared for:

Trustees of the Christian Brothers  
in WA Incorporated  
Level 1  
189 Hay Street  
Subiaco WA 6008

Report Date: 17 July 2008  
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17 July 2008

Trustees of the Christian Brothers  
in WA Incorporated  
Level 1  
189 Hay Street  
Subiaco WA 6008

**Attention: David Gregg**

Dear David

**RE: Foreshore Management Plan  
Cygnia Cove Estate, Waterford**

Please find following a copy of the approved Foreshore Management Plan for the Cygnia Cove Estate, Waterford.

For and on behalf of Coffey Environments Pty Ltd



Paul Zuvela  
Manager Environmental Planning

## RECORD OF DISTRIBUTION

No. of copies	Report File Name	Report Status	Date	Prepared for:	Initials
1	ENVIPERT00210AA_Foreshore Management Plan_001_KL_V3	Version 3	16 July 2008	Richard Noble & Co	PZ
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## 1 INTRODUCTION

The Trustees of the Christian Brothers in WA Incorporated propose to develop their land at Clontarf for a residential subdivision to be known as Cygnia Cove Estate.

The development of Cygnia Cove has been planned as part of the Christian Brothers' strategy to generate funds for the on-going maintenance of the Clontarf Campus as well as other community services provided by the Christian Brothers in both Western Australia and South Australia.

ATA Environmental (now Coffey Environments) was commissioned by The Trustees of the Christian Brothers in WA Incorporated (proponent) to prepare a Foreshore Management Plan (FMP) for the proposed Cygnia Cove Estate residential subdivision to be built on land formerly known as East Clontarf. The FMP documents the biophysical environment including management measures and implementation of works for that section of the Clontarf foreshore adjacent to the development site.

The site is located approximately 8km southeast of the Perth Central Business District and is bound by the Canning River to the south, Manning Road to the north, Centenary Avenue to the east, and the Clontarf Campus to the west (Figure 1). The Clontarf foreshore is the City Of South Perth's south-eastern most foreshore on the northern bank of the Lower Canning River, downstream from the Shelley Bridge. The foreshore is located between Waterford Foreshore Reserve and the City of Canning's Centenary Park.

Under the Metropolitan Region Scheme (MRS) the Clontarf foreshore strip is reserved for Parks and Recreation as Regional Open Space, and is still in the ownership of the proponent. The Foreshore Reserve, as defined by the MRS, will be ceded to the Crown and vested in the City of South Perth as a condition of subdivision approval.

The existing Foreshore Reserve comprises a narrow linear wetland varying in width from 55m to 115m at the eastern end and comprises part of Bush Forever Site 333 (Canning River Foreshore, Salter Point to Wilson) and is linked to Bush Forever Site 227 (to the west) and 224 (to the east). The Reserve has an approximate 240m frontage onto the Canning River and contains a diversity of environments including remnant woodland, reed beds and salt marshes.

As part of the negotiations with the Appeals Convenor to gain environmental approval to develop the site, the proponent agreed to cede an additional 8,350m<sup>2</sup> of the development site to the Crown for purposes of amalgamation with the existing Foreshore Reserve (Figure 2). The proposed rehabilitation of the foreshore area to the west of the creekline will be included in a separate Wetland Management Plan and has therefore not been included in the development of this FMP.

The site has historically been used for farmland (grazing and market gardens), pine plantation and building infrastructure (City of South Perth, 1993). Much of the site's native vegetation was cleared pre-1948 and the farm paddocks created originally extended to the periphery of the wetlands with the swampy areas being fenced to prevent stock gaining access and becoming bogged in the mud. The Christian Brothers had little use for the foreshore because the adjacent land was sufficient for their farming needs, and the foreshore vegetation remained relatively undisturbed as bands of fringing forest, salt-marsh and sand ridges (Brooker *et al.*, 1993). More recently rubble in the form of brick fragments, concrete blocks, glass, ceramic tiles,

metal sheets, rods and asbestos cement sheeting fragments has been deposited as uncontrolled fill on the site, including the Foreshore Reserve area in order to raise the level of the land to form playing fields. The foreshore has also been significantly impacted upon through weed invasion.

The FMP provides a framework of management actions to rehabilitate the degraded riparian environment along the banks of the Canning River. Environmental attributes and conservation values of the Foreshore Reserve on the Canning River will be enhanced through the proposed rehabilitation works. The improvement of the degraded foreshore environment will enhance native vegetation linkages and habitat values.

The FMP also details effective interaction between the subdivision and the foreshore area, including educational awareness and ways of minimising impacts upon the natural environment along the foreshore.

## 1.2 Objectives

In January 2003 the proposed residential development of the site was referred to the Environmental Protection Authority (EPA), pursuant to section 38 (1) of the *Environmental Protection Act 1986*. It was determined that the potential environmental impacts arising from the proposal warranted further investigation and assessment was set at Public Environmental Review (PER). The PER prepared for the proposed development of the site was subsequently reviewed by the EPA (EPA Assessment No. 1467).

In the PER, the proponent committed to preparing and implementing a FMP for the section of the Foreshore Reserve adjacent to the site. The subsequent Ministerial Statement by the Minister for the Environment (Ministerial Statement No. 692 released in September 2005) included the table of Environmental Management Commitments for the residential development of the Cygna Cove site, Waterford including:

### **Proponent Commitment No.2: To prepare a Foreshore Management Plan**

**Objective:** To protect the conservation values identified for protection within the development adjacent to the Canning River foreshore. To mitigate proposed clearing within the development and enhance linkages and habitat value.

**Action:** To prepare and implement a Foreshore Management Plan (FMP) to the satisfaction of the Department for Planning and Infrastructure (DPI), Swan River Trust (SRT) and the City of South Perth (CoSP) which addresses:

- Comprehensive weed eradication program;
- Revegetating and restoring foreshore POS adjoining conservation areas with appropriate indigenous flora of the Canning River;
- Increasing the area contained within POS adjoining Bush Forever Site No. 333;
- Creation of habitat and wildlife corridors;
- Controlling vehicle and pedestrian access;
- Construction of a dog-proof fence along the existing Foreshore Reserve, if considered appropriate;
- Provision of public facilities;
- Soil and plant source material hygiene;
- Fire management including provision of fire hydrants;

- Provision of educational and interpretative materials within the area to raise awareness of Japan (China)/Australia Migratory Bird Agreement (JAMBA/CAMBA) species that frequent the area;
- Encouraging community involvement and awareness promoting control of pets (e.g. cats and dogs);
- Water conservation principles;
- Monitoring re-establishment of native and exotic plant species for a period of not less than three years followed by a review;
- Monitoring criteria to determine the success of the revegetation and weed eradication program;
- Progress and compliance reporting; and
- Timing and implementation schedule.

This FMP has been prepared to fulfil Proponent Commitment No. 2 of Ministerial Statement No. 692.

## **2 DESCRIPTION OF THE ENVIRONMENT**

### **2.1 Landform and Soils**

The Swan Coastal Plain extending from the Darling Scarp to the Indian Ocean was formed by wind and water action. The wind-formed dunes of eastern South Perth form part of the oldest dune system, the Bassendean Dune System. The aeolian deposits of the Bassendean are described as sand plains with low dunes and occasional swamps; iron or humus podsols and areas of complex steep dunes. The dunes have been leached and flattened over time resulting in soils with depleted nutrients. Erosional material from the Darling Scarp has been carried downstream by the river systems with the dune topography influencing their course. Meandering rivers over the plain have deposited fertile sediment loads forming alluvial clays, sand and loams (Pen, 1993).

The site contains two different landforms. The higher northern part of the site adjacent to Manning Road comprises a Bassendean dune formation which slopes down to the peat wetland on the flat plain lying adjacent to the alluvial soil along the river. A small sand dune exists to the south of the wetland near Centenary Avenue. The elevation also rises on the western boundary of the wetland near the Clontarf Campus.

### **2.2 Climate**

The Perth region is characterised by warm to hot, dry summers and cool, wet winters. The pattern is commonly referred to as a Mediterranean climate and is largely determined by two major global influences: the Southern Tropical Ridge and cold fronts generated in the Southern Ocean. Tropical monsoons can also affect the south-west climate with rainfall events that follow the incursion of warm, humid air during summer and autumn.

Metropolitan Perth's mean maximum temperature is 24.5°C with a minimum mean temperature of 12.8°C. The average annual rainfall for Perth is 773.7mm. The wettest period of the year is May to September, and prolonged dry periods are common (Bureau of Meteorology, 2006).

### **2.3 Surface Hydrology**

The main channel of the Canning River is approximately 80km in length and has a catchment area of 1,150km<sup>2</sup> draining a large part of the northern jarrah-marri forest where rainfall is between 1100 and 700mm annually, before passing down a small and increasingly urbanised valley to discharge onto the Swan Coastal Plain at Kelmscott. Thereafter it meanders across the Swan Coastal Plain through the southern metropolitan area of Perth. As it does it gathers water from a number of scarp tributaries, the largest of which is the Southern-Wungong River. The mouth of the Canning lies at Riverton, and upstream of the old Riverton Bridge it supports the relatively natural Canning River wetlands, which include the original delta islands. In this area Kent Street Weir separates the saline estuary from the upstream freshwater river (Pen, 1999).

At the site, the 1 in 100 year floodway level extends approximately 30m into the Foreshore Reserve. The flood fringe extends only a short distance further inland than the floodway. The proposed development area lies outside of the area affected

by the 1 in 100-year flood events. The surface hydrology of the Cygnia Cove site has been investigated by JDA Consultant Hydrologists (JDA). JDA (2004) reported that the development area receives surface drainage from several external catchments and estimates that the total upstream area draining into development area is approximately 35.4ha of which 33.9ha drains directly into the wetland and is then discharged to the Canning River via the outlet drain (creekline) constructed between the wetland and the river.

## **2.4 Native Vegetation**

### **2.4.1 Vegetation Complexes**

The flora of the Clontarf foreshore on the Canning River is part of the Darling District of the South-West Province and the Drummond sub-district dominated by *Casuarina-Banksia* low woodland with scattered Jarrah (Beard, 1981).

The vegetation of the Clontarf foreshore has been degraded by past land use and weed invasion. The existing vegetation consists of a tall open shrubland of *Casuarina obesa*, *Melaleuca raphiophylla* with scattered *Eucalyptus rudis* (Flooded gum) over *Juncus kraussii*, *Juncus pallidus* and *Schoenoplectus validus* (Lake club rush). These areas have been invaded by various weed species, in some cases dominating the understorey. These include *Pennisetum clandestinum* (Kikuyu), *Cynodon dactylon* (Couch), *Romulea rosea* (Guildford grass), *Oxalis pes-caprae* (Soursob), *Vicia sativa* (Vetch) and *Euphorbia terracina* (Geraldton Carnation Weed).

The sedgeland fringing the Canning River is dominated by *Juncus kraussii*, *Schoenoplectus validus*, and *Halosarcia halocnemoides* (Samphire), and is generally in good condition although it is being encroached by *Pennisetum clandestinum* (Kikuyu) in some areas.

The eastern section of the foreshore contains a unique salt marsh system with sand bar islands and contains a native grass (*Sporobolus virginicus*).

The eastern boundary of the Foreshore Reserve contains a low-lying area dominated by the introduced *Typha orientalis* (Bulrush). This area is fed by overland flow from a stormwater culvert located in the Centenary Avenue road reserve.

The remainder of the foreshore along the northern boundary, on the higher (uncontrolled fill) ground has been highly modified and is dominated by introduced grasses including *Cynodon dactylon* (Couch), *Ehrharta calycina* (Veldtgrass), *Eragrostis curvula* (Lovegrass), *Arundo donax* (Giant Reed), *Cortaderia selloana* (Pampas grass), *Chamaecytisus palmensis* (Tagasaste), *Agave americana* (Century Plant), *Chasmanthe floribunda* (Cornflag) and *Pelargonium capitatum* (Pelargonium). A few scattered native species remain including *Eucalyptus rudis* (Flooded gum), *Jacksonia furcellata* (Grey Stinkwood) and *Viminaria juncea* (Swishbush).

The location of vegetation types is shown on Figure 3.

### **2.4.2 Vegetation Assessment**

Several flora surveys of the site have been conducted between 2001 to 2003 for the purposes of the environmental assessment for the PER (ATA Environmental, 2003). The list of plant species identified on the Cygnia Cove site is presented in Appendix 1. Plant species identified in the Foreshore Reserve during the

August 2006 assessment for the foreshore management plan are highlighted on the plant list in Appendix 1.

A total of 69 plant species have been identified on the greater Cygnia Cove site of which 47 are introduced species. The flora comprises representatives from 25 families with the Papilionaceae (pea family) - 11 genera, Poaceae (grass family) - 11 genera, Asteraceae (daisy family) - eight genera, and Myrtaceae (eucalypt family) - seven genera, being the most common. The number of plant species is low for an area of this size but is consistent with the mostly degraded and cleared nature of the site.

A search was undertaken of the Department of Environment and Conservation's (DEC) Threatened (Declared Rare) and Priority Flora database (February 2000) and the Western Australian Herbarium Specimen database (February 2000) to identify any known populations of significant flora in the vicinity of Cygnia Cove.

No Declared Rare or Priority flora species were recorded on the site, including the Foreshore Reserve during the flora surveys.

### 2.4.3 Vegetation Condition

Vegetation condition was assessed using the Bush Forever Vegetation Condition Rating Scale as developed by Keighery (1994). This scale ranges from Pristine to Completely Degraded, as shown in Table 1. The condition of the vegetation in the Foreshore Reserve is mapped on Figure 4.

**TABLE 1**

**VEGETATION CONDITION RATING SCALE**

<b>Pristine</b> Pristine or nearly so, no obvious signs of disturbance.
<b>Excellent</b> Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
<b>Very Good</b> Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
<b>Good</b> Vegetation structure significantly altered by very obvious signs of multiple disturbance. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.

**Degraded**

Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management.

For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.

**Completely Degraded**

The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

#### 2.4.4 Vegetation Significance

Native vegetation is of significance for bank stability, water quality improvement and for provision of food and habitat to native wildlife.

Bush Forever (Government of Western Australia, 2000) identifies regionally significant vegetation for protection on the Swan Coastal Plain within the Perth Metropolitan area. The Foreshore Reserve vegetation has been included in Bush Forever Site No.333 "Canning River Foreshore, Salter Point to Wilson". The native vegetation on the remainder of the site has not been identified as a Bush Forever site.

Given the condition of the dryland native vegetation on the site it is not possible to assign any of these mapped vegetation types to a particular Floristic Community Type. Accordingly, the vegetation would not belong to any Threatened Ecological Communities (TEC) according to the Commonwealth list of Endangered Communities and the DEC's TEC database.

The mapped vegetation types in the foreshore area are consistent with Floristic Community Type 16, which is described as present at the site in Bush Forever documentation. This Floristic Community Type is described as "highly saline seasonal wetlands". This Community Type is not listed as a TEC either in the Commonwealth list of Endangered Communities or the DEC TEC database.

## 2.5 Vertebrate Fauna

### 2.5.1 Native Fauna

Information on the fauna of the Cygnia Cove site has been obtained through a series of site surveys undertaken at various times throughout the year in 2000 by ATA Environmental in association with Bamford Consulting Ecologists (ATA Environmental, 2003).

The list of fauna for the greater Cygnia Cove site, identifying species recorded for the Foreshore Reserve is presented in Appendix 2.

### 2.5.2 Faunal Assemblage

Surveys undertaken recorded 12 species of herpetofauna, 52 species of avifauna and four species of mammals occurring within the survey area, which included the entire development site and Foreshore Reserve area.

### 2.5.3 Herpetofauna

Of the 31 species of herpetofauna potentially occurring within the survey area (nine frog and 23 reptile species), six species of frogs, five reptiles and one tortoise were recorded. One of the species of frogs, the Banjo Frog (*Limnodynastes dorsalis*) was recorded only from nearby sites.

Frogs were recorded within portions of the wetland, drainage lines, in a highly disturbed pit or sand quarry on the site, and along the river foreshore. Within the wetland, records of frogs were curiously restricted to the western side nearest to the buildings of Clontarf, the drainage line extending to the river, and within the drain that passes under Centenary Avenue. Three species were recorded within the disturbed sand pit area south of the wetland towards the eastern side of the property. This sand pit and wheel ruts potentially provide ideal breeding habitat for the Moaning Frog (*Heleioporus eyrei*) and Quacking Frog (*Crinia georgiana*) although the latter species was not found on site.

The absence of *Litoria adelaidensis* (Slender Tree Frog), which was calling abundantly elsewhere around Perth during the survey, strongly suggests this species is not present, although the site appeared suitable. *Litoria moorei* (Motorbike Frog) was recorded only within the marsh areas adjacent to the river although the habitat within the wetland also appeared suitable for this species.

While 23 species of reptiles are thought to potentially occur within the survey area, only six species of reptile, *Chelodina oblonga* (Long-necked Tortoise), *Acriscincus trilineatus*, *Cryptoblepharus plagiocephalus* (Fence Skink), *Lerista elegans*, *Notechis scutatus* (Tiger Snake) and *Pseudonaja affinis* (Dugite) were recorded as present during the surveys. This was thought to be due to the disturbed and highly modified nature of the habitats present on-site. All of the species are typical of the habitats present at Cygnia Cove and often persist in modified areas.

### 2.5.4 Avifauna

Fifty-two bird species were recorded during the site survey (ATA Environmental 2003). Eighteen waterbird species were recorded on the river, while six wetland dependant species were observed or heard within the wetland area on the site. The observation of a pair of Pacific Black Ducks (*Anas superciliosus*) with nine ducklings may indicate the importance of this part of the river for the breeding of this and other waterbird species.

The wetland on the site provides habitat for three species of waterbirds, the Spotless Crake (*Porzana tabuensis*), Clamorous Reed-Warbler (*Acrocephalus stentoreus*) and Little Grassbird (*Megalurus gramineus*) which were not recorded along the river. The Spotless Crake was recorded in rushes of the wetland from calls only, so identification is tentative. One of the other small crakes, such as Baillon's Crake (*Porzana pusilla*), could possibly occur in the wetland.

The terrestrial species recorded are generally typical of the disturbed habitats and stands of mature eucalypts and other trees available on the site.

### 2.5.5 Feral Animals

No native mammals were recorded during the site survey. The survey revealed evidence (mainly of scats and tracks) that foxes (*Vulpes vulpes*), rabbits (*Oryctolagus cuniculus*), feral or semi-domestic cats (*Felis catus*) and at least one species of introduced rat (*Rattus rattus*) are likely to occur within the site.

Predation by cats and foxes is expected to have an impact on the abundance and species occurring at the site.

#### **Other**

The introduced Mosquito Fish (*Gambusia holbrooki*) is present within the wetland.

Gilgies (*Cherax quinquecarinatus*) also occur within the wetland, especially where it flows from the wetland to the river.

### 2.5.6 Significant Fauna

#### 2.5.6.1 Specially Protected and Priority Fauna

A search of DEC's database of Specially Protected and Priority Fauna species identified the following species as possibly occurring in the vicinity of Cygna Cove site, but not necessarily present at the site:

- **Short-billed Black-Cockatoo or Carnaby's Cockatoo - Schedule 1**

Schedule 1 designates fauna which are "rare or likely to become extinct". The Short-billed Black-Cockatoo or Carnaby's Cockatoo (*Calyptrorhynchus latirostris*) may be a seasonal visitor in the area using large eucalypts as roosting sites. Nomadic flocks of this species are relatively common throughout much of the Perth Metropolitan Region.

- **Peregrine Falcon - Schedule 4**

Schedule 4 designates fauna which are "otherwise specially protected" but are not considered to be rare or likely to become extinct. These are known as Specially Protected (Threatened) Fauna and are protected by the *Wildlife Conservation Act 1950*. The Peregrine Falcon (*Falco peregrinus*) may occur as a vagrant in the area mostly in flooded gum woodlands along the Canning River. The species is fairly common in certain habitats in the Perth Metropolitan Region and even occurs in the Central Business District.

- **Southern Brown Bandicoot or Quenda - Priority 4**

Species listed as Priority Fauna do not have any special protection afforded them and are in need of monitoring. Priority 4 species are defined by DEC as

“taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change”. The Southern Brown Bandicoot or Quenda (*Isodon obesulus fusciventer*) has been recorded nearby in Wilson and may be present on the site, but this is thought to be unlikely. This species typically prefers low dense vegetation without too much water. Due to the disturbed nature of the site and the presence of foxes it is unlikely that populations of the Quenda persist at the site. This species may however colonise the area periodically from other habitats that adjoin the river in nearby localities provided continuous access is available along the river.

In addition, the Water Rat (*Hydromys chrysogaster*) could occur along sections of the river and may occasionally access the site. No evidence of this species was recorded during the site surveys, however the species may move along the river foreshore area and colonise the section of the Canning River adjoining Cygnia Cove.

#### **2.5.6.2 Other Significant Fauna**

The list of bird species recorded during the surveys included four species identified as category 3 or 4 Significant Birds on the Swan Coastal Plain in the Perth metropolitan area in Bush Forever (Government of WA, 2000). Category 3 species are considered to be habitat specialists with reduced distribution on the Swan Coastal Plain and at the site include *Biziura lobata* (Musk Duck), *Anas rhynchos* (Australasian Shoveller) and *Malurus splendens* (Splendid Fairy-Wren). Category 4 species are wide-ranging species with reduced populations on the Swan Coastal Plain, and in this category *Accipiter cirrhocephalus* (Collared Sparrow Hawk) was recorded at the site. The City of South Perth has also advised that the Category 4 species the New Holland Honeyeater (*Phylidonyris novaehollandiae*) has been recorded at the site, although it was not recorded during on-site surveys conducted by Mike Bamford in 2000.

Siemon (2000) noted that the mudflats to the west of the site are frequently exposed and provide a feeding ground for wading birds thereby supporting a greater diversity of species than along other parts of the Canning River. The waders can be divided into two groups: trans-equatorial migrants including species such as the Grey Plover (*Pluvialis squatarola*) and Greenshank (*Tringa nebularia*) and Australian resident species such as the Red-capped Plover (*Charadrius ruficapillus*) and Black-winged Stilt (*Himantopus himantopus*).

Thirteen of the significant bird species that have been recorded as either being on-site during surveying or possibly occurring on-site are waterbirds that would primarily use the riverine habitat and potentially the wetland habitat. Seven of the species are birds of prey that may hunt at the site or adjacent river and/or opportunistically perch in the trees. The remainder could occur within the shrubs and trees of the upland and fringing wetland/riverine areas.

In order to protect species of migratory birds in danger of extinction that migrate between Australia and Japan, and Australia and China, the governments of these countries have signed agreements to take special measures to protect them, their eggs and their habitat (Japan Australia Migratory Bird Agreement (JAMBA) and the China Australia Migratory Bird Agreement (CAMBA)).

The list of Significant Bird species recorded, expected, or potentially present at the Cygnia Cove site is shown in Table 2. The Common Greenshank (*Tringa nebularia*) and the Common Sandpiper (*Tringa hypoleucos*) have previously been recorded in Bush Forever Site No. 333 "Canning River Foreshore, Salter Point to Wilson" (which incorporates the foreshore area adjacent to the proposed development), are identified in Table 2 as Category 2 birds protected under the JAMBA/CAMBA Agreements.

**TABLE 2**

**SITE FINDINGS OF SIGNIFICANT BIRDS OF THE SWAN COASTAL PLAIN**

SCIENTIFIC NAME	COMMON NAME	SIGNIFICANCE	STATUS
<b>Order: ANSERIFORMES</b>			
Family: ANATIDAE			
<i>Oxyura australis</i>	Blue Billed Duck	3	expected
<i>Biziura lobata</i>	Musk Duck	3	recorded
<i>Anas rhynchotis</i>	Australasian Shoveler	3	recorded
<i>Malacorhynchus membranaceus</i>	Pink-eared Duck	3	may be present
<i>Aythya australis</i>	Hardhead	3	may be present
<b>Order: CICONIIFORMES</b>			
Family: ARDEIDAE			
<i>Nycticorax caledonicus</i>	Rufous Night Heron	4	expected
<i>Ardea Alba</i>	Great Egret	2	may be present
<b>Order: FALCONIFORMES</b>			
Family: ACCIPITRIDAE			
<i>Haliastur sphenurus</i>	Whistling Kite	4	expected
<i>Accipiter fasciatus</i>	Brown Goshawk	4	expected
<i>Aquila morphnoides</i>	Little Eagle	4	may be present
<i>Aquila audax</i>	Wedge-Tailed Eagle	4	may be present
<i>Accipiter cirrhocephalus</i>	Collared Sparrow Hawk	4	recorded
Family: FALCONIDAE			
<i>Falco berigora</i>	Brown Falcon	4	expected
<i>Falco peregrinus</i>	Peregrine Falcon	1, schedule 4	may be present
<b>Order: GRUIFORMES</b>			
Family: RALLIDAE			
<i>Gallinula tenebrosa</i>	Dusky Moorhen	3	may be present
<b>Order: CHARADIFORMES</b>			
Family: SCOLOPACIDAE			

SCIENTIFIC NAME	COMMON NAME	SIGNIFICANCE	STATUS
<i>Tringa nebularia</i>	Common Greenshank	2	recorded
<i>Tringa glareola</i>	Wood Sandpiper	2	expected
<i>Tringa hypoleucos</i>	Common Sandpiper	2	recorded
Family: LARIDAE			
<i>Sterna bergii</i>	Crested Tern	2	may be present
Family: CHARADRIIDAE			
<i>Pluvialis squatarola</i>	Grey Plover	2	may be present
<b>Order: PSITTACIFORMES</b>			
Family: PSITTACIDAE			
<i>Calyptorhynchus latirostris</i>	Carnaby's Cockatoo	Schedule 1, 4	expected
<b>Order: PASSERIFORMES</b>			
Family: MALURIDAE			
<i>Malurus splendens</i>	Splendid Fairy-Wren	3	recorded
Family: MELIPHAGIDAE			
<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater	4	Recorded by City of South Perth.
<i>Phylidonyris nigra</i>	White-cheeked Honeyeater	4	expected
<i>Anthochaera lunulata</i>	Little Wattlebird	4	expected
Family: ARTAMIDAE			
<i>Artamus cinereus</i>	Black-faced Woodswallow	4	expected

\* Source: Government of Western Australia (2000)

Note:

Significant Bird Species:

1 = species listed under the *Wildlife Conservation Act 1950*

2 = species listed on the JAMBA/CAMBA agreements

3 = habitat specialists with a reduced distribution on the Swan Coastal Plain

4 = wide-ranging species with reduced populations on the Swan Coastal Plain locally extinct.

Schedule 1 = fauna which are rare or likely to become extinct

Schedule 4 = specially protected (threatened) fauna

### 3 ENVIRONMENTAL IMPACTS AND MANAGEMENT ISSUES

#### 3.1 Rehabilitation of Riparian Vegetation

All of the foreshore vegetation adjacent to the Canning River and contained within the Bush Forever Site No. 333 will be protected and an additional 8,350m<sup>2</sup> of POS that will adjoin the Bush Forever Site will be effectively added to the Foreshore Reserve and will act as a buffer between the proposed residential development and the Bush Forever Site (Figure 2).

Fringing vegetation plays an important role in the maintenance of a biologically balanced and healthy waterway. It provides a wide range of functions that are essential for supporting plant and animal life and for maintaining the quality of the environment, including: flood control, shoreline stability, sediment, nutrient and pollutant filtering as well as providing food, shelter and breeding habitat for a wide range of organisms.

The condition of the vegetation in the Foreshore Reserve ranges from Degraded to Excellent (see Figure 4). Native vegetation along the foreshore of the Canning River requires protection from disturbance. Public access to the Foreshore Reserve will be restricted through the construction of a limestone retention wall/batter and dog-proof fence to delineate the subdivision from the Foreshore Reserve. The subdivision will also be separated from the Foreshore Reserve by a road, road reserve, and dual use path.

In accordance with Ministerial Condition 8 and Proponent Commitment 6 (Ministerial Statement No. 692), a Site Remediation and Validation Plan has been prepared for the whole Cygna Cove Estate site (Coffey Environments, 2008). This Management Plan identifies areas containing uncontrolled fill that extend into the extension of the Foreshore Reserve (see Figure 5).

All contaminated soil will be removed from the extended portion of the Foreshore Reserve and clean soil brought in prior to any rehabilitation works commencing. Any excavation should be undertaken in the dry season where practicable. Excavation is expected to be up to approximately 1m in depth, however this may vary depending on the extent of uncontrolled fill. The excavated areas will be backfilled to existing ground levels with clean fill which is free from dieback (and other soil pathogens) and then revegetated with native species of local provenance.

Under Schedule 6 Exemptions of the *Environmental Protection Act 1986*, Clause No. 2 a clearing permit is not required for the site. This exemption applies to clearing of a site that has been formally assessed as part of a proposal under section 38 of Part IV of the Act (refer to section 1.2). However where native vegetation is to be retained on-site, it will be clearly flagged prior to the commencement of remedial works. Some stands of Tree Lucerne (an introduced species) in the proposed extended foreshore area may be cleared where remedial works are required. Where excavation is not required, existing stands of Tree Lucerne will be retained as requested by the Department for Planning and Infrastructure in their correspondence to Coffey Environments (dated 21 June 2007).

The rehabilitation of the riparian zone will involve restoring the capacity of the native vegetation to regenerate. Weed control is necessary for long-term sustainability of

the riparian system and the recovery of native vegetation function. There will be clearing of woody weed species and the control of grass and herbaceous weeds prior to revegetation of the area.

### Management Recommendations

**M1** Undertake remediation and validation of areas of uncontrolled fill prior to foreshore rehabilitation commencing. Remove all rubbish from the Foreshore Reserve.

#### 3.1.1 Rehabilitation Zones

Due to the variability of vegetation condition and the complexity of the potential removal of uncontrolled fill in some sections, the Foreshore Reserve has been divided into four rehabilitation zones (FSR1, FSR2, FSR3 and FSR4) requiring weed eradication and revegetation (Figure 6).

These rehabilitation zones vary in:

- The local native plant species and density that will be used for revegetation;
- The intensiveness of weed control required; and
- Potential areas for the removal of uncontrolled fill prior to soil infilling and revegetation.

The rehabilitation zone descriptions are:

**FSR 1:** This zone incorporates the lowland area adjacent to the river not including the salt marsh zone with samphire and native *Sporobolus* grass (*Sporobolus virginicus*) on the eastern end of the foreshore, or the stream revegetation area adjacent to the outflow of the constructed wetland. The area requires the identification and protection of all native species, particularly the native *Sporobolus* grass. A small portion of FSR 1 may be required to be excavated to remove areas of uncontrolled fill. The excavation of uncontrolled fill will provide an opportunity to widen the vegetated buffer of lowland species in this zone as well as the removal of weed species, including the small *Typha* infestation. Particular care should be taken near the creekline and the salt marsh area to the east to avoid adverse impacts of any excavation. Weed control and replanting will be undertaken in degraded areas (refer to Table 4).

**FSR 2:** This zone represents the higher landward side of the proposed extended Foreshore Reserve. This area is dominated by exotic grasses and other weeds with scattered *Eucalyptus rudis* (Flooded gum). Some scattered woodland trees such as *Corymbia calophylla* (Marri) and *Banksia* species will be planted in this zone (refer to Table 5).

**FSR 3:** This zone consists of the area of Samphire salt flats at the western side of the foreshore reserve. This zone will be revegetated with *Halosarcia halocnemoides* (Samphire) at a density of 500cts, using an estimated total of 7,300 cuttings.

**FSR 4:** This zone consists of the areas adjacent to the outflow of the constructed wetland. This zone will be revegetated with *Juncus pallidus*, the Pale Rush, at a density of 500cts, using an estimated total of 1,440 tubestock plants.

### 3.1.2 Weed Management

Weed invasion in the Foreshore Reserve is a major issue requiring careful planning. Due to the disturbed nature of much of the foreshore at Cygnia Cove the weeds, such as exotic grasses will be a constant management problem. A weed control program is proposed with resources focused towards eradicating the introduced species that have the greatest potential to invade other areas and compete with native species.

Successful weed control is the single most important aspect of site preparation with the aim to provide weed-free conditions adjacent to trees, shrubs, sedges and groundcovers for the first year and preferably longer. On-going weed control will be required along the foreshore to ensure the success of the revegetation program.

Chemical control of weeds on waterways requires careful consideration. Issues that must be considered prior to any type of chemical control include the effects of the herbicides on native flora and fauna and water quality. Most weeds can be controlled by regular spot-spraying or removal by hand. This can be done periodically over several years. Care should be taken not to spray over open water or disturb the natural vegetation unnecessarily as this will encourage further weed invasion. Care will be taken when removing weeds to not increase soil erosion and avoid the introduction of weeds during the construction phase. Herbicide application will be in accordance with the recommendations contained in 'Herbicide Use in Wetlands' – Water Note WN22 (Water and Rivers Commission, 2001).

The stands of Tree Lucerne (*Chamaecytisus palmensis*) scattered along the Foreshore Reserve provide local habitat for the New Holland Honeyeater. The stands of Tree Lucerne will be retained on-site where excavation for remedial works is not required to be undertaken.

### 3.1.3 Weed Control Implementation

Weed control will be necessary on much of the landward side of the Foreshore Reserve, although the extent will be dependent on the proposed excavation to remove uncontrolled fill from the area.

The narrow strip of fringing sedgeland vegetation dominated by *Juncus kraussii* with scattered *Melaleuca raphiophylla* and *Casuarina obesa* is in good condition and should be left to regenerate naturally. Where exotic grasses dominate, spot-spraying will be undertaken prior to revegetation commencing. Many woody and herbaceous weeds are also present and will require control to avoid them spreading throughout the area. A list of the weed species found in the Foreshore Reserve is provided in Appendix 1.

Prior to planting, which is anticipated to commence prior to autumn rains in 2008, the foreshore area and riparian vegetation will require application of herbicide to kill existing weeds and germinants resulting from the anticipated rainfall during May and June. In order to give the revegetation a better chance to become established when it is planted, two weed control treatments will be undertaken prior to revegetation. Given the location of the site in close proximity to a watercourse, the recommended herbicide is Glyphosate Bi-Active. Herbicide use should be in accordance with the recommendations contained in 'Herbicide Use in Wetlands' – Water Note WN22 (Water and Rivers Commission, 2001).

Weed growth will be monitored on a bi-monthly basis (every two months) after rehabilitation has commenced and appropriate control methods will be implemented as necessary. The requirement and frequency for weed growth monitoring will be assessed after the initial 12 months following planting and a revised program established for the following 24 months based on the experience over the previous year.

A full list of weed species recorded in the proposed Foreshore Reserve can be found in Appendix 1. The appropriate methods to eradicate and control major weed species found within the foreshore area are outlined in Table 3. The use of fire as a management tool to control weeds is not recommended due to its effects in favouring weeds over native vegetation.

The most up to date information regarding herbicides and application rates should be sought from the Department of Agriculture and Food Western Australia and Environmental Weeds Action Network prior to implementing weed control programs.

**TABLE 3**  
**CONTROL METHODS FOR WEED SPECIES**

WEED SPECIES	METHOD	NOTES
Kikuyu ( <i>Pennisetum clandestinum</i> )	1,2,3	<ul style="list-style-type: none"> <li>• Rake and roll out from other vegetation with as little digging and remove as much as possible.</li> <li>• 100mL Glyphosate Bi-active (450g/L) with 25mL Pulse in 10L water – hand spray after moving/slashing when actively growing.</li> <li>• Several applications may be necessary</li> </ul>
Couch ( <i>Cynodon dactylon</i> )	3,4	<ul style="list-style-type: none"> <li>• 100mL Glyphosate Bi-active (450g/L) with 25mL Pulse in 10L water – hand spray late spring to autumn.</li> <li>• Several applications may be necessary.</li> <li>• Care must be taken to differentiate between this and native <i>Sporobolus</i> grasses</li> </ul>
Giant reed ( <i>Arundo donax</i> )	1,2,3	<ul style="list-style-type: none"> <li>• Cut down and spray re-growth when 0.5-1m high, thoroughly wetting foliage.</li> <li>• Use Glyphosate Bi-active, 100mL in 10L of water.</li> <li>• Repeat application may be necessary.</li> </ul>
Bulrush ( <i>Typha orientalis</i> )	1,2,3	<ul style="list-style-type: none"> <li>• Remove flowers and seed source.</li> <li>• Cut below waterline at flowering in late spring.</li> <li>• Repeated cutting in summer will kill plants</li> <li>• Remove cut material.</li> <li>• For the area where the detention storage area is proposed, will be physically removed using construction equipment available on-site.</li> </ul>
Brazilian Pepper Tree ( <i>Schinus terebinthifolius</i> )	1,2	<ul style="list-style-type: none"> <li>• Cut down the tree and immediately paint freshly cut surface with Glyphosate Bi-active, or try Velpar of Garlon.</li> <li>• Follow-up treatment is essential.</li> <li>• Check the seedlings yearly and remove.</li> </ul>
Century Plant ( <i>Agave</i> )	1	<ul style="list-style-type: none"> <li>• Spear the centre of the plant with a crowbar and pour in neat Glyphosate Bi-active when plant is actively growing.</li> </ul>

WEED SPECIES	METHOD	NOTES
<i>americana</i> )		
Pampas Grass ( <i>Cortaderia selloana</i> )	1, 2, 3	<ul style="list-style-type: none"> <li>Remove flower plumes and destroy</li> <li>Cut down as low to ground as possible - remove</li> <li>Apply Glyphosate Bi-active with wick applicator to new growth in late spring - summer</li> </ul>
Guildford Grass ( <i>Romulea rosea</i> )	1, 3	<ul style="list-style-type: none"> <li>Remove small infestations by hand</li> <li>Spot spray infestations with Glyphosate Bi-active just prior to flowering</li> </ul>
Soursob ( <i>Oxalis pes-caprae</i> )	1, 3	<ul style="list-style-type: none"> <li>Remove small infestations by hand</li> <li>Spot spraying with Glyphosate Bi-active late July to early September when actively growing</li> </ul>
Vetch ( <i>Vicia sativa</i> )	1, 3	<ul style="list-style-type: none"> <li>Remove small infestations by hand-pulling in winter before flowering</li> <li>Spot spraying with Glyphosate Bi-active</li> </ul>
Geraldton Carnation Weed ( <i>Euphorbia terracina</i> )	1, 3	<ul style="list-style-type: none"> <li>Hand remove</li> <li>Spot spray using spray seed 200</li> </ul>
Veldtgrass ( <i>Ehrhata calycina</i> )	3, 4	<ul style="list-style-type: none"> <li>Remove small infestations by hand – cut roots as close to culms as possible with small knife</li> <li>Spot spray larger infestations with Glyphosate Bi-active through winter to spring prior to flowering</li> </ul>
African Lovegrass ( <i>Eragrostis curvula</i> )	3	<ul style="list-style-type: none"> <li>Spot spray new growth with Glyphosate Bi-active in summer months before seed set.</li> </ul>
Cornflag ( <i>Chasmanthe floribunda</i> )	1, 3	<ul style="list-style-type: none"> <li>Hand weed small populations using a Peter lever.</li> <li>Spot spray with 100g 2,2-DPA (740g/L) plus 25mL wetting agent in 10L water at flowering time.</li> <li>Use a sponge glove with 1L Glyphosate Bi-Active (450g/L) plus 2L water for sensitive areas</li> </ul>
Pelargonium ( <i>Pelargonium capitatum</i> )	3	<ul style="list-style-type: none"> <li>Pull plants in autumn / winter</li> <li>20mL 2,4-D amine (500g/L) plus 25mL wetting agent in 10L water</li> </ul>

Sources: Moore, J and Wheeler, J (2002), and Scheltema, M. and Harris, J. (1995).

Note:

Method of Control:

1. Hand weeding, pulling, digging
2. Herbicide wipe, stem injection, cut stump
3. Spot spraying
4. Blanket spraying

### Management Recommendations

- M2** Use best practise management to avoid introducing weeds during construction activities.
- M3** Herbicides used in close proximity to the river will be suitable for application in wetland and riparian environments.
- M4** Two weed control treatments will be undertaken prior to revegetation commencing.
- M5** Implement a weed control program that prioritises control of weeds in the rehabilitation zones, using weed control methods prescribed in Table 3.
- M6** Monitor weed growth on a bi-monthly basis after rehabilitation has commenced.
- M7** Based on weed monitoring results, implement appropriate weed control methods as necessary.
- M8** Retain the stands of Tree Lucerne (*Chamaecytisus palmensis*) in areas of the Foreshore Reserve where remediation work is not required to provide habitat for the New Holland Honeyeater.

#### 3.1.4 Flora and Revegetation

The foreshore area is limited in terms of existing species diversity in some sections due to degradation from past landuse and weed invasion, as well as the nature of estuarine environments. Only species known to occur over other parts of the river foreshore will be used in revegetation works. All existing stands of native vegetation need to be protected from any construction activities on the adjoining areas.

Planting using seedlings is the preferred technique for embankment revegetation where direct seeding is difficult and where there is excessive weed competition. Planting will be undertaken in spring/summer along the lower embankment (sedgeland vegetation) and in autumn on the higher ground in the foreshore. Shrubby Samphire (*Halosarcia halocnemoides*) can be established by dispersing mature fruiting segments onto lightly tilled soil prior to the first autumn rains. Fruiting segments are green in colour and should be harvested in late summer.

After the removal of any contaminated soil/rubble in the Foreshore Reserve, weed control and subsequent revegetation can be undertaken. Each of the zones proposed for revegetation require all levels of the stratum to be restored including tress, shrubs, sedges and groundcovers, where present.

The revegetation techniques proposed for the foreshore area include:

- Ideally, dryland seedlings will be planted in late autumn to early winter to take advantage of the following winter rainfall to reduce water use; estuarine and wetland species may be planted up until early spring;
- Seedlings will only be sourced from NIASA accredited nurseries that provide greenstock grown in soil that is certified weed and dieback free so that additional weed species are not introduced to the foreshore;
- No fertilisers will be used at the time of planting;
- Care will be taken to ensure dryland plants in FSR 2 are randomly placed to achieve a natural effect;

- Plants in the riparian zones (FSR 1 and FSR 4) will be planted more homogenously to imitate natural patterns; and
- Spacing of seedlings will be in accordance to Tables 4 and 5, and as described.

The zones FSR 1 and FSR 4 will be focusing on rehabilitating and reinstating the fringing wetland vegetation, particularly the shrub and sedge/rush understorey. FSR 2 will involve the re-establishment of the woodland species including trees, shrubs and groundcovers. Overstorey species will be planted in clumps. FSR 3 will consist of infill Samphire plantings.

Tables 4 and 5 list the suite of species recommended for planting in the rehabilitation zones FSR 1 and FSR 2 and individual densities for planting. These species have been selected on the basis that they are local native species already growing at the site or occurring in similar habitats within the Canning River environment.

**TABLE 4**

**RECOMMENDED SPECIES AND PLANTING DENSITIES FOR FSR 1**

Scientific name	Common name	Form	Height	Planting	Density	Estimated number
<i>Juncus kraussii</i>	Shore rush	Rush	1.2	Tubestock	575cts	2320
<i>Ficinia nodosa</i>	Knotted clubrush	Rush		Tubestock	575cts	2320
<i>Banksia littoralis</i>	Swamp Banksia	Tree	10	45Lt-100Lt bag	As shown	3
<i>Banksia grandis</i>	Bull Banksia	Tree	8	45Lt-100Lt bag	As shown	3
<i>Corymbia calophylla</i>	Marri	Tree	35	45Lt-100Lt bag	As shown	3
<i>Eucalyptus rudis</i>	Flooded gum	Tree	15	45Lt-100Lt bag	As shown	3
<i>Melaleuca rhaphiophylla</i>	Swamp paperbark	Tree	8	45Lt-100Lt bag	As shown	3

**TABLE 5**

**RECOMMENDED SPECIES AND PLANTING DENSITIES FOR FSR 2**

Scientific name	Common name	Form	Height	Planting	Density	Estimated number
<i>Acacia saligna</i>	Coojong	Shrub	6	Tubestock	575cts	880
<i>Acacia pulchella</i>	Prickly Moses	Shrub	2	Tubestock	575cts	880
<i>Hypocalymma angustifolium</i>	White myrtle	Shrub	1	Tubestock	575cts	880
<i>Hardenbergia comptoniana</i>	Native wisteria	Creeper	0.5	Tubestock	575cts	880
<i>Jacksonia furcellata</i>	Grey stinkwood	Shrub	4	Tubestock	575cts	880
<i>Banksia littoralis</i>	Swamp Banksia	Tree	10	45Lt-100Lt bag	As shown	5
<i>Banksia grandis</i>	Bull Banksia	Tree	8	45Lt-100Lt bag	As shown	5
<i>Corymbia calophylla</i>	Marri	Tree	35	45Lt-100Lt bag	As shown	8
<i>Eucalyptus rudis</i>	Flooded gum	Tree	15	45Lt-100Lt bag	As shown	8
<i>Melaleuca raphiophylla</i>	Swamp paperbark	Tree	8	45Lt-100Lt bag	As shown	8

**Management Recommendations**

- M9** Native vegetation to be retained will need to be clearly flagged/marked before any weed control measures or other activities commence.
- M10** Use existing degraded or disturbed areas for provision of access to undertake any activities.
- M11** Rehabilitate zones identified in Figure 6 through planting using the species and densities recommended in Tables 4 and 5, and as described.
- M12** Establish local native shrubs adjacent to the pathway and limestone wall to prevent divergence from paths, but still retaining viewing opportunities of the river.

### 3.1.5 Native Vertebrate Fauna

Management of native fauna within the Foreshore Reserve should focus on maintaining and improving habitat and refuge for native fauna. Through the implementation of weed control measures and the revegetation using local native species, the foreshore environment will be enhanced improving the biodiversity and habitat values of the riparian environment.

Public access within the Foreshore Reserve will be prevented to minimise disturbance to fauna and fauna habitat. The fringing sedgeland along the river and the area of salt marsh on the eastern end of the Foreshore Reserve will be protected to enable fauna to roost and feed. Following remediation earthworks within the Foreshore Reserve, timber poles or branches will be installed along the river edge in degraded areas for safe roosting places for waterbirds, away from the residential area.

The protection of habitats and native fauna can be achieved through:

- Minimising any native vegetation clearing;
- Controlling human access;
- Implementation of weed control and revegetation;
- Increasing community awareness/education of the habitat values of the foreshore area;
- Ensuring appropriate fire management measures are in place; and
- Using best practice dieback prevention measures.

Management of fauna in the Foreshore Reserve area is focused on maintaining and improving habitat and refuge for fauna. By minimising loss and alteration of the habitats, the local populations may be able to be sustained and be more resilient to the effects of predation or disturbance.

The implementation of weed control measures and revegetation with local species will improve the habitat for fauna. In particular, the progressive removal of weeds from sections of the foreshore margins and establishment of sedges will provide habitat that is presently limited along this section of the Canning River.

Interpretative signage will be used to inform visitors of species of fauna occurring along the foreshore and the river and their habitats. In particular, signage and interpretative information installed will raise awareness of the potential occurrence of the following JAMBA/CAMBA species that are known to frequent the general Canning River area:

- Great Egret (*Egretta alba*);
- Crested Tern (*Sterna bergii*);
- Grey Plover (*Pluvialis squatarola*);
- Common Greenshank (*Tringa nebularia*);
- Wood Sandpiper (*T. glareola*); and
- Common Sandpiper (*T. hypoleucos*).

Based on surveys undertaken in 1993, several introduced mammal species are known or are expected to presently occur within the area and may increase following development of the site (City of South Perth, 1993). Domestic and feral cats (*Felis catus*) and foxes (*Vulpes vulpes*) are known to predate on native fauna and dogs are known to also disturb and kill native fauna. These species could have a significant impact on the local native fauna.

In relation to the significance of the habitats of Cygnia Cove to fauna, the main observations or findings of the vertebrate fauna surveys are as follows:

- The sheltered cove of the adjacent Canning River is important for a range of waterbirds. This is probably due to several factors, but the outflow of freshwater from the site may attract Black Swans, Musk Ducks, and other species that need to drink freshwater regularly, to the location.
- The small area of salt marsh on the river foreshore together with the other largely well vegetated sections of foreshore is attractive to a range of fauna. The foreshore forms an important part of a largely continuous riparian habitat for fauna moving along the Canning River (such as Water Rats, Southern Brown Bandicoots and various birds).
- Flowering of fringing vegetation including introduced Tree Lucerne supports permanent and transient populations of nectar-feeding birds that utilise the area (ATA Environmental, 2003).

### **Management Recommendations**

- M13** Interpretative signage will be installed to educate residents of the importance of the fringing riparian vegetation and the fauna species inhabiting or frequenting the foreshore area, particularly Japan/China and Australia Migratory Bird Agreement (JAMBA/CAMBA) species of migratory bird.
- M14** Restrict public access to the Foreshore Reserve, particularly the fringing sedgeland along the river and the salt marsh area on the eastern boundary.
- M15** Maintain and enhance linkages supporting native vegetation with adjoining areas of riverine foreshore including the proposed constructed wetland adjacent to the river and the POS along the creekline and with the remnant Marri trees in the northeast.
- M16** Provide timber poles or branches in degraded areas along the river edge for safe roosting places for waterbirds away from the residential area.

### **3.1.6 Fauna/Wildlife Corridors**

The weed control measures and revegetation works proposed in this management plan will improve the existing degraded environment by widening the buffer of native vegetation along the Canning River foreshore. The Foreshore Reserve vegetation on the site is part of Bush Forever Site No.333 (Canning River Foreshore, Salter Point to Wilson). The foreshore is linked to Bush Forever Site No 227 (to the west) and 224 (to the east). Access to the Foreshore Reserve will be controlled with the public having no direct access to the river through the Foreshore Reserve. The controlled access and the construction of a dog-proof fence will ensure minimal disturbance to fauna.

### **Management Recommendations**

- M17** Install a 1.5m high dog-proof fence along the top of the proposed limestone wall/batter on the northern boundary of the Foreshore Reserve to protect wildlife.

### 3.1.7 Feral/Domestic Animals

The fauna surveys previously undertaken (ATA Environmental, 2000), revealed evidence (mainly of scats and tracks) that foxes (*Vulpes vulpes*), rabbits (*Oryctolagus cuniculus*), feral or semi-domestic cats (*Felis catus*) and at least one species of introduced rat (*Rattus rattus*) are likely to occur within the site. Predation by cats and foxes is expected to have an impact on the abundance and species occurring in the Foreshore Reserve.

Rabbits have the potential to hinder revegetation efforts. The total removal of rabbits from the area is probably not feasible, however their potential impact on the vegetation and habitats will be controlled through the use of tree guards and brush to protect regenerating vegetation and weed control measures. Targeted baiting will also be undertaken to reduce rabbit populations.

In regard to controlling pets, community involvement and awareness promoting control of pets such as cats and dogs is an important aspect of managing predation by introduced species. Dogs will be prevented from accessing the Foreshore Reserve with a dog-proof fence to be installed along the top of the limestone wall/batter on the northern boundary of the Reserve. Dogs should also be prohibited from other POS areas unless on a lead on a walk trail, while owners of cats should be encouraged to keep them in at night, and preferably at all times.

#### Management Recommendations

- M18** Use tree guards/stakes and brush in the rehabilitation zones to prevent rabbits from eating seedlings.
- M19** Undertake a targeted baiting program to reduce rabbit numbers.
- M20** Install signs indicating that dogs are only to be walked on designated paths, and restricted to being on leash.
- M21** Provide educational material on the impact of pets such as cats and dogs on native fauna in the natural environment in the land sales office.
- M22** Permit dog ownership by residents in accordance with the *Local Government Dog Act 1976*.

### 3.2 Construction Impacts and Contaminated Soil Management

To ensure that construction activities associated with the proposed development do not extend into the Foreshore Reserve, the limit of development will be clearly delineated with stakes and flagging tape prior to and during each working activity on the site. Any machinery to be used in the area needs to use the cleared, degraded areas for access where practicable. The potential for contamination of the Canning River during the general site works and during the wetland construction activities will be managed through a Construction Environmental Management Plan (CEMP).

The CEMP will address detailed remediation assessment of contaminated soils, acid sulphate soil management and construction noise and dust management plans. The CEMP will minimise direct and indirect impacts associated with the construction of the residential development and surrounds on fauna, surface and groundwater quality and quantity, and local residents. All contaminated soil, including uncontrolled

fill previously deposited in the extended portion of the Foreshore Reserve will be removed off-site and replaced with clean fill as prescribed in Section 3.1.

The existing stand of Marri trees located to the northeast of the Foreshore Reserve will be retained in Public Open Space and linked to the dual use path that will border the Foreshore Reserve. The interface between the development area and the POS Foreshore Reserve will be defined by terraced limestone walls and a dual use path/road.

### Management Recommendations

**M23** All native vegetation to be retained in the existing Foreshore Reserve will be protected using appropriate method such as flagging prior to construction activities commencing.

**M24** Machinery to be used in the area should use the cleared, degraded areas wherever practicable.

### 3.3 Soil and Plant Material Hygiene

Dieback is a deadly plant disease that has the ability to significantly affect bushland areas. The disease is caused by the introduced pathogen *Phytophthora cinnamomi*. In sloping areas, *Phytophthora* dieback spreads quickly when its microscopic spores move downwards in surface and sub-surface water flows. It spreads slower up-slope and on flat ground (approximately one metre per year) because it is restricted to movement by root to root contact. However, human activity can cause the most significant, rapid and widespread distribution of this pathogen. Bush restoration projects can also inadvertently spread the pathogen through the inadvertent use of infected plant stock and importation of infested soil.

Dieback management in the Foreshore Reserve should include, but not be limited to the following:

- Scheduling activities that involve soil disturbance during low rainfall months (November to March) when the soil is dry;
- Minimising any tracks through the foreshore area;
- Vehicles, tools, equipment and machinery should be free of all mud and soil when entering the foreshore area;
- Introducing soil, gravel or sand into the foreshore area that is free of *Phytophthora* dieback or purchased from a soil supplier with Nursery Industry accreditation;
- Purchasing plants from nurseries with Nursery Industry accreditation;
- Using only mulch that has been well composted;
- Restricting pedestrian access into the foreshore area to avoid any spread of dieback; and
- Observing susceptible plants and noting any deaths. Administer phosphite treatment to dieback susceptible species if plant deaths occur in the general area.

## Management Recommendations

- M25** Any use of machinery should be avoided in the Foreshore Reserve, however if required (such as to excavate uncontrolled fill) the contractors will need to clean vehicles and equipment (and boots) before entering the foreshore area.
- M26** Plants of local provenance to be sourced from dieback- and weed-free accredited nurseries.

### 3.4 Fire Management

A Preliminary Fire Management report has been prepared to assess the proposed development and in particular the proposed management of the public open space areas (Thompson McRobert Edgeloe, 2008).

The report specifically examines the potential fire hazard and fire management principles including fuel loadings, hazard separation, building protection zones, boundary treatment for public open space, water supply, site access and adjoining land uses.

The report notes that river foreshore is estimated to have an approximate area of 2 ha with an average width of between 50m and 60m. The rehabilitation of the river foreshore will create a bushland environment, with the associated fire risk, in close to proximity to residences. Over time fuel in this area will naturally increase, which will also increase the fire risk.

In a semi-rural environment bushland reserves would still be expected to have a perimeter bare earth firebreak which is usually 3m wide.

The level of fire risk emanating from the foreshore conservation area will be directly related to:

1. The density of the vegetation, especially the lower and middle story species;
2. The slope of the site; and
3. The distance from residences.

It is assumed that the foreshore conservation area is likely to contain trees at a density where the foliage coverage is less than 30% of the site and contain tall shrubs up to 10m high where the foliage cover is greater than 30%. With a site slope of less than 10 degrees (20%) a separation distance of 40m would normally be recommended between the conservation area and any dwellings. This separation distance can include the 12m wide road reserve and the 6m building setback on the lots.

The above distance is based upon the foreshore conservation area having a width of 100m. As it only has a width of approximately 50m there is an argument to reduce the separation distance. However the larger the separation distance, the safer any dwellings will be. In this instance it is necessary to balance community safety with conservation and design objectives.

The separation distance should not be reduced to less than 20m as this equates to the normal distance required for the building protection zone. The effectiveness of this would also be enhanced by "tapering" the planting density on the fringe of the conservation area to reduce the fuel loadings.

### Management Recommendations

- M27** A hazard separation zone be provided between the foreshore conservation area and the boundary of the adjoining allotments. This should be a minimum of distance of 20m and can include the road reserve and dual use path. The hazard separation zone should be maintained in a low fuel state.
- M28** The rehabilitation of the fringe zone of the foreshore conservation area should be tapered with reduced planting densities to provide a graduated fuel loading decreasing towards the boundary.
- M29** All lots within the estate and all parts of each lot must be situated within 120m of a fire hydrant in accordance with the Water Corporation's design specifications. This should also include the adjoining area of POS where the lots are backing onto it.
- M30** Any fire hydrants located in landscaped areas must be protected to ensure that the landscaping does not obscure the location of the hydrants (i.e. by ground mulches, low shrubs etc). This also applies to the road verges within the subdivision and private landowners must not obstruct the visibility of hydrant locations.
- M31** Where lots are backing onto or fronting areas of POS, the dual use path system must be capable of providing access for emergency vehicles.

### 3.5 Stormwater Management

The development of the site will generate stormwater from hard surfaces such as roads and paths. The treatment of this stormwater has been designed to comply with the requirement of the Statement of Planning Policy No. 2 i.e. to 'maximise the consumption and retention of stormwater drainage on site' (Western Australian Planning Commission, 2003) and the Swan River Trust policy SRT/DE4 – Stormwater Disposal (Swan River Trust, 1999).

Stormwater generated from a portion of the proposed development will be collected in a detention storage area to be constructed in the south-eastern area of the POS adjacent to the BBQ and playground facilities.

A secondary objective of the detention storage area will be to act as a detention area for stormwater in which nutrients and other pollutants are concentrated. The resultant batters of the basin will be at a maximum slope of 1 in 6. One-year Average Recurrence Interval (ARI) events will be infiltrated, consistent with the (then) DoE/SRT (2005).

Stormwater will enter the detention storage area from an outlet designed in consultation with the City of South Perth. The bank and base of the detention storage area will be reinforced with limestone at the outlet point/s to prevent scouring and erosion should overflow occur.

Freshwater flows supporting flora and fauna will be maintained at pre-development levels. Half of the water discharged from the existing wetland will be diverted into the constructed wetland and the balance will be discharged to the Canning River via the existing drainage channel. Peak flows will be diverted down the drainage line, thereby by-passing the constructed wetland. This will result in no net impact to flows.

Further details on stormwater and nutrient management within the development are provided in the Drainage, Nutrient, Irrigation and Water Quality Management Plan that has been prepared for the site as a requirement of Ministerial Condition No.7. (Coffey Environments, 2007).

The amount of grassed landscaping requiring fertiliser application has been kept to a minimum within the development. Residential lot sizes will limit the amount of garden and lawn areas on each lot. In addition new residents will receive an information package that promotes water-wise gardens to reduce water and nutrient application.

### **Management Recommendation**

**M32** Residents to be given educational information in regard to water-wise gardening, minimising nutrient application and promotion of the unique fringing habitat of the Canning River upon purchase.

### **3.6 Monitoring Revegetation**

It is an important objective of any rehabilitation works to monitor and evaluate changes at the site to keep track of the results of the process. Photographs are a convenient method of recording landscape change over time, as they can reveal a great deal about growth rates of plants and the effectiveness of weed control and give an overall impression of the success or otherwise of the project's activities. They are an effective management tool and require no specialist equipment.

Several permanent quadrats will be established in the Foreshore Reserve to monitor the success rate of weed control measures and revegetation. The location of the quadrats will be marked through the installation of star pickets or by using an existing feature such as a tree as a marker. GPS coordinates will be taken of each of the quadrats to ensure that the same locations are monitored at every sampling period.

Monitoring of each quadrat will be undertaken on a six-monthly basis. Photographic evidence will be provided with the date and identification number clearly shown on the quadrat (Hussey, 2002).

Plantings that fail will need to be replaced on a yearly basis to give the best chance of success for the revegetation works. In the case where plants have not necessarily failed, but plantings have not been successful enough to provide a good level of coverage, further infill plantings will need to take place.

### **Management Recommendation**

**M33** A monitoring program using permanent sampling quadrats will be implemented to monitor the progress of revegetation and weed control plans. Monitoring will be undertaken on a six-monthly basis.

**M34** Failed plants will be replaced on a yearly basis.

**M35** Further infill plantings will be undertaken if coverage is not adequately achieved

### **3.7 Recreation Management**

#### **3.7.1 Access Requirements**

Pedestrian access to the Foreshore Reserve will be restricted to protect the ecological integrity of the foreshore. There is no path system proposed to go through the foreshore area. Some access, however, will be required to enable the rehabilitation works, maintenance and fire fighting. This access will be from the proposed designated dual-use path system on the northern side of the Foreshore Reserve. Stair access into the Foreshore Reserve will be provided at regular intervals to permit access by maintenance staff. However, no ramp will be constructed as vehicular access will not be permitted in the Foreshore Reserve.

Refer to Appendix 3 and 4 showing the Landscape Concept Plan and Sections prepared by Plan E Landscape Architect Consultants.

#### **3.7.2 Dual Use Pathways**

The objective of retaining and enhancing the existing native vegetation within the Foreshore Reserve will be assisted by controlling access to designated paths. A dual use path (DUP) will be constructed between the residential area and the Foreshore Reserve and built within the road reserve. The DUP will enable residents and visitors the opportunity to view and appreciate the river foreshore environment. The proposed location of the DUP is shown in Appendix 3. The interface between the development area and the Foreshore Reserve will be defined by terraced limestone walls. The proposed fence will provide a barrier to the movement of people beyond the proposed access path.

To ensure the construction activities associated with the proposed development are minimised, the limit of development will be clearly delineated with stakes and highly visible flagging tape prior to and during earth working activities on the site.

#### **3.7.3 Facilities**

Viewing areas will be provided from the proposed dual use path/boardwalk above the limestone wall delineating the boundary of the Foreshore Reserve. The path will provide good viewing opportunities to appreciate the natural fringing riparian environment of the Canning River. Seating will be provided along the dual use pathway.

BBQ facilities and a playground will be located in the eastern area adjoining the POS adjacent to the Foreshore Reserve as shown in Appendix 3 and 4. This POS contains a stand of remnant Marri trees and it is considered to be an appropriate location for an informal picnic area.

#### **Management Recommendations**

**M36** Provide occasional seating along the dual use pathway for the public to rest and appreciate the amenity of the foreshore environment.

#### **3.7.4 Interpretation and Education**

Public awareness of the value of the Foreshore Reserve's environment along the Canning River should be promoted to the residents and the general public using the

path system. Management issues affecting the Foreshore Reserve need to be promoted through signage and educational pamphlets. Signage information will include:

- Directional information e.g. to indicate location of paths, facilities and points of interest;
- Interpretative information e.g. explanation of the natural environment, exclusion areas; and
- Public safety information e.g. warnings in areas where potential hazards are known.

Directional signs will be located at entry points into the dual-use pathway system from adjoining properties and the residential area. They will identify the locations of facilities such as the BBQ and playground. Interpretative signs will be used to inform residents and the general public of the importance of the foreshore area in providing habitat for native fauna species. Reference will be given to the unique fauna utilising the foreshore, particularly the JAMBA/CAMBA bird species listed in Table 2.

Signage should be clearly visible but should not detract from the aesthetic appeal of the viewing areas. Directional and interpretative signs may consist of painted waist high posts with sturdy, metal plaques. Public safety signs will be clearly visible and may need to be taller and of more notable design. It is important for a uniform style to be developed for the signage in the area prior to signage fabrication and installation.

There will be a number of interpretative signs installed along the length of the pathway/boardwalk each identify a particular plant, mammal, reptile or bird species and providing information regarding its behaviour, habits and where it is likely to be observed.

New residents will receive an information package that promotes water-wise gardens to reduce water and nutrient application.

### **Management Recommendations**

- M37** Develop a uniform style for proposed signage that complements the environment.
- M38** Install directional, interpretative and public safety signage along the pathway system on the northern side of the Foreshore Reserve. Interpretative signage should include information on the revegetation and weed control works as well as education on local wildlife including the migratory birds listed under the JAMBA/CAMBA agreement.
- M39** Residents to be provided with educational information in regard to water-wise gardening, minimising nutrient application and promotion of the unique fringing habitat of the Canning River upon purchase.
- M40** Provide interpretative promotion of the unique fringing habitat of the Canning River in the land sales office, as well as information relating to the regional significance of the Bush Forever site.

## **4 IMPLEMENTATION**

### **4.1 Progress and compliance reporting**

The developer will be responsible for the implementation of the management measures presented in this management plan, including the ongoing management, maintenance and monitoring to the satisfaction of the City of South Perth, Swan River Trust and the Department for Planning and Infrastructure's Bush Forever Office for a period of at least three years.

The removal of contaminated soil off-site will commence when the CEMP is approved by relevant regulatory authorities. The proposed rehabilitation work may then be able to commence at the earliest in winter-spring 2008. The weed and revegetation management will be monitored for a period of not less than three years followed by a review of the findings of the monitoring.

### **4.2 Prioritisation, Timing and Estimated Costing of Management Proposals**

Table 6 details the timing of, and responsibility for the proposed management recommendations for the Foreshore Reserve.

Monitoring the success of the management recommendations proposed in Table 6 is essential for the purposes of review and updating the management plan by the various stakeholder groups in two years time. Monitoring and performance criteria will ensure that the objectives of the management plan are achieved while also being flexible to incorporating any changes or community values into the management plan. Details of monitoring and performance criteria can be found in Section 4.3, following Table 6.

**TABLE 6**  
**MANAGEMENT RECOMMENDATIONS AND PRIORITIES FOR IMPLEMENTATION**

ISSUES		RECOMMENDATIONS	TIMING	RESPONSIBILITY
<b>Rehabilitation of Site</b>	<b>M1</b>	Undertake remediation and validation of areas of uncontrolled fill and remove all rubbish from the Foreshore Reserve.	Prior to foreshore rehabilitation commencing	Proponent
<b>Weed Management</b>	<b>M2</b>	Use best practise management to avoid introducing weeds during construction activities.	Ongoing	Proponent
	<b>M3</b>	Herbicides used in close proximity to the river will be suitable for application in wetland and riparian environments.	Ongoing	Proponent for 3 years City of South Perth (CoSP) thereafter
	<b>M4</b>	Two weed control treatments will be undertaken prior to revegetation commencing.	Prior to revegetation	Proponent
	<b>M5</b>	Implement a weed control program that prioritises control of weeds in the rehabilitation zones, using weed control methods prescribed in Table 3.  Monitor weed growth on a bi-monthly basis after rehabilitation has commenced.	Within 2 years  Ongoing	Proponent

ISSUES		RECOMMENDATIONS	TIMING	RESPONSIBILITY
	<b>M6</b>	Based on weed monitoring results, implement appropriate weed control methods as necessary.	Ongoing	Proponent for 3 years CoSP thereafter
	<b>M7</b>	Retain the stands of Tree Lucerne ( <i>Chamaecytisus palmensis</i> ) in areas of the Foreshore Reserve where remediation work is not required to provide habitat for the New Holland Honeyeater.	Dependant on establishment rate of revegetation	Proponent for 3 years CoSP thereafter
	<b>M8</b>			Proponent
<b>Revegetation</b>	<b>M9</b>	Native vegetation to be retained will be clearly flagged/marked before any weed control measures or other activities commence.	Immediately	Proponent
	<b>M10</b>	Use existing degraded or disturbed areas where practicable for provision of access to undertake any activities.	Ongoing	Proponent
	<b>M11</b>	Rehabilitate zones identified in Figure 6 through planting using the species and densities recommended in Tables 4 and 5, and as described.	Within 2 years	Proponent
	<b>M12</b>	Establish local native shrubs adjacent to the pathway and limestone wall to prevent divergence from paths, but still retaining viewing opportunities of the river.	Within 2 years	Proponent

ISSUES		RECOMMENDATIONS	TIMING	RESPONSIBILITY
<b>Native Vertebrate Fauna</b>	<b>M13</b>	Interpretative signage to be installed to educate residents of the importance of the fringing riparian vegetation and the fauna species in the foreshore, particularly Japan/China and Australia Migratory Bird Agreement (JAMBA/CAMBA) species of migratory bird.	Within 3 years	Proponent
	<b>M14</b>	Restrict public access to the Foreshore Reserve, particularly the fringing sedgeland along the river and the salt marsh area on the eastern boundary.	Within 1 year	Proponent
	<b>M15</b>	Maintain and enhance linkages supporting native vegetation with adjoining areas of riverine foreshore including the proposed constructed wetland adjacent to the river and the POS along the creekline and with the remnant Marri trees in the northeast.	Within 3 years	Proponent
	<b>M16</b>	Provide timber poles or branches in degraded areas along the river edge for safe roosting places for waterbirds away from the residential area.	Within 3 years	Proponent
<b>Feral/domestic animals</b>	<b>M17</b>	Install a 1.5m high dog-proof fence along the top of the proposed limestone wall/batter on the northern boundary of the Foreshore Reserve in an effort to protect wildlife.	Within 1 year	Proponent
	<b>M18</b>	Use tree guards/stakes and brush in the rehabilitation zones to prevent rabbits from eating seedlings.	Ongoing	Proponent

ISSUES		RECOMMENDATIONS	TIMING	RESPONSIBILITY
	<b>M19</b>	Undertake a targeted baiting program to reduce rabbit numbers.	Ongoing for 3 years	Proponent
	<b>M20</b>	Install signs indicating that dogs are only to be walked on designated paths, and restricted to being on leash.	Within 1 year	Proponent
	<b>M21</b>	Provide educational material on the impact of pets such as cats and dogs on native fauna in the natural environment in the land sales office.	From outset	Proponent
	<b>M22</b>	Permit dog ownership by residents in accordance with the <i>Local Government Dog Act 1976</i> .	Ongoing	City of South Perth
<b>Construction Impacts and Soil Contamination Management</b>	<b>M23</b>	All native vegetation to be retained in the existing Foreshore Reserve will be protected using appropriate method such as flagging prior to construction activities commencing.	Prior to construction commencing	Proponent
	<b>M24</b>	Machinery to be used in the area should use the cleared, degraded areas wherever practicable.	Ongoing	Proponent
<b>Soil and Plant Material</b>	<b>M25</b>	Any use of machinery should be avoided in the Foreshore Reserve, however if required (such as to excavate uncontrolled fill) the contractors will need to clean vehicles and equipment (and	Ongoing	Proponent

ISSUES		RECOMMENDATIONS	TIMING	RESPONSIBILITY
Hygiene		boots) before entering the foreshore area.		
	M26	Plants of local provenance to be sourced from dieback- and weed-free accredited nurseries.	Ongoing	Proponent
Fire Management	M27	A hazard separation zone be provided between the foreshore conservation area and the boundary of the adjoining allotments. This should be a minimum of distance of 20 metres and can include the road reserve and dual use path. The hazard separation zone should be maintained in a low fuel state.	Within 2 years	Proponent
	M28	The rehabilitation of the fringe zone of the foreshore conservation area should be tapered with reduced planting densities to provide a graduated fuel loading decreasing towards the boundary.		
	M29	All lots within the estate and all parts of each lot must be situated within 120m of a fire hydrant in accordance with the Water Corporation's design specifications. This should also include the adjoining area of POS where the lots are backing onto it.		
	M30	Any fire hydrants located in landscaped areas must be protected to ensure that the landscaping does not obscure the location of the hydrants (ie by ground mulches, low shrubs etc). This also applies to the road verges within the subdivision and private landowners must not obstruct the visibility of hydrant locations.		

ISSUES		RECOMMENDATIONS	TIMING	RESPONSIBILITY
	<b>M31</b>	Where lots are backing onto or fronting areas of POS, the dual use path system must be capable of providing access for emergency vehicles.		
<b>Stormwater Management</b>	<b>M32</b>	Residents to be given educational information in regard to water-wise gardening, minimising nutrient application and promotion of the unique fringing habitat of the Canning River upon purchase.	Ongoing	Proponent
<b>Monitoring Revegetation</b>	<b>M33</b>	A monitoring program using permanent sampling quadrats will be implemented to monitor the progress of revegetation and weed control plans. Monitoring will be undertaken on a six-monthly basis.	Ongoing for 3 years	Proponent
	<b>M34</b>	Failed plants will be replaced on a yearly basis.	Ongoing for 3 years	Proponent
	<b>M35</b>	Further infill plantings will be undertaken if coverage is not adequately achieved.	Within 3 years	Proponent
<b>Facilities</b>	<b>M36</b>	Provide occasional seating along the dual use pathway for the public to rest and appreciate the foreshore environment.	Within 2 years	Proponent

ISSUES		RECOMMENDATIONS	TIMING	RESPONSIBILITY
<b>Interpretation and Public Education</b>	<b>M37</b>	Develop a uniform style for the signage that complements the environment.	Prior to signage being installed	Proponent
	<b>M38</b> (inc. M13)	Install directional, interpretative and public safety signage along the pathway system on the northern side of the Foreshore Reserve. Interpretative signage should include information on the revegetation and weed control works as well as education on local wildlife including the migratory birds listed under the JAMBA/CAMBA Agreement.	Within 1 year	Proponent
	<b>M39</b>	Residents to be provided with educational information in regard to water-wise gardening, minimising nutrient application and promotion of the unique fringing habitat of the Canning River.	Ongoing	Proponent
	<b>M40</b>	Provide interpretative promotion of the unique fringing habitat of the Canning River in the land sales office, as well as information relating to the regional significance of the Bush Forever site.	Ongoing	Proponent

### 4.3 Monitoring, Completion Criteria and Reporting

The implementation of management strategies detailed in this Plan will be an on-going process, which should be flexible in responding to changes in the natural environment and the recreational use of the environment. Monitoring procedures will assist in the adaptive management of the foreshore, as well as informing the progress of management. The program of monitoring the success of the strategies is essential for the purposes of reviewing and updating the Plan. This will ensure that the objectives of the Plan are achieved and that any changes or new developments in management techniques can be incorporated.

#### 4.3.1 Performance Monitoring

The proponent will implement monitoring procedures to assess the success of management strategies addressing rehabilitation works and weed control during the three year management period. This will allow the identification of area requiring augmentation or remedial works to be identified early and appropriately planned. In addition, the monitoring will ensure that an adequate representation of species and plant diversity is achieved.

#### 4.3.2 Rehabilitation Completion Criteria and Reporting

Prior to the City of South Perth accepting responsibility for the management of the Foreshore Reserve, it will need to be demonstrated that the completion criteria for the rehabilitation works have been achieved. The completion criteria for the Foreshore Management Plan are:

- 80% survival of stated plant numbers within each zone;
- A maximum of three invasive weeds per m<sup>2</sup> with a maximum of 5% cover excluding *Typha orientalis*;
- No bulbous, noxious (such as Pampas Grass) or woody weeds and rhizomatous grass species in the foreshore area;
- Removal of *Typha orientalis* from the eastern portion of the Foreshore Reserve. It should be noted that it may not be possible to remove all *Typha orientalis* from the drainage line in the western portion of the Foreshore Reserve due to the extent of the *Typha orientalis* infestation upstream and continued off-site stormwater inputs which may carry *Typha orientalis* seeds.
- Fencing and other infrastructure maintained in good condition; and
- Completion of all other commitments as specified in the Foreshore Management Plan to the satisfaction of the City of South Perth.

An annual progress report detailing rehabilitation work undertaken will be submitted to the City of South Perth, the Swan River Trust, and the DPI's Bush Forever office. Assuming a commencement of works in winter 2008 the reporting periods will be July 2008 - June 2009, July 2009 - June 2010, and July 2010 – June 2011. Should the commencement of works be delayed, these reporting periods will be adjusted accordingly.

The first annual report will include species and numbers of plants planted in the Foreshore Reserve to facilitate future monitoring requirements.

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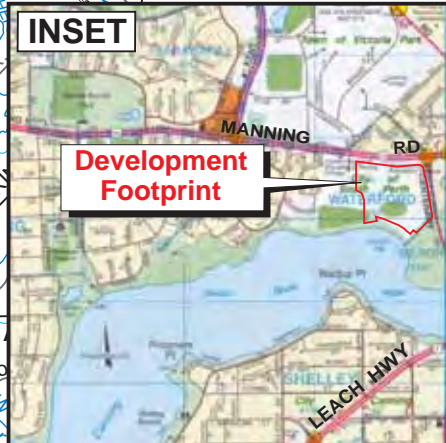
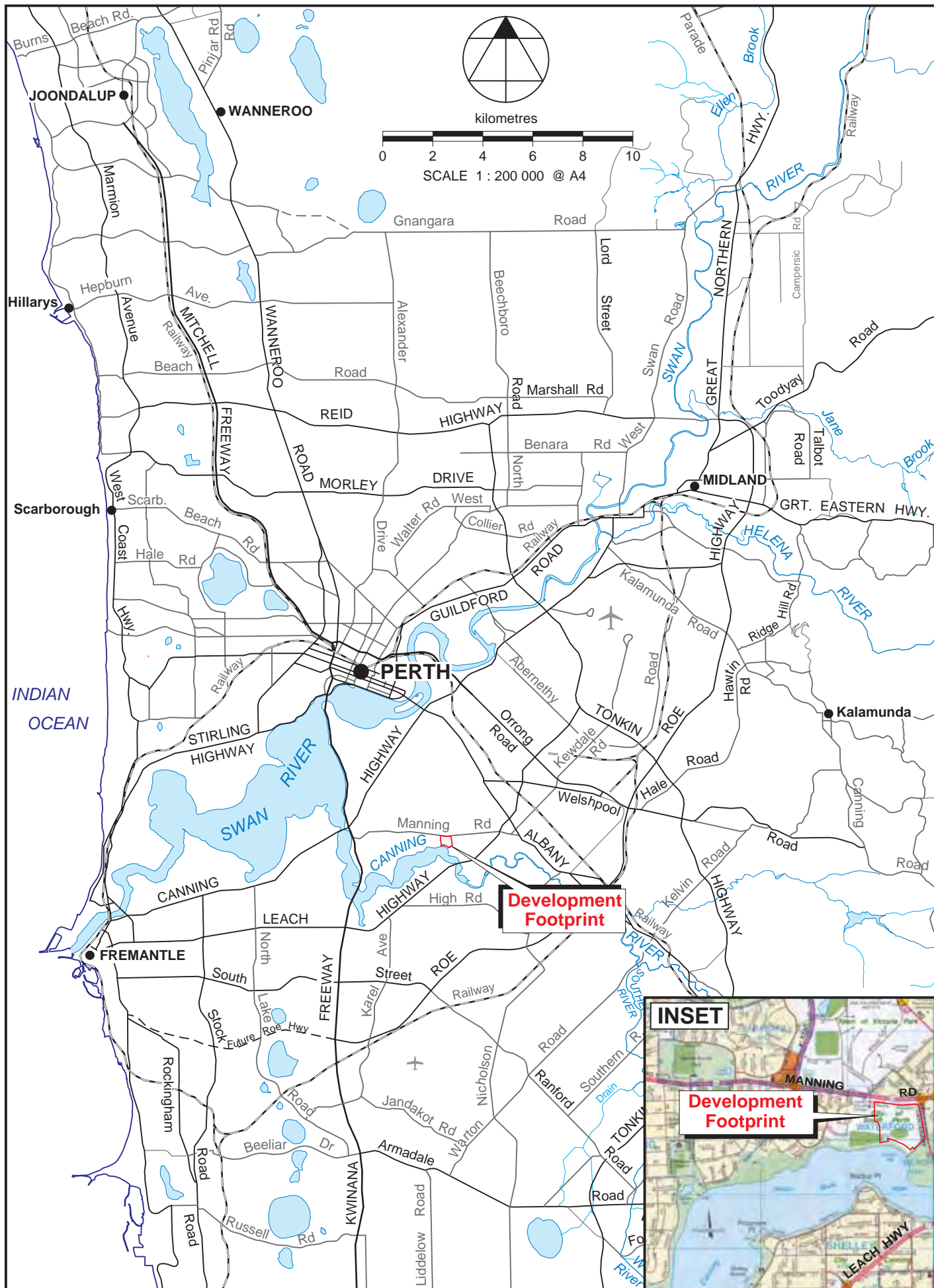
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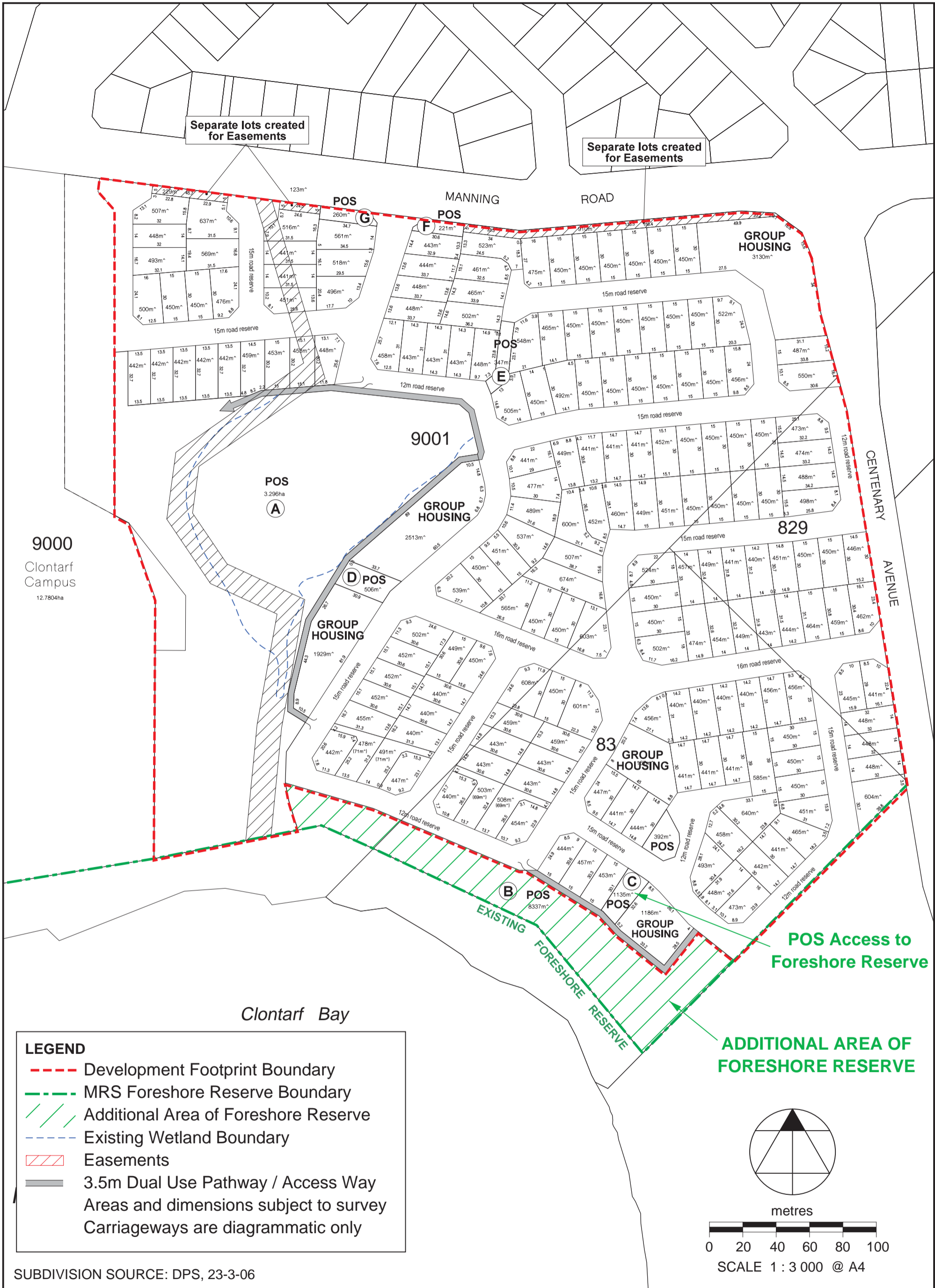
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# Figures

**Foreshore Management Plan  
Cygnia Cove Estate, Waterford**



FORESHORE MANAGEMENT PLAN  
CYGNIA COVE, WATERFORD  
**REGIONAL LOCATION**  
FIGURE 1



SUBDIVISION SOURCE: DPS, 23-3-06

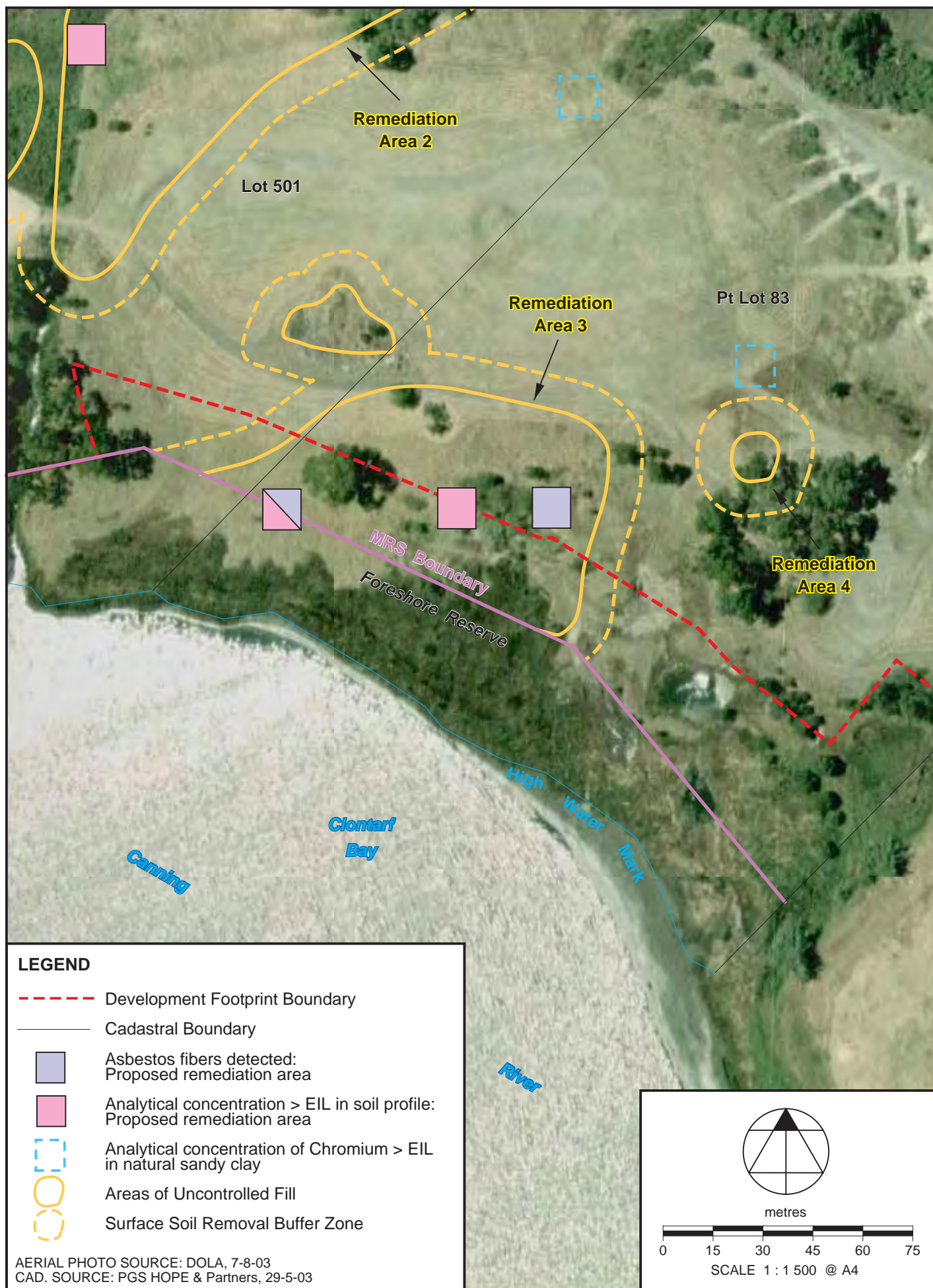




**LEGEND**

- Development Footprint Boundary
- Parks & Recreation Boundary in the MRS
- Limit of Management Plan Area along Foreshore
- Cadastral Boundary
- Vegetation Condition Boundary

SOURCES: AERIAL PHOTO: DOLA, 7-8-03 ; CADASTRE: DOLA, 2000 ; FOOTPRINT: DPS, 9-5-06



**PLANTING ZONE LEGEND**
**EXISTING WETLAND**

-  Bushucker Gardens
-  Dry Revegetation
-  Lower Embankment  
Re-vegetation/ submerged

**CONSTRUCTED WETLAND**

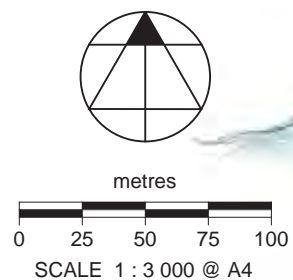
-  Dry Revegetation
-  UWS Upper Embankment  
Revegetation
-  GWS Lower Embankment Infill
-  GWS Lower Embankment  
Revegetation/ submerged

**FORESHORE RESERVE**

-  FSR1 Foreshore Infill
-  FSR2 Woodland Vegetation
-  FSR3 Sphagnum Revegetation
-  FSR4 Stream Revegetation

**STREETSCAPE**

-  SS1 Median Strip Planting
-  SS2 Verges Planting



SOURCE: PLAN E, Job No. 02132-01, October 2007 Rev E

Appendix A  
Native Species and Weeds Recorded at  
the Cygnia Cove Site and Proposed  
Foreshore Reserve

**Foreshore Management Plan  
Cygnia Cove Estate, Waterford**

**APPENDIX A**  
**EAST CLONTARF FLORA LIST**

**FERNS**

DENNSTAEDTIACEAE  
*Pteridium esculentum* #

**MONOCOTYLEDONS**

ARACEAE  
\**Zantedeschia aethiopica*

CYPERACEAE  
*Baumea articulata* #  
*Isolepis cernua*  
*Bolboschoenus caldwellii*  
*Lepidosperma longitudinale*  
*Schoenopletus validus* #

IRIDACEAE  
\**Chasmanthe floribunda* #  
\**Homeria flaccida*

JUNCAEAE  
*Juncus pallidus* #  
*Juncus kraussii* #

SCHEUZERIACEAE  
*Triglochin mucronata*

POACEAE  
\**Avena fatua* #  
\**Arundo donax* #  
\**Briza maxima* #  
\**Cortaderia selloana* #  
\**Cynodon dactylon* #  
\**Ehrharta calycina* #  
\**Eragrostis curvula* #  
\**Lolium perenne* #  
\**Poa annua*

\**Sporobolus virginicus* #

\**Pennisetum clandestinum* #

**DICOTYLEDONS**

ASTERACEAE  
\**Arctotheca calendula* #  
\**Conyza bonariensis* #  
*Cotula coronopifolia*  
\**Hypochaeris glabra*  
\**Hypochaeris radicata*  
\**Sonchus oleraceus*  
*Senecio lautus* ssp. *maritimus*  
\**Ursinia anthemoides*

BRASSICACEAE  
\**Raphanus raphanistrum*  
\**Rorippa nasturtium - aquaticum*

CHENOPODIACEAE  
*Enchylaena tomentosa* #  
*Halosarcia halocnemoides* #  
\**Rumex acetosella*

CASUARINACEAE  
*Casuarina obesa* #

EUPHORBIACEAE  
\**Euphorbia terracina* #

FUMARIACEAE  
\**Fumaria capreolata*

GERANIACEAE  
\**Pelargonium capitatum* #  
\**Erodium moschatum* #

LYTHRACEAE

RESTIONACEAE	*Lythrum sp.
Leptocarpus diffusus	MIMOSACEAE
	Acacia stenoptera
	Acacia saligna#
TYPHACEAE	
*Typha orientalis	MENYANTHACEAE
	Villarsia albiflora
MYRTACEAE	
Astartea fascicularis	OROBANCHACEAE
Corymbia calophylla	*Orobanche minor
*Eucalyptus citriodora	OXALIDACEAE
*Eucalyptus camaldulensis	*Oxalis pes-caprae #
*Eucalyptus robusta	PAPILIONACEAE
Eucalyptus rudis#	Jacksonia furcellata#
Melaleuca raphiophylla #	*Cytissus proliferus
	*Lotus sp.
POLYPOGONACEAE	*Lupinus cosentinii#
*Persicaria decipiens	*Lupinus mutabilis
*Polypogon sp.	
	*Medicago polymorpha#
SOLANACEAE	*Trifolium arvense
*Solanum nigrum	*Trifolium campestre
*Solanum americanum	*Trifolium glomeratum
	*Vicia sativa#
	Viminaria juncea #

- weed species
- # species recorded within the Foreshore Reserve

Appendix B  
Fauna Species Recorded or Expected to  
Occur at Cygnia Cove Site

**Foreshore Management Plan  
Cygnia Cove Estate, Waterford**

## VERTEBRATE FAUNA RECORDED OR EXPECTED TO OCCUR

For the purposes of this species list, the East Clontarf site is considered to include the freshwater wetland, upland areas around the wetland, and the adjacent river and foreshore. The habitat and fauna with all these areas would potentially be affected by development of the site.

Species were recorded on the site during:

- May (08 May 2000 and 16 May 2000)
- August (21 August 2000)
- October (31 October 2000)
- December (21 December 2000)

### KEY:

- ✓: Species recorded at the site
- \*: Species expected on the site
- +: Species that may be present

Species present during a particular survey date are indicated as

- R: On the river
- U: In upland habitats
- W: Within the wetlands

- “nearby” species recorded nearby but not on the site
- “report” species reported by people spoken to during the survey
- “fly” species recorded as flying over the site

- (S1 - 4) Specially Protected species (Schedules 1 – 4)
- (P1 - 4) species listed as Priority taxa (Priority 1 - 4)
- (I) introduced species

Totals provided in parentheses ( ) indicate number of species expected or possible (including those that were recorded) at the site.

Note: a number of bird species have been excluded from this list as they would only occur at the site as vagrants.

# VERTEBRATE FAUNA RECORDED OR EXPECTED TO OCCUR

		Overall	May	Aug	Oct	Dec
<b>Amphibians</b>						
<b>Myobatrachidae</b> (ground frogs)						
Quacking Frog	<i>Crinia georgiana</i>	✓		W	W	
Glauert's Froglet	<i>Crinia (Ranidella) glauerti</i>	✓	W	W	W	W
Sandplain Froglet	<i>Crinia (Ranidella) insignifera</i>	✓	W	W		
Moaning Frog	<i>Heleioporus eyrei</i>	✓	W			
Pobblebonk	<i>Limnodynastes dorsalis</i>	✓		nearby		
Turtle Frog	<i>Myobatrachus gouldii</i>	+				
Guenther's Toadlet	<i>Pseudophryne guentheri</i>	+				
<b>Hylidae</b> (tree frogs)						
Slender Tree Frog	<i>Litoria adelaidensis</i>	*				
Motorbike Frog	<i>Litoria moorei</i>	✓		W		
<b>Sub-Total</b>		<b>6 (9)</b>	<b>3</b>	<b>5</b>	<b>2</b>	<b>1</b>
<b>Reptiles</b>						
<b>Chelidae</b> (side-neck tortoises)						
Long-necked Tortoise	<i>Chelodina oblonga</i>	✓	W			W
<b>Gekkonidae</b> (geckoes)						
Spiny-tailed Gecko	<i>Diplodactylus spinigerus</i>	*				
Marbled Gecko	<i>Phyllodactylus marmoratus</i>	*				
<b>Pygopodidae</b> (legless lizards)						
Sandplain Worm Lizard	<i>Aprasia repens</i>	*				
Burton's Legless Lizard	<i>Lialis burtonis</i>	+				
Common Scalefoot	<i>Pygopus lepidopodus</i>	+				
<b>Agamidae</b> (dragon lizards)						
Western Bearded Dragon	<i>Pogona minor</i>	+				
Sandhill Dragon	<i>Tympanocryptis adelaidensis</i>	+				
<b>Varanidae</b> (monitors or goannas)						
Gould's Sand Goanna	<i>Varanus gouldii</i>	+				
<b>Scincidae</b> (skink lizards)						
	<i>Acritoscincus (Bassiana) trilineatum</i>	✓		WU	WU	WU
Fence Skink	<i>Cryptoblepharus plagiocephalus</i>	✓	U			
	<i>Ctenotus fallens</i>	+				
King's Skink	<i>Egernia kingii</i>	+				
	<i>Hemiergis quadrilineata</i>	*				
	<i>Lerista elegans</i>	✓				U
	<i>Lerista praepedita</i>	*				
Dwarf Skink	<i>Menetia greyii</i>	*				
	<i>Morethia lineocellata</i>	+				
Dusky Morethia	<i>Morethia obscura</i>	+				
Western Bluetongue	<i>Tiliqua occipitalis</i>	+				
Bobtail	<i>Tiliqua rugosa</i>	*				
<b>Elapidae</b> (front-fanged snakes)						
Tiger Snake	<i>Notechis scutatus</i>	✓		WU	WU	
Dugite	<i>Pseudonaja affinis</i>	✓		report		U
<b>Sub-Total</b>		<b>6 (23)</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>4</b>
<b>Birds</b>						
<b>Anatidae</b> (ducks, geese and swans)						
Black Swan	<i>Cygnus atratus</i>	✓	R			R
Australian Shelduck	<i>Tadorna tadornoides</i>	✓	R	R		
Pacific Black Duck	<i>Anas superciliosus</i>	✓	R	R	RW	

		Overall	May	Aug	Oct	Dec
Grey Teal	<i>Anas gibberifrons</i>	✓		R	R	
Chestnut Teal	<i>Anas castanea</i>	+				
Australasian Shoveler	<i>Anas rhynchotis</i>	✓		R		
Pink-eared Duck	<i>Malacorhynchus membranaceus</i>	+				
Hardhead (White-eyed Duck)	<i>Aythya australis</i>	+				
Australian Wood Duck	<i>Chenonetta jubata</i>	+				
Musk Duck	<i>Biziura lobata</i>	✓	R			R
Blue-billed Duck	<i>Oxyura australis</i>	*				
<b>Podicepsidae</b> (grebes)						
Hoary-headed Grebe	<i>Poliocephalus poliocephalus</i>	+				
Australasian Grebe	<i>Tachybaptus novaehollandiae</i>	+				
<b>Anhingidae</b> (darters)						
Darter	<i>Anhinga melanogaster</i>	✓	R		R	R
<b>Phalacrocoracidae</b> (cormorants)						
Great Cormorant	<i>Phalacrocorax carbo</i>	✓	R		R	R
Pied Cormorant	<i>Phalacrocorax varius</i>	✓	R			
Little Black Cormorant	<i>Phalacrocorax sulcirostris</i>	✓	R	R		
Little Pied Cormorant	<i>Phalacrocorax melanoleucos</i>	✓	R	R	R	R
<b>Pelecanoididae</b> (pelicans)						
Australian Pelican	<i>Pelecanus conspicillatus</i>	✓	R	R	R	R
<b>Ardeidae</b> (herons and egrets)						
White-faced Heron	<i>Egretta novaehollandiae</i>	✓	R	R	W	UR
Little Egret	<i>Egretta garzetta</i>	+				
White-necked Heron	<i>Ardea pacifica</i>	+				
Great Egret	<i>Egretta alba</i>	✓	R	R		
Nankeen Night Heron	<i>Nycticorax caledonicus</i>	*				
<b>Plataleidae</b> (ibis and spoonbills)						
Australian White Ibis	<i>Threskiornis molucca</i>	✓	fly	W	RW	
Straw-necked Ibis	<i>Threskiornis spinicollis</i>	*				
Yellow-billed Spoonbill	<i>Platalea flavipes</i>	✓	R			
<b>Accipitridae</b> (kites, hawks and eagles)						
Osprey	<i>Pandion haliaetus</i>	*				
Black-shouldered Kite	<i>Elanus notatus</i>	✓		U	U	U
Whistling Kite	<i>Haliastur sphenurus</i>	*				
White-bellied Sea Eagle	<i>Haliaeetus leucogaster</i>	+				
Swamp Harrier	<i>Circus approximans</i>	*				
Brown Goshawk	<i>Accipiter fasciatus</i>	*				
Collared Sparrowhawk	<i>Accipiter cirrhocephalus</i>	✓		U		U
Wedge-tailed Eagle	<i>Aquila audax</i>	+				
Little Eagle	<i>Hieraetus morphnoides</i>	+				
<b>Falconidae</b> (falcons)						
Peregrine Falcon	<i>Falco peregrinus</i> (S4)	+				
Australian Hobby	<i>Falco longipennis</i>	✓		U		
Brown Falcon	<i>Falco berigora</i>	*				
Nankeen Kestrel	<i>Falco cenchroides</i>	*				
<b>Rallidae</b> (crakes and rails)						
Buff-banded Rail	<i>Rallus philippensis</i>	*				
Baillon's Crake	<i>Porzana pusilla</i>	*				
Australian Spotted Crake	<i>Porzana fluminea</i>	*				
Spotless Crake	<i>Porzana tabuensis</i>	✓		W		
Dusky Moorhen	<i>Gallinula tenebrosa</i>	+				
Purple Swamphen	<i>Porphyrio porphyrio</i>	*				
Eurasian Coot	<i>Fulica atra</i>	✓				R

		Overall	May	Aug	Oct	Dec
<b>Scolopacidae</b> (sandpipers)						
Common Greenshank	<i>Tringa nebularia</i>	✓			R	
Wood Sandpiper	<i>Tringa glareola</i>	+				
Common Sandpiper	<i>Tringa hypoleucos</i>	✓			R	
<b>Recurvirostridae</b> (stilts and avocets)						
Black-winged Stilt	<i>Himantopus himantopus</i>	✓	R		R	R
Red-necked Avocet	<i>Recurvirostra novaehollandiae</i>	*				
<b>Charadriidae</b> (lapwings and plovers)						
Grey Plover	<i>Pluvialis squatarola</i>	+				
Red-capped Plover	<i>Charadrius ruficapillus</i>	*				
Black-fronted Dotterel	<i>Elseya melanops</i>	+				
Banded Lapwing	<i>Vanellus tricolor</i>	+				
<b>Laridae</b> (gulls and terns)						
Silver Gull	<i>Larus novaehollandiae</i>	✓	R	R	R	
Caspian Tern	<i>Hydroprogne caspia</i>	✓	R	R		
Crested Tern	<i>Sterna bergii</i>	✓	R		R	
Whiskered Tern	<i>Chlidonias hybrida</i>	+				
<b>Columbidae</b> (pigeons and doves)						
Rock Dove (feral pigeon)	<i>Columba livia</i> (I)	✓	U			
Spotted Turtle-Dove	<i>Streptopelia chinensis</i> (I)	✓	U			U
Laughing Turtle-Dove	<i>Streptopelia senegalensis</i> (I)	✓	U		U	
<b>Cacatuidae</b> (cockatoos)						
Short-billed Black-Cockatoo	<i>Calyptorhynchus latirostris</i> (S1)	*				
Galah	<i>Cacatua roseicapilla</i>	✓		U	U	U
Long-billed Corella	<i>Cacatua tenuirostris</i> (I)	✓	U			
Western Corella	<i>Cacatua pastinator</i>	*				
Little Corella	<i>Cacatua sanguinea</i>	*				
<b>Psittacidae</b> (lorikeets and parrots)						
Rainbow Lorikeet	<i>Trichoglossus haematodus</i> (I)	✓		U	U	fly
Purple-crowned Lorikeet	<i>Glossopsitta porphyrocephala</i>	+				
Red-capped Parrot	<i>Purpureicephalus spurius</i>	✓			U	
Australian Ringneck	<i>Barnardius zonarius</i>	*				
<b>Cuculidae</b> (cuckoos)						
Pallid Cuckoo	<i>Cuculus pallidus</i>	+				
Horsfield's Bronze-Cuckoo	<i>Chrysococcyx basalis</i>	+				
Shining Bronze-Cuckoo	<i>Chrysococcyx lucidus</i>	+				
<b>Strigidae</b> (hawk-owls)						
Southern Boobook Owl	<i>Ninox novaeseelandiae</i>	*				
<b>Tytonidae</b> (barn owls)						
Barn Owl	<i>Tyto alba</i>	*				
<b>Podargidae</b> (frogmouths)						
Tawny Frogmouth	<i>Podargus strigoides</i>	+				
<b>Apodidae</b> (swifts)						
Fork-tailed Swift	<i>Apus pacificus</i>	+				
<b>Halcyonidae</b> (forest kingfishers)						
Laughing Kookaburra	<i>Dacelo novaeguineae</i> (I)	*				
Sacred Kingfisher	<i>Todiramphus sanctus</i>	*				
<b>Meropidae</b> (bee-eaters)						
Rainbow Bee-eater	<i>Merops ornatus</i>	*				
<b>Maluridae</b> (fairy-wrens)						
fairy-wren ? splendid	<i>Malurus splendens</i>	✓				WU
<b>Pardalotidae</b> (pardalotes)						
Spotted Pardalote	<i>Pardalotus punctatus</i>	*				

		Overall	May	Aug	Oct	Dec
Striated Pardalote	<i>Pardalotus striatus</i>	✓	U	U	U	
Western Gerygone	<i>Gerygone fusca</i>	✓			U	
Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>	*				
<b>Meliphagidae</b> (honeyeaters)						
Red Wattlebird	<i>Anthochaera carunculata</i>	✓	U		U	U
Western Wattlebird	<i>Anthochaera lunulata</i>	*				
Singing Honeyeater	<i>Lichenostomus virescens</i>	✓	U	U	U	U
Brown Honeyeater	<i>Lichmera indistincta</i>	✓	WU	WU	WU	WU
New Holland Honeyeater	<i>Phylidonyris novaehollandiae</i>	*				
White-cheeked Honeyeater	<i>Phylidonyris nigra</i>	*				
White-fronted Chat	<i>Epthianura albifrons</i>	*				
<b>Pachycephalidae</b> (whistlers)						
Rufous Whistler	<i>Pachycephala rufiventris</i>	*				
<b>Dicruridae</b> (flycatchers)						
Magpie-lark	<i>Grallina cyanoleuca</i>	✓	U	U	U	U
Grey Fantail	<i>Rhipidura fuliginosa</i>	*				
Willie Wagtail	<i>Rhipidura leucophrys</i>	✓	U	U	U	U
<b>Campephagidae</b> (cuckoo-shrikes)						
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>	✓		U	U	U
White-winged Triller	<i>Lalage sueurii</i>	*				
<b>Artamidae</b> (woodswallows)						
Black-faced Woodswallow	<i>Artamus cinereus</i>	*				
Grey Butcherbird	<i>Cracticus torquatus</i>	✓		U		
Australian Magpie	<i>Gymnorhina tibicen</i>	✓	U	U	U	U
<b>Corvidae</b> (ravens and crows)						
Australian Raven	<i>Corvus coronoides</i>	✓	U	U	U	U
<b>Motacillidae</b> (pipits and true wagtails)						
Richard's Pipit	<i>Anthus novaeseelandiae</i>	✓	U		U	U
<b>Dicaeidae</b> (flower-peckers)						
Mistletoebird	<i>Dicaeum hirundinaceum</i>	*				
<b>Hirundinidae</b> (swallows)						
White-backed Swallow	<i>Cheramoeca leucosternus</i>	*				
Welcome Swallow	<i>Hirundo neoxena</i>	✓	U	U	U	
Tree Martin	<i>Hirundo nigricans</i>	✓	U		U	
Fairy Martin	<i>Hirundo ariel</i>	*				
<b>Sylviidae</b> (Old World warblers)						
Clamorous Reed-Warbler	<i>Acrocephalus stentoreus</i>	✓	W	W	W	W
Little Grassbird	<i>Megalurus grammurus</i>	✓		W		W
<b>Zosteropidae</b> (white-eyes)						
Silvereye	<i>Zosterops lateralis</i>	✓		WU	WU	WU
<b>Sub-Total</b>		<b>52 (113)</b>	<b>34</b>	<b>31</b>	<b>33</b>	<b>27</b>
<b>Mammals</b>						
<b>Peramelidae</b> (bandicoots)						
Quenda or Southern Brown Bandicoot	<i>Isodon obesulus</i> (P4)	*				
<b>Phalangeridae</b> (possums)						
Brush-tailed Possum	<i>Trichosurus vulpecula</i>	*				
<b>Mollosidae</b> (mysticivorous bats)						
White-striped Bat	<i>Nyctinomus (Tadarida) australis</i>	*				
<b>Vespertilionidae</b> (vesper bats)						
Gould's Wattled Bat	<i>Chalinolobus gouldii</i>	+				
	<i>Vespadelus (Eptesicus) regulus</i>	+				
Lesser Long-eared Bat	<i>Nyctophilus geoffroyi</i>	+				

		Overall	May	Aug	Oct	Dec
<b>Muridae</b> (rats and mice)						
Rakali or Water Rat	<i>Hydromys chrysogaster</i> (P4)	*				
House Mouse	<i>Mus musculus</i> (I)	*				
Black Rat	<i>Rattus rattus</i> (I)	✓	W			
Brown Rat	<i>Rattus norvegicus</i> (I)	*				
<b>Leporidae</b> (rabbits and hares)						
Rabbit	<i>Oryctolagus cuniculus</i> (I)	✓				U
<b>Canidae</b> (foxes and dogs)						
European Red Fox	<i>Vulpes vulpes</i> (I)	✓	U	U		U
<b>Felidae</b> (cats)						
Feral Cat	<i>Felis catus</i> (I)	✓	U			
<b>Sub-Total</b>		<b>4 (13)</b>	<b>2</b>	<b>1</b>	<b>-</b>	<b>2</b>
<b>TOTAL</b>		<b>67 (158)</b>	<b>41</b>	<b>40</b>	<b>37</b>	<b>34</b>

Note. Fish have not been included in the species list. The introduced Mosquito Fish *Gambusia holbrooki* is present in the wetland.

Appendix C  
Cygnia Cove Indicative Landscape  
Concept Masterplan

**Foreshore Management Plan  
Cygnia Cove Estate, Waterford**



# CYGNIA COVE

## LANDSCAPE CONCEPT MASTERPLAN

JOB No. 02132-01

SCALE 1:100 @A1

OCTOBER 2007

REV E

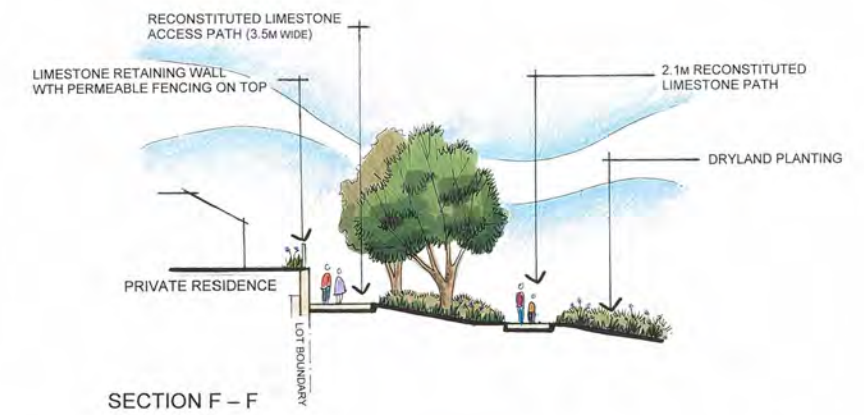
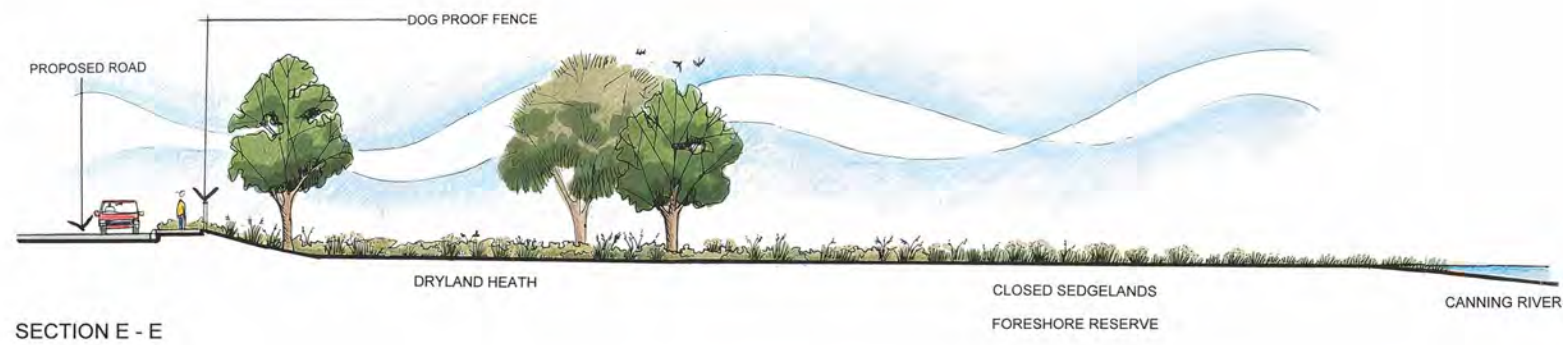
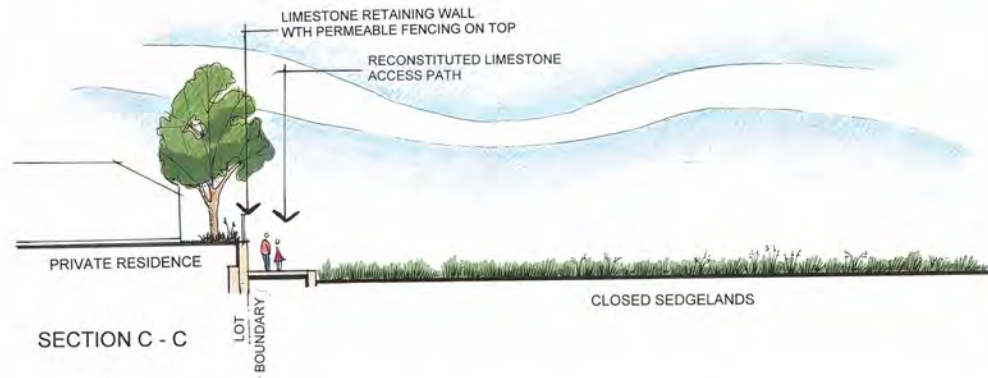
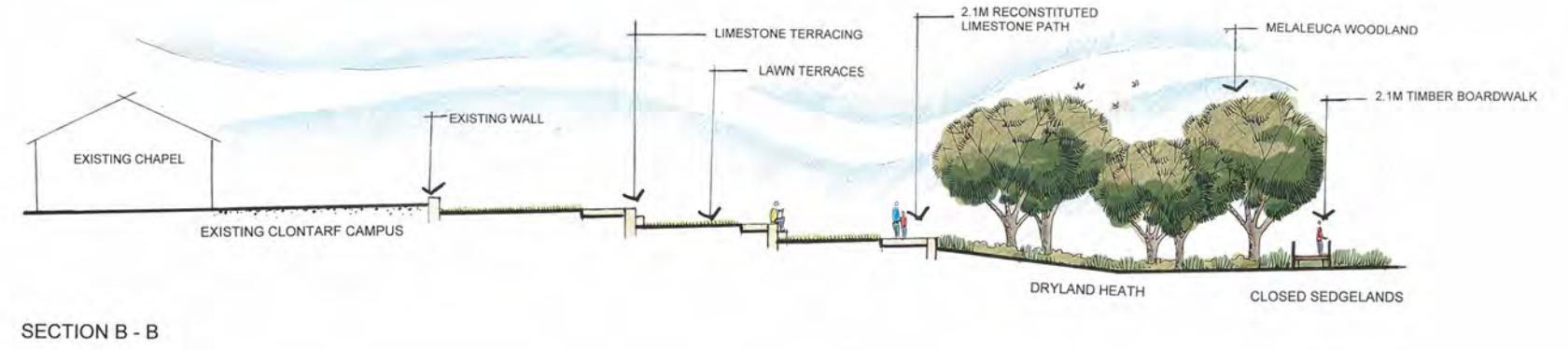
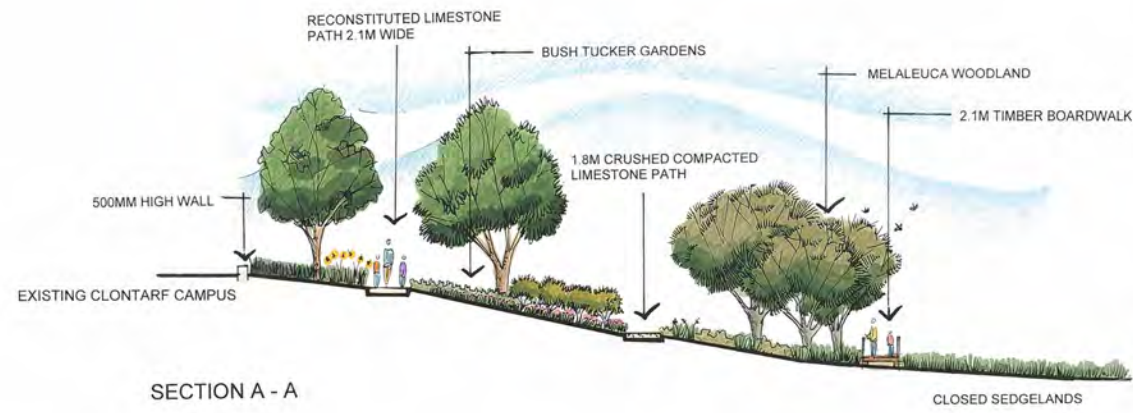
PLAN 

LANDSCAPE ARCHITECTS  
ENVIRONMENTAL CONSULTANTS

# Appendix D

## Cygnia Cove Concept Landscape Sections

**Foreshore Management Plan  
Cygnia Cove Estate, Waterford**



# CYGNIA COVE LANDSCAPE CONCEPT SECTIONS

Job No. 02132

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PLAN E LANDSCAPE ARCHITECTS  
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