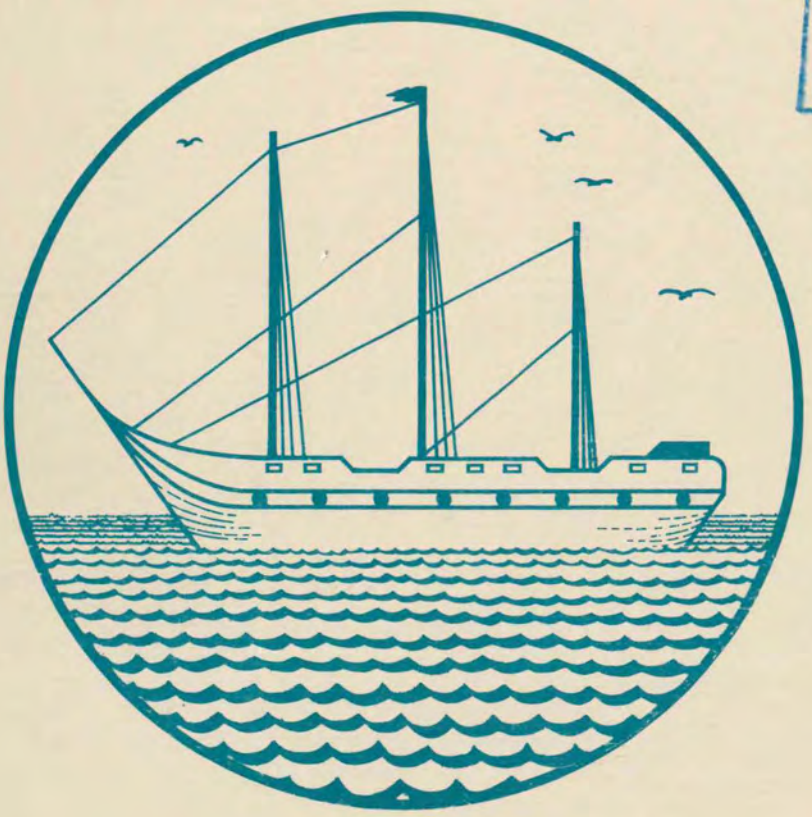
Kwinana — Draft Coastal Management Plan



Department of Conservation and Environment
Perth, Western Australia.
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KWINANA : DRAFT

COASTAL MANAGEMENT PLAN

A study promoted by the
Department of Conservation and Environment

and the

Coastal Management Co-ordinating Committee

in co-operation with the
Town of Kwinana

and the

University of Western Australia
Department of Geography

Department of Conservation and Environment

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SUMMARY

In May 1983 the Town of Kwinana approached the Department of Conservation and Environment (DCE) for assistance in preparing a management plan for the Kwinana coastline. Such a plan was to complement the current revision of the Town of Kwinana Town Planning Scheme by Russell Taylor and William Burrell, Consultants in Town Planning and Urban Design. The emphasis of the plan was to be upon the few recreational beach sites situated between the main industrial properties along the Kwinana foreshore.

Initial analysis focused on the physical environment of the area along with apparent use pressures. This analysis enabled identification of the opportunities and constraints of the area. The following broad management aims will guide the Kwinana Council toward appropriate long term care of the coast:

- Preserve the natural systems of the area.
- Provide for increasing recreational use of the area in a manner consistent with its protection and effective use of the resource base.
- Provide formal access to the foreshore without degrading the dune environment.
- Implement a public education programme as an aid in the conservation of the area and to encourage maximum utilisation of available resources.
- Improve the landscape character of the area.

The plan contains management proposals which have been prepared to assist in achieving these aims. Specific recommendations regarding access, dune conservation, facility provision and landscape improvements are detailed for each beach. Procedures required to effect the plan are discussed in a chapter on implementation.

INTRODUCTION

Location

Kwinana is primarily a port oriented industrial area with a number of small recreational sites situated between its main industrial properties on the waters of Cockburn Sound (Figure 1). The narrow coastal strip comprising the study area is located at 32° 13' south and 115° 45' east, and is in the Town of Kwinana 35 km, by road, south of Perth. The Metropolitan Region Planning Authority (1970) Corridor Plan for Perth places Kwinana in the South-West Corridor.

Background

In May 1983 the Town of Kwinana approached the Department of Conservation and Environment (DCE) for assistance in preparing a management plan for the Kwinana coastline. Such a plan was to complement the current revision of the Town of Kwinana Town Planning Scheme by Russell Taylor and William Burrell, Consultants in Town Planning and Urban Design.

Purpose of Plan

Until now coastal recreation in Kwinana has been largely ignored in favour of port and industrial development. Industrial activities have had a considerable impact upon the aesthetic and environmental quality of the Cockburn Sound foreshore. Environmental changes which are apparent along the Kwinana coastline are not considered to be a danger to public health, and there is scope for improving the foreshore for the benefit of people who choose to frequent the beaches. The purpose of preparing this plan is to provide guidelines for the management of the few localities along the Kwinana foreshore which are able to accommodate recreational use.

Study Area

The land described in the study includes a number of Crown reserves and vacant Crown land which is vested in the Town of Kwinana or other authorities for various purposes.

The study area is bounded by the northern boundary of Reserve 24576 and the southern side of Class A Reserve 24575. These boundaries correspond to the northern and southern extent of the Town of Kwinana municipality. The eastern boundary of the study area corresponds to the inland extent of vacant Crown land and coastal reserves described in Table 1, and by an inland distance of 200m along the area of freehold land. Low water mark has been used to define the western boundary of the study area. The area included in the study is shown on Figure 2.

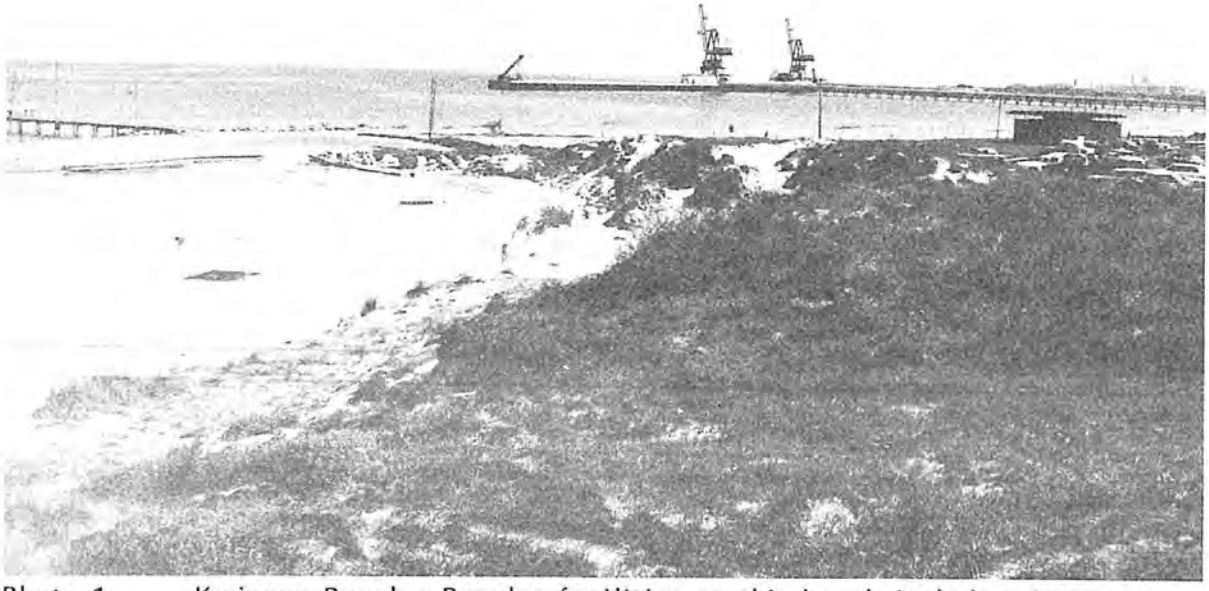


Photo 1 Kwinana Beach : Popular facilities at this beach include a boat ramp, fishing jetty and shelters.

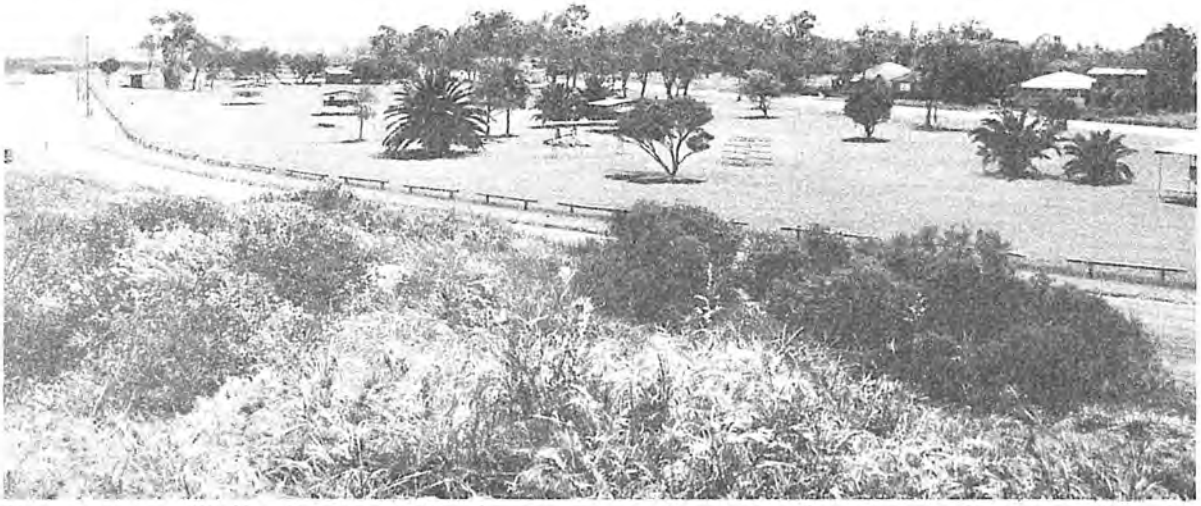


Photo 2 Wells Park : This large grassed area adjacent to Kwinana Beach provides a pleasant setting for family groups picnicking and playing games.

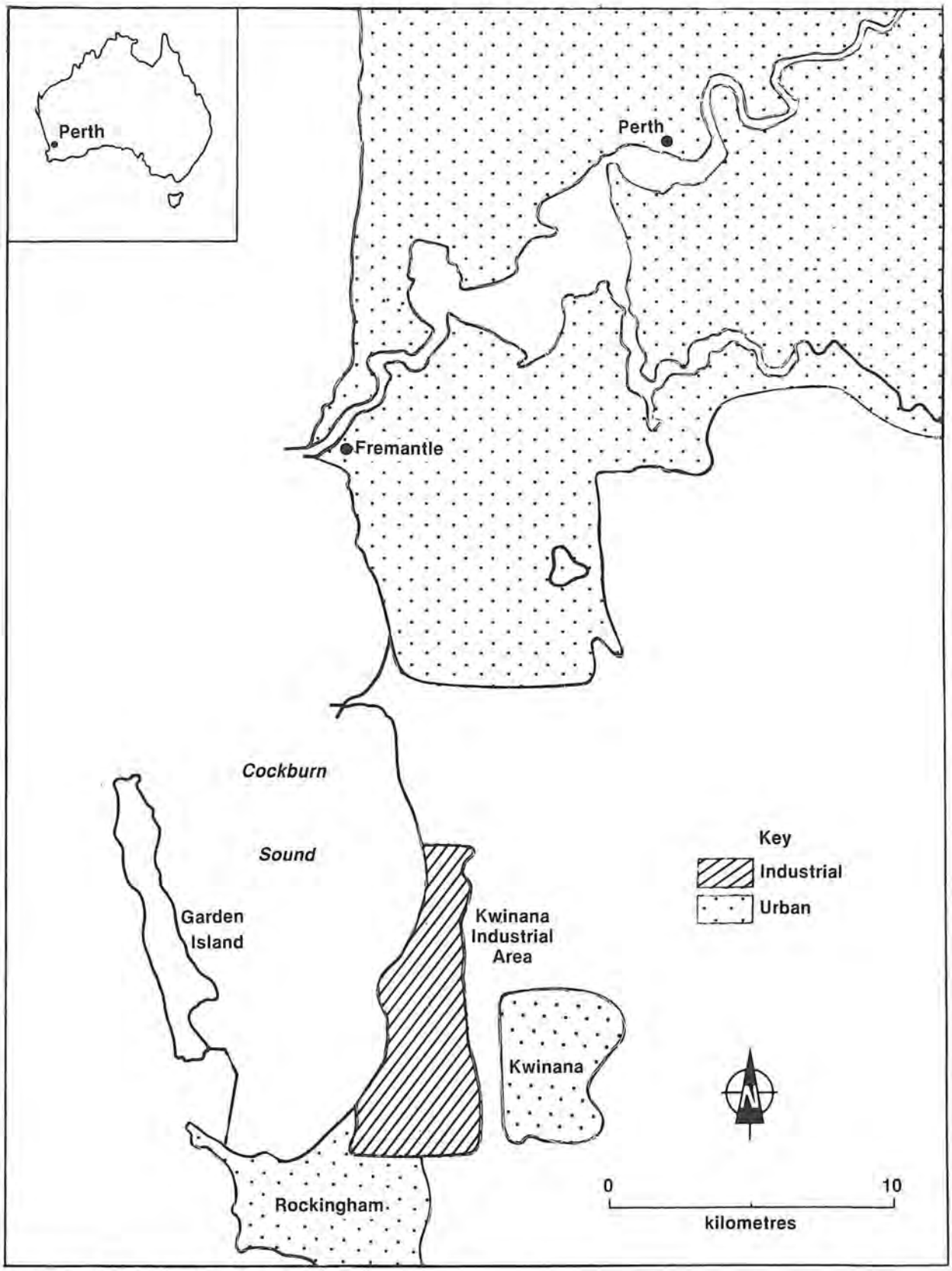


Figure 1 Location of Study Area

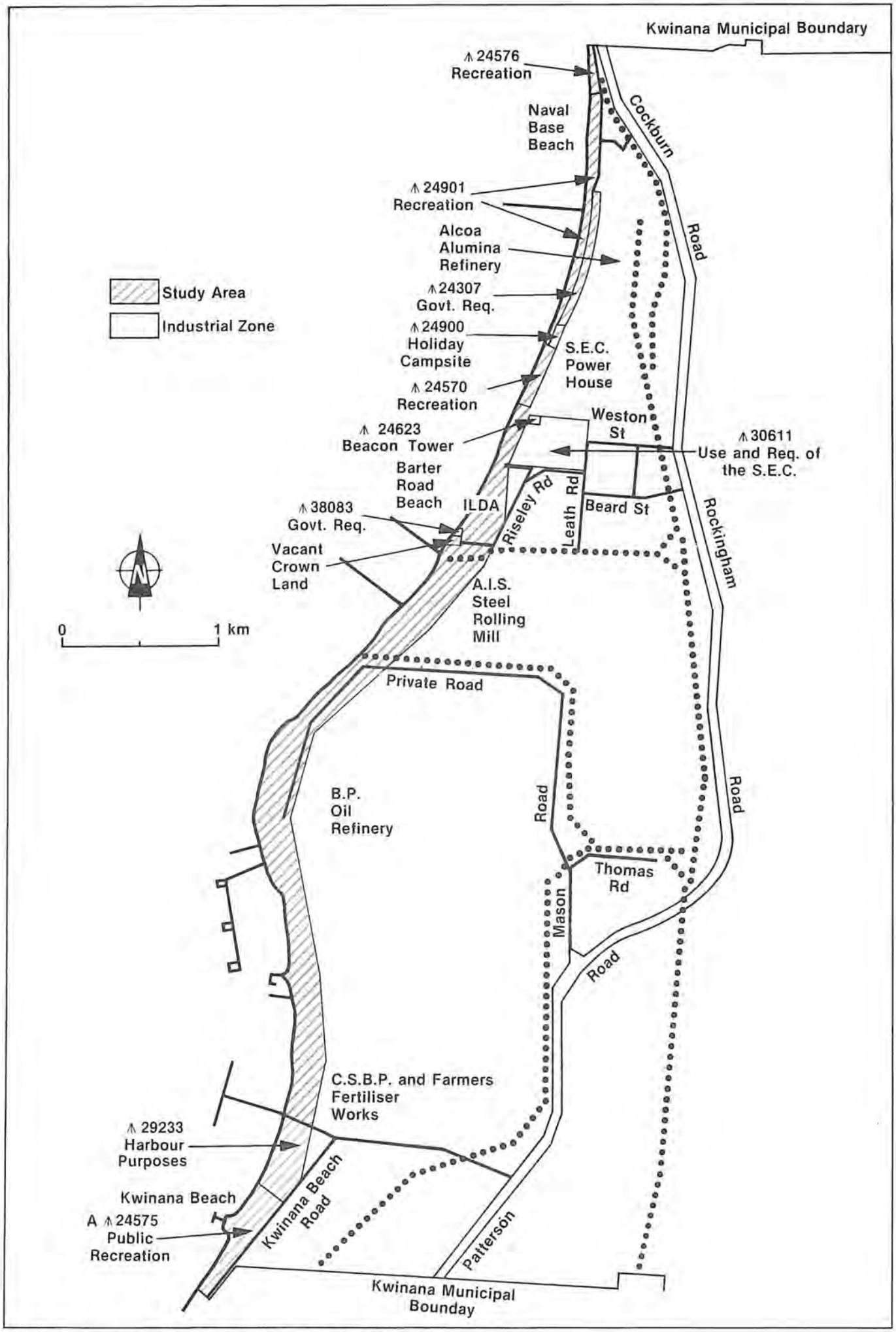


Figure 2 Reserves, Major Industries and Foreshore Access

Table 1

Kwinana Coastal Reserves

Reserve No.	Lot No.	Area (ha)	Purpose	Vested Authority
24576	C.S.1837	0.6830	RECREATION	TOWN OF KWINANA
24901	C.S.1863	3.7810	RECREATION	NOT VESTED
33554	C.S.2214	0.0732	DRAINAGE	TOWN OF KWINANA
33555	C.S.2215	0.0614	DRAINAGE	TOWN OF KWINANA
33556	C.S.2216	0.0591	DRAINAGE	TOWN OF KWINANA
33557	C.S.2217	0.0428	DRAINAGE	TOWN OF KWINANA
33558	C.S.2218	0.0386	DRAINAGE	TOWN OF KWINANA
24307	C.S.1744 C.S. 153	1.8166	GOVT. REQ.	NOT VESTED
24900	C.S.1862	0.6273 CAMPSITE	HOLIDAY	NOT VESTED
24570	C.S.1835	2.3067	RECREATION	TOWN OF KWINANA
•24623	C.S.1772	0.2577	BEACON TOWER	FREMANTLE PORT AUTHORITY
•30611	K. 161	11.2073 OF THE SEC	USE AND REQ.	NOT VESTED
38083	K. 55	0.2428	GOVT. REQ.	NOT VESTED
*29233	K. 120	14.5537 PURPOSES	HARBOUR	NOT VESTED
A24575	C.S.1836	11.3312 RECREATION	PUBLIC	TOWN OF KWINANA

* Although Reserve 29233 is not vested at present it was formerly vested in the Fremantle Port Authority and that Authority has definite intentions for its future use. The FPA presently has the reserve fenced off and is leasing out existing buildings on the reserve.

• Reserves excluded from study area.

SOURCE: Department of Lands and Surveys, 22 May 1984.

PHYSICAL ENVIRONMENT

Introduction

Land use planning requires a knowledge of the attributes which comprise the physical environment of an area. The coastal environment provides a number of opportunities which are attractive to a variety of land use activities, but it also imposes restrictions upon the nature of activities an area is capable of supporting. Previous research dealing with the physical environment of the Kwinana coastline provided valuable information relevant in the preparation of this management plan.

Geology

The Geological Map of W.A. (1:2,500,000 scale) shows Kwinana to be in a Phanerozoic Basin which contains a series of Quaternary coastal barriers. The most recently developed barrier was formed over the past 10,000 years (Holocene Period) and comprises the Becher-Rockingham beach ridge plain. An understanding of the development of this barrier system is fundamental to long term land use planning in the region. Figure 3 shows a simplified geology of the Rockingham coastal barrier.

Woods and Searle (1983) have described the Holocene history of the Becher-Rockingham beach ridge plain which includes Kwinana Beach. The plain is bound to the east and west by north-south trending calcarenite ridges. The eastern ridge of the coastal limestone forms the mainland coast, while the lower western ridge is partially submerged and forms a chain of islands, reefs and passages. The bathymetry of the drowned landscape has determined wave refraction patterns and hence the transport and accumulation of sediment within Cockburn Sound. Deposition occurs when sediment supply is adequate, as it was when the inner shelf was drowned 6,000 to 4,000 years B.P.

Shepherd (1981) has attributed the formation of the unconsolidated Holocene sand dunes and beach ridge deposits which fringe the Becher-Rockingham coast to processes of foredune accretion and beach 'cut and fill'. This mechanism suggests that a highly variable shoreline condition has existed through the mid to late Holocene period, i.e. over the past 6,000 years. Recently deposited sand dunes are backed by low undulating beach ridges with a median height of 3.6 m. The high frontal dunes indicate a period of lower sediment supply to the shoreline and substantial reworking of the beach ridge margin.

The calcareous beach and dune sands at Kwinana are geologically named as the Safety Bay Sand unit. They correspond with the Quindalup soil unit (Biggs et al., 1980). The beach ridges and older dunes display some cementation of sand in the lower horizons and the soils have a darker colour than more recently deposited dunes.

Coastal Processes

The Kwinana coastline is largely sheltered from open ocean waves by the presence of offshore islands and reefs in the Garden-Rottnest Island chain. The islands and reefs create a low energy environment with very calm waters. Water movement within Cockburn Sound is very slow and it tends to act largely as a self contained body of water (Steedman and Craig, 1979).

During summer months prevailing south westerly winds propagate waves from the south to create a northerly littoral drift. The summer waves build up the beach berm. Northerly storm wave conditions that periodically occur in winter reverse this trend.

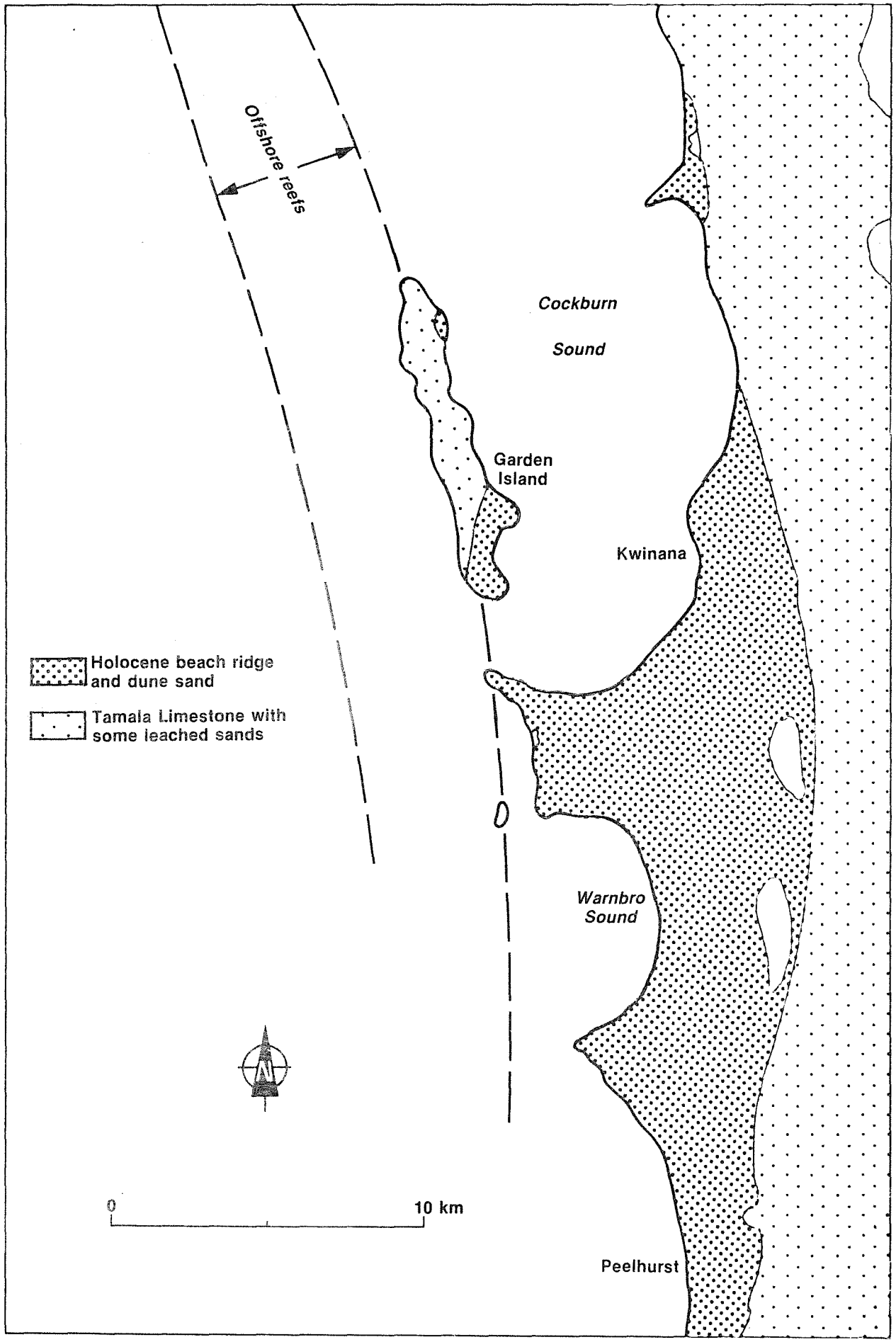


Figure 3 Simplified Geology
Source: Shepherd, 1981

They create a southerly littoral drift. The northerly waves are superimposed upon an elevated sea level and subject the beaches to erosion.

Today, sediment supply from offshore is apparently limited. Loss of sediment is indicated by cliffing along the shoreline and by dune instability. In places along the Kwinana foreshore there may be net loss of sediment from the beach system over a period of many years. In the short term the shoreline is generally stable.

Shoreline movements along the Kwinana coastline have been documented by Andrew (1979) as shown on Figure 4. Shoreline changes between the years 1942 and 1976 were described for the area north of the wreck site to Naval Base Beach, and between 1955 and 1976 for the area south of the wreck. The shoreline changes along this coast are complicated by industrial developments that have imposed artificial features which locally generate changes of shore alignment and stability. The shoreline is considered dynamically stable although areas of recession include James Point and the foreshore area south of BP jetty. An erosion scarp is present along the seaward face of the foredune south of the wreck at Kwinana Beach. There is thus a need to accommodate for a potential loss situation when considering long term future use of the coast.

Furthermore, the removal of some stabilising vegetation cover from recent dunes has exposed bare sand to the prevailing winds. Management problems associated with degraded dune environments include blowout activity, advancing dunes and sand drift.

Vegetation

Knowledge of the coastal vegetation is necessary when implementing dune stabilisation and rehabilitation programmes. Plant species growing on Kwinana dunes are listed in Appendix 1.

The vegetation of the study area belongs to the South-West Botanical Province (Beard, 1981). More specifically the area is part of the Rockingham System which is characterised by scrub and coastal heath communities, together with Acacia rostellifera thickets.

The incipient foredune is largely vegetated by the primary coloniser Spinifex longifolius with a smaller amount of Salsola kali. The swale landward of this dune supports little vegetation although Trachyandra divaricata is dominant. The foredune supports grasses and mat plants including Spinifex hirsutus and Tetragonia decumbens, with Scaevola crassifolia appearing on the sheltered side of the dune. The primary dune supports Pelargonium capitatum, Carpobrotus edulis, Lepidosperma gladiatum, and coastal wattles including Acacia rostellifera and Acacia cyclops. The topographic position of the dune vegetation is shown on Figure 5.

Climate

Meteorological data indicate that winters are cool with a minimum average temperature of 9°C occurring in July and August. Summers are hot with the highest average temperature of 30°C occurring in January and February. The average temperature range is thus 21°C. Average annual rainfall is approximately 900mm falling mainly in the cooler months between May and September. Meteorological data recorded at Perth is shown in Table 2.

This Mediterranean climate with hot dry summers and cool wet winters restricts the growing season to spring and autumn months.

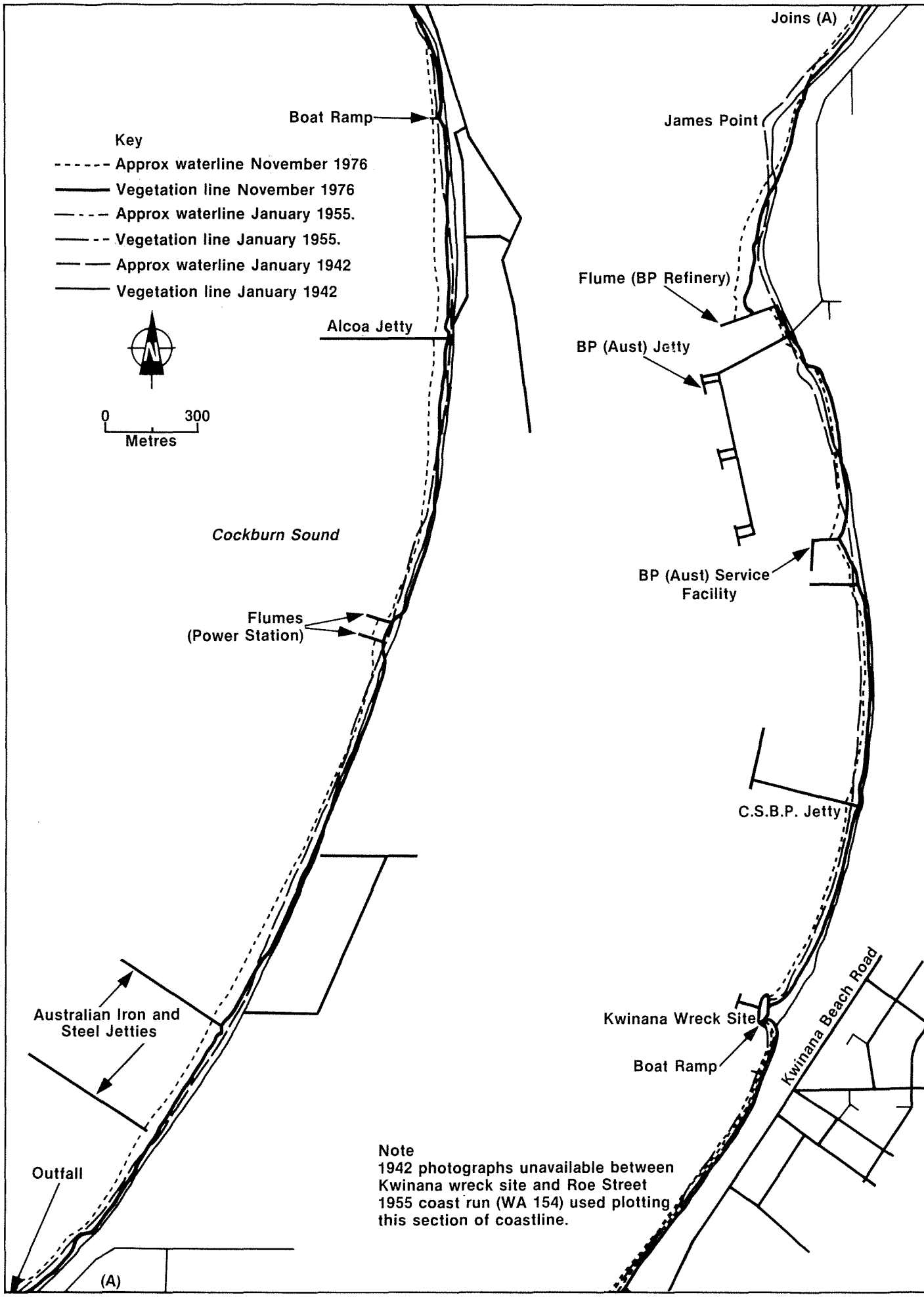


Figure 4 Shoreline Movements. Source: Andrew, 1979.

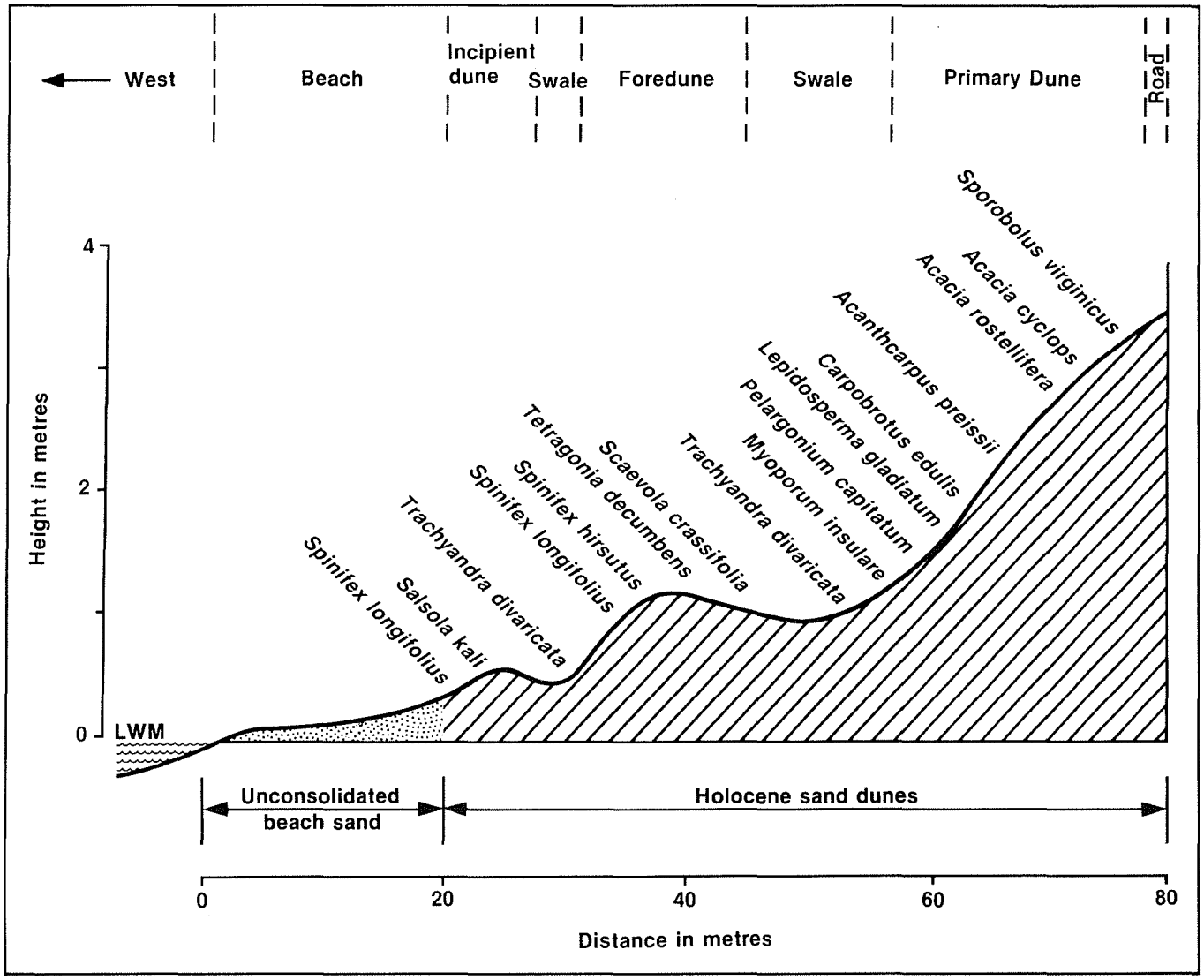


Figure 5 **Topographic Position of Dune Vegetation**

Seasonal variation in rain and temperature also has a strong implication for recreational use of the Kwinana foreshore. Although the beaches are used for recreation throughout the entire year, peak usage is realised during summer.

Table 2

Summarised Meteorological Data Recorded At Perth

	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Spt	Oct	Nov	Dec	Total or mean
RAINFALL (mm)													
Mean	8	11	20	46	125	187	174	139	82	55	21	15	883
Median	5	4	12	39	124	182	167	140	75	51	17	10	882
Highest monthly	55	166	145	149	308	476	425	318	199	200	71	81	
Lowest monthly	0	0	0	0	14	55	61	12	9	1	0	0	
Av.no. rain days	3	3	4	8	14	17	18	17	14	11	6	4	119
TEMPERATURE (°C)													
Mean maximum	30.3	30.3	28.1	23.9	21.2	18.6	17.6	18.0	19.4	21.9	24.8	28.2	23.5
Mean minimum	18.6	18.6	17.0	14.1	11.9	10.7	9.2	9.1	10.1	11.9	14.2	16.9	13.5
Highest	44.7	44.6	41.3	37.6	32.4	28.1	26.3	27.8	32.7	37.3	40.3	42.3	
Lowest	9.2	8.7	7.7	4.1	1.3	1.6	1.2	1.9	2.6	4.2	5.6	8.6	
RELATIVE HUMIDITY(%)													
Average index	45	46	51	59	61	70	69	65	62	54	50	47	56

Source : Commonwealth Bureau of Meteorology, 1975

Chemical and Biological Characteristics of Cockburn Sound and Owen Anchorage Waters

The disposal of industrial chemicals, effluents and by-products into Cockburn Sound and Owen Anchorage has been associated with changes in the chemical and biological characteristics of these waters. The accumulation of pollutants in Cockburn Sound is attributable to the lack of water exchange with the sea.

Reports dealing with the chemical and biological characteristics of Cockburn Sound and adjacent waters were prepared for the DCE (1979) Cockburn Sound Environmental Study. The reports showed that the quality of the water in Cockburn Sound has deteriorated through the occurrence of undesirable blooms of free drifting algae, attributable to nutrient input. It was also shown that micro-organisms in waters along several segments of the eastern shoreline of the Owen Anchorage-Woodman Point area included faecal coliform and Salmonella serotypes in concentrations of concern from a public health standpoint.

Photo 3 Erosion Scarp at Kwinana Beach : A receding shoreline and degraded dunes at this site create the need for special management techniques.

Photo 4 Naval Base Beach : The introduction of well designed facilities and a planting programme to screen surrounding industry will improve the amenity of this beach.

Considerable improvements in the quality of Cockburn Sound waters have been achieved since 1979. The closure of several foreshore industries and the implementation of new waste disposal techniques have produced significant improvements in water quality. Sampling data from Jervoise Bay waters collected by the Health Department of W.A. in 1980-81, showed very low counts of faecal coliform and strepts, while Salmonella was not isolated in any of the samples. The Cape Peron Ocean Outfall is expected to further aid the recovery of Cockburn Sound and Owen Anchorage waters.

Continued use of Kwinana beaches for recreational purposes may thus be made with no apparent risk to public health.

Summary

The physical environment of the Kwinana coastline has been considerably altered by man's activities. Industrial land uses have been the principal cause of environmental change, particularly in terms of shore alignment and pollution. Recreational use of the Kwinana foreshore has brought about changes to the dune environment.

USE PRESSURES

Introduction

Various land use activities are attracted to the safe, calm waters of Cockburn Sound. Industry is expected to remain the dominant land use activity along the Kwinana coastline, while planning for the South-West and South-East Corridors envisages an expansion of urban land uses in these areas. Population growth forecasts for these planning corridors will increase the demand for available recreational foreshore space along the coast south of Fremantle. For this reason, it is anticipated that Kwinana public beaches will continue to play a significant role as coastal recreational sites in the Cockburn Sound area.

Industry

Port oriented industries have been attracted to the waters and coastal environs of Cockburn Sound along the Kwinana coastline. Development of the Kwinana industrial area began in the 1950s and it is now the most important heavy industry complex in the Perth region. The impact of industrial activities upon the natural environment at Kwinana has been enormous.

- Chemicals and effluent disposed into Cockburn Sound have resulted in, (a) eutrophication, and (b) decline of seagrass meadows (Chiffings, 1979 ; Cambridge, 1979). Eutrophication and associated decline in water quality has made beaches close to discharge sites less attractive for recreational activities such as swimming. The decline of seagrass meadows has resulted in a reduction of fish productivity within the Sound.

- Industrial discharges producing unpleasant odours are occasionally evident along the Kwinana coastline. These odours affect beaches closest to discharge sites.

- The built industrial landscape does little to enhance the coastal scenery at Kwinana. As most of the industrial buildings are not screened by vegetation their impact upon the appearance of the coast is severe.

Several companies and government agencies located in the Kwinana industrial complex have implemented works programmes designed to preserve or improve the environment at their coastal sites.

- Alcoa of Australia Ltd. - Alcoa has implemented a tree landscaping programme along the railway property and around carparks located at their site.

- State Energy Commission of W.A. - The SEC has worked together with the Department of Agriculture in establishing a dune revegetation scheme along the seaward boundary of their power house property.

- Industrial Lands Department Authority - ILDA have not undertaken any management works at their Kwinana coastal site.

- Australian Iron and Steel Pty. Ltd. - The AIS Kwinana steel works are presently non-operational.

- BP Refinery (Kwinana) Pty. Ltd. - BP has built engineering structures to prevent further beach erosion at James Point. The dune system south of James Point is largely intact and well vegetated, while the dunes north of James Point have been levelled and developed as a grassed area.

- CSBP and Farmers Ltd. - The dune system along the foreshore of the CSBP property is stable with a good cover of vegetation. A shrub and tree planting programme established by the company along the eastern edge of the dunes has been very successful. Rocks and boulders have been placed along the seaward edge of the dune system to reduce beach erosion during high energy storms.

Urban Growth

Census data show varying rates of change in population growth in the Kwinana beach hinterland centres since 1976. While the Kwinana New Town Centre population increased by 12.5% between 1976 and 1981, the population of the Kwinana Shire declined by 0.5%. Rockingham Shire, immediately south of Kwinana, experienced a rapid population growth of 43.6% over the same five year period. The Town of Cockburn to the north of Kwinana increased by 7.5% between 1976 and 1981. In total the above three centres grew from 60,403 in 1976 to 70,068 in 1981.

The overall growth pattern is expected to continue, increasing the demand and pressure on coastal recreational sites in Cockburn Sound. The South-West Corridor is expected to have a population of 370,000 by the year 2010 (Metropolitan Region Planning Authority, 1980), and the substantial increases in the Kwinana Beach user population have been forecast to the year 1990 (Feilman Planning Consultants, 1978).

Public Access and Facilities

Many sites along the Kwinana foreshore are not easily accessible to the public because of the presence of industrial activities and private roads and jetties. Road access is not available to the foreshore area between the Alcoa jetty and the SEC power house, or between Risely Road and the southern boundary of Reserve 29233. Jetty terminals located in these areas tend to inhibit pedestrian movement along the beach.

Public roads provide access to three beaches, these being Naval Base Beach (via Sutton Road), Barter Road Beach (via Barter Road) and Kwinana Beach (via Kwinana Beach Road) as shown on Figure 2. Parking facilities have been established at each of these sites. A system of informal vehicular and pedestrian access tracks has been created by people at some coastal sites. The creation of a formal access system is considered an important aim of this plan.

Directional signs are necessary to guide people to available coastal recreation sites. Kwinana Beach is well signposted along the major coastal route, Patterson Road. Other public beaches along the Kwinana coastline are not clearly signposted.

Kwinana Beach, which includes Wells Park, has a wide range of facilities available for the public including a boat launching ramp, fishing jetty, toilets, changerooms, shelters, childrens play equipment and barbecues. Naval Base Beach has a beach shelter, and a boat ramp although this is now largely unusable.

Day Visitors

Feilman Planning Consultants (1978) conducted a recreational survey of the Kwinana foreshore. The survey focused upon the demographic and sociological characteristics of people visiting Kwinana Beach. Over 600 people have been recorded at this beach on a single day, and it is overwhelmingly the most popular Kwinana coastal site. The following are some of the results of the survey.

- Kwinana Beach is very much a family beach with 97% of beach users surveyed visiting in family groups. The age structure of beach users reflects the family group character of this population with a predominance of people being 30 to 49 years of age (29%) and 0 to 9 years of age (25%).

- Reasons for selecting Kwinana Beach as a recreational setting also reflect the needs of families with small children. The safe nature of the beach makes it suitable for children and attracted 20% of beach users, while 12.5% of people visited the beach because it was nice, quiet and they liked it. A smaller percentage (6.3%) of beach users visited Kwinana Beach because it was good for swimming.

- Kwinana residents constituted 24% of beach users surveyed with other people travelling from Kelmscott (12%), Cockburn (9%) and Rockingham (8%). Kwinana Beach has a high level of local usage but it appears also to be an important regional recreational resource with about half the beach users originating from more distant metropolitan locations (Figure 6).

- Kwinana Beach is visited regularly by many people with 30% of beach users visiting the beach monthly and 24% visiting it weekly. Local users visited the beach more frequently than visitors travelling longer distances.

Community Groups

Feilman Planning Consultants (1978) also surveyed 65 community groups within the area between Cockburn Sound and Owen Anchorage to establish their attitudes toward the current use and condition of beaches within the area.

The community groups surveyed generally rated the beaches with the most facilities as the most suitable foreshore areas for recreational purposes. Kwinana Beach was considered a 'fair to good' beach for recreation. There would appear to be scope for improvement with only 8.9% of the groups nominating Kwinana Beach as the best developed beach location in Cockburn Sound. This may be related to the poor landscaping of existing facilities at the beach.

A large proportion (65.7%) of the community groups believed that the future use of Cockburn Sound should be recreational. None of the groups felt there should only be more industry, although 6.0% were in favour of more industry and more recreation and 28.3% believed that the present balance should be maintained.

Bathing

Kwinana beaches are popular for swimming and sunbathing. The most popular site for such activities is Kwinana Beach with other less popular locations being Naval Base Beach and Barter Road Beach. Summer swimming classes for school children are conducted at Naval Base Beach each January by the Education Department.

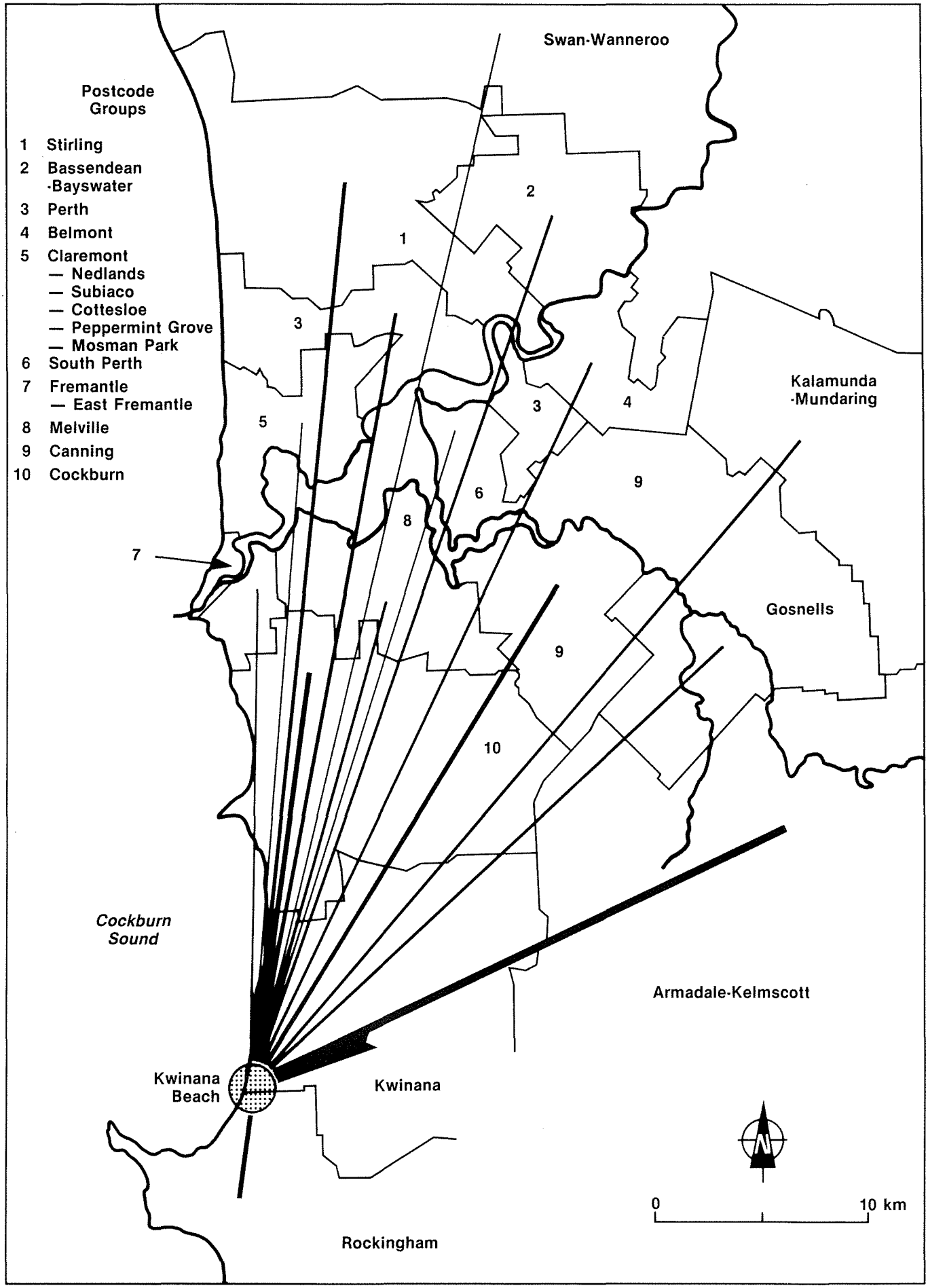


Figure 6 Origin of People Visiting Kwinana Beach on Peak Surveyed Day (29/1/78).
Source: Feilman Planning Consultants, 1978.

Picnicking and Games

Picnicking and playing games are popular activities pursued by people using the foreshore and grassed areas at Kwinana Beach. Some of the facilities conducive to these activities appear to reach their full capacity on peak usage days. These facilities will need to be increased to meet projected demands.

Pleasure Boating

Pleasure boating, including the use of dinghies, powered craft and yachts ensures heavy use of the launching ramp at Kwinana Beach. Use of the small ramp at Naval Base Beach is made difficult by the accumulation of sand which has almost totally buried it. Demand for boat launching facilities along the Kwinana coastline is likely to increase in the future. Facilities should be provided to encourage this activity at sites other than Kwinana Beach.

Fishing

Cockburn Sound is an important area of fish production and hence boat, jetty and beach fishing are popular along the Kwinana coastline, particularly at Kwinana Beach. Fish species caught in the area by amateur fishermen include blue manna crab, herring, whiting, skipjack, garfish and yellow-tail scad.

Sightseeing

Offshore islands provide a scenic attraction for people visiting the Kwinana foreshore. Good access facilities including the provision of appropriately located carparks could do much to enhance the view for sightseers. The wreck of the SS Kwinana at Kwinana Beach is of historical interest and could be promoted as a special tourist attraction.

Off-Road Vehicles

Vehicles have been driven over the dunes and beaches at some Kwinana coastal sites. Off-road vehicle access to the beach should be restricted to well defined tracks as the sand dune system is not capable of sustaining a large number of vehicles.

Holiday Camp Settlement

The Naval Base cabin settlement adjacent to the northern boundary of the study area comprises 143 cabins with four caravan bays. The cabins are leased for a period of 21 years. They are mostly vacant in winter but are occupied by family groups in summer. The popularity of these cabins is not expected to decline in the future.

Horse Training

Barter Road Beach, and Kwinana Beach south of Rockingham Road are used by horse trainers in the early mornings. These foreshore sites are considered suitable for horse training because of their accessibility and gradual grade offshore. Demand for foreshore areas to exercise horses is likely to continue.

Summary

The sheltered waters of Cockburn Sound are attractive to a variety of industrial and recreational land use activities. Along the Kwinana coastline industry has imposed severe alterations upon the natural environment, although several private companies and government agencies have undertaken foreshore management works at their sites. Despite the enormous impact of the industrial activities, the available recreational sites at Kwinana are popular for pursuing a number of leisure time activities, and greater utilisation of these areas is expected in the future.

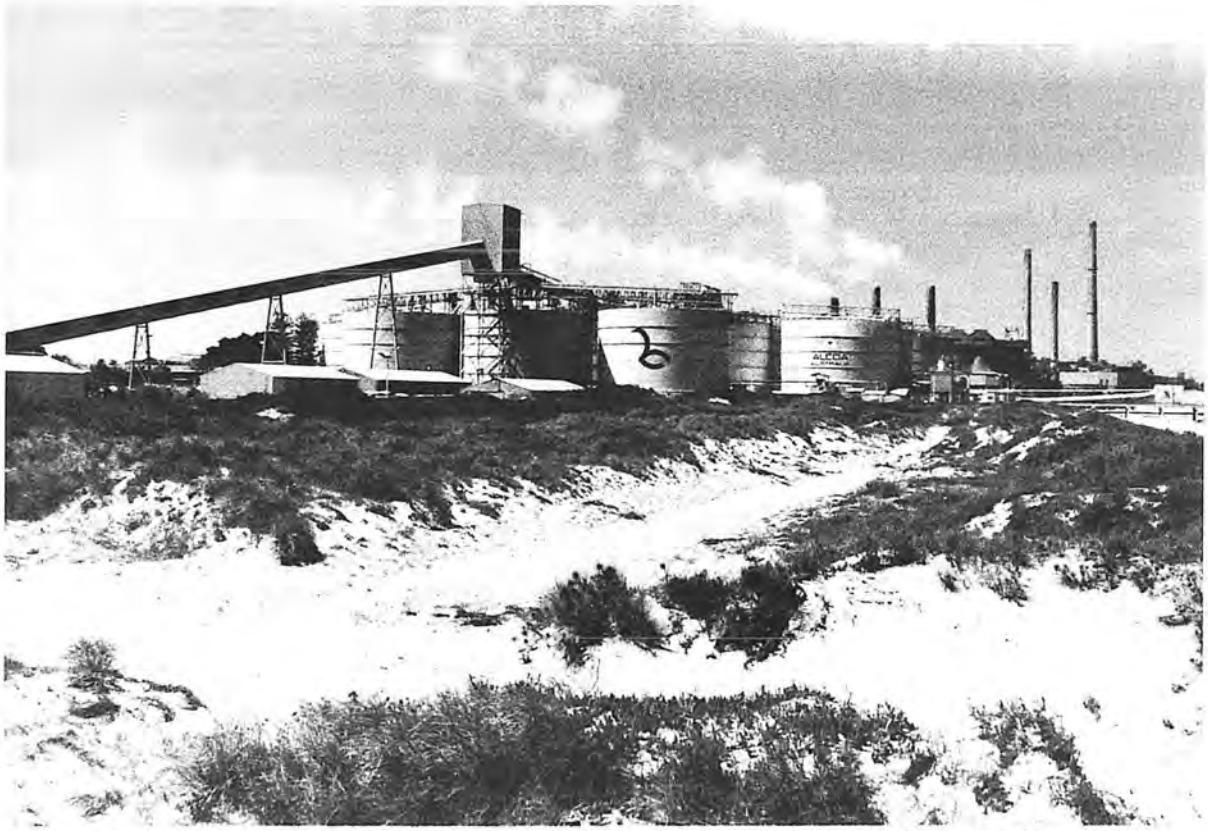


Photo 5 Degraded Dunes : Informal access tracks result in loss of stabilising dune vegetation and associated erosion.

Photo 6 Foreshore Access : Opportunity exists to fence existing parking areas and to establish pathways to provide adequate access to the beach.

STATEMENT OF OPPORTUNITIES AND CONSTRAINTS

The Kwinana coastal environment has the following opportunities :

1 Sheltered beaches which provide safe waters suitable for a wide variety of water based recreational activities including bathing, sailing and angling.

2 Scenic views of offshore islands which are suitable for sightseers.

3 A system of roads and carparks.

4 A management infrastructure based on the facilities and staff of the Town of Kwinana.

The Kwinana coastal environment has the following constraints :

1 A long history of shoreline fluctuations indicated by the development of the beach ridge plain by cut and fill processes.

2 A frontal dune system which is not capable of sustaining pedestrian or vehicular traffic.

3 Areas of eroding shoreline which are not suitable for developments that are to be of long term amenity.

4 Water, atmospheric and visual pollution at some sites due to the presence of industry.

5 Increasing use pressures and limited resources.

6 Fragmented public access along the coast.

MANAGEMENT GOAL AND AIMS

In October 1983 the Western Australian Government approved a Position Paper on Coastal Planning and Management with the following goal :

> "The goal of coastal planning and management is to achieve a balance between the protection of environmental quality and provision for the social and economic needs of the community."

The following management aims are defined to assist the Kwinana Town Council in the long term care of the coast in a manner consistent with the goal of coastal planning and management.

1 Preserve the natural systems of the area.

2 Provide for increasing recreational use of the area in a manner consistent with its protection and effective use of the resource base.

3 Provide formal access to the foreshore without degrading the dune environment ;

4 Implement a public education programme as an aid in the conservation of the area and to encourage maximum utilisation of available resources.

5 Improve the landscape character of the area.

MANAGEMENT PROPOSALS

The following management proposals are intended to realise the aims of this plan. The proposals provide a framework for preserving and enhancing the resources of the area.

Access Management

Access management is a crucial aspect of this plan. Vehicle and pedestrian movement should be confined to formally designated roads, carparks and paths. This is necessary to prevent damage to dune vegetation and associated erosion. The maintenance of these access facilities is the responsibility of the Town of Kwinana. Controlled vehicle and pedestrian movement may be achieved by :

1 The provision of adequate access to popular sites. This can be made possible by the staged development of roads, carparks and paths.

2 Education of the public by providing adequate information concerning the access system and the need to conserve the dune environment.

Dune Conservation

Erosion along the coast is caused naturally by running water, wind and the sea. Human use of the coast may also produce erosion, primarily through the loss of stabilising vegetation which allows dune sands to become mobile. Management problems due to dune erosion and sand drift are apparent along the Kwinana coastline. The following techniques are suitable for preventing erosion or for repairing dunes degraded as a result of man's activities :

1 Formal access provision including roads, carparks and paths. Post and rail fencing provides an effective means of delineating pathways through dunes. Paths should follow a route which is mainly oblique to the prevailing southwesterlies so as to avoid a wind tunnelling effect and thus minimise further loss of sand. Paths crossing sandy slopes should be surfaced with limestone. Steps may be required on steeper slopes.

2 Use of brush matting as a surface stabilising agent in exposed dune areas. Brush matting is an effective technique in dune conservation because it is visually acceptable, it serves to temporarily stabilise the sand and it identifies areas of restricted dune access. Areas with brush matting should be broken into cells and the brush should be treated with a fire retardant to reduce the risk of fire damage.

3 Pine log fencing should be used to fence off dunes and thus restrict access and prevent trampling of vegetation.

Siting and Design

Coastal development and facilities should blend with and enhance the natural beach environment if they are to add to the amenity of the area. The following siting and design considerations apply to the Kwinana coastline:

1 Facilities should be constructed of aesthetically pleasing materials such as pine logs and hardwood.

2 Concentrate facilities into a number of discrete nodal points so as to avoid overall degradation of the dune environment.

3 Stable interdunal swales may be suitable locations for developments such as picnic areas.

4 Develop an efficient system of garbage disposal and litter control. This requires the provision of a number of strategically placed garbage bins.

5 Native shrubs and trees should be planted to screen unattractive industrial developments and essential facilities such as toilets, to provide shade and to create a more interesting coastal landscape.

6 Provision should be made for continued maintenance of facilities by responsible authorities.

Public Education Programme

The management of resources, including their protection and effective utilisation, may be greatly aided by a public education programme. The objectives of the programme should be to orientate visitors and to influence their behaviour. A public education programme for the Kwinana coastline should involve the following :

1 Erection of well designed signs to indicate the presence of dune conservation programmes.

2 Directional signposts to guide the public to recreational sites, sites of special interest such as the wreck of the SS Kwinana and to available facilities at each site.

3 Preparation of a pamphlet containing details of access facilities, boat launching ramps and picnic areas.

MANAGEMENT AREA RECOMMENDATIONS

Beaches along the Kwinana coastline have been analysed in terms of vegetation cover, dune stability, shoreline movements, existing access and facilities, and nature of surrounding land use. When combined, these factors have a number of implications for each area in terms of their environmental management and usage value (Table 3).

Kwinana Beach

Recreational facilities and developments along the Kwinana coastline are mainly concentrated at this site (Figure 7). Improvements at the beach attract a large number of people including family groups, fishing and boating people who use the boat launching ramp. Sealed roads and a carpark provide good access to this beach.

The dune system has been largely modified to accommodate a sealed carpark and grassed area. To the north is a stable dune hollow, whilst immediately south of the wreck site there is an erosion scarp and the trampling of vegetation by pedestrians has resulted in a degraded dune system. Blowout activity, sand drift and advancing dunes create the need for special management techniques.

Policy Statement

Recommendations for Kwinana Beach aim to improve the amenity of the beach and coastal environs (Figure 8). It is anticipated that the beach will continue to be the most popular Kwinana coastal site and steps must be taken to protect the environment from further degradation.

Access

1 Erect post and rail fencing to delineate formal paths linking existing parking areas to the beach.

2 Discourage uncontrolled pedestrian movement through dunes. Pine log fencing is to be erected along the perimeter of dunes to restrict access through these areas.

3 Place directional signs to guide the public to designated access points.

Dune Conservation

1 Use of brush matting to encourage vegetation growth and dune stabilisation in degraded areas.

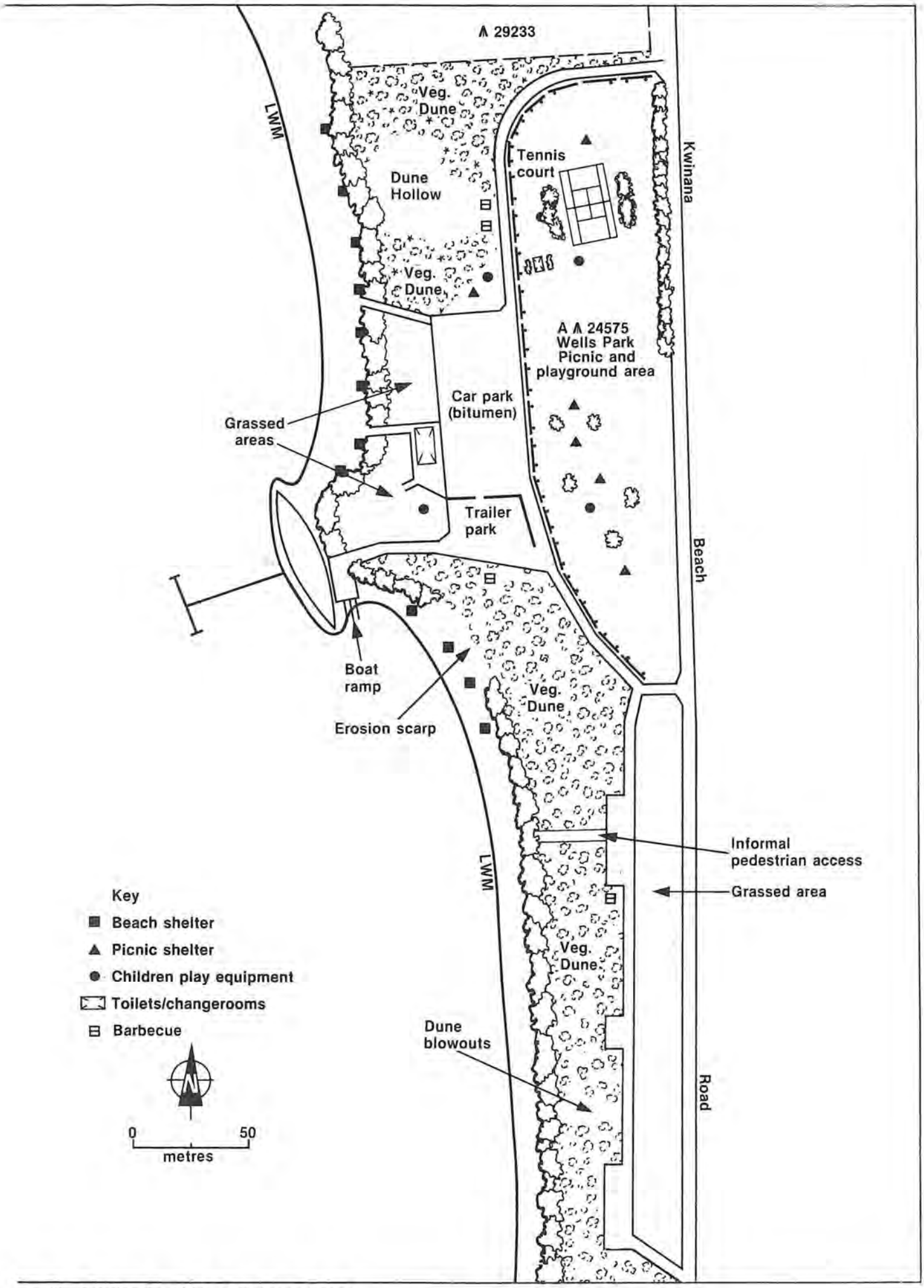
2 Erect signs indicating the presence of the dune conservation programme to members of the public.

3 Restrict dune access as described above.

Table 3

Management Priorities for Beaches in the Study Area

Beach	Vegetation	Dune Stability	Recent Shoreline Changes	Land Based Development	Access	Facilities	Usage	Management Priorities
Naval Base	Dense cover.	Stable	Accretion	Industry	Sealed road, gravel car-park.	Boat ramp, shelter.	Low-moderate. Bathing, boat launching.	1. Provide formal foreshore access to avoid dune degradation. 2. Directional signposting along major coastal route to increase public awareness of beach. 3. Upgrade existing facilities and introduce new facilities to increase usage potential. 4. Plant shrubs and trees to screen industry.
Barter Road	Moderate cover, some loss due to un-controlled access.	Largely stable. Dune re-vegetation project near north-ern boundary.	Minor erosion.	Industry	Sealed road, rough carpark.	Nil	Major use is horse training Low usage for bathing.	1. Provide formal foreshore access to avoid further dune degradation. 2. Increase directional sign-posting to beach.
Kwinana	Dense cover north of carpark. Low cover south of wreck due to un-controlled access.	Stable north of carpark. Erosion, blowouts and sand drift south of wreck.	Accretion north of wreck. Erosion scarp south of wreck.	Residential. Sites being acquired for industry.	Sealed road and carparks.	Boat ramp, toilets, changerooms, shelters, childrens play equipment, grassed area.	High. Boat launching, bathing, picnicking and games, fishing, sightseeing.	1. Implement dune stabilisation programme for environmental reasons as well as to protect Council assets. 2. Establish a formal pedestrian access system as an aid in dune restoration. 3. Plant shrubs and trees to improve landscape character. 4. Upgrade and expand facilities.



gure 7 Existing Facilities at Kwinana Beach

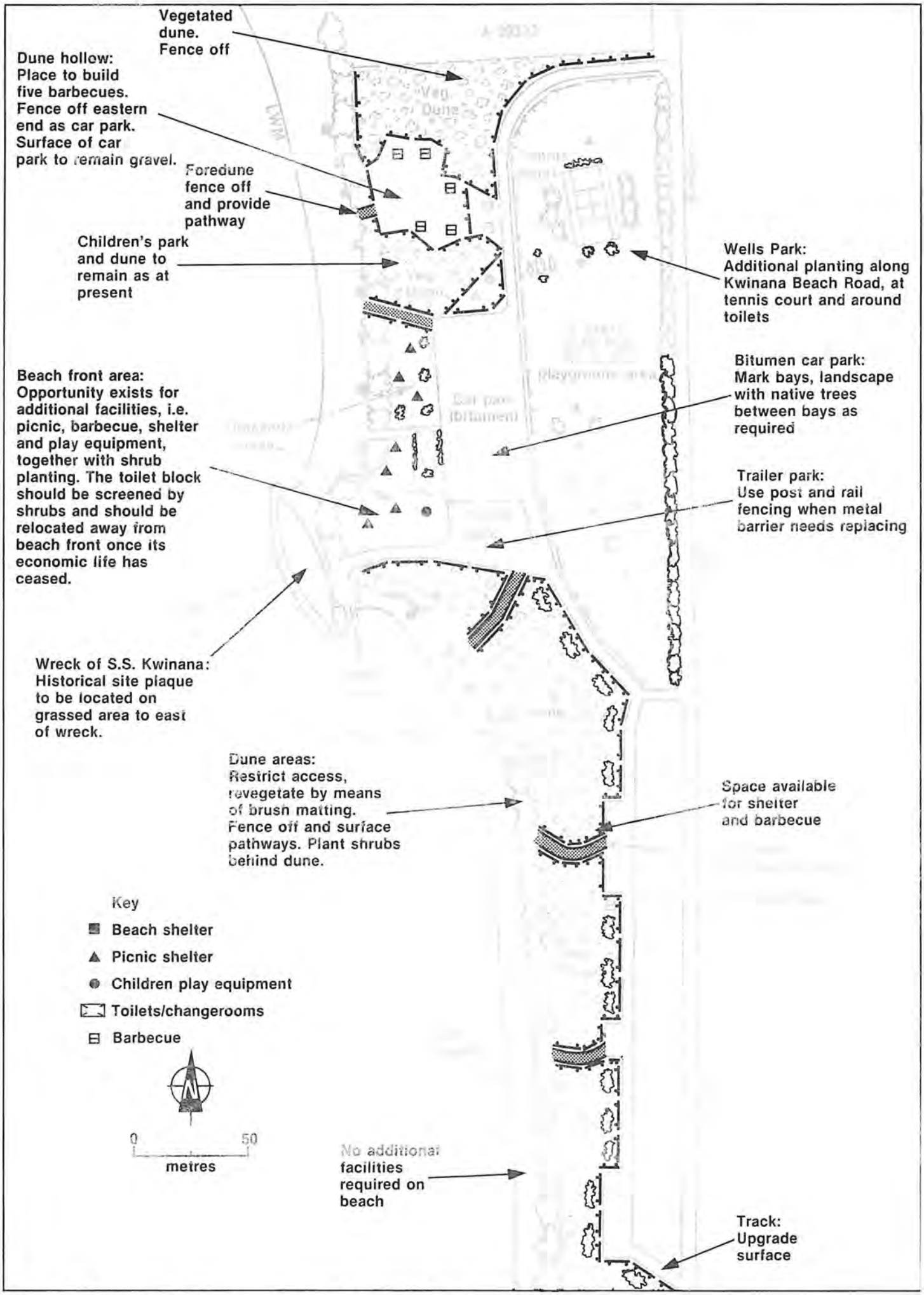


Figure 8 Management Recommendations for Kwinana Beach

Facility Provision

1 Orient developments toward the large number of family groups who frequent the beach.

2 Existing facilities including picnic areas and barbecues should be upgraded and expanded to improve the amenities near the beach.

3 Place directional signs to guide the public to available facilities.

Landscape Improvements

Implement a shrub and tree planting scheme for the following effects :

1 Afford privacy to small groups picnicking on grassed areas.

2 Screen developments including toilets, changerooms and tennis courts.

3 Improve the appearance of the large car parking area.

4 Give edge definition to Wells Park.

Barter Road Beach

Barter Road Beach, with few developments in the form of a sealed road and rough parking area, has no recreational facilities attractive to beach users (Figure 9). However, being one of only two legal horse training beaches along the Kwinana coastline it attracts a particular user group. Unpleasant odours from nearby industries are apparent on occasion, and the general setting of the beach is poor. Access to the beach is made difficult by a lack of directional signposts and the need to travel through an industrial estate.

The activities of horse trainers and other beach users have resulted in loss of vegetation and minor degradation of the dune environment near Barter Road. Further north, the Department of Agriculture and the SEC are involved in a joint project to revegetate a heavily degraded dune area. Minor erosion is apparent along the greater length of the beach, although there has been accretion near its southern boundary.

Policy Statement

Barter Road Beach is to be retained primarily as a horse training beach and as a low key recreational site. Recommendations for the beach recognise the need to prevent further dune degradation (Figure 10).

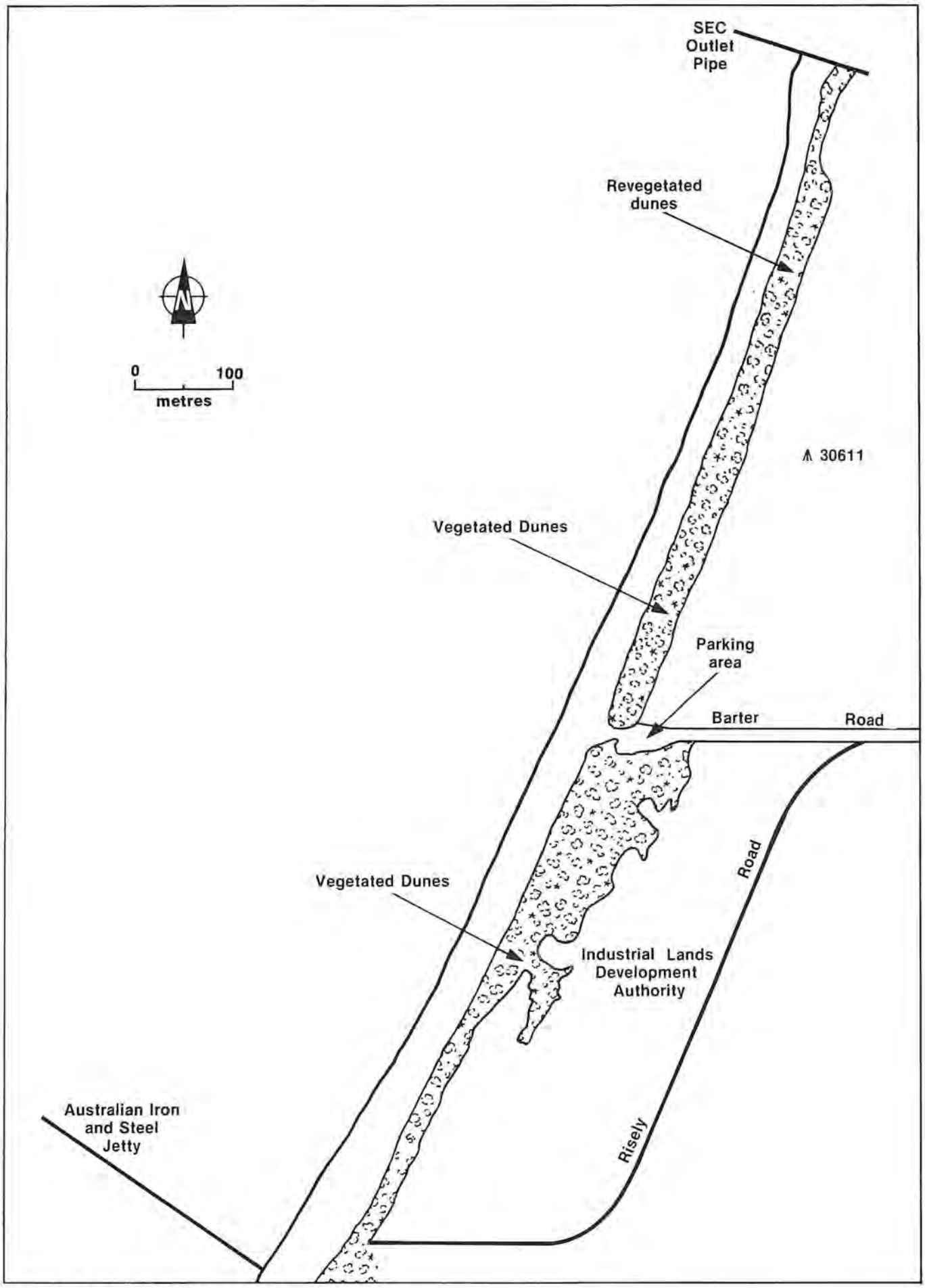


Figure 9 Existing Facilities at Barter Road Beach.

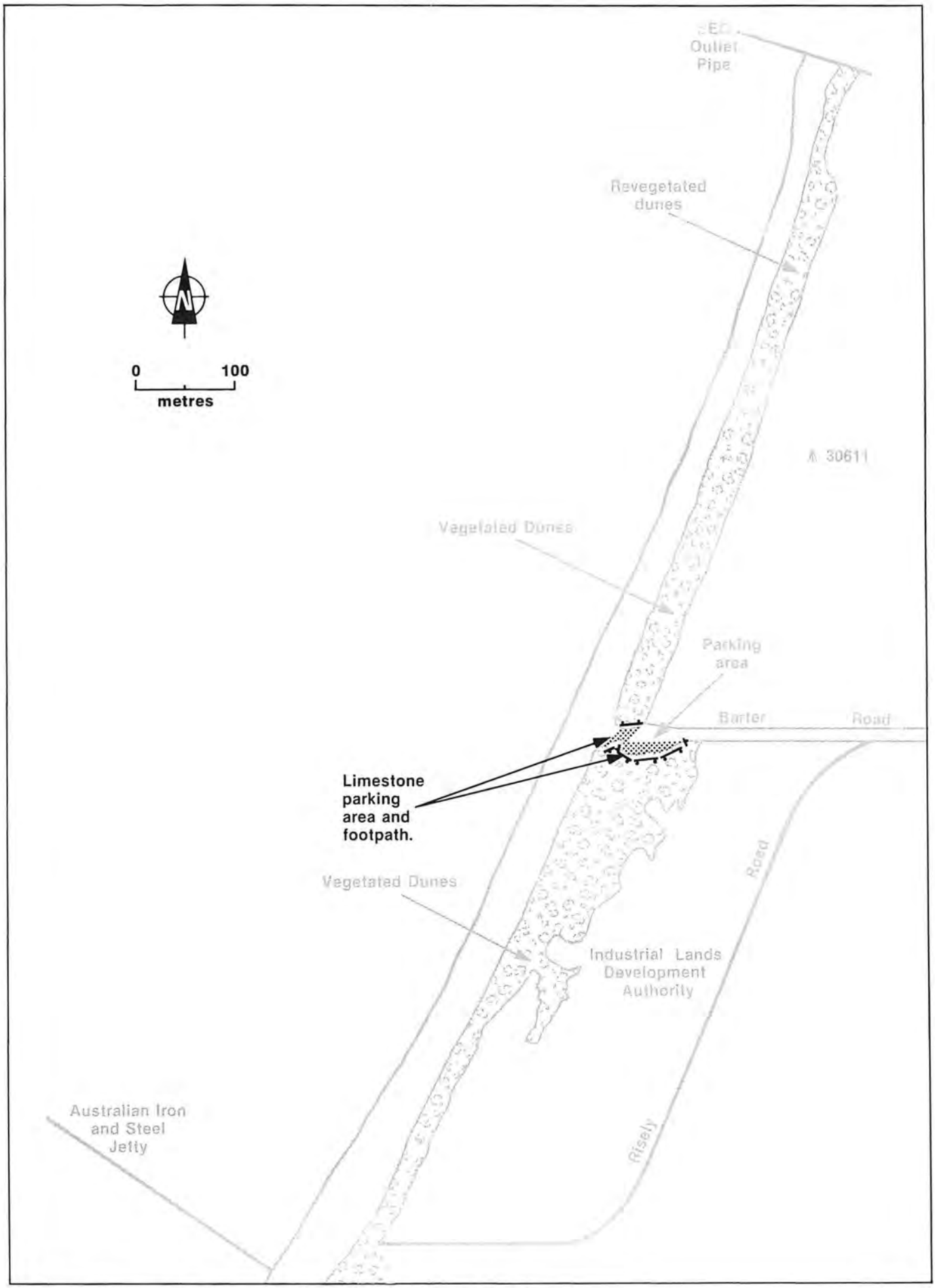


Figure 10 Management recommendations for Barter Road Beach.

Acces

1 Surface the existing rough carpark with limestone.

2 Erect post and rail fencing to delineate a formal path linking the parking area to the beach.

3 Place directional signs to guide the public to the beach and to designated access points.

Dune Conservation

1 Restrict dune access as described above to prevent further degradation of the dune environment.

Naval Base Beach

Naval Base Beach is situated immediately north of the Kwinana heavy industrial area. Nearby industries create major visual pollution to the south, and unpleasant odours are occasionally apparent. Despite this, the general condition and setting of the beach is conducive to recreational usage. At present the beach lacks the facilities required to enable it to realise its full potential (Figure 11). A sealed road together with a gravel carpark provides foreshore access. Directional signs along Cockburn Road, the major coastal route a short distance east of the beach, are poor, making it difficult to locate the beach.

Incipient foredunes, a foredune, primary dune and interdunal swales remain largely intact at the beach. Vegetation is in good condition with minimal degradation south of Hogg Road due to off-road vehicles. A considerable amount of accretion occurs along the beach.

Policy Statement

Naval Base Beach has the potential to be developed as a moderately popular recreational site and recommendations for the beach aim to increase its usage level (Figure 12). The plan for this beach allows for optional developments to enable the introduction of additional facilities as demand necessitates. Disturbance to the stable dune environment will be minimised with good management techniques.

Access

1 Erect post and rail fencing to give edge definition to existing parking areas and to delineate formal paths providing beach access.

2 Provide for car and trailer parking along the eastern side of Sutton Road.

3 Place directional signs along Cockburn Road to increase public awareness of the beach, and to indicate available access facilities.

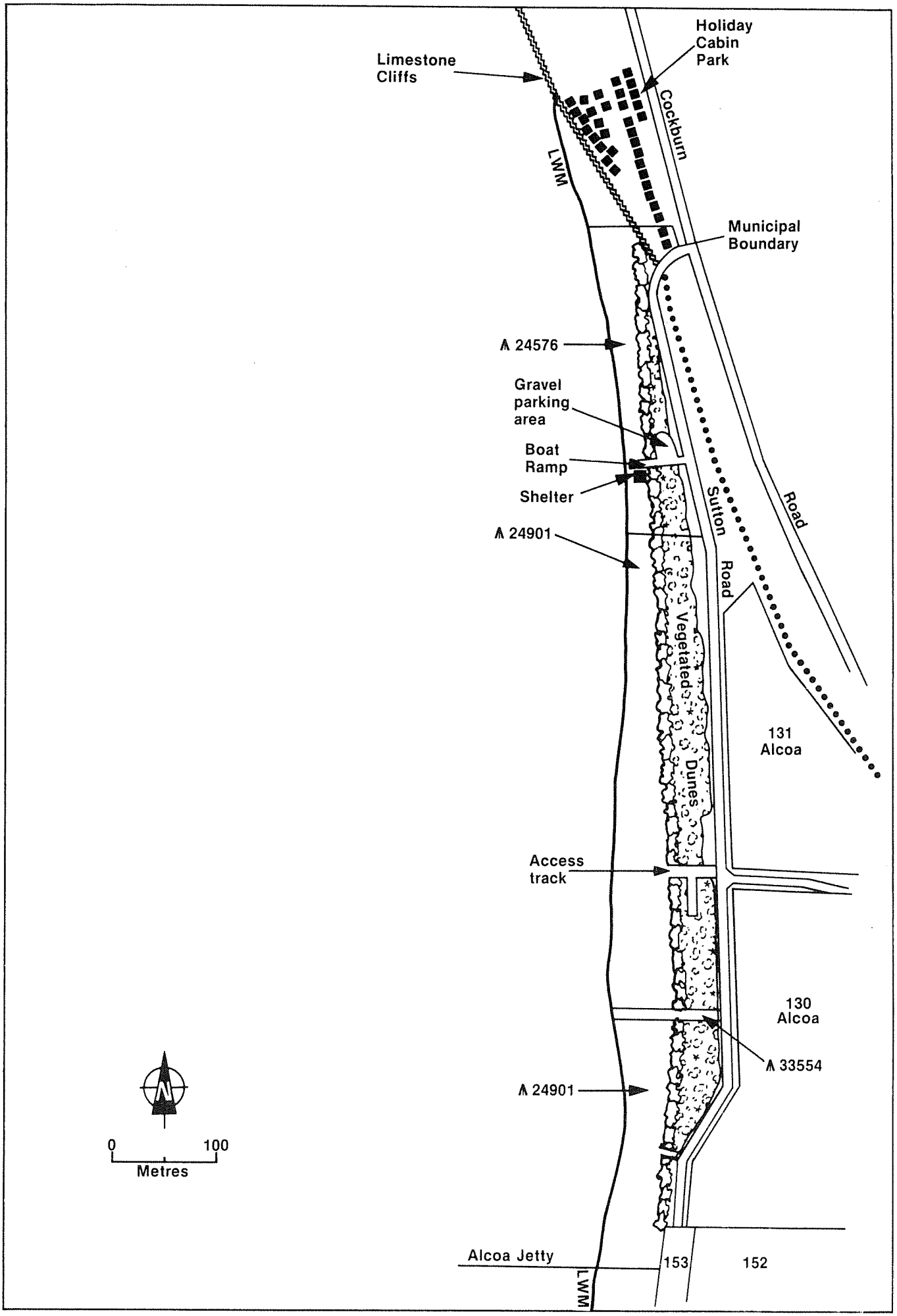


Figure 11 Existing Facilities at Naval Base Beach

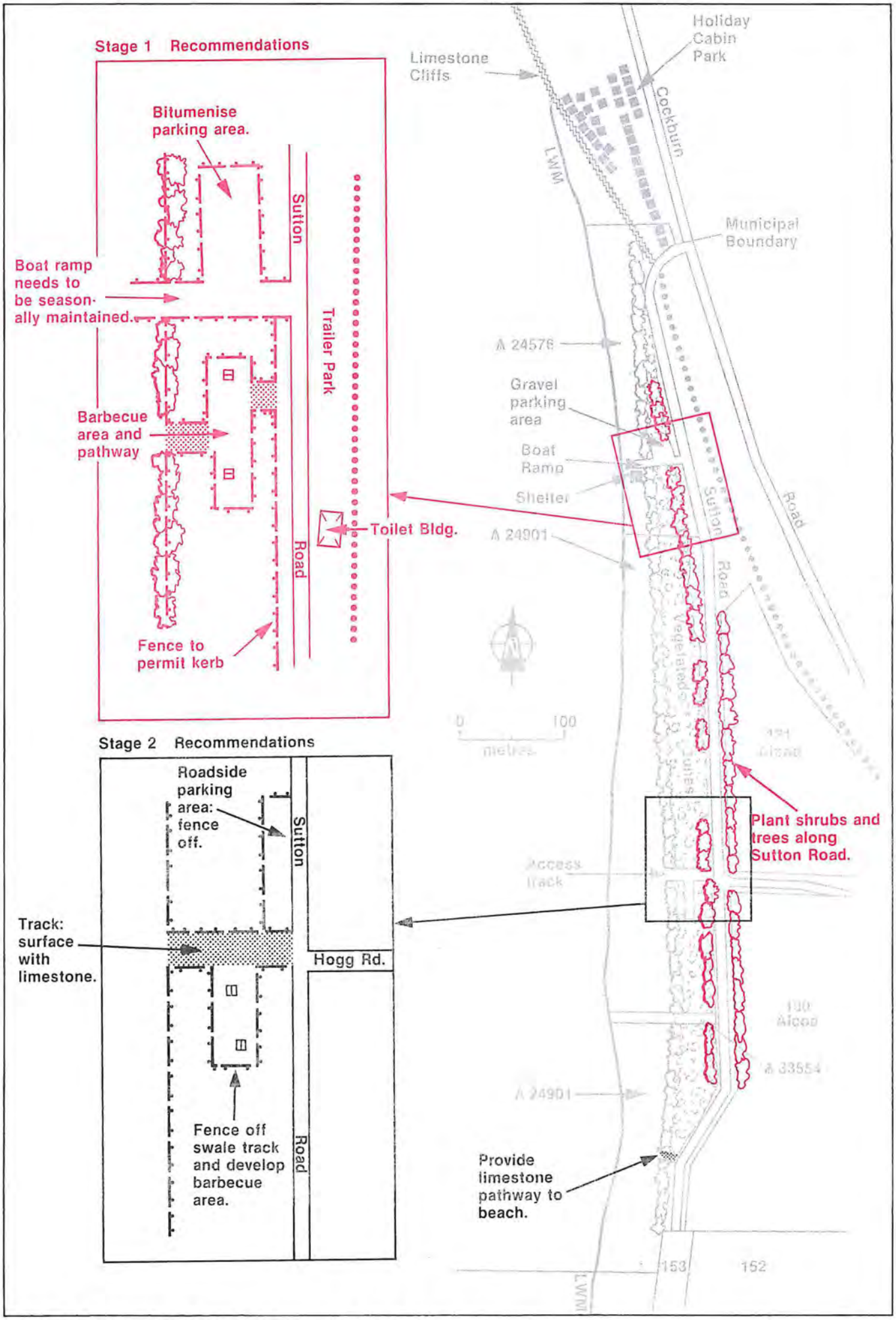


Figure 12 Management recommendation for Naval Base Beach

Dune Conservation

1 Restrict dune access as described above to prevent further degradation of the dune environment.

Facility Provision

1 Stage 1

- Introduce essential facilities such as toilets, changerooms and other facilities including barbecues near the northern boundary of the beach. The toilets and changerooms should be located away from the beach, on the eastern side of Sutton Road. The primary interdunal swale provides a suitable location for barbecues.

- Upgrade the existing boat ramp which has been made unusable because of sand accumulation. This facility will attract small boat users if regularly maintained.

2 Stage 2

- A second development node may be established in the dune area opposite Hogg Road. Facilities at this site should include a fenced parking area along the western side of Sutton Road, and barbecues in the primary interdunal swale.

3 Place directional signs to guide the public to available facilities.

Landscape Improvements

1 Implement a shrub and tree planting programme along Sutton Road to soften the starkness of the surrounding industrial landscape.

IMPLEMENTATION

The implementation of the plan is primarily the responsibility of the Town of Kwinana. Various government agencies may provide further advice and assistance. This section discusses assistance which will be required to effect the plan.

Funding

Finance is required to undertake coastal management programmes and currently most of this cost is borne by the local government authority.

Council should make provision for the necessary funds to allow the implementation of the plan. Financial assistance for specific projects may be sought from DCE, Public Works Department, Department for Youth, Sport and Recreation, and Tourism Commission.

Commonwealth employment scheme funds may be sought to allow implementation of the labour intensive proposals outlined in the plan.

Management priorities for each beach have been outlined in Table 3. Council should use this information as a guide in the allocation of funds for programmes according to need.

Reserve Vesting

The proper management of the Kwinana coastline will require alterations to the vesting and purpose of some land in the study area as shown on Figure 13. These alterations include :

1 Reserve 24576 is to remain vested in the Town of Kwinana for the purposes of Recreation and Foreshore Management.

2 Set apart a new reserve for the area covering the Alcoa jetty to low water mark.

3 Set apart a new reserve west of the SEC power house. This reserve is to be vested in the SEC for the purposes of Government Requirements SEC.

4 Reserve 24901, north of the SEC outlet pipes, is to be amalgamated with the portion of Reserves 24307 and 24900 not included in (3) above. This reserve will be vested in the Town of Kwinana for the purposes of Recreation and Foreshore Management.

5 The portion of Reserve 24570 not included in (3) above, south of the SEC outlet pipes, is to be vested in the Town of Kwinana for the purposes of Recreation and Foreshore Management

Council should approach the Under Secretary for Lands seeking these changes.

Technical Assistance

Council may approach government agencies for technical assistance in the implementation of the plan. DCE, Department of Agriculture and Public Works Department can offer further advice with regard to the management programmes recommended in the plan.

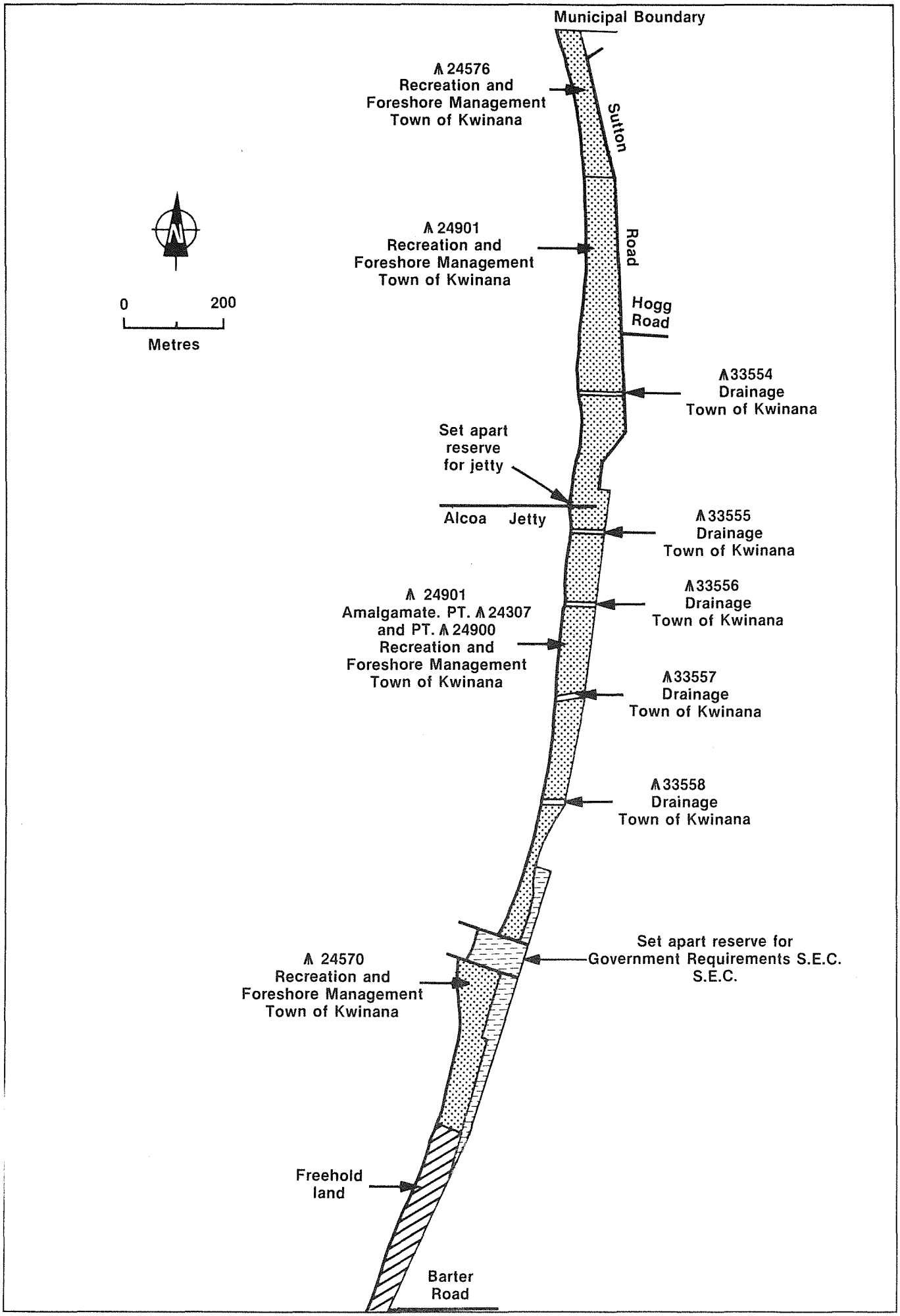


Figure 13 Proposed Reserve Structure — Sutton Road to Barter Road

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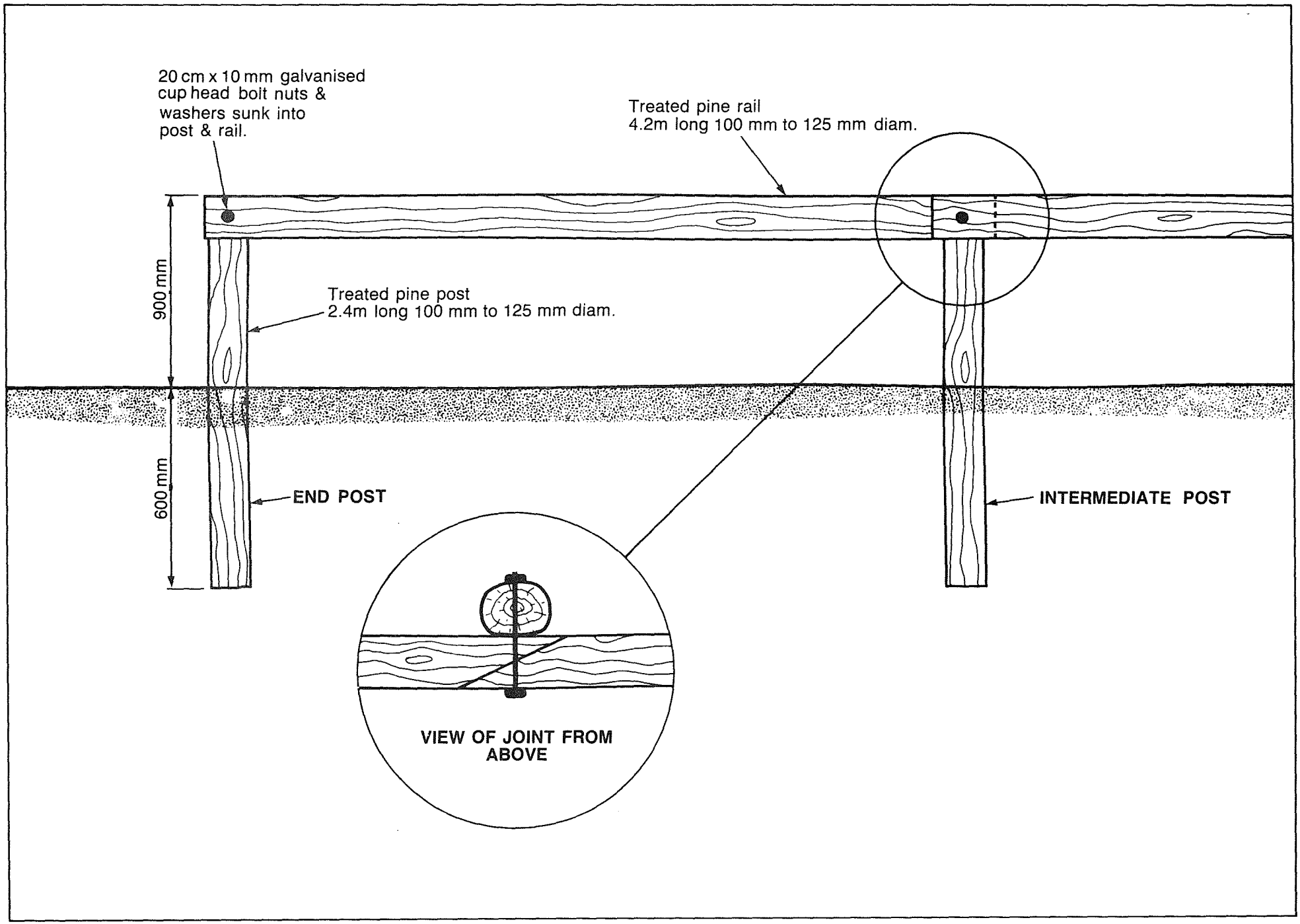
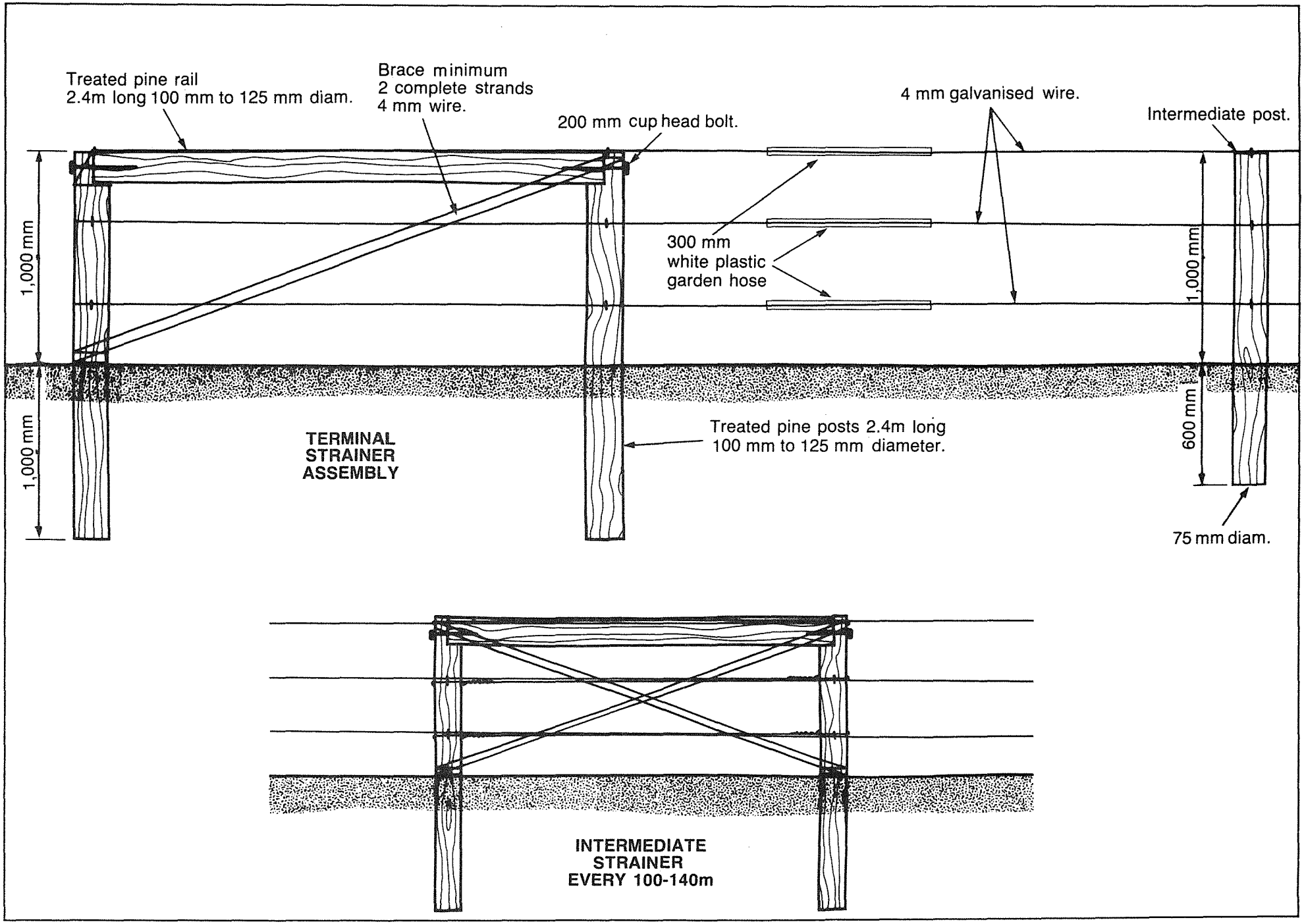
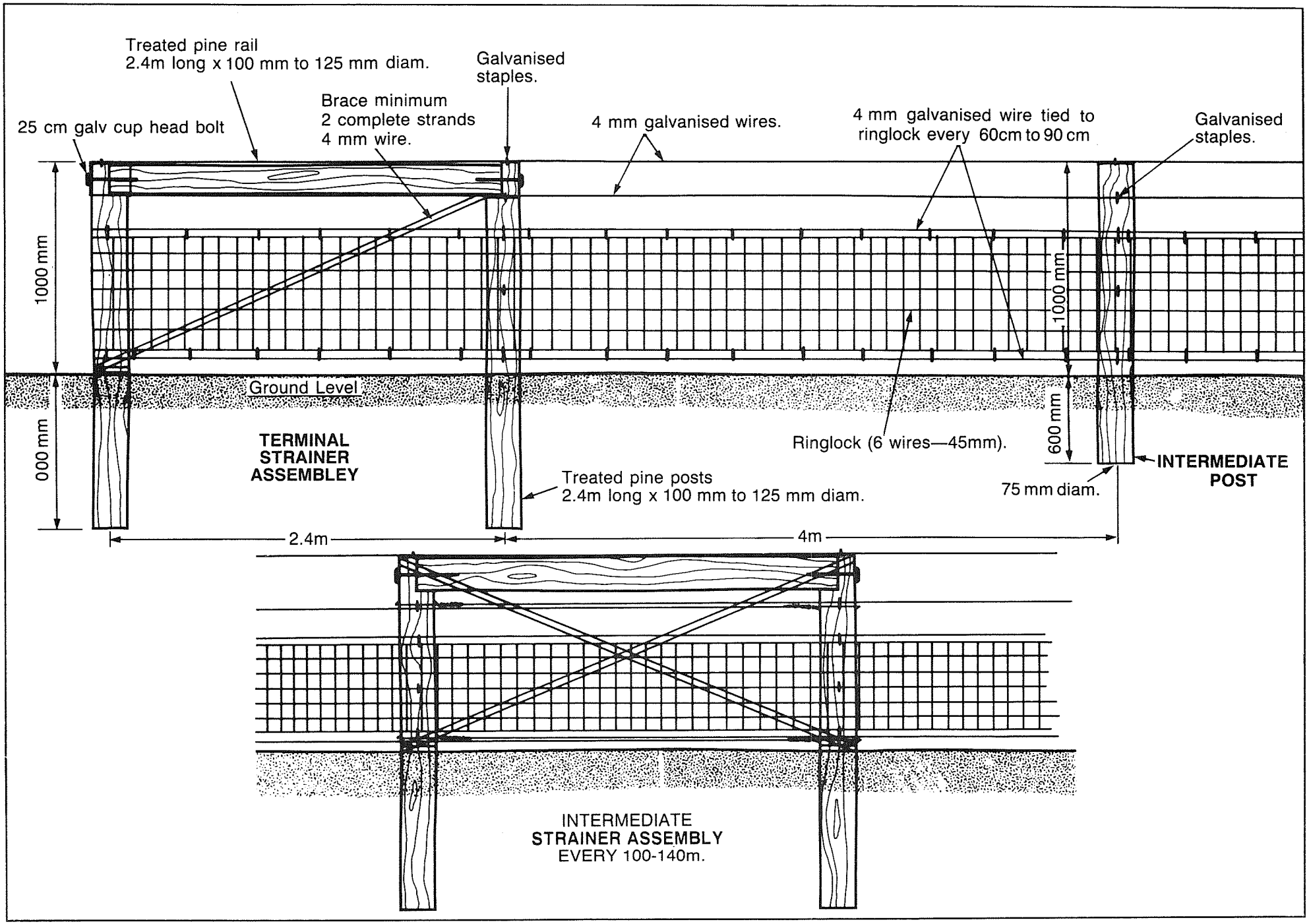
APPENDIX 1 DUNE VEGETATION

KEY:
- ID incipient foredune
- FD foredune
- PD primary dune
- RD revegetated dune areas

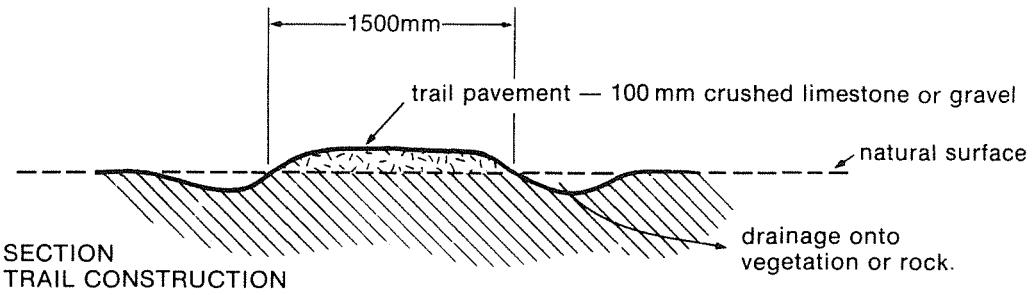
Salsola kali	ID
Spinifex longifolius	ID, FD
Tetragonia decumbens	ID, FD
Trachyandra divaricata	ID, FD, PD
Spinifex hirsutus	FD
Scaevola crassifolia	FD, PD
Myoporum insulare	PD
Pelargonium capitatum	PD
Carpobrotus edulis	PD
Lepidosperma gladiatum	PD
Sporobolus virginicus	PD
Acanthocarpus preisii	PD
Spyridium globulosum	PD
Scirpus nodosus	PD
Acacia rostellifera	PD
Acacia cyclops	PD
Ammophila arenaria	RD


20 cm x 10 mm galvanised cup head bolt nuts & washers sunk into post & rail.
Treated pine rail 4.2m long 100 mm to 125 mm diam.
900 mm
Treated pine post 2.4m long 100 mm to 125 mm diam.
600 mm
END POST
INTERMEDIATE POST
VIEW OF JOINT FROM ABOVE

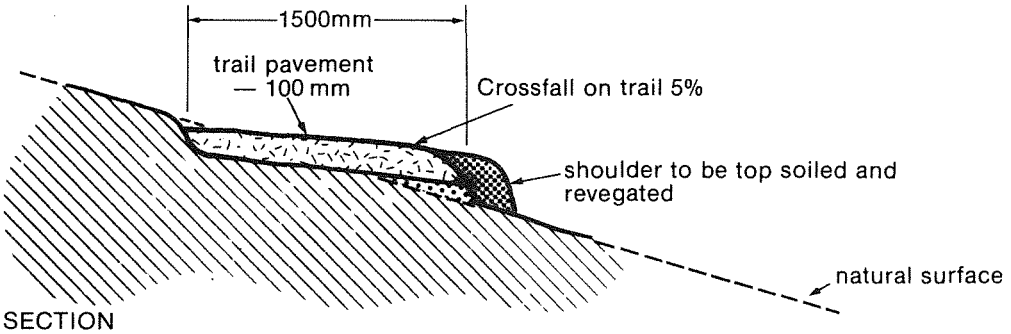

Treated pine rail
2.4m long 100 mm to 125 mm diam.
Brace minimum
2 complete strands
4 mm wire.
200 mm cup head bolt.
4 mm galvanised wire.
Intermediate post.
1,000 mm
300 mm
white plastic
garden hose
1,000 mm
1,000 mm
600 mm
TERMINAL
STRAINER
ASSEMBLY
Treated pine posts 2.4m long
100 mm to 125 mm diameter.
75 mm diam.
INTERMEDIATE
STRAINER
EVERY 100-140m


Treated pine rail
2.4m long x 100 mm to 125 mm diam.
Galvanised staples.
Brace minimum
2 complete strands
4 mm wire.
25 cm galv cup head bolt
4 mm galvanised wires.
4 mm galvanised wire tied to ringlock every 60cm to 90 cm
Galvanised staples.
1000 mm
1000 mm
Ground Level
600 mm
000 mm
TERMINAL STRAINER ASSEMBLEY
Ringlock (6 wires—45mm).
INTERMEDIATE POST
Treated pine posts
2.4m long x 100 mm to 125 mm diam.
75 mm diam.
2.4m
4m
INTERMEDIATE
STRAINER ASSEMBLY
EVERY 100-140m.

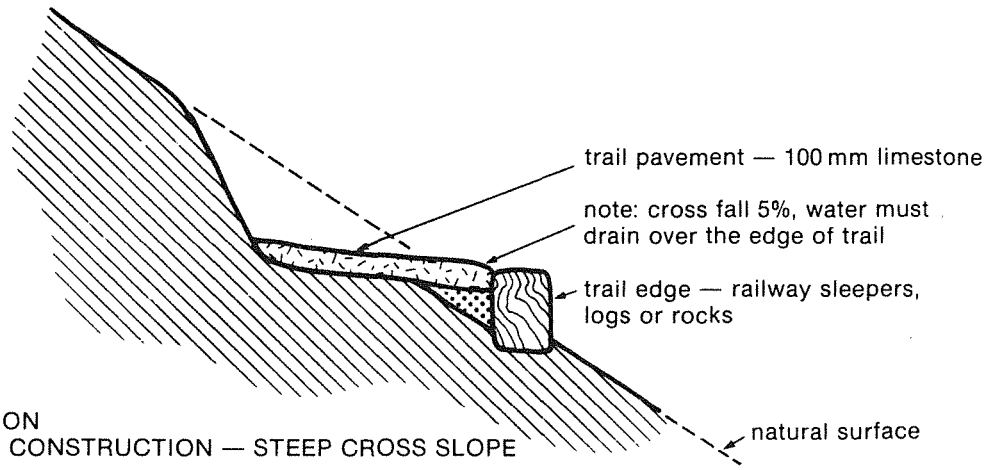
APPENDIX 3 WALKING TRAIL DESIGN



SECTION
TRAIL CONSTRUCTION

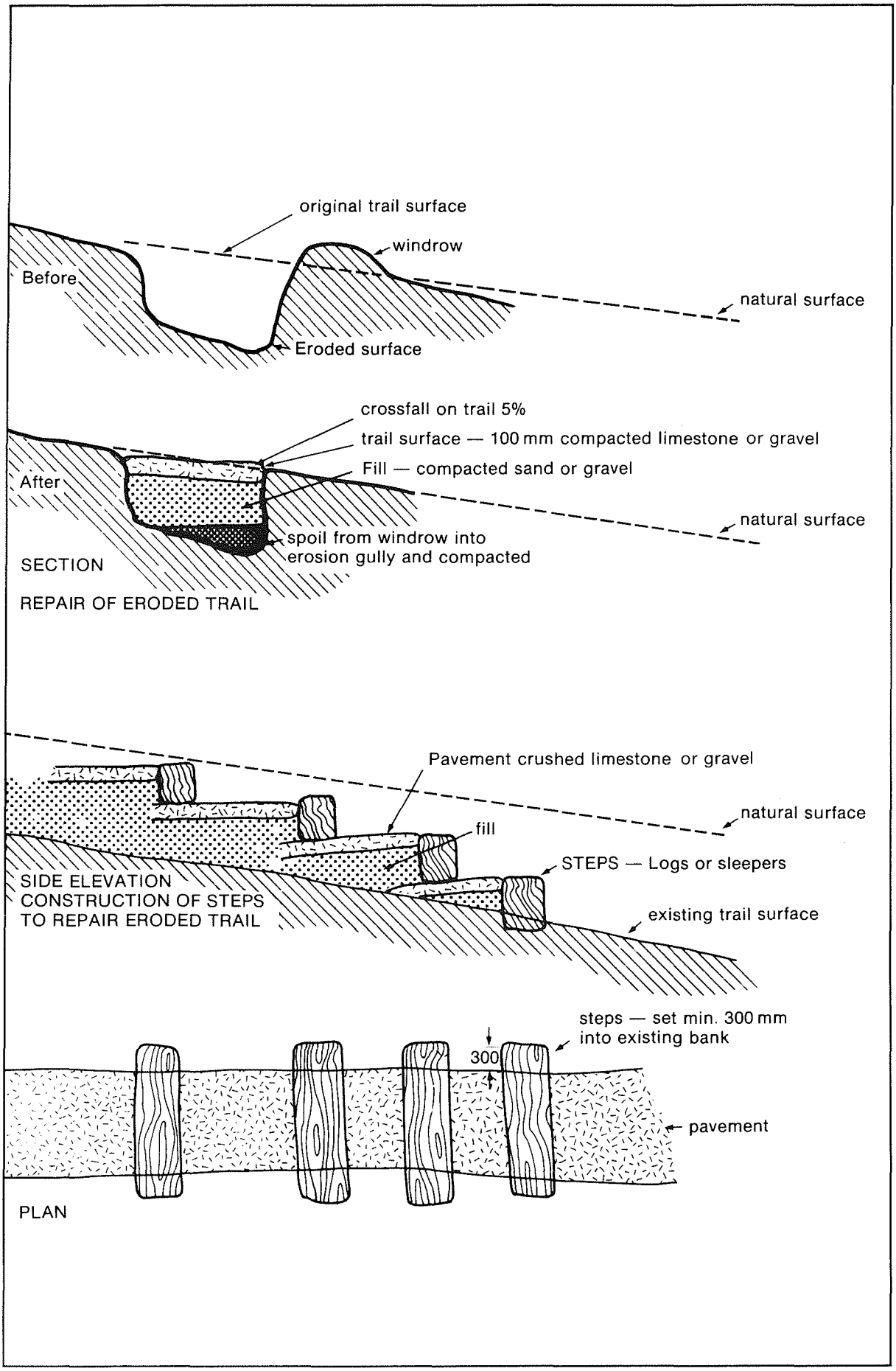


SECTION
TRAIL CONSTRUCTION — GENTLE CROSS SLOPE



SECTION
TRAIL CONSTRUCTION — STEEP CROSS SLOPE

APPENDIX 3 WALKING TRAIL DESIGN (continued)



APPENDIX 3 WALKING TRAIL DESIGN (continued)