

**ADOPTED TWO ROCKS YANCHEP  
FORESHORE MANAGEMENT PLAN**

**FINAL**

**May 2007**



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## **1.0 INTRODUCTION**

### **1.1 Background**

In 1997, Council adopted two Foreshore Management Plans for the Two Rocks Yanchep foreshore area, these being:

1. The Two Rocks - Yanchep Foreshore Management Plan for the foreshore areas adjacent to the two townsites. This plan was prepared by Bill James Landscape Architects on behalf of the City.
2. The Lot 614 Yanchep Foreshore Management Plan relating to the foreshore area abutting the Ocean Lagoon Estate, Yanchep. This plan was prepared by O'Brien Planning Consultants on behalf of Peet and Company as part of its land development obligations.

Council considered a consolidation and review of these plans at its meeting on 17 December 2002 and resolved to endorse a series of management strategies and plans for the purposes of advertising. The review was generally an update of the strategies contained in the 1997 plans and related to various rehabilitation, fencing and other works that were still to occur in the subject area. In addition, the review sought to investigate an alternative site for the Yanchep Surf Life Saving Club and a pathway/boardwalk connection between Compass Circle and Foreshore Vista.

The review was advertised for an eight-week period concluding on 21 March 2003. Twelve submissions and a 158-signature petition were received. Many of these submissions identified the need for a more detailed assessment of the environmental issues affecting this foreshore area. Flora and vegetation surveys, together with associated management recommendations have since been undertaken by an environmental consultant in order to verify the suitability of the plan's recommendations. Appropriate adjustments have been made to the plan's recommendations, where necessary, to reflect the environmental assessment.

Council adopted the Capricorn Coastal Village Structure Plan at its meeting on 14 October 2003. This structure plan area is located to the immediate north of the existing Yanchep Townsite and abuts the foreshore reserve that exists between the Yanchep Lagoon and the existing Club Capricorn Holiday Village. A draft independent Foreshore Management Plan was prepared for the foreshore area abutting this estate by the developer, however, in order to provide for a higher level of integration, the developer agreed to assist in preparing a single consolidated plan for the overall area. This was also agreed by Council at its meeting on 16 March 2004.

The current plan represents a consolidation and review of the previous Foreshore Management Plans for the Two Rocks - Yanchep area.

### **1.2 Purpose**

The purpose of the Foreshore Management Plan is to provide a framework for protecting and enhancing the environmental, landscape, heritage and recreation values of the study

area, whilst providing for a level of infrastructure necessary to cater for the significant planned future growth of the Two Rocks and Yanchep areas.

Whilst the Foreshore Management Plan is intended to be a strategic document, which will guide development, use and management of land within the study area over the long term, the plan will require periodic review in order to ensure that it remains relevant and that its objectives are being met.

### **1.3 Objectives**

The objectives of the Foreshore Management Plan are to:

1. Identify the natural resources and processes as well as the necessary management measures for preserving and enhancing the environmental values of the study area;
2. Identify and provide for sustainable levels of leisure, recreation, tourism, commercial and general public infrastructure necessary for the planned population growth in the surrounding area;
3. Identify and provide opportunities for interpretational facilities consistent with the environmental and heritage values of the area;
4. Develop an implementation plan for future development and management within the study area, which outlines priorities, responsibilities and an indication of the likely costs of each action.

### **1.4 Study Area**

The study area is located approximately 50 kilometres north of the Perth Central Business District, within the north western part of the City of Wanneroo. It extends a distance of around seven kilometres and an area of 1,350 hectares.

The study area comprises two separate sections, being the areas of foreshore located:

1. Between the Club Capricorn Resort and the southern extent of Trumpeter Way in the 'Ocean Lagoon' Estate, Yanchep; and
2. Adjacent to the existing Two Rocks residential area.

**Figure 1** indicates the regional location and extent of the study area.

### **1.5 Land Tenure**

The study area consists of numerous land parcels in both Crown and freehold ownership, as detailed in **Tables 1** and **2** and **Figure 2**.

**TABLE 1 - LAND TENURE – TWO ROCKS**

<b>Reserve(R)/Lot No.</b>	<b>Owner/ Vesting Agency</b>	<b>Purpose</b>	<b>Power to Lease (years)</b>
R20561	Crown/ City of Wanneroo	Recreation and purposes incidental thereto	21
R45379	Crown/Department of Land Information	Foreshore Management	N/A
R33444	Crown/City of Wanneroo	Public Recreation	No
R44322	Department for Planning and Infrastructure	Navigation Beacon	N/A
Lot 34601	Crown Land/DLI	Government Purposes	N/A
Lot 8796	Crown land leased to Yanchep Sun City P/L	Marina	
R34379	Crown/ Water Corporation of WA	Sewer Pump Station	N/A
Lot 8506	Crown/DLI		
Lot 8508	Crown/DLI		
R33431	Crown/City of Wanneroo	Public Recreation	No
Lot 10	Tokyu Corporation	Parks and Recreation	N/A
Lot 8989	Pyrford Court Pty Ltd	Parks and Recreation and Urban Development	N/A
R30959	Crown/City of Wanneroo	Public Recreation	No

**TABLE 2 - LAND TENURE - YANCHEP**

<b>Reserve (R)/Lot No.</b>	<b>Owner/ Vesting Agency</b>	<b>Purpose</b>	<b>Power to Lease</b>
R20561	Crown/City of Wanneroo	Recreation and purposes incidental thereto	21
R32510	Crown/City of Wanneroo	Public Recreation	No
Lot 304	Capricorn Investment Group Pty Ltd	Public Recreation and Urban Development	N/A
R29352	Crown/City of Wanneroo	Public Recreation	No
R39022	Crown/City of Wanneroo	Clubrooms	Up to 21
R12439	Crown/City of Wanneroo	Recreation (A Class Reserve)	No
R43792	Crown/City of Wanneroo	Purposes ancillary to beachfront recreation	Up to 21
R29694	Crown/City of Wanneroo	Recreation	Up to 21
R29354	Crown/City of Wanneroo	Public Recreation	No
R32978	Crown vested City of Wanneroo	Public Recreation	No
Lot 612	Crown/City of Wanneroo	Public Recreation	No
R45385	Crown/City of Wanneroo	Public Recreation	No
Lot 132	Freehold	House	N/A
Lot 133	Freehold	House	N/A
Lot 134	Freehold	House	N/A
Lot 135	Freehold	House	N/A

## **1.6 Zoning**

The study area is predominantly reserved for Parks and Recreation under both the Metropolitan Region Scheme and City of Wanneroo District Planning Scheme No. 2, with some small areas zoned Urban and Urban Development under the respective schemes. Detailed zonings of the study area and surrounding land are shown on **Figures 3 and 4**.

## **2.0 Natural Environment**

### **2.1 Climate**

The Two Rocks - Yanchep area experiences a warm Mediterranean climate with hot dry summers and cool wet winters. Air temperatures are similar to those experienced in Perth, where mean daily maximum temperatures vary from 30°C in summer to 17.5°C in winter, and mean daily minimum temperatures vary from 18.5°C in summer to 9.1°C in winter.

Rainfall in the area occurs mostly during the winter months, with monthly totals during this period occasionally in excess of 100mm. Monthly rainfall of up to 50mm may occur in the remaining months. Previous records indicate that the average annual rainfall is around 670mm.

Winds are an important climatic factor in the Two Rocks - Yanchep area as much of the landscape in the study area has been constructed by aeolian (wind driven) deposition and is particularly susceptible to the erosive powers of the wind if the natural vegetation is removed.

During the summer months winds blow from the east to south-east in the morning (4am to midday) and from the south-west in the afternoon (1pm to 6pm). Alternatively, winter is characterised by north-westerly storm winds that back to the west and south-west, interspersed with calmer periods.

Major storms during winter, involving 70 km/h winds for periods of 6 to 24 hours, occur two to ten times per year. Occasionally, in the period of summer to autumn, tropical cyclones migrate further southwards than normal and may bring gale force winds to the Two Rocks, Yanchep coastline. During these events winds up to 130km/h are often experienced.

### **2.2 Geology**

The geological formations present in the study area consist of Holocene Safety Bay Sand and the Pleistocene Tamala Limestone.

Safety Bay Sand occurs within the Quindalup Dune System, which is the most recent of the dune systems represented on the Swan Coastal Plain. It comprises white, fine to medium grained, sub-rounded sand composed of small marine organism skeletal fragments with small amounts of quartz and feldspar. The calcium carbonate content is generally greater than 50%.

The coastal dunes adjacent to the beach have been formed from the action of the ocean and wind on the Safety Bay Sand. The Safety Bay Sand is generally unconsolidated but may be weakly cemented in places. The sand is stabilised temporarily by vegetation but where disturbance has occurred and this vegetation cover is lost the sand becomes highly mobile.

Tamala Limestone occurs within the Spearwood Dune System, which is the intermediate aged (late Pleistocene) dune system of the Swan Coastal Plain. It is made up of light to yellowish brown fine to coarse grained, sub angular to well rounded aeolian calcarenite (sand grains cemented together by calcium carbonate to form rock.) Tamala limestone occurs within the study area as exposed beach cliffs, wave cut platforms and rock shelves where the overlying Safety Bay Sand has been removed through wind and wave action.

### **2.3 Geomorphology**

The geomorphic unit of the study area is the Quindalup Dune System. This system is a Holocene aeolian (wind-formed) landform of the Safety Bay Sand. It contains a variety of dune forms with those present within the study area consisting fretted parabolic dune field and discontinuous shore parallel ridges including fore dunes.

Parabolic dunes are sand dunes that are u-shaped to spatulate in plan, and are convex in the downwind direction. Fretted describes a condition where the arms of the dunes have developed subsidiary smaller blowouts and parabolic dunes. These dunes predominate at both Two Rocks and Yanchep.

Shore parallel ridges are a system of linear parallel sand ridges developed transverse to the shore. These dunes occur in areas of accretion, that is where sand is being deposited by wave and wind action. These dunes form narrow strips at the back of the beach north of Yanchep and south of Two Rocks.

Where the dunes have been cut back by the sea to expose limestone, the underlying Spearwood Dune System outcrops as Tamala Limestone.

### **2.4 Tides**

The study area has one tide per day. The normal tide is 0.5 metre with a range over the year in the order of 1 metre. A 100-year storm surge will produce a tidal surge of 1.9 metre above chart datum. This compares to a mean high water level of 0.9 metre and the highest astronomical (storm independent) tide level of 1.3 metres.

### **2.5 Wave Climate**

Wave conditions are influenced by a variety of factors including wind, tides, atmospheric conditions and bathymetry.

The Two Rocks - Yanchep area experiences a prevailing refracted long period (7-15 seconds) south-west swell. Local wind conditions may generate short period (2-7 second) waves which are superimposed on the swell.

Sea breezes reinforce south-west waves in summer and may cause seas of up to 1.5 metres. North-west and westerly gales may produce high energy waves. Summer sea breezes and winter storms will cause seasonal variation in the prevailing wave conditions.

Wave attenuation occurs by wave refraction, shoaling, breaking, atmospheric inputs, bottom friction, wave interaction and wave diffraction. The extent of attenuation will

depend on nearshore bathymetry, seagrass cover and the presence/absence of offshore reef.

## **2.6 Ongoing Coastal Processes**

Coastal processes are dominated by wind and tidal action, which distribute sediment by seasonal onshore and offshore migration and longshore transport. The magnitude of these processes is dependant on climatic conditions.

A primary factor influencing these processes in the Two Rocks - Yanchep area is the prevailing south westerly swell. This has eroded the outer reefs, caused onshore sediment transport, and continues to produce longshore currents that mobilise sand in the surf zone.

Diffraction of the swell waves as they pass through the inner chain of reefs produces local longshore currents in the surf zone that flow in various directions, depending on the complex patterns of divergence and convergence produced during diffraction. Wind generated waves have a significant effect in this near shore environment because they overprint local currents to produce a sustained unidirectional longshore current. Such sustained currents generally move sediment northward during summer and southward during winter in response to prevailing seasonal winds. As the summer wind, swell, and wave regime is dominant, there is a slight northerly bias to net sediment transport.

The banks of offshore reefs and seagrass meadows that generally are adjacent to the coast, significantly attenuate the offshore wave climate and reduce wave heights, resulting in a considerably milder sediment transport regime along much of this coast than might be expected on an open coast.

During winter, steep wind generated waves contribute to coastal processes by combining with surges during storm events, to attack high parts of the beach normally isolated from wave action. This type of wave attack erodes the beach and foredunes and produces an offshore bar. During summer, sediment from the bar and sediment generated by erosion of pre-existing geomorphic features, such as reefs and the sea floor, is returned to the beach by the prevailing south-west swell and wind waves.

## **2.7 Shoreline Movement**

An analysis of aerial photographs between 1941 and 1996 indicates that the vegetation line to the south of the Yanchep Lagoon has been fairly constant. The waterline in this area has however experienced large fluctuations over time with an overall erosion of around 30 to 40 metres. In the Lagoon area itself, the vegetation line has moved offshore in the northern sector and remained constant in the southern sector. The waterline in the lagoon area has however fluctuated significantly over time, with the northern section showing an offshore movement, or accretion, whilst the southern section closest to the reef showing erosion.

To the north of the Lagoon, the construction of the Club Capricorn groyne appears to have influenced sediment movement and shoreline stability, interrupting the longshore movement of sand causing erosion on the northern side and accretion on the southern side of the groyne. From 1971, when the groyne was constructed, to 1982, the vegetation line in the area between the groyne and the Lagoon has moved offshore by around 50 metres.

The shoreline in this area has also accreted significantly with the groyne now being saturated to its end with sand. Since 1982, the waterline has remained fairly constant, fluctuating within a 20 metre band. The accreting influence of the groyne appears to extend between 700 and 1,000 metres south of the groyne. There was no evidence that the groyne has affected the Lagoon. North of the groyne the vegetation has exhibited continual offshore movement. In contrast, the waterline moved continually onshore, narrowing the gap between the water and vegetation, until 1987 when slight accretion has occurred, indicating that the sand bypassing the groyne had become more significant. Immediately north of the groyne, there has been continual accretion, particularly between 1971 and 1982, following the construction of the groyne.

The construction of the Two Rocks marina also appears to have influenced sediment movement and shoreline stability for the Two Rocks portion of the study area. An analysis of aerial photographs showing the coastal vegetation line in the vicinity of the Two Rocks marina from 1941 to 1973 indicates that the position of the coastal vegetation during this time generally varied less than ten metres. These plans also show that from 1973, when the marina was constructed, to 1983, there was significant accretion of the coast immediately south of the marina. In 1997, a more detailed shoreline movement study was undertaken which indicates that the vegetation line moved in a seaward direction by about 21 metres between 1985 and 1996. The steep sandy cliff face along the beach to the north of the marina indicates that this section of coastline is experiencing erosion. Given the present configuration of the breakwaters and the net longshore transport from south to north, it is anticipated that this pattern will continue for decades to come.

## **2.8 Sea Level Change**

There is strong evidence and international consensus that the global climate is changing and that increasing concentrations of greenhouse gases in the atmosphere is playing a significant contributing role in this. The potential impacts of global climate change includes a rise in sea level, with the resultant implications for coastal stability.

Predictions for sea level rise vary, with recent estimates ranging from a rise of 9 to 88 centimetres to 2100AD. A one centimetre rise in sea level is likely to cause a one metre shoreline retreat on a sandy beach. The State Coastal Planning Policy has accepted a sea level rise figure of 38 centimetres for inclusion in its coastal setback development guidelines.

The issue of potential climate change and any resultant effects on coastal processes is quite complex and would be site specific. For example, the future potential erosion from climate induced sea level change could be offset by the shoreline accretion to the south of the Two Rocks marina.

## **2.9 Flora and Vegetation**

A flora and vegetation survey for the majority of the study area was carried out by Bowman, Bishaw, Gorham Environmental Management Consultants in 2002. The Survey methodology, flora, vegetation types and condition are detailed in **Appendices 1 – 3** respectively. The remaining portion of the study area, being that area north of the Yanchep Lagoon, was surveyed by ATA Environmental in 1992 and 2004.

### 2.9.1 Flora

The plant taxa recorded from survey work are estimated to constitute more than 80 per cent of the expected flora present within the study area, both native and alien. Ten taxa which, according to Bush Forever are significant, were recorded during survey work. They are *Acacia xanthina*, *Actites megalocarpa*, *Agonis flexuosa*, *Allocasuarina lehmanniana*, *Callitris preissii*, *Eucalyptus foecunda*, *Grevillea obtusifolia*, *Melaleuca cardiophylla*, *Melaleuca lanceolata* and *Stylidium maritimum*. However, four of these taxa - *Agonis flexuosa*, *Callitris preissii*, *Grevillea obtusifolia* and *Melaleuca lanceolata* - are suspected of having been planted or otherwise introduced into the study area.

No Declared Rare or Priority 1 or 2 Flora plants were found in the study areas, nor are any likely to be there.

### 2.9.2 Vegetation

#### Bush Forever

The majority of the study area lies within Bush Forever Site 397, which relates to the coastal strip from Wilbinga to Mindarie. The boundary of Bush Forever Site 397 in relation to the study area is shown in **Figure 5**.

Bush Forever lists vegetation complexes of the Swan Coastal Plain portion of the Perth Metropolitan Region, along with their areas and other information. Forty eight percent of the original 24,381 ha of Quindalup Complex remains. This percentage is more than the 30% “threshold level” specified by the Environmental Protection Authority to remain uncleared. However, it should be noted that this information was based on 1997 aerial photos and much clearing has happened since then. Fourteen percent (3,527 ha) of the original Quindalup vegetation has some existing protection. Bush Forever specifies that at least 10 per cent of each vegetation complex needs effective protection.

#### Vegetation Types and Condition

The vegetation types and condition recorded during the survey work has been mapped and included in **Figures 6** and **7**. **Figure 6e** provides a list of the vegetation types mapped in the study area and **Table 3** contains the six-point condition scale used, which is consistent with the scale used in Bush Forever.

**TABLE 3**  
**Vegetation Condition Scale**

Symbol	Condition	Description
P	Pristine	No obvious signs of disturbance
E	Excellent	Vegetation structure intact, disturbance affecting individual species, weeds are non-aggressive species
V	Very Good	Vegetation structure altered, obvious signs of disturbance
G	Good	Vegetation structure significantly altered by very obvious signs of multiple disturbance; basic vegetation structure or ability to regenerate it is retained
D	Degraded	Basic vegetation structure severely impacted by disturbance; scope for regeneration but not to a state approaching good condition without intensive management
CD	Completely Degraded	Vegetation structure not intact; the area completely or almost completely without native species ('parkland cleared')

#### Floristic Community Types

Seven Floristic Community Types (FCTs) were inferred from the survey data. From the species recorded during the survey and reference to Gibson *et al.* (1994) and Bush Forever FCTs 16, 27, 29a, 29b, S11, S13 and S14 are those most likely to be represented in most of the study area.

The names given to the seven floristic community types in Bush Forever are:

- FCT 16 Highly saline seasonal wetlands (*Frankenia pauciflora* - *Sarcocornia quinqueflora*)
- FCT 27 Species-poor mallees and shrublands on limestone
- FCT 29a Coastal shrublands on shallow sands
- FCT 29b *Acacia* shrublands on taller dunes
- FCT S11 Northern *Acacia rostellifera* – *Melaleuca acerosa* (*M. systema*) shrublands
- FCT S13 Northern *Olearia axillaris* – *Scaevola crassifolia* shrublands
- FCT S14 *Spinifex longifolius* grasslands and low shrublands.

The Reservation and Conservation Status given by Gibson *et al.* (1994) for four of the seven floristic community types (FCTs) which may be represented in the study area are as follows:

FCT	Extent of Reservation	Risk
FCT 16	Poorly reserved	Vulnerable
FCT 27	Well reserved	Low risk
FCT 29a	Poorly reserved	Susceptible
FCT29b	Poorly reserved	Susceptible

Bush Forever lists Floristic Community Types 16, S11 and S14 as being confined to the Perth Metropolitan Region. Type 29b is sampled and inferred in most of the coastal Bush Forever sites, but the only coastal Bush Forever Site listing Type 27 is Site 325 (Ocean Reef).

None of these seven floristic community types is listed as a threatened ecological community in Bush Forever. However, Floristic Community Types 29a and 29b have been proposed for listing as ranks 100 and 101 respectively (English and Blyth 1997).

### Vegetation Significance

Griffin (1993) and Griffin and Trudgen (1994, 1991) have concluded from detailed studies of Quindalup Dunes flora and vegetation north of the Swan River and south of Mandurah that there is significant variation in vegetation along the coast. Even within the relatively short distance covered in this Foreshore Management Plan, there appears to be significant variation between areas, even if allowance is made for variation in defining vegetation types. The survey work implies variation in both flora and especially vegetation. Consequently, and at least provisionally, any vegetation type in the study area assigned a condition rating of Very Good or Excellent probably warrants consideration as significant for conservation.

Larger stands of *Melaleuca cardiophylla* are considered significant also because such stands are at the southern end of their range and are poorly reserved in the Perth Metropolitan Region. Griffin and Trudgen (1994) list the range of *Melaleuca cardiophylla* as Exmouth to Mullaloo. Forms of the *Melaleuca cardiophylla* association were found throughout the study area, but the largest stands and the ones assessed to be in the best condition adjoin study area, in particular south-east of the Two Rocks South portion of the study area. *Melaleuca cardiophylla* Closed Scrub is widespread to the south and east of the residential area of Two Rocks. It also occurs in one isolated patch near 'The Spot', located between the Two Rocks and Yanchep.

*Melaleuca systena* – *Acacia lasiocarpa* Low Shrubland over *Lomandra maritima* graminoid Herbland (MAL) vegetation within a few metres of the coast in the Two Rocks North and Yanchep foreshore areas is considered significant because it is atypically close to the coast.

The *Scaevola nitida* vegetation in the south-eastern corner of the Yanchep foreshore area is considered significant not only because it is in Very Good to Excellent condition, but also because it may be rare in the Perth Metropolitan Region. At least neither it, nor its dominant species, is referred to in the Bush Forever descriptions of coastal Bush Forever sites more than once or twice.

### Weeds and other Alien Species

37 of the taxa recorded in the study area are established aliens or environmental weeds. (Refer to **Appendix 2**). The aliens include some south-western native trees and large shrubs which, in the context of the study area are aliens. They are not native to the study area and were probably, at least originally, planted and have spread since then. These species include *Eucalyptus utilis* and *Melaleuca nesophylla* and probably *Callitris preissii*,

*Agonis flexuosa* and *Melaleuca lanceolata*. The Victorian Tea Tree *Leptospermum laevigatum* was also planted and is now spreading.

The beach and foredune vegetation is now largely alien, mainly due to the perennial rhizomatous grasses *Thinopyrum distichum* and *Ammophila arenaria*, that have been planted to stabilise the sand, and the herbaceous plants *Cakile maritima*, *Euphorbia paralias* and *Tetragonia decumbens*. These species are largely restricted to loose sandy disturbed areas near the coast but some, especially the *Tetragonia*, impact upon native species there.

Another grass planted to stabilise sand, *Ehrharta villosa*, which is established in the Two Rocks South and Yanchep sections of the study area, is spreading and has the potential to become a major environmental weed. In the southern strip of the Yanchep section of the study area, it is already smothering native vegetation on one dune between Brazier Road and the beach. Several other annual grasses are serious weeds, but they are long established and do not smother mature shrubby vegetation.

The most widespread conspicuous weeds in the study area are *Pelargonium capitatum* and *Trachyandra divaricata*. These introductions from South Africa are probably the most serious widely distributed non-grass weeds of the coastal dunes.

Several garden daisies, including *Arctotis stoechadifolia*, *Gazania linearis* and *Osteospermum ecklonis* are now well established in some of the foreshore study area, especially disturbed sites in the northern Two Rocks area. Some of these species may have potential to spread more widely and to invade bushland areas after fires.

## **2.10 Fauna**

Alan Tingay and Associates carried out a vertebrate survey for the broader Two Rocks Yanchep area in 1993. As part of this survey, the coastal heath habitat unit (which includes the study area) was sampled for the presence of frogs, reptiles, birds and mammals. The species observed during the survey included one frog species, 10 reptile species, 26 bird species and one mammal species. The fauna identified is generally typical of the region.

In 2003, Alan K Jones and Cheryl Gole carried out a survey and review of Birds and Reserves of the City of Wanneroo, a project initiated by Birds Australia Western Australia (Inc), which was jointly funded by the City of Wanneroo and the Perth Biodiversity Project. This survey incorporated the coastal area, which includes the study area. This survey also identified 26 bird species including some now extinct at most metropolitan coastal areas. Significant species recorded in the coastal area of Wanneroo include the Variegated Fairy-wren, White-winged Fairy-wren, White-browed Scrubwren, White-breasted Robin and Tawny-crowned Honeyeater.

## **2.11 Landscape**

The landscape within the study area is generally of low to moderate relief. The coastline comprises a series of long gentle crescent shaped beaches contained by sandy points. The major visual element is the shoreline. This line, where the ocean meets the land, leads the eye along the beach into the distance terminating where a sandy point meets the sea. The

dunes to the east of the shoreline form the limit of view from the beach, while to the west the panorama extends to the level horizon over open water. In places the view from the beach includes nearshore and offshore rock formations. For example, the view from Leeman's Boat Landing includes the "two rocks" from which the locality gets its name. The Yanchep Lagoon is a major landscape feature as is the high dune crest behind the kiosk.

The study area provides panoramic views of open ocean and long, one sided, vistas along the shore. Attention is drawn to visual detail in the foreground and middle ground. This detail becomes very important as it can easily detract from an otherwise very attractive view. Within more extensive backdune areas there are contained vistas of undulating landform, coastal vegetation and introduced planting and buildings.

The landscape within the coastal reserve is generally of high visual quality. The minor bare sand areas do not detract significantly from the overall quality. The major bare sand dune slope encroaching onto Two Rocks Road at the entrance to Two Rocks and the north western slope of this same dune do have a significant visual impact.

### Major Viewing Locations

The major viewing locations at Yanchep and Two Rocks foreshores are as follows:

1. The Kiosk at Yanchep - provides views over the Lagoon and north up the coast to groynes at Club Capricorn;
2. The hill directly behind the Kiosk is potentially a major viewing location providing 360 degree panoramic views;
3. The informal track at the south end of Compass Circle provides long views south along the shoreline and over dunes to a distant sandy point and north over dunes and along the beach to a small salient south of the Lagoon;
4. Leeman's Boat Landing memorial provides panoramic ocean views with interest created by rock formations emerging from the sea in the foreground. Also provides a long vista south along the coast terminating at "the Spot"; and
5. The proposed beacon site provides long views over sand dunes and ocean to the north terminating at a sandy point, and over dunes and the Marina to the south.

### The Built Form

The following are the built forms at Yanchep and Two Rocks foreshores:

1. The Tavern at Two Rocks has a very strong affinity with its site in form, texture and colour. It is distinctly Mediterranean in style with no visible roofline. This building is a fine example of built form respecting its environment;

2. The orange and white burr shaped building at Two Rocks is totally alien to the landscape. It is highly visible and very intrusive. It may be “fun” but it is also hideous;
3. The Marina and its buildings are functional and appropriate to their location and use;
4. The Marina car park is without a sense of human scale. The horizontal plane is unrelieved by any vertical elements and the ground plane is very harsh. The edges to the north, south and west of the car park are abrupt, harsh and untidy;
5. The Leeman’s Boat Landing memorial is isolated and unattractively fenced;
6. The Yanchep Kiosk building is well sited and is pleasing in form, scale and colour. The associated car park, road, retaining walls, steps, barriers and bins are, however, of poor visual quality. The road and the car park visually cut the kiosk off from the beach. Power lines to the north of the kiosk intrude into the view from the Kiosk to the north;
7. The toilet at Fisherman’s Hollow is partially hidden from the view of the passing traffic. The colours could be changed to match the Kiosk;
8. The car park at Fisherman’s Hollow visually dominates the entrance to the open space. The space is poorly defined and the edge details of post and rail barriers and large limestone boulders are poor;
9. The car parks on Compass Circle visually extend the bitumen road surface into the dune landscape to the point where they become dominant;
10. Signs are of varying quality. The large “Dog exercise area” signs on the beaches at Yanchep and Two Rocks are very intrusive;
11. The beach end of some path fences at Yanchep are broken down and unattractive; and
12. The sump on Brazier Road is visually intrusive and unscreened from the road.

## **3.0 Social Environment**

### **3.1 Cultural Heritage**

#### **3.1.1 Aboriginal Heritage**

Under the Aboriginal Heritage Act, 1972 it is an offence to damage, alter or destroy any aboriginal site, unless the consent of the Minister for Aboriginal Affairs has been obtained. This includes sites that are both registered and not registered.

A search of the Department's Register of Aboriginal Sites in January 2005, revealed that two mythological sites had been registered within the Yanchep portion of the study area. These sites are "The Limestone Reef" and "The Yanchep Beach" whose ID numbers are 17596 and 17599 respectively.

The Final Report prepared by Lily Bhavna Kauler for Elder Harry Nannup of Aboriginal Community College, Gnangara (1997-1998) included the following story:

*"The Story has been told about the shark and the whale and the crocodile and the fight that they had and the formation of Rottnest and Garden Island and as the crocodile was walking back he laid down exhausted at what is now known as Yanchep beach and here you can see the outline of his whole skeletal frame work and it was here that he shed his skeletal frame work and then moved on."*

It will be necessary to seek appropriate clearances under the Aboriginal Heritage Act prior to undertaking works within this part of the study area.

#### **3.1.2 European Heritage**

##### Yanchep Lagoon and Fisherman's Hollow

Although understood to have been used prior to European occupation by Aboriginal people as a swimming and fishing hole, Fisherman's Hollow together with the Yanchep Lagoon have been frequented by holidaymakers since the early 1900s. The Lagoon became an anchorage for the Cray fishing fleet in the late 1950s and 1960s before the Two Rocks Marina was built.

##### Lindsay Homestead

In 1926 Mary Lindsay purchased approximately 23,000 acres of land along the coast to the approximate location of Two Rocks, which became known as Yanchep Estate. Prior to this, the land was owned by the Midland Railway Company, which was granted the land following the construction of the railway to Geraldton, completed in 1894. The Lindsay family lived in tents while a timber-framed homestead was constructed by the Bunning Brothers in the area north of Brazier Road and west of Two Rocks Road. This homestead still remains today. The stables and men's quarters are believed to have been built nearby

from some of the materials from the wreck of the Alex T Brown, although it is not known if any fabric remain.

In 1927 Mary Lindsay built a hostel and a store for campers in the area. Although meals were not provided, camping accommodation and essential supplies including water, food and fishing tackle were available. Mary Lindsay was well known for her work protecting the natural dune landscape and vegetation. During World War II, the army took over the premises. The homestead during World War II was used for entertaining VIP guests including military service personnel.

### Leeman's Boat Landing

In March 1658, Abraham Leeman van Santwits, first officer and navigator of the Waeckende Boey and thirteen sailors came ashore in the vicinity of Wanneroo Beach where they found wreckage from the Vergulde Draeck but no sign of survivors. Unable to return to their ship because of bad weather, and abandoned by Samuel Volkersen the skipper of the Waeckende Boey, Leeman set sail for Batavia in a overloaded open boat. He and three sailors survived the journey.

In 1982 a limestone obelisk was erected at the end of Marcon Street in Two Rocks in recognition of Leeman's Landing. A plaque at the Leeman's Boat Landing site, signifies the area where Leeman and his men came ashore. Twenty years before the arrival of the British settlers, whalers visited this region as they followed pods of whales along the Western Australian Coast.

### **3.1.3 Shipwrecks**

There is one identified wreck site off the study area, the "Emily", which was wrecked in 1868, just south of the Two Rocks town site. Although the current position of the wreck is not known, this wreck, if it still exists, is considered to be important in terms of early industrial development in Western Australia.

A second wreck, that of the "Alex T Brown" which ran aground in 1917, still lies 100 metres south of the "Spot". This wreck is the only example of a wooden schooner of its class to be wrecked along the Western Australian coastline. While this wreck is located outside the study area, it will have significance as a destination from both Yanchep and Two Rocks.

### **3.2 Population Growth**

A population of approximately 4,000 people currently reside within the Two Rocks Yanchep area. The townsites at Two Rocks and Yanchep are surrounded by approximately 4,000 hectares of vacant urban zoned land, which is currently being planned for a community of around 150,000 people. A District Concept Plan has recently been lodged with the City by the predominant landowner, Yanchep Sun City Pty Ltd. Once adopted this plan is intended to form the basis of a District Structure Plan which will be used to guide the future planning and development of Two Rocks and Yanchep.

Whilst more detailed planning for a number of development fronts within the Two Rocks Yanchep area is underway, the most relevant to the study area is the Capricorn Coastal

Village Structure Plan, which relates to the coastal area immediately north of the Yanchep townsite. This structure plan provides the planning framework for a future population of over 7,500 people and depicts a coastal road along its interface with the foreshore and a coastal centre in the vicinity of the Club Capricorn Resort. Subdivision approval for the southern portion of this structure plan area has now been approved by the Western Australian Planning Commission, with the first stages of subdivision planned to be undertaken in the near future.

Recent population projections undertaken for the City of Wanneroo indicate that the Two Rocks Yanchep area will grow to an approximately population of 5,100 by 2006, 8,800 by 2011 and 21,300 by 2021. This growth will have implications for the study area, both in terms of management and infrastructure provision. Existing levels of facilities and infrastructure need to be reviewed and a greater potential for conflict between different recreational user groups will become evident. Increased population will also place greater pressure on natural areas. This will necessitate formalising access tracks to focus pedestrian access to the beach and other focal points. Indirectly, the natural environment may also be compromised through increased littering, possible disease, introduction of weeds and pollution. The planned population growth will also provide opportunities for the study area. It will create the opportunity to provide a greater range of facilities and infrastructure, including commercial and tourist facilities to the area. The greater population and increased use of the study area will also increase surveillance of the area, which could potentially reduce antisocial activities such as graffiti and vandalism.

### **3.3 Recreation Use**

The main focus in the Two Rocks portion of the study area is the marina. Facilities here include a small boat launching ramp, tavern, shops, car parking and mooring facilities for both commercial and pleasure craft.

The main focus of activity in the Yanchep portion of the study area is the Lagoon. The Lagoon is a popular coastal destination for both Yanchep and Two Rocks residents as well as visitors and tourists. The main attraction of the area is its suitability for family swimming due to the protection afforded by the offshore reef, which attenuates wave energy to produce calm onshore conditions on most occasions. The area also has high scenic value and is popular for snorkelling, recreational fishing and windsurfing. Existing facilities at the Lagoon include car parking, picnic areas, a kiosk, toilet facilities and a surf club.

The foreshore area adjacent to the Club Capricorn Resort is generally utilised by guests and visitors of the chalets, hotel and caravan park. Facilities in the foreshore area currently consist of two car parking areas accommodating approximately 20 bays each and informal beach access tracks through the dunes. The beach area is used for walking, sunbathing, recreational fishing, surfing (experienced and beginners) and swimming. The beach is mostly suitable for experienced swimmers due to the in-shore wave breaking pattern and cross-shore currents.

The Lindsay Homestead is located within privately owned portion of the study area to the north of the Lagoon. The homestead has historic significance as the first building in the Two Rocks Yanchep area. The homestead is currently occupied as a private residence and contains some modern additions to the original building. A large shed is located close to

the house. A large Melaleuca tree, possibly planted by the Lindsay family is located close to the south-western corner of the house. A sandy track situated in a natural valley provides pedestrian access between the homestead and the beach.

Four private lots are located north of the existing surf club. There is currently no gazetted road access to these lots. The location of these private residences, surrounded by public reserves appears incongruent and land ownership, use and management issues require resolution between the landowners, the Western Australian Planning Commission and the City of Wanneroo. The houses directly abut the foreshore reserve. A system of sandy tracks provides access between each house and the beach.

Outside the Lagoon and marina areas a series of small car parks and beach access tracks link the coastal road with the beach. Two dog exercise beaches also exists to the south of the Lagoon and marina.

A beach user survey carried out by Coastwise Coastal Planning and Management in February 1999 indicates low to medium use of beach facilities within the study area. At the time of survey, the Lagoon was the most popular beach in the study area with 141 people present. None of the beach car parks were filled to capacity at the time of survey. Results of the survey are outlined in **Table 4**.

**TABLE 4  
RESULTS OF BEACH USER SURVEY ON 7 FEBRUARY 1999**

Location	People on Beach	People in Water	Total people	No of Cars
Beach Access Path North of Marina	-	7	7	3
Marina Southern Carpark	10	-	10	49
Marcon Street Car Park	1	1	2	4
Informal Car Park Southern Two Rocks	8	6	14	5
Club Capricorn	15	21	36	14
Yanchep Lagoon	123	18	141	106
Yanchep lagoon South	20	14	34	11
Brazier Road Car Park	7	-	7	2
Ocean Lagoon	3	17	20	10

### **3.4 Anticipated Future Beach Use**

In order to plan for the future demands likely to be placed on the foreshore reserve, it is necessary to determine which activities are likely to occur, and what associated facilities will be needed to support these activities. Recreational pursuits will be determined primarily by the physical characteristics of the coast and secondly by the types of services or facilities that will be provided in the area. For example, while most people are attracted to the beach to use the natural features of the environment such as the water, beach and dunes, the provision of cafes and grassed recreation areas may also attract people.

The types of activities expected to occur in the study area in the future are listed in **Table 5**.

**TABLE 5**  
**TYPICAL ACTIVITIES EXPECTED TO OCCUR IN THE STUDY AREA**

<b>Water-related</b>	<b>Reef-related</b>	<b>Beach-related</b>	<b>Foreshore Area</b>
Windsurfing	Scuba Diving	Fishing	Picnicking
Kite surfing	Snorkelling	Walking	Walking
Surfing		Jogging	Jogging
Swimming		Dog Exercising	Cycling
Wading		Sunbathing	Viewing Scenery
Boogie Boarding		Sports	Environment and
Surf-lifesaving		Relaxing	heritage education
		Surf-lifesaving	

Many of these activities do not require provision of support facilities, beyond amenities for human comfort. Activities that will require facilities are:

- Cycling and walking - Dual use path, bike racks, watering facilities at stopping points, and toilets at regular intervals.
- Fishing – Possible fish cleaning area.
- Picnicking - Tables, seats, shelters, kiosks, toilets, barbeques, water supply, and bins.
- Surf lifesaving - Storage area for equipment, meeting rooms, exercise and social areas.

All of these activities require access roads and pedestrian beach access paths in the foreshore area. Associated facilities include car parking space, dual use paths, and bicycle racks. Beaches expected to attract large numbers of people will also require toilets, showers, change rooms, a kiosk, and possibly hire facilities. Rubbish bins are also necessary on the beach itself, and shade shelters on the beach also may be considered.

District beaches have a physical environment suitable for a relatively wide range of activities and therefore require facilities to cater for the likely number of beach users. They also require appropriate levels of road access connecting to the district distributor road network. Development adjacent to district beaches should be commensurate with the area's significance.

Local beaches have fewer uses and therefore require limited amenities. Such areas may be suited to more specific activities such as dog exercising or fishing. They will require a lower order of road access connecting from the district distributor road network but should still be easily accessible to those from outside of the local area. Development adjacent to local beaches is usually suitable for low to medium density housing with some potential for kiosk facilities. The provision of passive recreational areas such as grassed play or picnic areas are appropriate within the foreshore reserve of local beaches.

It is essential to ensure that the physical environment can meet the recreational demands and also support the infrastructure likely to be imposed by these demands.

## **4.0 Tourism Development**

The Two Rocks Yanchep area has long been associated with tourists and visitors. Historically both areas have attracted a significant injection of capital funds from Bond Corporation and others which have seen the development of wild life parks, a marina and other built facilities which all contribute to tourist potential. Yanchep National Park has a vital role in influencing the tourism interest for the area as a whole. This park has an iconic status in Perth. Recent studies have illustrated the economic value of National Parks for the region in which they are situated to be significant. The contribution to the local economy generated by the Yanchep National Park is estimated at \$16,594.500 based on 2004 visitor figures of 185,000. This contribution will be strengthened with the expansion of associated facilities in the area to entice visitors to linger and spend time and money locally.

The foreshore area itself has an abundance of natural resources, including high quality beaches, scenery, surfing, fishing, diving and boating opportunities, heritage and environmental interpretive opportunities that combine to provide a valuable basis for expanding the areas tourist potential. Capturing the tourism potential of these facilities will begin to create demand for a range of ancillary services including dining and accommodation facilities and the planned population growth for the surrounding area will act to reinforce demand for these facilities.

The Foreshore Management Plan seeks to facilitate the tourism potential of the area by providing for the development of several activity nodes along the Two Rocks - Yanchep foreshore. The Two Rocks marina is planned to be subjected to future structure planning. The area in the vicinity of Leeman's Boat Landing is proposed to be developed with a broad range of picnic and recreational facilities. The Club Capricorn area is planned to be redeveloped as a coastal village centre as part of the development of the adjoining land estate and the concept plan for the Yanchep Lagoon included in this management plan not only provides for the redevelopment of the entire area to ultimately include a full range of picnic and recreational facilities, but also provides for several future building sites that could potentially attract the development of tourist/recreation based retail, cafes/dining/tavern facilities or short stay accommodation.

## 5.0 THE PLANNING CONTEXT

The following planning policies are considered relevant in the formulation of the Management Proposals for the Two Rocks and Yanchep study area.

### Statement of Planning Policy No.2.6: State Coastal Planning Policy

In recognition of the demands and pressures on the coast and the need for coordinated decision-making, the Western Australian Planning Commission developed this policy under section 5AA of the Town Planning and Development Act. The policy seeks to ensure that coastal issues are appropriately considered in planning decisions and actions.

The objectives of the policy are to:

- Protect, conserve and enhance coastal values, particularly in areas of landscape, nature conservation, indigenous and cultural significance;
- Provide for public foreshore areas and access to these on the coast;
- Ensure the identification of appropriate areas for the sustainable use of the coast for tourism, recreation ocean access, commercial and other activities; and
- Ensure that the location of coastal facilities and development takes into account coastal processes including erosion, accretion, storm surge, tides wave conditions, sea level change and biophysical criteria.

Some of the key measures of this policy are to:

- Ensure that when selecting a development location, regard is given to infrastructure capacity, and where possible existing infrastructure be upgraded and improved;
- Ensure that new buildings and foreshore infrastructure on the coast are positioned to avoid risk of damage from coastal processes and, where possible, avoid the need for physical structures to protect development from potential damage caused by physical processes on the coast. The policy includes setback guidelines, which should be applied to determine appropriate setbacks to accommodate coastal processes.

### Bush Forever (Government of Western Australia, 2000)

Bush Forever applies specifically to bushland within the Swan Coastal Plain portion of the Perth Metropolitan Region. It identifies 51,200 hectares of regionally significant bushland for protection, covering 26 vegetation complexes. This amounts to about 18% of the original extent of vegetation on the Swan Coastal Plain portion of the Metropolitan Region. Areas selected as Bush Forever Sites, which are representative of regional ecosystems and habitats, play a central role in the conservation of Perth's biodiversity.

As part of the Bush Forever process, specific criteria were developed to select coastal areas in the metropolitan area suitable for conservation areas. The six criteria relate to:

- Inclusion of a succession of different Quindalup dune types;
- The requirement for the site to be of sufficient size that natural processes such as dune formation can continue;
- Inclusion of sandy and/or rocky shorelines;
- Linkage to other bushland or coastal areas;
- Possession of a variety of vegetation types; and
- Possession of a variety of adjacent habitats to provide for the diverse reptilian and bird fauna of the coastal dunes.

The majority of the study area lies within Bush Forever Site 397, which relates to the coastal strip from Wilbinga to Mindarie. The boundary of Bush Forever Site 397 in relation to the study area is shown in **Figure 5**.

The Bush Forever designation has implications for planning and management within the study area. The natural vegetation in the area has been identified as regionally significant. Development in this area must have conservation as a high priority with minimal clearing. Possible environmental impacts of proposals on the surrounding bushland must also be minimised. The Bush Forever Practice Note 14 does however recognise that Parks and Recreation Reserves perform a variety of functions other than just conservation and provides for a case-by-case review involving consideration of planning and environmental issues beyond bushland protection.

#### Draft Bushland Policy for the Perth Metropolitan Region Statement of Planning Policy 2.8 (2004)

The aim of this draft policy is to provide a statutory policy and implementation framework that will ensure bushland protection and management issues in the Perth Metropolitan area are appropriately addressed and integrated with broader land use planning and decision making to secure long-term protection of biodiversity and associated environmental values.

Some of the specific measures of this policy relating to the Bush Forever Protection Areas are that proposals or decision making should support a general presumption against the clearing of regionally significant bushland, except where a proposal or decision:

- Is consistent with the overall purpose and intent of an existing reserve, existing approved uses and/or existing planning or environmental commitments or approvals; or
- Is in accordance with an existing endorsed master plan, management plan or similar, which has appropriately considered bushland protection requirements; or it is considered through a whole-of-site, formal master plan or management plan process, or similar, which effectively coordinates bushland protection and future development requirements within an overall strategic framework and seeks to maximise the protection of conservation values; or
- Can be reasonably justified with regard to wider environmental, social, economic or recreational needs and all feasible alternatives have been considered in order to avoid or minimise any direct loss of regionally significant bushland; and reasonable

mitigation strategies are secured to offset any loss of regionally significant bushland where appropriate and practical.

### Previous Coastal Planning Studies

A Coastal Planning Strategy for the Yanchep area was prepared on behalf of Tokyu Corporation, as supporting documentation for the amendments to the Metropolitan Region Scheme in the Yanchep-Two Rocks area in 1996.

The Strategy defined the Foreshore Reserve boundary for the Two Rocks Yanchep area, taking into account the physical environment and the potential for coastal recreational demand. Potential locations for supporting facilities and amenities were also identified.

The strategy classified beaches along the Two Rocks Yanchep coastline as either regional, district or local, based on their potential to attract people. Those beaches classified as regional in nature being those which were likely to be the focus of use by residents of the surrounding region as well as local residents; local beaches were classified as those which were likely to be used more by people within walking or cycling distance of the beach; and district beaches were classified as those which displayed a combination of both regional and local beach characteristics. The following table outlines how the various beaches within the study area were classified under this hierarchy.

<b>Beach Location</b>	<b>Classification</b>
North of the Two Rocks Marina	Local/District
South of the Two Rocks Marina	District
Between Club Capricorn Groyne and the Yanchep Lagoon	Local
Yanchep Lagoon	District
South of the Yanchep Lagoon	Local

Bill James Landscape Architects prepared a Foreshore Management Plan, for the foreshore areas adjacent to the Yanchep and Two Rocks townsites in 1995. Council adopted this plan on 22 October 1997. The plan provided proposals for appropriate infrastructure and management of the foreshore area. Key issues arising from the plan included pedestrian/vehicular conflict at the Yanchep Lagoon, the lack of beach facilities at Two Rocks and the unstable nature of the foreshore to the north of the Two Rocks marina.

O'Brien Planning Consultants prepared a Foreshore Management Plan for the foreshore area adjacent to Lot 614 (the Ocean Lagoon Estate) in 1997. The plan provided proposals for coastal car parks, access paths and lookouts as well as proposals for the ongoing management of the foreshore area.

## **6.0 PROPOSALS**

The study area has been divided into five sectors, namely Two Rocks North, Two Rocks South, Yanchep North, Yanchep South and the Yanchep Lagoon. The following sections describe the proposals relevant to each sector.

### **6.1 Two Rocks North**

This sector extends between the northern boundary of the study area and Leeman's Landing. It includes the marina, associated facilities and the car park.

The area to the north of the marina is experiencing gradual erosion. Given the configuration of the marina breakwaters and the net south to north longshore sediment transport, this erosion is likely to continue for many years. In June 2004, Council resolved to fund, in conjunction with the Department for Planning and Infrastructure, the appointment of a coastal engineering consultant to investigate the likely extent of erosion and propose potential management strategies to address the issue. This is a separate detailed engineering study for this part of the coastline, which will require separate consultation and consideration by Council. The Foreshore Management Plan should therefore refer to the study as an action to be completed.

In 2002, the City replaced the boardwalk adjacent to Sceptre Court with a concrete beach access way, including a viewing platform, a wooden stairs to the beach and a 10-bay parking area at the entrance of the beach access way. Given the erosion being experienced in this part of the foreshore, this access way remains the only one north of the marina. Depending on the outcome of the erosion study referred to above however and the likely impact that the chosen strategy will have on erosion, it may be necessary to revisit the appropriateness of additional beach access ways through this part of the foreshore.

Seagrass currently accumulates on the beach to the immediate south of the marina's southern breakwater. The City, in conjunction with the Department for Planning and Infrastructure and key landowners in the area prepared a Sea Grass Strategy to investigate possible solutions to this issue. As an outcome of this strategy in December 2004, Council provided in principle support to the expansion of the Two Rocks Marina in order to assist in accommodating the future demand for marina facilities in the region. It also resolved to seek similar support from the State Government, before progressing further planning for this option. In view of this, the foreshore management plan identifies the marina area as being subject to future structure planning and does not contain any specific proposals for this area at this time.

A gazetted dog exercise area is located between the marina and the Leeman's Boat Landing site. Sign posting to the area is unsightly and could be replaced with more visually sympathetic signage.

#### Opportunities:

- The beach north of the Marina is a suitable beach for swimming and fishing and provides walking access to popular surfing area to the north of the study area;

- A concrete surface beach access way provides connection to the beach;
- The coastal vegetation is in a healthy and relatively undisturbed condition; and
- A gazetted dog exercise area is located between the marina and the Leeman's Boat Landing site.

#### Constraints:

- The steep sand cliff is gradually eroding;
- Accumulation of seaweed to the south of the marina; and
- No dual use pathway along Sovereign Drive.

#### Specific Recommendations:

1. Complete the existing investigation into the likely extent of erosion north of the marina and the potential management strategies to address this.
2. Following the outcome of the above study review the appropriateness of additional beach access ways through this part of the foreshore
3. Provision of a 2.5 metre wide dual use path along the western side of Sovereign Drive;
4. Provide a shower at the Sceptre Court beach access way; and
5. Replace signage at the dog exercise area with more visually sympathetic signage.

**Figure 8a** depict the proposals of this Sector.

## **6.2 Two Rocks South**

This sector extends from the Leeman's Boat Landing to the southern boundary of the Two Rocks study area. The foreshore reserve ranges in width between 200 and 400 metres. Two Rocks Road form the eastern boundary.

The area comprises extensive dunes with vegetation in a relatively undisturbed state. The condition of the vegetation between Two Rocks Road and the secondary dunes is stated to be 'Very Good to Excellent'. Between the beach and the secondary dunes the condition is 'Good'. There are numerous tracks linking Two Rocks Road to the beach through the dunes.

The Leeman's Boat Landing area is located at the northern end of an outstanding regional beach. Some basic facilities currently exist at this location, including a toilet block, car park, memorial and pathways, although much of this infrastructure is in a dilapidated condition. In order to recognise the significant attributes of this location and provide a beach node for the Two Rocks community, the Foreshore Management Plan proposes the preparation and implementation of a concept plan making provision for a broad range of picnic and recreational facilities.

#### Opportunities

- The extensive and relatively undisturbed dunes between Two Rocks Road and the beach are an important coastal landscape feature which will become increasingly valuable as urbanization proceeds; and

- The beach is wide and stable providing suitable conditions for a wide variety of beach activities.
- The presence of high dunes provide an opportunity to locate look-outs to enjoy the panoramic views of the ocean.
- An existing bituminised car park at the Leeman's Landing.
- An existing concrete surfaced beach access way connecting Leeman's Landing with the beach.
- The beach to the south of Leeman's Boat Landing is an ideal swimming beach;
- The accretion terrace to the north and south of Leeman's Boat Landing is evidence of a stable shoreline;
- The cleared and degraded land around Leeman's Boat Landing is suitable for development of a grassed parkland;
- Leeman's Boat Landing site provides panoramic views to the south and the north west; and
- The heritage significance of Leeman's Boat Landing site can be used to give identity to the area.

#### Constraints:

- An area zoned Urban intrudes into the foreshore to the west of Two Rocks Road;
- The numerous tracks between Two Rocks Road and the beach degrade the dune landscape;
- The area is presently accessible to off road vehicles.
- Leeman's Boat Landing site and other infrastructure in the vicinity are poorly presented and inadequate in the longer term.

#### Specific Recommendations:

1. Prepare and implement landscape concept plans for a Leemans Boat Landing picnic/recreation area, including provision for an expansion of the existing car park, upgrade of the existing toilet facility and memorial, the conversion of the existing drainage sump into a landscaped swale, pathways and a range of recreation/picnic facilities.
2. Provide two beach access ways, including associated car parking, lookouts, signage, bins and bike racks, as shown on the concept plans.
3. Provide a 2.5m wide dual use path along the foreshore between the fore and secondary dunes, linking Leeman's Boat Landing to the southern boundary of the study area and indicating a possible link toward the Yanchep Lagoon;
4. Close and rehabilitate the remaining tracks;

**Figure 8b** shows the Foreshore Management proposals for this sector.

### **6.3 Yanchep North**

This sector is approximately 1.3 km long and extends from the northern boundary of the Yanchep portion of the Study Area to the immediate north of the Yanchep Lagoon. The proposed coastal road within the Capricorn Village Structure Plan area would form the eastern boundary of this sector. When the Capricorn Village is developed the foreshore at

this sector would be about 250 metres in width. The foreshore undulates and contains several significant high dunes. A ridge runs parallel to the beach.

A groyne is located at the northern end of this sector and provides a safe swimming beach to the immediate north of the groyne. The beach to the south of the groyne has been accreting since the construction of the groyne in the early 1970s resulting in a wide sandy beach. When the Capricorn Village Structure Plan area is developed, this beach could become a very popular beach attracting beach goers from various localities. Currently, it is also a popular surfing beach.

The Club Capricorn Resort gains access off Two Rocks Road via a private road, which terminates at the groyne. There are two car parking areas at the groyne, which all together makes provision for about 30 bays. Due to its relative isolation and the private status of the access road to the Capricorn Village beach, not many beach goers use this beach. This situation would undoubtedly change once the Capricorn Village is developed with a network of public roads that leads to this beach.

The Lindsay Homestead, a heritage building, is located within this sector and gains access off Two Rocks Road. This building is currently under the ownership of the Capricorn Village Joint Venture.

Four freehold lots each containing a house is located within this sector. These houses gain access via a limestone track off Two Rocks Road. The southernmost house also gains access off Brazier Road via a limestone track, which is also used by the Yanchep Surf Life Saving Club. Private landscaping and other works have been informally extended into the foreshore area. The plan includes recommended actions to address these encroachments and better define the boundary between public and private land.

The vegetation condition of this foreshore from the northern boundary up to the Lindsay Homestead and to the east of the proposed coastal road is classified as 'Very Good to Excellent'. Between the Lindsay Homestead and the southern boundary of the sector the condition ranges from "Degraded to Very Good". At the beach the condition ranges from 'Degraded to Good'.

The coastal road is proposed intersect with Brazier Road within the Yanchep Lagoon area. The road would generally take an alignment through the crest of the dunes, not only to minimise the extent of the road batters, but also to provide magnificent views to the road users. The batters of the coastal road would be stabilised and vegetated to suit the landscaping treatment or native vegetation of the adjacent areas.

### Yanchep Surf Life Saving Club

The existing Yanchep Surf Life Saving Club is located at the northern end of the Yanchep Lagoon. Whilst minor renovations were undertaken in 2003, it is generally accepted that the existing facility does not adequately cater for existing or future needs. With considerable population (and therefore beach patronage) increases forecast in the area, the City engaged consultants to investigate, amongst other things, the most appropriate future location for the surf club facility. This study was undertaken in conjunction with a Project Reference Group comprising Elected Members, City Officers and representatives from the Yanchep Two Rocks Recreation Association, Two Rocks Yanchep Residents Association,

Yanchep Surf Life Saving Club, Yanchep Sun City Pty Ltd, and Surf Life Saving Western Australia. The study identified three possible sites for the future Yanchep Surf Life Saving Club, including the Yanchep Lagoon, the existing surf life saving club and the beach adjoining Club Capricorn. The preferred option recommended by the study and supported by the Project Reference Group was for the fore dune area adjacent to the Club Capricorn groyne. This site offered good swimming and carnival beaches, was well located to serve the growing community, allowed sufficient space for ancillary amenities, provided good presence and effective surveillance of popular swimming areas.

The consultant's report noted however that access and service provision to the preferred site would be problematic in the short term and therefore provided an interim development option for the existing facility at the Lagoon. This interim option included additional storage, access, car parking and amenities. Concern was however raised by the Project Reference Group regarding the cost of this interim solution (\$520,020) and the fact that it would not effectively deal with existing beach access issues. It was noted that further discussions would be required between the relevant stakeholders to develop an alternate interim solution.

Council considered the study at its meeting on 14 December 2004 and resolved to note the outcomes of the study and refer the report and recommendations for consideration in the preparation of this foreshore management plan.

In the context of the future growth planned for the Yanchep area, the Club Capricorn site provides the best long term location for the club facility, subject to the detailed location and design of the facility integrating with the planning currently occurring for the Capricorn Coastal Village centre. Given the current access and servicing difficulties to the new site and the fact that it is removed from the present development front, an acceptable and cost effective interim solution is required to meet the short to medium term needs of the club and beach going community. Key issues with the existing facility that need to be addressed if this facility is to be maintained include the dilapidated condition of the existing building, the surface and gradient of the beach access ramp, inadequate car parking and vehicle/emergency access, visual isolation of the club building and the provision for growth (storage and meeting facilities etc).

The foreshore management plan deals with a number of these issues (under the Yanchep Lagoon section) and discussions are continuing with relevant stakeholders with a view to proposing an acceptable and cost effective interim solution for the facility for Council to consider in adopting the final plan.

#### Lindsay Homestead.

As regards the usage of the Lindsay Homestead, in the short-term, the residential use of the house will be maintained. However, as the land within the Structure Plan is progressively developed, a number of alternative uses for the homestead are being considered. These could include:

- Community Purposes - heritage/environment centre; day care; community centre.
- Sales Office/Information Centre.
- Commercial - kiosk, bed and breakfast, or café.

A combination of these public and commercial uses will ensure that the general public will have access to this unique heritage building. It is envisaged that the Homestead will become a focal point of this southern area. Strong pedestrian links will be provided between the adjoining residential areas and the beach.

The longer-term options for the homestead lot will also involve developing the surrounding valley for recreational use as a grassed picnic area. The vegetation condition within the valley is found to be “Completely Degraded to Degraded’ due to many years of associated uses with the residence. The valley is sufficiently protected from the sea breeze that any proposals would function very well.

### Public Open Space areas

In the draft Capricorn Village Structure Plan, two public open space areas have been proposed at the interface of the Structure Plan area and the foreshore, which form part of the open space requirement for the Capricorn Village Structure Plan area. These open space areas have been proposed to be extended into the foreshore to create functional areas to provide foreshore recreational facilities.

The northern open space area (1.65 hectares) is located in a valley near the groyne. Considering the possible demand for recreational facilities within this foreshore from the future residents of Capricorn Village Structure Plan area, it is proposed to use this open space area for community gathering and to include a possible amphitheatre in a natural hollow as a public venue. The dunes surrounding this site will shelter it from south-westerly winds. This open space would also contain other recreation and picnic facilities. Along the northern boundary of this open space a car park is proposed, in addition to the parking embayments proposed along the coastal road.

The vegetation condition of this portion of the foreshore, including the open space area is stated to be “Very Good to Excellent”. The open space proposals would result in only minimal area of vegetation within this sector. However, in view of the likely demand for recreational facilities on the foreshore to cater to the needs of the future population, this proposal is considered to be appropriate.

The other open space area (1.05 hectare) is proposed adjoining the Lindsay Homestead. As the majority of the vegetation at this location is stated to be in “Good to Completely Degraded” condition, this proposal is not likely to have a significant environmental impact.

A concept plan will be developed for each of these recreation areas prior to development taking place.

### Dual use paths and beach access ways

A 2.5 metre wide sealed dual use path is proposed to run just behind the low fore dunes. It would provide good views of the ocean to the users. The vegetation condition along the alignment of this dual use path is ‘Degraded to Good’ and therefore this proposal would not impact on high quality vegetation.

As the vegetation condition to the east of the proposed dual use path is ‘Very Good to Excellent’, in order to achieve minimum vegetation disturbance, 1.5 metre wide boardwalks are proposed at an interval of about 200 metres to connect the Coastal Road and the beach. These access ways would be approximately 150 to 250 metres in length. Most of the boardwalks are proposed at a minimum gradient of 1:14 to allow access to the physically challenged.

The existing approach road to the beach at the groyne is proposed to be retained as an Emergency Vehicular Access.

#### Opportunities:

- A coastal road, positioned to provide magnificent views to the road users;
- Accreting stable beach due to the groyne;
- Beaches suitable for both swimming as well as surfing;
- The high dunes which could provide opportunities for sheltered recreational areas and lookouts;
- The vegetation condition of this sector is stated to be ‘Very Good to Excellent’.

#### Constraints:

- Currently no accessible public road and lack of a road link to the Lagoon;
- Development of the foreshore depends on the development of the Capricorn Village Structure Plan area; and

#### Specific Recommendations:

1. Prepare and implement landscape concept plans for the two picnic/recreation areas;
2. Establishment of a new Surf Life Saving Club adjacent to the Club Capricorn Groyne;
3. Provide a 2.5 metre wide dual use path along the foreshore as shown on the concept plans;
4. Provide beach access ways, including associated car parking, lookouts, signage, bins and bike racks, as shown on the concept plans
5. Provision of new car parking areas and upgrading the existing car parking areas at the groyne;
6. Provide clear interface between private housing lots and the foreshore reserve and rehabilitate adjacent foreshore
7. Investigate potential future uses for the Lindsay Homestead

**Figure 8c** shows the Foreshore Management Proposals of the Yanchep North sector.

### **6.3.1 Yanchep Lagoon Area Precinct**

This precinct extends generally between the existing Yanchep Surf Life Saving Club in the north and the intersection of Brazier Road and Wilkie Avenue in the south. The natural setting of the Yanchep Lagoon area provides an opportunity for the development of an exceptional coastal node. The Lagoon is already the most popular swimming beach in the district, and with major population growth planned in the short to medium term, its

popularity is set to increase. The run down state of much of the infrastructure at the Lagoon provides an opportunity to replan the area to provide for this growth and also address a number of existing design and operational issues.

Brazier Road runs north-south through the locality of Yanchep, traverses through the Lagoon area and joins Two Rocks Road. As Brazier Road approaches the Lagoon area from the south, it forms a T-junction with Wilkie Avenue before entering the Lagoon area. Within the Lagoon area, the road provides panoramic views to the passers-by and therefore it attracts through traffic. The road is too narrow with a pavement width of about 5.5 metres. It makes a sharp 'S' bend before joining Two Rocks Road. The high dunes on either side of the 'S' bend restrict visibility to the motorists.

A kiosk is strategically located about 4 metres above the road level to the east of Brazier Road overlooking the ocean and providing panoramic views of the ocean. This kiosk, constructed by the City in the 1980s, is situated within a Crown Reserve vested in the City. The kiosk has been leased till 2009 with an option to extend the lease to 2016. There are parking areas at the kiosk between the road and the kiosk making provision for about 90 carparking bays.

The Yanchep Surf Life Saving Club is located off Brazier Road via a limestone driveway. Being located behind a dune, the club building is not visible from the road. This building does not have parking facilities.

There are two picnic areas within the precinct, which are maintained by the City of Wanneroo. The northern picnic area (referred as Picnic Cove) is located to the immediate south of the SLSC on the western side of Brazier Road. It has a grassed area with a few gazebos and a barbeque. A beach access way runs through the picnic area connecting it to the SLSC and the beach. This picnic area is subject to seasonal strong summer south-westerly winds.

The southern picnic area is at Fisherman's Hollow. This picnic area is sheltered behind dunes. It has a large grassed area with a few gazebos and a barbeque. There are parking and toilet facilities attached to this picnic area. At the Fisherman's Hollow, Brazier Road runs over a limestone cliff overhang. The overhang was designated as dangerous because of slabbing roof. The 'Review of Coastal Limestone Hazards' conducted by Gordon Geological Consultants in 1998 recommended that this overhang should be filled in.

There are a number of access ways leading to the beach.

### Vision

A beachfront node with exceptional landscape qualities providing a diverse range of facilities and experiences for people to gather, recreate and socialise.

### Key Drivers for Change

- Existing popular beach node
- Lack of quality facilities – those that are available are rundown
- Huge planned population growth

## Opportunities

- Existing popular beach location for both residents and visitors
- Offshore reef which provides a sheltered basin for safe swimming
- Undulating dunal topography providing for panoramic views and vistas from several locations, including major viewing locations at the kiosk – to Club Capricorn and the prominent dune behind the kiosk – 360 degree views
- Sheltered areas at Fisherman’s Hollow and Picnic Cove
- Indigenous and European heritage providing opportunities for interpretative facilities and public art theme
- Existing buildings (Kiosk, surf club and toilet block)
- Relatively low ultimate traffic volumes due to district roads bypassing area
- Stable coastline
- Enormous planned population growth
- Imminent development of Capricorn Coastal Village bringing access to public utility services in particular reticulated water and sewer
- Rundown existing infrastructure providing imperative for early development and reducing design constraints
- Popularity and developing population provides economic opportunities for range of tourist, recreation and convenience uses
- Holiday zoning of adjacent site
- Expansive are of natural dunal vegetation still in good condition

## Constraints

- Strong summer south westerly winds
- Fragile coastal vegetation etc
- Existing A-Class reserve (for recreation) designation over northern portion of Lagoon precinct.
- Bush forever designation constraining extent of possible works.
- Extent of existing services especially reticulated sewer and water.
- Location and level of the kiosk constrains design options.
- Cliff overhangs.
- Safety of northern approach road.
- Location of the prominent dune constrains design options.
- Poor visual quality of existing roads, car parks, retaining walls, steps, barriers, bins, signage, landscaping, etc

## Urban Design principles

- Built on existing assets – natural setting and environment including topography and site features, climate (sun, shade, wind) and protection of viable stands of coastal vegetation, indigenous and European heritage, key landmarks and existing facilities
- Provide a unifying theme to overall Lagoon area and strategies to reinforce this to create image and ensure all elements blend together as a coherent whole rather than assembled piecemeal as for impact on overall character of the area - for signs,

paving materials and design, public art, trees, furniture bins, seats, lighting, bike racks other furniture etc - architectural detail, colours, materials etc

- Clearly identifiable focus for overall area
- High level of pedestrian amenity and accessibility both into and around the Lagoon area
- Legibility to create a sense of place and a distinctive identity – precincts, paths, nodes, edges and landmarks
- Quality design and materials (esp. fundamental elements such as pavement, trees, seats, lighting)
- Continuous edge to buildings
- Diverse range of facilities and experiences to provide a vibrant atmosphere, appropriate for a wide range of people which will extend the use of the area and overall popularity of the area
- Crime Prevention Through Environmental Design principles

### Summary of Key Considerations

#### Movement Considerations

- Existing movement systems require total overhaul.
- New movement systems should focus on providing pedestrian priority (retain traffic flow, minimal speed and visually integrated car parking. The area should be considered firstly a public space and secondary focus as a traffic route for vehicles)
- Lagoon should be the focus of movement systems throughout the Yanchep area (pedestrian/cycle, vehicle and bus)
- Through movement for vehicles provides opportunity for viewing, scenic drop off etc and therefore should be maintained.
- Coastal road should be relocated eastwards to provide better separation to cliff/banks.
- Vehicular and pedestrian link from the proposed Capricorn Village should be provided.
- Northern approach road should be redesigned to improve safety.
- Approach roads should be located to take advantage of scenic vistas
- Strong links to neighbourhood pedestrian/cycle paths (existing and proposed) should be provided as a popular recreation/exercise facility.
- Wide clearly defined paths should be provided along both sides of coastal road to provide high quality pedestrian access between nodes, furniture, opportunity for stopping to view, bikes, side by side walking etc.
- Pedestrian safety and amenity should be improved in particular, design of coastal road to be low speed emphasising pedestrian orientation through narrow lanes, street parking, lighting, pavement material and design, separation of paths and vehicle lanes, median, crossings etc to maximise pedestrian safety.
- .
- Around 200 car bays should be provided at the Lagoon, predominantly as street side parking to minimise visual impact.
- Tourist bus access should be provided particularly bus embayments and road design to facilitate access.

- Easy access should be provided for all user groups including disabled, elderly, young.

#### Public Space Considerations

- Emphasise gateway to Lagoon precinct from north and south approaches.
- Well defined edges to precincts to encourage more intensive use and greater potential for pedestrian use and social interaction
- Provide venue for outdoor performances, fairs, markets and other community activities
- Provide interpretive facilities to through public art etc to emphasise and promote cultural heritage of area.
- Strong pathway link between Picnic Cove and Fisherman's Hollow
- Provide for opportunities activities, festivals eg amphitheatre, pavement square
- Provide picnic and playground facilities
- Streetscape and public areas should be provided with consistent theme for trees, signs, furniture (bins, seats), lighting, public art required to hang development together
- Well serviced (eg plenty of seating in/out of sun) and well lit for night time use
- Protect natural areas that area planned to be retained – fencing and management

#### Built Form Considerations

- Provide increased opportunity for compatible commercial businesses such as cafes, restaurants, hotel etc to improve range of facilities and diversity and vibrancy of area, employment opportunities,
- Provide opportunity for short stay accommodation to increase activity level in terms of intensity and duration, facilitate tourism and provide presence at night for safety and security reasons.
- Improve relationship of Surf Club with Picnic Cove area by part removal of dune.
- Reuse of Surf Club building
- Built form to be designed with active edges to streets and other public spaces, landmark elements, interest, safety, views, vistas, shade etc.
- Heritage and landscape qualities of area to be reinforced in built form.
- Focal points at each end of picnic cove (surf club and kiosk) to stimulate activity.

#### Key Actions

A detailed concept plan has been prepared for the Lagoon area as shown on **Figure 9**. Key features of this concept plan are as follows:

- The exclusion of a future road, planned under the 1997 Foreshore management plan to extend through the dune to the east of the kiosk. The exclusion of this proposal under the new plan will lead to the retention of a sizable, intact, high quality conservation area and ensure that the Lagoon area remains on a through traffic route, which will assist in maintaining the vitality of the area and a high level of passive surveillance.

- The realignment of Brazier Road to remove the ‘S’ bend on its northern approach and provide a greater buffer to the coastal cliffs. This will also provide for a significant recreation area at the northern end of the lagoon in the vicinity of Picnic Cove. To maximise safety, the road design is planned to be low speed and pedestrian oriented. Car parking areas are planned to be visually integrated into the design by use of street side bays. Design levels of the road will require steps and ramping structure to the kiosk and adjoining planned development sites.
- A road connection from the Capricorn Coastal Village to the Lagoon area as required by the developer’s subdivision approval and formalised vehicle access to the existing surf club facility with additional car parking in this vicinity.
- Generous pathways along both sides of Brazier Road with links to the adjoining neighbourhood path system in order to provide an interconnected system of recreational circuit paths.
- Improvements in the picnic, recreation and landscape facilities at both the ‘Picnic Cove’ and ‘Fisherman’s Hollow’, including the removal of the small dune to the immediate south east of the existing surf club facility in order to increase the useable recreation area, visually integrate the building into the recreation area and improve passive surveillance to the building.
- Provision for additional beach commercial/tourist buildings such as cafes, a hotel, short stay accommodation, tourist shops etc to the west of the realigned Brazier Road diagonally opposite the kiosk and provision for the redevelopment of the existing Surf Club building for commercial/community use.
- Provision of a lookout and associated access to the significant dune crest to the east of the kiosk.
- Fencing and rehabilitation of conservation areas and improvements to controlled beach access ways, including surf club access and the provision of disabled access.
- Themed building guidelines, landscaping, signage, street furniture, lighting, public art and interpretive facilities etc.

This plan would require a staged implementation program to ensure minimum disruption to the operation of the area and cost effective construction. The construction of the Brazier Road realignment and the link road to the Capricorn Coastal Village, together with general earthworks of the new Picnic Cove recreation area would need to be undertaken in the first instance. Much of the land affected by this is, however, located within an A Class reservation and it is therefore likely that the approval process for these works could take up to 18 months. Once these works have been completed, the staging of the remaining works could be undertaken as discrete projects based on priority and the extent of available funding.

### Specific Recommendations:

1. Realign and upgrade Brazier Road including associated pathsparking bays. and earthworks for expanded Picnic Cove.
2. Construct the link road to the Capricorn Coastal Village
3. Development of expanded Picnic Cove
4. Upgrading of Fisherman's Hollow
5. Construct new access way/car park to existing Surf Life Saving Club
6. Construction of a beach access way meeting disabled access standards
7. Investigate opportunities for the establishment of additional commercial/tourist facilities to the west of the realigned Brazier Road diagonally opposite the kiosk and the redevelopment of the existing Surf Life Saving Club site for commercial/community use
8. Extend the pathway system within the Lagoon area to link with pathways in the adjacent residential area sufficient to provide a network of recreational circuits.
- 9.
10. Construct a lookout and associated paths on the dune crest east of the kiosk
11. Undertake an ongoing monitoring program of the water depth within the Yanchep Lagoon.

**Figure 9** depicts the Yanchep Lagoon area proposals.

#### **6.4 Yanchep South**

This sector covers the area to the south of the lagoon area up to the southern boundary of the Yanchep Study Area. Brazier Road, Compass Circle, Foreshore Vista and Trumpeter Way provide the eastern boundary.

The width of the foreshore reserve in this sector generally varies between 100 and 200 metres. At the south-western corner of Brazier Road and Wilkie Avenue there are houses which back directly onto the reserve. Consequently the foreshore reserve behind these houses is about 50 metres wide. These houses are about 10 metres above the beach level. Some of the residents have encroached upon the foreshore reserve by way of extending their backyard.

A gazetted dog exercise area is located in this sector covering a length of 400 metres. This area is serviced with a bituminised beach accessway and a carpark. An unsightly fenced drainage sump is located adjacent to the carpark as well as large unsightly signage.

An extensive rock shelf extending off the "Lagoon" rock shelf runs parallel to the beach. Beach sand extends out to this shelf during the summer and is removed in winter, leaving a shallow lagoon of calm water.

The condition of the dune vegetation is classified as 'Very Good to Degraded'. There are small limestone cliffs offering shelter from south-west winds. A low pine post and rail barrier on portion of the boundary controls indiscriminate access.

This is a local beach with two small carparks on Compass Circle and Brazier Road, which make provision for about 10 bays each. These parking areas are not line marked. There are

numerous access paths to the beach. The beach is used for swimming, sunbathing, fishing, relaxing and walking.

As per the recommendations of the previous adopted FMP, the City constructed two beach accessways off Compass Circle. Peet and Company, which developed Ocean Lagoon Estate constructed a part of the dual use path and the beach accessway off Foreshore Vista.

#### Opportunities:

- Pleasant local beach with adequate existing facilities for local users.
- High dunes provide lookouts over the coast; and
- A dual use path exists at the southern section of the sector abutting Ocean Lagoon Estate and connected to the beach by a beach accessway.

#### Constraints:

- Absence of a dual use paths running north-south; The relative narrowness and steepness of the landform constrain the location of a dual use path within the foreshore reserve;
- 'Dog Exercise Area' sign large and unsightly;
- Sump adjacent to Brazier Road unsightly;
- The dunes are susceptible to wind erosion and bare sandy areas will need to be repaired;
- Sand accretion at the foot of the constructed beach accessways; and
- The beach at the Ocean Lagoon Estate is subject to rip currents, which are hazardous to bathers.

#### Specific Recommendations:

1. Provide beach access ways, including provision/upgrading of associated car parking, lookouts, signage, bins and bike racks, as shown on the concept plans
2. Provide 2.5-metre wide dual use path along the western side of Brazier Road and Compass Circle.
3. Provide a dual use path connecting Foreshore Vista and Compass Circle with a combination of concrete surface and boardwalk including a lookout at the Compass Circle end
4. Provide car parking embayments on Foreshore Vista between Tarwhine Turn and Longfin Vista.
5. Provide clear interface between private housing lots and the foreshore reserve and rehabilitate adjacent foreshore
6. Replace the drainage sump at the entrance of the beach access way leading to the Dog Exercise Area with a swale incorporating a recreation area.
7. Convert the existing southern beach access way off Compass Circle into a 'Controlled Emergency Vehicular Access way'
8. Replace the two 'Dog Exercise Area' signs with more visually sympathetic signage

**Figure 8d** depict the proposal for this Sector.

## 7.0 Foreshore Management

### 7.1 Dune rehabilitation

**Figures 11a to c** depicting the Rehabilitation Plans outline the areas for rehabilitation as follows;

- Areas requiring minimal rehabilitation and weed removal,
- Areas requiring significant rehabilitation and weed removal, and
- Beach areas/dune faces requiring native species replanting.

These plans do not include the Capricorn Village foreshore since the adjacent area is generally in good condition as there are no residential developments except for the Club Capricorn Resort. Consequently, the foreshore vegetation is not disturbed. Any rehabilitation works required would be undertaken only after the foreshore proposals are built.

Most of the dune surfaces facing the beach require at least low levels of rehabilitation to ensure longer-term sand stability. These seaward margins are areas of lower stability, because of their generally steep slopes, lesser degree of stabilisation by vegetation, and their high exposure to coastal winds.

The following are some of the rehabilitation methods.

#### Stabilisation

Brushing of areas outlined in **Figures 11a to c** as requiring significant rehabilitation should be undertaken, and replanting of native species is recommended at rates of one plant per square metre.

Brushing is considered the most effective and economical method of surface stabilisation for coastal environments. Brushing provides wind protection and discourages people from walking across the dunes. Brush should be laid with the stems facing to the prevailing wind, starting at the top of the dune or area to be protected. Successive layers of brush are to overlap the stems of the preceding rows. Areas to be cleared in the vicinity would be the preferred source as seeds would contain local genetic diversity.

#### Species Selection

Native species that were observed regularly along the dune faces and beach areas are shown in **Appendix 4**. It is recommended that these native species be planted along beach lines and on dune faces, as they are currently able to maintain the dune face and exhibit resilience to conditions faced.

A preliminary list of species for use in general rehabilitation of the degraded areas, based on those species observed or expected to occur in the foreshore reserve, is presented in **Appendix 4**.

#### Weed Control

Out-competing introduced species by planting native species is recommended, particularly in areas of lower stability such as dune and beach areas, rather than removing existing weeds with soil holding capacity. Areas that require minimal weed removal are outlined in **Figures 11a to c**.

The removal of weeds should be staged and replanting of these areas should be undertaken concurrently to maintain the soil holding capacity of these introduced species.

Introduced species that require gradual removal are; *Ehrharta villosa*, *Pelargonium capitatum*, *Euphorbia paralias* and *Trachyandra divaricata*.

Before a dune can be revegetated there may first be a need to provide some protection to the sand surface to prevent excessive sand movement and to provide a suitable microclimate for plant germination and development. Stabilization may consist of laying brush on the ground, or erecting sand trapping fences, or a combination of both. Prior to this it will often be necessary to regrade the dunes to provide a suitable landform. Steep slopes, particularly those facing the west and southwest, may be impossible to stabilize without first reducing the slope. An ideal maximum slope is about 1 in 6.

## **7.2 Dune Building Fences**

Fences, which trap sand can be used to build up a dune. These are particularly useful for re-establishing breached or eroded foredunes.

## **7.3 Fire Control**

The exclusion of wild fires from dune areas is essential for successful rehabilitation. If a fire should begin it is more easily controlled if there are established fire breaks running across the direction of the fire advance. Paths to the beach will act as fire breaks but being quite narrow they will be only effective in stopping a fire of low intensity. They will, however, provide firefighters with a line to defend and to work from. In extensive dune areas wider paths of 3.0m should be provided. Dual use paths, roads and wider than normal beach access paths will serve this purpose.

## **7.4 Plan Disease Management**

### Dieback

*Phytophthora* is unlikely to express as dieback disease in the study area due to its well drained and alkaline soils. However hygiene measures used to control *Phytophthora* can also be useful in restricting the introduction of weeds and disease in general. Care is taken to prevent dieback being transported in soil or plant root material to other bushland areas. Dieback can be spread by the introduction of plants and soil for bushland restoration, and vectors such as vehicles, earth-moving equipment, humans, bikes and horses through movement of infested soil and plant matter on tyres, boots and hoofs.

CALM has specified factors that indicate the degree of risk of spreading dieback (CALM, 1992). The risk of spreading dieback is related to the nature of the proposed operation or development, and the nature of the site. The sort of operations and activities that could

occur with the City of Wanneroo that relate to dieback include track and firebreak construction and maintenance, weed control, bushland restoration, building construction (for example, the construction of the new Surf Life Saving Club), general maintenance, vehicle movement and pedestrian movement.

### Honey Fungus

A plant pathogen, which may be found in the City of Wanneroo foreshore region is *Armillaria luteobalbina* (also known as honey fungus), which is a mushroom-producing fungus that is native to Western Australia and commonly occurs in the south-west of the state. *A. luteobalbina* poses a greater threat to vegetation communities than *Phytophthora*, as it is not restricted to certain soil types and can occur anywhere along the foreshore. There is no known cure for the disease.

As *A. luteobalbina* is not purely a soil-borne pathogen, it is difficult to contain the pathogen by utilising current hygiene practices. The best strategy for minimising the impact of the fungus is by reducing plant stress which will enable plants to resist and combat fungal attack. Spreading infected plant material during any dune stabilisation operations and other earthmoving activities should also be avoided.

### Aerial Canker

At present there are no mechanisms to control this fungus other than removing infected material, so the best mitigating action would be to minimise factors that cause plant stress which will allow infected plants to combat infection.

### Restricting Spread

As there is no practical large-scale cure for *Phytophthora* or *Armillaria* dieback, prevention of infection is the primary means of defence. This involves preventing movement of infected soil, plant matter and water into uninfected areas, and careful placement of tracks so that they do not cross between infected and uninfected areas. Any soil or plant material used for bushland restoration or landscaping should be certified as *Phytophthora*-free. Hygiene procedures should be implemented when conducting works within the study area including:

- disinfecting all machinery equipment and boots before entering bushland areas; and
- imported soil and fill should be certified dieback-free.

### Reducing Plant Stress

Management strategies for reducing plant stress involve the ready availability of the plants' needs and prevention of adverse external factors. The use of appropriate revegetation techniques and minimisation of disturbance is of high importance particularly in the initial stages of plant development. Following is a list of techniques that can act to minimise plant stress and increase survival rates of seedlings.

- Tree guards help maintain a moist microenvironment and shelter from wind stress

- sandblasting;
- Mulch primarily discourages weed growth but also helps trap nutrients and water and stabilises sand;
- Weed control is necessary to prevent competition;
- Limited reticulation may be required in some areas to alleviate water stress;
- Soil preparation – fertiliser may sometimes be required; and
- Brushing stabilises sand and deters disturbance by people.

The level of care required depends on the species. When planting hardy dune binding grasses such as *Spinifex* species, techniques to stabilise the sand and combat wind stress and water loss will be more important than maintaining nutrient levels. In these areas placement of brush or tritter is all that will be necessary. When planting heath species in more sheltered and stable areas, additional methods such as tree guards and reticulation may be used depending on the situation and the budget.

### Education

Perhaps the most important aspect of plant disease management is education in hygiene procedures for people undertaking rehabilitation or other conservation works in natural areas. Short day-courses can be an invaluable way to raise awareness amongst rehabilitation practitioners and can also provide an opportunity for conservation workers from friends groups and local government to meet and interact.

## **7.5 Fauna Management**

Fox control using 1080 poison (sodium monofluoroacetate) is not appropriate within the area due to the proximity of the bushland to urban areas. Native animals tolerate low levels of 1080 poison, but the poison is highly toxic to humans and domestic animals as well as feral animals. If foxes become a problem, a program of trapping should be initiated in consultation with the Department of Conservation and Land Management.

Control of feral cats is very difficult; however selective trapping and removal of individuals could be implemented if cats became a significant problem in the area. Domestic cats that roam at night also pose a significant threat to wildlife and a strategy of education should be implemented.

Rabbit control should be undertaken in areas of rehabilitation and revegetation. The use of Pindone baits may not be appropriate, particularly considering non-target native fauna may also be affected. Instead, rabbit-proof fencing should be erected around rehabilitation areas. If rabbit infestation is high, mesh or wire tree-guards may be necessary.

Dogs are not permitted on most of the study area except within the gazetted 'dog exercise areas' located at Two Rocks and Yanchep foreshores. Unrestrained dogs can have an impact on the natural environment as well as posing danger or distress to other recreational users. Dog faeces pose a hazard to health and must be removed by the dog owners. There is little scope for additional dog-exercising areas within the study area due to potential conflicts between other users and threats to natural areas. Signs are already erected at most beach access points. Signs should also be erected at access points to the Dual Use Pathway.

## **7.6 Signs**

Appropriate signs should be erected at strategic locations. This should be based on an Aquatic Safety Assessment, which would provide recommendations for eliminating or mitigating risks. The Royal Life Saving Society Australia in its submission has indicated its intentions to assist the City of Wanneroo to prepare this assessment during the time of the implementation of the FMP proposals. It is important that signage throughout the study area is designed with a consistent theme and the design coordinates with other infrastructure. The preparation of a sign plan for the study area is therefore recommended to guide the location and design of new or replacement signs.

## 8.0 Implementation

It is anticipated that the recommended actions will be undertaken over a period of time in a staged manner **Table 6** below summarises the recommended Foreshore Management Plan actions.

**TABLE 6**

### RECOMMENDED FORESHORE MANAGEMENT PLAN ACTIONS

Each of the recommended actions have been assigned a priority and responsibility for implementation. The priority rating system applicable is as follows:

- High [H] primary importance/implement immediately (within 2 years)
- Medium [M] secondary importance/implement within 2 – 5 years
- Low [L] longer term consideration/implement within 5 years plus

The primary responsibility for implementing or overseeing implementation of each recommended action is also nominated. The key for symbols used in the table is as follows:

- PD Planning and Development
- I Infrastructure
- CD Community Development
- CS Corporate Services
- CVJV Capricorn Coastal Village Joint Venture

#### General Recommendations (Applicable to the entire Study Area)

No	Proposal	Priority	Responsibility
1	Establish a coordinating group to oversee implementation of this Management Plan.	H	PD
2	Apply to the relevant state government agencies to rationalise the existing reservations, purposes and vestings to reflect the management plan proposals and enable consistent management.	H	PD
3	Carry out assisted natural regeneration following the principles of the Bradley method in good to excellent condition areas progressing to fair to good areas.	H-M	I
4	Carry out reconstruction/revegetation of in areas of degraded and completely degraded.	H	I
5	Close and rehabilitate all tracks not required for access, walking trails or fire breaks.	H-M	I
6	Implement a comprehensive weed control program	H-M	I

No	Proposal	Priority	Responsibility
	within the study area in conjunction with regeneration and rehabilitation works.		
7	Develop a fire management plan that details specific strategies to minimise the risk of fire within the study area and enable effective response and rehabilitation in the event of an outbreak.	H	CD/ I/PD
8	Keep accurate records of fire history of the study area including details of date and extent of fires.	H	CD
9	Use appropriate hygiene procedures to prevent the spread of dieback and other plant diseases into infected areas.	Ongoing	I
10	Upgrade and install fencing to conservation areas.	H	I
11	Monitor and record feral cat and fox sightings and these become a significant problem in the study then implement selective trapping and removal of individuals	L	I
12	Initiate an education campaign to raise awareness of the environmental problems of cats roaming at night targeting local residents.	M	PD
13	Formalise beach access ways as indicated on the concept plans.	H-M	I
14	Construct a continuous coastal dual use path within the foreshore and adjoining coastal road as specified in the concept plans.	H-M	I/CVJV
15	Construct lookouts in locations specified on the concept plans.	M-L	I
16	Restrict access to limestone cliffs, install cliff hazard warning signage and stabilise cliffs where appropriate for safety reasons by way of filling, collapsing etc.	H	I
17	Install bin housings throughout the study area.	M	I
18	Install recycle bin facilities at all key recreation areas within the study area.	M	I
19	Prepare consistent theme for buildings, signage, furniture, landscaping, lighting bins, bike racks throughout study area.	H	PD/ I
20	Prepare and implement a signage plan to direct the placement and replacement of signs within the study area. Signage types to include directional, information, interpretative, educational, safety etc.	H	PD/ I
21	Ensure appropriate clearances are received under the Aboriginal Heritage Act prior to undertaking works.	H	PD
22	Incorporate information on Aboriginal and non-aboriginal history into interpretive material where appropriate.	M	I

## Specific Recommendations

### Two Rock North

No	Proposal	Priority	Responsibility
23	Complete the existing investigation into the likely extent of erosion north of the marina and the potential management strategies to address this.	H	I
24	Following the outcome of the above study review the appropriateness of additional beach access ways through this part of the foreshore.	M	PD
25	Provide a 2.5 metre wide dual use path on the western side of Sovereign Drive.	H	I
26	Provide a shower at the northern beach access way	H	I
27	Replace the 'Dog Exercise Area' signs with more visually sympathetic signage	H	I

### Two Rocks South

No	Proposal	Priority	Responsibility
28	Prepare and implement landscape concept plans for a Leemans Boat Landing picnic/recreation area including provision for an expansion of the existing car park, upgrade of the existing toilet facility and memorial, the conversion of the existing drainage sump into a landscaped swale, pathways and a range of recreation/picnic facilities.	M	
29	Provide a 2.5 metre wide dual use path along the foreshore as shown on the concept plans	M	I
30	Provide two beach access ways, including associated car parking, lookouts, signage, bins and bike racks, as shown on the concept plans	H	I

### Yanchep North

No	Proposal	Priority	Responsibility
31	Prepare and implement landscape concept plans for the two picnic/recreation areas	M	CVJV
32	Planning and establishment of a new Surf Life Saving Club in the vicinity of the Club Capricorn Groyne, noting that the detailed location and design of the facility should integrate with the planning for the adjacent Capricorn Coastal Village	M	CD
33	Provide a 2.5 metre wide dual use path along the foreshore as shown on The concept plans	L	CVJV
34	Provide beach access ways, including associated car parking, lookouts, signage, bins and bike racks, as	M	CVJV

	shown on The concept plans		
35	Provide clear interface between private housing lots and the foreshore reserve and rehabilitate adjacent foreshore	M	I
36	Investigate potential future uses for the Lindsay Homestead	L	CD/CVJV

### **Yanchep South**

<b>No</b>	<b>Proposal</b>	<b>Priority</b>	<b>Responsibility</b>
37	Provide beach access ways, including provision/upgrading of associated car parking, lookouts, signage, bins and bike racks, as shown on the concept plans	H	I
38	Provide 2.5-metre wide dual use path along the western side of Brazier Road and Compass Circle.	M	I
39	Provide a dual use path connecting Foreshore Vista and Compass Circle with a combination of concrete surface and boardwalk including a lookout at the Compass Circle end.	H	I/Peet & Co.
40	Provide clear interface between private housing lots and the foreshore reserve and rehabilitate adjacent foreshore	H	I
41	Replace the drainage sump at the entrance of the beach access way leading to the Dog Exercise Area with a swale incorporating a recreation area.	L	I
42	Convert the existing southern beach access way off Compass Circle into a 'Controlled Emergency Vehicular Access way'	H	I
43	Replace the two 'Dog Exercise Area' signs with more visually sympathetic signage	H	I

### **Yanchep Lagoon Area Precinct**

44	Realign and upgrade Brazier Road including associated paths, parking bays, entry statements, barrier wall and earthworks for expanded Picnic Cove.	H	I
45	Construct the link road to the Capricorn Coastal Village	H	CVJV
46	Development of expanded Picnic Cove	H	I
47	Upgrading of Fisherman's Hollow	M	I
48	Construct new access way/car park to existing Surf Life Saving Club	H	I
49	Construction of a beach access way meeting disabled access standards	H	I
50	Investigate opportunities for the establishment	M-L	CS

	of additional commercial/tourist facilities adjacent to the kiosk and the redevelopment of the existing Surf Life Saving Club site for commercial/community use.		
51	Extend the pathway system within the Lagoon area to link with pathways in the adjacent residential area sufficient to provide a network of recreational circuits.	H	I
52	Construction of a viewing deck opposite Fisherman's Hollow	H	I
53	Construct a lookout and associated paths on the dune crest east of the kiosk	M	I
54	Undertake an ongoing monitoring program of the water depth within the Yanchep Lagoon.	M	I

## **9.0 Monitoring And Review**

It is recommended that this management plan be reviewed in five years time since the plan is adopted by the City. A review will provide a formal opportunity to review the effectiveness of the plan in meeting present and changing needs and pressures. It is likely that some amendments may be required before this five-year review due to changed circumstances and public demand. These amendments can very likely be accommodated in the detailed designs of the specific proposals contained in this report.

## **10. REFERENCES**

1. Bowman Bishaw Gorham (2003) - *Foreshore Vegetation Survey and Management Recommendations Mindarie, Yanchep and Two Rocks*
2. ATA Environmental (2004) – *Draft Capricorn Coastal Village Structure Plan*
3. Bill James Landscape Architects (1997)- *Two Rocks – Yanchep Foreshore Management Plans*
4. O’Brien Planning Consultants (1997) – *Foreshore Management Plan for Lot 614 Yanchep*
5. Gordon Geological Consultants (1998) – *Review of Coastal Limestone Hazards.*

## Appendix 1.- Survey Methodology and Limitations

### METHODS

The vegetation survey, condition assessment and rare flora search comprised the following three, overlapping stages:

- preparation for fieldwork, including familiarization with the appearance of the significant flora to be searched for and examination of relevant reports, maps and other information;
- fieldwork to determine types, distribution and condition of vegetation units and significant flora habitats, and presence or absence of any rare flora and other significant flora, and
- office and herbarium work done following the periods of fieldwork (1) to check identifications of plant specimens collected and photographed during fieldwork and (2) to prepare this report.

#### Prior To Field Work

Prior to field work, potentially relevant maps, publications and reports were searched for and those that were located were reviewed, and aerial photography was examined.

The aerial photography examined includes stereoscopic pairs of 1:20,000 scale contact prints from Metro Regional Area aerial photography, mostly flown in 1998 and earlier, stereoscopic pairs of photocopies of that aerial photography enlarged to 300% and 400%, and digital printouts of aerial photography. This aerial photography was used for inferring extent and boundaries of vegetation units before, during, between and after field work.

Lists of Declared Rare and Priority Flora taxa recorded in the vicinity of the study areas were compiled from results of two sets of searches of three databases carried out in November 2002 by the Wildlife Branch of Department of Conservation and Land Management. These three Department of Conservation and Land Management databases are *Threatened Flora*, *Priority Species List* and *WA Herbarium Specimen*, and the search area parameters used are:

- Yanchep – Two Rocks coastal area  
Coordinates: 115<sup>^</sup>33' – 115<sup>^</sup>39' and 31<sup>^</sup>29' – 31<sup>^</sup>36'  
Names: Alkimos, Eglington, Two Rocks, Yanchep
- Mindarie coastal area  
Coordinates: 115<sup>^</sup>40' – 115<sup>^</sup>44' and 31<sup>^</sup>39' – 31<sup>^</sup>44'  
Names: Burns Beach, Hillarys, Iluka, Jindalee, Mindarie, Ocean Reef, Quinns Rock, Tamala Park

Eight taxa were listed in results of these searches. These eight taxa and their Conservation Codes are:

• <i>Astroloma microcalyx</i>	Priority 2	P2
• <i>Conostylis bracteata</i>	Priority 3	P3
• <i>Eucalyptus argutifolia</i>	Declared Rare Flora	DRF
• <i>Hibbertia spicata</i> subsp. <i>leptotheca</i> ,	Priority 3	P3
• <i>Lasiopetalum membranaceum</i>	Priority 3	P3
• <i>Sarcozona bicarinata</i>	Priority 3	P3
• <i>Tetratheca pilifera</i>	Priority 3	P3
• <i>Thomasia triloba</i>	Priority 3	P3

The cover letter with the results from the database searches emphasizes that “the information supplied should be regarded as an indication only of rare flora that may be present”. There may well be Priority Flora in the area other than those listed in the Department of Conservation and Land Management results, but probably none other than those listed in the *Bush Forever* Table 13 list of significant flora (Government of Western Australia 2000, Vol. 2, pp. 51-55). However, this list predates the current master list of Declared Rare and Priority Flora (Atkins 2001, 2002).

Herbarium specimens of the eight taxa in the printouts, and of other taxa listed in *Bush Forever*, Volume 2 Table 13 and pages 380 and 383, and their labels in the Western Australian Herbarium were examined, and other botanists and various publications were consulted, including Atkins (2001), Paczkowska and Chapman (2000), Hoffman and Brown (1998) and Hopper *et al.* (1987).

### Field Work

Dr. Arthur Weston, sometimes with Carolyn Harding or other assistants, walked transects through the study area in November and December 2002, looking for significant flora and describing and photographing vegetation at representative, releve sites. The principal taxa of significant flora searched for are the eight listed above, in Section 2.1, but other coastal significant flora listed Table 13 of *Bush Forever*, Volume 2, both Priority flora and non-Priority taxa, were also searched for. Further checking was done in February 2003.

Observations on vegetation structure and floristic composition of vegetation were recorded and condition of the vegetation was assessed. Most stands of vegetation, especially on the older dunes, were in various stages of secondary succession, and no attempt was made to infer what climax vegetation would be.

The system used for describing vegetation and the six-point scale used for assessing vegetation condition are, basically, from Keighery (1994), Muir (1977) and Government of Western Australia (2000, Vol. 2, p. 493), and from Keighery (1994), Trudgen (1991) and Government of Western Australia (2000, Vol. 2, p. 493-494), respectively.

The part of the system for descriptions of vegetation used in this report, and with the additions of two occasionally used height categories, Very Tall and Very Low, is:

Canopy cover / Form, height	100% - 70%	70% - 30%	30% - 10%	10% - 2%
Trees 10-30m	Closed Forest	Open Forest	Woodland	Open Woodland
Trees < 10m	Low Closed Forest	Low Open Forest	Low Woodland	Low Open Woodland
Shrub Mallee	Closed Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Shrub Mallee
Shrubs > 4m	Closed Very Tall Scrub	VeryTall Open Scrub	Very Tall Shrubland	VeryTall Open Shrubland
Shrubs > 2m	Closed Tall Scrub	Tall Open Scrub	Tall Shrubland	Tall Open Shrubland
Shrubs 1-2m	Closed Heath	Open Heath	Shrubland	Open Shrubland
Shrubs < 1m	Closed Low Heath	Open Low Heath	Low Shrubland	Low Open Shrubland
Shrubs < 0.5m	Closed Very Low Heath	Open Very Low Heath	Very Low Shrubland	Very Low Open Shrubland
Grasses	Closed Grassland	Grassland	Open Grassland	Very Open Grassland
Herbs	Closed Herbland	Herbland	Open Herbland	Very Open Herbland
Sedges	Closed Sedgeland	Sedgeland	Open Sedgeland	Very Open Sedgeland

The six-point condition scale is, basically:

- P     Pristine            No obvious signs of disturbance,
- E     Excellent           Vegetation structure intact, disturbance affecting individual species (plants?), weeds are non-aggressive species,
- V     Very Good           Vegetation structure altered, obvious signs of disturbance,
- G     Good                 Vegetation structure significantly altered by very obvious signs of multiple disturbance; basic vegetation structure or ability to regenerate it is retained,
- D     Degraded           Basic vegetation structure severely impacted by disturbance; scope for regeneration but not to a state approaching good (sic) condition without intensive management, and
- C     Completely  
Degraded            Vegetation structure not intact; the area completely or almost completely without native species ('parkland cleared').

Hussey *et al.* (1997), Marchant *et al.* (1987) and other floras and field guides were used for tentative plant identifications in the field.

### After Field Work

Plant specimens collected during the field work were pressed, dried and identified by checking them against a variety of keys and descriptions in floras and taxonomic works, only some of which are referred to in the report, by consulting other botanists, and by comparing them with specimens in Western Australian Herbarium collections.

During the process of identification and following it, the names of the plants identified were checked against the Table A list in Appendix A and other lists of significant flora, including those listed in the *Bush Forever* (2000, Volume 2, Table 13) list of significant flora.

The provisional vegetation descriptions and boundaries were revised, refined and finalised, and the significance of plant associations, vegetation complexes and floristic community types in the study area was assessed in terms of conservation and reservation status.

Report preparation including drafting a vegetation map to show boundaries and condition of vegetation units in the study areas.

## LIMITATIONS

### Vegetation

Although several days were spent in the field sampling vegetation and ground-truthing vegetation mapping, it was impossible to describe every stand of vegetation in detail. As is standard practice in vegetation mapping, it was necessary to infer vegetation similarities from texture, colour and patterns on aerial photography viewed stereoscopically.

Delimiting stands of vegetation and assigning names to them is, perforce, much more arbitrary than identifying plants, because they usually do not have clear boundaries or consistent features and because vegetation is not static; it is continually changing, and at various rates. It changes rapidly during and immediately after fire or other major disturbance, more slowly as it approaches a climax state, and its appearance changes during the year. Consequently, it may be difficult, or impossible, to match what is seen on aerial photography with what is observed on the ground, especially if the aerial photography is, as in the case of the stereoscopic aerial photography used in this study, several years old.

Setting out and sampling sets of quadrats according to methods described by Keighery (1994) and subsequent analysis of the samples using the appropriate PATN programs would be useful in validating the inferences made in this report about representation of floristic community types in the study area.

### Flora

Many species of plants were not in flower at the time of the survey, and no attempt was made to compile a comprehensive list of species. Many species could be added to the list if more field work were undertaken during peak periods of flowering, and at other times, and, as was done, e.g., by Keighery *et al.* (1997), during three flowering seasons in consecutive years. The resulting list might, possibly, include Priority Flora and other significant species, but probably not any Declared Rare Flora or high Priority species.

Identification of species that are very similar when they are vegetative, e.g. several species of Iridaceae, can be confirmed only when they are in flower, generally in early spring.

**Appendix 2- Flora of the Foreshore Study Areas****Flora of the Wanneroo Foreshore Study Areas (by taxon name)**

<b>Taxon Name</b>	<b>Form</b>	<b>BS397</b>	<b>Notes</b>
Acacia cochlearis	Sh	TY	
Acacia cyclops	Sh	TY	
Acacia lasiocarpa var. lasiocarpa	Sh	TY	
Acacia rostellifera	Sh	TY	
Acacia saligna	Sh	TY	
Acacia truncata	Sh	TY	
Acacia xanthina	Sh	TY	
Acanthocarpus preissii	Sh/He	TY	
Acrotriche cordata	Sh	TY	
* Agave ?americana	He	TY	
Agonis flexuosa	Tr/Sh	-Y	alien?; r, s
Allocastrum lehmanniana	Sh	-Y(19)	s
* Anagallis arvensis	He	TY	
* Arctotheca calendula	He	TY	
* Arctotis stoechadifolia	He	TY	
Austrodanthonia sp.	Gr	TY	
Austrostipa ?flavescens	Gr	TY	
* Avena barbata	Gr	TY	
* Bartsia trixago	He	T-	=Bellardia t.
Beyeria cinerea	Sh	TY	
* Brassica tournefortii	He	TY	
* Bromus diandrus	Gr	TY	
* Cakile maritima	He	TY	
Callitris preissii	Tr/Sh	-Y	natural?; s, E
Calothamnus Quadrifidus	Sh	??	
Carpobrotus virescens	He/Sh	TY	
Cassytha ?aurea	Vi	TY	
Cassytha glabella	Vi	TY	
Cassytha racemosa	Vi	TY	
Cassytha sp.	Vi	??	
Clematis linearifolia ('C. microphylla')	Vi	TY	
Comesperma integerrimum	Vi	-Y	
Conostylis aculeata subsp. aculeata	He	TY	
Conostylis candicans (narrow-leaf form)	He	TY	
Conostylis pauciflora subsp. euryrhipis (P3)	He	X	P3, p, s
* Conyza bonariensis	He	??	
* Crassula glomerata	He	TY	
Cryptandra mutila	Sh	T-	
* Cuscuta epithimum	Bi	TY	
Cynodon dactylon	Gr	??	
Desmocladius flexuosus	Se	TY	
Dianella revoluta	He	TY	
Diplopeltis huegelii subsp. huegelii	Sh	X	
* ?Diplotaxis tenuifolia	He	T-	
* Dischisma arenarium	He	TY	
Dodonaea aptera	Sh	TY	
Dryandra lindleyana	Sh	??	
Dryandra sessilis var. cygnorum	Sh	X	few
* Ehrharta longiflora	Gr	TY	

* Ehrharta villosa	Gr	TY	
Eremophila glabra	Sh	TY	
Eucalyptus gomphocephala	Tr	-Y	
* Euphorbia paralias	He	TY	few?
* Euphorbia terracina	He	TY	major weed
Exocarpos sparteus	Sh	TY	
* Foeniculum vulgare	He	TY	
Frankenia pauciflora	Sh	-Y	few
* Galenia pubescens	He	-Y	few
* Gazania linearis	He	TY	
Gompholobium tomentosum	Sh	TY	
Grevillea obtusifolia (planted?)	Sh	T-	?;s,e, EN
Grevillea preissii subsp. preissii	Sh	X	
Guichenotia ledifolia	Sh	T-	
Hardenbergia comptoniana	Vi	TY	
* Hedypnois rhagadioloides	He	TY	
* ?Helminthotheca echioides	He	-Y(17)	
Hemiandra pungens	Sh	TY	
Hibbertia huegelii	Sh	??	
Hypochaeris glabra	Sh	??	
Iridaceae spp.	He	??	
Isolepis nodosa	Se	TY	
Kennedia prostrata	Vi	TY	
* Lagurus ovatus	Gr	TY	
Lechenaultia linarioides	Sh	X	p
Lepidosperma gladiatum	Se	TY	
Lepidosperma squamatum	Se	TY	
Leptomeria preissiana	Sh	TY	
* Leptospermum laevigatum	Sh	TY	
Leucophyta brownii (=Calocephalus brownii)	Sh	TY	
Leucopogon insularis	Sh	TY	
Leucopogon parviflorus	Sh	TY	
* Lolium rigidum	Gr	?TY	
Lomandra maritima	He	TY	
Lysinema ciliatum	Sh	T-	
* Matthiola incana	He/Sh	-Y	
Melaleuca cardiophylla	Sh	TY	r, s
Melaleuca huegelii	Sh	TY	
Melaleuca lanceolata	Sh	T-	planted?; d, s
Melaleuca nesophila	Sh	TY	alien
Melaleuca systema	Sh	TY	=M. acerosa
* Melilotus indicus	He	TY	
Myoporum insulare	Sh	TY	
Nemcia reticulata	Sh	T? Y	
* Nerium oleander	Sh	TY	few
* Oenothera drummondii	Sh/He	TY	
Olearia axillaris	Sh	TY	
Opercularia vaginata	He	-Y	
* Orobanche minor	He	?Y	
* Osteospermum ecklonis	He	T-	
* Oxalis pes-caprae	He	??	
Ozothamnus cordatus	He/Sh	TY	
* Parapholis incurva	Gr	-Y(17)	few
* Pelargonium capitatum	He	TY	

Phyllanthus calycinus	Sh	TY	
Pimelea ferruginea	Sh	TY	fls wh
* Plantago lanceolata	He	T-	
Poa sp.	Gr	TY	> 1 sp.?
* Reichardia tingitana	He	T-	
Rhagodia baccata	Sh	TY	
* Romulea rosea	He	TY	
Salsola tragus	He	T-	
Santalum acuminatum	Tr/Sh	TY	
Sarcocornia blackiana	Sh	-Y	
* Scabiosa atropurpurea	He	T-	
Scaevola crassifolia	Sh	TY	
Scaevola globulifera	Sh	T-	
Scaevola nitida	Sh	-Y	
Scaevola thesioides subsp. thesioides	Sh	TY	
* Schinus terebinthifolia	Sh/Tr	TY	few
Senecio lautus subsp. maritimus	He	TY	
* Solanum nigrum	He	-Y	
* Sonchus oleraceus	He	TY	
Spinifex hirsutus	Gr	TY	
Spinifex longifolius	Gr	TY	
Spyridium globulosum	Sh	TY	
* Stenotaphrum secundatum	Gr	TY	few?
Stylidium maritimum	He	X	P3, p, s
* Tamarix aphylla	Sh?	-Y	very few
Templetonia retusa	Sh	TY	
* Tetragonia decumbens	Sh/He	TY	
* Thinopyrum distichum	Gr	TY	=Elymus d.
Thomasia triphylla	Sh	-Y	
Threlkeldia diffusa	Sh	TY	
Thysanotus arenarius	He	T-	few
* Trachyandra divaricata	He	TY	
Tricoryne elatior	Sh/He	-Y(1)	
Trifolium sp.	He	??	
Trymalium ledifolium	Sh	X	
Wahlenbergia sp.	He	-Y	
Westringia dampieri	Sh	T-	

\* = Alien specie

## Legend

### Column 1 Taxon Name

An asterisk (\*) preceding the taxon name indicates that the species is a weed.  
 A question mark (?) indicates that the identification to the name following it is tentative.

### Column 2 Form growth form of plants

Gr	(grass),
He	(herbaceous plant),
M	(mallee),
Se	(sedge),
Sh	(shrub),
Tr	(tree),
Vi	(vine).

### Column 3 BS397 recorded in Bush Forever Site 397

T	in Two Rocks North and/or Two Rocks South study areas
Y	in Yanchep study area
()	site in which recorded
?	probably in T / Y but not confirmed
X	listed in <i>Bush Forever</i> for Bush Forever Site 397

### Column 4 Notes

Significance codes (from *Bush Forever* Table 13)

P3	(Priority 3: poorly known taxa),
d	(disjunct populations),
e	(endemic to the Swan Coastal Plain),
p	(poorly reserved),
r	(northern or southern limit of known range),
s	(significant populations)
E	(endemic to the swan coastal plain in the perth metro region)

## Appendix 3 - Vegetation Types and Condition

### Two Rocks North

#### Quindalup Dunes Uplands – Older dunes and plains

(1) Open Low Heaths and Low Shrublands dominated by few to all of the generally very low shrubs <i>Melaleuca systema</i> , <i>Leucopogon parviflorus</i> , <i>Leucopogon insulare</i> , <i>Acrotriche cordata</i> over <i>Lomandra maritima</i> graminoid Open to Closed Herbland with <i>Acanthocarpus preissii</i> and <i>Desmocladius flexuosus</i> common; extensive in northern half.	Condition generally Very Good, often Excellent, sometimes Good	MAL, MAL+, Mi/MAL, O/MAL, SMiAc/MAL
(2) Open to Closed Heaths and Shrublands dominated by <i>Melaleuca cardiophylla</i> , sometimes with, or sparately, <i>Acacia cyclops</i> , <i>Acacia xanthina</i> , <i>Melaleuca huegelii</i> , <i>Myoporum insulare</i> or <i>Spyridium globulosum</i> generally over very weedy understories; several small stands on the eastern side; <i>M. cardiophylla</i> and <i>M. huegelii</i> are more commonly associated with Spearwood Dunes Uplands – Tamala Limestone	Condition generally Good, seldom Very Good, more often Degraded	McAc, McAx, Mch, MchAc, McMi, MiMc, MiMh, Mi, Ac, McMiax, Ac/Pc, AcMi, Acx/Pc

#### Quindalup Dunes Uplands – Younger dunes

(1) Heaths and Low Heaths to Shrublands dominated by <i>Scaevola crassifolia</i> , <i>Myoporum insulare</i> or, less commonly and taller, <i>Spyridium globulosum</i> or <i>Olearia axillaris</i> , often over <i>Rhagodia baccata</i> Open Low Heath or <i>Lepidosperma gladiatum</i> Sedgeland to Open Sedgeland and <i>Acanthocarpus preissii</i> or <i>Tetragonia decumbens</i> Herbland to Closed Herbland	Condition generally Good to Very Good, with large areas Degraded to Completely Degraded	Mi/ApLg, MiS, MiSc, MiScS, MiScT, MiSSc, OMi/Lg, Mi, OMiSc/ApLg, O/Sc/ApLgT, ScMiO, SMi O/Rb
(2) Shrubland of <i>Olearia axillaris</i> over <i>Rhagodia baccata</i> Open Low Heath to Low Shrubland, with <i>Threlkeldia diffusa</i> ; one small stand above the northern end of <i>Lepidosperma gladiatum</i> due south of the tower, in the central western part of the study area	Condition Very Good to Excellent	

#### Quindalup Dunes Uplands - Beach and fore-dunes to loose sand face of mobile dunes

(1) Open to Closed Grasslands of <i>Thinopyrum distichum</i> , <i>Spinifex longifolius</i> and <i>Spinifex hirsutus</i> with/and Herblands to Closed Herblands of <i>Tetragonia decumbens</i> or <i>Cakile maritima</i> ; patchy on the strand and open sand of fore-dunes and blowouts	Condition of <i>Spinifex</i> generally Very Good to Excellent; the other species are aliens	SIT, Sl/T, Sh, Sl+, SITdT, Cm, Td, T, B
(2) Low Open Shrubland to Low Open Heath of <i>Leucophyta brownii</i> ; few small stands on loose sand on blowouts on coast due south of tower	Condition Very Good to Degraded	Lb

#### Quindalup Dunes Wetlands

Sedgelands to Closed Sedgelands of <i>Lepidosperma gladiatum</i> , with <i>Rhagodia baccata</i> , depressions (mainly) south of the tower, mainly in the central strip of the study area	Condition of stand nearest the tower Excellent; others Very Good to Degraded	Lg
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## Weeds and other aliens

Herblands, Grasslands and smaller areas of other vegetation structural classes (formations) dominated by aliens	Condition Completely Degraded (to Degraded)	W, C, Cm, Ac/Pc, Acx/Pc, As', MI, Mn, Mn/Pc, Pc, PcEtAs', St
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## Two Rocks South

### Spearwood Dunes Uplands – Tamala Limestone

(1) Open to Closed Heaths and Shrublands and Tall Scrubs dominated by <i>Melaleuca cardiophylla</i> and <i>Dodonaea aptera</i> , often with <i>Melaleuca huegelii</i> and <i>Spyridium globulosum</i> , sometimes with <i>Acacia xanthina</i> or <i>Acacia cyclops</i> , generally over <i>Melaleuca systema</i> , <i>Rhagodia baccata</i> Low Shrubland to Open Low Heath and Open Grassland of <i>Poa</i> sp., often with many annual weeds, sometimes over <i>Melaleuca systema</i> , <i>Leucopogon parviflorus</i> , <i>Leucopogon insulare</i> , <i>Acrotriche cordata</i> Open Low Heaths and Low Shrublands over <i>Lomandra maritima</i> graminoid Open to Closed Herbland; mainly in the southeastern part of the study area	Condition generally Very Good, with some Excellent and some Degraded to Completely Degraded	McD, AxMcD, AxMcD/MAL, McD/MAL, Ac, McD/W
(2) Open Heath to Shrubland and Tall Shrubland dominated by <i>Melaleuca cardiophylla</i> , mostly over and with <i>Westringia dampieri</i> Low Shrubland to Open Low Heath over <i>Melaleuca systema</i> , <i>Leucopogon parviflorus</i> , <i>Leucopogon insulare</i> , <i>Acrotriche cordata</i> Open Low Heaths and Low Shrublands over <i>Lomandra maritima</i> graminoid Open to Closed Herbland; limited area in southeastern corner and southeast of it	Condition Very Good to Degraded	McWd, Mc/W, Wd/MAL

### Quindalup Dunes Uplands – Older dunes and plains

(1) Open Low Heaths and Low Shrublands dominated by few to all of the generally very low shrubs <i>Melaleuca systema</i> , <i>Leucopogon parviflorus</i> , <i>Leucopogon insulare</i> , <i>Acrotriche cordata</i> over <i>Lomandra maritima</i> graminoid Open to Closed Herbland with <i>Acanthocarpus preissii</i> and <i>Desmocladius flexuosus</i> common, sometimes with overstorey of <i>Spyridium globulosum</i> , <i>Myoporum insulare</i> or <i>Dodonaea aptera</i> ; extensive in central and central eastern parts.	Condition generally Excellent to Very Good, sometimes Good or Degraded	MAL, MAL2, MiD/MAL, S/MAL, Pc/MAL
(2) Open to Closed Heaths and Shrublands to Tall Shrublands dominated by <i>Melaleuca cardiophylla</i> , sometimes with, or separately, <i>Acacia cyclops</i> , <i>Acacia xanthina</i> , <i>Melaleuca huegelii</i> , <i>Myoporum insulare</i> or <i>Spyridium globulosum</i> generally over very weedy understories; several small stands on the eastern side.	Condition generally Good to Degraded; some Completely Degraded and some Very Good	Ac, Mc, AcS, Ax, Mi, AcMh
(3) Open Heath to Open Shrubland of <i>Olearia axillaris</i> over <i>Acacia truncata</i> , <i>Melaleuca systema</i> Low Shrubland to Open Low Heath	Condition Very Good to Excellent	O/AtMs

### Quindalup Dunes Uplands – Younger dunes

(1) Heaths and Low Heaths to Shrublands dominated by <i>Scaevola crassifolia</i> , <i>Myoporum insulare</i> or, less commonly and taller,	Condition generally Good to Very	OSc/Lg, MiO, SOAc
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<i>Spyridium globulosum</i> or <i>Olearia axillaris</i> , often over <i>Rhagodia baccata</i> Open Low Heath or <i>Lepidosperma gladiatum</i> Sedgeland to Open Sedgeland and <i>Acanthocarpus preissii</i> or <i>Tetragonia decumbens</i> Herbland to Closed Herbland	Good, with large areas Degraded to Completely Degraded	
(2) Open Heath of <i>Olearia axillaris</i> over <i>Scaevola crassifolia</i> Open Low Heath over <i>Lepidosperma gladiatum</i> Sedgeland to Open Sedgeland; on western slopes of two largest central dunes	Condition Excellent to Very Good	O, OSc
(3) Open Heath dominated by <i>Acacia rostellifera</i> , <i>Acacia saligna</i> (possibly planted for rehabilitation) over and with <i>Pelargonium capitatum</i> and/or other weeds, mainly <i>Euphorbia terracina</i> , <i>Trachyandra divaricata</i> and <i>Bromus</i> spp. and other grasses; plateau of truncated central dune	Condition Degraded to Completely Degraded	Ars/Pc

### Quindalup Dunes Uplands - Beach and fore-dunes to loose sand face of mobile dunes

(1) Closed Grassland of <i>Thinopyrum distichum</i> , with areas of <i>Cakile maritima</i> Herbland, especially in the north, and <i>Spinifex longifolius</i> Grasslands; edge of strand and fore-dunes along most of coast	Condition of <i>Spinifex</i> generally Very Good to Excellent; the other species are aliens	SIT, SI/T, SI, Cm, Td, B
(2) Open Heath of <i>Olearia axillaris</i> over <i>Spinifex longifolius</i> Grassland to Closed Grassland and weeds; on low, long parallel dunes bordering <i>Thinopyrum distichum</i> Closed Grassland in central and south-western part of study area	Condition Good	O/SI

### Weeds and other aliens

Herblands, Grasslands and smaller areas of other vegetation structural classes (formations) dominated by aliens	Condition Completely Degraded (to Degraded) or worse	W, C, Cm, Pc, Ev, Fv, G, Pc/MAL (in part), PcW
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### Yanchep

#### Spearwood Dunes Uplands – Tamala Limestone

(1) Open to Closed Heaths and Shrublands dominated by <i>Melaleuca cardiophylla</i> and <i>Melaleuca huegelii</i> , sometimes with <i>Santalum acuminatum</i> , generally over <i>Melaleuca systema</i> , <i>Leucopogon parviflorus</i> , <i>Leucopogon insulare</i> , <i>Acrotriche cordata</i> Open Low Heaths and Low Shrublands over <i>Lomandra maritima</i> graminoid Open to Closed Herbland; on limestone and shallow soils on the eastern side of the northern part of the study area, west of Newman Road	Condition generally Very Good, with some Good to Degraded	Mh, Mc(h), MhSa/MAL, Mh/MAL
(2) Very Low to Very Low Open Shrubland of <i>Frankenia pauciflora</i> , (cliff-edge community), with <i>Sarcocornia blackiana</i> ; also with <i>Scaevola crassifolia</i> on adjacent sandy slope; few small areas on beach-edge limestone platforms west of Fisherman's Hollow	Condition Very Good	Fp

**Quindalup Dunes Uplands – Older dunes and plains**

(1) Open Low Heaths and Low Shrublands dominated by few to all of the generally very low shrubs <i>Melaleuca systema</i> , <i>Leucopogon parviflorus</i> , <i>Leucopogon insulare</i> , <i>Acrotriche cordata</i> over <i>Lomandra maritima</i> graminoid Open to Closed Herbland with <i>Acanthocarpus preissii</i> and <i>Desmocladius flexuosus</i> common, sometimes with overstorey of combinations of <i>Spyridium globulosum</i> , <i>Acacia cyclops</i> , <i>Olearia axillaris</i> , <i>Santalum acuminatum</i> and <i>Acacia cochlearis</i> ; a large proportion of the northern part of the study area, north of Wilkie Avenue	Condition generally Very Good to Excellent	MAL, AcS/MAL, SaAc'/MAL, OS/MAL
(2) Heaths to Scrubs (to Shrubland) of <i>Spyridium globulosum</i> , in the northeastern corner of the study area and, in a small area bordering Wilkie Avenue, with <i>Acacia cyclops</i> and <i>Schinus terebinthifolia</i>	Condition generally Excellent to Good, small areas Degraded	S, AcSSt
(3) Low Closed Forest of <i>Eucalyptus gomphocephala</i> over <i>Spyridium globulosum</i> , <i>Rhagodia baccata</i> Open to Closed Heath and Low Woodland with shrubs of <i>Spyridium globulosum</i> and <i>Acacia cyclops</i> ; in centre of northern part of study area	Condition Good to Degraded	Eg, EgSAc
(4) Shrubland to Open Shrubland of <i>Scaevola crassifolia</i> , <i>Olearia axillaris</i> over <i>Hemiandra pungens</i> , <i>Melaleuca systema</i> Open Low Heath over <i>Acanthocarpus preissii</i> Herbland and <i>Desmocladius flexuosus</i> Sedgeland; small stand in southeast corner of study area and another, smaller, unmapped stand 300-400m northwest of it	Condition Very Good to Excellent	SnO
(5) Tall Open Scrub of <i>Melaleuca cardiophylla</i> , ( <i>Olearia axillaris</i> ); very small stand in southeast corner of study area	Condition Very Good	Mc

**Quindalup Dunes Uplands – Younger dunes**

(1) Heaths and Low Heaths to Shrublands dominated by <i>Scaevola crassifolia</i> , <i>Myoporum insulare</i> or, less commonly and taller, <i>Spyridium globulosum</i> or <i>Olearia axillaris</i> , often over <i>Lepidosperma gladiatum</i> Sedgeland to Open Sedgeland and <i>Acanthocarpus preissii</i> or <i>Tetragonia decumbens</i> Herbland to Closed Herbland; almost all of southern part of study area and western edge of northern part	Condition generally Very Good, with some areas Good to Degraded and others Excellent	MiScO, ScO, MiScO/Lg, MiSAc/Lg, MiSc/Lg, ScMi
(2) Open to Closed Very Low Heath of <i>Scaevola crassifolia</i> , <i>Frankenia pauciflora</i> ; lower sand slopes adjacent to beach-edge limestone platforms west of Fisherman's Hollow and southwest of junction of Kaiber Avenue with Brazier Road	Condition Very Good to Excellent	ScFp

**Quindalup Dunes Uplands - Beach and fore-dunes to loose sand face of mobile dunes**

(1) Closed Grassland of <i>Thinopyrum distichum</i> , with areas of <i>Spinifex hirsutus</i> and <i>Spinifex longifolius</i> Grasslands; edge of strand and fore-dunes along most of coast, with <i>Olearia axillaris</i> Shrubland to Open Shrubland overstorey southwest of junction of Wilkie Avenue with Brazier Road	Condition of <i>Spinifex</i> generally Very Good to Excellent; the other species are aliens	TdShl, B, O/TdShl
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(2) Low Open Shrubland to Low Open Heath of <i>Leucophyta brownii</i> ; small area with ScFp southwest of junction of Kaiber Avenue with Brazier Road	Condition Very Good	Lb
(3) Shrubland to Open Shrubland of <i>Olearia axillaris</i> over <i>Pelargonium capitatum</i> shrub-like Herbland, with few <i>Spinifex longifolius</i> , <i>Scaevola crassifolia</i> , <i>Acanthocarpus preissii</i> and <i>Senecio lautus</i> and weeds, especially <i>Trachyandra divaricata</i> ; fore-dune swales in northwestern part of study area	Condition Degraded Completely Degraded	O/Pc to

**Quindalup Dunes Wetlands**

Closed Sedgeland of <i>Lepidosperma gladiatum</i> , with <i>Rhagodia baccata</i> ; depression near invagination of northern boundary of study area	Condition Excellent	Lg
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**Weeds and other aliens**

Herblands, Grasslands and smaller areas of other vegetation structural classes (formations) dominated by aliens	Condition Completely Degraded (to Degraded) or worse	W, C, Ev, Fv, G, LI, LIW, LI/MAL
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## **Appendix 4 – Rehabilitation Species List**

### Native Species For Replanting Beach Areas/Dune Faces

*Olearia axillaris*  
*Scaevola crassifolia*  
*Spinifex longifolius*

### General Native Replanting Species List

*Acacia rostellifera*  
*Acanthocarpus preissii*  
*Desmocladius flexuosus*  
*Hardenbergia comptoniana*  
*Lepidosperma gladiatum*  
*Leucophyta brownii*  
*Lomandra maritima*  
*Melaleuca huegelii*  
*Olearia axillaris*  
*Pimelea ferruginea*  
*Rhagodia baccata* subsp. *baccata*  
*Scaevola crassifolia*  
*Spinifex hirsutus*  
*Spinifex longifolius*  
*Spyridium globulosum*  
*Templetonia retusa*