LESCHENAULT INLET MANAGEMENT AUTHORITY

Northern Leschenault Estuary Foreshore Management Plan

WATER RESOURCE MANAGEMENT SERIES

WATER AND RIVERS COMMISSION REPORT WRM2

1997

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NORTHERN LESCHENAULT ESTUARY
FORESHORE MANAGEMENT PLAN

Report to the Leschenault Inlet Management Authority and the Shire of Harvey

Water and Rivers Commission
South West Region

WATER AND RIVERS COMMISSION
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Foreword

The waterways and foreshores of the Leschenault Estuary and associated rivers combine to form a singular significant conservation resource providing a recreation focus for the Bunbury region.

The northern Leschenault Estuary foreshore is particularly important to the community because it is relatively open, providing unconstrained access to the Leschenault Estuary. During summer many people access the Estuary from this foreshore, with large concentrations of people using the cleared grassed road verges for picnicking and making use of barbeques and crab cookers.

With such intense usage, the foreshore and fringing vegetation, particularly shore rush, is being damaged and degraded and there is a need to better define where and how people will access the Estuary, and to manage vehicle access within the foreshore area and on the road reserve.

The Cathedral Avenue road reserve is recognised as having heritage value, for the amenity provided by the paperbarks on the road verge. The paperbark trees have been degraded over time with road works, stripping of bark from the trunks, and frequent fires. Positive action is required to protect the 'cathedral' appearance and to rehabilitate degraded areas.

This management plan has been prepared by a working group involving the local community. The plan is designed to promote a better understanding of the area and to provide a formal agreement

between the parties involved on how the area is to be used and managed.

It is the aim of the plan to develop the recreational and conservation opportunities of this foreshore, and to protect fringing vegetation and foreshore stability.

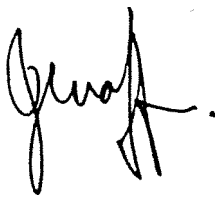
In order to achieve these objectives a series of recommendations has been developed.

It is intended that these recommendations be implemented over a five year period, and to involve the community as much as possible in actively managing the area.

Vern Haley

Mr Vern Haley
Chairman
Leschenault Inlet Management Authority

Cr Jim Offer
Shire President
Shire of Harvey



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1. INTRODUCTION

The eastern foreshore of the Leschenault Estuary, including the northern section which is the subject of this study, is one of the most frequently used areas of foreshore in the Bunbury/Australind region and provides the principle points of access to the Estuary. As a consequence, the fringing vegetation is highly disturbed and there is increasing pressure on the foreshore for recreational activity and access to the water.

Plate 1: View from Crimp Crescent showing narrow foreshore adjacent to the Leschenault Estuary.

The principle component of the northern Leschenault Estuary foreshore is the Cathedral Avenue road reserve which is narrow in parts, limiting the provision of facilities including carparking and recreation space.

Recent developments along the Estuary flats have resulted in additional foreshore open space as a result of the subdivision process. Much of this recently acquired foreshore has been used for agricultural pursuits in the past and as a consequence much of the foreshore and fringing vegetation is in need of rehabilitation and maintenance.

As a result, the Leschenault Inlet Management Authority, in conjunction with the Shire of Harvey and community representatives, have worked together to develop a series of recommendations which detail works and actions required to rehabilitate the natural ecosystem and to upgrade public recreational facilities.

2. DEVELOPMENT OF THE PLAN

A working group was formed in February 1995 to prepare a management plan for the northern Leschenault Estuary foreshore. The management plan was initially prepared as a draft document to present background information and recommendations for management and use to the community. This final document has been prepared following the release of the draft plan and a public submission period.

2.1 Working group members

The working group comprises six members drawn from the local community, the Shire of Harvey and the Leschenault Inlet Management Authority (LIMA).

Mr Eric Wright (Chairman)	Leschenault Inlet Management Authority
Mr Charles Lockwood	Shire of Harvey
Mr Graham Edwards	Community Representative
Mr George Mardon	Community Representative
Cr Peter Eckersley	Shire of Harvey (to May 1996)
Mr John Evans	Leschenault Inlet Management Authority

2.2 Relevant studies and reports

The following studies and reports have been considered in the preparation of this management plan. Some of these studies influence how the area is to be managed and/or used and readers are referred to these reports for further information and an understanding of the approach taken with the preparation of the management plan.

- Leschenault Estuary, Collie River, Preston River Regional Flood Study (George 1981)
- System 6 Report (Department of Conservation and Environment 1983)
- Clifton Park Foreshore Reserve Management Plan (Waterways Commission 1989)
- Leschenault Waterways Management Programme (Waterways Commission 1992)
- Collie and Brunswick Rivers Foreshore Reserves Study Draft Report (Woodcock 1993)
- Fringing Vegetation of the Lower Collie and Brunswick Rivers 1992 (Pen 1992)
- Lot 131 Clifton Park Draft Management Plan (Wright 1993)
- Eaton Foreshore Draft Management Plan (Wright et al 1995)
- Bunbury Wellington Region Plan (Department of Planning and Urban Development 1993)

2.3 Public consultation

The Northern Leschenault Estuary Foreshore Draft Management Plan was released for public comment during December 1995. A public workshop was held in conjunction with the release, at which staff of the Water and Rivers Commission (formerly Waterways Commission) were available to explain the draft recommendations and to listen to additional comments and points of view from the community. A three month public submission period followed and a summary of the submissions received is contained in Appendix 3.

2.4 Schedule

February 1995	Form Working Group
November 1995	Draft Plan Completed
December 1995	Release Plan for Public Comment
February 1996	Finalise Plan from Public Input
June 1996	Plan Completed
July 1997	Release Final Plan and Commence Implementation
June 2002	Review Plan

3. TERMS OF REFERENCE

The following terms of reference for the working group were prepared by Mr Eric Wright, and amended by the working group after discussion at its first meeting.

3.1 Aim

To identify issues relating to the use and management of the northern Leschenault Estuary foreshore at Australind, and to prepare recommendations for the development and maintenance of the area to enhance public usage while protecting foreshore vegetation and the Estuary environment.

3.2 Objectives

3.2.1 Recreation

- Provide opportunity for recreation which is compatible with the natural environment.
- Enhance the recreation value of the area.
- Provide a means of access to and through the foreshore reserve.
- Provide appropriate levels of access to the Estuary.

3.2.2 Conservation

- Protect and improve the fauna and indigenous flora in foreshore areas of the Estuary system in order to maintain its natural conservation values.

3.2.3 Landscape protection

- Maintain existing vegetation on the foreshore area.
- Provide a mechanism for rehabilitating degraded foreshore vegetation.
- Provide a mechanism to maintain and enhance the vegetation comprising the 'cathedral' effect along Cathedral Avenue.

3.2.4. General

- Develop appropriate mechanisms to protect public facilities from vandalism.
- Involve the public with the ongoing management of the area in order to protect the area from vandalism.
- Provide public education and information on the environmental and recreational value of the area.
- Develop appropriate controls for levels of mosquito breeding.

3.3 Study area

The study area includes the Leschenault Estuary foreshore area adjacent to Cathedral Avenue and the Cathedral Avenue road reserve. The study area is bounded by Buffalo Road to the north and by Dawesville Channel in the south. The private lots on the Estuary flats between Cathedral Avenue and the escarpment are not within the scope of this Management Plan. Figure 1 shows the area under study.

4. DEFINITION OF THE STUDY AREA

4.1 Physiography, landform and relationships

The Leschenault Estuary is located in the Bunbury region of Western Australia (33° 21' S 115° 42' E) in the southern part of the Swan Coastal Plain.

The region experiences a mediterranean climate with an annual rainfall of 871mm occurring mainly from May to August. The northern Estuary foreshore is located on the eastern side of the Leschenault Estuary.

The study area is located entirely on the Leschenault Estuary flats and is comprised of the Cathedral Avenue road reserve, four foreshore reserves and two lots owned by the Crown. The foreshore area is narrow in parts with only a few metres between high water mark and the roadway. In the vicinity of Crimp Crescent the foreshore widens to a maximum width of approximately 220 metres narrowing again further north.

The whole of the study area is flat and level, and is generally between mean high water mark and the 2 metre contour line in elevation.

The area under study contains three main geomorphic subunits, the main features of which are related to depth of water (Semeniuk and Meagher, 1981).

The samphire and sedge flats are shoreline flats covered by high tide and storm event water levels. Sediments underlying the surface in this zone are variable and include root structured muds, sand mixtures and muds mixed with organic detritus. Substrates are grey to black sand sediments containing organic detritus and iron sulphide (Semeniuk and Meagher, 1981).

Sand shoals and platforms occur along both sides of the Estuary between mean high water mark and 0.2m below mean low water mark. Sediments of shoals and platforms are derived from quartz sand along the north eastern shore.

The top layers of sediments in the Leschenault Estuary are well bioturbated by crustaceans, worms and fish. Benthic fauna contribute shells and skeletal silt to the sand sediment, resulting in sediments having proportions of shelly sand, muddy sand and burrowed sand (Semeniuk and Meagher, 1981).

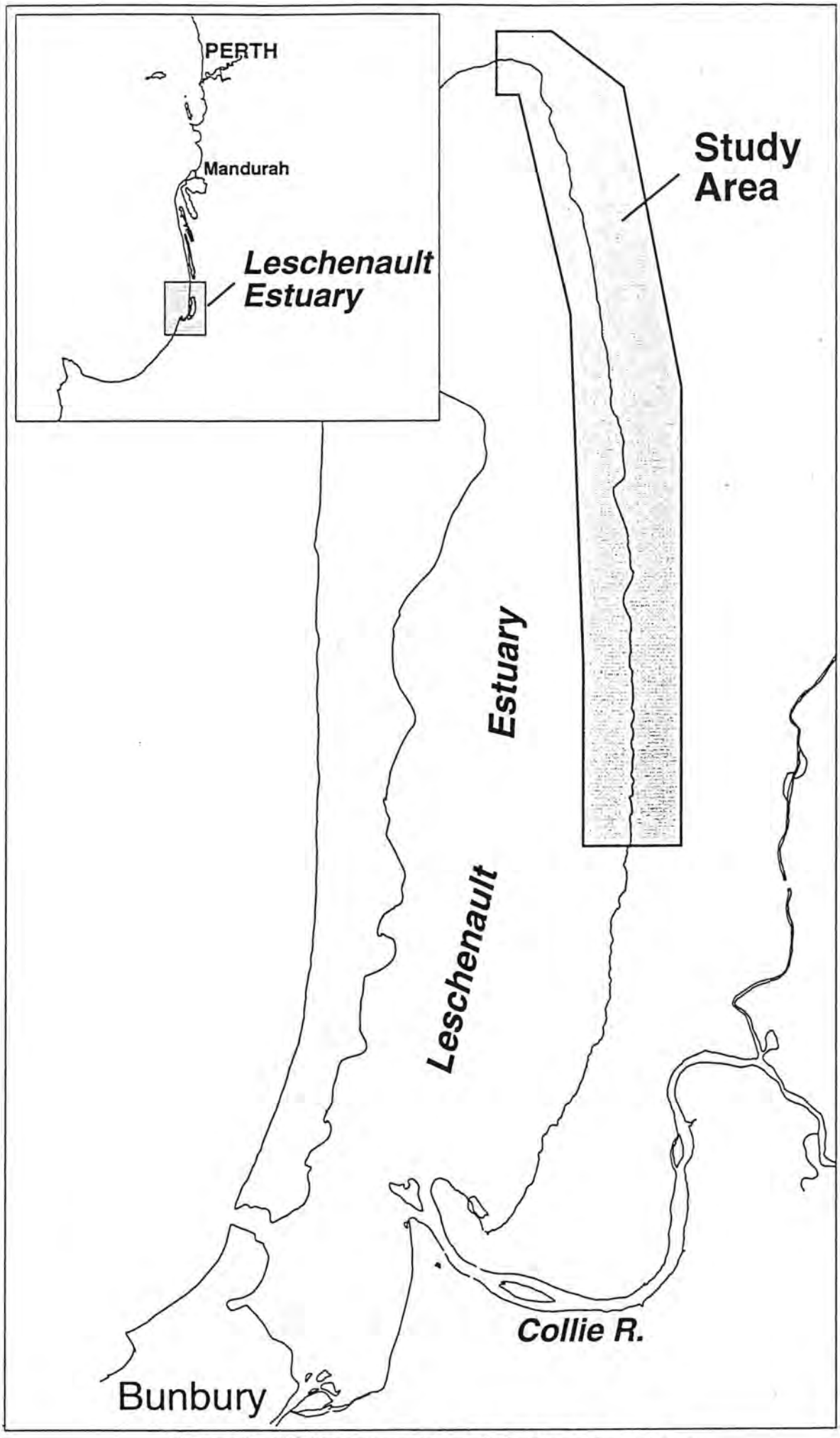

Figure 1 : Northern Leschenault Estuary Foreshore

4.2 Vegetation

A study by Pen (1992) identified twenty eight plant communities fringing the Leschenault Estuary. These communities are classified into salt marsh; fringing vegetation; fringing estuarine forest; freshwater; and sandy rise vegetation. Appendix 1 contains Figures A to F which illustrate these vegetation communities as detailed below.

4.2.1 Salt marsh vegetation

Salt marshes develop in areas which are saline either through continuous tidal inundation or as a result of tidal indundation followed by evaporation of water trapped on the marsh by a shoreline levee. Invertebrates remain in the salt marsh on the receding tide and provide food for birds and fish.

4.2.1.1 *Sarcocornia quinqueflora* salt marsh complex

Sarcocornia quinqueflora low closed herbland

This community is widely distributed around the Estuary and primarily takes the form of extensive mats of samphire *(Sarcocornia quinqueflora)*, either fringing the shoreline or behind a shoreline strip of shore rush (*Juncus kraussii* closed rushland).

The following species are also commonly associated with this vegetation community:

Suaedaaustrali	seablite
Frankenia pauciflora	seaheath
*Triglochin striata*streaked	arrow grass
*Samolus repens*creeping	brookweed
Halosarcia halocnemoide	annual beard grass
Polypogon monspeliensis	grass wort
Sporobolus virginicus	saltwater couch

Suaeda australis - Sarcocornia quinqueflora closed herbland

This community is very similar to the *S. quinqueflora* low closed herbland but is dominated by seablite (*Suaeda australis*).

Samolus repens - Sarcocornia quinqueflora closed herbland

In this community the small herb, *Samolus repens* dominates. This community fringes the *Sarcocornia quinqueflora* closed herbland.

Sarcocornia quinqueflora - Bolboschoenus caldwellii closed herbland

In a few sites, the seasonal sedge club rush (*B. caldwellii*) grows through samphire (*S. quinqueflora*) mats over winter and spring becoming dormant for the remainder of the year.

4.2.2 Fringing vegetation

Fringing vegetation consists of emergent species, that is, species which live more or less permanently in shallow water.

4.2.2.1 *Schoenoplectus validus* closed sedgeland

This tall weeping sedge, commonly referred to as lake club rush, reaches up to 2 metres in height, forming one small narrow monospecific stand near the north-eastern end of the Estuary (Figure B). A large area of *Melaleuca rhaphiophylla - Agonis flexuousa* pastured woodland is found on the central eastern foreshore from Australind Road to the base of the ridgeline (Figure C). This suggests that the *M. rhaphiophylla - A. flexuosa* low open-closed forest was once far more extensive along the Leschenault Estuary than it is today.

Plate 2: The narrow band of shore rush along the Estuary needs to be protected.

4.2.3 Fringing estuarine forest vegetation

Fringing estuarine forest, typically the small saltwater sheoak (*Casuarina obesa*), saltwater paperbark (*Melaleuca cuticularis*), paperbark (*M. viminea*) and swamp paperbark (*M. rhaphiophylla*), occurs where the groundwater level increases and salinity levels, although high at times of the year, are not extreme.

4.2.3.1 *Avicennia marina* isolated mangrove trees

The grey, or white, mangrove *Avicennia marina* forms large stands of fringing forest in the nearby Leschenault Inlet which was once part of the narrow channel connecting the Leschenault Estuary to the ocean. On the north eastern Estuary foreshore only isolated mangrove trees occur as illustrated in Figure C. These stands form the southern most mangrove colonies in Western Australia, the nearest being at the Abrohlos Islands.

4.2.3.2 *Melaleuca cuticularis* low open-closed forest

The small saltwater paperbark *Melaleuca cuticularis* is typically found on the saline soils bordering estuaries and along the Leschenault Estuary foreshore it is restricted mainly to the north eastern foreshore (Figures C and D). Here it forms long bands of forest mostly to the landward side of samphire flats or fringing rushes. The understorey consists mainly of the following species:

Juncuskraussii	shorerush
Halosarciaindicabidens	shrubby glasswort
Sarcocornia quinqueflora	samphire
Suaeda australis	seablite
*Sporobolus viginicus*saltwater	couch
Gahnia trifida	tufted coastal saw sedge

The introduced species wild aster (*Aster subulatus**[1]), marsh saltbush (*A. hastata**), couch (*Cynodon*

[1] Throughout the document * indicates an introduced species

*dactylon**), water couch (*Paspalum distichum**) and dock (*Rumex crispus**) are also often present.

Saltwater paperbark (*M. rhaphiophylla*) and saltwater sheoak (*Casuarina obesa*), and the golden wreath wattle (*Acacia saligna*) occur occasionally in the upperstorey.

4.2.3.3 Melaleuca rhaphiophylla - M. cuticularis low open forest

In one area near Crimp Crescent (Figure D) the small swamp paperbark (*M. rhaphiophylla*) shares the upperstorey with saltwater paperbark (*M. cuticularis*) forming a low open forest between shore rush (*J. kraussii*) and landward pasture. Understorey species are generally the same species as found in *M. cuticularis* low open-closed forest.

4.2.3.4 *Melaleuca viminea* low open-closed forest

In saline sandy areas adjacent to salt marsh or close to the foreshore, the small paperbark (*M. viminea*) forms a community with a number of salt marsh species which occupy the understorey. Shrubby glasswort *(Halosarcia indica bidens*), samphire (*Sarcocornia quinqueflora*), seablite (*Suaeda australis*), shore rush (*J. kraussii*), saltwater couch (*Sporobolus virginicus*) and occasional seaheath (*Frankenia pauciflora*) and coastal saw sedge (*Gahnia trifida*) are present. *M. viminea* low open-closed forest is found near Crimp Crescent (Figure D).

4.2.4 Freshwater vegetation

4.2.4.1 *Baumea juncea* sedgeland

the Twig rush (*B. juncea*) can be found on landward side of the shore rush (*J. kraussii)* closed sedgeland which intermittently fringes the Estuary shoreline from Cathedral Avenue to Point Douro. Only rarely does it form a band of sufficient depth to enable its recognition as a separate community. Twig rush (*B. juncea*) is found in low lying areas apparently prone to freshwater flushing. Such areas were probably favourable for clearing and pasture development in past years and as a consequence little of *B. juncea* closed sedgeland remains today.

4.2.4.2 *Melaleuca rhaphiophylla-Agonis flexuosa* low open-closed forest

M. rhaphiophylla - A. flexuosa low open-closed forest is found on either side of Cathedral Avenue in the vicinity of Crimp Crescent. This community is located either between high dry pasture, sandy rise vegetation or salt-marsh and water logged pasture (Figures C, D and E). This suggests a strong association with freshwater flushing. Native understorey species such as golden wreath wattle (*Acacia saligna*), mat grass (*Hemarthria uncinata*), jointed twig rush (*B. articulata*), common sword sedge (*Lepidosperma longitudinale*), the tall sedge (*L. angustatum)*, pale rush (*Juncus pallidus*) and twig rush (*B. juncea*) which are typical of freshwater conditions are present. Fringing estuarine species, including shore-rush (*J. kraussii*), knob sedge (*Carex inversa*) and coastal saw sedge (*Gahnia trifida*) are also present.

A number of freshwater weeds are present including bridal creeper *(Asparagus asparagoides**), soursob (*Oxalis pes-caprae**), kikuyu (*Pennisetum clandestinum**), an Iridaceae species, arum lily (*Zantedeschia aethiopica**) and buffalo grass (*Stenotaphrum secundatum**).

4.2.5 Sandy rise vegetation

4.2.5.1 *Acacia saligna* low closed forest

The golden wreath wattle (*Acacia saligna*) is common in parts of the study area. This community favours disturbed areas (particularly areas disturbed by fire). Golden wreath wattle has invaded and now dominates plant communities throughout the study area. In places these invasions are so severe that the species forms a low closed forest. The best example occurs just north of Crimp Crescent (Figure D).

4.2.5.2 *Juncus kraussii - Isolepis nodosa* low closed sedgeland

Knotted club rush (*Isolepis nodosa*) is often found on sand dunes or sandy rise areas to the landward side of the shore rush (*Juncus kraussii*) closed rushland. Along the foreshore, areas of native vegetation have been cleared and replaced with grassed recreation areas and as a consequence the *J. kraussii - I. nodosa* low closed sedgeland is often only present as a remnant narrow strip bordering these grassed areas (Figures D, E and F).

4.2.6 Other plant communities and vegetation types

4.2.6.1 Pastured woodlands

In some parts of the study area remnant trees from past stands of forest and woodland communities remain over parkland or pasture.

Plate 3: Shore rush and paperbarks stabilise the Estuary foreshore.

4.3 Fauna

4.3.1 Avian

Wykes, in his 1990 survey, found that the Leschenault Estuary supports over sixty species of wetland birds on its open waters and in its fringing tidal saltmarsh. The Estuary is the principal wetland of the Bunbury region with up to 5,000 birds present at a time. Breeding colonies of egrets, cormorants, darters, spoonbills and herons commute to the Estuary from nearby swamps; swans and ducks from the surrounding countryside seek refuge during summer drought; and trans-equatorial wading birds escape the northern winter on the shores around the river mouths. Wader numbers are not extensive but include eighteen species which are listed in the Japan-Australian and China-Australian Migratory Bird Agreements. Some species which regularly occur here are uncommon elsewhere. Species commonly seen in the area are listed below.

Great cormorant	*Phalacrocorax carbo*
Pied cormorant	*Phalacrocorax varius*
Little pied cormorant	*Phalacrocorax sulcirostris*
Little black cormorant	*Phalacrocorax sulcirostris*
Banded stilt	*Cladorhychus leucocephalus*
Black winged stilt	*Himantopus himantopus*
Black duck	*Anas supercilosa*
Australian shell duck	*Tadorna tadornoides*
Grey teal	*Anas gibberifrons*
Musk duck	*Biziura lobata*
Chestnut teal	*Anas castanea*
Black Swan	*Cygnus atratus*
Australian pelican	*Pelecanus conspicillatus*
Rufous night heron	*Nycticorax caledonicus*
White faced heron	*Ardea novaehollandiae*
Little egret	*Egretta garzetta*
Great egret	*Egretta alba*
Eurasian coot	*Fulica atra*
Pied oystercatcher	*Haematopus longirostris*
Silver gull	*Larus novaehollandiae*
Darter	*Anhinga melanogaster*
Sacred ibis	*Threskiornis eathiopica*
Straw necked ibis	*Threskiornis spinicollis*
Hoary-headed grebe	*Poliocephalus poliocephalus*

Red-kneed dotterel	*Erythrogonys cinctus*
Caspian tern	*Hydroprogne caspia*
Crested tern	*Sterna bergii*
Little Australian grebe	
Yellow billed spoonbill	*Platalea flavipes*
Sea eagle	*Haliaeetus leucogaster*
Maned woodduck	
Black shouldered kite	*Elanus notatus*
Whistling kite	*Haliastur sphenurus*
Australian kestrel	*Falcoenchroides*
Elegant parrot	*Neophema elegans*
Grass parrot	
Australian raven	*Corvus coronoides*
Dotterel	
Silver gull	*Larus novaehollandiae*
Pacific gull	*Larus pacificus*
Fairy tern	*Sterna nereis*
Kookaburra	*Dacelo novaeguineae*
Welcome swallow	*Hirundo neoxena*
Richards pipit	*Anthus novaeseelandiae*
Willy wagtail	*Rhipidura leucophrys*
Blackfaced cuckoo-shrike	*Coracina novaehollandiae*
Scarlet robin	*Petroica multicolor*
Grey fantail	*Rhipidura fuliginosa*
Splendid fairy wren	*Malurus splendens*
Silvereye	*Zosterops lateralis*
Mudlark	
Yellow rumped thornbill	*Acanthiza uropygialis*
Western thornbill	*Acanthiza inornata*
Dusky woodswallow	*Artamus cyanopterus*

4.3.2 Other fauna

Fauna in the study area is restricted mainly to waterbirds. Snakes, waterrats, lizards and kangaroos would be expected to be present however these have not been documented. Populations of feral animals such as foxes, rabbits and cats exist on the Leschenault Peninsula and would therefore be expected within the study area. CALM has a control programme for feral animals on the Peninsula. The foreshore vegetation is isolated and there are no vegetation corridors connecting the foreshore to the escarpment or Peninsula. These factors combined with the presence of feral predators is likely to reduce the abundance of native fauna other than waterbirds.

4.4 Hydrology and drainage

4.4.1 Estuarine hydrology

Water depth in the Estuary varies from 0.3m on the shallow sand flats on the eastern edge, to 2.0m in the central channel. Due to the shallow nature of the Estuary, water temperature is dictated by air temperature resulting in diurnal and seasonal changes. During summer the water temperature is about 25 ^{0}C and during winter it is approximately 14 ^{0} C.

The salinity of the Estuary changes seasonally and in accordance to the distance from the Cut. The northern section of the Estuary becomes hypersaline in summer due to limited tidal influence and the concentration of salts due to evaporation. In winter, rainfall and freshwater runoff from the rivers and drains dilute the water body and salinity levels decrease. The Parkfield Drain located at the northern end of the Estuary, in combination with drainage channels on the Estuary flats along Cathedral Avenue are the main sources of fresh water input into the northern section of the Leschenault Estuary.

4.4.2 Groundwater and surface water characteristics

In 1991 a geological survey was carried out to estimate the groundwater nutrient input into the Leschenault Estuary. Groundwater in the north eastern section of the Estuary was found to discharge into the fringing vegetation from springs occurring on the foreshore. For example, adjacent to Waterloo Head groundwater appears to be discharged from springs where waterbirds congregate. (Waterways Commission 1994).

Appleyard (1992) commented that it is likely that groundwater discharge on the eastern foreshore of the Leschenault Estuary is partially controlled by topography and the degree of urban development. A low, north-south trending scarp runs along the eastern side of the Estuary. In the north the distance between the scarp and the Estuary increases and a broad area of low lying, marshy land borders the Estuary. Groundwater rises to the surface in this area. The surface water then enters the Estuary via a series of small drains running along the foreshore.

4.5 Visual qualities

The study area consists of a narrow foreshore reserve bounded by fringing rush community to the west. The area is highly disturbed and artificial, yet remains attractive. Recreational facilities and amenities are provided along the foreshore which are poorly maintained and in many instances require replacement or repair. This area of foreshore is attractive with stunning views of the Estuary and bird life. and is reasonably free from rubbish.

Plate 4: The "cathedral" effect of the paperbark trees is a major attraction.

Leschenault Estuary and across the water, the Leschenault Peninsula. This provides an attractive view as the birds dart on and off glistening water, backed by an undulating, vegetated sand dune. This scenic view is popular with tourists and residents, and provides the perfect backdrop to a well used foreshore area.

To the east of the foreshore are housing developments, pasture land and the Leschenault escarpment. The housing developments are comfortably nestled into the escarpment background detracting little from the view. In summer the area dries out and vegetation coverage dies off. In the winter however, the grass is green and the area is flooded with pools of water, providing feeding grounds for wading and forest birds.

The Knapps Channel foreshore area is the only major vegetated area along the northern foreshore. The area is in need of rehabilitation, yet still provides a haven for numerous bird species. Although the area has few amenities it is regularly used by the local community. The area has a boat ramp and an open cooker for crabs. A number of old walking and vehicle tracks exist through fringing forest and salt marsh plant associations.
These tracks are well used and provide a community. Cathedral Avenue is a scenic alternative to the Old Coast Road. Shore and water birds are readily observed from quiet picnic spots amongst paperbarks and reeds, such as at Knapps Channel.

The road reserve at the top of Crimp Cresent hill provides a scenic viewing point of the northern Estuary.

The cathedral effect produced by the paperbark trees lining and overhanging the narrow road is a tourist attraction in itself and has heritage value.

4.6 Other studies

A number of other studies have been completed over recent years which have included the area currently under study.

The then Department of Conservation and Environment's *The Darling System - System 6* parts I and II (1983) list general and site specific recommendations for the management of conservation reserves of Western Australia. Section C66 of Part II lists six recommendations for management for the Leschenault Inlet referring to the area between Australind and the Indian Ocean, the area which is called the Leschenault Estuary in this report.

The report suggests that open space in the Leschenault Estuary area should be considered for inclusion in a Regional Park.

The Bunbury-Wellington Region Plan (1993), which details suggested land use for the region, notes that the Leschenault Estuary is likely to be subject to increasing pressure from human activity and therefore requires close monitoring and management.

The Cathedral Avenue Northern Estuary Planning Study is currently in draft form. The Study has now been incorporated into the Shire of Harvey's District Planning Scheme Number 1 which is being finalised by the Shire of Harvey.

5. LAND DEVELOPMENT AND USE

5.1 Land tenure and ownership

The study area is comprised of Reserves 43513, 36857, 36030 and 9722 all of which are vested with the Shire of Harvey for the purpose of Recreation or Public Recreation; Lots 116 and 152 and the Cathedral Avenue road reserve.

Reserves 9722 (1.7705 ha) and 36030 (0.3490 ha) are located immediately north and south of Elinor Bell Road. Reserve 43513 (0.9460 ha) is located north of Crimp Crescent while Reserve 36857 (5.5296 ha) is located south of this road.
Lots 116 and 152 (8.0495 ha) have been ceded free of cost to the Crown as part of the subdivision process.

Plate 5: Cathedral Avenue has been widened at the southern end.

5.2 Land zoning

Under the Shire of Harvey's Town Planning Scheme No 10, Reserves 43513, 36030, 9722 and Lots 152 and 116 are zoned for recreation. Reserve 36857 is currently zoned for General Farming.

The Shire's District Planning Scheme No 1 is currently in preparation. Under this scheme all the above reserves and the two lots will be zoned for Recreation.

5.3 Patterns of human use

The Leschenault Estuary is used throughout the year. The waters of the Estuary provide users with opportunities for fishing (both recreational and professional), crabbing, prawning, swimming, boating and windsurfing.

The foreshore area provides access to the water and recreational facilities. Within the study area, boat launching facilities are available at Dawes and Knapps Channels, while pedestrian and vehicle access is currently available at numerous locations along the foreshore. The large number of pedestrian and vehicle tracks from Cathedral Avenue to the water's edge are some indication of the demand this area must meet.

Along much of the foreshore, grassed areas regularly maintained by the Shire of Harvey, provide picnic and recreation sites. At many of these locations barbecues and crab cookers, picnic tables and rubbish bins are provided. Many of these facilities are in need of replacement or repair and additional facilities are required in some areas.

Cathedral Avenue is a recognised scenic drive providing attractive views across the Estuary to the Leschenault Peninsula and through the "cathedral" effect created by the paperbarks (*Melaleuca rhaphiophylla*). The construction of a "new" Cathedral Avenue has provided safe pedestrian access along the old roadway in some areas and on completion of the roadworks additional safe walking space will be provided. Rehabilitation and additional tree planting has been carried out in this area by the Leschenault Inlet Management Authority and the community to maintain, preserve and enhance this heritage listed area.

At low tide, wide expanses of sand flats are exposed which create an additional attraction to the area as it provides an interesting area in which to walk and observe the birdlife.

Horses are regularly exercised along the Estuary flats.

5.4 Cathedral Avenue road works

Cathedral Avenue is of regional significance, and is considered to have heritage value due to its unique overhanging paperbark trees, and the visual amenity of the surrounding area. The origin of the roadway is itself a factor, having been constructed with convict labour.

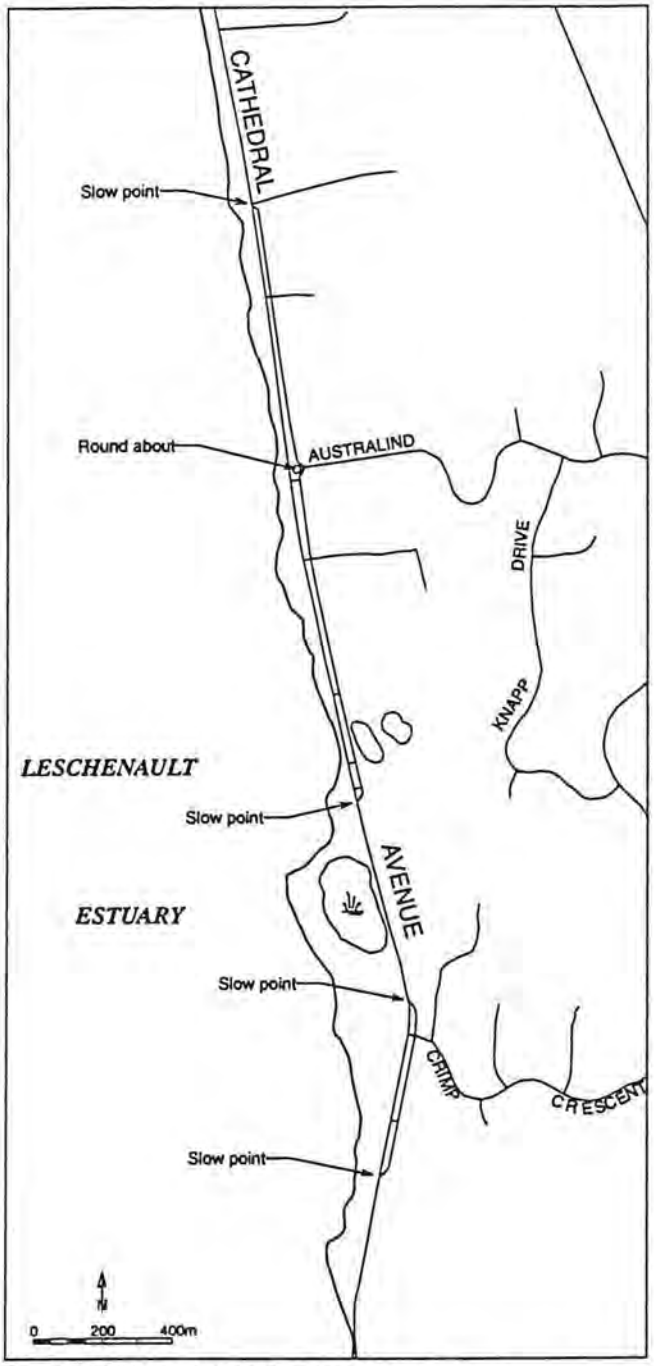

Fig 2.1 Existing Cathedral Ave Road Layout

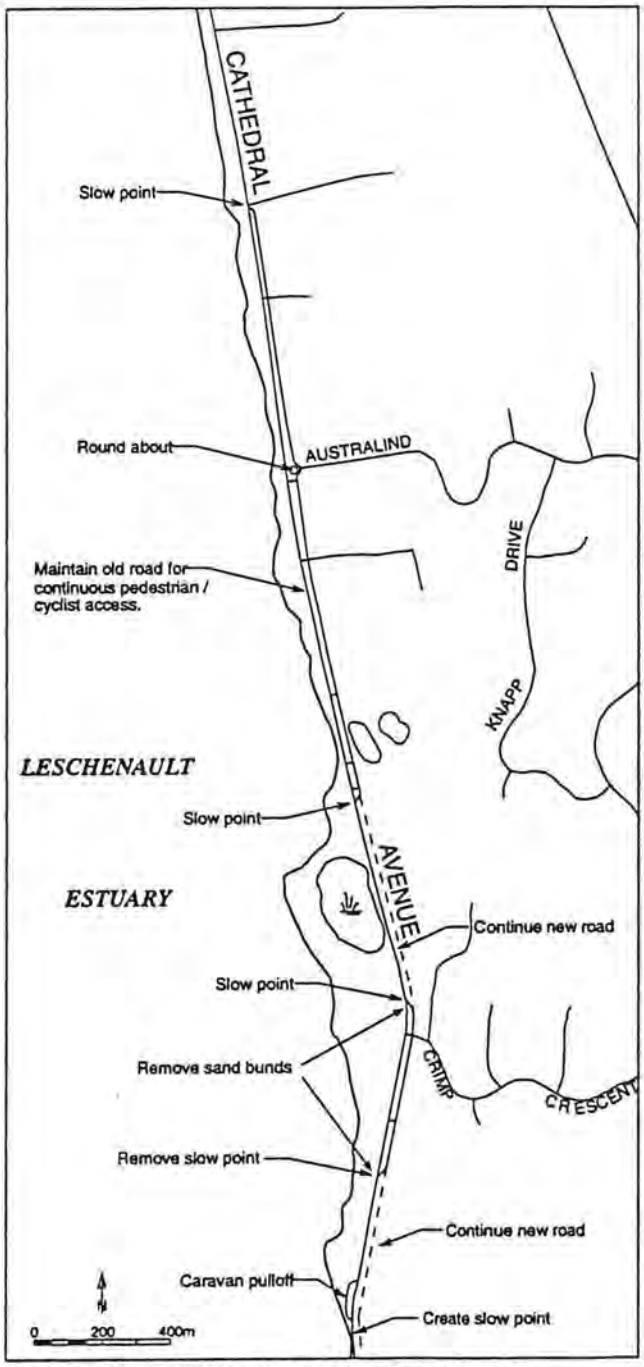

Fig 2.2 Proposed Cathedral Ave Road Layout

During the 1980s the Shire of Harvey and other planning authorities anticipated increased future use of the scenic drive and the Estuary foreshore through subdivision and development of surrounding land. Given the heritage value of the Cathedral Avenue roadway, it was agreed that a second carriageway should be constructed to the east of the old road as an alternative to upgrading the existing roadway which would require the removal of trees and understorey.

The construction of the eastern carriageway was funded by the developers of adjacent lots and constructed to a standard width. Parts of the eastern carriageway have not been completed because some of the lots have yet to be subdivided.

In 1992 the Shire Engineer took the initiative of designing a system of slow points to discourage through traffic and high speed driving. A public meeting was held to inform people of the proposed changes to the roadway, and allow public input into how the roadway would be developed. The public meeting broadly endorsed the Shire Engineer's proposal, with the proviso that the works be as unobtrusive as possible and not change the character of the area. The kerbed slow points just north and south of Crimp Crescent were to be temporary, pending the Taylor and Williams subdivisions. The southernmost slow point would later be shifted to the southern end of the paperbarks.

Early in 1993 five slow points were installed, with associated kerbing, hot mix paving, signage and mounds of sand blocking Scenic Drive and/or parts of the median strip. As clay and loam became available from other Shire works, it was deposited on the sand mounds for the purpose of enhancing growth of shrubs and trees to be planted on the mounds when they are extended and reshaped. At some points, gravel paths have been installed to permit pedestrians and cyclists access through the barriers on the western carriageway. The works have yet to be completed.

In 1993 a second public meeting was held to discuss the changes to the roadway. Documentation from this meeting is contained in Appendix 2. It was the feeling of those present at the meeting that the visual amenity of the area and the paperbark trees that form the cathedral effect along the road are extremely valuable and should be maintained and enhanced. It was felt that the best way to achieve this and provide safe motoring and pedestrian/cyclist access to the area was to construct two carriageways with several controlled access points. The eastern carriageway should be for through traffic while the western carriageway should be for sightseeing motorists, pedestrians and for access to the Leschenault Estuary foreshore. The meeting also recommended that the earth bunds which presently exist be replaced with barrier fencing.

Plate 6: Construction of the eastern carriageway for through traffic.

6. MANAGEMENT ISSUES

The following issues have been identified by the working group, and from public comments, for the management of the northern Estuary foreshore area.

- protection of wildlife habitats
- rubbish on the foreshore
- location of points for public access to the Estuary
- levels of public access
- control of public access
- control of weeds, introduced grasses and exotic plants
- control of mosquito breeding
- fire control
- provision of public facilities
- public education and information
- control of vandalism
- protection for vegetation
- suitable management structure for the foreshore area
- maintenance of foreshore and public facilities
- maintenance and enhancement of the 'Cathedral Avenue' vegetation
- monitoring levels of nutrients in groundwater seepage to the Estuary
- location, alignment and structure for the roadway comprising Scenic Drive and Cathedral Avenue
- erosion of foreshores - natural processes
- boat launching
- judicious use of signage

6.1 Northern foreshore

Areas of the northern Leschenault Estuary foreshore are in a generally poor condition with only fringe rush associations remaining in a natural state as there has been considerable invasion by weed and grass species. A number of walk and vehicle tracks have been created along the foreshore contributing to the disturbance of the natural vegetation.

Plate 7: There are a number of picnic areas on the narrow foreshore.

A variety of facilities and accessways to the water's edge are provided along the northern Estuary foreshore. Many of these facilities are degraded and in need of repair and the surrounding vegetation in need of rehabilitation as described below. Appendix 4 to 7 lists details of areas A to W shown in Figures 3.1, 3.2 and 3.3.

6.2 Vegetation status

Between 1941 and 1989 approximately 350 hectares of fringing vegetation was lost through clearing and drainage work, mainly at the north and south ends of the Estuary. Thurlow and Pen (1994) documented the degradation of vegetation, through invasion by introduced species, of the remaining native species. A summary of their findings on the northern Estuary area is listed in Table 1.

Table 1. Vegetation changes along the North-Eastern Leschenault Estuary Foreshore.

Changes	Location	Reason	Vegetation change	Solution
Clearing of fringing vegetation	North of Buffalo Road	Clearing and drainage for agriculture	Loss of samphire glasswort heath and fringing forests of paperbark and peppermint	
Decline of estuarine fringing vegetation	Crimp Crescent	Salinity rise caused by artificial drainage	Loss of shore rush and increase in samphire species	
Encroachment of shore rush into estuary	Eastern foreshore locations	Reduction in mean water level during winter as a result of the Cut	Shore rush growing into the estuary over samphire, beach sand or estuary bottom. 5-20m over 40 years	
Local infestations of *Acacia saligna* (orange wattle)	North - eastern foreshore	Favoured by frequent fires	So successful that it is developing its own fringing forest	Reduce risk of fire
Infestation of *Myrsiphyllum asparagoides* (bridal creeper)	North of Crimp Crescent	Seeds possibly spread from market gardens through drainage system	Abundant in the paperbark/peppermint forest. Can smother native shrubs and juvenile trees.	Remove by hand or spray with environmentally sensitive herbicide
Drainage network	North-eastern side of estuary north of Crimp Crescent	Increased salinity due to drainage water going straight into estuary rather than flushing	Fringing forest to saltmarsh, specifically shorerush to samphire. Current volume of drainage water is low so minimal impact	Clear drains of obstructions of weed and sediment to ensure water discharge is directly into the estuary. Plant native species along drains and in pasture areas to increase uptake of nutrients and stabilise drainage.

6.3 Vegetation conservation and rehabilitation

Future management of the Estuary and its foreshore needs to address the distribution of plant communities around the Estuary and to maintain representative stands of the various elements of fringing vegetation. Thurlow and Pen (1994) have compiled a list of suitable plant species for revegetation. A summary of this list is presented in Table 2.

Table 2. Vegetation Rehabilitation along the North-Eastern Leschenault Estaury Foreshore.

Area	Species	Common name
Immediate foreshore or beach	*Juncus kraussii* *Schoenoplectus validus** *Sacocornia quinqueflora* *Avicennia marina ** *Casuarina obesa*	shore rush lake shore rush samphire grey mangrove saltwater sheoak
Salt marsh often inundated by the tide and fringing the estuary waters	*Sarcocornia quinqueflora* *Suaeda australis* *Samolus repens* *Sporobolis virginicus* *Halosarcia halocnemoides* *Frankenia pauciflora*	samphire seablite creeping brookweed saltwater couch samphire glasswort seaheath
High salt-marsh only inundated at high tide but very saline	*Halosarcia halocnemoides* *Haloscaria indica bidens* *Halosarcia syncarpa ** *Sacrocornia blackiana ** *Melaleuca viminea*	samphire glasswort shrubby glasswort samphire paperbark
Landward periphery or saltwater - receiving freshwater input	*Juncus kraussii* *Gahnia trifida* *Melaleuca cuticularis*	shorerush saw sedge saltwater paperbark
Land adjacent to the saltmarsh or estuarine fringing forest - receiving considerable freshwater	*Melaleuca rhaphiophylla* *Agonis flexuosa* *Viminaria juncea* *Juncus kraussii* *Baumea juncea* *Lepidosperma longitidinale* *Lepidosperma gladiatum*	swamp paperbark peppermint golden spray shore rush bare twigrush common sword sedge coast sword sedge
Winter wet pastured floodplain - along Cathedral Avenue north of Crimp Crescent	*Melaleuca rhaphiophylla* *Melaleuca pressiana* *Agonis flexuosa*	swamp paperbark moonah paperbark peppermint
High pastured floodplain - north-east area cornered by Buffalo Road and Old Coast Road	*Eucalyptus gomphocephala* *Agonis linearifolora*	tuart swamp peppermint

6.4 Weed control

The spread of weed species on the foreshore area is a matter of serious concern. A large number of species have been identified in the study area including:

- bridle creeper *(Asparagus asparagoides*)*
- soursob (*Oxalis pes-caprae**)
- kikuyu (*Pennisetum clandestinum**)
- arum lily (*Zantedeschia aethiopica**)
- buffalo grass (*Stenotaphrum secundatum**)
- wild oats
- rye grass

- dock species
- cape weed
- clover species
- variety of introduced grasses

Verge maintenance costs can be considerably reduced by controlling weed species on the road side and along drainage lines. This can be achieved by a number of methods including careful chemical spraying to avoid damaging native vegetation, or manual removal. Revegetation between the old and new roads would limit the mowing required in this area and the opportunities for weed species which take advantage of gaps in the native vegetation.

Weed species are easily dispersed and there is therefore a need to control weed and exotic tree species in the vicinity to prevent their dispersal to the foreshore. Arum lilies and silky oak grow prolifically on the eastern side of Cathedral Avenue and should be controlled to prevent their further dispersal.

6.5 Fauna

The lack of native animals except birds is due to land clearing which has resulted in the fringing vegetation along the Estuary being cut off and isolated. To entice native fauna back into the area, a vegetation corridor needs to be established to provide a linkage to the vegetated escarpment. This however, may be impractical due to the difficulty of buying land back to enable the corridor to be established. Rehabilitation of the present vegetation will provide for additional bird habitats.

6.6 Mosquito control

The Draft Integrated Mosquito Control Strategy for the Leschenault Estuary Region, Western Australia (Chester and Klemm, 1990) clearly sets out the procedure for mosquito control in the area.

The aim of the strategy is to establish a programme for the control of health threatening mosquitoes that is cost-efficient, effective by health standards and sustainable, whilst maintaining the integrity of wetland systems. This strategy is comprised of a number of components:

1. Research into the ecology of Ross River virus and the mosquito breeding fluctuations;
2. Landuse planning to take into account potential mosquito problems before development occurs;
3. Education to ensure that preventative measures are taken by the public;
4. Monitoring of mosquito populations and the factors influencing them;
5. Larvicidal agents that kill larval mosquitoes before they emerge as adults and become a problem;
6. Source reduction, ie physical modification to reduce or eliminate breeding in some carefully selected areas.

Limiting vehicle access to the foreshore can assist in the control of mosquito populations by preventing the creation of wheel ruts which then fill with water providing a suitable mosquito breeding habitat.

6.7 Fire control

The large number of weed species contributes to the fire risk in the area. The control of these weeds through slashing and careful chemical spraying so as not to damage native flora is required to reduce this fire risk.

Annual inspections of the foreshore are required in conjunction with the Shire of Harvey, the Leschenault Inlet Management Authority, the Leschenault Volunteer Fire Brigade and the local community to determine what additional measures are required to minimise fire risk.

6.8 Boat launching

In 1982 the Leschenault Inlet Management Authority resolved that it would prohibit the further construction or maintenance of existing private channels in the Leschenault Estuary and that the Authority would accept responsibility for construction or maintenance of up to eight channels.

This policy means that no further channels are to be constructed in the Leschenault Estuary and as a consequence it is inappropriate for further boat launching areas to be designated.

Small boats such as dinghies may be launched by hand at a number of points along the Estuary.

7. RECOMMENDATIONS FOR MANAGEMENT

The following recommendations for management have been prepared by the Working Group after consideration of previously listed issues.

7.1 Land use and management

R1. Ensure the Cathedral Avenue road reserve and Reserves 43513, 36857, 36030 and 9722 are managed to protect and enhance wildlife values, and to provide recreation areas for both local and regional communities.

R2. Ensure recreational activities are in keeping with protection and enhancement of wildlife values.

R3. Involve the general community in the provision of resources for recommended works, and in seeking sponsorship and grant funding to assist with the works program and general maintenance.

R4. The Leschenault Progress Association be requested to participate in the management of the northern Leschenault Estuary foreshore reserves and in implementation of the recommendations from the management plan.

R5. Arrange for joint vesting of foreshore reserves within the study area between the Shire of Harvey and the Leschenault Inlet Management Authority and develop a formal management agreement for the resourcing of development and maintenance of the reserves.

7.2 Environmental

R6. Rehabilitate the paperbark trees along Cathedral Avenue to restore the 'cathedral' effect along the road reserve. Clean out bridal creeper, golden wreath wattle, and kikuyu and buffalo grasses from under and around paperbarks. Plant additional paperbark seedlings.

R7. Control weeds and introduced vegetation species along the road reserve by slashing, the careful and controlled use of chemical sprays and physical removal.

R8. Plant additional trees and understorey in areas shown on Figure 4.

R9. Convert existing soak (watering point) into a small wetland by creating appropriate side slopes, ground preparation and planting fringing and emergent vegetation.

R10. Remove litter, unnecessary fences and building rubble.

R11. Discourage pedestrian and vehicle access through rehabilitated areas by constructing barrier fencing.

R12. Mosquito control mechanims to be as per CLAG recommendations for this area and managed by the Shire of Harvey.

7.3 Recreational

R13. Prohibit camping on foreshore.

R14. Maintain public pedestrian and vehicle access to the Estuary flats as detailed on Figures 3.1, 3.2 and 3.3.

R15. Repair, replace and install additional barbecue and crab-cooker facilities as detailed on Figures 3.1, 3.2 and 3.3.

R16. Upgrade existing toilet facilities north of Australind Road and adjacent to Elinor Bell Road.

Plate 8: Remains of past agricultural activity are to be removed and grasses and weeds controlled.

R17. Construct toilet facility adjacent to caravan pulloff area in Section 1 as shown on Figures 4.

R18. Retain existing boundary fence along boundary between Cathedral Avenue and the wide foreshore area to control pedestrian and vehicle access to the foreshore reserves.

R19. Construct gazebo in Sections 1 and 3 as detailed on Figure 4.

R20. Erect barrier fencing to prevent further use of vehicle tracks in Sections 1, 2 and 3 as shown on Figure 4.

R21. Construct walktrail along Estuary foreshore as shown on Figure 4.

R22. Construct additional pedestrian access points to Estuary as shown on Figure 4.

R23. Construct boardwalk across drain/channel entry to the wetland in Section 3 as shown on Figure 4 to link the foreshore walk trail to the Knapps Channel area.

7.4 Other

7.4.1 Road and vehicle access

R24. Maintain existing boat launching access at Knapps Channel, Dawes Channel and adjacent to the caravan park.

R25. Discourage boat launching at all other foreshore locations except at designated dinghy/small boat launching areas.

R26. Construct and designate car parking areas as detailed on Figures 3.1, 3.2 and 3.3 and on Figure 4.

R27. Complete construction of caravan pulloff area at the entry to Section 1 on Figure 4.

R28. Discourage vehicle access and parking in non-designated areas using barrier fencing as detailed on Figures 3.1, 3.2 and 3.3.

R29. Complete roadworks along Cathedral Avenue as detailed in Figures 2.1 and 2.2. Provide

continuous dual use path by connecting sections of old road surface. Resurface the old road to make it more suitable for cycle use. Install vehicle slowing devices and road restrictions on the old road to control vehicle speeds.

R30. Complete new, high road for through traffic, with slow points to reduce overall speed.

R31. Maintain old road as vehicle access and scenic drive with priority to pedestrians and cyclists.

R32. Review road alignments after final arrangements are in place to determine whether there is a need to close the low road to through traffic and maintain the road for pedestrians and cyclists and for vehicle access to foreshore areas.

R33. Block off vehicle tracks through shore rush as indicated on Figure 4.

R34. Provide access and parking at selected points for vehicles towing horse floats.

7.4.2 Site interpretation

R36. Provide interpretive shelter at Section 1 as shown on Figure 4.

7.4.3 Fire control

R37 Slashing and chemical control of weeds along the foreshore.

R38 Annual fire control inspection by representatives of the Shire of Harvey, the Leschenault Inlet Management Authority and the local community to determine other measures required.

8. REVIEW OF PUBLIC CONSULTATION

Comments and suggestions received during the public consultation period have been reviewed by the working group. A summary of the submissions received is contained in Appendix 3.

9. IMPLEMENTATION

9.1 Funding and management responsibilities

The Shire of Harvey as the authority with vesting of the reserves is responsible for the day to day management and maintenance of the area and also manages the Cathedral Avenue road reserve. The Shire has support from LIMA for works associated with the Estuary, the Estuary foreshore and fringing vegetation.

It has been recognised however, that funding for general works and maintenance by government departments and local authorities is decreasing and that significant community input will be required in order to implement all of the recommendations.

The community can assist with construction and maintenance through direct sponsorship; provision of equipment, materials or labour, and by seeking state and federal government grants for community based programs or environmental programs. Individuals within the community are welcome to approach the Shire with suggestions on how they may assist.

9.2 Implementation schedule

The recommendations developed in the management plan will be implemented over a five year period, subject to sufficient funding and resources being available from managing authorities or the community.

July 1997 - June 1998

- Remove bridal creeper, golden wreath wattle (*Acacia saligna*), kikuyu and buffalo grass from under and around paperbarks.
- Plant additional paperbarks.
- Remove and control grasses and other introduced species along road verge with chemical spraying, slashing and manual removal.
- Prohibit camping on the foreshore and erect signage to this effect.
- Remove litter, unnecessary fencing and building rubble.
- Implement appropriate mosquito control measures.
- Foreshore inspection with representatives of the Shire of Harvey, LIMA, the local fire brigade and members of the community to determine appropriate fire control measures.
- Maintain existing boat launching access at Knapps Channel, Dawes Channel and adjacent to the caravan park.
- Discourage boat launching at all other foreshore locations except at designated dinghy/small boat launching areas.
- Complete construction of caravan pulloff area.
- Additional tree and understory planting.
- Liaise with the Leschenault Progress Association regarding assistance with the management of the northern Leschenault Estuary foreshore reserves and in implementation of the recommendations from the management plan.
- Liaise with the Shire of Harvey and the Department of Land Administration (DOLA) to establish joint vesting of the reserves.

July 1998 - June 1999

- Complete roadworks along Cathedral Avenue.
- Complete new, eastern road for through traffic, with slow points to reduce overall speed.
- Maintain old road as vehicle access and scenic drive with priority to pedestrians and cyclists.
- Provide continuous dual use path access by connecting sections of old road surface. The road should be resealed to make it more suitable for vehicle and cycle use.
- Install vehicle slowing devices and road restrictions on the old road to slow traffic.
- Upgrade existing toilet facilities north of Australind Road and adjacent to Elinor Bell Road.
- Construct walk and cycle trails along Estuary foreshore.
- Construct boardwalk across channel entry to wetland.
- Construct gazebo.
- Erect barrier fencing to prevent further use of inappropriate vehicle and pedestrian tracks and to discourage parking in non-designated areas.
- Foreshore inspection with representatives of the Shire of Harvey, LIMA, the local fire brigade and

members of the community to determine appropriate fire control measures.

- Remove and control grasses and other introduced species along road verge with chemical spraying, slashing and manual removal.
- Maintain existing boat launching access at Knapps Channel, Dawes Channel and adjacent to the caravan park.
- Repair or replace existing barbecues and crab-cookers or install new facilities where required.
- Convert existing soak into a small wetland.
- Additional tree and understorey planting.

July 1999 - June 2000

- Construct and designate car parking and horse-trailer parking areas.
- Construct additional Estuary access points.
- Foreshore inspection with representatives of the Shire of Harvey, LIMA, the local fire brigade and members of the community to determine appropriate fire control measures.
- Remove and control grasses and other introduced species along road verge with chemical spraying, slashing and manual removal.
- Maintain existing boat launching access at Knapps Channel, Dawes Channel and adjacent to the caravan park.
- Additional tree and understorey planting.

July 2000 - June 2001

- Foreshore inspection with representatives of the Shire of Harvey, LIMA, the local fire brigade and members of the community to determine appropriate fire control measures.
- Maintain existing boat launching access at Knapps Channel, Dawes Channel and adjacent to the caravan park.
- Construct toilet facility adjacent to caravan pulloff area.
- Additional tree and understorey planting
- Remove and control grasses and other introduced species along road verge with chemical spraying, slashing and manual removal.

July 2001 - June 2002

- Foreshore inspection with representatives of the Shire of Harvey, LIMA, the local fire brigade and members of the community to determine appropriate fire control measures.
- Remove and control grasses and other introduced species along road verge with chemical spraying, slashing and manual removal.
- Maintain existing boat launching access at Knapps Channel, Dawes Channel and adjacent to the caravan park.
- Review Cathedral Avenue road alignment after final arrangements have been completed to determine whether there is a need to close the western roadway to through traffic and maintain the road the for pedestrians, cyclists and for vehicle access to foreshore areas.
- Additional tree and understorey planting.

10. REVIEW OF MANAGEMENT PLAN

The management plan is to be reviewed and revised after five years. This process will include further public consultation and review of existing recommendations and implementation progress.

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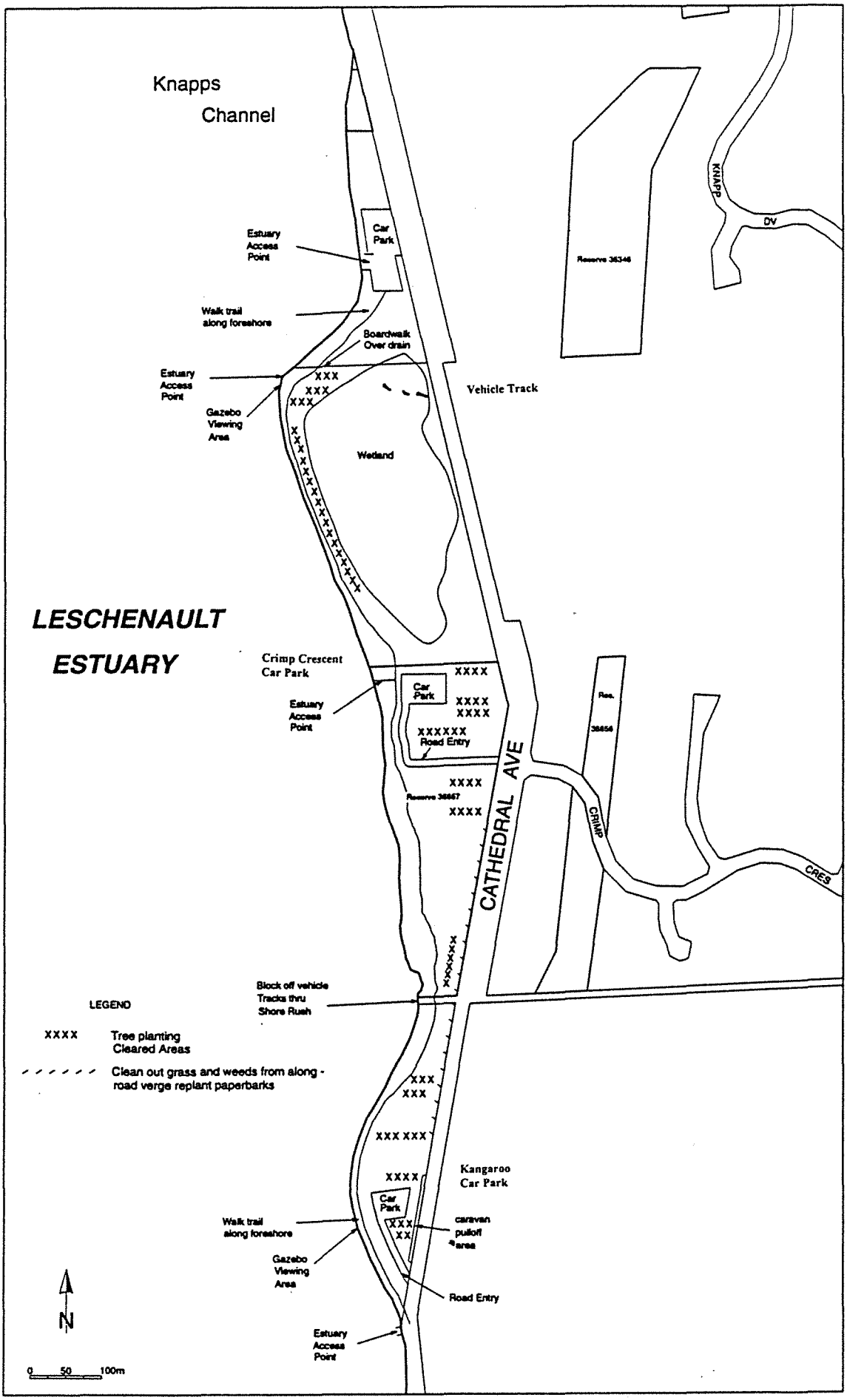
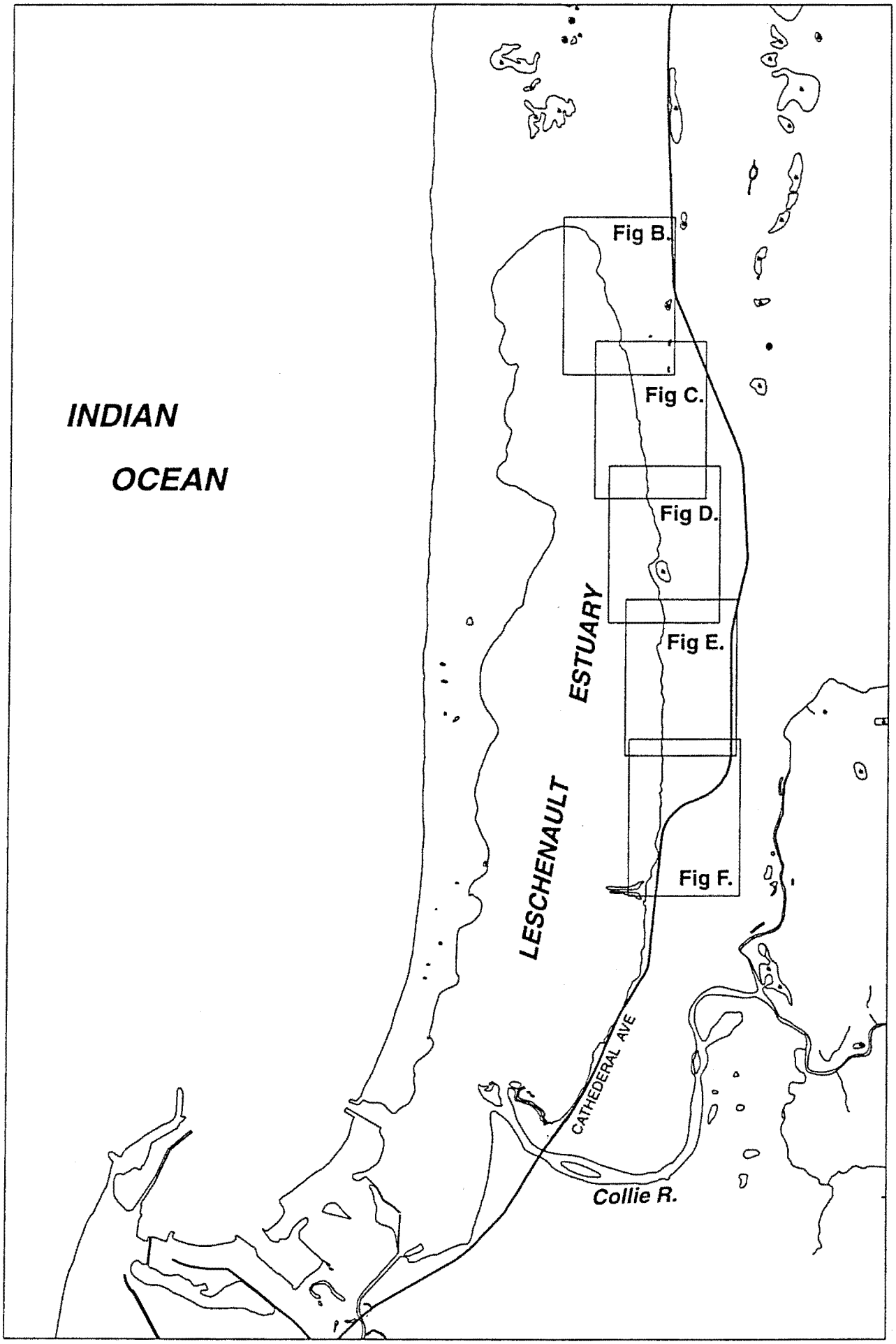
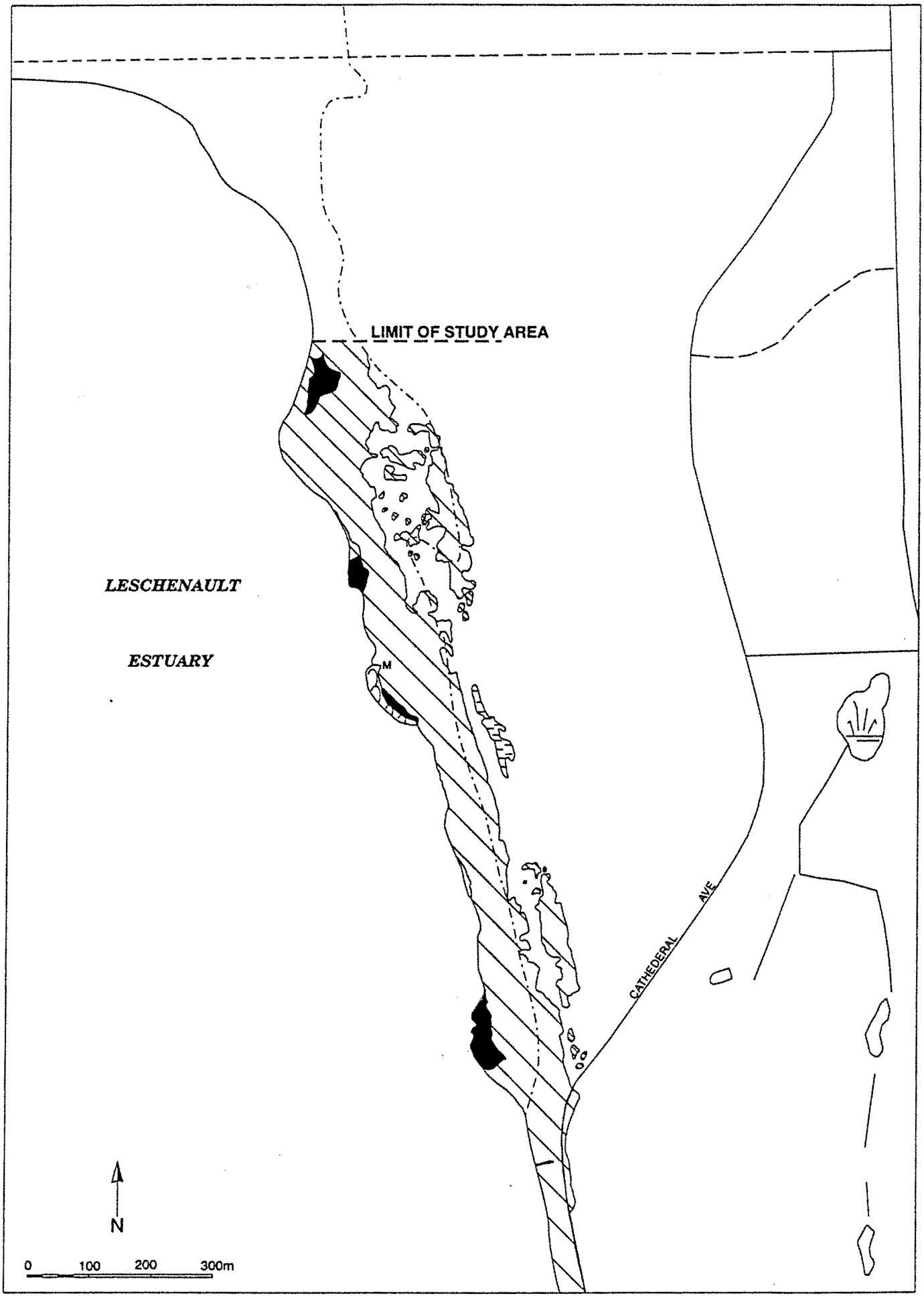


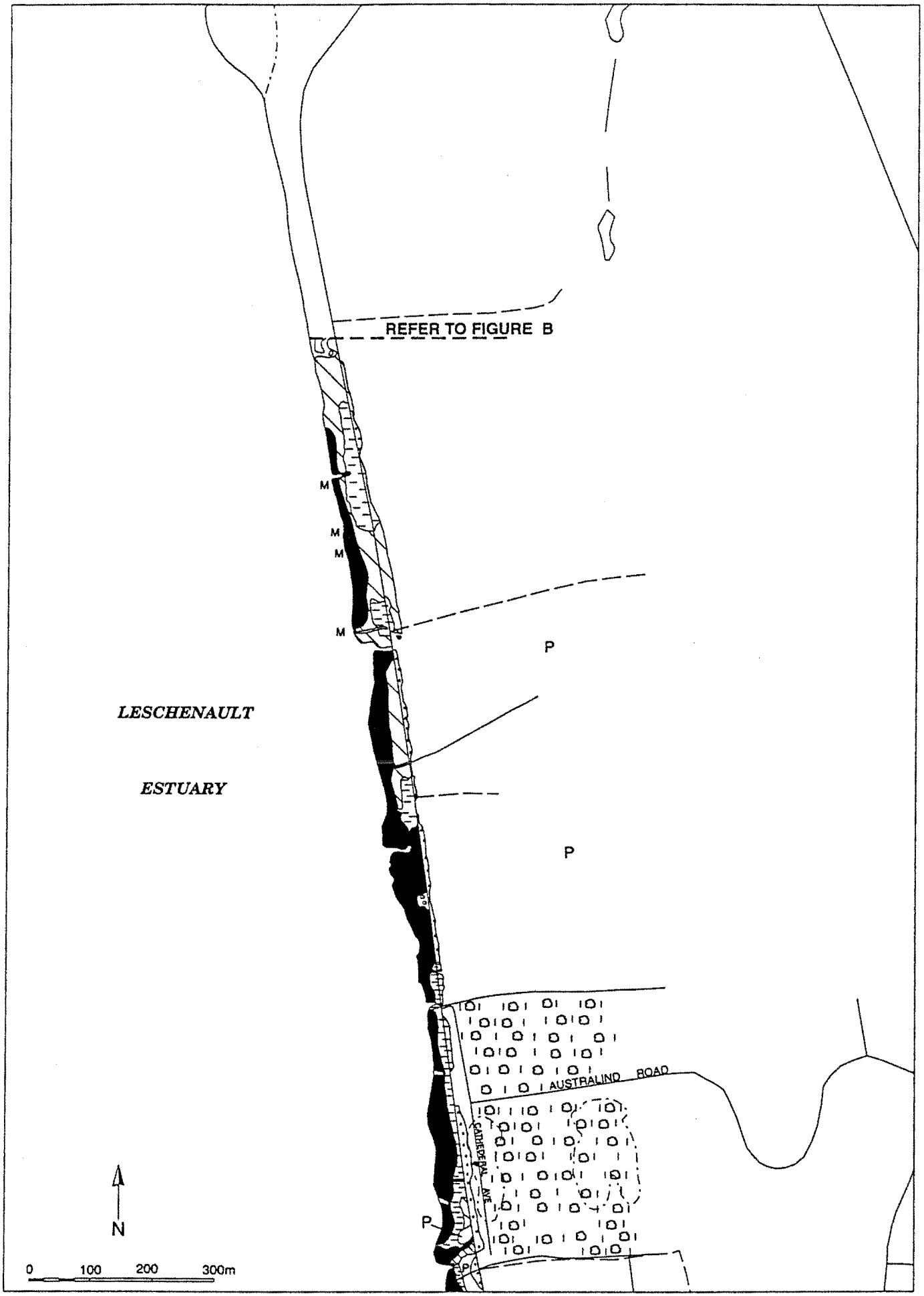
Figure 4 : Northern Leschenault Estuary Foreshore Draft



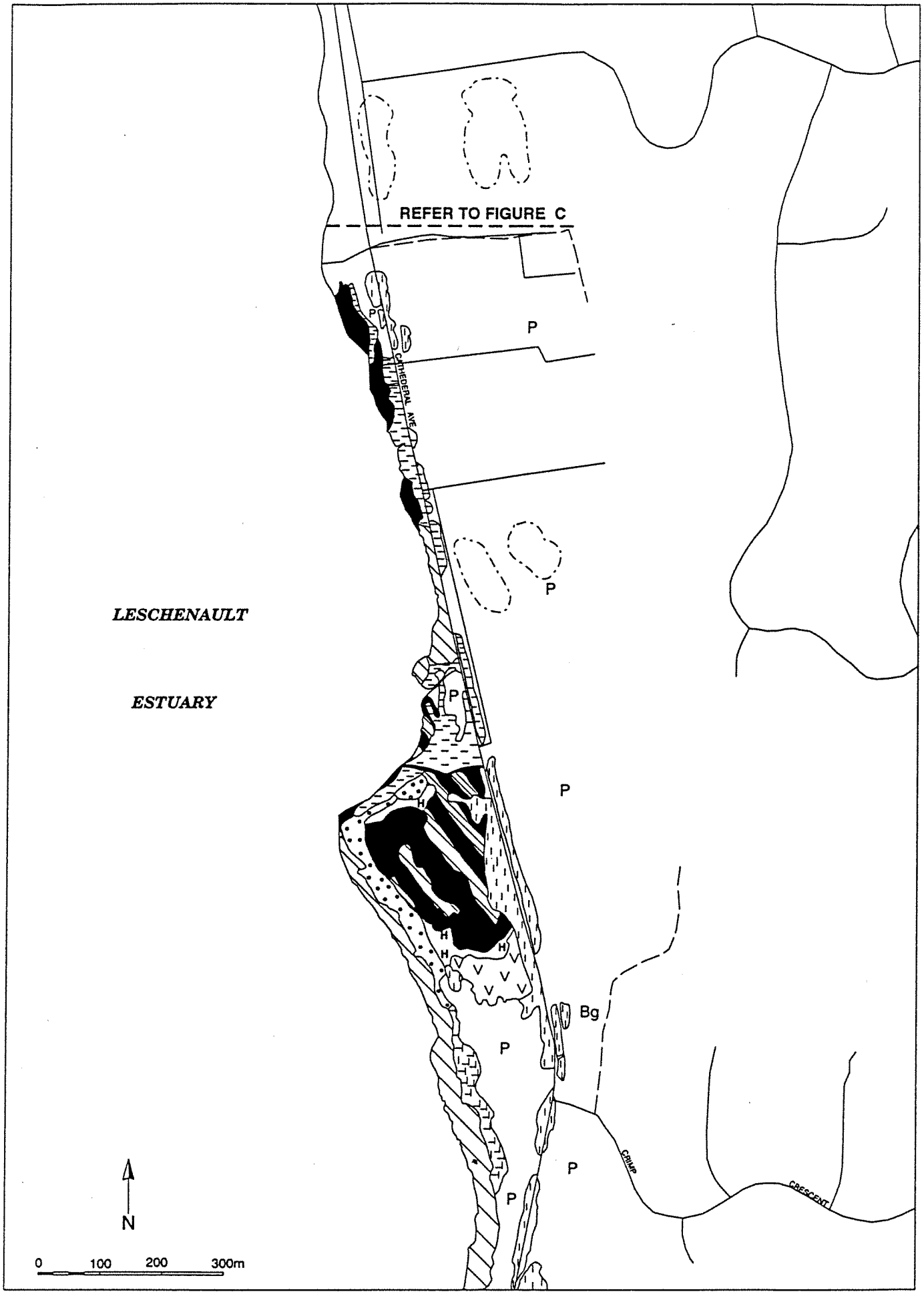
Appendix 1, Figure A : Overview of vegetation maps.



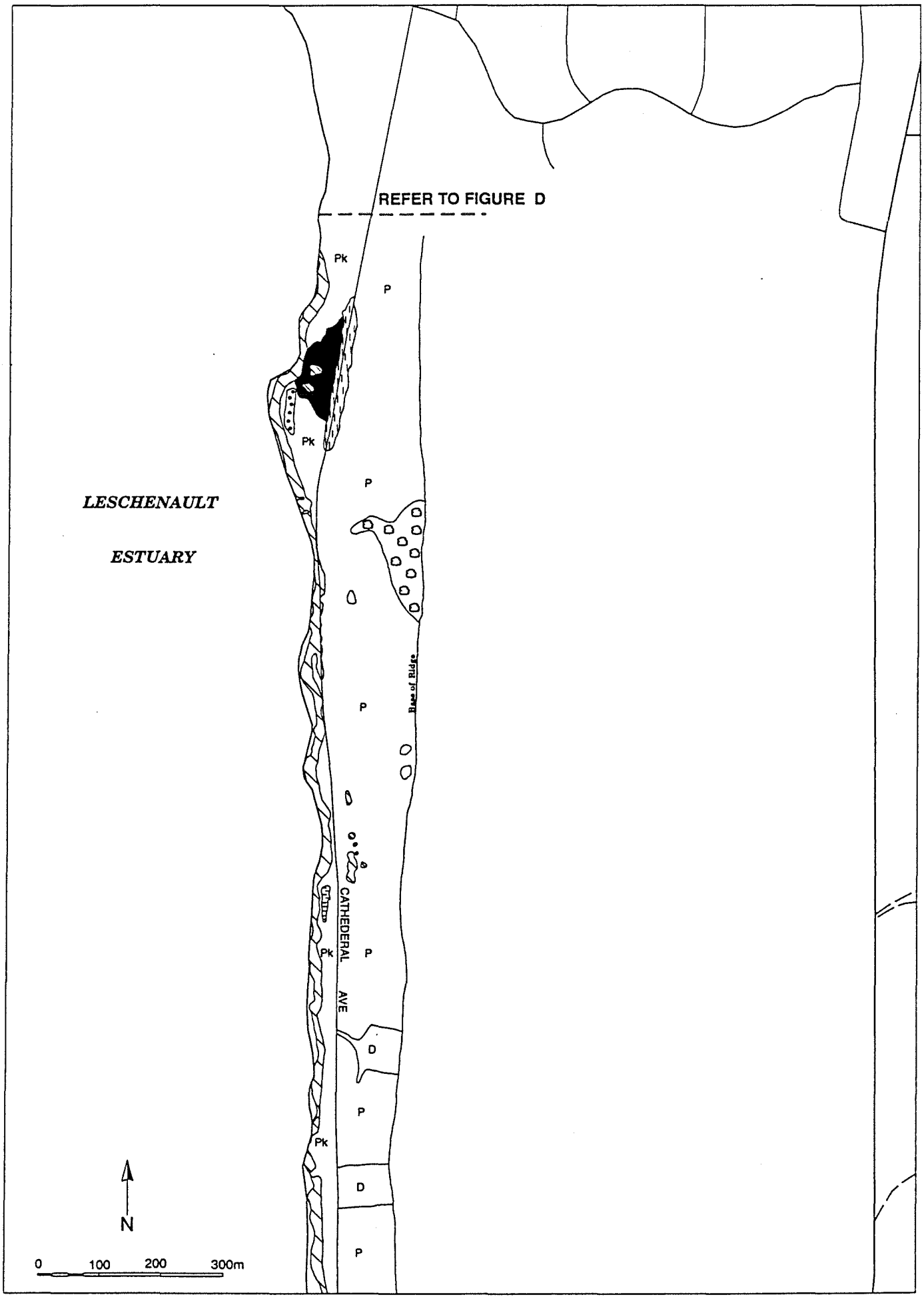
Appendix 1, Figure B : Northern Leschenault Estuary Foreshore Vegetation



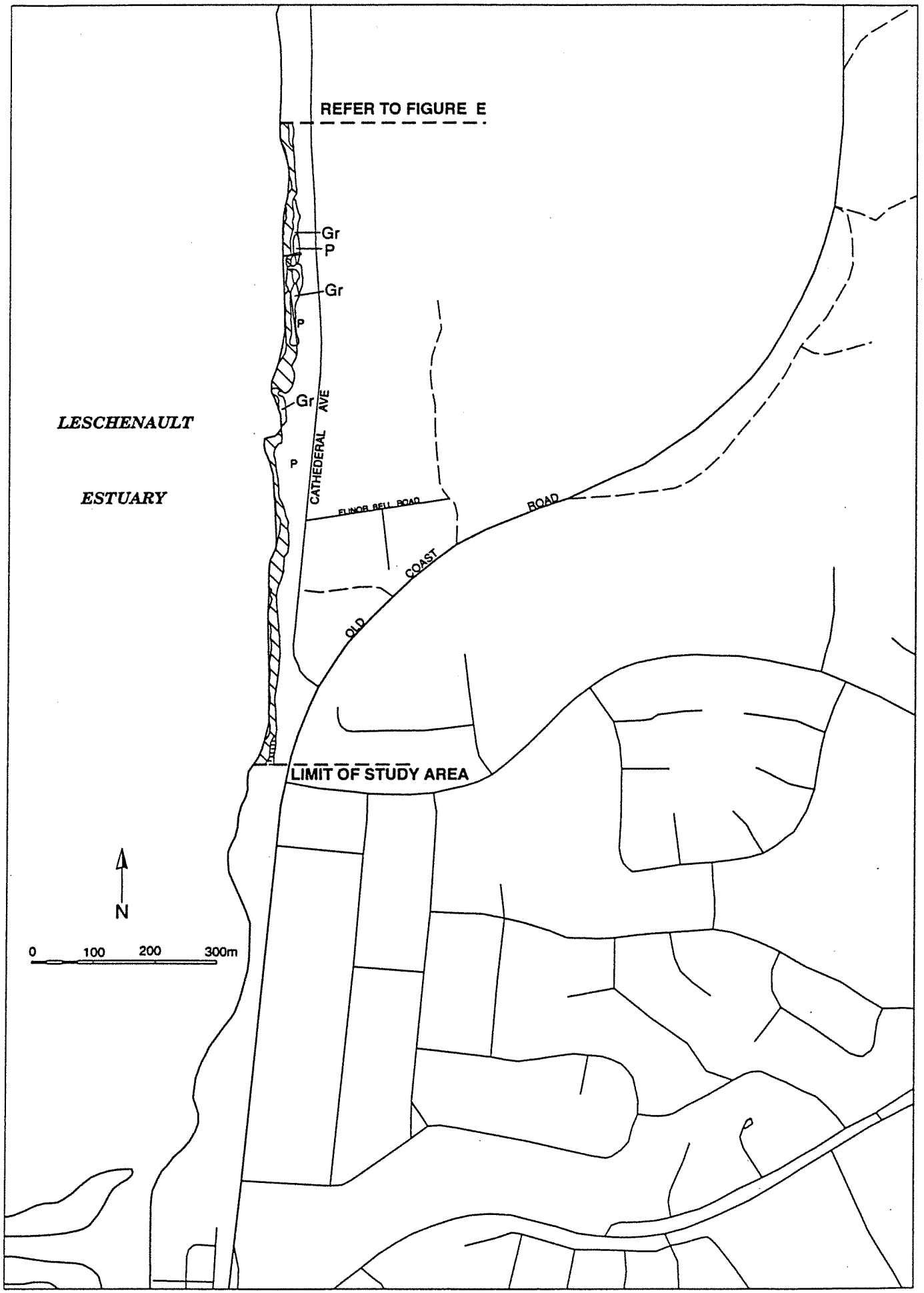
Appendix 1, Figure C : Northern Leschenault Estuary Foreshore Vegetation



Appendix 1, Figure D : Northern Leschenault Estuary Foreshore Vegetation



Appendix 1, Figure E : Northern Leschenault Estuary Foreshore Vegetation



Appendix 1, Figure F : Northern Leschenault Estuary Foreshore Vegetation

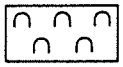
LEGEND

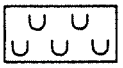
Northern Leschenault Estuary Vegetation

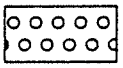
Salt-marsh vegetation


Juncus kraussii (closed sedgeland)

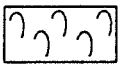

Sarcocornia quinqueflora
(salt marsh complex)


Frankenia pauciflora - S. quinqueflora
(low closed heath)


Halosarcia halocnemoides
(low open heath)

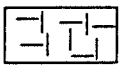

Halosarcia indica bidens
(low open heath)

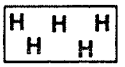
Fringing vegetation


Schoenoplectus validus
(closed sedgeland)

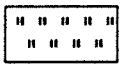
Estuarine fringing forest


Melaleuca cuticularis
(low open - closed forest)


Melaleuca rhaphiophylla - M. cuticularis
(low open forest)


Melaleuca viminea
(low open-closed forest)

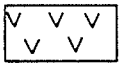
Freshwater vegetation


Melaleuca rhaphiophylla
(low open-closed forest)


Melaleuca rhaphiophylla - Agonis flexuosa
(low open-closed forest)

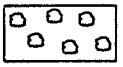
Sandy Rise Vegetation


Jacksonia furcellata
(open - closed forest)


Acacia saligna
(low closed forest)

Other plant communities


Melaleuca rhaphiophylla - A. flexuosa
(pastured woodland)


Agonis flexuosa
(pastured woodland)

Symbols

M	*Avicennia marina*	mangrove
Bg	Bare ground	
P	Pasture	
Pk	Parkland	
Gr	Scattered grasses	

APPENDIX 2

Cathedral Avenue Community WorkshopReport

BACKGROUND INFORMATION SUPPLIED TO PARTICIPANTS

Cathedral Avenue itself is of regional significance because of its unique overhanging paperbark trees, the quietness of the area, and the outlook on the estuary to one side and "rural" landscape to the other side (with open paddocks, livestock, grazing kangaroos, ducks and other birdlife, and trees). The origin of the roadway is itself a factor, having been constructed with convict labour. In a world that is rapidly changing, with expanding population and urban development, areas such as Cathedral Avenue become even more precious because they are relatively unchanging.

Early 1980's: Expecting increased future use of the Scenic Drive and estuary foreshore, the Harvey Shire and other planning authorities agreed that a condition of subdivision of the lots between the Scenic Drive and Old Coast Road should be the acquisition of land along the western boundary for construction of a second carriageway. One of the advisers involved at the time has said that the new carriageway was developed to allow the old one to be used for walking, cycling and parking, given that it would not be acceptable to widen it for increased motor vehicle traffic.

The eastern carriageway was funded by the developers of respective lots and constructed to a standard width. Parts of the eastern carriageway have not been completed because some of the lots have not yet been subdivided (eg. Taylor and Williams properties south and north of Crimp Crescent respectively).

A consequence of the new wide road, and of increased numbers of people visiting Buffalo Beach, has been *more high speed traffic* along Scenic Drive.

In 1992 the Shire Engineer took the initiative of designing a system of slow points to discourage through traffic and high speed driving. He invited Leschenault Environmental Study Group to convene a public meeting at which he could consult with residents about his plans. All residents in the area between Old Coast Road and Scenic Drive were letterboxed advising of this meeting. It was attended by 22 people, who broadly endorsed the Shire Engineer's proposal, with the caveat that the works should be as unobtrusive as possible, not changing the character of the area. The

kerbed slow points just north and south of Crimp Crescent were to be temporary, pending the Taylor and Williams subdivisions. The southernmost slow point would later be shifted to the southern end of the paperbarks.

A second meeting was held a week later, with a similar conclusion.

Early in 1993 five slow points were installed, with associated kerbing, hot mix paving, signage and prominent mounds of yellow sand blocking Scenic Drive and/or parts of the median strip. This was done at a cost of well over $20,000 to the Shire. Subsequently, as clay/loam became available from other Shire works, it was deposited on the sand mounds for the purpose of enhancing growth of shrubs and trees to be planted on the mounds, after they are extended and reshaped. At some points, gravel paths have been installed to permit pedestrians and cyclists access through the barriers on the western carriageway. The works have yet to be completed to the design which the Shire Engineer has in mind.

Many of us feel the work completed to date has spoiled the amenity of the drive. A number of us have expressed anger and sadness over the loss of a treasured view of overhanging trees as we drive/ride/walk along Scenic Drive (especially the section south of Crimp Crescent), and displeasure over the visual impact of the work to date.

I think it is fair to say that some of us who were consulted in 1992 did not envisage the reality of the mounds as providing such a stark barrier across the western carriageway, and blocking entry to the western carriageway at the foot of Crimp Crescent and Australind Road.

In late May the Shire Engineer informally invited the Leschenault Environmental Study Group to suggest which species it would prefer to see planted on the mounds. He had in mind some fast-growing colourful shrubs, rather than simply paperbarks. At our request, he has kindly agreed to widen the consultation beyond plant selection, hence the planned workshop.

Maps of the area will be brought to the workshop.

Peter Eckersley, 21 July 1993

Arrangements

The public were invited to participate in the workshop by distributing a notice to all letter boxes in the area bound by Old Coast Road on the east and Scenic Drive on the west, and by a media release used by both local radio and newspaper. The workshop was held in Australind Community Centre on Saturday 31 July 1993 and was attended by 24 people.

Introduction

Councillor Peter Eckersley welcomed participants and pointed out the name stickers and attendance sheet for participants to complete.

Before introducing the Chairman Greg Sawyer he suggested that, while the past could not be undone, we can make the future. He was pleased that a good many people had come along.

Shire action - past and planned

Shire Engineer Charles Lockwood outlined the history of development in the area.

The dual carriageway between Knapps Channel and Australind Road was not effective because some motorists used sections of the *low* (old) *road* to travel in either direction. There were several accidents and near misses along both this and the section of road near Crimp Crescent. Thus safety concerns were the primary reason for the present arrangement.

The southernmost slow point was planned to be moved to the southern end of the paperbarks when the Taylor property subdivision proceeds, at which time the western edge of the property would be used for extended construction of the *high road* (eastern carriageway).

Similarly, when the Williams property subdivision proceeds, the slow point just north of Crimp Crescent would be moved further north to a point just south of the present slow point near Knapps Channel.

This double slow point would be needed to slow traffic on the high road. Otherwise, in the rural ambience and with a wide straight road, drivers would expect to drive at high speed. In these circumstances the Main Roads Department policy is for the road to be 'unrestricted', meaning that they would not permit the imposition of speed limits.

The mounds of soil have been installed to ensure that motorists do not see oncoming headlights at night and mistakenly assume that the road continues along its old course. These mounds have been constructed at lowest possible cost to the Shire, by staging to use earth removed for other work at Harvey. He would like to know what species to use for planting up the mounds when they have been fully extended as planned.

LIMA vision

Senior Environmental Officer Eric Wright outlined Leschenault Inlet Management Authority's vision for the area. LIMA has been concerned for several years that current and past management practice has led to the degradation of vegetation along the Cathedral Avenue.

Regular burning of bush areas and road verges has prevented young paperbarks from propagating and replacing older trees. Many old trees along the main cathedral part of the Cathedral Avenue had been badly damaged by fire. The centre of the main trunks had been burnt out.

Cathedral Avenue has significant historic and landscape values, and has been given heritage listing with the Heritage Council. After seeking approval from the Shire of Harvey, LIMA resolved to embark on a long term program to regenerate the paperbarks and the cathedral effect of the roadway.

Two years ago LIMA started replanting paperbarks along the road verge, and in the island verge between the two roads in the main section. The plantings were being maintained by LIMA staff and community service workers, by keeping down grass and weeds from around the plantings. The Shire of Harvey has used small tractors to slash grass and weeds along the open areas of the road verge.

The Leschenault Environmental Study Group has also planted trees along the road verge and estuary foreshore area, and maintained plantings.

LIMA would like to see revegetation work maintained by LIMA and Shire of Harvey occasional staff, combined with community service workers, and the efforts of volunteer community groups. With local authority and department resources being stretched, volunteer community groups and community service workers will need to play an increasing role in the maintenance of these important conservation and recreation areas.

Workshop Session

The meeting split up into four groups of about six people each. Each group was assigned the task of addressing 8 questions, and adding any further issues or comments.

Question 1.

What should be the road's function?
Group 1

For access to the estuary. For use as a scenic drive. For access to Belvedere. Limited access for heavy vehicles. The major access to the scarp (residential areas) should be from the east.

Group 2

transport
sightseeing (visual attraction)
safety
access by residents
preservation of tree avenue (cathedral effect)

Group 3

For recreational access. To allow public appreciation of the natural amenity of the area. To enjoy the estuary vista. For full and open public access. Commuting should run a long last.

Group 4

Provide access to the estuary for passive recreation in a safe and aesthetically pleasing way. Providing a limited access for Leschenault residents (commuting?) whilst having a safe walking and cycling low road with vehicular access only restricted to about 20 kph.

Question 2.

How should it be designed to achieve this?

Group 1
Need to slow down the through traffic so it takes longer to go through than around. Use of garden islands. Narrow roads with passing bays.
Group 2

speed limits, rumble strips, humps, slow points
road separation - two separate carriageways for separate functions

Group 3

The narrow low road should be a safe pedestrian and cyclist access. Possibly one way to avoid the passing of vehicles which push into the vegetation on the road verge, and leaves no room for pedestrians or cyclists. Reduce the size of the mounds to preserve the view up the road of the paperbarks overhanging the roadway. Leave just enough soil for landscaping.

The low road could have short sections where vehicles enter at one end and exit at the other end, and then have other short sections along the road.

Group 4

Different colour road. Paving speed humps. Remove or relocate mounds. Need to maintain the see clear area at end of tunnel.

Question 3.

What other values are important?
Group 1

Retain the scenic beauty of the paperbark trees. Maintain access to the paperbarks.

Group 2

access to water
walking space
forward planning

Group 3

Did not address directly.

Group 4

Did not address directly.

Question 4.

How can the road design complement these?
Group 1

Move the piles of sand. Replace with a low fence.

Group 2

widen both roads and make dual carriageway all the way
take down some of the signs
landscape nicely
take out the roundabout at the foot of Australind Road

Group 3
Did not address directly.

Group 4

Consideration should be given to only having access to the Cathedral Avenue road from the extreme north and south, and block off Crimp Crescent and Australind Road.

Question 5.

What do you most like about Cathedral Avenue?
Group 1

The rural aspect of the area. With due care it has the potential to be something special. Wetlands important for wildlife.

Group 2

view of overhanging trees forming a tunnel for the old road

Group 3

Did not address directly.

Group 4

Did not address directly.

Question 6.

What factors do you see as threatening this?
Group 1

Lack of imaginative design. Human greed. Increased residential usage. Allowing the area to be used as a through road.

Group 2

Q 6. The factors we see threatening these are

weeds (cactus, silver poplar, kikuyu, wattle, bridal creeper
people stripping bark from paperbark
trucks knocking down branches
busy traffic
road widening

Group 3

Did not address directly.

Group 4

Did not address directly.

Question 7.
How do you think a solution can best be achieved?
Group 1

Should be an acceptable solution. Maximise the publicity about proposed changes and seek feedback. Possibly run a school competition for proposals. By being deadly serious about it.

Group 2

Did not address directly.

Group 3

Did not address directly.

Group 4

Did not address directly.

Written submission

The following was received from George Mardon before the workshop, with his apology.

Feeling amongst local groups that so-called "improvements" are

(a) unnecessary

It was felt, at a recent meeting of the Leschenault Environmental Study Group, that as housing development along the escarpment is likely to be limited to less than 50 dwellings, there is no need to build a "fast feeder road".

(b) in poor aesthetic taste

The Harvey Shire Council proposal to build an alternative parallel road to Cathedral Avenue seems no longer to be a priority, and the attempts to establish the road have not been successful on environmental and engineering grounds. The plethora of road signs, roundabouts, slow zones and mounds of earth detract from the "country lane" concept of the road.

(c) not working well

The present road system is not working well because, in spite of the abundant signage, users are confused with the options of which is road, cycleway, footpath or "shortcut". Some of the younger and more adventurous drivers are using the section of roadway to the north of Knapps Channel as a type of automobile slalom course and are causing damage and degradation to the median strip.

Future options

1. Retain original Cathedral Avenue as a laneway from Crimp Crescent to Buffalo Road. Leave the road as a rough and narrow laneway.

2. From Crimp Crescent south, retain the dual carriageway as it now exists with an option to extend dual carriageway to the end of the paperbark area (this will allow for commuter traffic from Crimp Crescent).

3. Rip up the new part of the dual carriageway to the north of Williams property, together with roundabouts and signage, and plant suitable dieback-resistant species on the raised ground. The raised ground can remain as a "bund wall" if tidal control flaps were placed on the drain pipes. Paperbark trees to be planted in swamp areas.

Other Suggestions and General Discussion

Signage at either end of Cathedral Avenue to deter trucks and caravans from entering.
Speed control measures on the high road Cathedral Avenue, such as dips and humps.
Declare the area near to Crimp Crescent where the foreshore widens out to be a recreational and conservation precinct, and direct traffic around it.
Have some tourist and conservation interpretation in the area.
Paint the kerbing of the slow points green.
The slow point near Knapps channel was not favoured.
Have other means of slowing traffic such as garden islands.
People did not favour a plethora of signs. Need to minimise the number of signs in the area.

Summary Of Issues Raised

Safety - road design and signage needs to take account of the behaviour of all motorists under each circumstance of ambience, policing.

Visual amenity - most people appear to place a high value on the opportunity to drive/cycle/walk along the old road with an unimpeded view of the tunnel of trees.

Paperbark trees - need to protect and rehabilitate paperbarks along the Cathedral Avenue.

Recreational access - need to provide recreational access to foreshore areas.

Recommendations For Management

Long term plan

R1 The best way to achieve the multiple purposes of Cathedral Avenue appears to be to keep the two carriageways separate apart from two or three controlled access points.

R2 The *high road* should be for through traffic, although designed in such a way as to discourage high speeds.

R3 The *low road* should be for sightseeing motorists, cyclists, pedestrians and access to recreation sites along the foreshore.

R4 Slow points should be limited to one at each end (south end being at the southern end of the paperbark archway, northern end being at the northern end of the *high road*) and one about half way.

R5 It will eventually become necessary to construct a separate dual-use path, for which land is available just west of the low road south of the Williams property

R6 The earth bunds should be removed, and replaced with pole barrier fencing.

R7 Maintain the extensive foreshore area to the west of Cathedral Avenue near the Crimp Crescent intersection as a conservation and recreation precinct. The roadways should be constructed around this area and not through it. The precinct should be the subject of a separate management plan.

Interim measures

R8 As land acquisition for completion of the *high road* must await the subdivision of Taylor and Williams properties, a long term design cannot yet be implemented. Therefore permanent treatment of the temporary slow points near Crimp Crescent, such as tree and shrub planting, is inappropriate. However, for the sake of safety and to avoid unnecessary expenditure, these slow points should remain as they are until the land is available for completion of the *high road.*

Participants

List of people attending.

Derrick	Brown	7 Christina St	Australind
Francis	Burke	37 Barnes Ave	Australind
Bruce	Cam	Lot 13 Randall Crt	Marina Waters
N	Foultanins	133 Travers Drive	Australind
Marian	Gee	10 Henderson Place	Ashmere Heights
John	Gee	10 Henderson Place	Ashmere Heights
A	Horsford	1 Hough Place	Eaton
Graham	Houghton	4 Sutton Crt	Clifton Park
A	Keough	Elinor Bell Rd	Australind
Peter	Layman	Lot 105 Elinor Bell Rd	Australind
Lila	Layman	Lot 105 Elinor Bell Rd	Australind
Charles	Lockwood	5 Absalon Cres	Australind
Ruth	Martin	2 Grey Court	Leschenault
Jim	Offer	18 Hudson Close	Australind
Don	Robertson	10 Lofthouse Drive	Leschenault
Paul	Sanderson	2 McKenna Mews	Leschenault
Rosemary	Sanderson	2 McKenna Mews	Leschenault
Greg	Sawyer	Lot 26 Clifton Close	Australind
Phil	Smith	23 Dunstan St	Bunbury
Vanna	Smith	23 Dunstan St	Bunbury
Margaret	Sparrow	24 Coral Drive	Riverlands
Mick	Taylor	Lot 4 Scenic Drive	Australind
Judy	Thompson	62 Old Coast Rd	Australind
Elsie	Wilkinson	Unit 19 St Nicholas Place	Australind

APPENDIX 3

At a public meeting held at the Australind Community Centre on Wednesday 20 December 1995 at 7.30pm the Northern Leschenault Estuary Foreshore Draft Management Plan was released for public comment.

During a six week public submission period one submission was received from Ms Kerrie Naughton, Regional Policy Officer - South West for the Fisheries Department of WA. Ms Naughton's submission related to the use of the Leschenault Estuary by professional fishers and to the protection of fish habitats.

APPENDIX 4

Area A	Retain existing facilities.
Area B	Repair existing barbecue. Install additional barbecue. Upgrade toilet facility
Area C	Repair barrier fencing
Area D	Repair barbecue.
Area E	Permit vehicle access
Area F	Pedestrian access only
Area G	Pedestrian access only
Area H	Pedestrian access only
Area I	(Balmoral Blvd) Create limestone surfaced parking area. Repair barbecue and cooker. Maintain pedestrian access to water. Small boat launching.
Area J	Barrier fencing across track through fringing vegetation.
Area K	Install barbecue and cooker. More tree planting.
Area L	Block off and rehabilitate one of the two estuary accessways.
Area M	(Knapps Channel) Level and resurface parking and roadways with limestone. Repair barbecue and bins. Control kikuyu and buffalo grasses in the vicinity. Clear *A. saligna* from access points to allow clear view of approaching traffic.
Area N	Erect barrier fencing to prevent vehicle access. Pedestrian access only.
Area O	(Northern toilet block area). Upgrade existing toilet facility, crab cooker and barbecue. Install new barbecue. One accessway to water only, barrier fencing to others. Formalise road entries and parking areas with barrier fencing. Resurface parking areas with crushed limestone. Small boat launching.
Area P	Create limestone surfaced parking area. Erect barrier fencing to prevent vehicle access to water's edge. Pedestrian access only.
Area Q	Retain area in present condition.
Area R	Create formal parking area between old and new road incorporating remains of old roadway using barrier fencing to create safe parking. Fence old access to Estuary to prevent vehicle access to water's edge allowing pedestrian access only.
Area S	Erect barrier fencing to block off northward track and rehabilitate track marks. Limestone required to formalise road and access point.
Area U	Retain area in present condition.
Area V	Erect barrier fencing to prevent vehicle acess to fringing vegetation and to track to south of road access. Retain access to Estuary and rubbish bin.
Area W	Retain existing vehicle turnaround area and vehicle access to water's edge. Block off track heading north with barrier fencing and rehabilitate track. Retain rubbish bin.

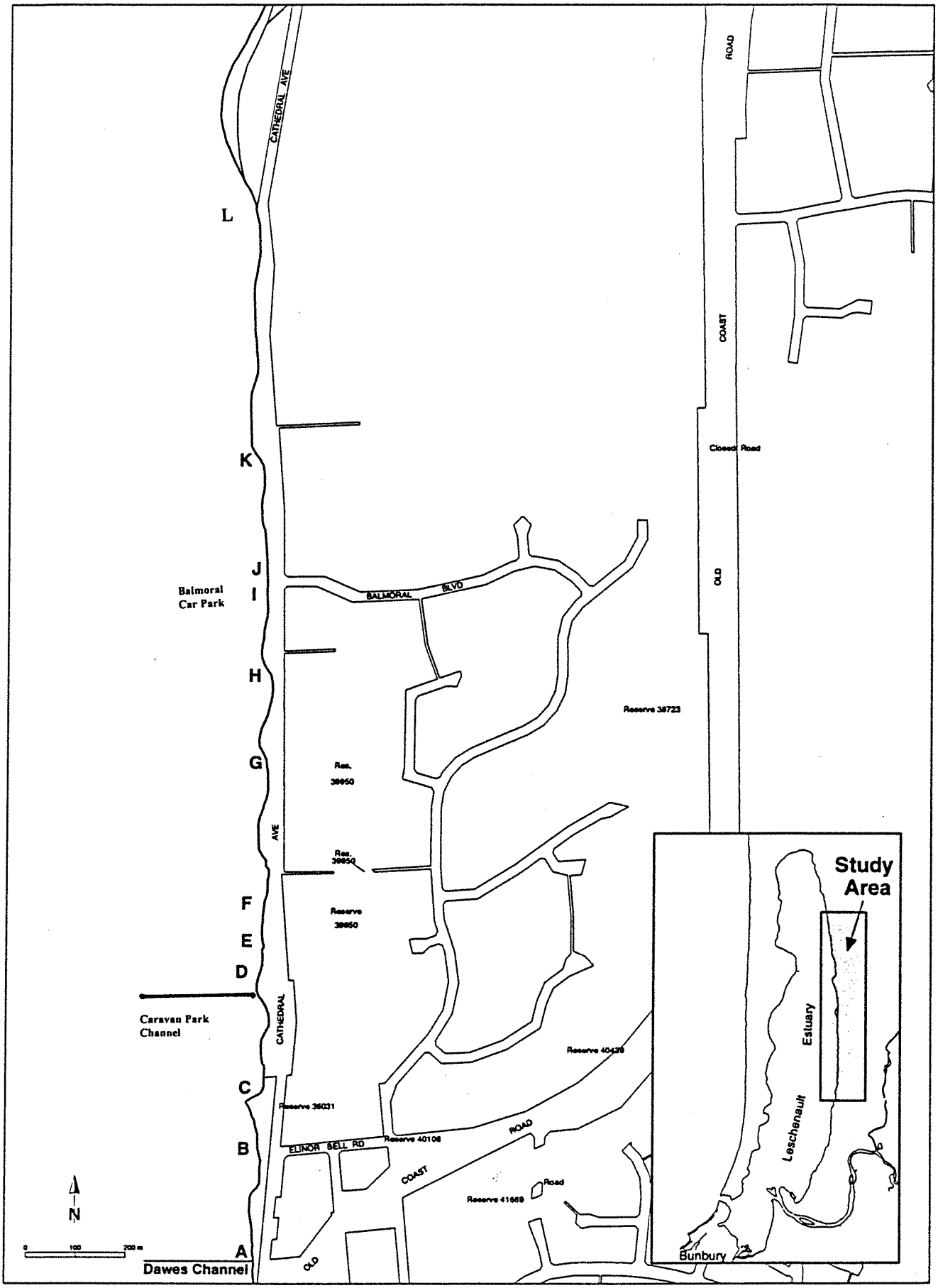


Figure 3.1 : Recreation facilities along the Northern Leschenault Estuary Foreshore

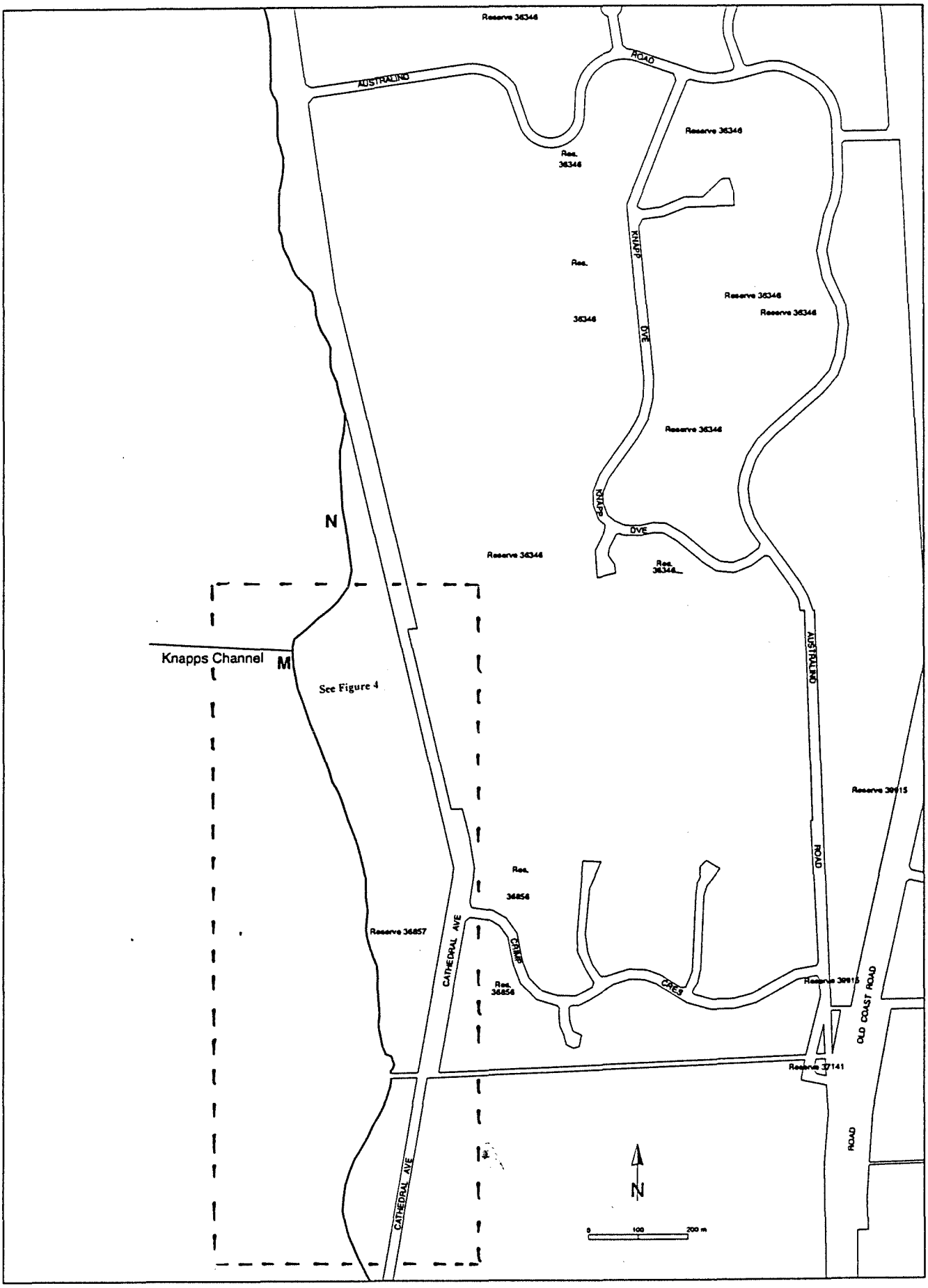


Figure 3.2 : Recreation facilities along the Northern Leschenault Estuary Foreshore

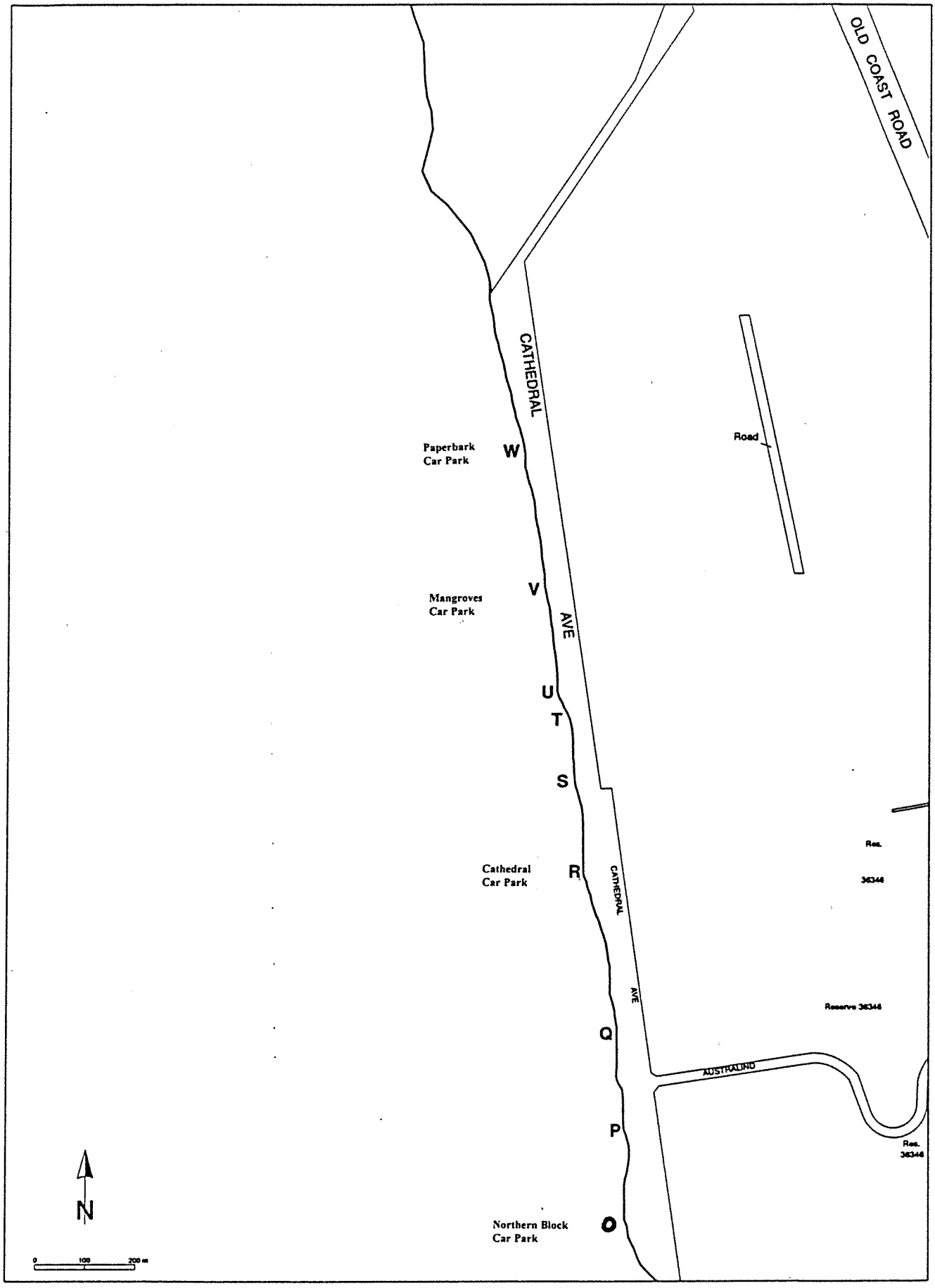


Figure 3.3 : Recreation facilities along the Northern Leschenault Estuary Foreshore