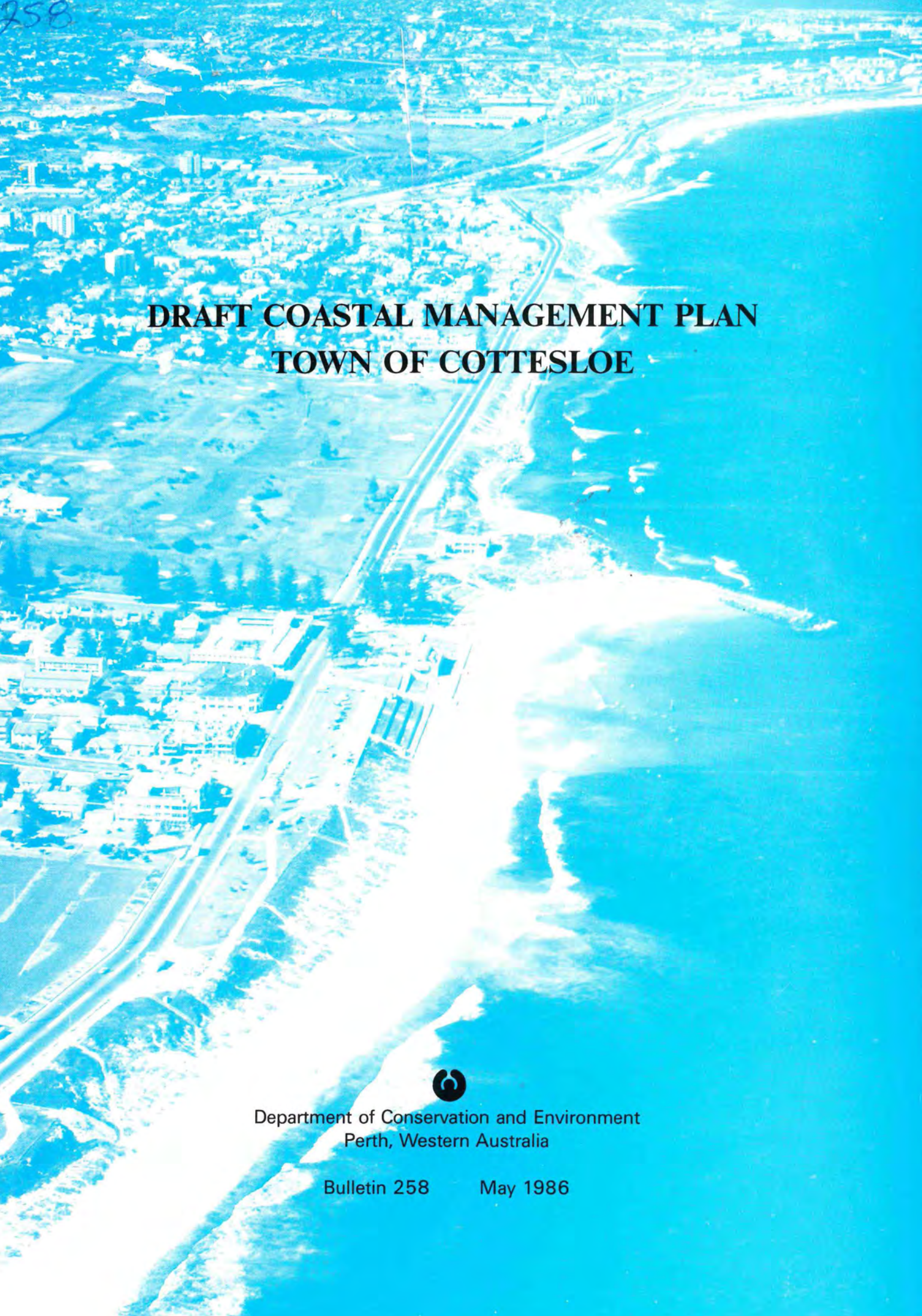

DRAFT COASTAL MANAGEMENT PLAN
TOWN OF COTTESLOE

Department of Conservation and Environment
Perth, Western Australia

Bulletin 258 May 1986

Draft Coastal Management Plan

Town of Cottesloe

by D E Hulajko

Department of Conservation and Environment
Perth, Western Australia

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(Photography by Stuart Chape)

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  . State Planning Commission

  . Department of Land Administration

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CONTENTS

CONTENTS (contd)

APPENDICES

Page

FIGURES

TABLES

PHOTOGRAPHS*

* Photographs were taken by the author on 24 March 1985.

1. INTRODUCTION

The Cottesloe beach has been an important regional recreation area for many years. Recognising this in 1978 Council approved a long-term development and management policy titled "Report of the Beach and Occasional Committee on a policy for Cottesloe Beaches". Since 1978 the area has been developed and managed in accordance with that policy, and consequently the foreshore is generally in a sound condition.

However, as Cottesloe is going to be an important vantage point for people watching the America's Cup, it is likely that resulting crowds will put considerable extra pressure on the coastal environment and public facilities along the foreshore. Consequently, Council approached the Department of Conservation and Environment (DCE) seeking assistance in the preparation of a management plan. This plan reassures development and management needs and provides the information required to prepare an application for a grant under the Commonwealth America's Cup funding arrangements. It makes recommendations about the rationalization of the use of the Cottesloe foreshore, improving parking and beach access, upgrading of toilets and other public facilities, protecting sensitive areas of sand dune vegetation from pedestrian traffic, and lanscaping and improvement of amenity.

The area of this study is bounded to the north by the administrative boundary with the City of Nedlands, to the south by the administrative boundary with the Town of Mosman Park, and to the east by Broome Street and Curtin Avenue. The western boundary is the low water mark. The boundaries of the study area are shown in Figure 1.

2. NATURAL ENVIRONMENT

2.1 PHYSICAL

2.1.1 GEOLOGY

The chronology of Western Australian coastal features has been described by Fairbridge and Teichert;[1] and Baker.[2]

The coastal zone of the study area is primarily composed of Holocene Safety Bay sand, indispersed with massive Pleistocene Tamala Limestone outcrops.

2.1.2 GEOMORPHOLOGY

The Geomorphology of the Swan Coastal Plain has been described by McArthur and Bettenay.[3]

The dunal landscape was inundated during the late stages of the Holocene and was subsequently modified by marine erosion. Holocene bank structures are now present over the Pleistocene foundations (Figure 2). A low hilly landscape, consisting of shallow brown sands over limestone, has formed through aeolian deposition. These features are named the Quindalup Dune System.

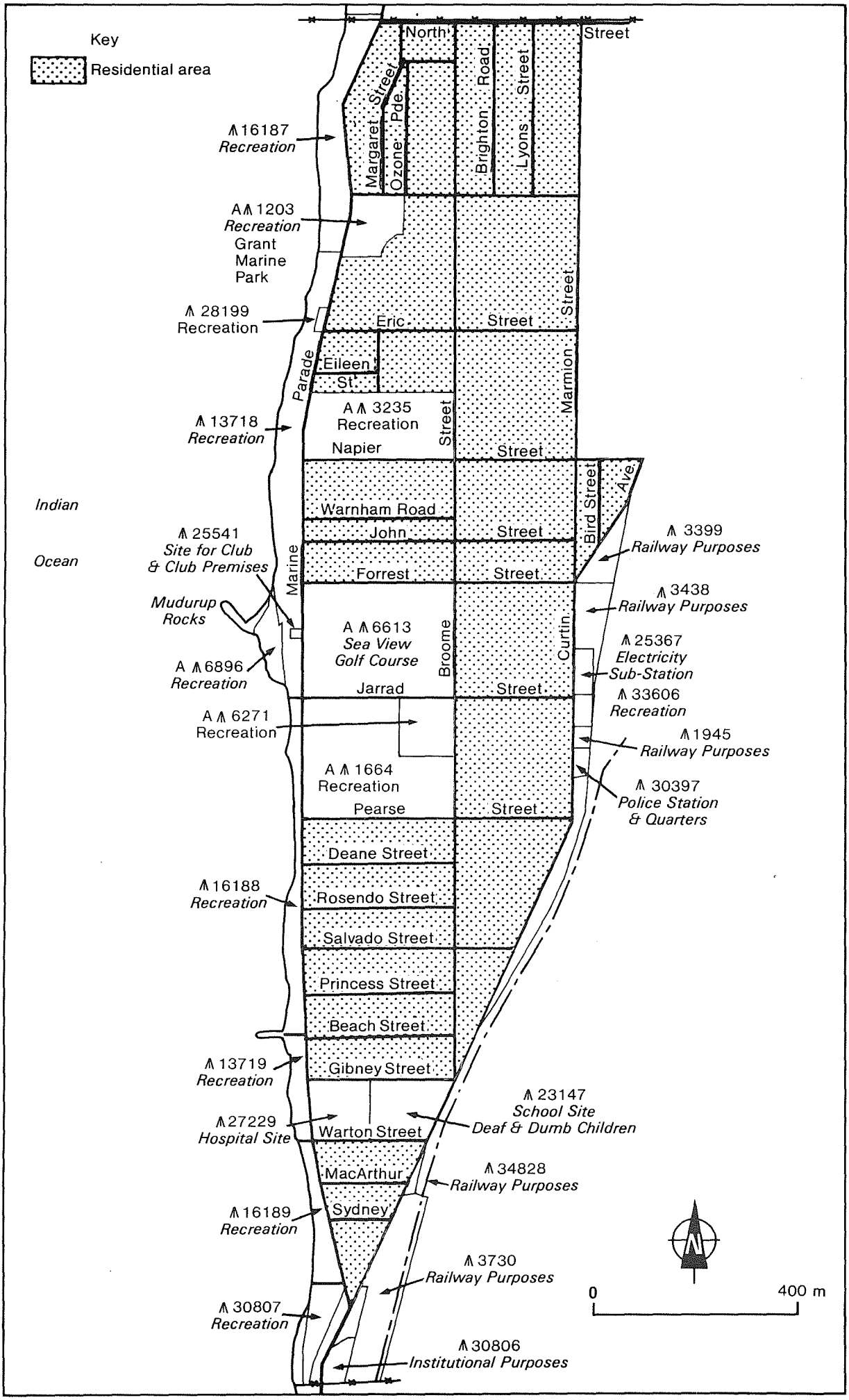


Figure 1. The study area showing the reserves and adjoining residential area at Cottesloe.

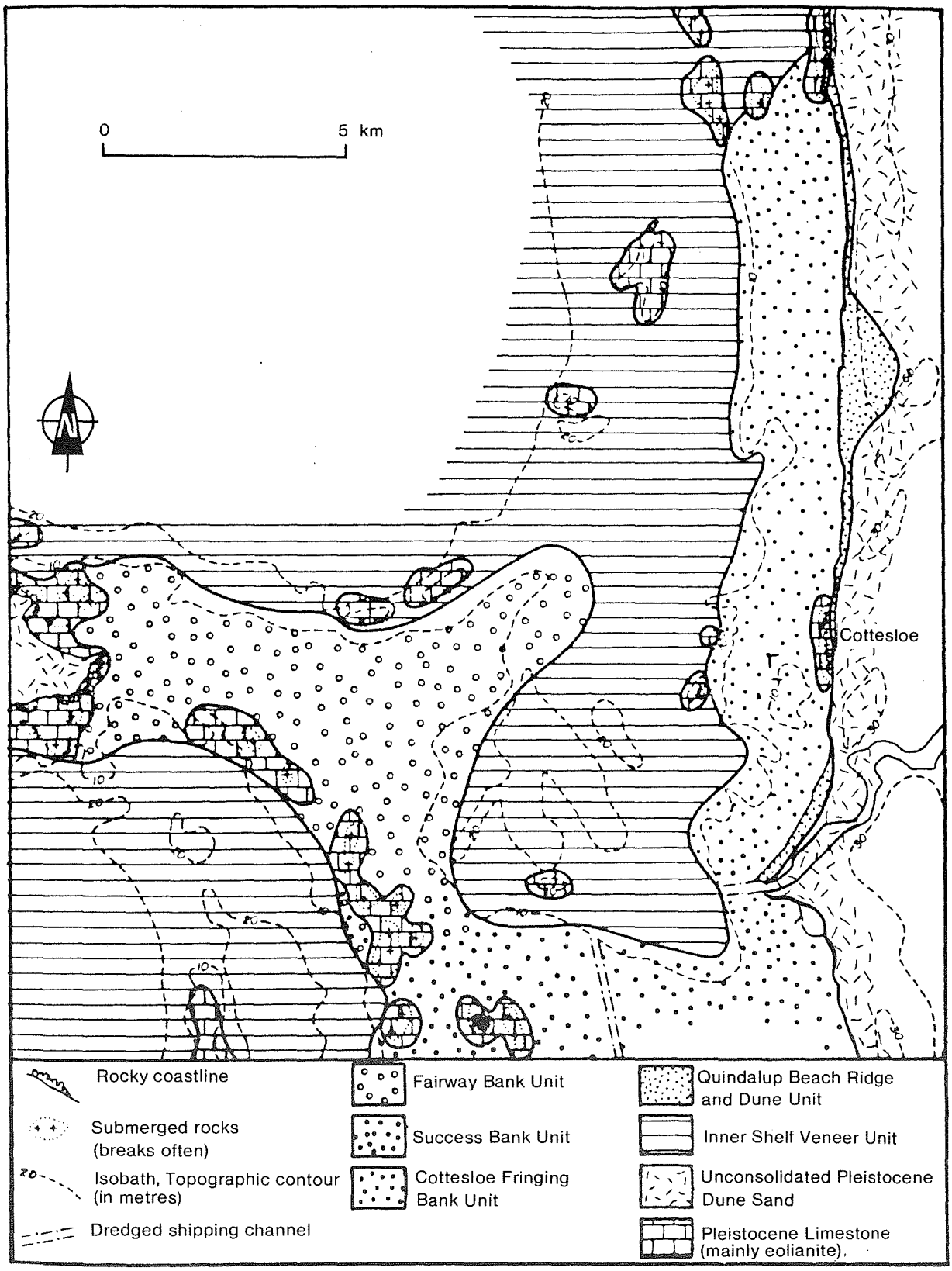


Figure 2. Distribution of Holocene sediment units.(4)

2.1.3 SOILS

The soils are related to geological units and the age of the landform. In general the soils are immature and covered with native coastal vegetation. On-site observation of soils at Cottesloe indicate permeable sands overlying porous limestones which are ideally suited to irrigation using saline waters.

2.1.4 HYDROLOGY

The aquifer is located under a dense residential area and is recharged from rainfall. It is susceptible to changes in surface runoff and to pollution from nutrients, pesticides and other chemicals.

In the past, storm water pipes discharging to the beach have caused considerable damage during storms, particularly in winter when the sand becomes saturated and mobile. This problem has been partially solved through the relocation of storm water pipes.

2.2 BIOTA

2.2.1 VEGETATION

Vegetation is typical of the rest of the coast with some exotic species.

In 1978 the Cottesloe Town Council conducted a survey of native vegetation at the Cottesloe Beach Reserve.

Three areas surveyed indicated a variety of coastal flora. These were the Vlamingh Memorial Area, Mudurup Rocks and near North Street.

The plants identified were:

Vlamingh Memorial area:

Ammophila arenaria	-	Marram grass
Tetragonia decumbens	-	Sea Spinach
Oenothera drummondii	-	Evening Primrose
Olearia axillaris	-	Coast Daisy - brush
Pelargonium capitatum	-	
Lepidosperma gladiatum	-	
Spinifex hirsutus	-	
Scaevola crassifolia	-	
Trachyandra divaricata	-	Onion weed
Calocephalus brownii	-	
Scirpus nodosus	-	Knotted club rush
Spinifex longifolia	-	
Cakile maritima	-	Sea rocket

Mudurup Rocks area

Tetragonia decumbens	-	Sea spinach
Pelargonium capitatum	-	
New Zealand Hibiscus	-	
Oenothera drummondii	-	Evening primrose
Scaevola crassifolia	-	
Olearia axillaris	-	Coast Daisy - brush
Ammophila arenaria	-	Marram grass

North Street area

Tetragonia decumbens	-	Sea spinach
Ammophila arenaria	-	Marram grass
Trachyandra divaricata	-	
Scaevola crassifolia	-	
Oenothera drummondii	-	Evening primrose
Spinifex longifolia	-	
Spinifex hirsutus	-	
Arctotheca populifolia	-	

Cottesloe beach provides an example of landscaping using native plants and grasses. Both treatments have advantages and disadvantages. In terms of recreation, a grassed area is more suitable. However, in terms of dune stability and sand trapping, native plant cover is more effective.

Norfolk Island Pine stands planted 30-50 years ago provide shade for beach users.

2.2.2 MARINE LIFE

The variety of marine fauna and flora between Trigg Island and Burns Beach has been described in DCE Bulletin 220.[5] It is assumed marine life in the Cottesloe littoral zone and low reef foreshore includes most of the species identified in the above publication.

2.3 CLIMATE AND OCEANOGRAPHY

Cottesloe experiences a seasonal climate with dry summers and mild wet winters. Annual rainfall is 698 mm (recorded at the nearest meteorological station in Mosman Park) with 635 mm (91%) falling in the months April to September.

2.3.1 WINDS

The dominant winds during summer are the easterlies which blow off-shore and the sea breezes.

Off-shore winds predominantly originate from the east and south-east, and rarely exceed 2-3 m/second. During anti-cyclonic conditions, constant easterly winds often reduce the sea to still water. Sea breezes originate from the west and south-west. During the average summer day, off-shore breezes prevail between approximately 3.00 and 4.00 am to midday. A sudden change in wind direction follows; and by 1.00 pm, a strong sea breeze which will continue until approximately 6.00 pm, usually prevails. By midnight the air is quite still. Wind conditions during winter are indefinate and variable with the possibility of storms. These storms bring mostly north-west and westerly winds backing to sudden south-west winds.

2.3.2 CURRENTS

Two seasonal currents dominate the Western Australian coast between Geraldton and Bunbury. Between September and April a relatively strong northerly trend is characteristic. This situation is reversed between June and September when a southerly current prevails.

Additionally, the warm Leeuwin Current has been identified off the Western Australian Coast south of Exmouth the current can be identified using

Table 1. Climatological Data - Perth Bureau of Meteorology

MONTH	WIND				TEMPERATURE	
	PREVAILING DIRECTION		SPEED			
	9 am	3 pm	Average	Highest	Maximum	Minimum
Number of years of observations	30 (a)		30 (a)	60	86 (b)	86 (b)
			km/h	km/h		
January	E	SSW	17.5	81	29.6	17.8
February	ENE	SSW	17.2	113	29.9	18.0
March	E	SSW	16.2	113	28.0	16.7
April	ENE	SSW	13.7	130	24.5	14.1
May	NE	WSW	13.5	119	20.8	11.6
June	N	NW	13.5	129	18.2	10.0
July	NNE	W	14.2	137	17.4	9.0
August	N	WNW	15.1	156	17.9	9.1
September	ENE	SSW	15.1	109	19.4	10.1
October	SE	SW	16.1	105	21.3	11.6
November	E	SW	17.2	101	24.5	13.9
December	E	SSW	17.7	103	27.4	16.2
Year - Average	E	SSW	15.6			
Extremes				15.6		

(a) Standard 30 year's normal (1911-1940)
(b) Standard 86 years (1900-1986)

satellite imagery (in winter) as a quasi-continuous stream of warm water situated along the upper continental slope. The current is typically of the order of 50 km wide and 200 m deep with southward speeds of 0.5 to 1.5 m/s. During the southern hemisphere winter the longshore sea level gradient almost doubles as the tropical water builds up in equatorial regions. The southward slope current is accordingly much stronger in winter (between Exmouth and Cape Leeuwin) than in summer.

2.3.3 SWELLS AND WAVES

Western Australia is bounded by open oceans where wind waves are generated by local winds and storms. Swells are normally generated by distant depressions and tropical cyclones.

Storm waves arrive at the coast during the winter months from north-west around to west-southwest.

Rottnest Island and its surrounding ocean bed contours refract westerly waves at an oblique angle to Cottesloe beach (Figure 3).

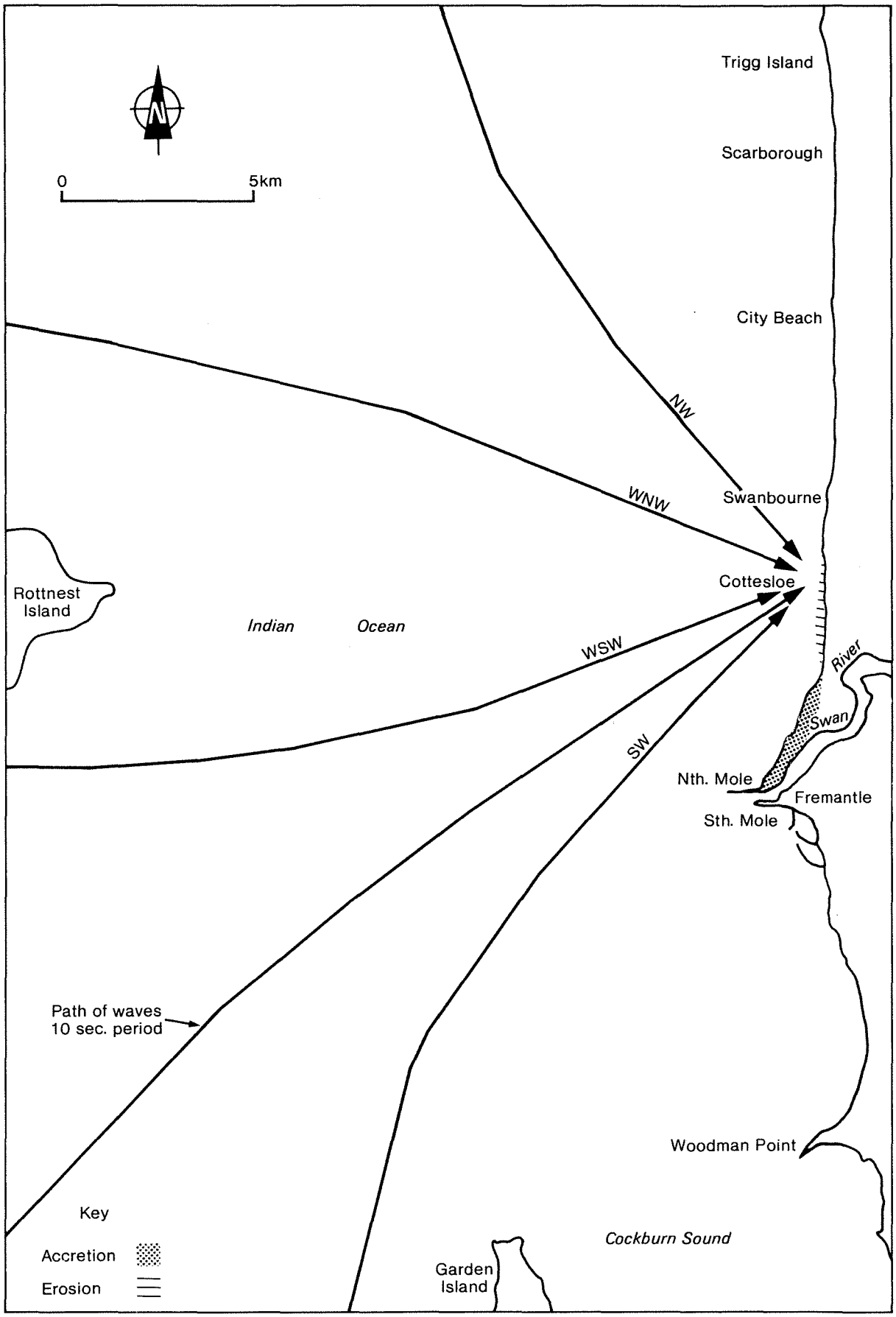


Figure 3. Location plan of Cottesloe showing adjacent beaches. Orthogonals of 10 sec waves are indicated.(6)

Throughout the year, particularly during summer, the south-west swell sweeps sand along shore to the north. A steep beach profile results and accretion occurs on the southern side of any structure - natural or man made - on the coast (Figure 4a).

The first winter storms erode this steeply graded beach material and deposit it as an offshore bar (Figure 4b). This bar inhibits further erosion; however, northerly storm waves continue to move some sediment southward (Figure 4c).

2.4 COASTAL PROCESSES

Coastal processes at Cottesloe have been surveyed by Kempin[7], Silvester[8] and Woods.[9]

Woods[10] describes the processes of the Cottesloe coast as follows:

"The metropolitan coast is subject to prevailing south-west swells and south-west seabreezes which generate south-west waves. These swells and waves (a) cause a northerly littoral drift which is capable of transporting beach sand, and are usually "constructive" and (b) lead to a net onshore movement of sand.

During winter storms and the occasional cyclone, the coast is subject to north-west winds, waves and swells which are usually "destructive" and lead to a temporary reversal of the prevailing northerly littoral drift, resulting in erosion of the beaches and offshore movement of sand.

After the storms, sand is returned to the beach by south-west swells and then blown up into dunes where it is held in reserve for the next storm attack."

These features are illustrated in Figures 4a, 4b and 4c and Photograph 1.

On-site observation and historical experience indicate that the Cottesloe beaches are not in equilibrium, ie they are eroding due to loss of sand. There are many reasons for this:

1. Sand along the south metropolitan coast can no longer move freely. The Fremantle Harbour walls prevent sand from Cockburn Sound moving north onto metropolitan beaches.

2. The Fremantle Harbour walls protect a zone immediately to the north of the North Mole that is not subject to the south-west winds and waves and thus to northern littoral drift. Sand which is eroded from beaches to the north and transported into the area during north-west storms is effectively trapped. The net result is accretion of sand behind the North Mole and corresponding permanent lost of sand from beaches to the north.

3. Under the influence of north-west storms and cyclones, the metropolitan coast is subject to southerly littoral drift. Sand moves southward from one beach to the next while sand further from the north moves in to take its place. With the return of south-west winds, sand is moved northward and back onto the beaches. Due to the construction of harbour walls however, some sand which has moved south in winter cannot be replaced in summer. Thus there is a region on the coast where sand is moving north

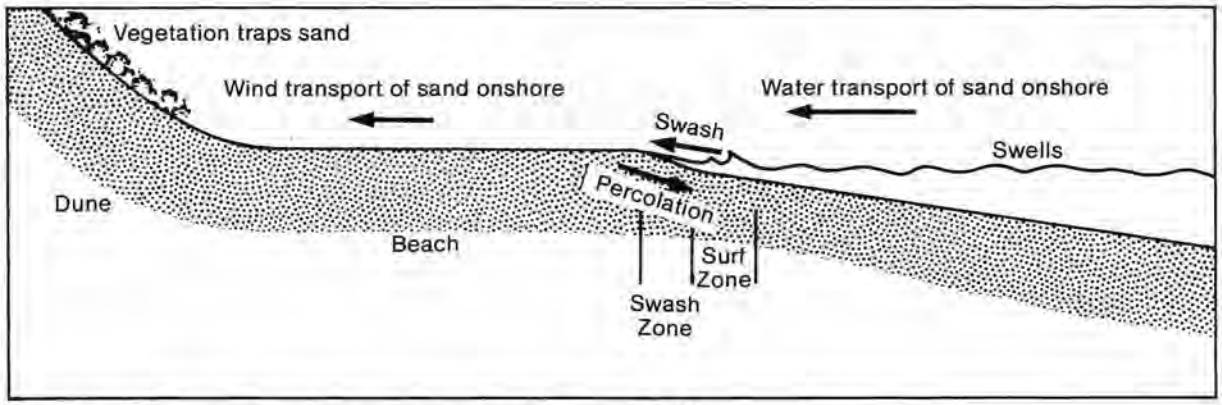


Figure 4a. Beach under accretion phase.(11)

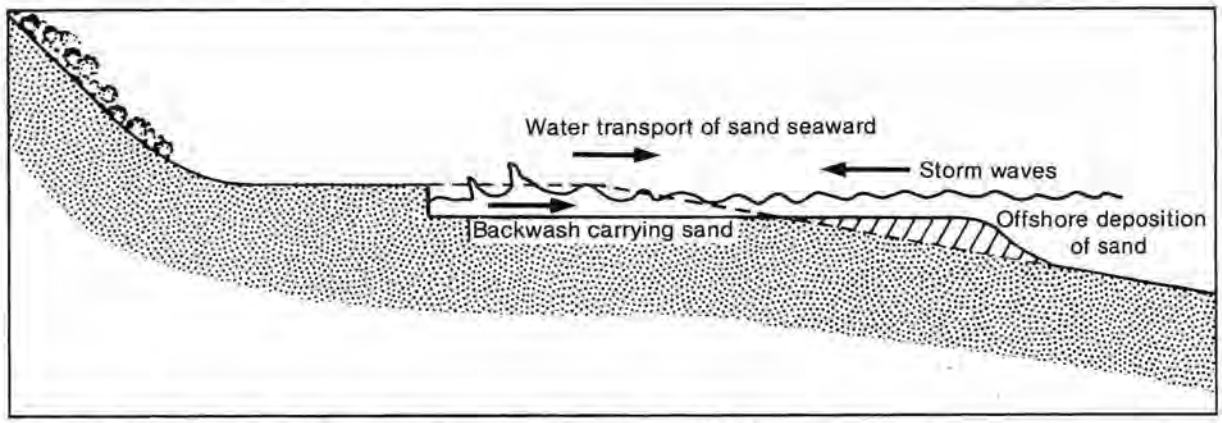


Figure 4b. Beach under early erosion phase.(12)

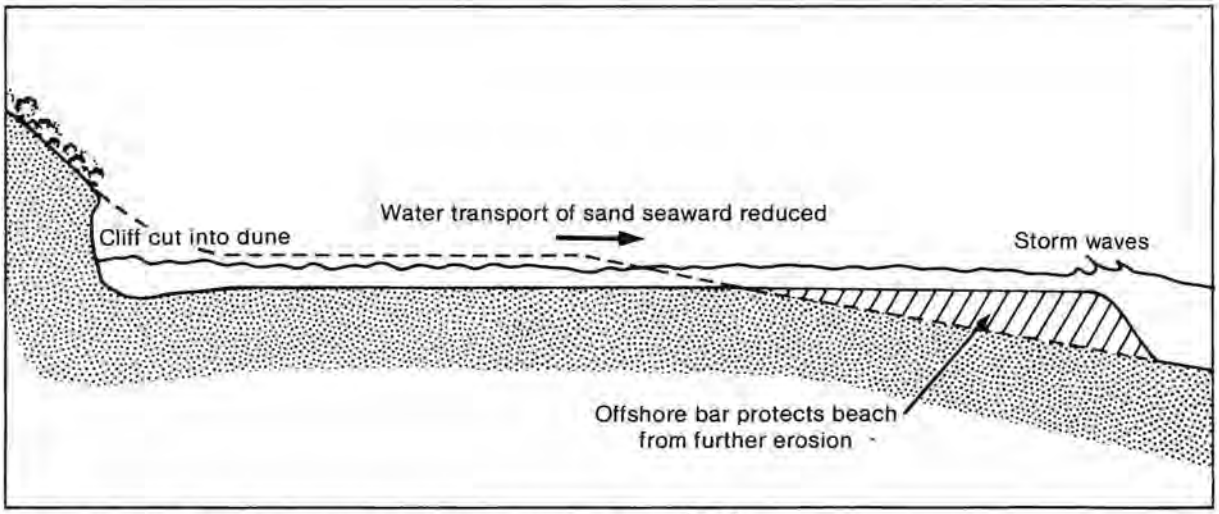


Figure 4c. Beach under late erosion phase.(13)

Photograph 1: The beach north of Grant Street under early erosion phase.

in summer while sand from further south is not moving in to take its place. It appears that Cottesloe is in this region. Under the present conditions it is likely therefore that Cottesloe will continue to lose sand.

4. Due to Cottesloe Beach's popularity, dune vegetation has been degraded by people pressure. The lack of a healthy vegetation cover exposes sand to wind erosion resulting in:

   (a) sand from the dune being blown inland; and

   (b) ineffective trapping of sand blown up from the beach.

   The loss of sand due to littoral drift is therefore aggravated by loss of sand through wind erosion.

5. The Cottesloe Coast is fringed by a low offshore reef which is broken in several places (eg Cottesloe, Peters Pool, North Cottesloe, Deane Street and Beach Street).

   Sand in the shallow water outside the reef is also subject to littoral drift. Under natural conditions this sand moves north outside the reef and comes ashore through breaks in the reef, where it accumulates on the beach and dunes.

   Cottesloe Beach itself constitutes a prominent break in this coastal reef and it is likely that a major part of the sand on the beach and dunes to the north came through this gap. The construction of Cottesloe groyne has disrupted this process.

6. The second groyne to the south traps only minor amounts of sand near Beach Street as:

   (a) most sand lies offshore in deeper waters beyond the reef;

   (b) there is only a minor amount of north-moving sand due to the harbour walls; and

   (c) the sand moving south in winter has been forced off-shore by the Cottesloe groyne.

   As the factors affecting the Cottesloe beach are unlikely to change, Cottesloe Council should recognise that the coast will probably continue to erode. To limit erosion and maintain the amenity of the beaches, it will be necessary to take action which:

   (a) reduces Man's contribution to the erosion problem; and

   (b) enhances natural protection.

2.5 LONG-TERM CHANGES

There is evidence throughout the West Australian coast that fluctuations in shoreline position have taken place over past centries in response to climatic change.

Numerous studies have been undertaken on coastline recession in the past 100 years. These indicated that a recession of 91 m had occurred between Cottesloe and Leighton from 1885 to 1955.[14] A comparison of maps prepared in 1874 with 1947 Royal Australian Navy charts and a 1985 map of shoreline configurations (Figure 5) indicates that sand accretion has occurred between North Mole and Leighton Beach, and that erosion occurred between Cottesloe and Leighton Beaches. It is understood that if the coastline was naturally receding without any sand replenishment from outside the area, further recession would occur in all areas in the future.

2.6 HUMAN

2.6.1 HISTORY

The site of Perth was discovered by Europeans in 1697 by the Dutch navigator Willem de Vlamingh.

The following extract from "**HISTORIES GENERALE DES VOYAGES" (PREVOST)** describes the discovery[15]

Isle Rottnest:	On 25 December, they sighted New Holland at 31°58' and Longitude 130°18'. Four days afterwards they were in the shelter of Rottenest Island (Rat's Nest) 8' further north and 3°7' further east. They took on supplies of firewood which was	29 December, 1696
1697 New Holland:	there in abundance. On 5 January 1697, Vlamingh landed on the shores of New Holland with ninety-eight armed men, they first walked eastward without finding anything that could serve for food, but	

	they saw a few big trees from which trickled a kind of lac or gum, and some little parrots which were very wild. After walking for about three hours, they came to a lagoon of brackish water where they noticed in the sand several footprints of men and children, without however meeting anyone. The next morning,	6 January, 1697
	they separated into three groups to inspect the country, to the south, to the north and to the east for a distance of one league from the spot where they had spent the night. All their investigations led only to the discovery of a few overturned huts, but no fresh water; yet when they dug a well, they found fairly good water. On their return, they noticed	Fresh water well
	that the water in the lake had dropped more than a foot, which led them to the conclusion that it must have access to the sea. Indeed, they were speedily convinced of this, by the sight of a canal in the south, where they had	
Black Swans:	brought their boats in, they found some black swans of which they took four, two of which were brought alive to Batavia, and a lot of fish. The days following did not produce any great discoveries, although they went up this lagoon or salt water river, up to ten or twelve leagues	30-36 miles
	inland. An exact observation showed them to be at $31^{o}43'$ south. A big reef dominates here for the extent of a league, at half that distance from the shore. They found another, strewn with points of rock at $30^{o}17'$. 13' further south, the compass varied to the north-west by $9^{o}21'$.	

(Translation from original French text by courtesy of Dr V A SUMMERS, OBE, MA, DUP)

Original volumes printed in 1758 and held in the Battye Library, Perth.

On the 5 January 1974, the 275th anniversary of the landing of Willem de Vlamingh, citizens of Western Australia dedicated a Memorial to commemorate the landing near the junction of Marine Parade and Curtin Avenue.

This is now known as the Vlamingh Memorial.

In 1801 the French surveyor Lt Commander Milhuis from the ship "Naturaliste", completed the first survey of Garden and Carnac Islands. A granite memorial was donated by Cottesloe's 150th Committee to recognise the part played by the French in the founding of the Swan Colony.

2.6.2 POPULATION GROWTH

The Town of Cottesloe's population was 6 750 in 1981.

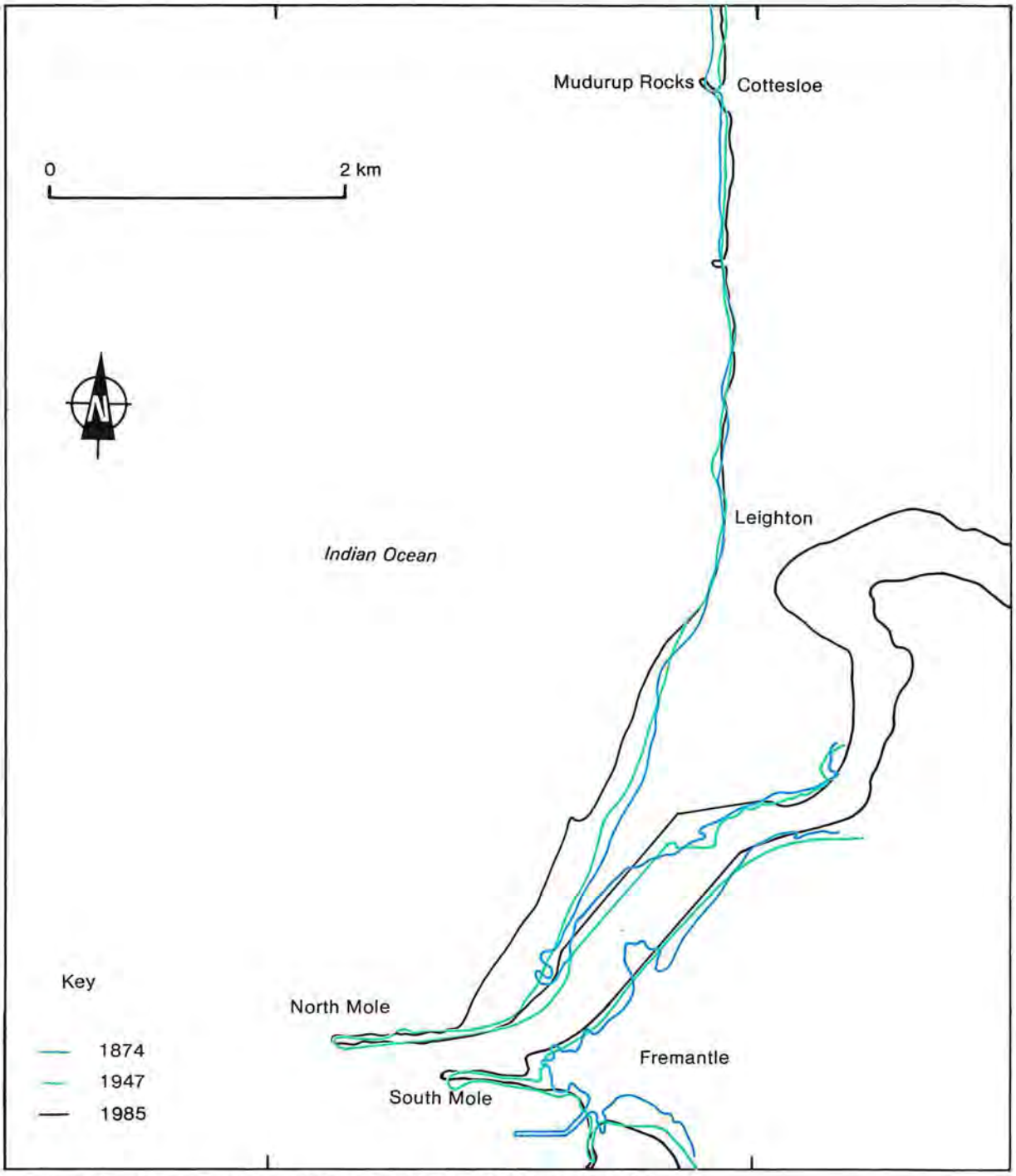


Figure 5. Shoreline movements 1874, 1947 and 1985.

Population figures given in the 1981 ABS Census indicate the proportion of the population in the age groups 50 years and over, (34% total population of Cottesloe) and, particularly 70 years and over, was higher than the for the Perth metropolitan area's average. Similarly, the proportion in the age groups 0-4 years, and 5-9 years (10% total population) was lower. However over recent years there has been a steady increase of younger families in the area. The proportion of children is therefore likely to rise, or, at least remain static, over the next few years.

Photograph 2. The Vlamingh Memorial, looking east. Dune vegetation has been damaged due to uncontrolled pedestrian traffic.

2.6.3 EXISTING TENURE

The coastal zone comprises a coastal reserve vested in the Town of Cottesloe for recreational purposes (Figure 1).

Recreational and other reserves within the study area are included in Table 2.

2.6.4 EXISTING USE

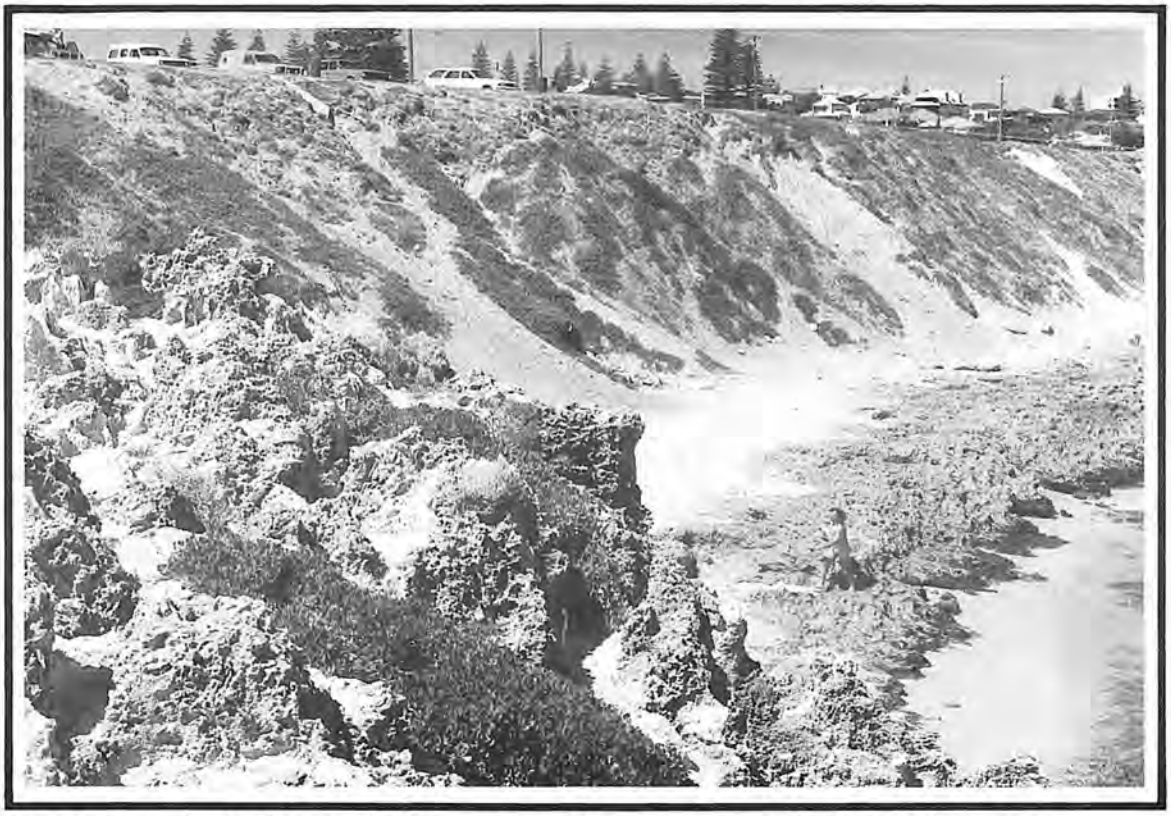
Most of the land in the coastal zone east from Marine Parade has been developed for private residential purposes. The main shopping centres are located near Marine Parade and Eric Street. The strip west of Marine Parade (Beach Reserves) is zoned public open space.

Swimming, surfing and passive beach recreation are most popular activities on all sandy sections of the Cottesloe foreshore. Beach fishing is popular at several locations.

The rocky coast at Mudurup Rocks is used for surfing, fishing and diving. Two sections of the beach have been set aside for animal owners.

2.6.5 EXISTING ZONING

Coastal reserves vested in the Town of Cottesloe for public recreational purposes are shown on Figure 1.



Photograph 3. Mudurup Rocks, the site of a popular surfing area. Note the cliff degradation.

East of Marine Parade there is public open space ie: Seaview Golf Course Res A1664, A6613; and special purposes reserves ie: School Site Deaf and Dumb Children Res 23147, Hospital Site Res 27193 vested in C G Fremantle Hospital Board, Res 30806 for Institutional Purposes vested in the Minister for Community Welfare (see Table 2 for details).

2.6.6 PROPOSED ZONING

The System 6 Study Report to the Environmental Protection Authority does not give specific recommendations for management in the Town of Cottesloe.(16)

The major modification is the proposed West Coast Highway link in a north-south direction from Swanbourne to Cottesloe. The new West Coast Highway route through Cottesloe will be constructed via Curtin Avenue and Servetus Street.

2.6.7 EXISTING FACILITIES

2.6.7.1 Urban development

Urban development of coastal land in Cottesloe has taken place close to the coastline. As there is insufficient space between the road and the beach, normal coastal processes are interrupted by man made structures like seawalls, buildings, roads and paths, which aggravates erosion problems (see Photograph 4).

Table 2. Reserves and Purposes in the Town of Cottesloe (Coastal Management Plan Area Only).

RESERVE	AREA (ha)	VESTING DATE	VESTED IN	PURPOSE
1664	8.7007	25.10.1935	Town of Cottesloe	Recreation Cottesloe Golf Club
3235	5.7642	8.11.1935	Town of Cottesloe	Recreation
3730	27.8923	25.10.1985	Cottesloe	Railway Purposes
6271	1.8210	25.05.1934	Town of Cottesloe	Recreation
6613	10.1980	25.10.1935	Town of Cottesloe	Parkland
6896	1.6095	17.01.1936	Town of Cottesloe	Recreation
1203	1.8417	08.11.1935	Town of Cottesloe	Recreation
13718	11.1541	18.08.1911	Town of Cottesloe	Recreation
13719	2.7443	18.08.1911	Town of Cottesloe	Recreation
16187	4.7348	05.11.1915	Town of Cottesloe	Recreation
16188	8.5136	05.11.1915	Town of Cottesloe	Recreation
16189	3.9331	05.11.1915	Town of Cottesloe	Recreation
23147	1.9880	06.10.1950	Cottesloe	Deaf and Dumb School Site
25541	0.0736	06.11.1964	C G Cottesloe Surf Life Saving Club Incorporated	Cottesloe Surf Life Saving Club Incorporated
27229	2.0626	19.06.1981	C G Fremantle Hospital Board	Hospital Site
28199	0.1573	22.07.1966	Town of Cottesloe	Recreation
30806	1.2057	26.08.1983	Minister for Community Welfare	Institutional purposes
30807	1.3645	23.04.1971	Town of Cottesloe	Recreation Vlamingh Memorial
34828	0.0740	26.08.1977	Cottesloe	Railway purposes

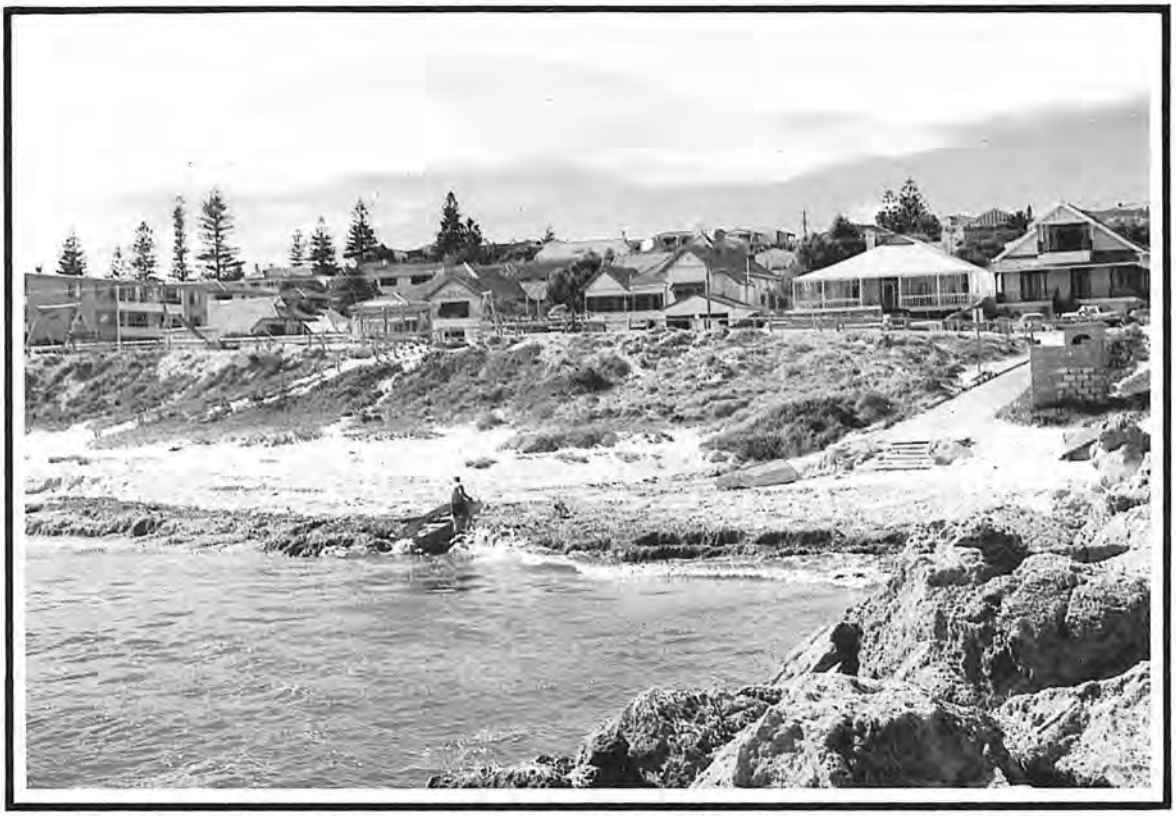
2.6.7.2 Roads

An investigation to improve north-south access through the Swanbourne-Cottesloe area was carried out in 1976 by Scott and Furphy Consulting Group.(17)

This survey indicated that the main access to Cottesloe Beach is via Eric Street, which provides east-west access for 46% of beach users. The remaining 54% come from streets including Jarrad, Salvado and Victoria. At present Marine Parade acts as a major coastal road. Improvement to north-south access through the western suburbs would benefit motorists travelling to Cottesloe from northern suburbs. This will also help restrict traffic along Marine Parade to beach users.

2.6.7.3 Car parks

There are 11 public car parks along the Cottesloe coastline on the west and east side of Marine Parade. These are built specifically for beach uses ie or on side streets adjacent to Marine Parade.



Photograph 4. The groyne at Beach Street which is frequently used as a boat launching site. Note old toilet block on the right.

The carparking areas, with total capacity of 741 cars, are as follows:

- at Vlamingh Memorial - capacity about 5 cars
- at Beach Street - capacity 20 cars
- between Rosendo and Deane Street - capacity 20 cars
- at Jarrad Street - capacity 35 cars
- at Forrest Street - capacity 102 cars
- at Cottesloe Beach - capacity 200 cars
- between Napier and Eileen Street on east side of Marine Parade - capacity 200 cars
- at "Van Eileen" - capacity about 15 cars
- south of North Cottesloe Surf Life Saving Club - capacity 20 cars
- in Grant Street capacity 50 cars
- at Eric Street - capacity 74 cars

Verge parking exists on Marine Parade between Grant Street and North Street. The north and south boundaries of the dog exercise beach are defined by these two roads.

Parking areas adjacent to Cottesloe Beach are considered to be conveniently located and provide adequate space.

2.6.7.4 Dual Purpose Pedestrian and Bicycle Tracks

A pedestrian and bicycle path has been constructted in the last two years along the coast between Mosman Park and Cottesloe. This 5 km-long path plays an important role as it provides a scenic route for pedestrians and cyclists which does not interfere with the dune system or local traffic on Marine Parade or Curtin Avenue.

Photograph 5. The pedestrian and bicycle path near Warton Street provides opportunities for sightseeing.

2.6.7.5 Pedestrian Access

At present there are 30 formal access ways to the beach at Cottesloe which consist of board and chain ramps or concrete steps and several informal ones.

Formal pedestrian paths consist of board and chain ramps, constructed to an average length of 50-100 m (see Figures 6-12). A few of the older steps have been damaged, making access to the beach difficult.

Concrete steps have been constructed over the limestone cliff to provide access to the beach, at several locations (Photograph 6).

2.6.7.6 Surf Life Saving Clubs

Two surf life saving clubs operate in the Town of Cottesloe. Both occupy buildings on the Beach Reserves: Cottesloe Club in Reserve 25541; and North Cottesloe Club in Reserve 28199.

Photograph 6. Access to the dogs' exercise beach north from Grant Street.

2.6.7.7 Grassed Picnic Areas

Major lawn areas on Cottesloe Beach Reserves are situated opposite Beach Street, Deane Street, Cottesloe main beach, Napier Street, North Cottesloe Beach and between Vera View and North Street.

Only Cottesloe main beach has a reticulation system.

2.6.7.8 Toilets and Changerooms

There are two sets of facilities at the Cottesloe Beach Pavilion and the North Cottesloe Club. The Cottesloe beach facility consists of male and female change rooms which include five cold-water showers and two toilets.

The North Cottesloe beach facility contains three showers and three toilets for both the male and female areas. A toilet block which is in urgent need of replacement also exists near the groyne at Beach Street.

2.6.7.9 Shops

Kiosks exist at Cottesloe main beach and at North Cottesloe beach, and there is a hamburger shop at the Van Eileen car park. These adequately supply the needs of both areas and no others appear to be necessary on the beach Reserve. Hotels, fast food shops and restaurants are opposite both beach areas east of Marine Parade.

Photograph 7. Cottesloe main beach. The concrete wall on the foreshore side has been cracked by storm water action.

2.6.7.10 Boat Launching Facilities

A frequently-used site for the launching of motor powered boats is the Beach Street groyne. The Beach Street groyne (north side) at Cottesloe beach is also used, but to a much lesser extent.

2.6.7.11 Other Facilities

A few shelters are located on Cottesloe main beach and on the grassed area near Beach Street. There are cold water showers at the Deane Street steps, the ramp to the beach overway at Cottesloe beach, the north-west corner of the Bathing Pavilion at Cottesloe beach, and at the Vera View Parade steps.

Several pieces of children's playground equipment are located on the grassed area west of Marine Parade. A children's wading pool is situated at Cottesloe main beach.

3. EXISTING PLANNING AND MANAGEMENT

At present the Cottesloe Council controls planning in the area, and is responsible for the management of beach reserves. In 1978 the Council prepared a policy for Cottesloe beaches.(18) The policy was adopted and has been followed until now.

The Committee's report basically supported the view that the Cottesloe Beach Reserves be allowed to be used to the maximum by Cottesloe residents, restricted only by the Reserve's carrying capacity and Council's ability to maintain them.

The Committee proposed that four elements be preserved to the exclusion of any use which would detract from their existence ie:

. unpolluted bathing area
. clean areas of beach sand
. stable dune face
. stable hind dunes.

3.1 USE PRESSURES

The beaches, reefs and water along this section of coast are subject to increasing human pressure (Photograph 8). The area is intensively used by people from both within and outside the Cottesloe area who are attracted by commercial facilities such as hotels, restaurants, cafe bars and shops; as well as natural attributes, including safe bathing, easy access, and general holiday atmosphere.

Photograph 8: Dunes south from Vlamingh Memorial. Beach access should be restricted to protect the dunes.

3.1.1 DEMANDS

The following general demands will need to be accommodated in the study area:

. Access - establishing additional formal access ways, upgrading of existing access

. Developments - new toilet block, sealing car park

. Conservation and security - new fence, brush matting, revegetation, sand replenishment (after severe winter storms)

. Recreation - reticulation of main grassed areas, additional shelters, seats

. Information and direction - additional signs, review location of existing signs.

3.2 OPPORTUNITIES

The Cottesloe study area has the following resources:

. sandy and rocky beaches;

. a high standard of facilities;

. convenient location of Cottesloe beach with easy access;

. beach reserves vested for recreational purposes; and

. large area of public open space including a golf course, ovals and parks.

3.3 CONSTRAINTS

The Cottesloe beach has the following constraints which limit use and the development of coastal resources:

. The beach is subject to constant erosion

. Poor fencing

. Informal path access to the beach

. Unclear sign posting for pedestrian traffic

. Denuded dune vegetation.

4. PLANNING AND MANAGEMENT ISSUES

4.1 PEDESTRIAN BEACH ACCESS

Pedestrian access is formalised along Cottesloe beach, with a few exceptions. This has been achieved by the use of post and wire fencing, post and rail fencing and brush matting which protect dune vegetation. Board and chain pathways have been used for beach access; however, some are in need of repair and should be fixed or replaced.

The dunes north and south from Vlamingh Memorial, and between Dean and Jarrad Street are covered by uncontrolled pedestrian tracks.

Increasing use of the beach will enhance the need for:

. additional formal access to the beach;

. effective fencing; and

. additional well designed signs indicating paths.

4.2 COASTAL PROCESSES

The Cottesloe coastline erodes naturally, though the construction of North Mole at Fremantle in 1890 accelerated the process by stopping sand movements northwards.

Mudurup Rocks groyne was built in 1960 to collect sand during north-west wave conditions. After 26 years it can be seen that conditions along beaches to the north have improved.

Action should be taken to stabilise existing dunes and foredunes which play an important part in trapping sand and restoring the beach.

Measures to counteract erosion include ensuring that there is adequate sand supply on the beaches and in the dunes along the Cottesloe coast. This can be achieved by:

- sand replenishment ie the technique of dumping sand collected from outside the area and building breakwaters to minimise sand drift; and

- trapping as much of the sand coming ashore as possible using fencing and revegetation techniques.

Sand replenishment was used at Cottesloe during 1980 and 1981 after heavy storms in 1976 and 1978. Approximately 9 311 m^3 of sand was scattered on the beach area between Warnham and Eileen Street in May 1980; and 10 000 m^3 between Eileen and Grant Street in April 1981.

Photograph 9: North Cottesloe Beach. Sand replenishment was carried out here in 1981 and the dunes are now stabilised by Marram grass.

4.3 COMPETING BEACH USES

To avoid competition for space at Cottesloe Beach, the Cottesloe Council has divided it into sections (Figures 6-12) for various uses, ie:

- Swimming area - area north of Mudurup Rocks to Grant Street
- Surfing and passive recreation area - area between Beach Street and Mudurup Rocks
- Dogs' exercise area - north of Vlamingh Memorial to the groyne at Beach Street, and area north of rocky outcrops north from Grant Street to North Street
- Boat launching areas.

The dogs' exercise area between Vlamingh Memorial and Beach Street groyne is well defined by the natural rocky feature. However, the dogs' exercise area extending from the rocky outcrops northwards to North Street has no clear physical boundary between it and adjacent Swanbourne swimming beach.

4.4 RETICULATION

The study area has approximately 13.5 ha of recreation space under groundwater irrigation.

Only Cottesloe main beach is reticulated. The remaining grassed areas along the foreshore are watered with movable sprinklers with hoses.

Problems that constantly occur with each area as a result of manual watering techniques include:

- inconvenience to the public;
- sprinklers being moved by people in order to use the grassed areas;
- vandalism of sprinklers and hoses;
- overspray onto roads and parked cars;
- lack of water near kerbs; and
- high labour content.

To overcome these problems it is recommended that an automatic irrigation system be installed to service the established grassed areas along the coast.

4.5 CONSERVATION

Narrow coastal reserves in Cottesloe are set aside for recreational purposes.

Expansion of beach reserves is deemed necessary in order to:

maintain foredune vegetation;

. maintain public access to the coast; and

. preserve selected areas for landscape and views.

4.6 AMERICA'S CUP

The America's Cup Yacht Race will be held off the Perth coast during early 1987. As a direct result of this race there will be increased pressure on the coast, including Cottesloe: both in terms of increased boating activity, increased demand in beach front accommodation, and general overall increase in tourism activity.

The Cottesloe Council has prepared the following expenditure proposals in relation to the forthcoming event (Table 3).

Table 3. List of projects and their associated values

Cottesloe Foreshore Reticulation	$275 000
Sun Shelters and Seats for Foreshore	48 000
Surfacing Car Park "Van Eileen Area"	13 500
Litter Control	10 000
Transport Facilities - Bus Shelters	5 200
Parking and Crowd Control - Temporary Rangers	12 500
Upgrading Beach Changeroom Facilities - Floor Tiling	11 700
Upgrading Children's Wading Pool	21 000

5. CONCEPT LOCAL MANAGEMENT PLAN

Proposed management recommendations are shown on Figures 6-12.

The purpose of management planning is to achieve a systematic and coordinated approach to planning, management and development that considers the natural environment together with human uses and needs.

The America's Cup event will undoubtedly increase pressure on Cottesloe Beach as a result of the increased activity of hotels, restaurants and rented accommodation.

To cater for these demands, it is important to identify coastal resources which are experiencing increasing pressure along Cottesloe beach.

The process involves consideration of the area's natural resources, its capacity to support particular uses, and recognising the potential impact of natural processes on proposed and existing developments.

5.1 OPPORTUNITIES, CONSTRAINTS AND RECOMMENDATIONS

The four kilometres of Cottesloe Beach have a variety of resources which offer opportunities for human needs.

Opportunities:

. Sandy beaches with easy access and a safe swimming areas

. Good surfing areas

. Good beach fishing

. Close to facilities

. A sound management structure based on the Town of Cottesloe and government authorities.

Constraints and Recommendations:

. The beach is subject to erosion.

To minimise this process, preserve the beach environment and amenity the following general recommendations should be considered:

. sand replenishment techniques should be employed on Cottesloe beach if required after storms;

. further development of facilities should not be considered on Beach Reserves;

. protection of all foredune areas through fencing, formal path networks and revegetation;

. public education programmes at schools and surf life saving clubs concerning the protection of the coastal environment; and

. new sea walls and solid steps should not be constructed where waves can damage them.

5.2 COASTAL DEVELOPMENTS

5.2.1 ROADS

An investigation of improvements to north-south access through the Swanbourne-Cottesloe area was conducted in 1976.[19] The report recommended a north-south connection for West Coast Highway going via Curtin Avenue, which will mean Marine Parade will become a no-through road.

5.2.2 CAR PARKS

Sealing of the small but well situated "Van Eilleen" carpark is recommended. This will provide a stable surface for vehicles and improve the amenity of this area.

5.2.3 ACCESS

The construction of concrete steps in areas where there is no limestone outcrop, eg Deane Street (Photograph 10) is not recommended.

During winter, storm waves may wash away the sand which has accummulated during summer. Generally, hard constructions disturb the natural beach cycle and there is little opportunity for the foredunes to develop in such areas.

Photograph 10. Concrete steps at Deane Street. Storm water reaches them during winter. Solid steps should not be built so close to the water in the future.

All damaged board and chain pathways should be replaced by the new design as shown in Appendix 1. Locations of such new pathways are illustrated in Figures 6-12.

Additional access to the beach should be formalised by post and rail fencing, using the newly designed pathway in the following locations:

- South from Vlamingh Memorial.
- At the boat launching area north from Warton Street.
- South from Mudurup Rocks, providing access to the surfing area. Soil and rockfill will be necessary prior to construction of the new steps.
- South from the Beach Street groyne, to provide access to the dogs' exercise area. Concrete steps on limestone outcrops could be built allowing easy access to the beach.
- Soil should be used as fill near the concrete steps at North Cottesloe Beach.

A lookout could be developed at Mudurup Rocks (Photograph 11).

Post and rail fences should be constructed (as shown on Figure 9) to define the lookout point and to avoid damage of natural shrub vegetation. The concrete slab of previous helicopter landings define the locations of point.

Photograph 11. Mudurup Rocks. The proposed lookout will be a good vantage point during the America's Cup.

5.2.4 FENCING

Both post and rail, and post and wire fence construction is recommended to control access to the beach, protect vegetation, and pedestrian security. The locations for the different types of fencing are indicated in Figures 6-12.

Details of construction of all types of fence mentioned above are included in Appendix 2 and 3.

Special consideration should be given to the protection of pedestrians and bicycle riders using Marine Parade (Photograph 12). Post and rail fences are recommended along sectors where a dual purpose path is located in close proximity to Marine Parade (see Figures 6-12).

The playground at Cottesloe main beach has no barrier separating it from the bicycle track and Marine Parade. The construction of a post and rail fence is recommended here as shown on Figure 10.

5.2.5 REVEGETATION

Revegetation work was undertaken by Cottesloe Council in 1985 at Mudurup Rocks. This successful work involved planting Spinifex cuttings (Photograph 13). This cheap method of stabilising loose dune sand is recommended in other Cottesloe Beach Reserves as shown on Figures 6-12.

Photograph 12: Storm water pipes near Mudurup Rocks. A post and rail fence is recommended along the dual use path to protect pedestrians from traffic on Marine Parade.

Photograph 13: Mudurup Rock. A successful revegetation programme using spinifex cuttings has been undertaken here by the Council over the last 12 months.

Further revegetation work at Mudurup Rocks will require reshaping of the 'blow outs' in the dune system (Figure 9).

5.2.6 RETICULATION

Because of the problem occurring with movable sprinklers as mentioned in Section 4.4, an automatic irrigation system should be installed to service the established grassed areas along the coast as shown on Figures 6-12.

5.2.7 BRUSH MATTING

Brush matting (a variety of different tree and shrub cuttings) should be used in various areas such as on the dunes south of Vlamingh Memorial, south of the groyne at Beach Street and at Mudurup Rocks (Figures 6-12). Brush matting plays an important role in the establishment of vegetation on the dunes.

5.2.8 SUN SHELTERS AND SEATS

Shelters and seats are recommended for public protection from the sun. New shelters could be installed at Cottesloe main beach, proposed grassed areas, and at the Beach Street grassed area.

Seats should be located on the grassed areas along the foreshore.

5.2.9 BOAT LAUNCHING SITES

It is proposed by the Cottesloe Council and DCE that no facilities be built for the launching of boats from Cottesloe Beach Reserves, and that motor powered boats be prevented from approaching within 400 m of the main bathing areas at Cottesloe and North Cottesloe beaches.

5.2.10 TOILETS

There is no toilet block between Leighton Beach and Cottesloe main beach. The old toilet block opposite Beach Street near the groyne should be demolished and a new one built.

5.2.11 SIGNS

Some existing signs along the beach are misleading and confusing. It is recommended that some of these be relocated, and that additional signs be located along the beach area at appropriate locations as indicated in Figures 6-12. This will enable better use of existing facilities.

These signs should be simple and easy to read, and should show the following:

- for dune protection areas:
  PROTECT DUNE VEGETATION ← PLEASE USE PATHS →
- for beach access paths:
  ← PLEASE USE PATHS →
- for boat launching areas, eg area north of Beach Street Groyne:
  ← BOAT LAUNCHING AREA →

Where more than one sign is required on any particular section of the beach, they should be concentrated at one location if practicable. For example, signs prohibiting dogs, vehicles, surfboards and nude bathing could be mounted on a common backboard at the top of each access path. Their visual impact would be minimal if they were located below the fence top.

The beach between Beach Street and Mudurup Rocks needs to be better defined and appropriate signs are recommended similar to those existing. The surfing area of Mudurup Rocks has a natural boundary from the north, but from the south a sign "SURFBOARDS" opposite the car park at Beach Street is recommended.

5.3 COMPETING BEACH USES

The present beach zoning at Cottesloe (see Section 4.3) is recommended, with the exception of the dogs' exercise beach, north from Grant Street.

Further, the beach, the two boat launching areas, and the surfing area need to be more clearly defined, as mentioned in Section 4.3.

The boundaries for the new defined beaches are as follows:

- Passive recreation and surfing beach - north from groyne at Beach Street to Mudurup Rocks

- Boat launching areas - north from groyne at Beach Street (about 30 m wide); and

  - near Warton Street (about 30 m wide).

The need for two existing dog beaches seems to be questionable. A survey carried out by geographers from the University of Western Australia indicated that the total number of people exercising dogs on any week day or on any weekend day is low. A recreational survey, which would find out what other beach uses people would like to have available in the area, is suggested.

A designated nude beach for Cottesloe does not appear to be necessary due to the close proximity of the Swanbourne nude beach.

6. COST

Estimated cost of board and chain pathway (improved version) per metre: materials only

11 pieces rough sawn jarrah timber 1.5 x 75 mm x 50 mm	$3.21 per length	$35.31
2 m chain (6 mm galvanised)	$5.25/m	10.50
2 pine posts 0.5 x 175 - 200 mm diam	$4.00 each	8.00
22 x (125 mm head) bolts	$50/100	11.00
	Total	$64.81/m

Approximately 11.1 m of such board and chain pathway is required to replace the old steps or build new ones.

Estimated cost of fence (including labour)

2000 m post and rail fence	$8.25/m	$16 500
110 m post and wire fence	$4.00/m	440
	Total	$16 940

The cost of soilfill and rockfill to provide new steps at the surfing area south from Mudurup Rocks is not included.

7. CONCLUSION

Future management of the Cottesloe Beach area should be considered in terms of limiting beach erosion. A continuous monitoring and management programme will be necessary to reduce people's contribution to the erosion problem.

Only under such circumstances will Cottesloe beach continue to exist to serve people in the future.

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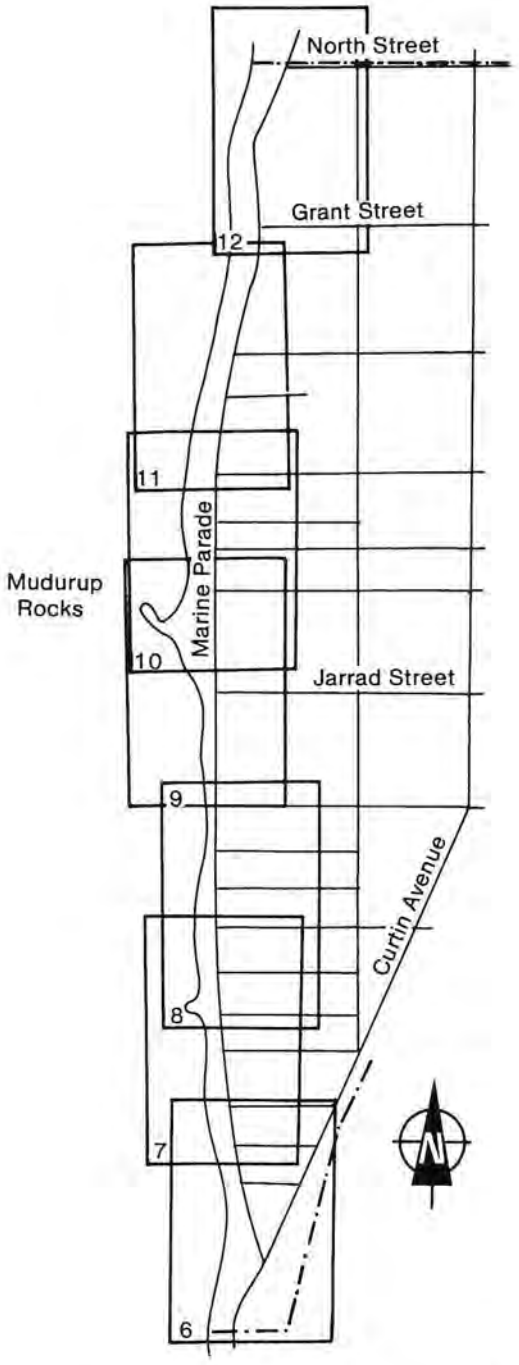
INDEX TO FIGURES



KEY

EXISTING SITUATION

- Sand replenishment
- Pedestrian and bicycle track
- Bumper rail
- Post and rail fence
- Post and wire fence
- Metal fence
- Concrete steps

MANAGEMENT RECOMMENDATIONS

- Sand replenishment
- Revegetation
- Brush matting
- Levelling dunes
- Reticulation
- Sealing car park
- Board and chain pathway/new version
- Formal access
- Post and rail fence
- Post and wire fence
- Toilets
- Lookout

SIGNS

- Protected Dune Vegetation Please Use Path

Figure 6a. Index to Figures 6-12.

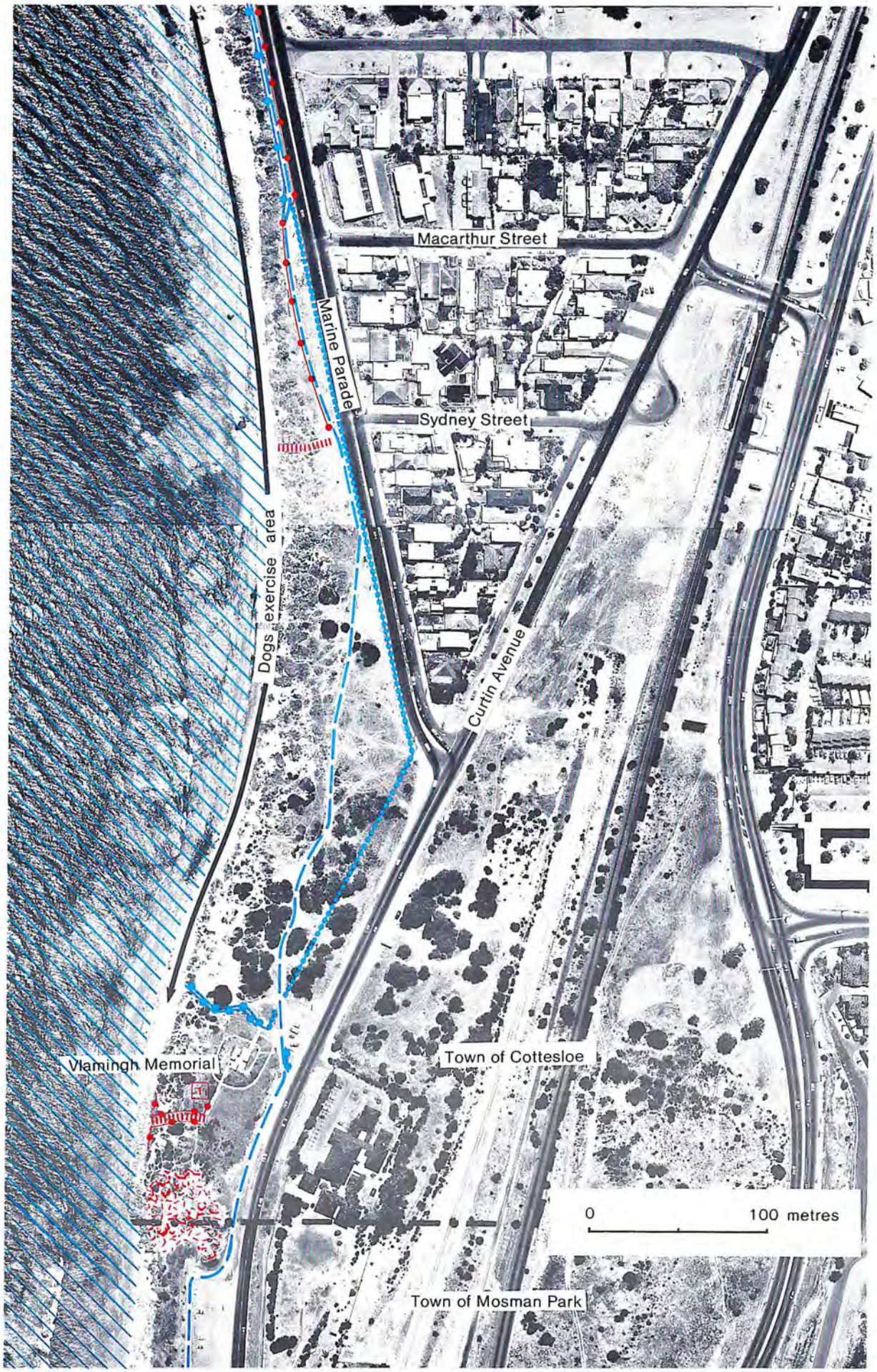


Figure 6. Existing situation and management recommendations (Aerial photography 12.2.86)

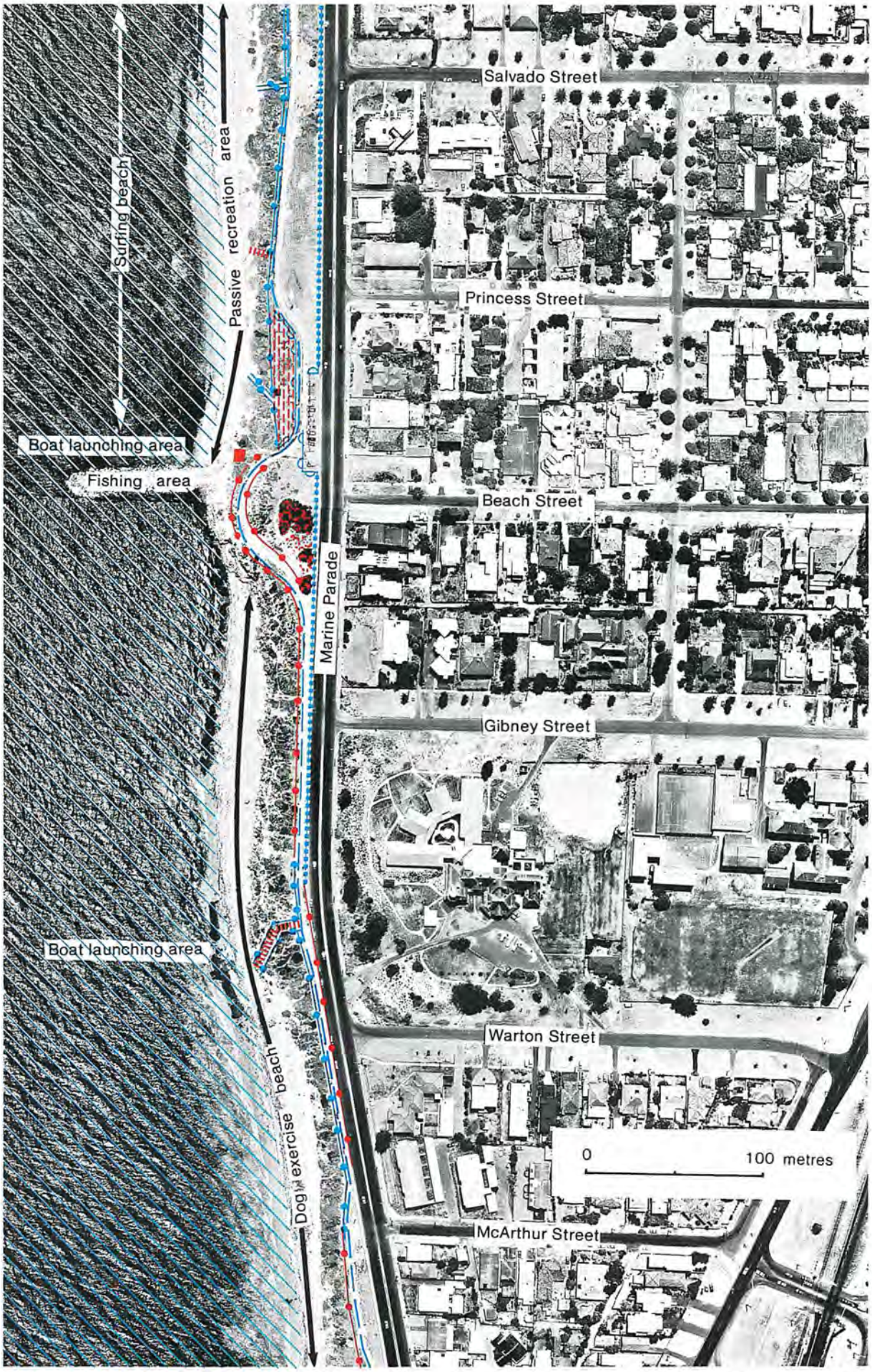


Figure 7. Existing situation and management recommendations (Aerial photography 12.2.86)

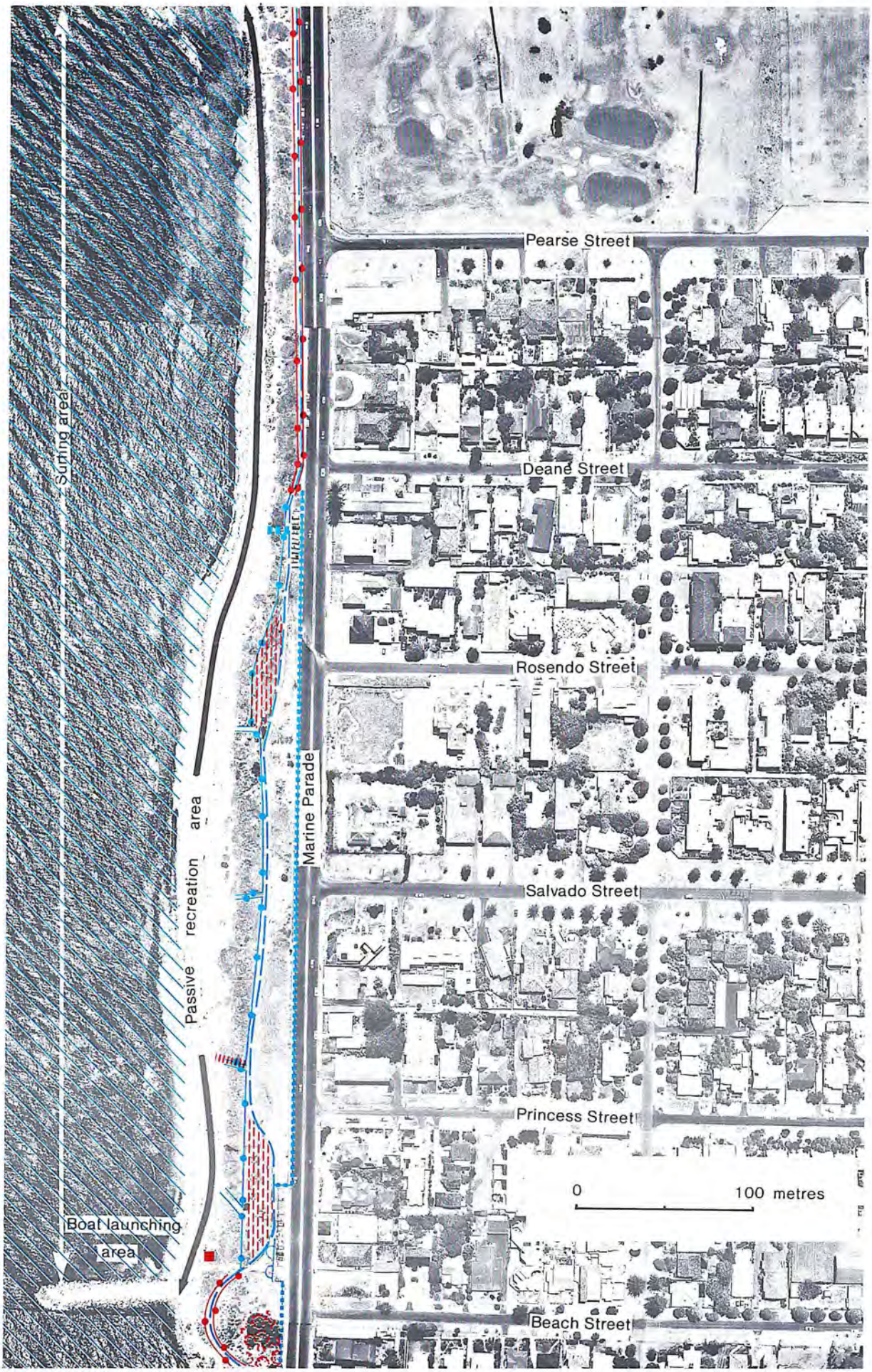


Figure 8. Existing situation and management recommendations (Aerial photography 12.2.86)

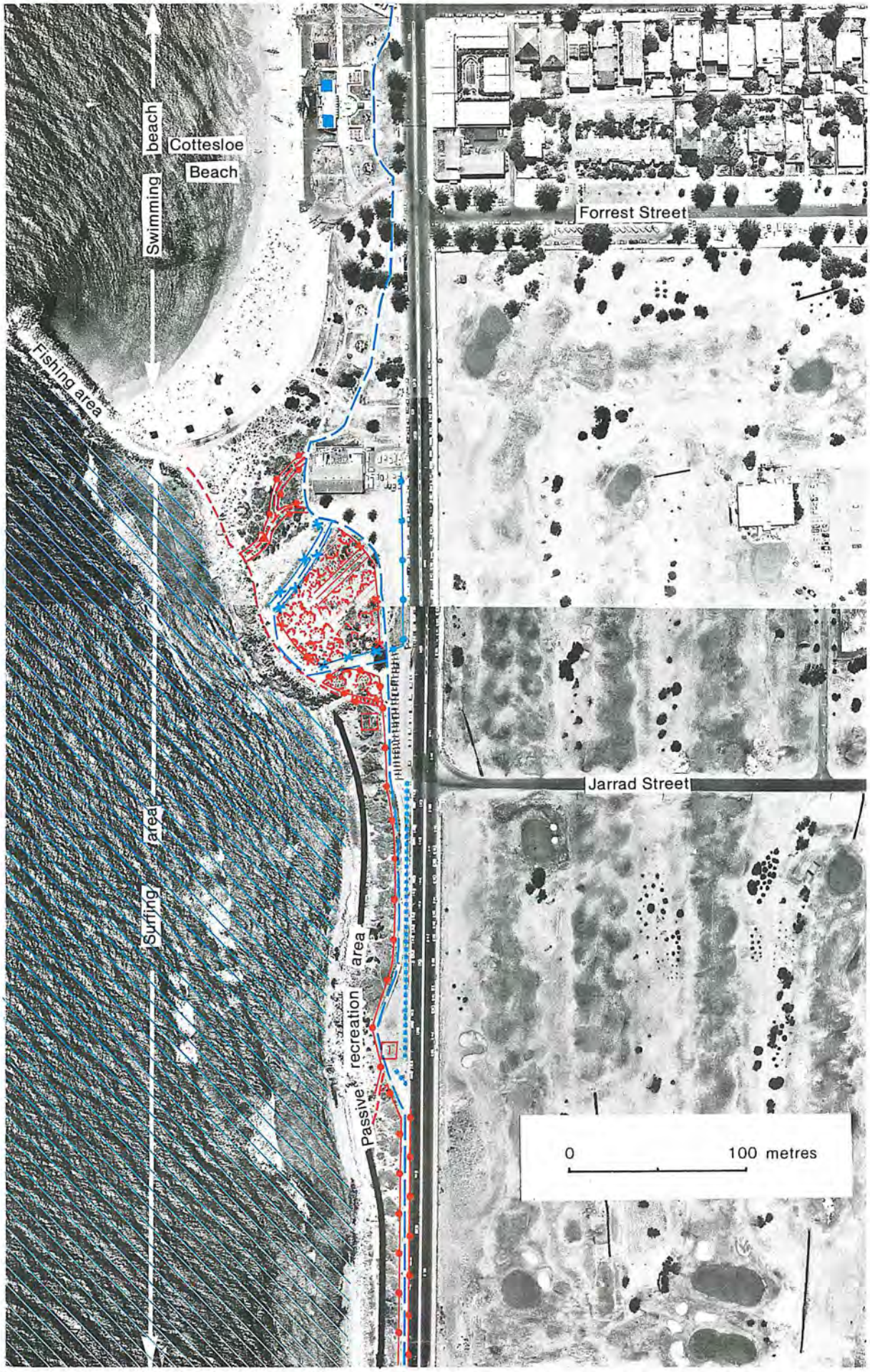


Figure 9. Existing situation and management recommendations (Aerial photography 12.2.86)

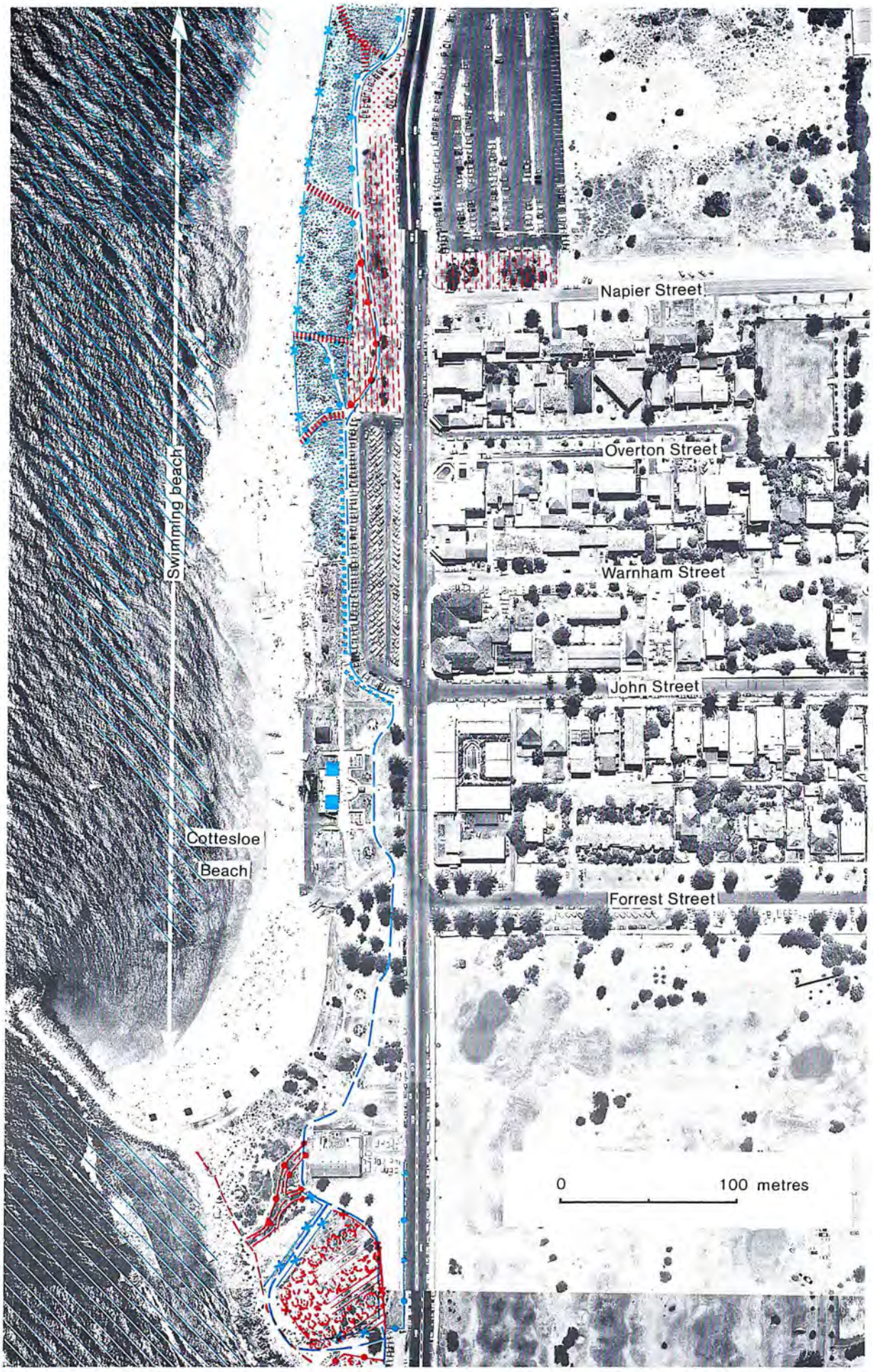


Figure 10. Existing situation and management recommendations (Aerial photography 12.2.86)

Figure 11. Existing situation and management recommendations (Aerial photography 12.2.86)

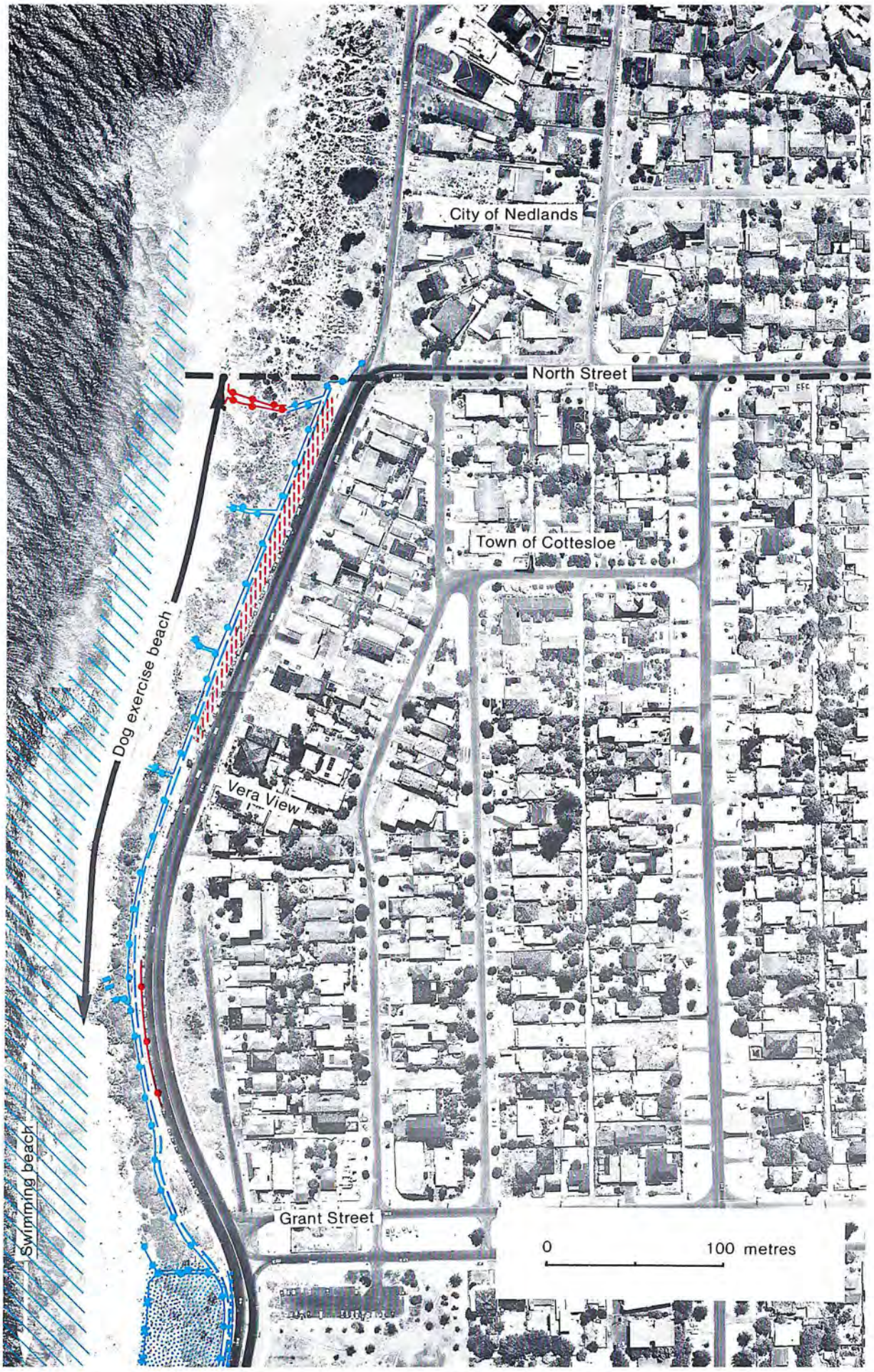
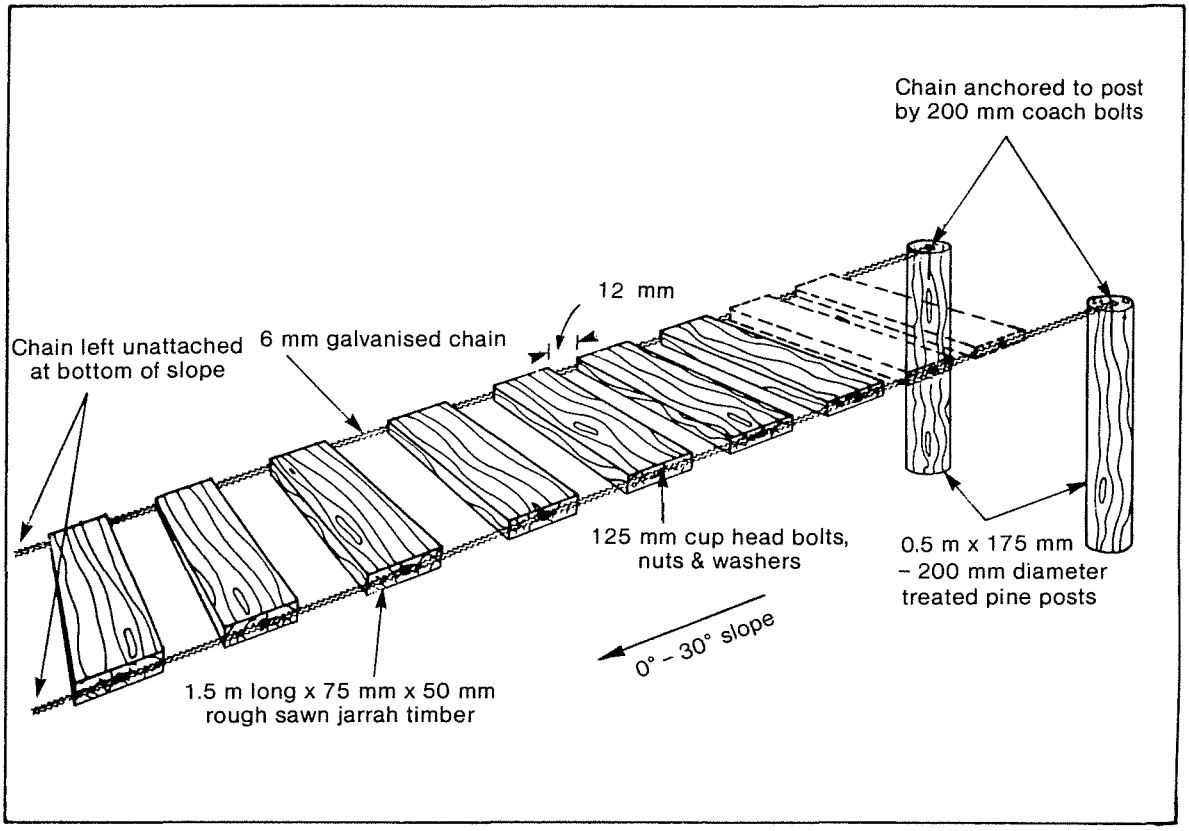


Figure 12. Existing situation and management recommendations (Aerial photography 12.2.86)

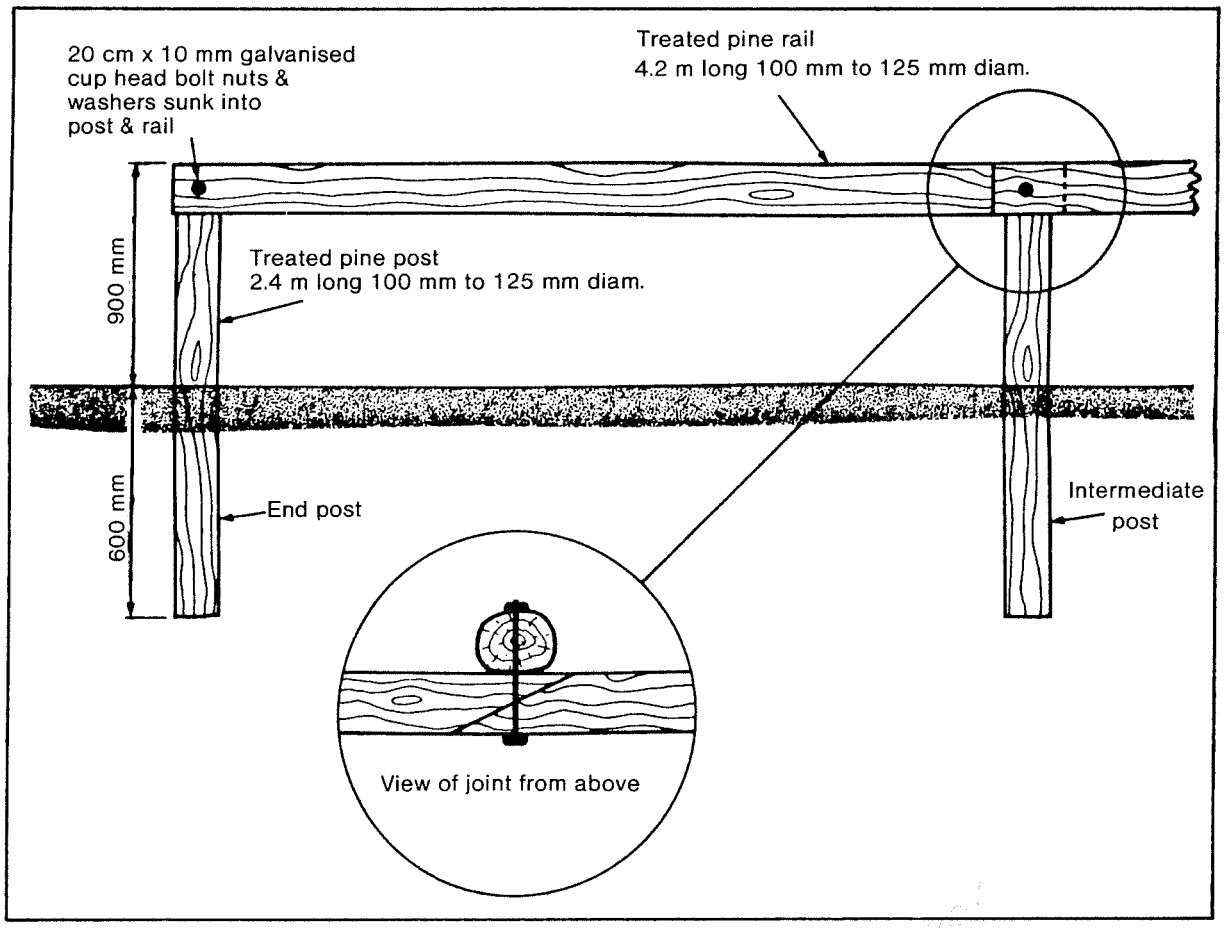
APPENDIX 1, 2, 3

BOARD AND CHAIN PATHWAY (IMPROVED VERSION)



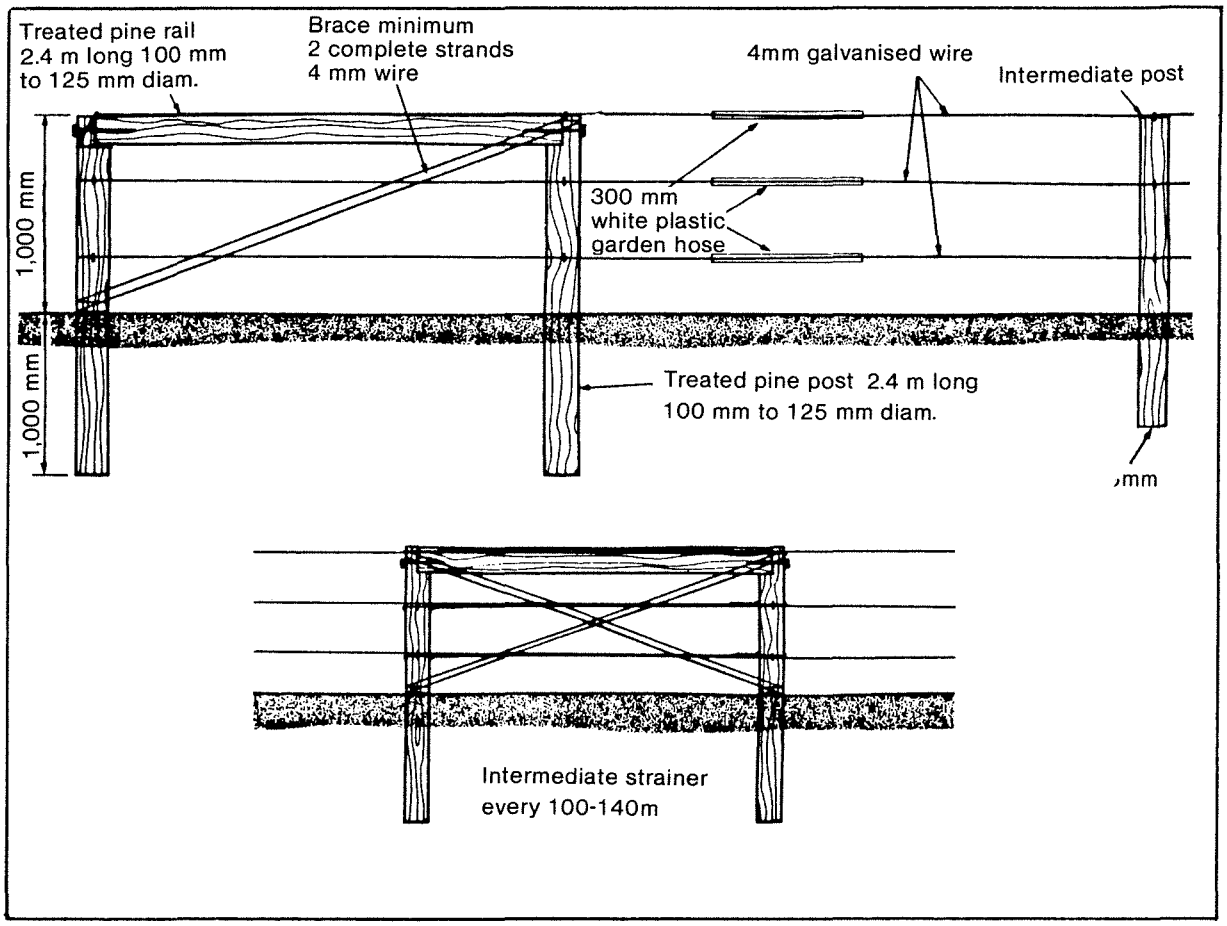
Appendix 1 Board and chain pathway (improved version)

POST AND RAIL FENCE



Appendix 2 Post and rail fence

POST AND WIRE FENCE



Appendix 3 Post and wire fence