City of Canning

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CITY OF MELVILLE

SWAN RIVER TRUST

Draft Lower Canning River Management Plan

Swan River Trust Report No. 15 1994

CITY OF SOUTH PERTH

DEPARTMENT OF PLANNING AND URBAN DEVELOPMENT

Swan River Trust

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DRAFT LOWER CANNING RIVER MANAGEMENT PLAN

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Report No. 15
January 1994

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CHAIRMAN'S FOREWORD

The Lower Canning is one of the most heavily used and extensively developed sections of the Swan and Canning River system. Recreation activities include powerboating, waterskiing, sailing, rowing, fishing, prawning and swimming. The foreshores are also used for recreation associated with these activities as well as cycling, walking and bird watching. Other areas also have considerable conservation and landscape value, particularly Mount Henry.

The Swan River Management Strategy (1988) recommends that a management plan be prepared for the area, addressing all the issues and bringing together all the findings and recommendations of previous and current studies in a co-ordinated manner.

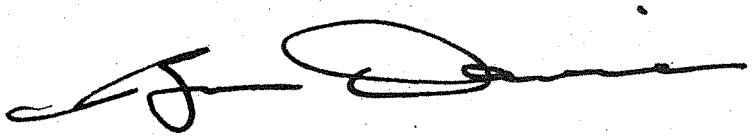
This draft management plan has been prepared by the Swan River Trust (SRT) with the assistance of the Cities of Melville, South Perth and Canning, Aquinas College and Department of Planning and Urban Development. A number of groups and individuals have expressed the need for the study. They have indicated their support for ongoing involvement in use and management of the area.

I am delighted with the spirit of cooperation which has resulted in this draft document and the commitment by all parties for ongoing involvement. A river is a complex system and there are many conflicting demands placed on it. This type of document considers the view of all interested parties. I believe this is the most appropriate mechanism to ensure that the river system is properly managed.

The plan will provide a vision for the future as well as guiding development. It is recognised that the river is a living system and its integrity should be maintained and enhanced to the greatest extent possible and that all proposed uses should be evaluated in terms of their capacity to adversely affect the system.

I urge you to read the draft management plan and forward any comments you may wish to make on the draft to the Swan River Trust. If you have any questions regarding the document please contact officers of the Trust. Information on how to make a submission is listed on page xi.

The draft will be modified after consideration of public comments and the final document produced. Implementation of the management plan is also subject to public scrutiny.



Ron Davies AM
Chairman
SWAN RIVER TRUST

DISCLAIMER

This document has been prepared in cooperation with staff of the Swan River Trust, the Citites of Melville, South Perth and Canning, Aquinas College and the Department of Planning and Urban Development. It has been agreed by these agencies to release this draft for public comment however the document has not been endorsed by any or all of the agencies.

TABLE OF CONTENTS

List of maps

List of tables

GUIDE FOR READERS

Abbreviations

Many organisations are mentioned in this draft management plan including State government agencies, local government authorities and community groups. For brevity, initials are used in most references. To aid the reader a foldout sheet listing all abbreviations is provided at the back of the document.

How can I make a submission

Public submissions on the Draft Lower Canning River Management Plan are now invited. All public submissions will be considered before preparation of the final management plan.

If you would like to make a submission towards preparation of the final document please comment on any part of the document you agree or disagree with. A tear out form is provided on the following page for this purpose. Send this to the Swan River Trust by 28 February 1994 at the address provided on the top of the form. Please note that submissions do not have to be confined to the length or layout of the form provided.

If more information is required prior to making your submission, officers of the Swan River Trust will be available to discuss any aspect of the draft plan.

Where can I get other copies of this document

Further copies of the management plan are available for viewing at:

- Local government public libraries in the Cities of Melville, South Perth and Canning.

Copies of the document can also be obtained free of charge from:

- Swan River Trust

  16th Floor London House

  216 St Georges Tce

  Perth WA 6000

  (09) 327 9777

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PUBLIC SUBMISSION FORM

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C/- Swan River Trust
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Name:.....

Title:.....

Organisation:.....

Address:.....

.....

.....

I would like to make the following comments on the Draft Lower Canning River Management Plan and would like them considered in the preparation of the Final Management Plan.

Comments:

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I would also like a copy of the Final Management Plan sent to the above address on its completion.

Signed

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1. INTRODUCTION

1.1 Need for the study

The Lower Canning is one of the most heavily used and extensively developed sections of the Swan and Canning River system. Recreation activities include powerboating, waterskiing, sailing, rowing, fishing, prawning and swimming. The foreshores are also used for recreation associated with these activities as well as cycling, walking and bird watching. Other areas also have considerable conservation and landscape value, particularly Mount Henry.

A number of studies have been undertaken for the area or parts of the area. There are three local authorities involved in planning and management of the foreshores and numerous private land owners and government agencies. The Swan River Management Strategy (1988) recommends that a management plan be prepared for the area, addressing all the issues and bringing together all the findings and recommendations of previous and current studies in a co-ordinated manner.

This draft management plan has been prepared by the Swan River Trust (SRT) with the assistance of local authorities, Aquinas College and Department of Planning and Urban Development.

In order to develop the plan, there needs to be a balance between the multiple use demands of the region and protection of flora, fauna and water quality.

There are a number of groups which have an interest in the river and its foreshores and have expressed the need for such a study. They have also indicated their support for ongoing involvement in use and management of the area.

1.2 Aim and philosophy

The aim of the study is to produce an extensive management plan for the area addressing all the issues associated with the development, conservation and management of the river and associated land.

The plan will provide a vision for the future as well as guiding development for the next 20 years and beyond. It is recognised that the river is a living system and its integrity should be maintained and sustained to the greatest extent possible and that all proposed uses should be evaluated in terms of their capacity to adversely affect the system.

To develop such a management plan there needs to be an understanding of the following:

- the concept of the river and foreshores as a living and dynamic system including the biological processes which occur, and the flora and fauna which exist in the study area,
- the physical environment including geology and landform,
- history of development and past uses,
- existing and potential uses.

Estuarine catchments are typically complex with a mix of land uses, and a high degree of variability in quantity, quality and timing of runoff. It is important for waterways managers to consider the entire catchment. There is a high demand for use of the waterways and management must provide a balance for the multiple uses of this resource.

1.3 Objectives

To achieve the above aim the following objectives have been developed.

Land use planning

Identify land uses that are compatible with the conservation of the river and foreshores.

Conservation

Conserve and enhance the natural environment.

Water quality

Protect the river and its foreshores from pollution.

Recreation

Provide opportunity for recreational use and public enjoyment of the river and foreshore areas.

Public education and involvement

Educate the public on the environmental value of the area and encourage their involvement with ongoing management.

Landscape protection

Conserve and enhance the scenic and aesthetic values of the river, foreshore and escarpment.

1.4 Public consultation and involvement

The foreshore and water area subject to this management plan is quite extensive and subject to intense interest and concern to a broad cross-section of the community. The overall public resources and issues (such as access) being considered directly affect, and frequently conflict with, those of the private land owners who reside in or have interests in the area and the variety of recreational users.

Advertisements were placed in local newspapers inviting the public to raise issues to be considered in the management plan. The responses highlighted issues including water quality, dredging, pressure on the river and foreshores from recreational activities and loss of fringing vegetation. A comprehensive submission was received from Canning River Estuary Watercare (CREW). CREW raised a number of issues such as uncontrolled public access, prawning, erosion, degradation of fringing vegetation and moorings all of which have been considered in this plan.

There were also a series of public workshops for foreshore reserves in the City of South Perth which coincide with the study area. Issues raised in these workshops were noted and have been considered in this management plan.

Further notices were forwarded to groups known to have a specific interest in the area, during early February 1993.

The main level of public consultation will occur subsequent to this draft, which will be advertised for public comment, and a series of workshops will be held to discuss the issues.

The Swan River Trust Act 1988 requires public participation in the development of management programmes.

The draft will be modified after consideration of public comments and the final document produced. Implementation of the management plan is also subject to public scrutiny.

1.5 How this document relates to other studies

Figure 1 outlines the major documents relevant to the study area.

Throughout the plan, reference is made to these documents. Where necessary, the recommendations of the various documents are endorsed or amended if appropriate.

Swan River Management Strategy (1988) is the overriding document, and this plan endorses all the broad management recommendations.

Figure 1 : Relation of this document to the literature

2. STUDY AREA

2.1 Location

The study area includes the Canning River between the South of Perth Yacht Club and Riverton Bridge, and the adjoining Metropolitan Region Scheme (MRS) Parks and Recreation Reservation (Map 1). Developments and other activities occurring outside the study area which may affect the area are also discussed.

2.2 Physical environment

The physical environment plays a major role in determining the associated form of fauna and vegetation, accessibility, and types and level of use of the river environment.

2.2.1 Geology, geomorphology and soils

The Swan and Canning River system is incised into the Swan Coastal Plain and drains the plateau to the east. There are four major bends in the river in the study area. At its widest the river is 600 m, at its narrowest 87 m.

Quaternary geology, geomorphology and soils of the Swan Coastal Plain have been described by Seddon (1972) and Collins (1987). Below is a brief description of these components.

The land adjacent to the study area is an alluvial flood plain and thus is relatively low lying. The exception to the flat topography of the area is Mount Henry which rises to a height of 25 m.

Tamala limestone extends from the South of Perth Yacht Club to Salter Point, beyond which the dominant geologic element is Bassendean Sands, which typically is composed of leached dunes of grey-white quartz sands.

The foreshore around Bull Creek and South Perth, including Mount Henry, is characterised by leached quartz sand and some rocky limestone outcrops. Along the northern river foreshore between Mount Henry and Shelley Bridge, the Guildford Formation predominates. This is characterised by sandy soils of fluvial origin and is dominated by colluvium and alluvium.

Deep alluvial estuarine sediment deposits composed of mud and silt with abundant detritus, prevail around Bull Creek. Wide tidal flats occur along stretches of the river between Bull Creek and Riverton Bridge. These muddy estuarine deposits lie over a shell and sand substrate.

2.2.2 Climate

The climate of the region is described as Mediterranean with summer temperatures averaging 29°C maximum and 17°C minimum with predominantly easterly winds during the forenoon followed by a south-westerly afternoon seabreeze. In the winter the average maximum temperature is 18°C with a 9°C minimum. Winds are predominantly north-west to south-west during this period.

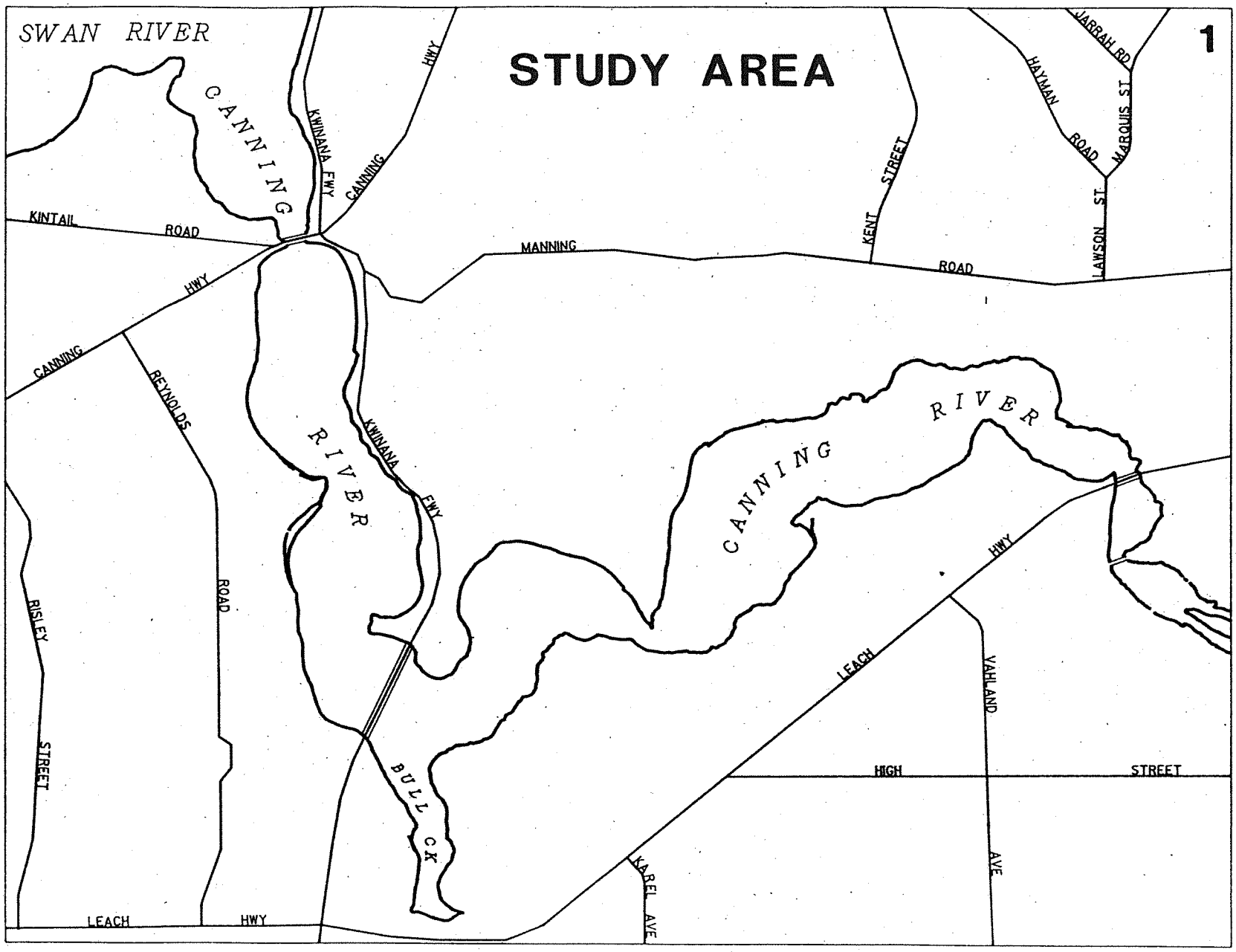
The average rainfall for the metropolitan region is 872 mm with the majority of rain falling between May and August inclusive (Thurlow et al. 1986).

2.2.3 Hydrology

Annual rainfall, storm water runoff and tidal exchange all contribute to the river hydrology. The volume of river inflow into the system is the principal factor determining the hydrological status.

The Swan and Canning River system experiences a mean daily tidal range of 0.36 m at the Barrack St Jetty (Rick Mahoney pers. comm.). The Kent Street Weir, about 3 km upstream of Riverton Bridge, is the limit of the tidal influence on the Canning River.

Modifications to river hydrology have included the construction of the Canning Dam in 1940, the deposition of land fill along the south side of the river between Fifth Avenue and Shelley Bridge, channel dredging and the construction of the Canning, Mt Henry and Shelley Bridges.


STUDY AREA
1
SWAN RIVER
CANNING
KWINANA FWY
CANNING HWY
KINTAIL ROAD
MANNING ROAD
KENT STREET
HAYMAN ROAD
JARRAH RD
MARQUIS ST
LAWSON ST
CANNING HWY
REYNOLDS ROAD
RISLEY STREET
KWINANA FWY
RIVER
CANNING RIVER
BULL CK
LEACH HWY
LEACH HWY
VAHLAND AVE
HIGH STREET
KABEL AVE

2.2.4 Bathymetry

Within the study area the river meanders approximately 8.5 km in a westerly direction.

Hydrographic survey work and site specific information obtained from the Department of Transport (DOT) shows that the substrate is characterised by a variety of features, including shallow sand banks, intermittent isolated deep holes and channel widths ranging between three and 10 m, and depths averaging around 1.2 metres. Water movement has scoured a deep hole (11 metres) immediately below Canning Bridge, the result of a continuous eddy created by the current. General water depths are outlined on Map 2.

Soundings and probes taken in the mid1960s suggest that the river bed is composed mainly of mud. However, nearer to the river banks, sand and shell and clay dominated sediments exist.

Where the river changes its flow from southerly to easterly, Bull Creek extends for about 900 m southwards. Only a remnant of the total extent of this arm persists, the remainder being filled for road construction and housing.

2.3 Biological environment

2.3.1 Aquatic vegetation

The aquatic flora and fauna within the study area are subject to increasing pressure from recreational demands. Aquatic plants and animals form the basis of the food chain, and provide larger vertebrates such as fish and birds with food. Seagrass beds are particularly important as functional fish nurseries, and the algae and invertebrates associated with these areas provide both food and shelter for the fry.

The Lower Canning River is characterised by large expanses of mud flats and sand banks, shallow water and extensive mussel beds which provide important breeding grounds for many species. This system supports both permanent and migrant fauna which utilise the estuary as a nesting or nursery site, drawn by abundant food availability. Estuaries in general are highly productive, however the shallow banks covered with seagrasses, predominantly *Halophila ovalis*, are particularly important to the aquatic fauna.

Research is continuing into the occurrence and distribution of aquatic flora within the study area. Species identified to date include the phytoplankton *Cryptomonas* and *Heterosigma*. The blue-green alga *Microcystis littoralis* has also been recorded in the Riverton Bridge area. The seagrass *Halophila ovalis* also grows in undisturbed areas of the Canning River estuary.

Species of macroalgae recorded include *Laurencia*, *Chadria* and *Graciliaia* and in recent years blooms of the filamentous green macroalgae *Rhizoclonium* have been recorded.

2.3.2 Foreshore vegetation

The flora of the study area represents a very important component of the Swan-Canning River system.

The foreshore vegetation of the Lower Canning River comprises:

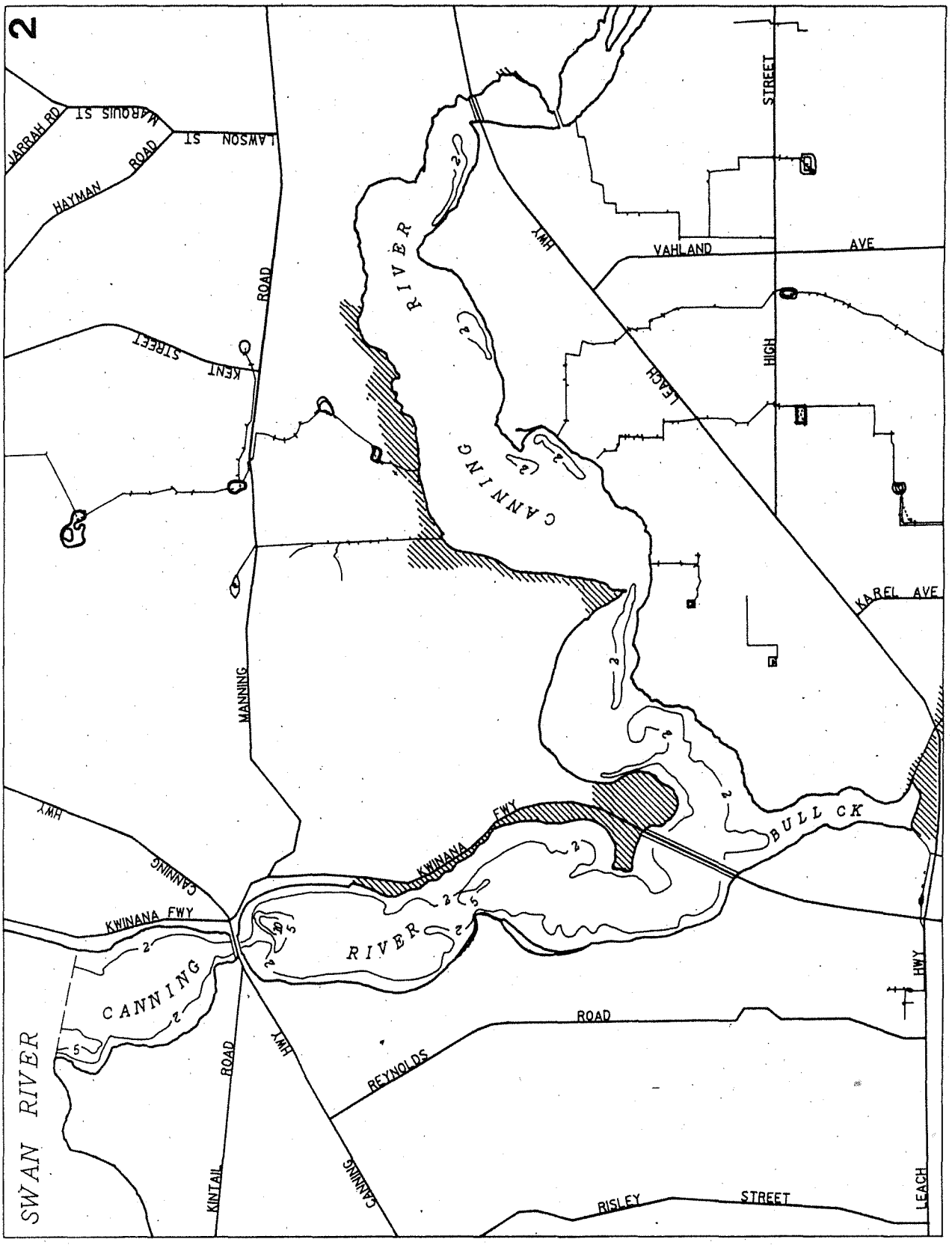
- extensive areas of remnant vegetation including wetlands and woodlands,
- narrow riverine fringes of vegetation, and
- areas modified for public access, predominantly grassed.

The northern shore of the Lower Canning is characterised by a number of continuous tracts of native vegetation, whilst the south shore is typified by a band of remnant vegetation less than five metres wide.

A total of approximately 350 species of indigenous and introduced plants are found throughout the study area, including a rare and endangered species of paperbark (*Melaleuca leptoclada*). More information on aquatic and terrestrial flora is given in Appendix 1.

The vegetation of the study area is dominated by six community types of variable dominance, understorey composition and level and types of weed invasion:

- *Melaleuca* spp. / *Juncus* spp. woodland
- *Allocasuarina* / *Juncus* spp. woodland
- *Eucalyptus* spp. woodland
- *Banksia* woodland
- *Melaleuca* spp. / *Juncus* spp. fringe
- *Allocasuarina* / *Juncus* spp. fringe


2
JARRAH RD
MARQUIS ST
LAWSON ST
HAYMAN ROAD
KENT STREET
ROAD
MANNING
CANNING HWY
KWINANA FWY
CANNING RIVER
SWAN RIVER
CANNING
RIVER
KWINANA FWY
BULL CK
HWY
ROAD
REYNOLDS
KINTAIL ROAD
CANNING HWY
RISLEY STREET
LEACH
HIGH
LEACH
VAHLAND AVE
KAREL AVE
STREET

Other community types are present but not widely distributed.

The fringing vegetation is important in stabilising the river bank and providing habitat for animals including prolific bird life.

2.3.3 Aquatic macrofauna

The majority of the commercial catches are sea mullet, yellow-eye mullet and Perth herring.

Some sections of the Lower Canning are popular recreational fishing areas. Species caught include black bream, tailor (in summer), large mulloway and yellow-eye mullet, cobbler, flathead and yellowtail trumpeter. Crabs and prawns are also caught throughout the year although these activities are concentrated around the summer months.

2.3.4 Invertebrates (terrestrial and aquatic)

These include crustaceans (barnacles, copepods etc.), molluscs (bivalves, gastropods, chitons), annelids (polychaetes, leaches), coelenterates (jellyfish), foraminiferans (skeleton producing protozoans), platyhelminths (flat worms) and bryozoans (plant like animals).

Two species of jellyfish (*Phyllorhiza punctata* and *Aurelia aurita*) are common in the Canning River estuary from spring to autumn, while marine conditions prevail. The population density of both species can become very high, making swimming unpleasant. Occasional incursions of open water marine stinging species such as *Chrysaora* and *Carybdea rastoni* have been recorded.

The diversity of invertebrates inhabiting the fringing vegetation, wetlands and sandy rise vegetation has not been comprehensively surveyed. A limited study undertaken for the City of South Perth identified 142 invertebrate species (Brooker 1993 unpubl.).

2.3.5 Amphibians and reptiles

Salter Point and Waterford Reserves were surveyed in the mid 1980s (Orr 1986, 1987). The Salter Point survey identified one frog and 11 reptile species, whilst the Waterford Reserve was found to support three frog and 11 reptile species.

A more recent investigation into the faunal composition of the three extensive wetlands in the Lower Canning River study area was initiated in early 1993 for the City of South Perth (Brooker 1993 unpubl.). This study covered the region between Keaney Gardens (Waterford) to the Mount Henry Spit (Manning). In total four frog and eight reptile species were captured in this study.

2.3.6 Water birds

The shallow tidal flats provide abundant food for water birds, in particular waders. Deep water areas are foraged by ducks, swans and cormorants.

A comprehensive list of birds was also established from a variety of sources including the Royal Australasian Ornithologists Union.

Twenty eight species of wading birds have been recorded in the Swan and Canning River system, 22 of which are trans-equatorial migrants and six Australian residents (Lane 1986). Common waders include :

- the red-necked stint (*Calidris ruficollis*)
- curlew sandpiper (*Calidris ferruginea*)
- red knot (*Calidris canutus*)
- grey plover (*Pluvialis squatarola*)
- red-capped plover (*Charadrius ruficappilus*)
- black-winged stint (Australian resident - *Himantopus himantopus*).

2.3.7 Mammals

The diversity of mammals inhabiting the fringing vegetation, wetlands and sandy rise vegetation has not been comprehensively surveyed. Information taken from the WA Museum database for Manning and Como (1992) suggested that species likely to occur along the South Perth foreshore include the lesser long-eared bat, brush tail possum and the native water rat (Brooker 1993b).

There is evidence that the native water rat, *Hydromys chrysogaster*, still persists in a number of locations within the study area.

2.4 Development history

The Canning River district was first visited by Europeans in 1801 during a French exploratory expedition. In 1827, Captain Stirling arrived in the HMS *Success*, from which the river was explored and named Canning after a British statesman.

By the 1830s most if not all riparian land on both sides of the Canning River, as far upstream as Gosnells, was in private ownership. It was good farming land, with an ample supply of water from both the river and shallow wells. It had only slight bush and tree cover, which was readily cleared for agriculture (Carden 1968). At this stage, the river was only navigable upstream of Mount Henry by flat-bottomed barges, because of snags, sand banks and jutting rocks (Riggert 1978).

During the 1860s jarrah logs were barged down the river from Cannington to Fremantle. Because the river was generally shallow, there was a need to dredge the river. Convicts constructed a fence to facilitate the dredging and trap logs. During construction they constructed a camp at Mumms Point. The history of the convict fence is discussed in Section 4.11.2. Navigation upstream of Salter Point was still difficult and dredging activity continued from barges. One of these barges, the 'Black Swan', was first brought to the area in the late 1880s.

In 1849 the first timber bridge was constructed across at Canning Bridge, and remained until 1908. A second bridge was constructed in 1892, however after it was finished it was realised that the 'Black Swan' could not pass beneath it, so the centre of the bridge was raised. In 1908, this structure was reinforced to allow the passage of heavy wagons. The present bridge was constructed in 1930 (Uren 1975).

The land surrounding the river remained largely undeveloped until the turn of the century. Early this century, market gardens, residential developments and small holdings were the predominant land uses.

Significant areas of water were reclaimed for roads, rubbish disposal and housing.

The opening of the Kwinana Freeway and the Narrows Bridge in 1959 encouraged rapid suburban growth south of the river. As the river is central to the metropolitan region, there is high demand for river front locations. With an increasing population has come a growing demand for access to and use of the river, and for riverside developments and amenities.

2.5 Land tenure and zoning

The predominant land use adjacent to the foreshores surrounding the river is private residential, however, some areas of bushland and wetland still persist. A number of recreational areas exist on the foreshores.

Land that is not reserved for Parks and Recreation or Waterways Reservation under the Metropolitan Region Scheme (MRS) is zoned for urban use.

There are a number of areas of vacant Crown land, Freehold on C/T, Road Reserves and Reserves. The land tenure in the study area is summarised in Table 1 and on Maps 4-11.

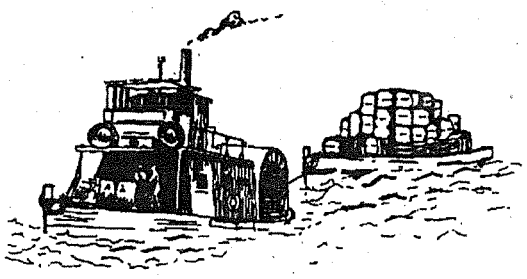


Table 1: Reserve status

RESERVE OR TITLE	SIZE (ha)	PURPOSE (CLASS)	TENURE
21288	2.13	Parkland (A)	City of South Perth
23967	7.47	Recreation (C)	City of South Perth
25511	0.54	Recreation excl camping and caravan parks (C)	City of Melville
25598	1.98	C.G. in Trust to SPYC	South of Perth Yacht Club
25599	0.48	Free public pedestrian access and use for SPYC (C)	City of Melville
26085	0.16	Hall site leased to Boy Scouts Assoc. (C)	DOLA
26086	0.07	Use by Boy Scouts Assoc. and pedestrian access (C)	DOLA
26292	16.28	Parks and Recreation (C)	City of Canning
26533	0.02	Footway (C)	unvested
26811	0.39	Recreation and parking (C)	City of Melville
27449	0.15	Drainage (C)	Water Authority
28747	0.31	Public Recreation (C)	City of South Perth
29130	5.40	Conservation flora and fauna (C)	City of Canning
30584	0.52	Recreation (C)	City of Melville
30646	2.00	Public Recreation (C)	City of Melville
31986	0.22	Sewage Pumping Station (C)	Water Authority
33804/5	13.85	Recreation (C)	City of South Perth
36621	0.78	Parks and Recreation (C)	Metro Region Planning Authority
36622	0.85	Parks and Recreation (C)	Metro Region Planning Authority
36766	0.02	Starting box and boat shed (C)	City Canning (21 year lease SSC)
37712	4.41	Public Recreation (C)	City of South Perth
37753	0.03	Sewage Pumping Station (C)	Water Authority

37754	0.04	Sewage Pumping Station (C)	Water Authority
38926	0.92	Recreation (C)	City of Melville
41511	0.01	Sewage Pumping Station (C)	Water Authority of Western Australia
41708	0.01	Sewage Pumping Station (C)	Water Authority of Western Australia
CT1049/790	3.6 ha		DPUD
CT48/513	8.9 ha	Freehold	Christian Brothers W.A.
CT1550/176		Freehold	Christian Brothers W.A.
CT1818/277	8.75	Freehold	Christian Brothers W.A.
CT1935/240	8.09	Freehold	Christian Brothers W.A.
CT1649/492	8.09	Freehold	Christian Brothers W.A.
CT1731/311	5.21	Freehold	Christian Brothers W.A.
CT1649/492	17.30	Freehold	Christian Brothers W.A.
CT1731/307	7.76	Freehold	Christian Brothers W.A.
CT1731/311		Freehold	Christian Brothers W.A.
CT1731/311		Freehold	Christian Brothers W.A.
CT		Freehold	Commissioner for Main Roads

The Main Roads Department (MRD) has made recommendations to rationalise the vesting of the land north and south of Canning Bridge, through amalgamation of the vacant Crown land, Road Reserves and Freehold on CT.

3. ORGANISATIONAL ROLES

There are a number of different organisations which are responsible for planning and management of the Swan and Canning River system (Appendix 2). Different agencies have different levels of responsibility. Local authorities are more involved in day to day management issues such as foreshore reserve maintenance and implementation, whereas the State Planning Commission plans at a strategic level.

The Department of Transport is responsible for boating safety and navigation. The Swan River Trust (SRT) is responsible for planning, managing and protecting the SRT Management Area which includes the waters of the Swan and Canning River system and adjoining Parks and Recreation Reservation.

Figure 2 outlines the relationships between the organisations with interests in the study area.

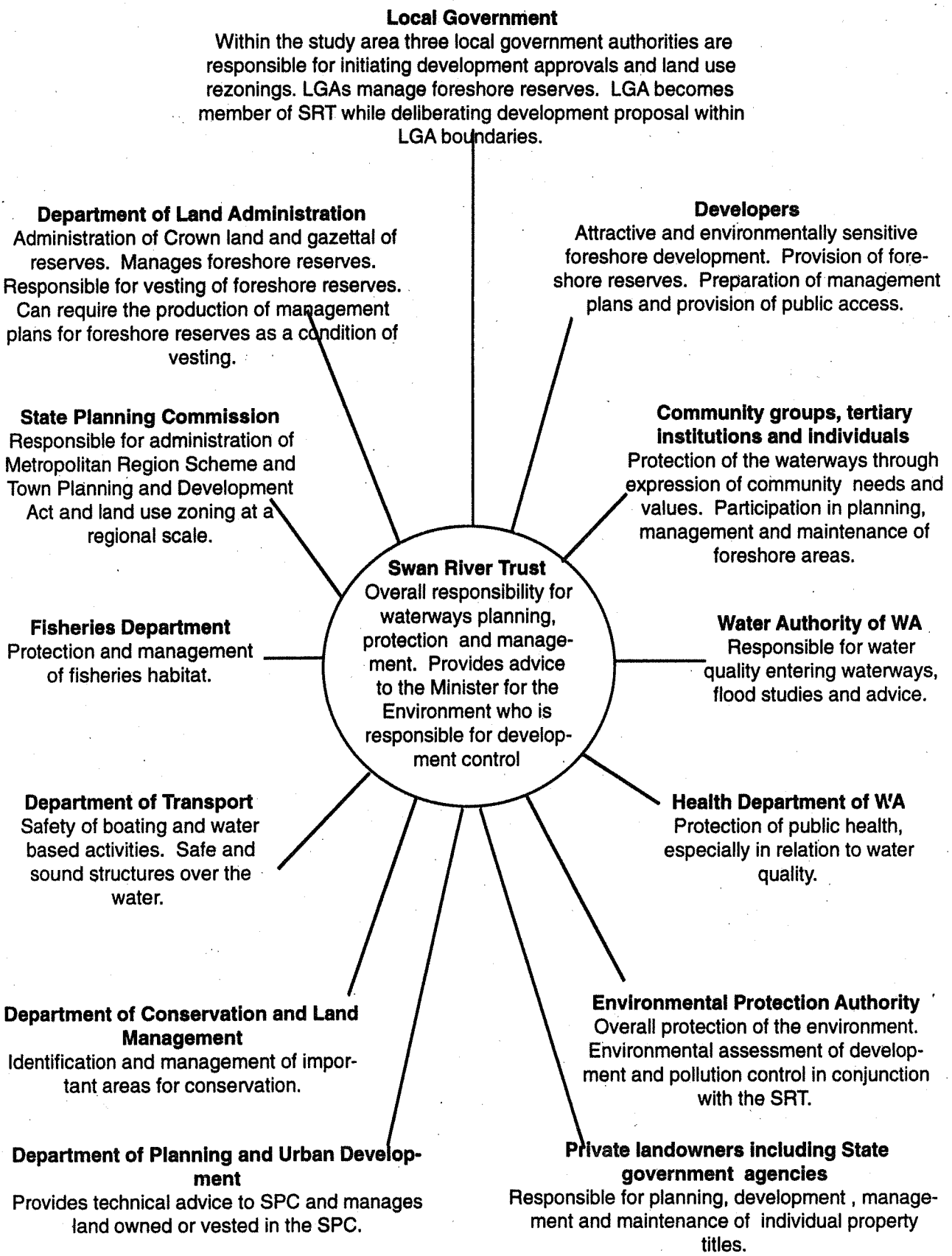


Figure 2:

The role of the Swan River Trust in relation to the role of other organisations and groups involved with planning and managing the waterways and foreshores within the study area.

4. MANAGEMENT ISSUES AND RECOMMENDATIONS

Discussed below are issues affecting the management area. These issues were identified after consideration of public comments, discussion with local and State government agencies, and consideration of the waters and foreshore areas. Each issue is considered individually and a set of recommendations developed to address the issues. Map 3 is a key to resource maps 4-11 of the study area. Section 5 lists site specific recommendations.

Only those issues requiring action have been addressed in the plan. New problems may arise in the future and can never be foreseen. For this reason the plan will be kept under review.

4.1 Physical environment

The physical environment will always limit the development of an area. It is however possible to allow for greater use of the environment through site modification. These two must be balanced for the waterway environment to maintain a functional healthy ecosystem.

4.1.1 Water quality

Water quality can be affected by inputs of nutrients (such as nitrogen and phosphorus), heavy metals and bacterial pollution. Reduced water quality may result in fish and bird deaths and a general reduction in the ecological integrity of the river environment, foul odours, increased public health risks, and a decrease in the aesthetic value of the area.

Heavy metals can enter waterways from:

- industrial discharges,
- pesticide, herbicide and fertiliser residues from the catchment,
- accidental spillages,
- stormwater runoff from roads, and
- pollutants from waste disposal (land fill) sites.

Throughout the summer of 1992-1993, an intensive water quality and algal monitoring program for the Swan and Canning River system was initiated by the Swan River Trust. This program monitored a series of water quality health indicators including: salinity, temperature, dissolved oxygen, water clarity, forms of phosphorus and nitrogen, and chlorophyll-a, and further identified and quantified phytoplankton species throughout the water column. This program was based on fortnightly sampling which was increased in frequency as water quality decreased.

Two sampling sites fall within the study area: Salter Point and Riverton Bridge. Results indicate the area is generally suitable for contact recreation however there is an increasing frequency of algal blooms in the area during spring/summer.

A number of schools are involved in the Ribbons of Blue water quality monitoring scheme. Students monitor drains, creeks and other water bodies near their schools for a number of contaminants. This program helps children develop an understanding of wetland functions and further provides information to bodies such as the Swan River Trust.

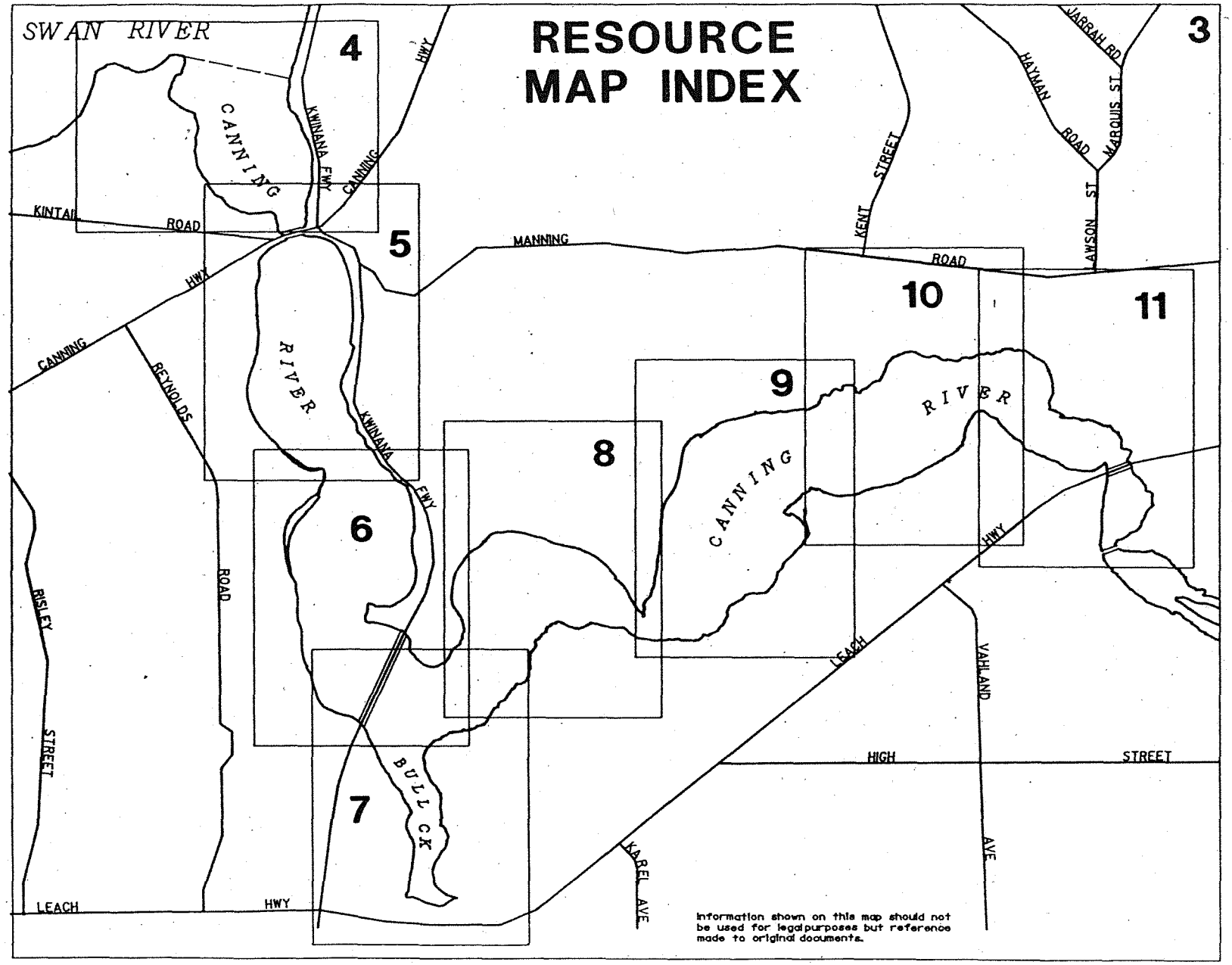
Accidental spillages are unpredictable, however they can have a major impact on the waterway. The Swan River Trust has developed emergency procedures for accidental spillages, and containment of pollutants in the river. Local and State government agencies need to be aware of the procedure to follow in such an event.

Recommendations

1 **Continue the SRT water quality monitoring program (SRT).**

2 **Encourage more local schools to become involved in the Ribbons of Blue water quality monitoring scheme within the three municipalities (WWC).**

3 **Ensure contamination from oil spillages is prevented from entering the river. Service stations to develop contingency plans to respond to accidental spillages, and provide a copy to SRT Pollution Abatement Officer (Fuel companies).**


RESOURCE
MAP INDEX
SWAN RIVER
CANNING
KWINANA FWY
CANNING HWY
KINTAIL ROAD
MANNING ROAD
KENT STREET
HAYMAN ROAD
JARRAH RD
MARQUIS ST
LAWSON ST
CANNING HWY
REYNOLDS ROAD
RIVER
KWINANA FWY
CANNING RIVER
LEACH HWY
RISLEY STREET
BULL CK
KAREL AVE
VAHLAND AVE
HIGH STREET
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Information shown on this map should not be used for legal purposes but reference made to original documents.

4.1.1.1 Nutrients

Nutrients (particularly nitrogen and phosphorus) are applied to the land in the form of fertilisers, detergents and animal wastes. Too many nutrients entering a water body may lead to excessive plant growth, which is referred to as a bloom. There is evidence of nutrient enrichment in the area in the form of transient macroalgae and phytoplankton blooms and occasional fish kills have been recorded. These occur periodically (Appendix 1).

The majority of nutrients within the study area come from the catchment of the entire Canning River, which sustains a variety of agricultural, urban and industrial activities. Within the immediate area the dominant sources of nutrients arise from the urban catchment. Fertiliser applied to residential gardens and local parks, and detergents, can enter the river through the stormwater drainage system. It is important to manage fertiliser use and design drainage systems to minimise nutrient export to the river system. For detailed information on techniques refer to del Marco (1990).

Recommendations

4 **Encourage LGAs to develop turf maintenance programs for foreshore reserves in order to minimise nutrient loss to waterways. General guidelines for fertiliser use on foreshore areas should address:**

- **use of slow release fertilisers on any open parkland in the vicinity of the river,**
- **planting of indigenous vegetation throughout grassed areas,**
- **minimal reticulation where possible (WAWA and LGAs).**

5 **Develop educational material to encourage land owners to minimise fertiliser use on adjacent properties and areas that connect to the local drainage network (SRT and LGAs).**

6 **Design WAWA and LGA drainage systems to incorporate the principles of streamlining. Considerations to include:**

- **slowing of drainage water to enhance settling and other loss mechanisms, and**
- **use of efficient infiltration, compensating or nutrient stripping basins (WAWA and LGAs).**

4.1.1.2 Heavy metals

Within the Lower Canning River heavy metal contamination is thought to be low, however adequate sampling has not been conducted to confirm this. The Swan River Trust analysed fish for pesticide residues and heavy metals in 1992, and although some heavy metals were detected, all were well below levels considered safe for human consumption.

Past experience indicates that a source of heavy metals is leachates from old tip sites.

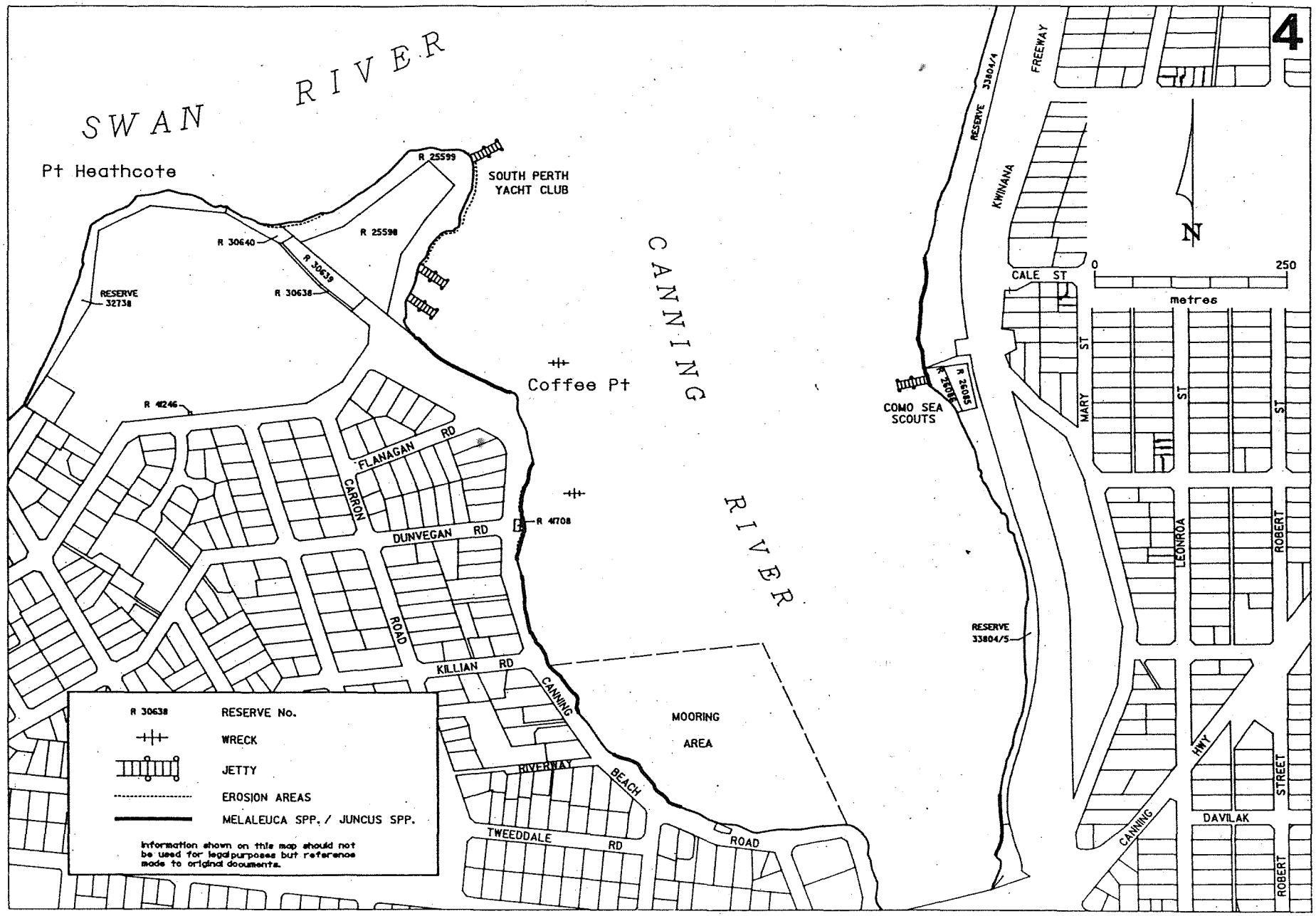
Recommendation

7 **Monitor leachates from old tip sites in the study area. Interpret and use resultant data as a guide to future management (SRT and LGA).**

4.1.1.3 Other pollutants

These generally arise from localised point sources:

- Suspended solids in rivers reduce water clarity, and very high amounts of suspended solids can result in deaths of photosynthetic plants. This rarely occurs in the study area because of the high level of tidal influence.
- Faecal and Salmonella contamination may result from silver gulls frequenting rubbish disposal sites and subsequently congregating in Bull Creek throughout summer.
- Faecal pollutants and nutrients from septic tank seepage and sewage pump station overflows have the potential to cause pollution of the waterways.
- Fuel storage facilities close to the river have the potential to leach hydrocarbons and heavy metals into the river via groundwater.


SWAN RIVER
Pt Heathcote
R 25599
SOUTH PERTH YACHT CLUB
R 25598
R 30640
R 30639
R 30638
RESERVE 32738
R 41246
Coffee Pt
CANNING RIVER
FLANAGAN RD
CARRON
DUNVEGAN RD
R 41708
ROAD
KILLIAN RD
CANNING
RIVERWAY
BEACH
TWEEDDALE RD
ROAD
MOORING AREA
RESERVE 33804/4
FREEWAY
KWINANA
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CALE ST
COMO SEA SCOUTS
R 25585
R 25586
MARY ST
ST
ST
LEONROA
ROBERT
RESERVE 33804/5
HWY
STREET
DAVILAK
CANNING
ROBERT
R 30638 RESERVE No.
WRECK
JETTY
EROSION AREAS
MELALEUCA SPP. / JUNCUS SPP.
Information shown on this map should not be used for legal purposes but reference made to original documents.

Suspended solid levels and faecal contamination are not known to have had a significant impact on the aquatic flora and fauna, and recreational users in the study area.

Pumping stations should have holding capacity for six hours flow to ensure adequate retention of waste in the event of pumping station failure.

Localised problems with suspended solids arise from dewatering activities.

SRT officers frequently receive complaints from concerned residents about surface water contamination near the Shell service station on the corner of The Esplanade and Canning Highway, and below ground storage at the Ampol station has leaked and contributed to groundwater contamination a number of times. Ampol has monitoring bores to detect hydrocarbon contamination of groundwater. Shell is currently undertaking preliminary investigations to determine if monitoring bores are required.

Recommendations

8 Endorse WAWA's strategy to connect unsewered areas near the river to deep sewerage (SRT).

9 Ensure pumping stations have adequate holding capacity and further provide copies of the WAWA contingency plan to SRT and local authorities (WAWA).

10 Ensure dewatering is in accordance with SRT Policy DE 6 (SRT).

11 Establish monitoring bores for all fuel storage facilities in order to detect hydrocarbon pollution leaching from ground fuel storage facilities. Bores should be established and monitored in accordance with Hirschberg (1991), and a copy of all results forwarded to SRT Pollution Abatement Officers (Fuel companies).

4.1.2 Drainage outlets

A number of local council drains have inadequate supports and generally require maintenance. Cities of Melville, South Perth and Canning have local drainage accessing the Canning River at many locations (Maps 4-11). Many of these outfalls require attention such as better outfall aprons to dissipate the flow onto rock and therefore reduce erosion.

Many drains are not aesthetically appealing and require attention.

Most drains in this area are situated in low gradients. Generally they may be improved by the deployment of limestone spalls as an apron at the outlet. Rushes and sedges may be planted amongst and around the spalls. Individual drains may be discussed further in the area specific recommendations (Section 5).

Where erosion and scouring are occurring, or additional supports are required, the necessary modifications should be undertaken. Conspicuous drains should be masked by planting rushes, sedges and paperbarks.

In addition, drains can upset hydrology patterns enabling the invasion of many exotic species including *Typha orientalis*. This issue is dealt with in Section 4.4.12.

Recommendations

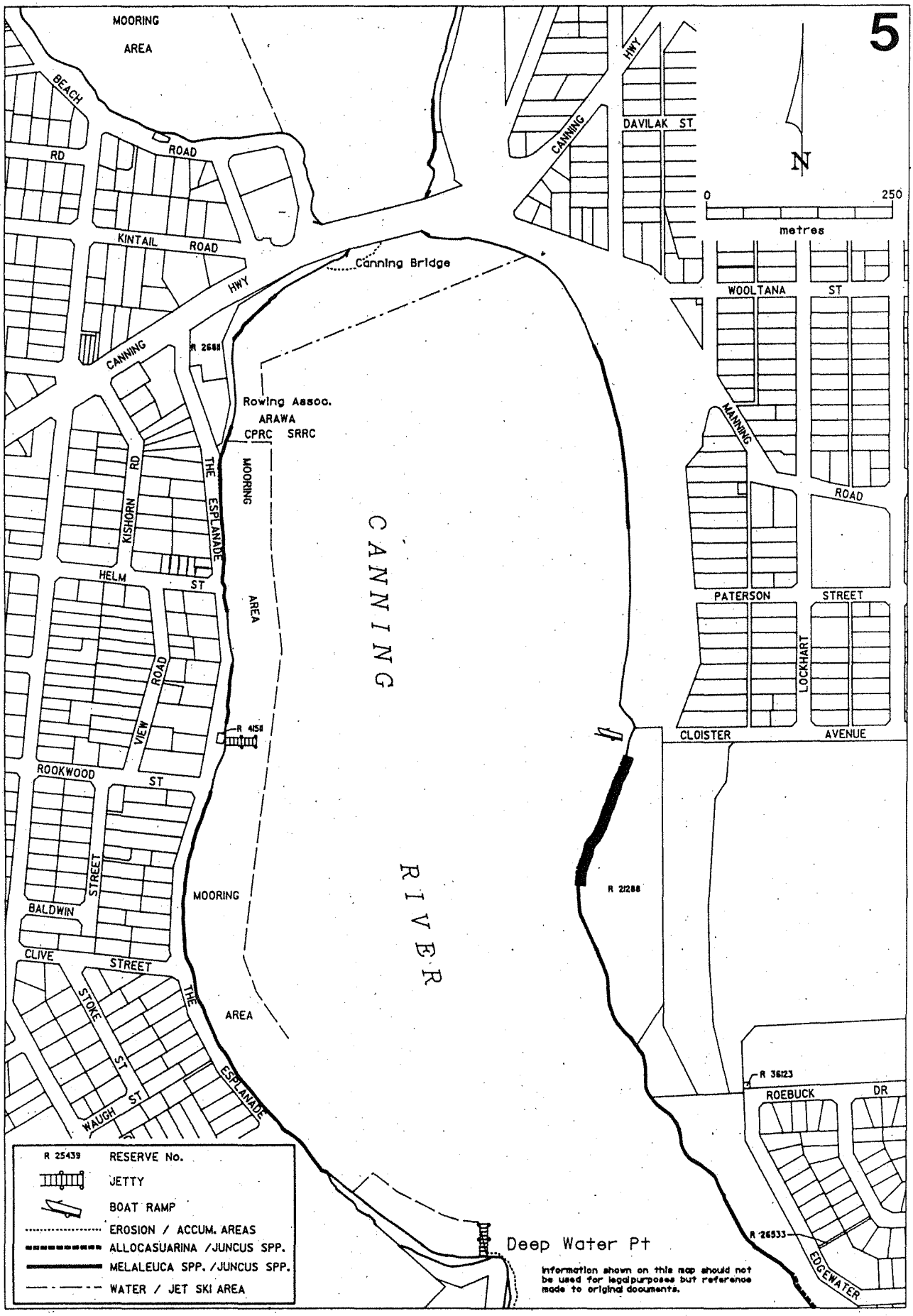
12 Establish an inventory of drainage outfalls, detailing their condition and function, and upgrade in accordance with guidelines outlined in Appendix 3 (LGA & SRT).

13 Remove drains which are no longer functional or necessary and rehabilitate the area (LGA).

4.1.3 Erosion and accretion

Erosion is a natural process which may be modified by human activities. It is sometimes necessary to control erosion because there is limited foreshore between the river and developed land. In areas where the water is slow moving and the gradient is flat, the preferred method is planting indigenous vegetation species. This also creates a habitat for invertebrate fauna. In areas where the river banks are steep and actively eroding it may be necessary to employ engineering solutions.

When selecting an erosion control strategy, consideration must be given to aesthetics,


5
MOORING AREA
BEACH RD
ROAD
KINTAIL ROAD
HWY
CANNING
R 2688
Canning Bridge
Rowing Assoc.
ARAWA
CPRC SRRC
MOORING AREA
THE ESPLANADE
KISHORN RD
HELM ST
VIEW ROAD
R 4158
ROOKWOOD ST
STREET
BALDWIN
CLIVE STREET
STOKE ST
WAUGH ST
THE ESPLANADE
MOORING AREA
CANNING RIVER
R 21288
CANNING HWY
DAVILAK ST
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WOOLTANA ST
MANNING ROAD
PATERSON STREET
LOCKHART
CLOISTER AVENUE
R 36123
ROEBUCK DR
R 26533
EDGEWATER
Deep Water Pt
R 25439 RESERVE No.
JETTY
BOAT RAMP
EROSION / ACCUM. AREAS
ALLOCASUARINA /JUNCUS SPP.
MELALEUCA SPP. /JUNCUS SPP.
WATER / JET SKI AREA
Information shown on this map should not be used for legal purposes but reference made to original documents.

significance of erosion, what the erosion affects and how it is affecting the foreshore. If feasible the Swan River Trust will attempt to stabilise river bank erosion using natural vegetation to retain and enhance the river landscape.

Erosion control methods may include:

- limiting human and animal access to the affected areas,
- stabilising with vegetation,
- beach renourishment, and
- provision of structures specifically designed to correct the local situation.

Any combination of these factors may be used.

Erosion in the study area is generally minor as wave energy is low, however there are a number of sites which are eroding at an unacceptable rate as a result of loss of vegetation. Recreation facilities such as dual-use paths are also located too close to the river edge. This creates pressure for artificial erosion control techniques in order to stop these facilities from being undermined and collapsing into the river These areas include:

- adjacent to Canning Beach Road, Applecross, between Flanagan Road and Dunvegan Road,
- adjacent to The Esplanade, Mount Pleasant,
- immediately north of the intersection of Tuscan St and Riverton Drive West, Rossmoyne,
- along Mumms Point,
- adjacent to T.S. Canning Naval Cadets,
- on the eastern foreshore immediately north of Shelley Bridge.

The beach immediately north of Canning Bridge, near the Raffles Hotel, has previously been renourished with sand to improve its amenity for pedestrian and boating usage.

Significant accretion areas occur:

- beneath Canning Bridge
- downstream side of Salter Point extending beyond the line of the navigation markers.

The build up of sediment beneath Canning Bridge confines the volume of water and leads to increased velocity of tidal interchange. This increased velocity is a safety hazard and contributes to the rapid transport of sediment.

At Salter Point, the accretion can make navigation difficult and the area hazardous.

In the past, public access to the water has not been considered and proposals for any erosion control works in the future should take this issue into account.

Recommendations

14 Stabilise erosion zones using native vegetation in accordance with Appendices 4 and 6 (SRT and LGAs).

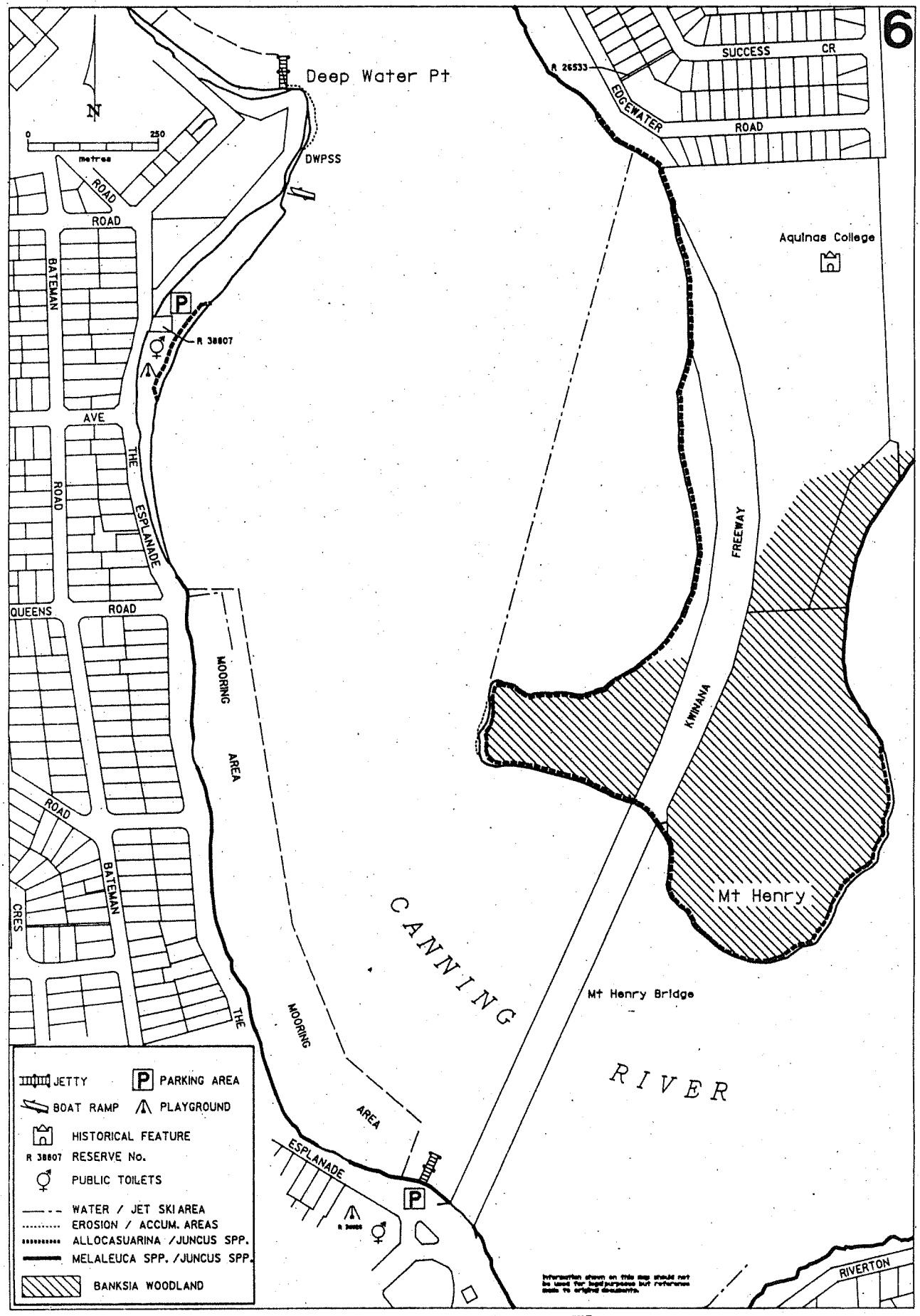
15 Ensure public access is adequately catered for when constructing erosion control structures (SRT and LGAs).

4.1.4 Dredging and reclamation

Dredging is controlled by the SRT. The Trust identifies two types of dredging: maintenance dredging to maintain existing channels and boat pens or to restore former water conditions, and development dredging for construction of new facilities or extension of existing areas.

Maintenance dredging is undertaken by DOT to ensure that marked channels remain navigable. Development dredging is unlikely to be approved, as most of the study area is characterised by shallow banks which are aquatic nursery areas and important feeding grounds for birds. (See Sections 4.4.2 and 4.4.3 for more details.)

There has been some discussion as to the viability of creating an island as a wildlife sanctuary using dredge spoil, somewhere within the study area. Although the Swan and Canning River system has few islands, a great deal of the original area of the river has already been reclaimed for urban expansion. The river is a limited resource, and its shallow banks are important to aquatic flora and fauna. It is not recommended that further areas of river are reclaimed for any purposes.


6
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ESPLANADE
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QUEENS
ROAD
MOORING
AREA
ROAD
BATEMAN
CRES
THE
MOORING
AREA
ESPLANADE
R 26533
EDGEWATER
ROAD
SUCCESS
CR
Aquinas College
FREEWAY
KWINANA
Mt Henry
Mt Henry Bridge
CANNING
RIVER
RIVERTON
JETTY
PARKING AREA
BOAT RAMP
PLAYGROUND
HISTORICAL FEATURE
R 38807 RESERVE No.
PUBLIC TOILETS
WATER / JET SKI AREA
EROSION / ACCUM. AREAS
ALLOCASUARINA /JUNCUS SPP.
MELALEUCA SPP. /JUNCUS SPP.
BANKSIA WOODLAND

Recommendation

16 Ensure dredging is in accordance with SRT policy DE 1 (SRT).

4.2 Recreation

The river environment provides an important focus for recreational activities. Effective planning and management require the provision of a broad range of opportunities best suited to the area. Conflict may arise between various types of water sports if inappropriate or no management strategies are employed.

The study area continues to be an important recreational resource for aquatic and shoreline based activities, with high recreational demand. The sheltered, wide and shallow body of water attracts various forms of recreation: including skiing, rowing, wind surfing, sailing, swimming, jet skiing, fishing and prawning. Dual-use paths and foreshore reserves allow residents and visitors to take advantage of the tranquil river aspects.

Issues include: safety and navigation aspects; environmental impact including water pollution, noise and impact on wildlife; and limited space within which these activities can occur. Many water-based activities also have an indirect impact on the foreshore, for example provision of parking, toilets etc.

If these activities are not planned and managed, the foreshores and river will be degraded, and the features which attract people to the area could be lost. Some activities including walking and bird watching do not disturb other users, whilst others such as high speed cycling, the use of personal powered watercraft and ski boats generate disturbance, the latter being associated with noise pollution. Conflicts of interest arise constantly between cyclists and pedestrians, and residents frequently complain of the noise generated in the vicinity of Deep Water Point.

Various facilities including public jetties, ramps, playgrounds and barbecues are available to recreational users. These are illustrated on Maps 4-11.

The presence of reserves has guaranteed public access to the foreshore throughout most of the study area, however land ownership restricts usage in some areas. Further, the establishment of a dual-use path around the periphery of the river has increased public access to the foreshore. Access for the disabled and infirm is available along the Cities of Melville and Canning foreshores, but is restricted in the City of South Perth.

4.2.1 Boating

Various forms of boating take place on the Canning River. These include water skiing, jet skiing, sailing, fishing from boats, rowing and canoeing.

A recreation study of the Swan River in 1985 (Thurlow 1990) reported a number of comments on boat usage, including:

- lack of consideration for other users,
- non compliance with regulations,
- noise generated by boats,
- alcohol induced situations,
- 'inexperienced' people in charge of boats and sail craft, with inadequate supervision,
- littering,
- speeding in restricted areas,
- boat wash creating problems for small craft and manually powered vessels, and
- inadequate policing of waters.

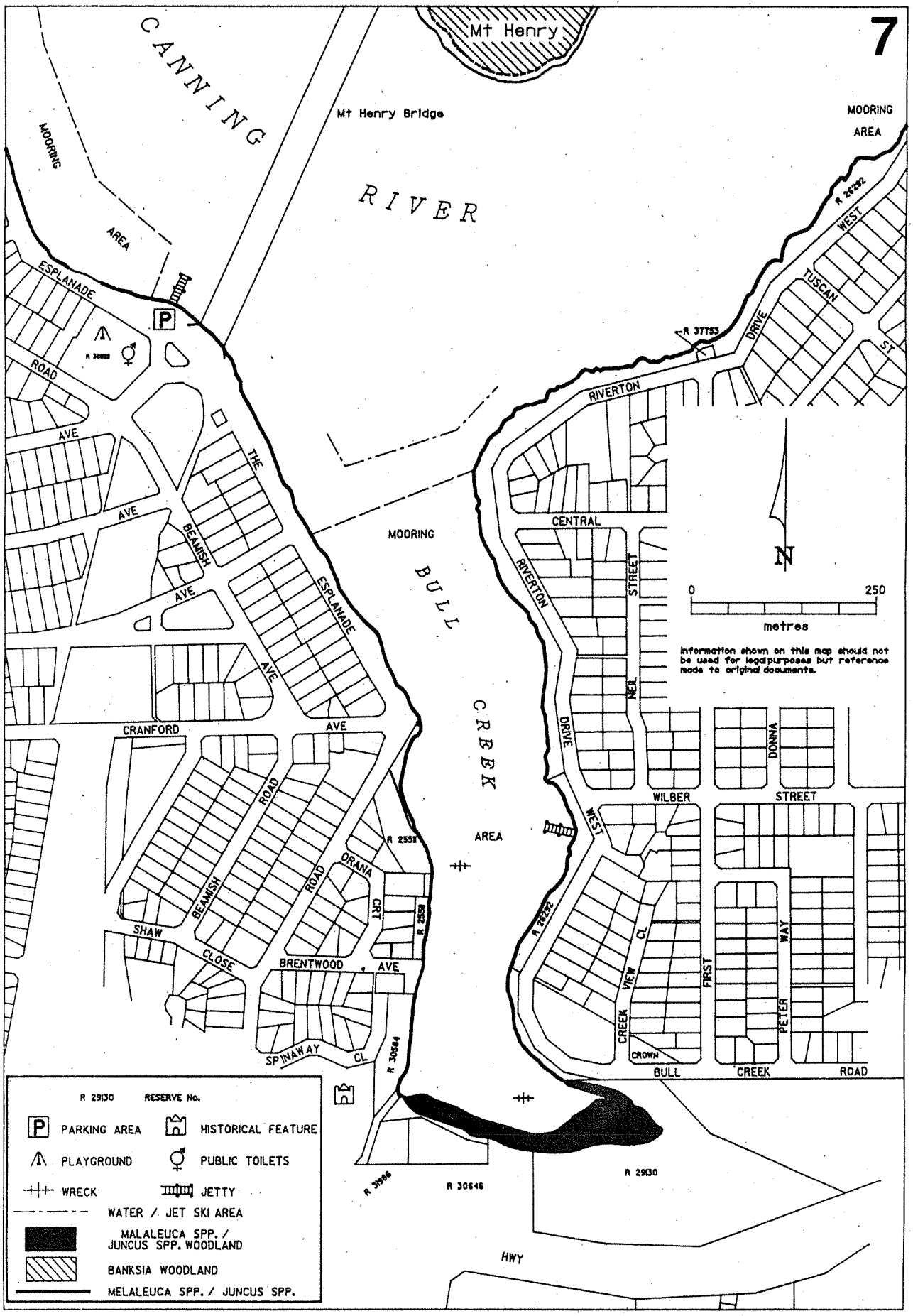
4.2.1.1 Power boating

Observation indicates that the area is already heavily utilised in terms of navigation and safety and, other than by time sharing, commercial or recreational boating uses requiring exclusive use of an area are not appropriate.

Although the Navigable Waters Regulations (amended) contain controls for the infringements outlined above, DOT do not have adequate resources to effectively police them.

The established navigation channels are sufficient to provide safe passage for vessels.

Private boat owners in WA do not require any knowledge of boating regulations.


7
CANNING
RIVER
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MOORING AREA
MOORING AREA
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SPINAWAY
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R 2553
R 30584
R 30586
R 30646
R 29130
MOORING
BULL
CREEK
AREA
R 37753
DRIVE
TUSCAN
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WEST
R 26292
RIVERTON
CENTRAL
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R 29130 RESERVE No.
PARKING AREA
HISTORICAL FEATURE
PLAYGROUND
PUBLIC TOILETS
WRECK
JETTY
WATER / JET SKI AREA
MALALEUCA SPP. / JUNCUS SPP. WOODLAND
BANKSIA WOODLAND
MELALEUCA SPP. / JUNCUS SPP.

Although information is available from DOT regarding safety and navigation, it is the responsibility of individual users to ensure they are familiar with the Navigable Waters Regulations.

Observation by officers of the Trust indicate that power boats intruding into shallow water can damage the estuarine flora (particularly seagrasses) and fauna, and detract from the enjoyment of people engaged in other activities on the river and along the foreshore.

Recommendations

17 Produce an educational brochure to distribute to boat users within the study area. The brochure should contain information on:

- **navigation rules,**
- **brief description of the area and permitted uses,**
- **consideration to other users,**
- **hints on safe boating (DOT and SRT).**

If this education program is successful in this study area, consideration should be given to its implementation throughout the Swan-Canning system.

4.2.1.2 Model boats

There has been an increase in the use of model power boats. The use of these craft has not previously been considered by the Trust however complaints are now being received. These include:

- excessive noise generation,
- damage to flora (especially seagrass) when passing at high speed over shallow flats,
- disrupting important fish feeding grounds, between Shelley and Riverton Bridges, and
- disrupting bird roosting and feeding.

It may become necessary to restrict their usage to an identified area within the river system.

Recommendation

18 Investigate the impact of the use of model boats on the river to determine whether an area should be gazetted for their use (SRT).

4.2.1.3 Sailing and associated facilities

Numerous people, including groups of school children, utilise the river for sailing and windsurfing.

This activity causes little direct damage to the river, however launching and retrieval of vessels may damage foreshore banks and vegetation. Further, littering and pollution can be a problem.

Conflicts between sail boat users and power boat users do occur. These difficulties are typically the result of poor knowledge of boating regulations.

There are two sailing clubs, the South of Perth Yacht Club (SPYC) and Shelley Sailing Club (SSC), based in the study area.

The SPYC provides moorings for approximately 370 sail and power boats. SPYC has fuel dispensers on jetties over the river. Facilities for boat maintenance and restoration are situated on the adjacent foreshore. A number of hazardous chemicals are used on the hard stands, including hydrocarbons and anti-fouling paints. Storage, use and transfer of these chemicals represents a potential source of pollution to the river.

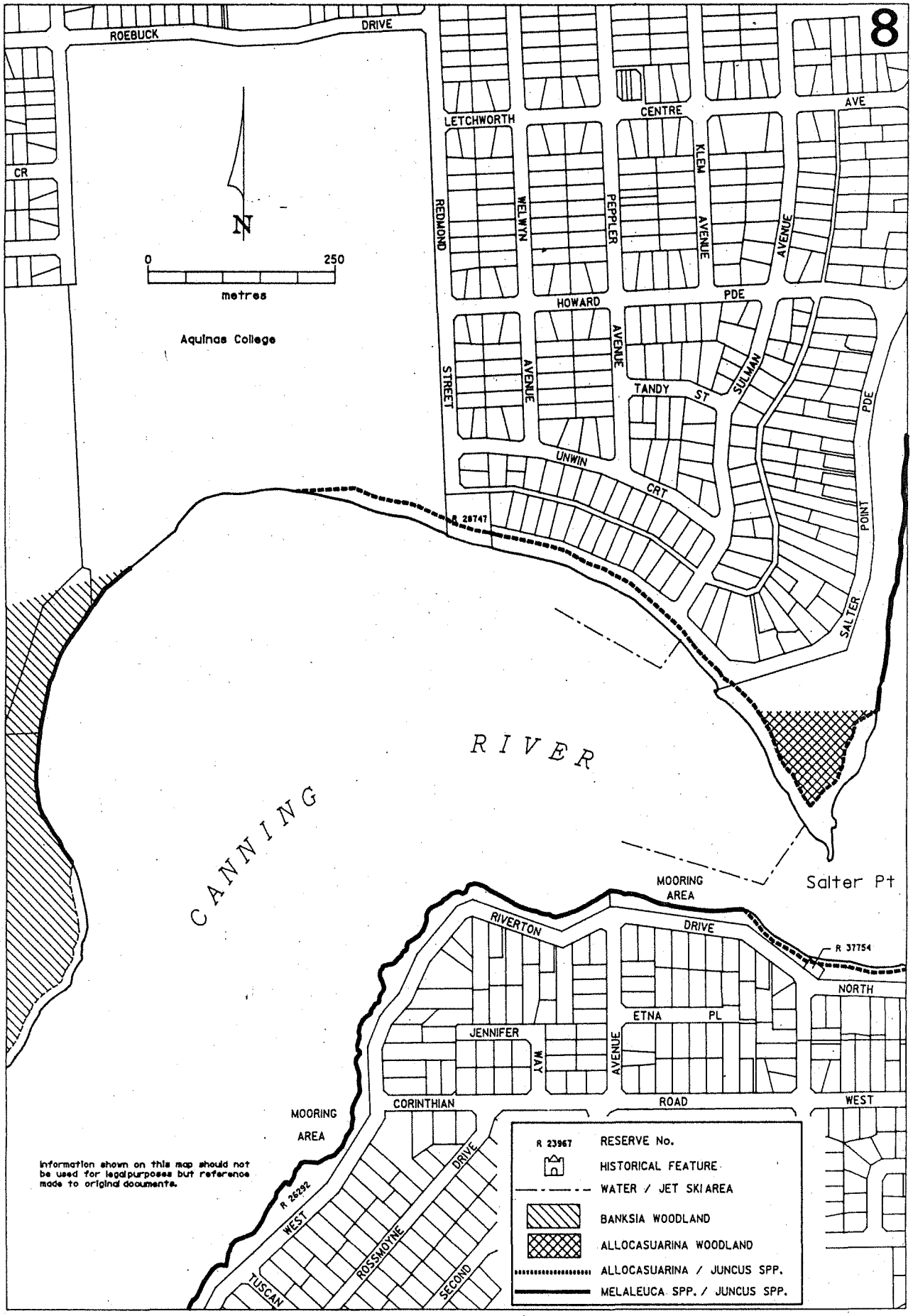
Associated issues include public access to the foreshore.

The extension of yacht clubs and associated facilities on the foreshore and in the river requires careful planning to avoid conflict and environmental degradation.

The SSC which occupies a portion of Mumms Point Reserve is very small but extensions have been approved by the SRT and work is due to commence. Approximately 60 boats are associated with the Club and use the river between Fifth Avenue (Rossmoyne) to Riverton Bridge. A management plan is being developed for this area as part of a condition of development set by the Minister for the Environment.

Recommendation

19 Monitor sailing activities in the study area (SRT).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ROEBUCK
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Aquinas College
LETCHWORTH
CENTRE
AVE
REDMOND
STREET
WELWYN
AVENUE
PEPPLER
KLEM
AVENUE
AVENUE
HOWARD
PDE
AVENUE
TANDY
ST
SULMAN
PDE
UNWIN
CRT
POINT
SALTER
R 28747
RIVER
CANNING
Salter Pt
MOORING
AREA
RIVERTON
DRIVE
R 37754
NORTH
ETNA
PL
JENNIFER
WAY
AVENUE
CORINTHIAN
ROAD
WEST
MOORING
AREA
R 25292
WEST
ROSSMOYNE
DRIVE
TUSCAN
SECOND
R 23967
RESERVE No.
HISTORICAL FEATURE
WATER / JET SKI AREA
BANKSIA WOODLAND
ALLOCASUARINA WOODLAND
ALLOCASUARINA / JUNCUS SPP.
MELALEUCA SPP. / JUNCUS SPP.
Information shown on this map should not be used for legal purposes but reference made to original documents.

4.2.1.4 Rowing and associated facilities

This section of the river is extremely important for rowing as it is the best course in the metropolitan region. The activity of rowing does not cause any direct management problems.

Facilities for Swan River Rowing Club, Amateur Rowing Association of W.A., Curtin University Boat Club and the Aquinas College Rowing Club are situated in the area.

This section of the river is extremely important for rowing as it complies with Olympic requirements for rowing courses. Use of clubhouses, down-loading and loading of sculls and boats can contribute to erosion, damage to foreshore vegetation and conflict with other foreshore users.

The main problems are the limited potential for development of facilities and conflict with other users, resulting from the exclusive use of the area. Recommendation 80 of the Swan River Management Strategy (1988) recommends the development of an alternative course elsewhere in the metropolitan area. This issue is still relevant and should be further investigated.

Recommendation

20 Encourage the implementation of Recommendation 80 of the Swan River Management Strategy (SRT).

4.2.2 Sea Scouts

The following Sea Scout clubs are situated on the Lower Canning: 1st Como; 1st Deep Water Point; 1st Salter Point and 1st Canning.

The Swan River Management Strategy contains recommendations that the proliferation of clubhouses for water-based activity be limited and, where possible, new groups should consider sharing facilities.

Recommendation

21 Endorse Recommendation 74 of the Swan River Management Strategy which considers the possibility of sharing shore-based club facilities (SRT).

4.2.3 Mooring areas

There are three mooring areas gazetted by DOT for public use within the study area (Maps 4-11). Proposals for new areas will be determined under Part V of the Swan River Trust Act.

The three areas have the capacity for 270 boats. Apart from four small areas at Corinthian Avenue and Second Avenue (Rossmoyne), south of Mumms Point and near Zenith Avenue (Shelley), the mooring sites are located between South of Perth Yacht Club and the tail of Bull Creek.

The number of moorings is believed to be sufficient and it is not recommended that any new mooring areas be established.

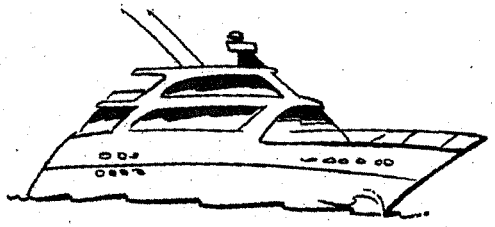
There are some boats moored outside gazetted areas. These were established prior to any formal controls over moorings and have been allowed to remain. DOT are currently developing a policy for all moorings outside gazetted areas.

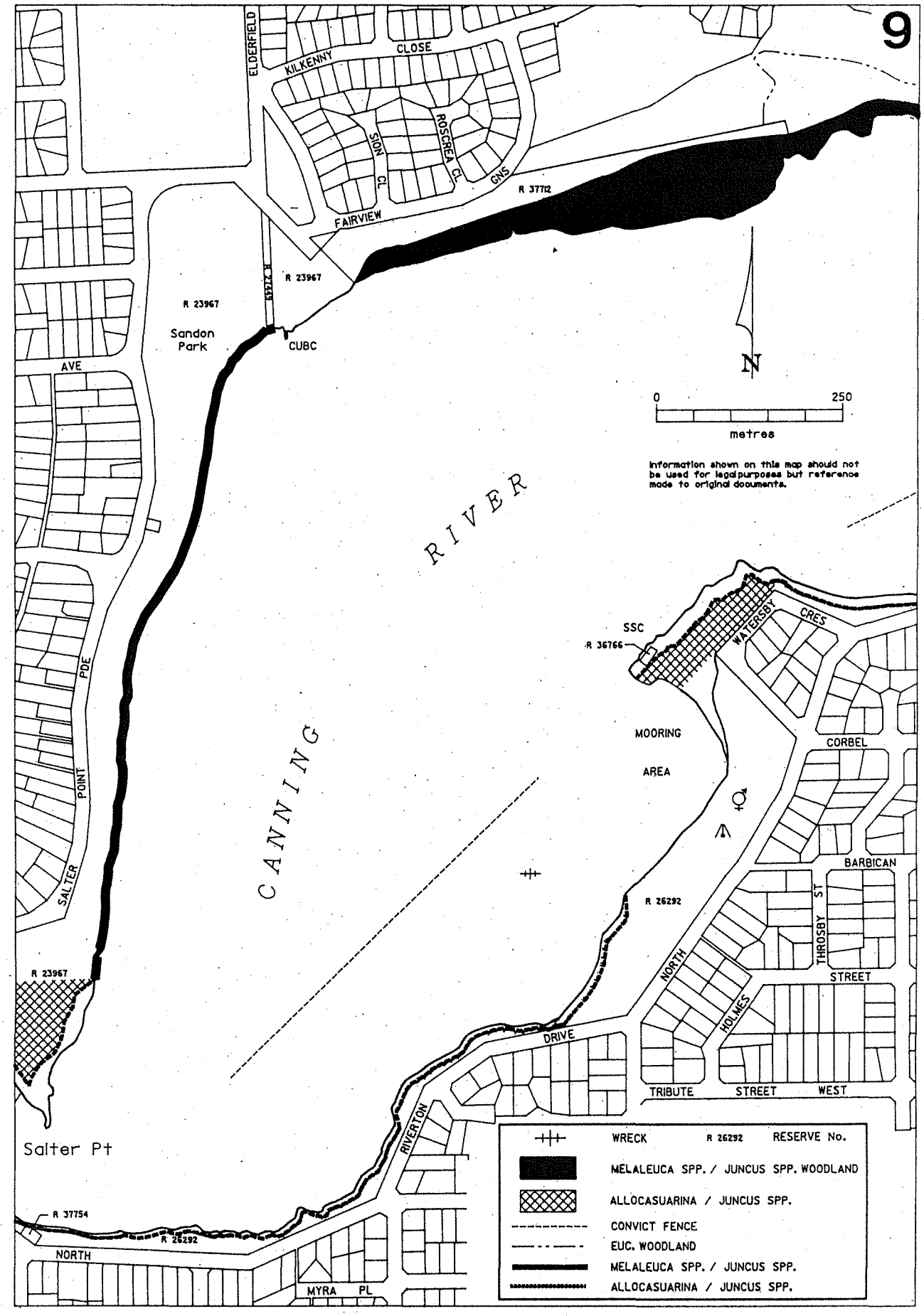
There are a number of poorly maintained moorings including some which are partly or fully submerged. These represent a danger to other river users.

Recommendations

22 Establish a consistent policy for existing mooring sites, and apply the recommendations to vessels upstream of Salter Point (DOT).

23 Remove or repair moorings which fail to conform to DOT standards (SRT).




9
ELDERFIELD
KILKENNY
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Sandon Park
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Information shown on this map should not be used for legal purposes but reference made to original documents.
RIVER
CANNING
SSC
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WATERSBY
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MOORING
AREA
CORBEL
BARBICAN
THROSBY ST
STREET
NORTH
HOLMES
TRIBUTE
STREET
WEST
DRIVE
RIVERTON
PDE
POINT
SALTER
R 23967
R 26292
Salter Pt
R 37754
R 26292
NORTH
MYRA PL
WRECK
R 26292
RESERVE No.
MELALEUCA SPP. / JUNCUS SPP. WOODLAND
ALLOCASUARINA / JUNCUS SPP.
CONVICT FENCE
EUC. WOODLAND
MELALEUCA SPP. / JUNCUS SPP.
ALLOCASUARINA / JUNCUS SPP.

4.2.4 Abandoned boats

There are numerous boats partly or fully submerged around the river. Some of these boats are considered by regular users of the area to be navigation and safety hazards, and in some instances are unsightly. The SRT Act 1988 provides for the removal of abandoned or derelict vessels, or those which constitute a hazard both on land and within the water.

Recommendation

24 **Remove vessels which are considered to be derelict, abandoned or constitute a danger to persons or other property (SRT).**

4.2.5 Boats stored on the foreshore

Many boats are left on the foreshore, as it provides free 'storage' and easy access. Many of these boats have not been used for some time. These boats restrict access and cause damage to trees and the understorey.

Under SRT legislation, it is illegal to leave boats on foreshores without permission from the foreshore manager.

Designated storage areas for boats on the foreshore would be appropriate in the Bull Creek backwater and along the Shelley and Manning foreshores. Rails should be provided to chain craft to rather than trees as at present. Boat storage areas should be sited with the objective of minimising damage to foreshore vegetation. This will also reduce access through and across rush and sedge stands.

Recommendations

25 **Designate storage areas and provide hitching rails on land for small boat owners and charge a levy sufficient to encourage bonafide users (LGAs).**

26 **Advise boat owners to utilise provided storage areas or remove their boats in accordance with the SRT Act (SRT and LGAs).**

27 **Inspect and remove boats which are not stored in accordance with the above recommendations. Advertise the removal at SRT, council offices and in the local paper (SRT and LGAs).**

4.2.6 Prawning

Prawning is a popular summer pastime for many Perth residents and visitors. It provides a recreational opportunity for families as well as the possibility of a meal of fresh prawns. Although prawning occurs throughout the study area, a number of locations are heavily used:

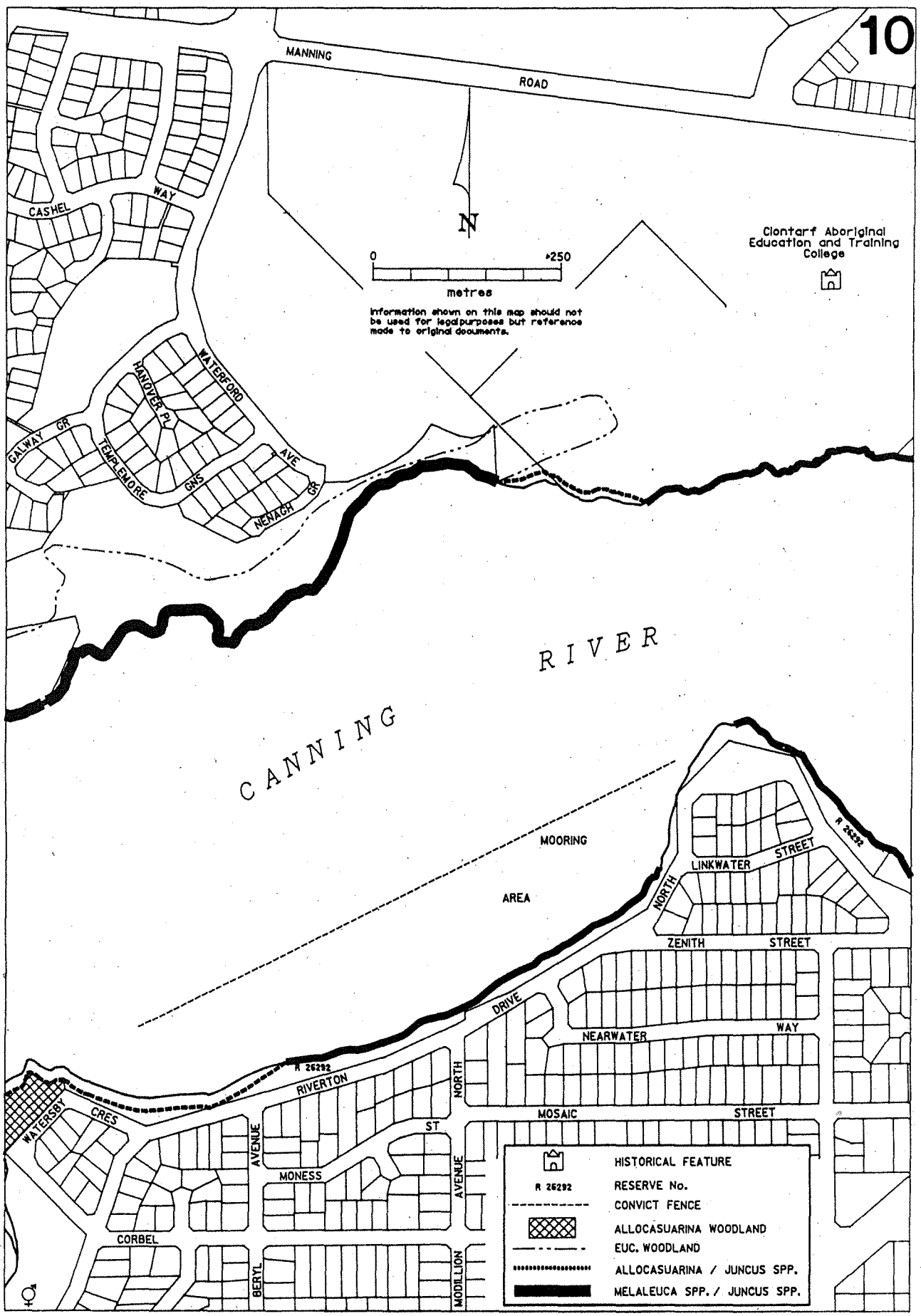
- western bay between the Raffles Hotel and SPYC,
- eastern foreshore between Canning Bridge and Cloister St. overpass,
- western foreshore between Canning Bridge and Helm St,
- between Bateman Rd and Queens Road, especially Deep Water Point,
- eastern foreshore adjacent to Edgewater Rd footbridge,
- adjacent to Mount Henry Bridge on both sides of the river,
- mount Henry Bridge to First Avenue in Shelley.

The popularity of prawning generates a number of management issues:

- Access to the foreshores in some areas is indiscriminate.
- Mounds of rubbish are left on the foreshore. This rubbish consists of discarded contents of prawning nets, which include rotting algae and dead fish (some of which may have poisonous spines), the remains of burnt out camp fires and associated litter. Much of this debris is dumped onto fringing rushes, sedges and grasses.
- Trampling of foreshore vegetation.
- Destruction of native vegetation for fires.

All of these issues contribute to the environmental impact of this activity.

The SRT field hands spend much of their time in summer cleaning up after prawners. Although prawning is an appropriate use of this resource, it must be well managed so that it will be enjoyed by future generations.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Prawns are a regional resource which require management at a regional level. There is a need for State and local government to address this issue comprehensively. Issues include:

- delineating access points,
- provision of sign posting,
- provision of cooking facilities,
- competition for limited foreshore and parking space,
- competition for a limited resource,
- disposal of organic waste, and
- disposal of other matter.

Prawners should return aquatic life back to the water immediately.

Recommendations

28 Survey prawners to determine:

- **level and frequency of use**
- **facilities required**
- **attitudes and behaviour (SRT).**

29 Establish information signs in areas frequently used, providing information on waterways management issues (SRT and LGAs).

30 Direct SRT staff and honorary inspectors to enforce relevant regulations where environmental damage occurs (SRT).

4.2.7 Fishing

Recreational fishing is popular and although no amateur net fishing (other than prawning) is permitted, a limited number of commercial licences are operational in the Swan and Canning River system.

Commercial fishing in the Lower Canning River predominantly occurs at night or early morning during the week, rather than in periods of peak use, on the weekends and public holidays.

Commercial fishing was amongst the first industries on the river and is a historic use and attraction on the river.

The Fisheries Department is responsible for managing amateur and commercial fishing in the Swan and Canning River system. Departmental policy allows existing licences to operate, however no new licences will be issued.

Accessible areas adjacent to deep water beneath Canning Bridge, the large wooden jetty on the western side of Mt Henry Bridge, and upstream in areas where the channel passes close to shore are the most popular shore-based fishing spots in the study area. Fishing activities are concentrated around early morning and late afternoon at most of these sites, but some people fish throughout the day.

At present it is believed that amateur and commercial fishing does not constitute a management problem.

Issues associated with this activity include worm digging (Section 4.2.8), littering (Section 4.8) and parking access (Section 4.3.4).

Recommendation

31 Continue to monitor amateur and commercial fishing (FD).

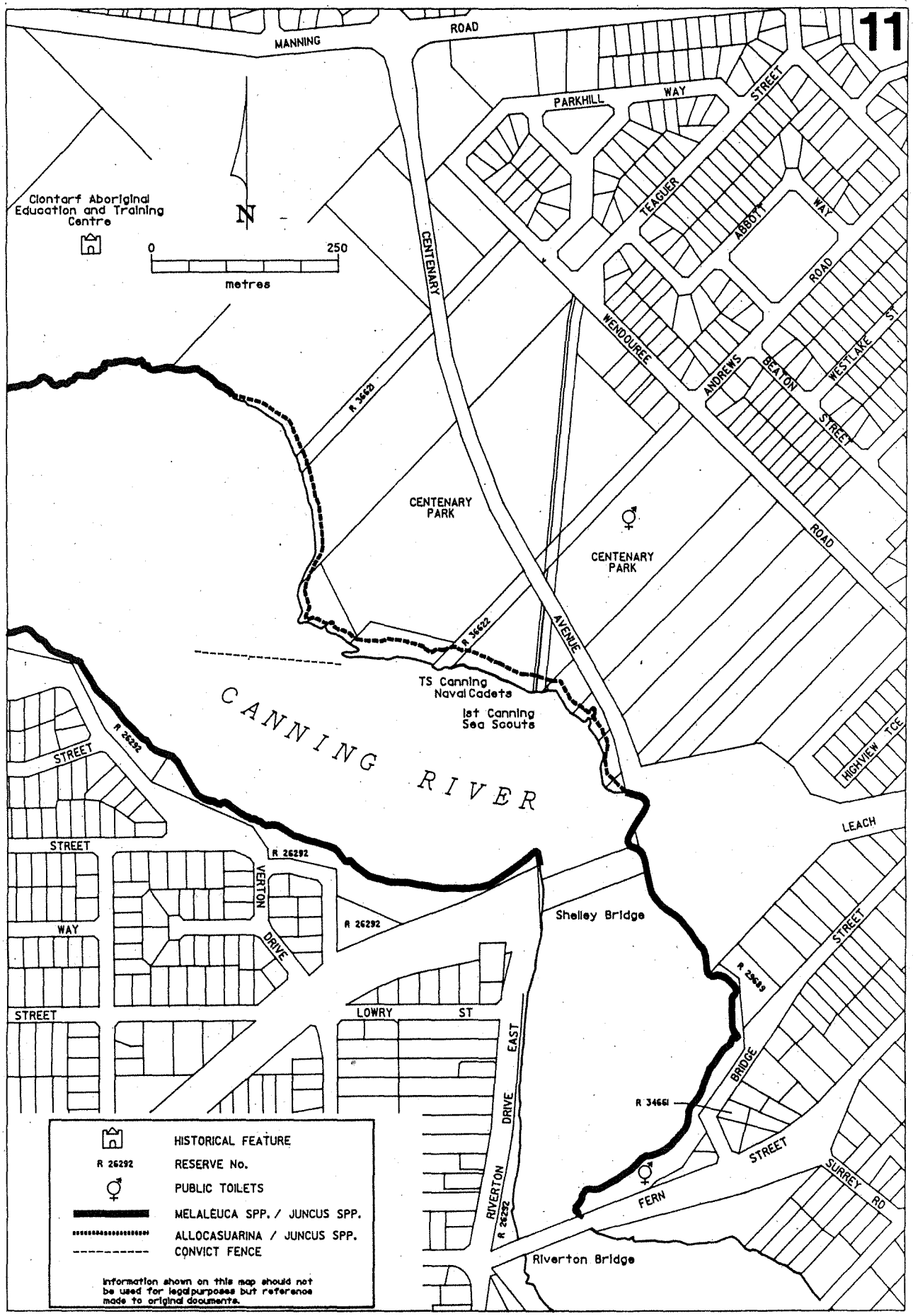
4.2.8 Worm digging

Worms are a popular bait for black bream and cobbler fishing. Swan River Trust regulations prohibit any activities which destabilise and/or damage the river beds and banks, or affect fringing vegetation detrimentally. Worm digging can increase erosion, whilst the dumping of worm digging spoil on rushes and grasses fringing the river smothers vegetation.

There are a number of locations in the study area where people dig for worms and dump the spoil on the rush beds. Evidence of this activity exists at Salter Point, Clontarf foreshore and small areas along the Riverton foreshore. This activity is inappropriate and has the potential to destroy valuable vegetation.

Six sites have been designated as worm digging sites by the SRT. They are:

- Belmont - upriver side of Abernethy Road,
- Maylands - East Street Jetty,
- East Perth - upstream of Bunbury Rail Bridge,
- Causeway No 4 car park to Trinity College,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VERTON
DRIVE
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WAY
STREET
LOWRY
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LEACH
Shelley Bridge
STREET
R 26689
BRIDGE
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STREET
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RESERVE No.
PUBLIC TOILETS
MELALEUCA SPP. / JUNCUS SPP.
ALLOCASUARINA / JUNCUS SPP.
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- South Perth - Narrows Bridge to Queen Street Jetty,
- Canning Bridge - Cloisters Ramp.

Within these sites the following rules apply to worm digging:

- no digging within 5 metres of any vegetation,
- diggings to be sorted below high water mark,
- all diggings to be returned to the water,
- people should only remove what they need.

Trust officers will take the appropriate action if people are not operating within the guidelines and sites listed above.

Recommendation

32 Direct SRT staff and honorary inspectors to enforce relevant regulations where worm digging is occuring outside the designated sites (SRT).

4.2.9 Cycling and walking

Dual-use paths occur along the foreshores of most of the study area. Deviations away from the foreshore occur at the municipal boundary between the City of Melville and Canning and throughout the City of South Perth.

Not only do these paths allow recreational use but they can delineate between native vegetation and lawn areas, and public and private land, and act as an effective firebreak.

Informal pathways should be blocked off to prevent further erosion and damage to the existing vegetation. These areas should be replanted.

Additional paths should be created if the current structure is insufficient distance from areas of remnant vegetation and there are open areas sustaining little native vegetation for an alternative route.

Where there is demand for access through wetlands, and there are already established trails with associated disturbance to the ecosystem, the formalised access way should traverse the area in this location, enabling the remainder of the wetlands to be left intact. Any trails passing through wetland areas should be raised open boardwalks, which do not impede water and animal movement beneath. Activities permitted in these locations should be conducive to the natural environment e.g. photography, walking and bird watching. Dogs and bicycles should be prohibited from such areas.

Seats should be provided along recreational trails and dual-use paths.

Appropriate signage is required, indicating to users the importance of complying with regulations, i.e. dogs, litter, use of trails, protection of flora and fauna and any other management needs.

There are a number of difficulties associated with conflicting usage by cyclists. There is a substantial number of commuter and professional and amateur cyclists who use the dual use paths for high-speed exercise. This conflicts with pedestrians and leisure cyclists, who feel threatened by cyclists passing at high speed. This problem has been addressed by the LGAs which have painted warnings to cyclists to ring their bells or travel on roads. Whilst this has alleviated the problem to some degree, it has not solved it.

Recommendations

33 Locate and design dual-use paths along the foreshore in consultation with the SRT addressing issues such as:

- **existing drainage patterns,**
- **protection of remnant vegetation,**
- **erosion of foreshore areas, and**
- **conflict between users (LGAs).**

34 Erect appropriate signage adjacent to dual-use paths (Bikewest).

4.3 Amenities

As the population of Perth increases so does the use of the foreshores, and subsequently the need to provide public amenities.

Development of facilities on the foreshore requires careful planning to ensure that the facilities are appropriate, correctly sited,

necessary and compatible with their surrounds. New facilities should not be constructed in a manner which detracts from the landscape value of the foreshore.

Provision of facilities may be funded privately or by government. In the public sector, much of the responsibility is held by LGAs. Additional funding may be provided by State government.

4.3.1 Lawn areas

The large number of grassed areas in the vicinity of the river are maintained by the LGAs. Traditional practices have involved broad-scale application of fertilisers, with little consideration given to the ultimate fate of such nutrients (del Marco 1990).

There are a number of regions which currently support few recreational activities. There are distinct advantages in minimising areas of grass which do not support high public usage, including:

- reduced maintenance costs (e.g mowing, fertilising, watering etc.),
- improved definition of access points,
- improve aesthetic value, and
- reduction of potential for weed invasion.

Many areas of open lawn lack shade trees. Provision of shade trees would enhance recreational usage. Preferred shade tree species are local varieties, which are suited to the harsh climate of this area and have significantly lower maintenance costs (Appendix 5).

Recommendations

35 Maintain lawns only in areas of high recreational pressure (LGAs).

36 Reinforce the number of shade trees in areas of high recreational use including:

- **Deep Water Point,**
- **Fifth Ave,**
- **Centenary Park,**
- **Salter' wetland, and**
- **Cloister Avenue overpass (LGAs).**

4.3.2 Toilets

There are five toilet blocks within the study area; two at Deep Water Point (Mt Pleasant), Mt Henry Bridge, near Beatrice Ave (Shelley) and Fern Road Bridge.

Existing facilities are well maintained however there are a number of heavily used areas which lack toilet facilities. It is important that existing and new facilities are designed to minimise nutrient leaching to the river.

Recommendation

37 Ensure that new toilet facilities are connected to reticulated sewerage or designed to minimise nutrient input to the river system (LGAs).

4.3.3 Kiosks

There is one kiosk at Deep Water Point, with the remainder of the study area lacking any such facilities. There are very few groups of shops in the vicinity of the river in this area.

The Swan River Management Strategy (1988) identifies criteria for the assessment of commercial development proposals.

Recommendation

38: Ensure that proposals to develop a kiosk in the area are in accordance with Recommendation 34 of the Swan River Management Strategy and Swan River Trust Policies (SRT).

4.3.4 Parking

There are relatively few formal parking areas despite the high level of recreational usage in the area. Car parks catering for 15 or more vehicles are located:

- immediately north of Killilan Road, Applecross,
- near the intersection of Ogilvie Road and Canning Beach Road,
- at WA Rowing Club Headquarters and Swan River Rowing Club,
- north and south of Deep Water Point,

- at Cloister Avenue overpass,
- beneath the Mount Henry Bridge,
- at the intersection of Beatrice Ave and Riverton Drive North, and
- at the intersection of Elderfield Road and Fairview Gardens.

There are numerous informal parking bays present along the foreshores, particularly in the Cities of Melville and Canning. The number and variety of recreational activities undertaken in these areas generates a high level of pressure for parking.

Further, in times of high levels of public usage, such as prawning and power boating and one-off events such as the Skyshow and the Head of the River, parking becomes a major issue. Competition for limited parking resources forces people to park on road verges and along side streets. This is unsatisfactory for local residents.

Creation of parallel parking on the existing road reserve would be appropriate adjacent to the extensive lawn areas in the City of South Perth, particularly Sandon Park.

It would be appropriate for many of the informal parking areas adjacent to the open pine bollards to be upgraded to semi-formal (limestone rubble or brick paving) parking areas including a petrol/oil trap. The brick paved parking areas established by the City of Canning are considered an appropriate strategy to reduce erosion of informal parking bays.

Recommendation

39 Develop a parking strategy for foreshore areas which considers:

- **level and types of recreational usage and associated parking demands,**
- **opportunities and constraints,**
- **available facilities,**
- **containment of stormwater drainage on site, and**
- **provision of oil and grease traps (LGAs).**

4.3.5 Jetties and boat ramps

Jetties and boat ramps have to be licensed under the Jetties Act 1926-1976 as either private or public structures.

Several private and public jetties are located in the lower reaches of the study area. Three public jetties are located at Deep Water Point, Mt Henry Bridge and Riverton Drive (Bull Creek).

The Swan River Trust policy on private jetties is, in part:

- owners of existing licensed jetties to continue to enjoy the use of their jetty,
- applications for new jetties abutting foreshore reserves will be refused, and
- applications for new jetties where the owners lot has a high water mark boundary will be considered by the Trust.

Existing jetties and boat ramps which are not licensed are illegal and may be removed if a licence is not granted. Four jetties in Bull Creek and Melville are unlicensed.

Jetties may be dangerous when inadequately maintained. It is necessary to ensure that each jetty licensee maintains the jetty to a suitably high standard in accordance with the conditions of the license.

While many jetties are designed for boating use only it is common for people to use these for swimming activities. The depth of water beneath these jetties creates a safety problem for diving and swimming.

There are three public boat ramps located in the study area. These are located at:

- Cloister Avenue overpass,
- Deep Water Point, and
- adjacent to the Curtin University Boat Club.

The capacity of these two launching areas is limited and because of the high demand for boat launching sites within the area, many people launch their boats illegally along the foreshore.

There is a need to formalise a small dinghy boat ramp on the Riverton foreshore, to discourage boat users from creating their own launching areas along the foreshore. The City of Canning needs to investigate the provision of additional parking for these purposes.

Recommendations

40 Establish a small boat ramp to accommodate small boat users in the City of Canning. The design should incorporate provision for parking and access to the ramp (City of Canning).

41 Erect signs on public jetties to prohibit diving or jumping from these jetties (SRT and LGAs).

4.3.6 Public access

Access to the river and foreshore is determined in part by:

- water depth,
- terrain,
- wetland or drainage systems,
- land ownership i.e. proximity of freehold title, and
- land use.

Access to the rivers in some other States, and indeed in other countries, is often severely restricted. Public access to rivers and the foreshores in the metropolitan area has always been considered a right, rather than a privilege. Most of the foreshores of the Swan and Canning River system are affected by a MRS Parks and Recreation Reservation. One of the reasons for the placement of Parks and Recreation Reservation was to ensure public access to the river and its foreshores. It is important to maximise public contact (both physical and visual) with the riverscape without detracting or endangering its viability as a natural system.

Although much of the foreshores in the study area are reserved for Parks and Recreation purposes not all are in public ownership. In addition the reservation line needs to be rationalised to ensure adequate public access and protection of the foreshore flora and fauna.

Public access needs to be managed to ensure that the river banks and foreshores are not degraded.

Access for the disabled in some areas is restricted. It is important to provide appropriate facilities to allow this group of users access to the river environment.

Recommendations

42 Encourage the Department of Planning and Urban Development to rationalise the Parks and Recreation Reservation within the study area and acquire all reserved land still in private ownership (SRT).

43 Ensure all foreshore facilities are designed to provide for access for the disabled (LGAs).

4.4 Biological environment

4.4.1 Aquatic flora

The Canning River supports a wide range of aquatic flora, both macroscopic and microscopic. These organisms form an essential part of the food chain and provide a habitat for invertebrates and other animals. The physical and chemical characteristics of the river waters affect the balance of the system, resulting in changes in the distribution and biomass (quantity) of aquatic flora.

Research into the aquatic flora distribution in the river system is continuing. Results to date indicate these waters are subject to occasional microscopic algae blooms, particularly phytoplankton. A number of potentially toxic dinoflagellate and blue-green algae species have also been recorded, however never in bloom situations.

The seagrass *Halophila ovalis* has been known to occur in the shallow waters of the study area. However it appears to die off after prolonged freshwater immersion in years with high rainfall. Preliminary data indicates that this species is able to recolonise the area, but little is known of the process. What is known is that seagrass beds are an important fish nursery area in estuaries, providing a direct food source for fish as the seagrass decays, or

an indirect food source with fish consuming invertebrates which feed on the seagrass and detritus. These areas are also an important sheltered habitat for small fish.

In more recent years macroalgae has accumulated on the banks of the river. Some of these accumulations have dispersed without intervention. In other cases they have been cleared by Swan River Trust staff. Rotting and drying macroalgae does, however, retain numerous invertebrates which many wading birds feed on. It is important to find a balance between removing macroalgae accumulations on the foreshore which are a nuisance to users or adjacent residents and allowing the waterways to function naturally so that the habitat, particularly the food source for birds is fish, are protected.

Recommendations

44 Monitor aquatic flora to identify temporal and spatial changes so that adverse environmental impacts can be managed and controlled (SRT and tertiary institutions).

45 Consider the importance of aquatic flora when assessing development applications in foreshore areas (SRT).

4.4.2 Aquatic macrofauna

Estuarine teleost fish, including species which typify the fish catch of the Swan and Canning River system, complete their entire life cycle within estuarine waters and are therefore able to tolerate seasonal variation in salinity. Despite increasing human pressure on fish resources, fish abundance has not appeared to decrease. Management of the fishery activity is necessary to maximise utilisation of the river by potentially harvestable fish. It is imperative that the level of disturbance to shallow banks and the foreshores adjacent to wetlands is minimised.

The Swan River Management Strategy has identified the majority of the study area as a fish nursery and made recommendations for its protection. Specifically, three areas in the Lower Canning River are important functional fish nurseries. These lie in the shallow waters periodically fringing the foreshore immediately west of the Kwinana Freeway between Canning Bridge and Mount Henry Bridge, Bull Creek backwater and finally from adjacent to the Waterford foreshore past Clontarf to Riverton Bridge. The continued survival of fish stock for amateur and commercial fishing depends upon the persistence of such nurseries.

Large holes have been observed in the sides of the sloping banks in deeper waters (>2 m) around Mt Henry. Professional fishermen have suggested that these features are cobbler holes or 'nests'.

Recommendations

46 Establish a public education program detailing the importance of riverine flora and fauna, and the importance of their protection, and outlining associated issues (SRT).

47 Improve the information signs for the boating public to encourage compliance with gazetted areas in order to protect aquatic flora and fauna (DOT).

48 Endorse Recommendation 51 of the Swan River Management Strategy (1988) which aims to reserve and protect fish nursery areas (SRT).

49 Consider the value of the area as a fish nursery when assessing developments (SRT).

50 Monitor aquatic fauna to identify detrimental impacts on the area (SRT and tertiary institutions).

4.4.3 Aquatic invertebrates

Estuarine systems and fringing wetlands generally support a high diversity of invertebrates.

The distribution of invertebrates varies with the tolerance of organisms to fresh, estuarine or saline water. The greatest abundance of benthic invertebrates occurs in the shallow tidal mud flats, providing the river's most abundant food source.

The undisturbed sandy shallows around the upper Canning River can be very productive in comparison to the dredged channels. These areas would be attractive to fish for feeding.

Dredging has an enormous impact on the aquatic invertebrate fauna, as it removes habitat and alters the composition of the substrate. The distribution of invertebrates is partly governed by depth, sediment type and the abundance of macroalgae. The recovery of dredged areas is slow and incomplete if the sediments remain soft and muddy.

Recommendations:

51 Oppose dredging upstream of Mount Henry Bridge in order to protect the integrity of the benthic environment (SRT).

52 Encourage post-graduate research into benthic fauna (SRT and LGAs).

4.4.4 Foreshore vegetation

Both aquatic and foreshore wetland habitats of a river are highly specialised and productive ecosystems. Within these systems plants and animals interact with the non-living surroundings (ie atmosphere, soil and water). Plant communities of the river and adjacent foreshore are involved in oxygen and nutrient dynamics and stabilisation of the sediments.

Fringing vegetation is important in maintaining a healthy river system. Fringing wetlands can trap heavy metals and various hydrocarbons before they reach estuarine and riverine waters. The organic peat which accumulates within these areas can bind pollutants and nutrients, regulating their passage into the river.

Wetlands fringing the river are a diminishing resource and are under constant development and recreational pressure.

A great proportion of the foreshore is subject to weed infestation by grasses such as buffalo grass (*Stenostaphrum secundatum*) and kikuyu (*Pennisetum clandestenum)*, dock, golden dodder and a number of tree weeds such as Japanese pepper and castor oil bush, and vines, for example morning glory and bridal creeper.

A brief description of the vegetation is in Section 2.3 whilst a technical description of vegetation is provided in Appendix 1.

Most of the remaining areas of fringing vegetation have been disturbed by drains, land fill and trail-bikes and generally contain sewerage and drainage works.

The remnant foreshore vegetation throughout most of the Cities of Melville and Canning is limited to a narrow band. The trees are nearing the end of their life span, and there are few areas with evidence of regeneration. It is important that existing stands of paperbarks, she oaks etc. are reinforced to ensure the long term persistence of these remnants. A reduction in the number and diversity of trees corresponds with a decrease in the fauna dependent on them.

There are a number of advantages in utilising locally derived seedlings (i.e. germinated from seeds collected from nearby areas) which

- arebetter suited to local conditions,
- maintain genetic stock in the local area, and
- facilitate the maintenance of genetic diversity in a regional context.

However, it is important to maintain some level of genetic mixing to avoid in-breeding and the associated deterioration of the community.

In many locations, exotic grasses have infiltrated the native vegetation. Mowing of these grasses exacerbates the problem. One strategy to minimise this problem would be to extend the native vegetation from the river to the dual-use path and remove all grass in this area. The dual-use path would then act as a barrier. Advantages of this include reduced mowing, weeding and other maintenance costs in the long term.

Recommendations

53 Conserve the stock and diversity of native flora by:

- **protecting remaining communities of special ecological, scientific, educational and recreational significance;**
- **restricting further human disturbance in the**

predominantly native communities;

- **planting seedlings germinated from local seed stock;**
- **encouraging and assisting public and private land holders in the management of existing remnant vegetation and other areas of conservation value;**
- **the protection of rushes, sedges etc. from invasion by grasses. This may be helped by placing structures such as dual-use paths between the lawn areas and native areas. Weed control can then be exercised with minimum threat to native vegetation (LGAs).**

54 Block informal pathways to prevent further erosion and damage to the existing vegetation. Replant these areas with indigenous species (LGAs).

55 Reinforce and maintain all remnant stands of vegetation (LGAs and SRT).

56 Reintroduce tree species such as flooded gum and tuart to the foreshore (LGAs).

57 Identify trial areas where native vegetation could be extended from the river to the dual-use path. Monitor the success of this strategy with the view to using it elsewhere (LGAs and SRT).

4.4.5 Terrestrial invertebrates

Data on terrestrial invertebrates is limited. One rare insect has previously been collected from the swampy ground alongside Bull Creek.

Recommendation

58 Encourage research into terrestrial invertebrates (SRT and LGAs).

4.4.6 Amphibians and reptiles

There is some detailed information regarding amphibians and reptiles within small sections of the study area. Some locations have extremely high conservation value as they contain rare and endangered species including a species of skink, *Lerista lineatus*.

Recommendation

59 Undertake a comprehensive fauna survey over several months, which focuses on the larger reserves (LGAs).

4.4.7 Water birds

Australian resident species and trans-equatorial migrant species from the northern hemisphere utilise the waters of the Canning River. The trans-equatorial group breeds in the northern hemisphere and spends the non-breeding season in the southern hemisphere. Most arrive during spring (September/October) and depart in autumn (March/April). Most Australian species make regular migrations within Australia.

Australia is bound under co-operative international treaties which require conservation of wetlands that migratory water birds use. Any strategic planning or development proposals must consider these treaties.

Ducks, swans, rails, waterhens, herons, egrets and ibis, estuarine fish-eating birds such as darters, grebes, cormorants and terns are all dependent on the river in some way.

Birds are conspicuous components of estuary life, enjoyed by the local residents and visitors to the area. It is important that the feeding grounds are maintained to ensure continued usage by the birds.

Recreational activities, dogs, noise and light etc. disrupt birds feeding, roosting and nesting. It is important to ensure that the requirements of these animals are provided for when determining recreational use of areas.

Recommendation

60 Investigate areas of importance for flora and

fauna, bird feeding and nesting grounds and develop a mechanism to protect these regions (SRT, LGAs, CALM).

4.4.8 Fringing forest birds

A variety of small birds are frequently observed feeding and roosting within the woodlands and fringing forest, including wrens, honeyeaters and finches. These areas provide for a high diversity of woodland bird species as a result of the variety of habitats created by the mosaic of different plant communities.

Recommendation

61 Investigate areas of importance for bird feeding and nesting grounds and develop a mechanism to protect these areas (SRT, LGAs, tertiary institutions, community).

4.4.9 Large predatory birds

A pair of ospreys are based on Mount Henry. Predatory birds are highly uncommon in the metropolitan area, and encouraging this pair to stay should be a priority. The tree upon which they nest however, is rotting and unlikely to persist for the duration of the birds' life span. It is important that an alternative structure is provided.

Owls are known to utilise feeding grounds within the Waterford, Clontarf and Salters Point foreshores. Protection of these wetlands and fringing forest is vital if these birds are to continue to access these areas.

Recommendations

62 Liaise with CALM and CSIRO to establish and provide an alternative nesting site for the ospreys at Mount Henry (Aquinas College).

63 Encourage a post-graduate student to investigate usage by owls or feeding grounds and nest locations, and develop mechanisms to ensure their usage in the future (SRT and City of South Perth).

4.4.10 Terrestrial macrofauna

A number of terrestrial mammals have been identified along the foreshores of the study area. None of the surveys to date have been comprehensive and therefore data on species, numbers or movement of these animals is not available.

Recommendations

64 Undertake a comprehensive fauna survey to determine species, numbers and movement of these animals, involving a comprehensive trapping program (LGAs).

65 Establish a joint funding arrangement to undertake the above recommendation (SRT and LGAs).

4.4.11 Ecosystem functioning

A number of studies have been undertaken to determine the presence of terrestrial and aquatic flora and fauna within the study area. Data to date indicate that the shallow areas in the study area are extremely important functional fish nurseries and bird feeding grounds, and contribute significantly to important habitat and ecosystem functions. The adjacent foreshore vegetation and fauna are also productive and support diverse communities.

Moreover within the City of South Perth exists a continuous foreshore habitat extending from Mt Henry Spit and Keaney Gardens. Such a continuous foreshore habitat facilitates the movement of species and therefore assists in maintaining genetic diversity. There is no similar foreshore vegetation elsewhere on the Canning or Swan Rivers (DCE 1981). Fauna within this section of the Canning River is isolated from other areas with similar habitat and, with the exception of some bird species, cannot be recolonised.

Notwithstanding this the terrestrial fauna are dependent on fringing vegetation to provide shelter and the basis for the food chain. The fauna themselves contribute to the maintenance of the vegetation by

undertaking functions including pollination of flowering plants, seed transferral and sometimes consumption of pests. Transitory animals spread seeds over large areas which may increase the distribution and diversity of vegetation.

Varied vegetation provides a number of habitats which can correspondingly support a greater diversity of animals. The wide range of habitats in the study area, including the waters, wetlands and tidal marshes, provides for a range of fauna. There are many groups of species present throughout the study area, including invertebrates such as prawns, amphipods, copepods and water snails, vertebrate species including fish, numerous lizards, frogs, birds, possums and the native water rat *Hydromys chrysogaster*.

Further urban development adjacent to the foreshore habitat may exacerbate problems of isolation and result in the foreshore being subject to increased disturbance. It is imperative that management strategies aim to minimise the risk of habitat disturbance and consequent loss of species diversity.

It is important to determine the faunal and floral components of both the foreshore and river ecosystems.

Recommendations

66 Ensure that the development proposals affecting the study area take into account the issue of ecosystem functioning (SRT).

67 Integrate the results of Recommendations 44 to 65 to determine the ecosystem functioning of the study area and develop strategies to ensure these attributes are protected (SRT).

4.4.12 Weed control

Weeds are a major problem throughout the Swan and Canning River system. There is a real possibility that weed communities will completely replace the rivers' remaining stands of indigenous vegetation. As the weeds become more established, the greater the difficulty in re-establishing native species. The damage caused by weed removal may be significant.

There is considerable variation in weed species established in the study area. These require intensive control programs, and ultimate eradication from wetlands and peripheral vegetation.

Weeding programs should concentrate on the removal of introduced species such as pampas, Japanese pepper, lantana, coastal tea-tree and castor oil which are all conspicuous elements of the Lower Canning River.

Kikuyu, buffalo and other grasses are all common on the Swan and Canning system. They invade adjacent areas of native vegetation, eventually reducing their distribution. There is a need to delineate between remnant vegetation and adjacent parkland, and control invasive grasses.

A recent study undertaken by the SRT indicates that flauziflop-butyl used under specific conditions does not harm aquatic and terrestrial invertebrates and can successfully control introduced grasses.

Uncontrolled pedestrian access to the foreshore and reserves has over the years contributed to soil erosion and disturbance, facilitating weed invasion. Restricting human disturbance in the predominantly native communities will decrease the risk of weed invasion. This is particularly important adjacent to dual-use paths, where encroachment of the weed communities into native plant communities is an increasing problem.

The initial physical disturbance during path construction allows the establishment of fast growing weed species to the exclusion of natives.

Consequently, one of the principal objectives of this plan is to control access to the river through defined areas rather than the present myriad of small casual tracks. Fencing can be introduced along each side of pathways where appropriate. Education and the direction of access along defined pathways with the help of appropriate signs will reduce disturbance of areas of remnant vegetation, which in turn will reduce the establishment of exotics.

One of the primary concerns within the study area is the presence of extensive areas of the introduced bulrush (*Typha orientalis*). The local bulrush (*Typha domingensis*) is under threat from the introduced bulrush, and lacks the ability to invade areas of remnant vegetation.

Complete eradication of the introduced species would be desirable, provided the native *Typha domingensis* is re-established in its place. Complete eradication of the *Typha* without such replacement is neither possible nor desirable as it provides an important refuge for invertebrate and vertebrate life. The key to successful re-establishment of other remnant vegetation species will involve control of *Typha orientalis* invasion.

The introduced species is most prevalent where there is continual fresh water discharge (i.e. drainage outfalls), out-competing the native bulrush in these circumstances provided there is high light attenuation. Further, native bulrush generally occurs in areas which are not permanently inundated with water, whereas the introduced species proliferates under such conditions.

Recommendations

68 Revegetate areas with native rushes etc. and fence off whilst regenerating (LGAs and SRT).

69 Ensure site specific rehabilitation plans include plans for the control of introduced weeds to the satisfaction of the SRT (LGAs).

70 Endorse the use of flauziflop-butyl to control grass in accordance with SRT recommendations (SRT).

71 Actively control grass invasion in areas dominated by native vegetation species, particularly fringing rushes and sedges, by

- **delineation of boundary with concrete rails, and**
- **spraying of herbicides (SRT and LGAs).**

72 Control introduced bulrush (*Typha orientalis*), concentrating efforts in stands adjacent to drainage outfalls (LGAs and SRT). The control methods should be in accordance with the methodology outlined in Appendix 4.

73 Co-ordinate the development of a weed control and eradication program for the river system in association with LGAs (SRT).

4.5 Pest fauna

4.5.1 Ferals

Introduced species of animals such as domesticated cats (*Felis cattus*) and dogs, foxes (*Vulpes vulpes*), and others including rabbits, degrade the natural environment through predation, competition for food resources and habitat destruction. Their presence in the geographically restricted habitats characterising this area has led to a drastic reduction of native populations, and may lead to local extinction.

4.5.1.1 Domesticated

Cats along with foxes represent the greatest threat to native animals. Apart from a few native water rats (*Hydromys chrysogaster*) and common brush-tail possums, there are no other mammals known to exist in the study area. Persisting populations of native animals have been severely reduced along the foreshores.

Local government authorities have little or no control over cats in their municipalities. The City of South Perth has by-laws restricting the number of cats to three per household. This is only enforced where complaints from nearby residents have been lodged, i.e. the cats are perceived to be a nuisance. Brief investigation indicated that the LGAs support legislation for control of total cat numbers.

The Kings Park Board (KPB) operates a cat control program based on trapping cats, transporting them to the Cat Haven where if not claimed within seven days they are put down. The KPB funds the humane disposal. The program has been extremely successful and adjacent land owners are beginning to control their cats. A similar program could be initiated for Mount Henry.

Dogs disturb native fauna particularly frogs, lizards, birds and mammals. Unrestrained dogs accessing wetland and bushland areas threaten this native fauna.

Areas with little remnant vegetation are appropriate regions for exercising dogs, however it is up to the LGAs to determine such access.

The LGAs have established quite rigorous controls over dogs and generally do not perceive cats to constitute a major problem or disturbance.

Recommendations

74 Support LGA by-laws controlling dogs and cats (SRT).

75 Initiate cat control programs in all large areas of remnant vegetation on advice from the Cat Haven (LGA).

4.5.1.2 Other pest species

There are a number of other introduced animals including rats, rabbits and foxes which are commonly displacing, competing with, or killing native fauna.

Rabbits are herbivorous and upset the natural ecological balance by destroying native vegetation and competing with native species for food. Juvenile shoots are particularly vulnerable to rabbits as they are tender, and where these leaves are from less common annual plants such as orchids, damage to the populations can be catastrophic.

Rats are omnivores and scavenge where possible. These animals represent a threat to native species in a number of ways including displacement, competition for food resources and predation. Rats can also carry a variety of diseases which can be passed on to the native fauna.

There are several rat control programs operational along the foreshores of the rivers. These have a number of benefits, however the baiting is non-discriminatory and may be killing the remnant populations of reptiles and native water rats. The remaining population of water rats is believed to be small, although there has not been an intensive investigation into the distribution and total population of this species. It is important to establish whether the baiting program is affecting these animals.

Foxes occur throughout the Metropolitan area and contribute to the reduction of native fauna, including frogs, lizards and mammals. The KPB have a cost-effective fox control program which involves the use of Phostoxin, which has successfully reduced the fox population. A similar program could be undertaken along the foreshore from Bull Creek, Mount Henry to Clontarf.

Recommendations

76 Determine pest species as part of Recommendation 64.

77 Introduce an eradication program for rabbits in the Mount Henry, Waterford and Clontarf area (LGA, Christian Brothers).

78 Remove foxes from Mount Henry, Yagan Reserve, Waterford foreshore and Clontarf, Sandon Park and Salter Point (LGA, CALM).

4.5.1.3 Mosquitoes

There needs to be a balance between public health concerns about the transmission of Ross River virus by mosquitoes and the provision of habitat. Although mosquitoes are responsible for the transmission of several diseases they are also a very important component of the diet of migratory and local birds. Introduction of mosquito eradication measures often results in degradation or loss of important wetland functions.

Monitoring and control of mosquito populations was limited prior to 1988, as there was little perceived health threat. Where mosquito control practices were employed there was no co-ordination between local and State government authorities. However, in 1988 there was an outbreak of Ross River virus. A series of effects including El Nino and high summer rainfall led to high river levels which resulted in increased mosquito breeding.

Mosquito breeding areas and current control strategies within each local authority are outlined below.

City of Melville: This Council does not have any areas of nuisance mosquito breeding within the area covered by this study. The only potential breeding area is

in wetlands fringing the Bull Creek backwater, possibly Reserve C32563.

City of Canning: There is one small breeding site immediately west of T.S. Canning. Monitoring has shown that 12 mosquito species are present in the area, two of which are a problem (*Aedes vigilax* and *Culex annulirostris*).

City of Canning have an environmentally sound effective and comprehensive mosquito monitoring and management program in place. They have pre-emptive control of breeding populations as a result of employing physical modifications and chemical use as back up.

City of South Perth: There are a number of sites which contain breeding populations of nuisance mosquitoes. The monitoring program involves the setting of traps throughout the municipality, and where high numbers of mosquitoes are recorded, treating accordingly.

City of South Perth do not yet have a complete inventory of breeding sites, and until this is done, cannot develop a comprehensive mosquito control program.

The Swan River Trust is in the process of developing a mosquito control strategy to provide background information on available mosquito control techniques and the current strategies used by local authorities adjacent to the Swan River, upstream of the Causeway. It is important that authorities become involved in pre-emptive mosquito control, to ensure that mosquito numbers are kept below levels at which they pose a health risk and serious nuisance problem.

State Government

A regional approach would be effective in the reduction of mosquito nuisance occurrences, particularly unusual events. The regional approach adopted by Cabinet identifies that funding will be shared between the State Government (through the Health Department) and Contiguous Local Authority Groups (CLAG). The CLAG will consist of adjacent local authorities with a shared mosquito problem and an arranged sharing of resources to enable effective control. The formation of Contiguous Local Authorities Groups and the acceptance of related conditions is a prerequisite for receiving Government funds for mosquito control (Chester and Klemm 1990).

Recommendations

79 Encourage local authorities to become involved in a CLAG to enable effective control of mosquitoes (SRT and HDWA).

80 Establish a comprehensive inventory of mosquito breeding sites in the City of South Perth and develop appropriate control strategies (City of South Perth).

4.6 Conservation reserves

Conservation reserves are important mechanisms to enhance the protection of the flora and fauna. The designation of areas for specific purposes ranging from sensitive prohibited areas to recreational areas has been achieved throughout the study area.

The majority of the study area is reserved for Parks and Recreation under the Metropolitan Region Scheme. Within the Reservation, some small pockets have been acquired by the Crown and are now reserved for conservation under the Land Act 1933.

Three large areas in the Lower Canning River, containing relatively intact remnant vegetation and providing habitats for native fauna, were singled out by the System Six Report (DCE 1983) as worthy of conservation. The associated recommendations have been implemented to varying degrees. The progress in each area is outlined below.

The System Six Report (DCE 1983) recommended the establishment of a regional park for the Swan and Canning Rivers and associated foreshores. This proposal has not been studied in detail although a number of regional parks around the metropolitan area have been established. Initial discussions have been undertaken between the Trust, CALM and EPA to investigate the feasibility of this proposal.

Recommendations

81 Provide assistance to local government in the development of the

management plans for System Six areas (SRT).

82 Continue to examine the feasibility of a regional park for the Swan and Canning River system (SRT, CALM, EPA).

4.6.1 M66: Mount Henry, Manning

The System Six study made two recommendations for M66. The first (M66.1) is the designation of this area as a Regional Park with the National Parks Authority holding the responsibility for co-ordinating the planning and management of these areas. The second recommendation (M66.2) requests the preparation of a management plan which gives consideration to the growth and regeneration of local indigenous flora.

Implementation of recommendation M66.2 is progressing, with Aquinas College and the City of South Perth having prepared a management plan encouraging indigenous flora and emphasising conservation and education. The plan has been ratified by Council and the final plan is due for imminent release.

Although this area is reserved for Parks and Recreation under the MRS it is still in private ownership with Christian Brothers. However Christian Brothers has made a commitment to manage this area in an environmentally sustainable manner. The philosophy of the Mount Henry Management Plan is for conservation of the area. It is therefore acceptable for the area to remain in private ownership while it is being managed in accordance with the plan.

The System Six recommendations were developed prior to the extension of the Kwinana Freeway. Mount Henry Spit was purchased by MRD during the construction of the Kwinana Freeway. Therefore the recommendations are no longer relevant and a new vesting or management agency is required, as long as the intent of the recommendations is not changed. DPUD recently acquired ownership and vesting. The City of South Perth is currently negotiating with DPUD for vesting.

Recommendations

83 Implement the Mount Henry Management Plan (City of South Perth).

84 Support the vesting of Mount Henry Spit in the City of South Perth (SRT).

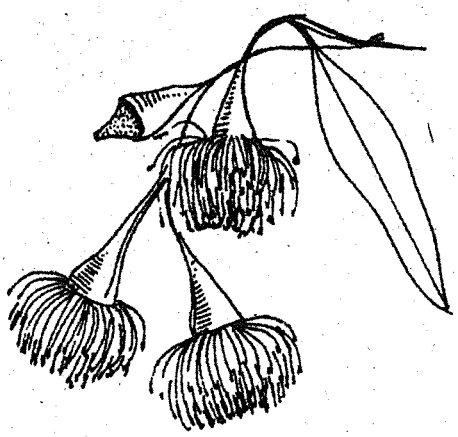
4.6.2 M67: Canning River Foreshore, Salter Point to Clontarf

The first recommendation (M67.1) is the designation of this area as a Regional Park with the National Parks Authority holding the responsibility for co-ordinating the planning and management of these areas. Recommendations M67.2 and M67.3 have been implemented. These recommendations required DPUD to extend the area reserved for Parks and Recreation under the Metropolitan Region Scheme, and further required the creation of a management plan by the City of South Perth. The management plan is currently being reviewed and amended by the City of South Perth.

The City of South Perth has developed two additional management plans for areas abutting System Six Recommendation M67. The plans recommend the inclusion of an area of remnant saltmarsh and Brother Keaney Gardens into Parks and Recreation Reservation Regional Open Space.

Recommendation

85 Encourage the Department of Planning and Urban Development to enact an amendment to the MRS Parks and Recreation Reservation to include Keaney Garden and remnant salt marsh (SRT and City of South Perth).



4.6.3 M74 : Bull Creek

The first recommendation (M74.1) has been implemented with Reserve C29130 now reserved for Conservation of Flora and Fauna vested in the City of Canning and Reserve C32563 now a Conservation Reserve vested in the City of Melville.

The Trust believes that the effective management of the adjoining reserves by the Cities of Melville and Canning must involve a commitment from each, to ensure consistent management practices are employed for both areas.

Recommendations M74.3 and M74.4 have both been partially implemented, with City of Melville having produced a management plan for Reserve C32563. This plan is currently under review by the Cities of Melville and Canning. The planning committee includes representatives of all land owners and other interested parties. The subject area of the management plan has been extended to include neighbouring reserves.

The recommendation involved the declaration of the triangular portion of vacant Crown land abutting the northern boundary of Reserve C32563 (vested with Department of Education) as a Class C Reserve for Conservation of Flora and Fauna with the Reserve being vested in the City of Melville. DOLA are negotiating to revest this area in the local authority for conservation, as there is currently little effort applied to management.

Recommendation

86 Provide assistance to City of Melville in the development of the Bull Creek Management Plan (SRT).

4.7 Fire management

Fires can enhance or reduce the ecological integrity of wetlands. The distribution and regeneration of some native species is enhanced by occasional fires. However, most common weeds proliferate rapidly after fires. While some native species have a similar response to fire, many have evolved alternative strategies over thousands of years.

There are two basic strategies to cope with fire: seeding and resprouting. Seeders are plants with a rapid life cycle, early maturation and prolific seed production. Resprouters on the other hand take a number of years to mature and produce viable seed. It is this group of plants which is lost in areas subject to frequent fires.

Fire management for vegetation conservation involves ensuring that fires do not occur more frequently than the time needed for all plants to reach adequate reproductive capacity.

Frequent fires have a number of impacts including:

- increased establishment of non-endemic grasses in drier areas surrounding the wetlands,
- decrease in the diversity of species in an area through loss of resprouting species, and
- increased invasive capability of exotic species.

Many people perceive the presence of native vegetation as a fire risk, however where exotic grasses such as veldt and African love grass occur, the fire risk is much greater. These weeds germinate, grow and die in one year, rapidly becoming a continuous fuel bed for fire.

Grass control and eradication may be achieved by encouraging the community to assist with hand weeding under supervision. This will reduce the fire risk.

Where there are already open lawn areas adjacent to areas of remnant vegetation, an effective fire break is established. Otherwise land managers are required by the Bush Fires Board to establish fire breaks for vegetation areas greater than 20 m wide.

It would be preferable for wetland areas and sandy rise vegetation to be excluded from burns for eight year cycles to help maintain plant diversity. Although, this may be difficult to ensure because of the frequency of illegally lit fires, none of the LGAs in the study area exercise control burning practices. The City of Canning reserves the power to burn off where required, whilst the Cities of Melville and South Perth have 'no burn' policies.

DPUD and Bush Fires Board guidelines for 'Planning for better bush fire protection' is useful as a basis for developing fire management practices.

Children are frequently responsible for starting bush fires. Involvement of school children in management of remnant vegetation, possibly as honorary wardens, would increase their appreciation of these areas.

Recommendation

87 Support post-graduate research to develop a suitable fire regime for all of the large wetland and sandy rise vegetation areas (LGAs, SRT, CALM, BFB and DPUD).

4.8 Litter and rubbish

The intense pressure applied to the river and foreshore in some areas of the Canning River is accentuated by the discarded litter along the foreshores and in the river. Litter includes plant material such as lawn cuttings, plastics, glass and paper.

Impacts associated with litter include:

- garden plant material often introduces exotic plants to the foreshores,
- discarded plastics and other materials are aesthetically displeasing, and are a safety hazard for birds and fish,
- glass, syringes and rusting tins constitute a safety hazard,
- paper and garden waste material add to the fire risk, and
- aquatic material from prawning nets dumped on fringing vegetation or beaches may:
  - contain poisonous fish (e.g cobblers, fortescue fish and blow fish) which may be consumed by dogs),
  - produce offensive odours, and
  - smother native vegetation.

The Swan River Trust field hands spend a high proportion of their time during summer picking up litter. There are also organised community rubbish pickups in the area. As a result the waters and foreshores remain relatively clean in comparison with water bodies elsewhere in the world. However these labour resources could be better utilised for more important management tasks if people disposed of their litter thoughtfully.

During the summer months, there is an increase in litter from boats, particularly plastics. A litter education program undertaken by DOT has been highly successful.

Some boat owners use plastic bags to deter birds from roosting on their boats whilst moored in the Lower Canning River. These plastic bags deteriorate with exposure to weather conditions, and eventually blow into the river. This practice should be discouraged.

Recommendation

88 Provide information on alternative methods of discouraging birds from roosting on moored boats (DOT).

4.9 Community involvement and education

A number of groups and individuals have expressed interest in the rivers and foreshores. The resource of community groups is invaluable in implementing the management recommendations endorsed by the Swan River Trust and the Cities of Melville, South Perth and Canning.

Germination programs should where possible involve local primary and secondary schools, to provide a mechanism for interactive learning for children. Children will be exposed to practical involvement in conservation practices, whilst helping to maintain regional genetic diversity.

There is a lot of potential throughout the study area to establish areas of heritage or scientific interest providing an educational resource for the residents and visitors to the Perth metropolitan area. The best method of providing such experiences whilst protecting the ecological integrity of the areas is through interpretive trails.

Areas which lend themselves to such developments include the Bull Creek backwater and Mount Henry. The Bull Creek backwater could be traversed by a wooden boardwalk, with appropriate signage detailing the history of the area and providing educational material about the wetland. The City of Melville has expressed an interest in establishing a heritage trail through the wetland (Reserve C30646), however, it may be more appropriately located in the river. There is also support for this concept from local residents and recreational cyclists.

Aquinas College staff utilise Mount Henry to improve student knowledge of natural history, and the land at Mount Henry under their control retains high conservation value and is ideal for educational programs. This area could be monitored by students, and rehabilitated so students see the results.

Involvement of educational institutions in the management of remnant vegetation could have a number of benefits including:

- an improved understanding of the biology and ecology of wetland and woodland areas,
- an increased appreciation of these areas resulting in reduction of potential fire lighting risks, littering and general vandalism, and
- enhancement of wetland attributes by implementation of rehabilitation plans.

Recommendations

89 Encourage and supervise community participation in determining faunal and floral components of the Lower Canning River (SRT and LGAs).

90 Encourage and supervise community participation in weeding programmes (LGAs and SRT).

91 Encourage schools to adopt wetland areas and develop rehabilitation programmes for these areas (LGAs).

92 Encourage and support schools to establish germination programmes utilising seed collection from particular areas (LGAs, SRT and KPB).

93 Support Aquinas College in its undertakings to allow other schools to use Mount Henry as an outdoor education site (SRT).

94 Investigate the potential for developing a boardwalk across Bull Creek as an educational and heritage tool and access way for pedestrians and recreational cyclists, and to protect the integrity of the wetlands and System Six area (Cities of Melville and Canning and SRT).

4.10 Landscape

The area is of regional significance because of its high conservation and recreation value.

The land adjacent to the study area is relatively low lying. Prior to the construction of the Canning Dam in 1940, it is assumed that the area was regularly flooded during winter months. The highest

point is Mount Henry which rises to 25 m. The land between Mount Henry and Salter Point is characterised by steep slopes (50°-60°).

Mount Henry is one of the most important landscape features of the Canning River landscape.

Sandy beaches are located along The Esplanade between Canning Bridge and Deep Water Point. These have been created and/or maintained through beach nourishment programs, while spoil from dredging activities along parts of Riverton Drive and Shelley Basin was used to create beaches.

The river is traversed by four bridges. Major road arteries running parallel to the foreshore include The Esplanade, Kwinana Freeway and Riverton Drive. The northern shore between Mount Henry and Riverton Bridge has no continuous road parallel to the foreshore, however this area is dissected by small clusters of roads some of which run down to the river in Manning and Waterford Estate.

The urban landscape in the Cities of Melville and Canning has few characterising features with the exception of jacaranda trees in residential gardens. In addition to the lack of homogeneity in the architectural designs and characteristics of residential homes, halls and commercial development, there are a number of features which detract from the aesthetic appeal of the river and its foreshore.

There is potential for more sensitive designs to replace some architectural and landscape features, without requiring additional intrusion into areas supporting indigenous vegetation. Such features include the Deep Water Point Sea Scout Hall, the Aquinas College Boat Shed, Curtin Rowing Club and the Shelley Sailing Club, Centenary Park and segments of the foreshore along the southern section of the river which lack vegetation.

Landscape protection can be achieved by maintaining and enhancing the special and significant views to and from the river. New developments should be visually unobtrusive and not detract from the riverine environment.

The Swan River Management Strategy recommends the development of a landscape plan for the entire Swan and Canning River system. This work is underway. This plan will identify components of the landscape and suggest strategies for protection and enhancement. In the meantime the Trust has developed a 'Conservation, environmental and landscape protection policy'.

Recommendations

95 Prepare guidelines for built structures near the river. The guidelines should address:

- **location**
- **height and form of buildings**
- **materials**
- **colour regime (SRT, LGAs).**

96 Continue the development of a comprehensive landscape plan (SRT).

97 Ensure the protection of landscape by assessing development applications in accordance with SRT Policy EA 1 (SRT).

4.10.1 Erosion control measures

Some severely eroded sections of the foreshore have been stabilised by conspicuous engineered structures. Other areas have been stabilised with wooden boards, and become overgrown by introduced grasses within six months of construction. This lack of consistency is in some cases a reflection of the different strengths of the erosive forces involved, however more effort is required to enhance the appearance of the river.

Recommendations

98 Develop detailed specifications for erosion control structures to ensure they do not detract from the environment. Undertake plantings to screen existing structures (SRT and LGAs).

99 Ensure erosion control measures are in keeping with landscape and vegetation characteristics of the area (SRT).

4.10.2 Views to and from the river

The presence of mooring sites for boats can enhance the appearance of the river but some vessels which are in a state of severe disrepair or sinking may detract from this.

There is a need to identify, maintain and enhance special and significant views to and from the river.

The Trust policy is to ensure development proposals do not detract from the riverine environment.

Recommendations

100 Identify special and significant views to and from the river and ensure development proposals do not impinge on these areas (SRT).

101 Assess all foreshore and riverine development proposals to ensure their impact on existing views is minimal. Plan tree planting programmes such that they do not detract from significant views to and from the river (SRT and LGAs).

4.10.3 Main Roads Department landscape plans

The Main Roads Department 'Freeway Enhancement Program' involves the introduction of plants native to Australia but not specifically the Perth region. However it would be more appropriate if planting regimes reflecting the vegetation patterns characteristic of this area were developed for the area. This would establish a sustainable plant community similar to those persisting on the foreshore.

A similar program has been established for the land around Shelley Bridge. The planting regimes were based on the vegetation patterns characteristic of the region, and will enhance the aesthetic and ecological value of the foreshore.

Recommendation

102 Ensure MRD landscape plans reflect vegetation patterns characteristic of the adjacent area and are in accordance with SRT policy (SRT).

4.10.4 Pipe line at Shelley Basin

Negotiations are currently underway between the City of Canning and WAWA regarding the pipeline crossing Shelley Basin, with the idea of covering the pipe to improve its visual amenity.

Recommendation

103 Support the enhancement of the Shelley pipeline (SRT).

4.10.5 Residential retaining walls

The majority of this area is characterised by well established residential developments. Where the gradient is steep, the escarpment defines the edge of major residential development. Some residences in Salter Point, however, have built stabilising structures, a number of which are incompatible with the landscape value of the area. These conspicuous structures detract from the river environment. As they age and require replacement they should be replaced by more aesthetically pleasing stabilising designs.

Recommendation

104 Ensure retaining walls for residential properties along the escarpment are in keeping with the natural environment (LGA).

4.10.6 Raffles Hotel

Although this hotel occupies a conspicuous position on the foreshore, it has not been designed in keeping with the riverine environment. This was recognised in the Swan River Management Strategy (1988). When these buildings reach the end of their useful life, they should be replaced by more attractive designs.

Recommendation

105 Endorse Recommendation A35 of the Swan River Management Strategy to redevelop the Raffles Hotel site in keeping with its riverside setting.

4.10.7 Kwinana Freeway

The Kwinana Freeway runs along the foreshore of much of the Canning River. Construction involved the filling of foreshore areas, restricting public access to the river. The presence of the Kwinana Freeway also limits the extent of the foreshore. It is visually intrusive and noisy. It is important that any further encroachment of freeway into the foreshore reserve is prevented if widening of the freeway is required.

Recommendation

106 Oppose any proposal which involves widening of the freeway and associated facilities onto the foreshore reserve. Provide advice about foreshore planting programmes and support continuing maintenance of the plantings on the foreshore reserves (SRT).

4.11 Heritage and cultural sites

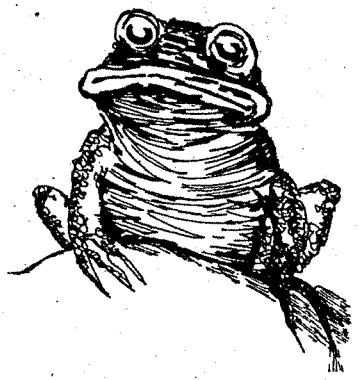
4.11.1 Aboriginal culture

Many Aboriginal communities utilised the Perth region on a seasonal basis. During summer Aboriginal people hunted and fished in and around the river. In winter, tribal groups moved inland to more sheltered areas where they hunted game and supplemented their diets with roots and seeds. Aboriginal people often set the bush alight to drive animals from the undergrowth and to encourage regrowth in the spring (Hallam 1987).

At the time of European colonisation, the Nyungar people occupied the south-west coastal areas, with smaller tribes occupying particular territories. The 'Whadjug' Tribe occupied the Perth metropolitan area. The Canning River was known as 'Dyarlgarro' (Green 1984).

By the early 1830s, European settlement began to affect the tribes (Calgan 1968). With loss of their traditional lands, raids on farms increased. The prominent Aboriginal Yagan set up camp at Bull Creek, and with around forty companions ambushed and killed two male settlers in retaliation for frequent attacks on Aboriginal people in his area. Yagan continued such acts of defiance until he was killed by two young male settlers.

An Aboriginal site survey of the South Perth foreshore between Mill Point to Canning Bridge was commissioned by Main Roads Department (MRD). It was found that this area was significant for the Ballaruk people, as a traditional hunting and fishing zone. MRD intends to erect a plaque to commemorate Aboriginal usage of the foreshore near Narrows Bridge.



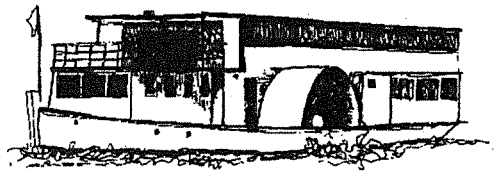
It is Aboriginal belief that the Dreamtime Serpent, the 'Wagyl', exists in the rivers and its bed. Aboriginals believe that alterations to the waters or the river bed disrupt the Wagyl's passage. Thus the waterway is of mythological significance and provides an important spiritual focus for Aboriginal people. Any direct impact on the river or its tributaries is likely to be of concern to Aboriginal people.

Information on Aboriginal sites is confidential and kept at the Aboriginal Sites Department of the Western Australian Museum. By referring all development proposals and management actions to this department, disturbances to any places of Aboriginal heritage can be avoided.

All sites are protected by the Aboriginal Heritage Act 1972-1980 and should not be disturbed without the consent of the Minister for Aboriginal Affairs.

Recommendation

107 Undertake a survey of the study area to determine its significance to Aboriginal people (SRT and LGAs).



4.11.2 European heritage and culture

Historic sites are an important component in the character of the waterway environment. Early settlements were founded on the river and estuary and therefore represent a link to the past.

During the 1860s the river represented the most efficient way of transporting jarrah from the Darling Scarp. Logs were drawn by bullock and dray from the Scarp to Mason's Landing at Cannington, where they were easily transported by water craft to Fremantle. Dredging was required to allow larger barges to pass, and convict labour was employed to remove sediment from the bed.

To facilitate the dredging, a fence was constructed of sharp jarrah stakes driven into the river bed along the proposed channel. It was backed by sheoak logs and boughs felled on nearby banks. The tops of the piles were linked by 10 by 10 cm planking, however no trace of this section remains (Hutchison and Davidson 1979). The top was designed to encourage scouring of the channel during winter flow. In 1866 the first section of fence was completed. Sections were added and the original fence repaired in 1869, 1872 and during 1887-88. Jarrah stakes can still be seen across Shelley Basin, dissecting the water body between Centenary Park and Salter Point (Maps 9, 10 and 11). One section adjacent to Shelley, near the end of Corbel Street, has been removed to allow boats to motor or sail across the basin.

The entire fence can not be considered a genuine relic of the convict era, in view of the extensive repairs and additions made to it since it was originally erected. However, it is possible that some sections of the work carried out by convicts still exist. It is apparent that the barrier constitutes an important part of the history of the Canning District because its erection and maintenance were obviously matters of great and continuing interest to settlers throughout the last half of the nineteenth century (Hutchison and Davidson 1979).

Six boat wrecks in the Lower Canning River are listed in Scrimshaw (1981): the *Lady Ord*, the *Helena*, the *Harley*, the *Mayflower*, the *Python* and an unidentified vessel.

The steam launch *Lady Ord* (14.5 metres long, 2.4 metres wide with a draft of 0.9 metres) was built in 1878 and used to carry passengers and tow coal barges from Fremantle to Coffee Point until 1904. Following this it was used by a firewood contractor for towing vessels from Canning to Perth. The *Lady Ord* was abandoned in 1905 along with several other vessels, including the *Helena* and the *Harley* at Coffee Point. Parts of the vessel were removed to allow ferries access to Coffee Point in 1921-1922. Some of the parts still remain.

The paddle-wheel steamships *Helena* and *Harley* (20.2 metres long, 3.7 metres wide with a draft of 1.6 metres) were built at Coffee Point in 1897. Both boats were used for weekend excursions to Attadale. In 1902, these vessels were abandoned and left to rust away at Coffee Point. As with the *Lady Ord* sections were removed in 1922, however it is believed parts of the boats remain.

The *Mayflower* (14.9 metres long, 3.4 metres wide with a draft of 1.2 metres) was built in 1908 and was used by the State Government on the Mends Street run from 1912. In 1938 the service also called at Queen Street. By 1949 the *Mayflower* was still with State Ferries and was also used for private charter cruises. In 1979 this boat drifted onto a shallow bank at Belmont, and once refloated was eventually moved to Bull Creek and moored where its hull still remains.

The *Python* (32 metres long, 8 metres wide with a draft of 2.7 metres) was built in 1907 for the Swan Shipping Co. Ltd, and was probably used as a towed barge for general cargo in the Swan Estuary. The *Python* ceased trading in 1946, prior to which it was used by Clontarf students to play on. The boat was being towed upstream for the purpose of using it as a jetty extension, but ran aground and was not moved. The hull of the barge now lies at the foot of Violet Street, Shelley, on the convict fence.

An unidentified vessel lies partially submerged at the extreme end of Bull Creek. This vessel is double ended and built of timber, and is 20 metres long and 3.9 metres wide. Historians have not yet established any reference to the boat's past and are continuing to research the vessel. It is possible that this barge was used last century for transporting timber down the Canning River.

These vessels represent part of the history of the Canning River.

Federally, the Australian Heritage Commission site register records the country's most important natural and man-made features, and it is believed that this register may be enhanced through the inclusion of structures such as old houses, mines, factories, harbour works and shipwrecks (Scrimshaw 1981). Site registers are as important at a local level as they are as a national listing. Such recognition increases public awareness and provides a mechanism to protect the site.

The convict fence in the Shelley Basin and the three visible boat wrecks in Bull Creek and off the Shelley foreshore constitute a reminder of the river's history. The *Lady Ord* and the *Helena* and the *Harley* lie on the river bed are not visible from the river or foreshore. Whilst the fence has attracted public sympathy since it was built (implied by the continual maintenance on it and the public uproar when a section was removed), the boat wrecks have received little attention. The wrecks are not maintained and a decision as to their importance should be reached.

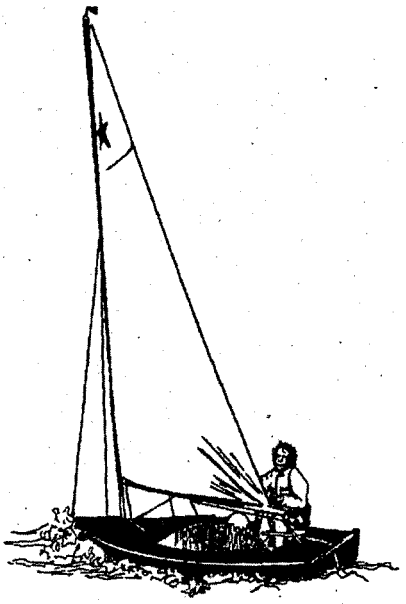
The convict fence has not been maintained since the mid 1900s. This is of concern. The preservation of this very important European heritage site should be a priority for government agencies.

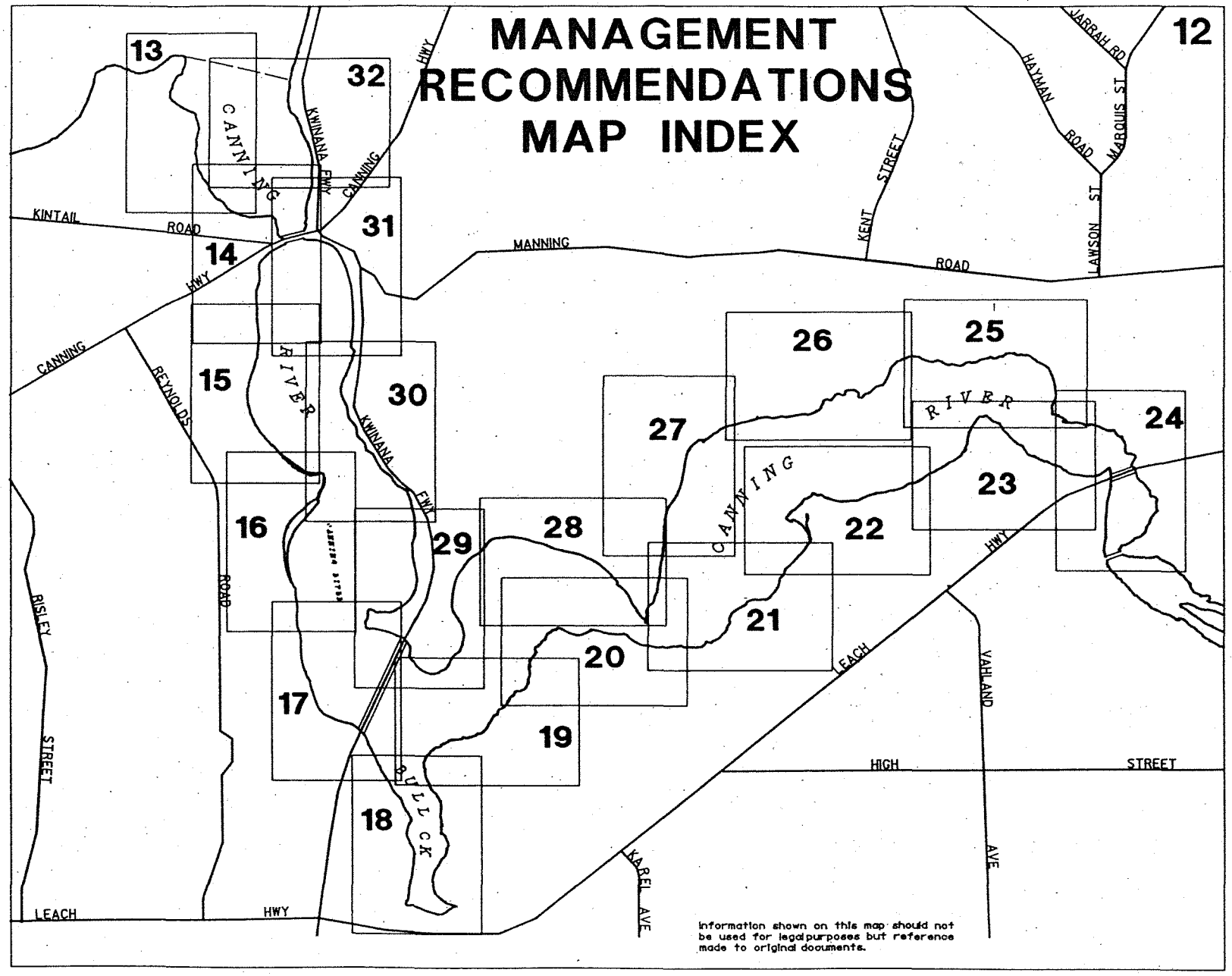
Recommendations

108 Encourage the Australian Heritage Commission (AHC) to record the fence and boat wrecks on its site register and become responsible for maintenance (SRT).

Should funding be difficult to acquire, the Cities of Melville, South Perth and Canning and SRT should be approached.

109 Encourage the AHC to erect signs in strategic locations, explaining the origins and circumstances of the convict fence, and the changing interest over time (SRT).




MANAGEMENT
RECOMMENDATIONS
MAP INDEX
13
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31
14
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12
CANNING
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HWY
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KENT
STREET
HAYMAN
ROAD
JARRAH RD
MARQUIS ST
LAWSON ST
CANNING
REYNOLDS
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RIVER
KWINANA
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CANNING
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KAREL AVE
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VAHLAND
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HIGH
STREET
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5. AREA RECOMMENDATIONS

This chapter deals with recommendations for specific areas of the waterway and its foreshores. Planning, development and use considerations of these regions are listed. The area breakdown is shown in Map 12.

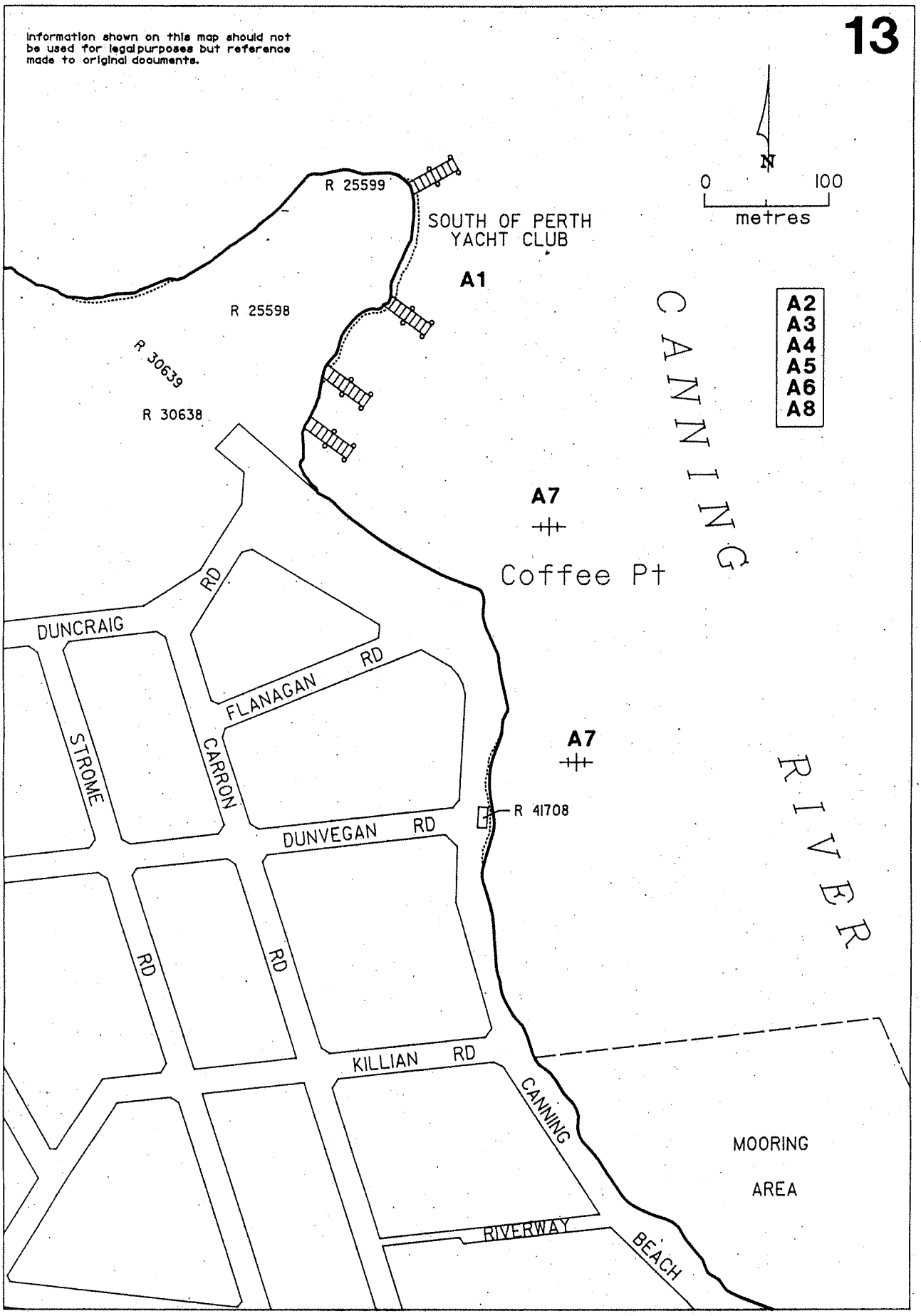
For ease of reading, the maps are presented with associated planning considerations and area recommendations on the page opposite each map.

The planning considerations for each map area include:

- physical resources,
- biological and conservation resources,
- human use,
- land tenure,
- opportunities for land use activities, and
- restraints such as land capability.

Recommendations are then developed regarding initiatives required to achieve the objectives of this management plan. The recommendation numbers are marked on the corresponding map. Where recommendations relate to more than one location these have been grouped on the map.

A foldout map legend is provided at the back of the document for Maps 13-32.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information shown on this map should not be used for legal purposes but reference made to original documents.
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SOUTH OF PERTH YACHT CLUB
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R 30639
R 30638
A2
A3
A4
A5
A6
A8
CANNING
A7
Coffee Pt
DUNCRAIG
RD
FLANAGAN
RD
STROME
CARRON
A7
R 41708
DUNVEGAN RD
RD
RD
KILLIAN RD
CANNING
RIVER
MOORING
AREA
RIVERWAY
BEACH

5.1 SPYC to Riverway Road (Applecross) (Map 13)

Planning and environmental considerations

- Public access along the foreshore area restricted by the SPYC.
- Storage, transfer and use of chemicals at SPYC represents a potential source of pollution to the river.
- South of Perth Yacht Club need to undertake regular maintenance dredging to maintain boat pens and channels.
- Degradation of native foreshore vegetation through lack of regeneration, uncontrolled pedestrian access, mowing etc.
- Foreshore strip is part of a road reservation.
- Erosion control measures limiting access to water's edge for prawning activities.
- Boats tied to trees damage trees and impede public access.
- Informal parking areas are eroding.
- Poorly arranged and maintained mooring sites create boating hazards and may restrict public use of waters.
- Dual-use path too close to river creating conflict between users.
- Dual-use path stabilisation leads to loss of foreshore vegetation.
- Historic boat wrecks lie on the river bed.

RECOMMENDATIONS

A1 Prepare a management plan for the South Perth Yacht Club which considers the following issues: (SPYC, SRT)

- **pollution containment strategy,**
- **stormwater drainage,**
- **public access,**
- **dredge spoil disposal,**
- **slipway maintenance and management in accordance with SRT guidelines,**
- **development of alternative locations for fuel dispensers and storage facilities with the assistance of the SRT Pollution Abatement Officer, and**
- **review of the contingency plan for response to spillages to ensure it is adequate.**

A2 Establish steps approximately every 50 m in existing areas of continuous gabions, to facilitate access for prawners (SRT).

A3 Maintain or improve informal car parks to reduce impact of erosion and compaction. It may be less costly to create semi-formal (brick paving or limestone rubble) parking areas, which will require less maintenance in the long term (City of Melville).

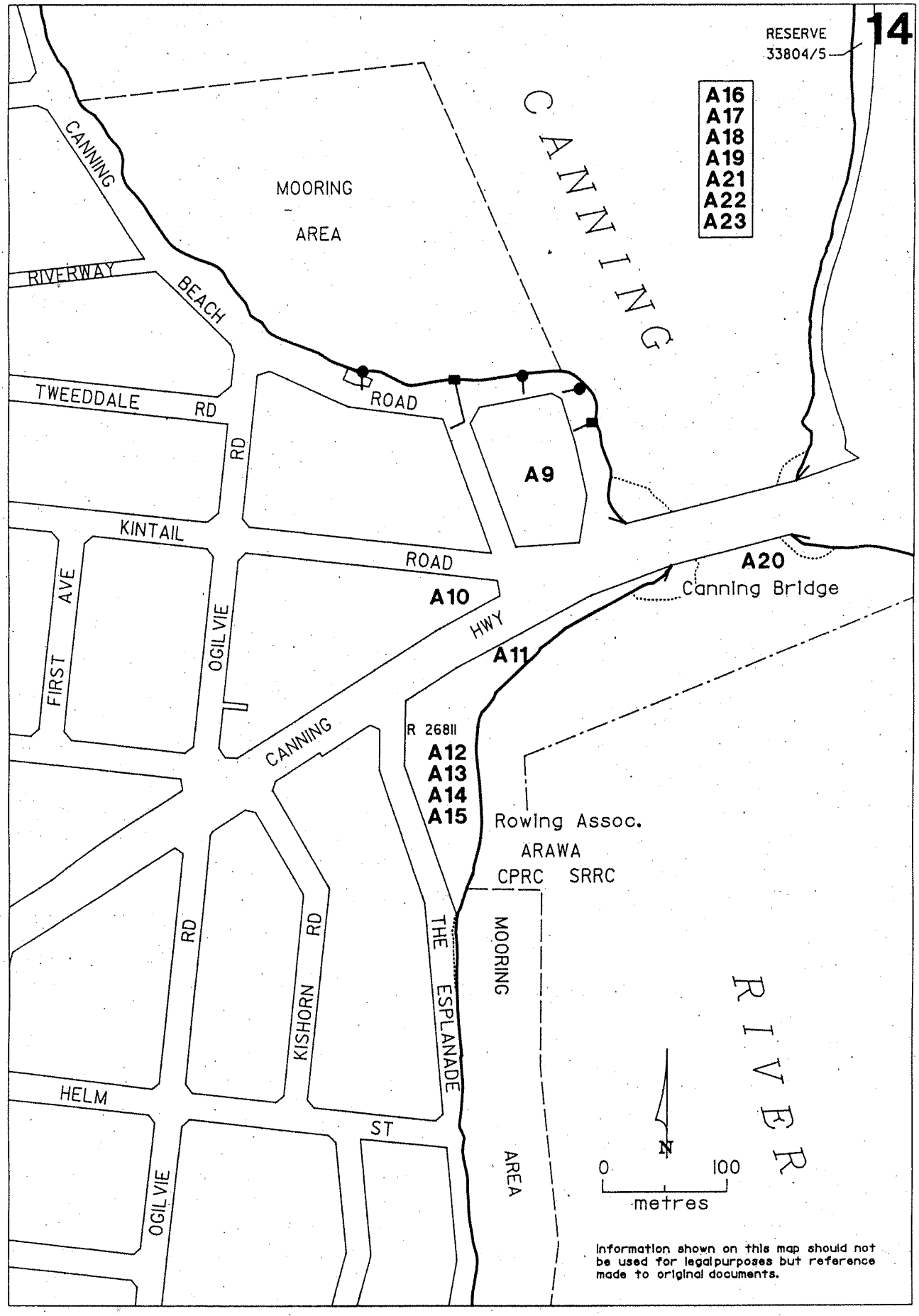
A4 Reinforce existing stands of vegetation and provide effective demarcation of the boundary between native vegetation and grasses (City of Melville and SRT).

A5 Exercise weed control and eradication, concentrating on Japanese pepper, dock and grasses in accordance with General Recommendations 68-72 (City of Melville and SRT).

A6 Define access points for users by placing individual bollards between beach areas and rushes, Appendix 6 (City of Melville).

A7 Determine the importance and value of the historic boat wrecks in accordance with General Recommendation 108 (AHC).

A8 Ensure council by-laws apply to both foreshore reserves and road reserves (LGA).


14
RESERVE 33804/5
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A21
A22
A23
CANNING
MOORING AREA
CANNING RIVER
RIVERWAY
BEACH
TWEEDDALE RD
ROAD
RD
A9
KINTAIL ROAD
A10
A20
Canning Bridge
HWY
A11
FIRST AVE
OGILVIE RD
CANNING
R 26811
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Rowing Assoc.
ARAWA
CPRC SRRC
KISHORN RD
THE ESPLANADE
MOORING AREA
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Information shown on this map should not be used for legal purposes but reference made to original documents.

5.2 Riverway Road (Applecross) to Helm Street (Mt Pleasant) (Map 14)

Planning and environmental considerations

- Degradation of native vegetation through significant weed invasion.
- Undefined access points for prawners.
- Exposed, poorly constructed and maintained log walls.
- Underutilisation of the Raffles Hotel/Motel site.
- Pollution of surface and ground water from below ground fuel storage facilities.
- Accretion under Canning Bridge.
- Foreshore strip is part of a road reservation.
- Parking pressure created by recreational activities.
- Poorly arranged and maintained mooring sites create boating hazards and may restrict public use of waters.
- There is evidence of damage to foreshore vegetation adjacent to the Swan River Rowing Club.
- Rowing club members discourage general public access near the rowing clubs and along the foreshore.
- Inadequately maintained, visually obtrusive drainage outlets and headwalls reduce aesthetic appeal of the foreshore.

RECOMMENDATIONS

A9 Endorse Swan River Management Strategy A35 which encourages redevelopment of the Raffles Hotel site to take greater advantage of its riverside location.

A10 Ensure fuel companies continue monitoring of below ground storage facilities, maintain appropriate pollution containment strategies and refer all results to the SRT (SRT).

A11 Fence off *Allocasuarina* and *Juncus* stands immediately south of Canning Bridge, control grass and replant the area with the same species (Rowing clubs and City of Melville).

A12 Establish a cost sharing arrangement between council and rowing clubs for fencing and rehabilitation of areas affected by rowing club activities (Rowing clubs and City of Melville).

A13 Establish agreements with rowing clubs stating defined locations where boats can be rigged and tents erected, to protect vegetation (SRT, City of Melville and Rowing clubs).

A14 Ensure public access is not restricted in front of the Swan River Rowing Club and the Amateur Rowing Association of Western Australia by erecting appropriate signs at ends of the beach (City of Melville).

A15 Replace groins and log walls near rowing clubs with constructions which conform to SRT requirements and are designed to blend in with the natural environment (Rowing clubs).

A16 Reinforce existing stands of *Melaleuca* and *Allocasuarina* (City of Melville and SRT).

A17 Establish shore rushes in front of retaining walls to reduce visual impact of these structures, Appendix 6 (City of Melville and SRT).

A18 Develop measures to alleviate parking difficulties during periods of high pressure (City of Melville).

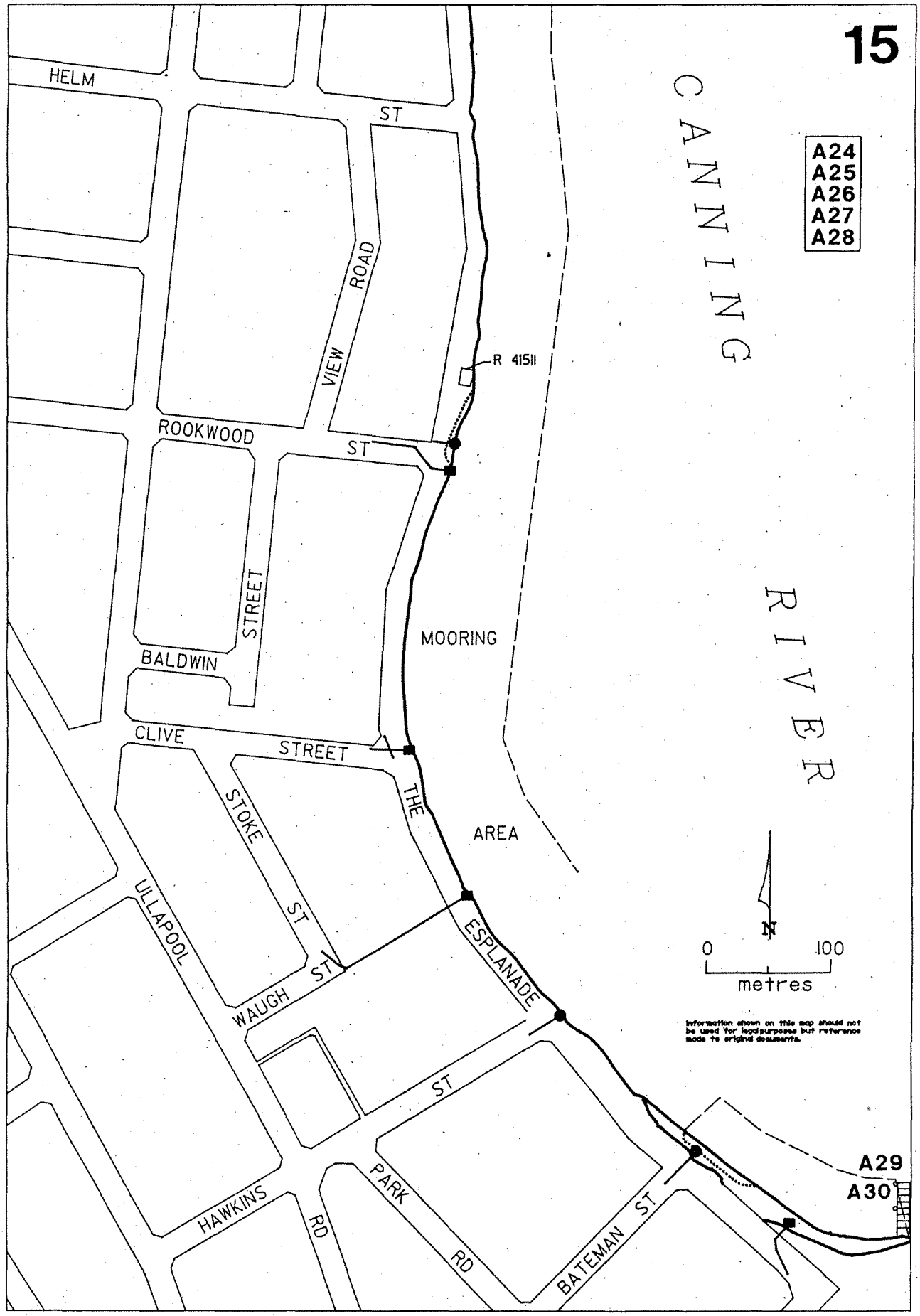
A19 Repair or remove moorings that fail to conform to DOT standards (DOT).

A20 Ensure navigable channels beneath Canning Bridge are maintained (DOT).

A21 Define access points for prawners by placing individual bollards between beach areas and rushes (City of Melville).

A22 Remove or repair inadequately maintained drains and conspicuous headwalls, a nd mask by planting rushes in accordance with guidelines outlined in Appendix 3 (City of Melville and WAWA).

A23 Control and eradicate grass and herbaceous species in an environmentally sound manner acceptable to the SRT (City of Melville and SRT).


15
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Information shown on this map should not be used for legal purposes but reference made to original documents.

5.3 Helm Street to Bateman Road (Mt Pleasant) (Map 15)

Planning and environmental considerations

- Poorly arranged and maintained mooring sites create boating hazards and may restrict public use of waters.
- Access to the jetty restricted by height difference between jetty and adjacent land.
- Jetty extends into shallow water.
- Existing paperbark and sheoak stands are extremely restricted and there is no evidence of regeneration.
- Grasses invading fringing vegetation, and introduced weed trees such as Japanese pepper among paperbarks.
- Boats tied to trees damage trees and impede public access.
- Sections of the foreshore strip are part of a road reservation.
- Undefined access points for prawners.
- The stands of rushes, sedges and paperbarks are being degraded by uncontrolled pedestrian access.
- Steep banks restrict access to the water.
- Prominent retaining walls affect the river landscape.

RECOMMENDATIONS

A24 Repair or remove moorings that fail to conform to DOT standards (DOT).

A25 Define access points for prawners by placing individual bollards between beach areas and rushes, Appendix 6 (City of Melville).

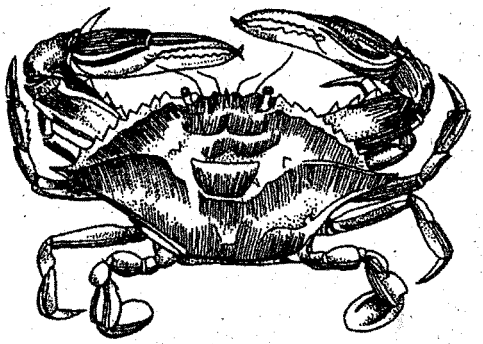
A26 Continue planting programme to mask conspicuous log retaining walls by planting rushes in accordance with guidelines outlined in Appendix 6 (City of Melville).

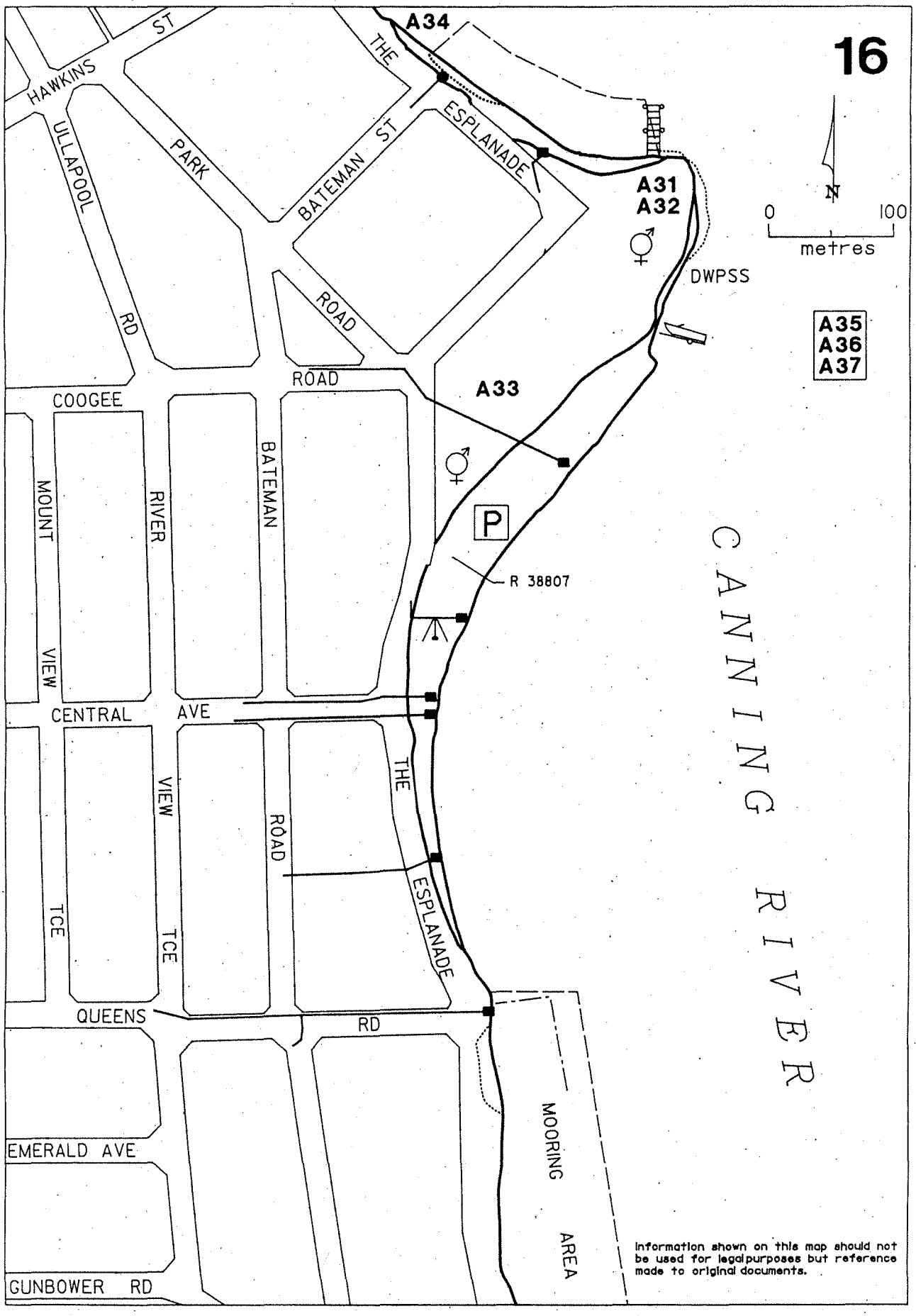
A27 Reinforce existing stands of paperbarks, sheoaks and understorey species including shore rush and sword sedges (SRT and City of Melville).

A28 Control and eradicate grass and herbaceous species in an environmentally sound manner acceptable to the SRT (City of Melville and SRT).

A29 Maintain public jetty in accordance with DOT requirements (City of Melville).

A30 Erect signs on the jetty warning of the danger of diving into shallow water (City of Melville).

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COOGEE ROAD
MOUNT VIEW
RIVER
BATEMAN
CENTRAL AVE
VIEW TCE
TCE
ROAD
THE ESPLANADE
QUEENS RD
MOORING AREA
EMERALD AVE
GUNBOWER RD
Information shown on this map should not be used for legal purposes but reference made to original documents.

5.4 Bateman Road to Gunbower Road (Mt Pleasant) (Map 16)

Planning and environmental considerations

- Insufficient shade trees provided at Deep Water Point Reserve.
- Area subject to high recreational pressure but lacking picnic/cooking facilities.
- Water skiers do not conform with DOT regulations which is resulting in environmental degradation.
- Car park and boat ramps bisect the reserve and endanger children and elderly people accessing the swimming beach, kiosk, jetty or swings.
- Inappropriate design of buildings with little or no surrounding vegetation.
- Access to jetty difficult due to poorly maintained jetty abutment.
- Sections of the foreshore strip are part of a road reservation.
- Conspicuous drains detract from aesthetic appeal of this area.

RECOMMENDATIONS

A31 Redesign jetty abutment to improve access and provide for the disabled with SRT advice (City of Melville and SRT).

A32 Erect signs on the jetty warning of the danger of diving into shallow water (City of Melville).

A33 Undertake a redevelopment plan for Deep Water Point which considers (City of Melville):

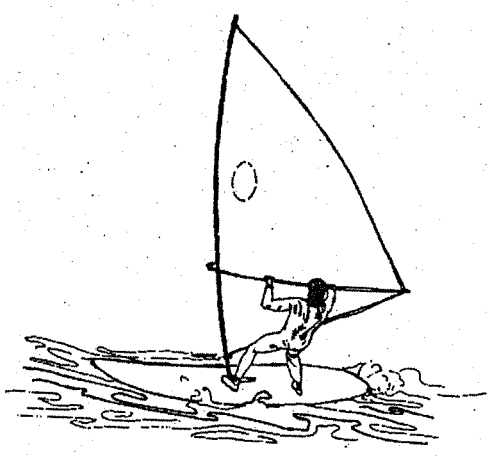
- **a detailed landscape plan for Deep Water Point which considers the need for shade trees, screening of buildings and the need to protect views from nearby properties, and safety issues,**
- **establishing gas barbecues and picnic tables at Deep Water Point Reserve,**
- **relocating the boat ramp to the southern end of the car park to reduce the safety hazard,**
- **the use of parking fees to fund the relocation of the boat ramp,**
- **drain concealment in accordance with Appendix 3.**

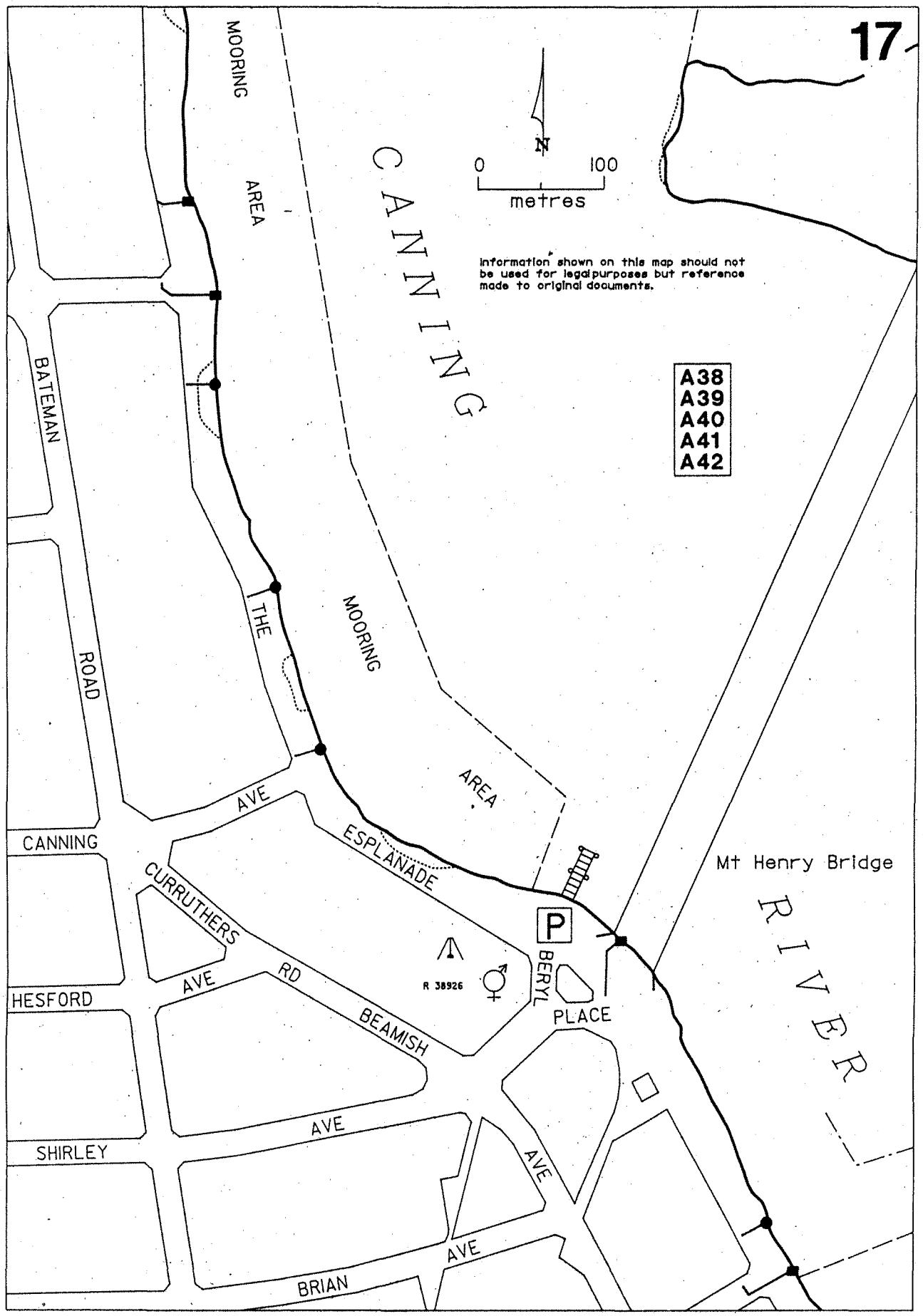
A34 Reinforce existing paperbark, sedge and rush stands on the northern section adjacent to the beach (City of Melville and SRT).

A35 Produce an educational brochure outlining the importance of shallow banks for aquatic flora and fauna and water birds for distribution to users of the reserves (SRT and DOT).

A36 Repair or remove moorings that fail to conform to DOT standards (DOT).

A37 Control weed encroachment into rushes in an environmentally sound manner which is acceptable to the SRT and concentrates on grasses (particularly kikuyu, couch and buffalo), dock and tree weed removal (City of Melville and SRT).




17
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BATEMAN ROAD
THE MOORING AREA
CANNING AVE
ESPLANADE
CURRUTHERS AVE
HESFORD RD
BEAMISH AVE
SHIRLEY AVE
BRIAN AVE
BERYL PLACE
P
R 38926
Mt Henry Bridge
RIVER

5.5 Gunbower Road to mouth of Bull Creek (Mt Pleasant) (Map 17)

Planning and environmental considerations

- Mature stands of paperbarks and no evidence of regeneration.
- Sections of the foreshore strip are part of a road reservation.
- Drainage outlets appear to be redundant and are inadequately supported.
- Introduced tree species and grass invasion into native vegetation stands.
- Boats tied to trees damage trees and impede public access.
- Poorly arranged and maintained mooring sites create boating hazards and may restrict public use of waters.
- Erosion control measures inadequately concealed.
- The stands of rushes, sedges and paperbarks are being degraded by uncontrolled pedestrian access.
- Steep banks restrict access to the water.

RECOMMENDATIONS

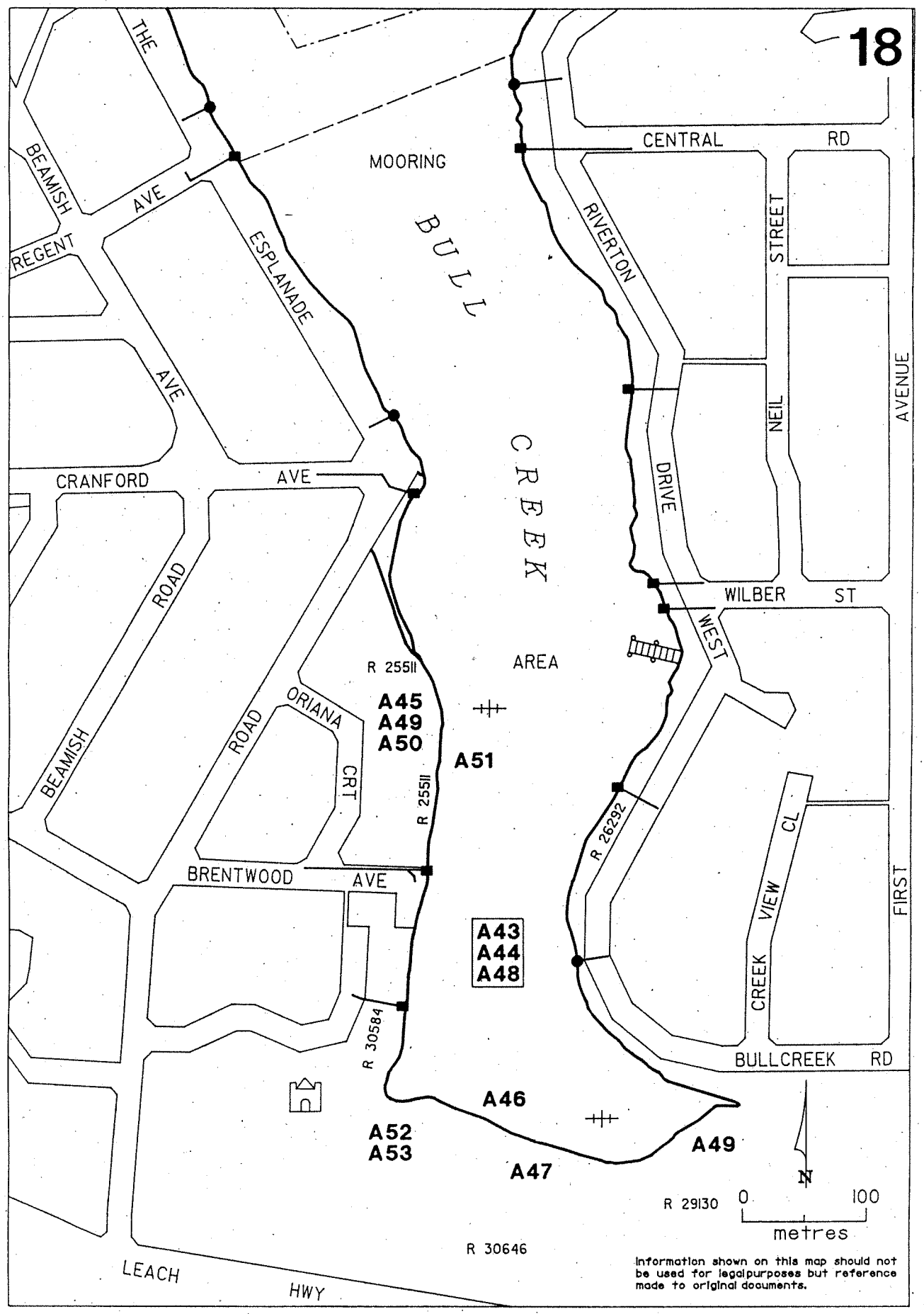
A38 Conceal erosion control measures by planting rushes in accordance with Appendix 6 (City of Melville and WAWA).

A39 Repair or remove moorings that fail to conform to DOT standards (DOT).

A40 Reinforce existing stands of vegetation and concentrate on tree weed removal and grass control (City of Melville).

A41 Remove unused drains, repair inadequately maintained drains and conceal drains through planting of native rushes and sedges in accordance with Appendix 3 (City of Melville and SRT).

A42 Control and eradicate grass and herbaceous species in an environmentally sound manner acceptable to the SRT in accordance with General Recommendations 68-72 (City of Melville and SRT).


18
THE
BEAMISH AVE
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CRANFORD AVE
BEAMISH ROAD
ROAD
ORIANA CRT
BRENTWOOD AVE
MOORING
BULL CREEK
AREA
CENTRAL RD
RIVERTON DRIVE
STREET
NEIL AVENUE
WILBER ST
WEST
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5.6 Regent Ave (Brentwood) to Central Road (Rossmoyne) (Map 18)

Planning and environmental considerations

- Grass encroachment into rushes.
- Extensive infestation of golden dodder throughout paperbark stands.
- Existing stands of paperbarks aging and little evidence of regeneration.
- Demarcation between foreshore reserve and private property inadequately defined resulting in the perception of private ownership limiting access.
- Illegal developments on Reserve 25511 including landscaping, jetties, boat storage facilities etc.
- Illegal and inadequately maintained jetties are present.
- Extensive weed areas encroaching into adjacent wetland areas.
- Dual-use path passing between the Cities of Melville and Canning is discontinuous.
- Bull Creek acts as a barrier to recreational walking and cycling.
- System Six area designated in part for conservation.
- Narrow foreshore reserve.
- Inadequate knowledge of flora and fauna in wetlands fringing the river.
- Extension of gardens from Seventh Day Adventist retirement home into Bull Creek reserve.
- Areas of relatively undisturbed fringing vegetation including:
  - * *Melaleuca Juncuss* complex
  - * *Juncus* complex

  and the importance of managing and protecting them.
- Boat wrecks, historic home and lack of signage explaining history.
- Inadequately maintained moorings and sunken boats constituting a navigation hazard.

RECOMMENDATIONS

A43 Reinforce existing stands of vegetation where regeneration is not occurring (Cities of Melville and Canning and SRT).

A44 Encourage community groups to manually remove golden dodder and other weed species (Cities of Melville and Canning and SRT).

A45 Undertake survey and peg the boundary between reserved land and private property (City of Melville).

A46 Investigate the possibility of establishing a boardwalk across Bull Creek below high water mark (Appendix 7). Incorporate vegetation protection and heritage and biological information signage (Cities of Melville and Canning and SRT).

A47 Undertake a comprehensive study of the flora and fauna in the Bull Creek reserves (Cities of Melville and Canning).

A48 Repair or remove moorings that fail to conform to DOT standards (DOT).

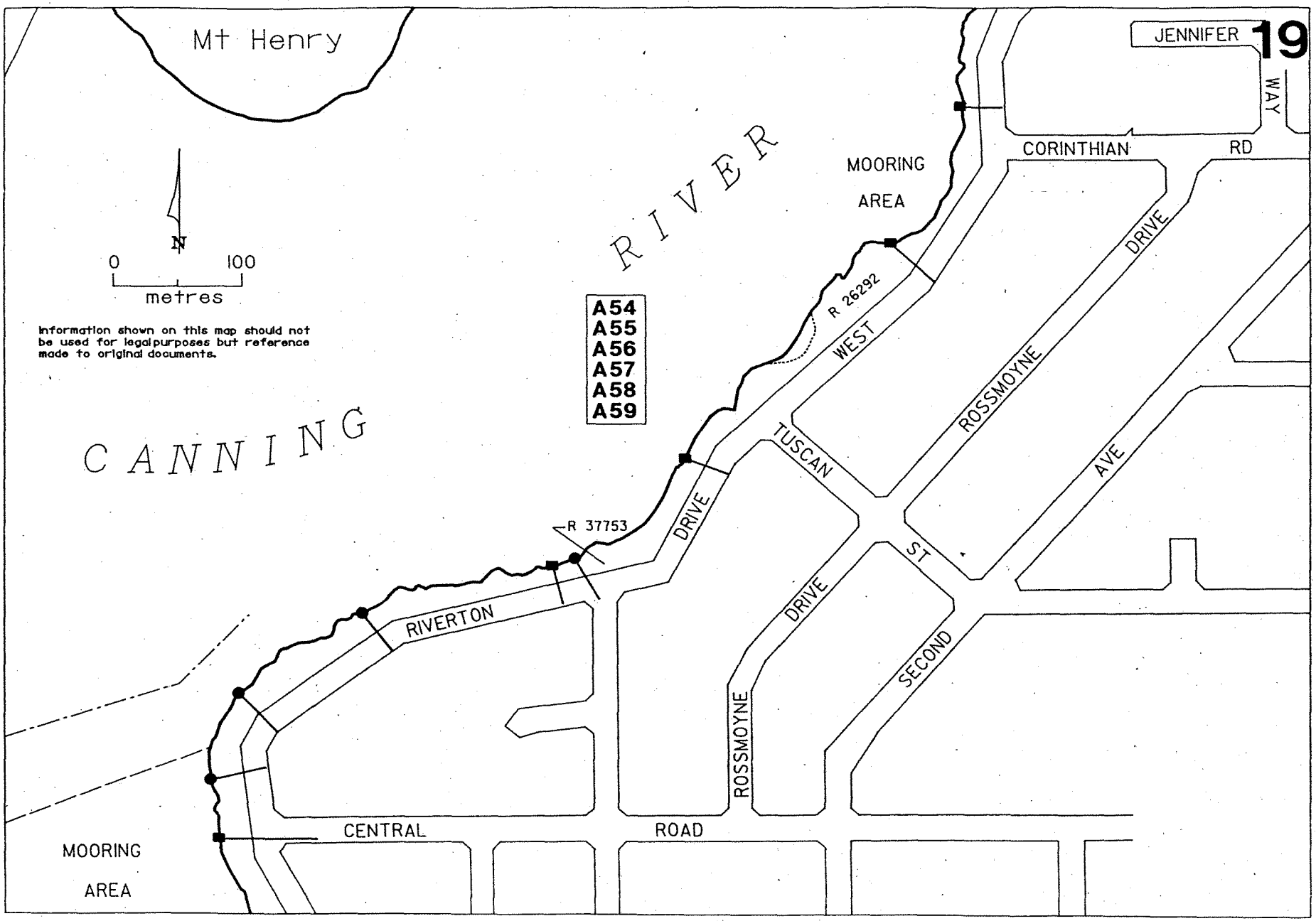
A49 Identify and remove incompatible and illegal developments within reserves 25511 and 29130 (Cities of Melville and Canning).

A50 Increase public awareness of the trail constructed along the foreshore reserve, to improve the level of usage (City of Melville).

A51 Identify the owners of unlicensed jetties and remove the jetties immediately (DOT).

A52 Introduce a rabbit and fox eradication program for Yagan Park (Cities of Melville and Canning).

A53 Introduce a cat control program in accordance with General Recommendation 75 (Cities of Melville and Canning).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WEST
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ROSSMOYNE
AVE
TUSCAN
ST
CANNING
R 37753
DRIVE
RIVERTON
DRIVE
SECOND
ROSSMOYNE
CENTRAL
ROAD
MOORING
AREA

5.7 Central Road to Corinthian Road West (Rossmoyne) (Map 19)

Planning and environmental considerations

- Significant infestation of dodder and grasses in aging *Melaleuca/Juncus* complex.
- Inadequate definition of boundary between grass and fringing vegetation.
- Conspicuous, inadequately maintained drains and headwalls detract from landscape value.
- Boats tied to trees damage trees and impede public access.
- Poorly arranged and maintained mooring sites create boating hazards and may restrict public use of waters.
- Inadequate definition of access for prawners, fisher people and other users degrading rushes and sedges.
- Sections of the foreshore strip are part of a road reservation.
- Lack of shade trees.
- Significant regional view of Mount Henry and Mt Pleasant foreshore.

RECOMMENDATIONS

A54 Reinforce existing stands of paperbarks, sedges and rushes (City of Canning and SRT).

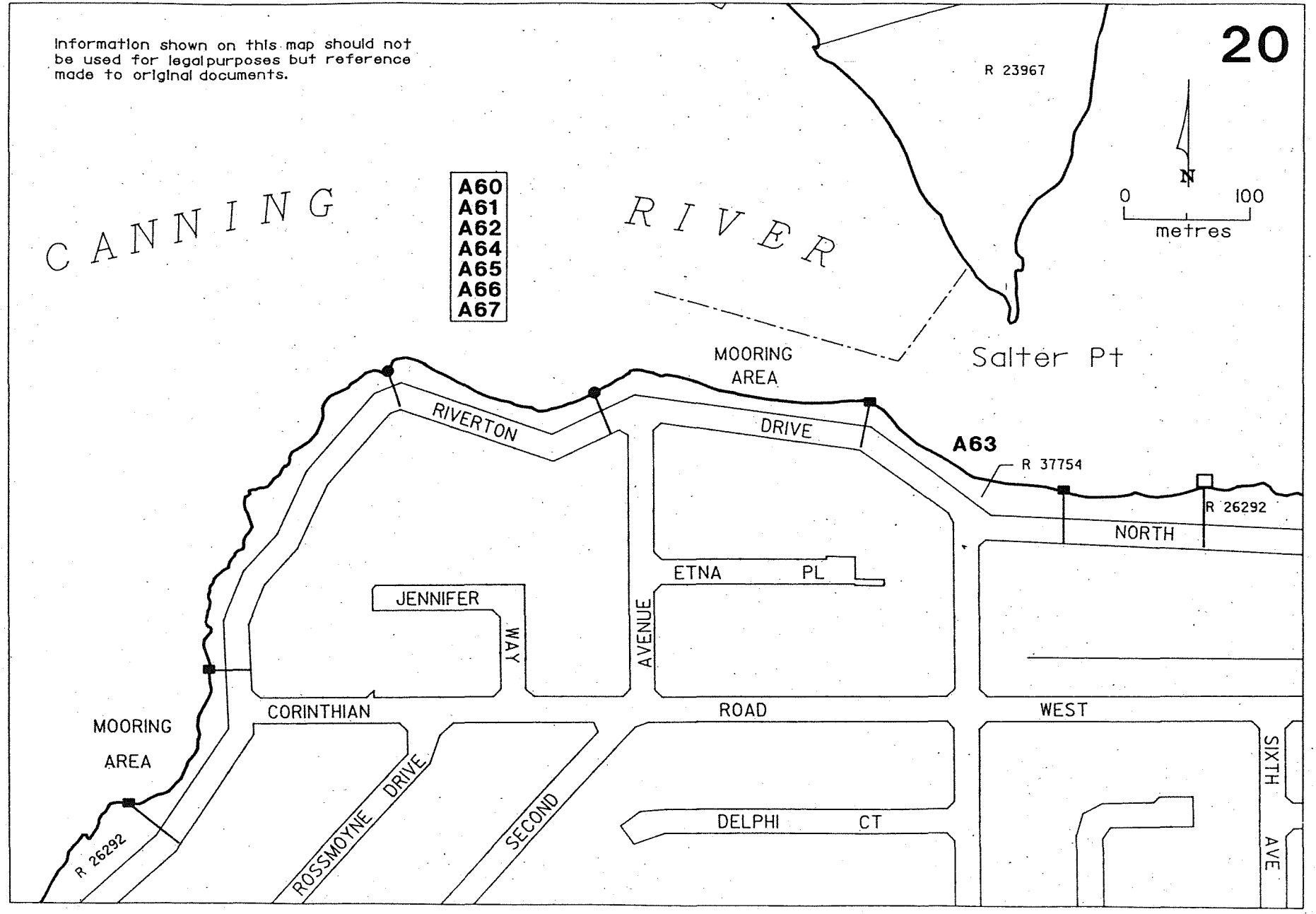
A55 Maintain and conceal conspicuous inadequately maintained drains by planting paperbarks, rushes and sedges in accordance with Appendix 3 (City of Canning and SRT).

A56 Define access points to water through vegetation by developing distinct paths sided by individual pine bollards (City of Canning).

A57 Establish sedges and native rush species in accordance with Appendix 6 (City of Canning and SRT).

A58 Ensure any proposed developments take into account the significant viewscape (SRT).

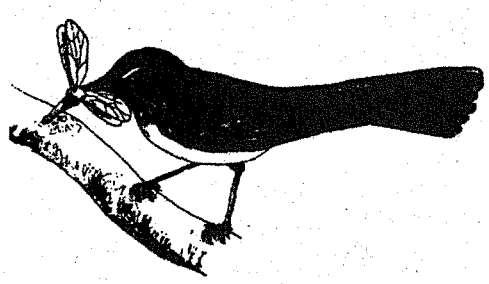
A59 Encourage community groups to manually remove golden dodder and other weed species (City of Canning and SRT).


Information shown on this map should not be used for legal purposes but reference made to original documents.
20
R 23967
N
0
100
metres
CANNING
RIVER
A60
A61
A62
A64
A65
A66
A67
MOORING AREA
Salter Pt
RIVERTON
DRIVE
A63
R 37754
R 26292
NORTH
ETNA
PL
JENNIFER
WAY
AVENUE
CORINTHIAN
ROAD
WEST
MOORING AREA
ROSSMOYNE DRIVE
SECOND
DELPHI
CT
SIXTH
AVE
R 26292

5.8 Corinthian Road West (Rossmoyne) to Sixth Ave (Shelley) (Map 20)

Planning and environmental considerations

- Existing paperbarks and sheoaks are aging and there is little evidence of regeneration.
- Grass invasion into rushes and sedges reducing diversity of understorey vegetation.
- Inadequate definition of boundary between grass and fringing vegetation.
- Part of the foreshore strip is road reservation.
- Local residents have taken an interest in the foreshore and have inadvertently introduced exotic plants to the reserve.
- Unmaintained, extruding drains reduce the aesthetic appeal of the area and constitute a safety hazard for children.
- Poorly arranged and maintained mooring sites create boating hazards and may restrict public use of waters.
- Dual-use path very close to shore and fringing vegetation.
- Launching of small boats over foreshore is damaging fringing vegetation.
- Recreational boat users, particularly water skiers and jet skiers disobeying DOT regulations and carrying out shallow water take-offs over fish nurseries and seagrass beds.
- White sand beaches highly desirable attribute of the area.
- Lack of indigenous trees in existing plantings.



RECOMMENDATIONS

A60 Reinforce existing stands of vegetation in accordance with Appendix 4 (City of Canning and SRT).

A61 Reintroduce tree species such as flooded gums and tuart to the landward margin of the foreshore reserves (City of Canning).

A62 Improve condition of drain outlets, remove where appropriate and conceal through planting of native tree, sedge and rushes in accordance with Appendix 3 (City of Canning and SRT).

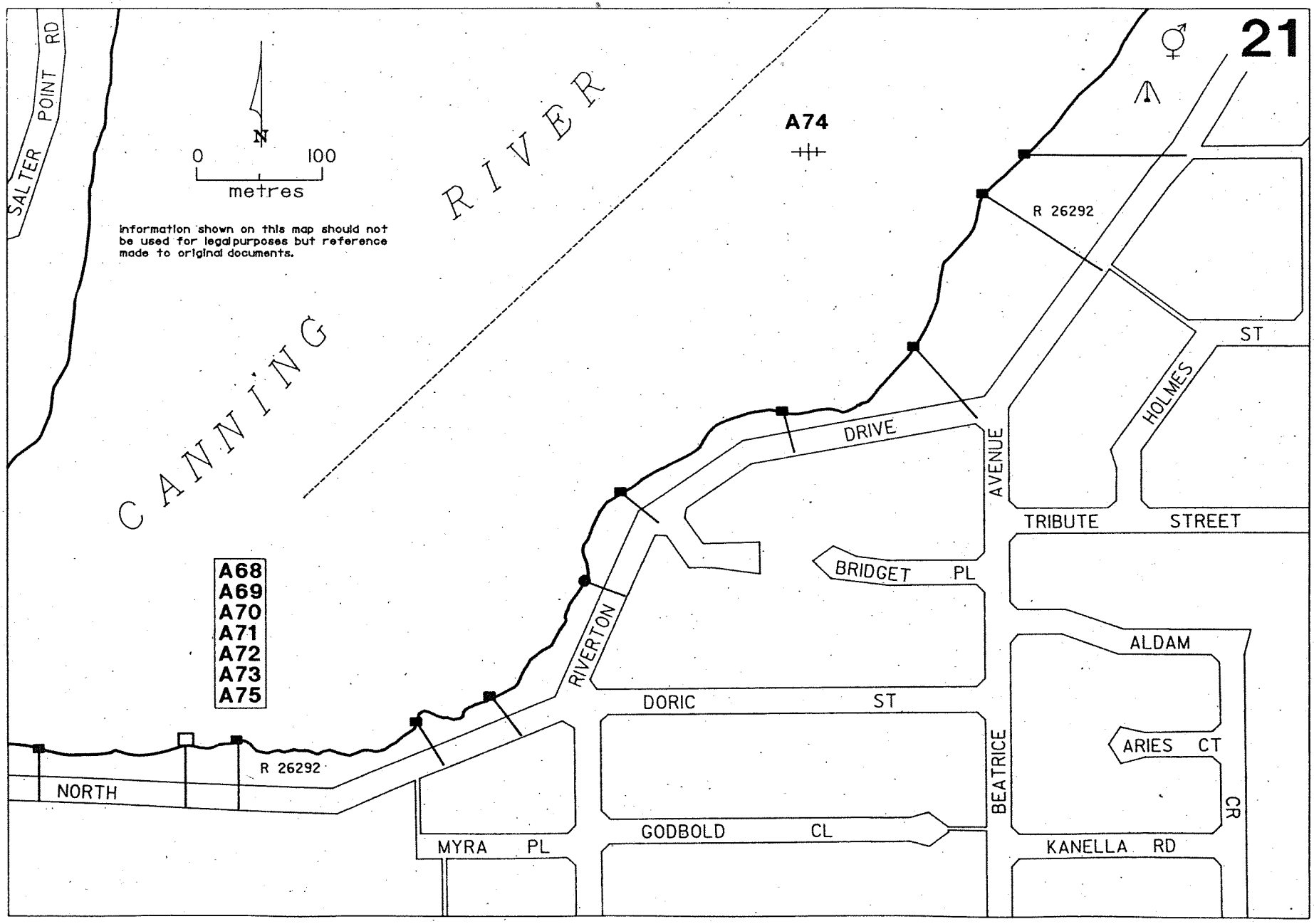
A63 Assess demand for a small boat launching facility and consider locating the boat ramp at the end of Fifth Ave (City of Canning).

A64 Construct bollards between fringing vegetation and adjacent sandy beaches to direct recreational users (City of Canning).

A65 Encourage residents to remove exotics introduced to the foreshore and replace with indigenous vegetation including myrtles, paperbarks and sedges (City of Canning and SRT).

A66 Encourage community groups to manually remove the various weed species (City of Canning and SRT).

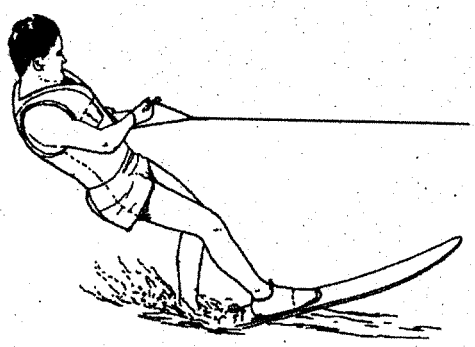
A67 Control and eradicate grasses and other herbaceous species, and tree weeds including Japanese pepper in an environmentally sound manner acceptable to the SRT (City of Canning and SRT).


21
SALTER POINT RD
CANNING RIVER
N
0
100
metres
information shown on this map should not be used for legal purposes but reference made to original documents.
A74
R 26292
ST
HOLMES
DRIVE
AVENUE
TRIBUTE
STREET
BRIDGET PL
RIVERTON
A68
A69
A70
A71
A72
A73
A75
ALDAM
DORIC ST
ARIES CT
BEATRICE
CR
R 26292
NORTH
MYRA PL
GODBOLD CL
KANELLA RD

5.9 Sixth Ave to Barbican St (Shelley) (Map 21)

Planning and environmental considerations

- Inadequately maintained, visually obtrusive drainage outlets and headwalls reduce aesthetic appeal of the foreshore.
- Inadequate definition of boundary between grass and restricted fringing vegetation.
- Important recreation node located at the termination of Beatrice Avenue.
- Informal parking areas are eroding.
- The foreshore area is, in part, road reserve.
- Erosion causing mature trees to become unstable.
- Paperbarks and sheoaks aging with little or no regeneration.
- Important continuous fringe of vegetation which is suffering weed invasion.
- Insufficient parking bays along Riverton Drive North.
- Launching of small boats over foreshore is damaging fringing vegetation.
- Convict fence and boat wreck are landscape features of historic significance.
- Important regional view of the South Perth foreshore including Mount Henry, parts of Waterford and the convict fence.



RECOMMENDATIONS

A68 ***Allocasuarina obesa*** **should be re-established along the shoreline in areas where the bank has eroded under them (City of Canning and SRT).**

A69 Reinforce existing vegetation nodes with *Melaleuca cuticularis* and *M. rhaphiophylla* where currently dominant (City of Canning and SRT).

A70 Remove or repair inadequately maintained drains and conspicuous headwalls, and mask by planting rushes in accordance with guidelines outlined in Appendix 3 (City of Canning and SRT).

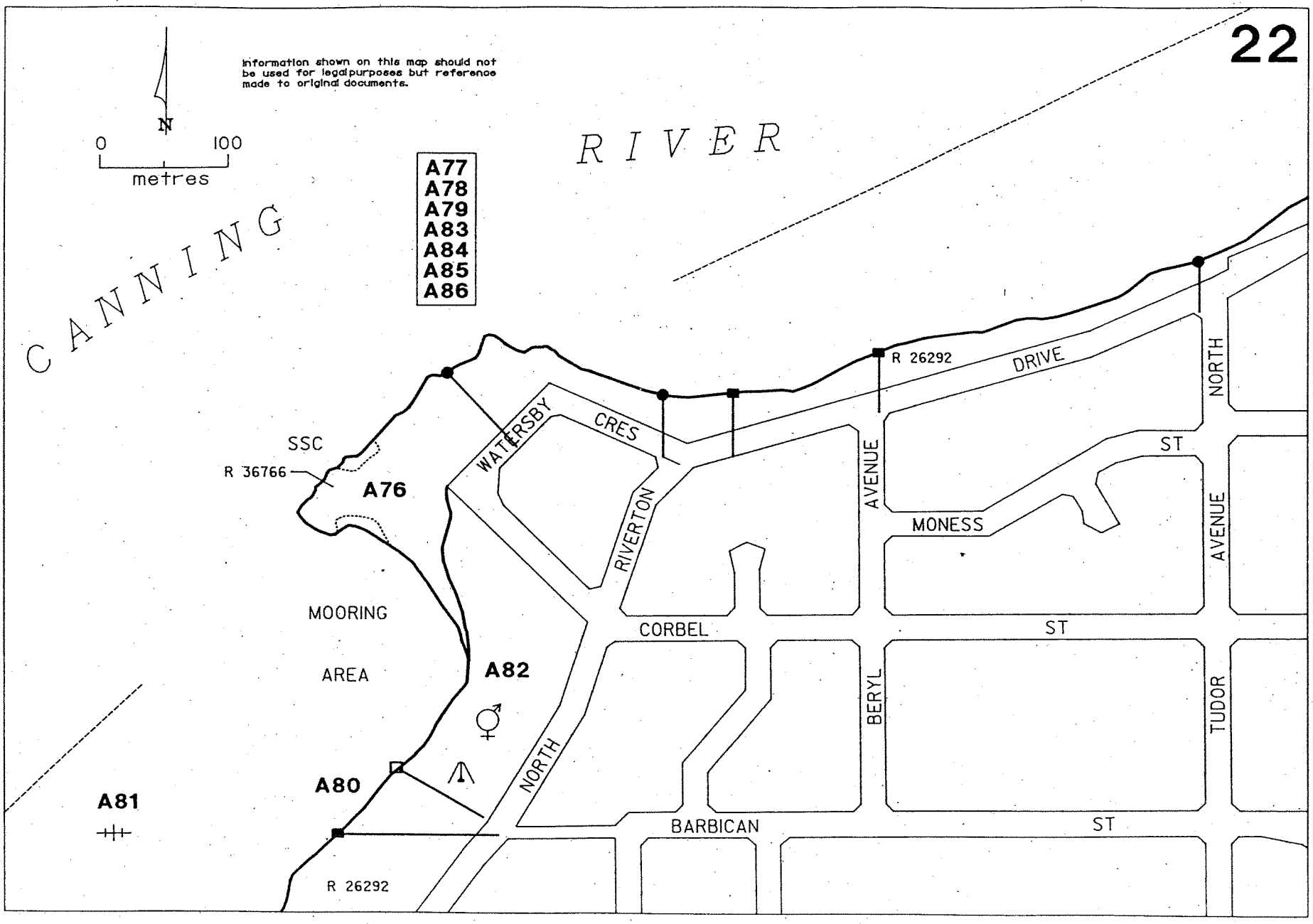
A71 Extend remnant vegetation to high water line or dual-use path in areas lacking high recreation use and define the boundary between grasses and native vegetation (City of Canning and SRT).

A72 Repair or remove moorings that fail to conform to DOT standards (DOT).

A73 Control and eradicate grasses and other herbaceous species in an environmentally sound manner acceptable to the SRT in accordance with General Recommendations 68-72 (City of Canning and SRT).

A74 Determine the importance and value of the convict fence and boat wreck and erect information signs near the water near the terminus of Beatrice Ave (AHC and Maritime Museum).

A75 Ensure the important regional view is considered when assessing development applications (SRT).


Information shown on this map should not be used for legal purposes but reference made to original documents.
N
0
100
metres
RIVER
CANNING
A77
A78
A79
A83
A84
A85
A86
R 26292
DRIVE
NORTH
AVENUE
ST
MONESS
AVENUE
WATERSBY
CRES
RIVERTON
SSC
R 36766
A76
MOORING
AREA
A82
CORBEL
ST
BERYL
TUDOR
NORTH
A80
A81
BARBICAN
ST
R 26292

5.10 Barbican St to Modillion Ave North (Shelley) (Map 22)

Planning and environmental considerations

- Shelley Sailing Club occupies Mumms Point and is developing a management plan for the area.
- Dredging of channel to Curtin University Boat Club.
- Convict fence is a landscape feature of historic significance.
- Sections of the foreshore reservation are road reserve.
- Unmaintained moorings close to areas where children learn to windsurf, sail etc.
- Important recreation node located south-west of Mumms Point.
- Extensive, popular recreation area with toilets and swings provided but lacking shade trees and barbecues to allow full utilisation of the area.
- WAWA drain adjacent to a large open grassed playing area which is subject to a lot of use by local residents, school children and visitors. The drain detracts quite severely from the aesthetic appeal of the area.
- Significant regional view across river to the Waterford foreshore, which retains important extensive areas of vegetation.
- Inadequately maintained, visually obtrusive drainage outlets and headwalls reduce aesthetic appeal of the foreshore.
- Limited extent of remnant vegetation.
- Degradation of native foreshore vegetation through lack of regeneration, uncontrolled pedestrian access, mowing etc., facilitating excessive weed invasion.

RECOMMENDATIONS

A76 Ensure the SSC management plan is consistent with requirements of the SRT and the City of Canning (SRT and City of Canning).

A77 Remove or repair inadequately maintained drains and conspicuous headwalls, and mask by planting rushes in accordance with guidelines outlined in Appendix 3 (City of Canning and SRT).

A78 Repair or remove moorings that fail to conform to DOT standards (DOT).

A79 Ensure dredging is in accordance with SRT Policy DE 1 (SRT).

A80 Camouflage WAWA drainage outfall by creating a small vegetation node surrounding the drain. Species to use could include native bulrush and *Juncus* spp. beneath a *Melaleuca cuticularis*, *M. rhaphiophylla* and *Allocasuarina obesa* overstorey (WAWA, City of Canning and SRT).

A81 Determine the importance and value of the convict fence and boat wreck and erect information signs at the water's edge near the terminus of Beatrice Ave (AHC and Maritime Museum).

A82 Undertake a recreation study of the area between Beatrice Ave and Mumms Point to assess (City of Canning):

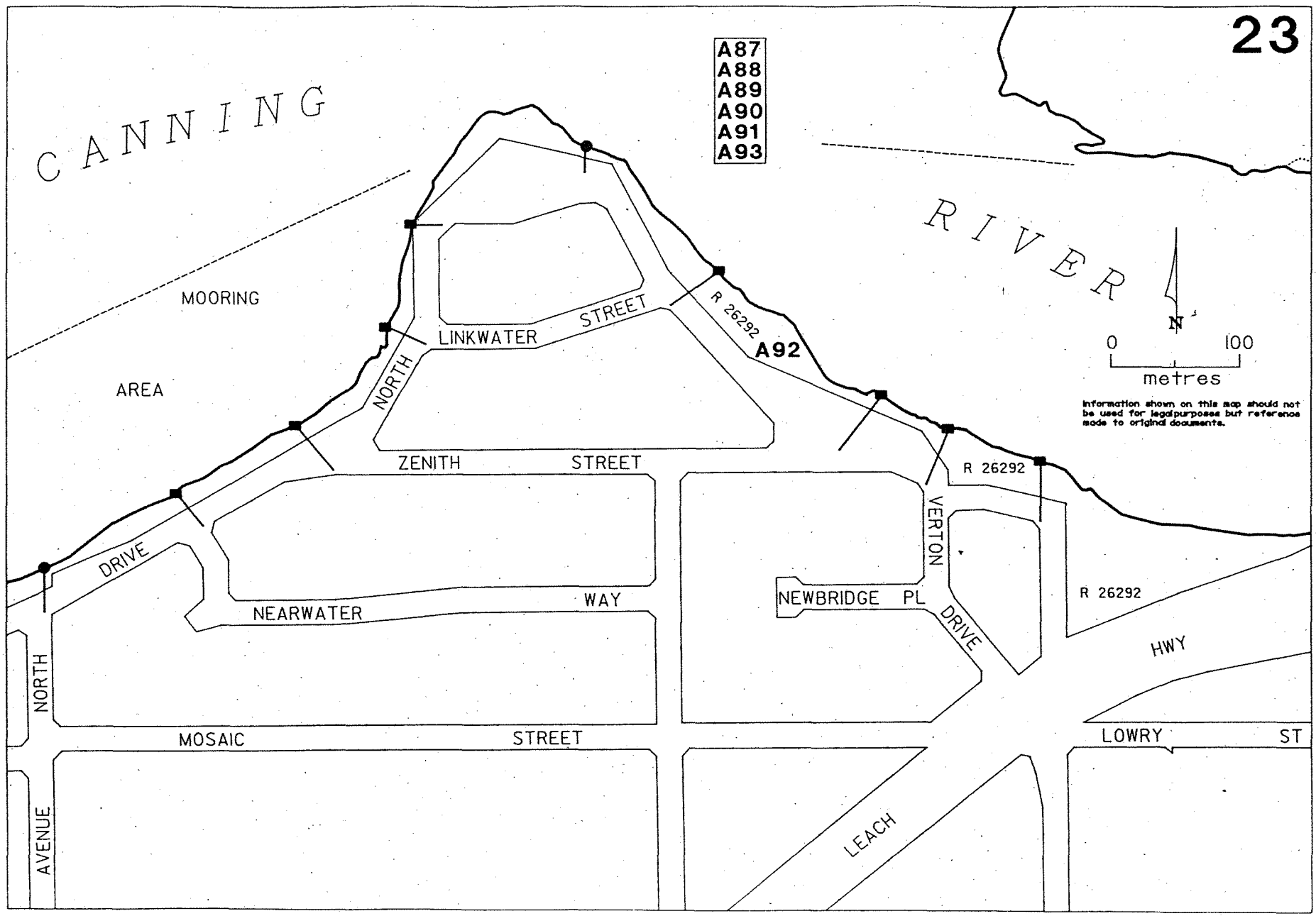
- **level and types of usage,**
- **requirements for recreation,**
- **the need for shade trees,**
- **provision of picnic facilities including barbecues and picnic tables.**

A83 Ensure regional views are considered when assessing development applications (SRT).

A84 Reinforce existing stands of vegetation and provide effective demarcation of the boundary between native vegetation and grasses (City of Canning and SRT).

A85 Exercise weed control and eradicate grasses and other herbaceous weeds in accordance with General Recommendations 68-72 (City of Canning and SRT).

A86 Re-establish vegetation nodes in denuded areas with appropriate species including swamp paperbarks, salt water sheoaks, flooded gum and a variety of understorey species including *Gahnia trifida, Juncus pauciflorus* and shore rush (SRT and City of Canning).


23
A87
A88
A89
A90
A91
A93
CANNING
RIVER
MOORING
AREA
LINKWATER
STREET
NORTH
R 26292
A92
ZENITH
STREET
DRIVE
NEARWATER
WAY
NORTH
MOSAIC
STREET
AVENUE
VERTON
NEWBRIDGE PL
DRIVE
R 26292
R 26292
HWY
LOWRY
ST
LEACH
N
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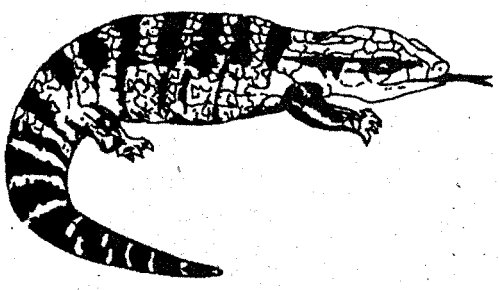
metres
Information shown on this map should not be used for legal purposes but reference made to original documents.

5.11 Modillion Ave North to Lowry Street (Map 23)

Planning and environmental considerations

- Significant regional view across river to Waterford with Centenary Park remaining an eye-sore.
- Important recreational fishing spot adjacent to navigation channel.
- Dual-use path too close to river creating conflict between river users, cyclists and pedestrians.
- Dual-use path stabilisation leads to loss of foreshore vegetation.
- Inadequately maintained, visually obtrusive drainage outlets and headwalls reduce aesthetic appeal of the foreshore.
- Continued degradation of currently limited native foreshore vegetation through lack of regeneration, uncontrolled pedestrian access, mowing etc., facilitating significant levels of weed invasion.
- Convict fence is a landscape feature of historic significance.
- Steep banks restrict access to the water.
- Poorly arranged and maintained mooring sites create boating hazards and may restrict public use of waters.



RECOMMENDATIONS

A87 Repair or remove moorings that fail to conform to DOT standards (DOT).

A88 Reinforce existing stands of vegetation and provide effective demarcation of the boundary between native vegetation and grasses (City of Canning and SRT).

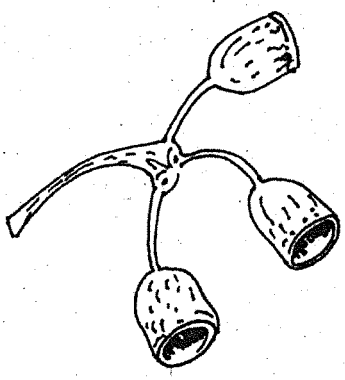
A89 Establish new native vegetation nodes in areas with steep, inaccessible banks and unsightly drainage outfalls (City of Canning and SRT).

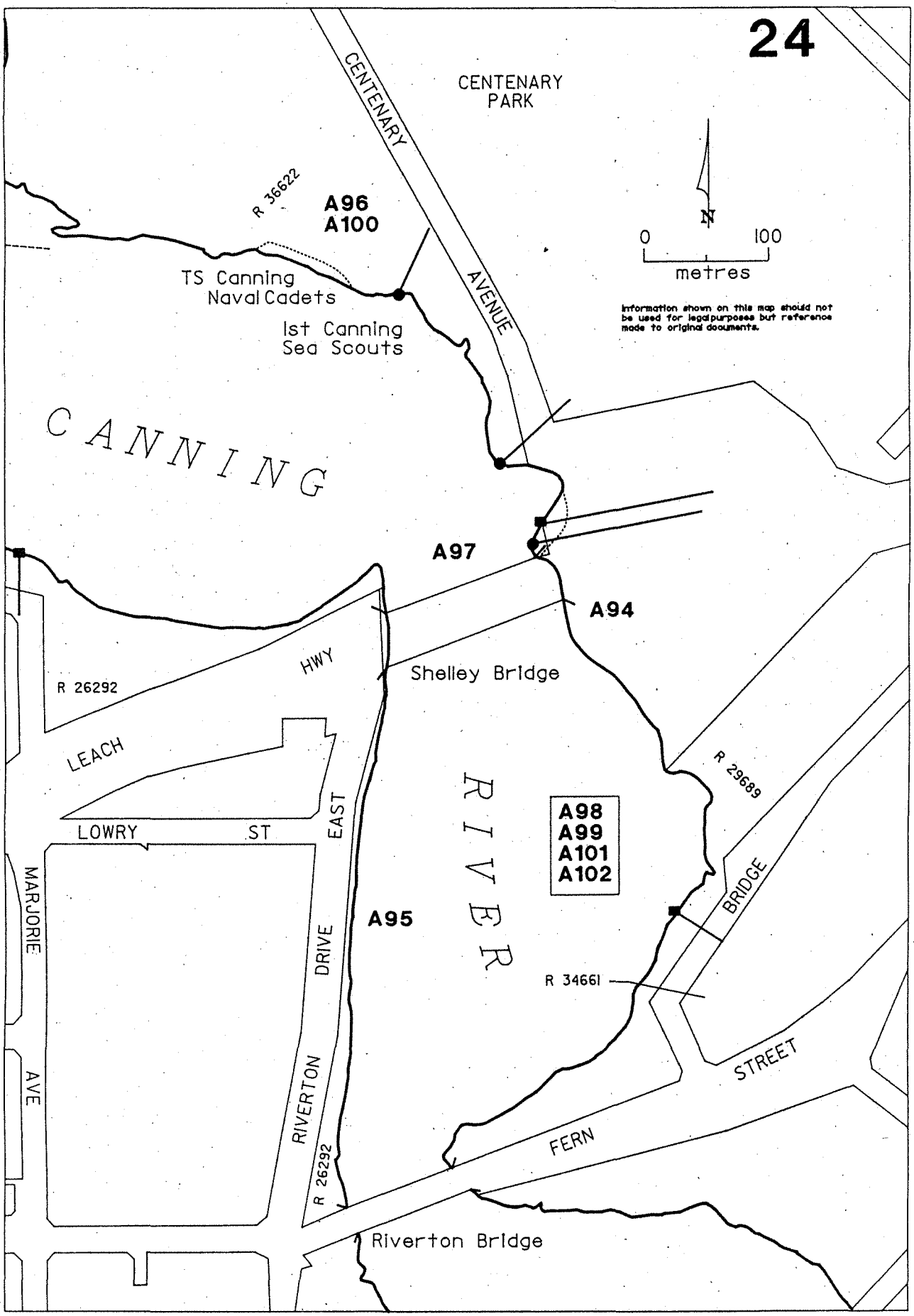
A90 Remove or repair inadequately maintained drains and conspicuous headwalls, and mask by planting rushes in accordance with guidelines outlined in Appendix 3 (City of Canning and SRT).

A91 Exercise weed control and eradicate grasses including kikuyu and buffalo grass, and other herbaceous weeds in accordance with General Recommendations 68-72 (City of Canning and SRT).

A92 Determine the importance and value of the convict fence and erect information signs in Reserve 26292 at the point adjacent to Linkwater St (AHC and Maritime Museum).

A93 Define access points for users by placing individual bollards in degraded areas with gently sloping banks and fence off and rehabilitate adjacent areas (City of Melville).




24
CENTENARY PARK
CENTENARY AVENUE
R 36622
A96
A100
TS Canning Naval Cadets
1st Canning Sea Scouts
CANNING
N
0
100
metres
Information shown on this map should not be used for legal purposes but reference made to original documents.
A97
A94
HWY
Shelley Bridge
R 26292
LEACH
LOWRY ST
EAST
MARJORIE AVE
DRIVE
RIVERTON
R 26292
A95
RIVER
A98
A99
A101
A102
R 29689
BRIDGE
R 34661
STREET
FERN
Riverton Bridge

5.12 Lowry Street to Centenary Park (Map 24)

Planning and environmental considerations

- Extensive areas of wide shallow estuary margins and seagrass beds which are important functional fish nurseries.
- T.S. Canning Hall lacks landscaping around the building and uses tyres as erosion control measures which detract significantly from the landscape.
- Remote power boat usage above important fish and bird feeding grounds between Shelley and Riverton Bridges.
- Degraded appearance of specific areas of the foreshore.
- Degradation of native foreshore vegetation through lack of regeneration, significant levels of weed invasion, mowing etc.
- Significant viewscape.
- Conspicuous water pipeline traversing the Canning River.

RECOMMENDATIONS

A94 **Implement and maintain MRD landscape plan for Shelley Bridge (MRD).**

A95 **Investigate the use of remote power boats and ascertain whether it is important to define an area for usage (SRT).**

A96 **Develop and implement a landscape plan to reduce the visual impact of the T.S. Canning Hall (T.S. Canning Naval Cadets).**

A97 **Support WAWA and City of Canning initiatives to disguise the pipeline (SRT).**

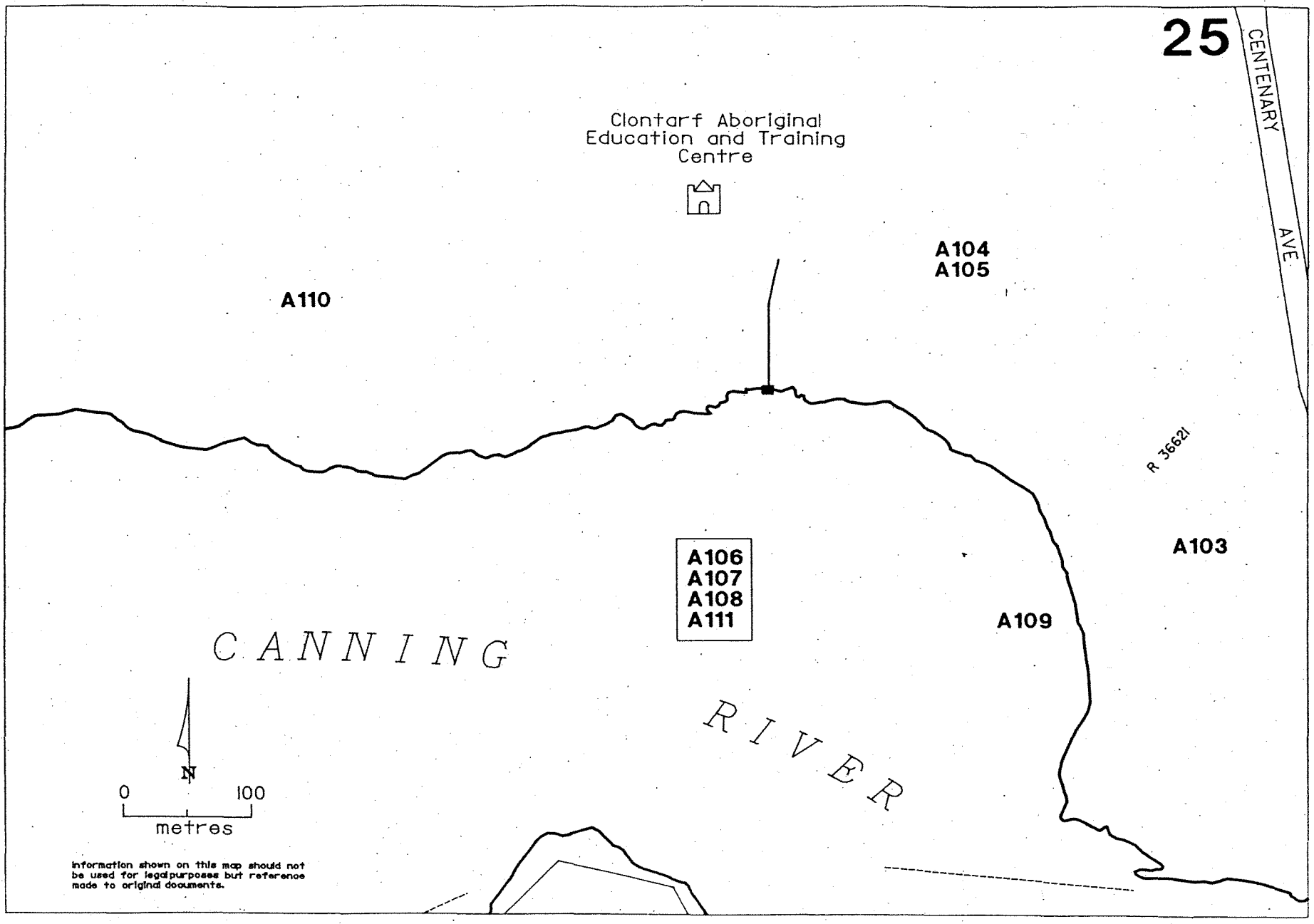
A98 **Reinforce existing stands of vegetation and provide effective demarcation of the boundary between native vegetation and grasses (City of Canning and SRT).**

A99 **Establish new native vegetation nodes in areas with steep, inaccessible banks and unsightly drainage outfalls (City of Canning and SRT).**

A100 **Encourage community groups such as T.S. Canning Naval Cadets and 1st Canning Sea Scouts to weed and rehabilitate sections of the foreshore (City of South Perth and SRT).**

A101 **Remove or repair inadequately maintained drains and conspicuous headwalls, and mask by planting rushes in accordance with guidelines outlined in Appendix 3 (City of Canning and SRT).**

A102 **Exercise weed control and eradicate grasses including kikuyu and buffalo grass, and other herbaceous weeds in accordance with General Recommendations 68-72 (City of Canning and SRT).**


25
CENTENARY AVE
Clontarf Aboriginal Education and Training Centre
A104
A105
A110
R 36621
A103
A106
A107
A108
A111
A109
CANNING
RIVER
N
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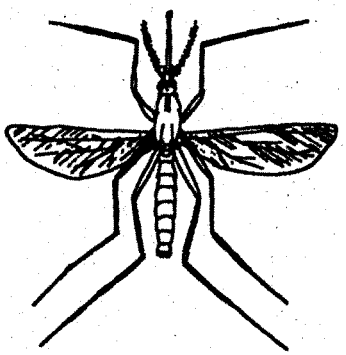
100
metres
information shown on this map should not be used for legal purposes but reference made to original documents.

5.13 Centenary Park to west end of Clontarf foreshore (Map 25)

Planning and environmental considerations

- Mosquito breeding in specific locations.
- The presence of restricted areas of samphire salt marsh of high ecological value.
- Degradation of foreshore by uncontrolled trail-bike access.
- Mosaic of severely degraded vegetation with areas of high conservation value.
- Public access restricted by land ownership.
- Limited presence of native vertebrate fauna, possibly as a result of predation by cats, dogs and foxes.
- Limited use of a prime waterfront area at Centenary Park.
- Clontarf foreshore management plan.



RECOMMENDATIONS

A103 **Undertake a feasibility study to assess potential public usage and demand for cafe/kiosk type facilities at Centenary Park, which considers issues identified in Recommendation 34 of the Swan River Management Strategy (City of Canning).**

A104 **Eradicate foxes and other introduced predators within this area (CALM).**

A105 **Introduce a cat control program with advice from the Cat Haven and in accordance with Recommendation 75 (City of Canning).**

A106 **Reinforce existing stands of vegetation and establish new vegetation nodes in denuded areas (Cities of Canning and South Perth and SRT).**

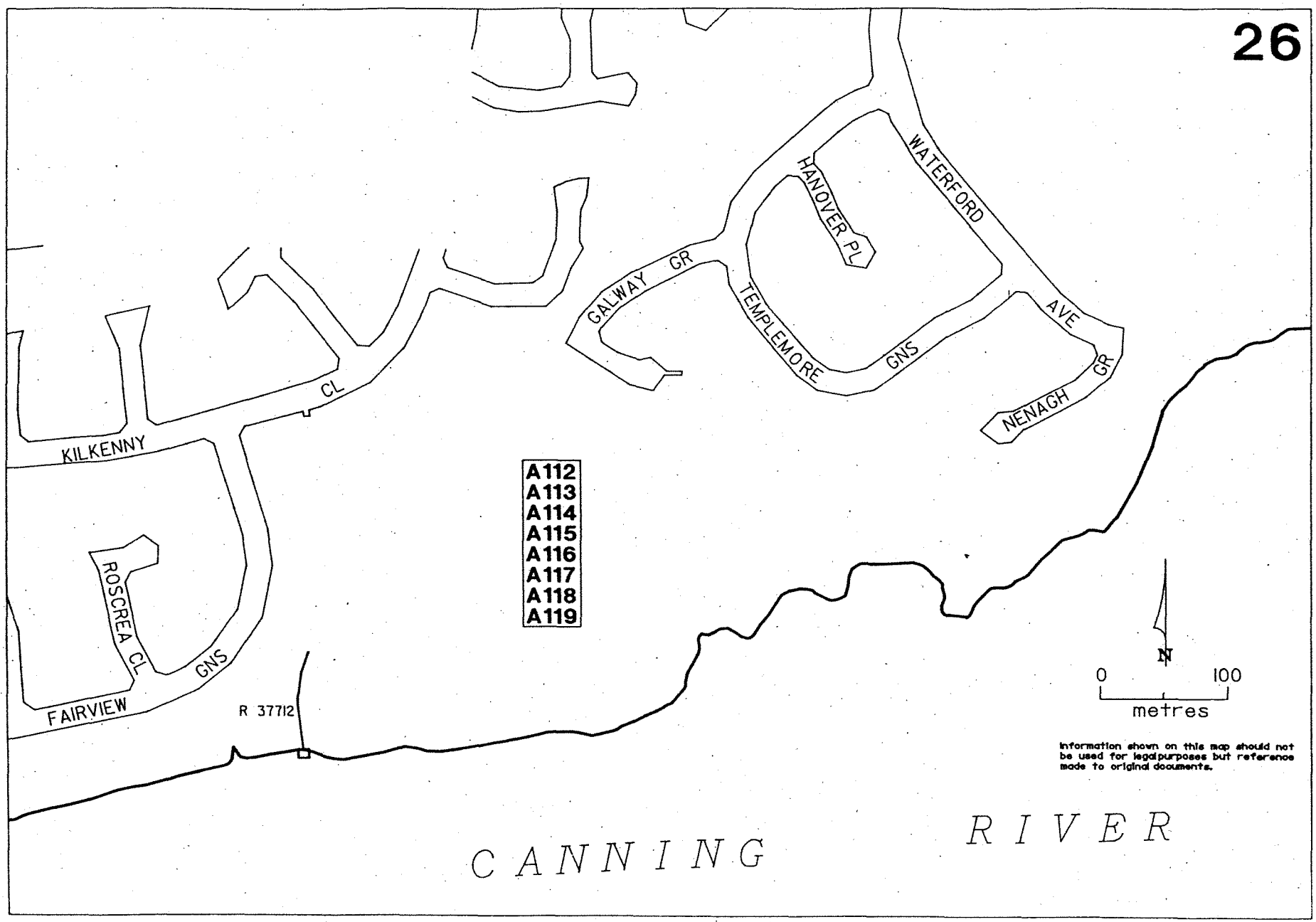
A107 **Establish effective demarcation of the boundary between native vegetation and grasses (Cities of Canning and South Perth and SRT).**

A108 **Establish new native vegetation nodes in areas with steep, inaccessible banks and unsightly drainage outfalls in accordance with Appendices 3 and 6 (City of Canning and SRT).**

A109 **Ensure remnant salt marsh is protected from uncontrolled vehicle and pedestrian access (City of Canning).**

A110 **Endorse the Clontarf foreshore management plan and support the City of South Perth to implement the plan (SRT).**

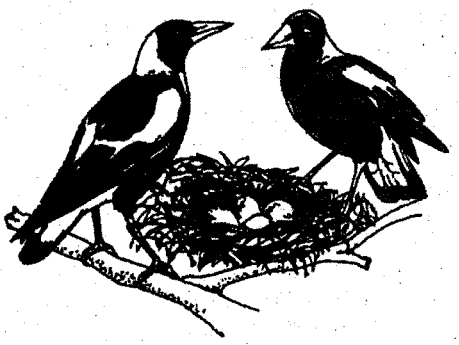
A111 **Fence areas of remnant vegetation with high conservation value (Cities of Canning and South Perth).**


WATERFORD
HANOVER PL
GALWAY GR
TEMPLEMORE
GNS
AVE
NENAGH
GR
CL
KILKENNY
ROSCREA CL
GNS
FAIRVIEW
R 37712
A112
A113
A114
A115
A116
A117
A118
A119
N
0
100
metres
Information shown on this map should not be used for legal purposes but reference made to original documents.
CANNING
RIVER

5.14 Waterford foreshore (Map 26)

Planning and environmental considerations

- Extremely valuable fringing vegetation including flooded gum, paperbarks and shore rushes.
- Important continuous habitat for a wide variety of fauna.
- Identified as a System Six area.
- City of South Perth to provide a dual-use path along the periphery of native vegetation.
- The need to provide access to the foreshore to cater for growing urban populations in the neighbourhood.
- Review of Waterford foreshore management plan.
- Grass and other weeds invading wetland areas.



RECOMMENDATIONS

A112 Eradicate foxes and other introduced predators within this area (CALM).

A113 Provide interpretation signs along the dual-use path to inform visitors of the importance of the wetlands (City of South Perth and SRT).

A114 Direct public access to the water by fencing a limited number of paths from the proposed dual-use path through disturbed areas adjacent to the extensive, healthy stands of paperbarks and sedge understorey (City of South Perth).

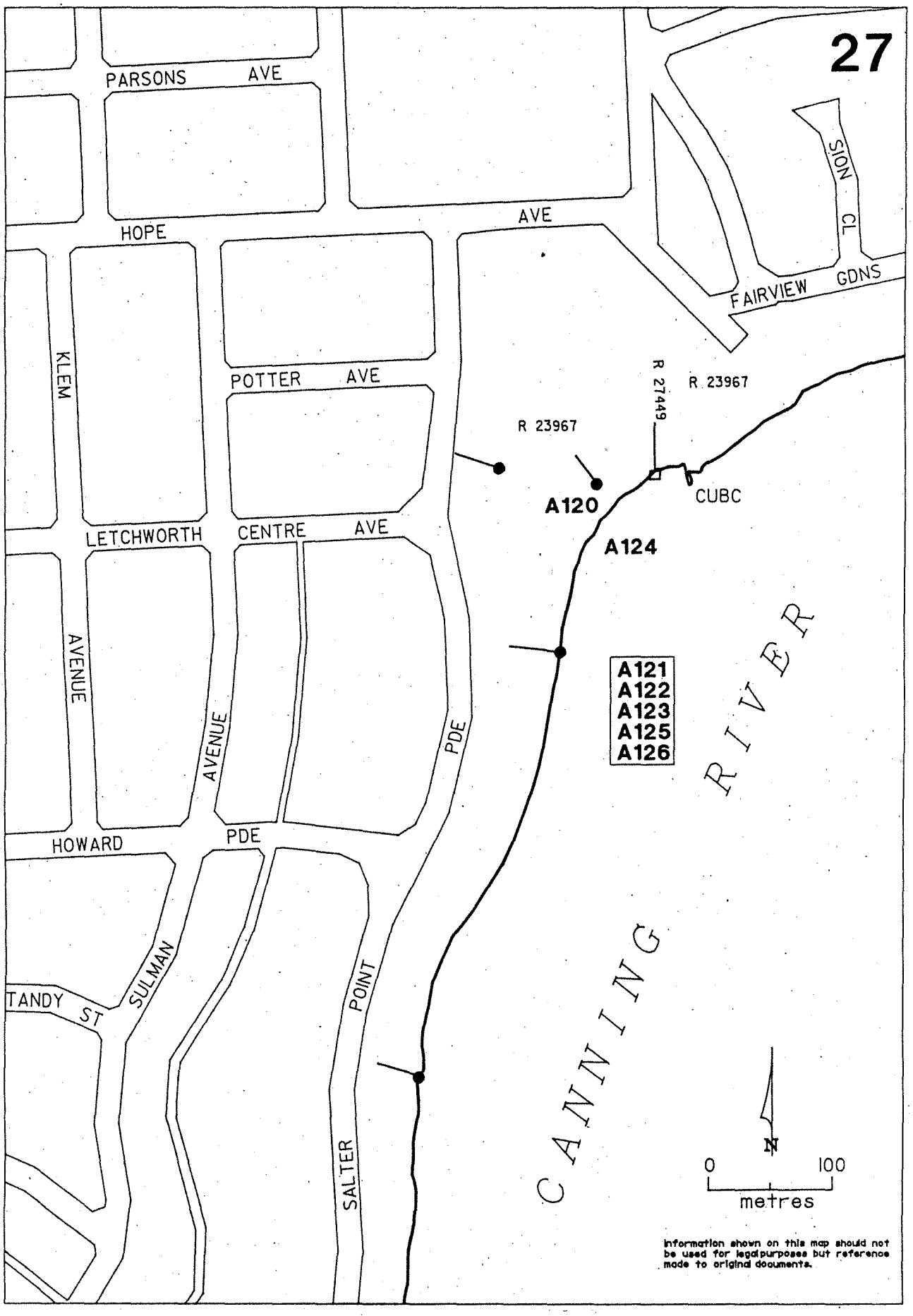
A115 Provide a fence between the dual-use path and the Waterford reserve, such that the dual-use path provides the barrier between introduced plants and an area of high conservation value (City of South Perth).

A116 Introduce a cat trapping program in accordance with Recommendation 75, with advice from the Cat Haven (City of South Perth).

A117 Provide an information leaflet on the importance of growth and regeneration of indigenous flora, preventing land uses which may adversely affect the environment and allowing recreation activities compatible with the conservation of flora and fauna in already disturbed areas (City of South Perth).

A118 Ensure the Waterford foreshore management plan is consistent with SRT requirements (SRT).

A119 Establish effective demarcation of the boundary between native vegetation and grasses (City of South Perth and SRT).


27
PARSONS AVE
HOPE AVE
SION CL
FAIRVIEW GDNS
KLEM AVENUE
POTTER AVE
R 23967
R 27449
R 23967
A120
CUBC
A124
LETCHWORTH CENTRE AVE
AVENUE
A121
A122
A123
A125
A126
PDE
HOWARD PDE
TANDY ST
SULMAN
POINT
SALTER
CANNING RIVER
N
0 100
metres
Information shown on this map should not be used for legal purposes but reference made to original documents.

5.15 Salter Point foreshore (Map 27)

Planning and environmental considerations

- The presence of a lagoon is a unique landscape feature in the Swan and Canning River system, contributing significantly to the appearance of the river.
- Identified as a System Six area.
- Continuous areas of remnant vegetation although of limited extent have extremely high conservation value.
- Grass and other weed invasion in *Juncus* stands and sandy rise vegetation.
- Review of Salter Point management plan.
- Inadequately maintained, visually obtrusive drainage outlets reduce the aesthetic appeal of the foreshore.
- Lack of regeneration of trees and revegetation difficult due to removal of plantings.

RECOMMENDATIONS

A120 Undertake a feasibility study to determine whether Sandon Park should become a recreational node (City of South Perth). The study should include:

- **current usage and potential usage,**
- **demand for, and provision of, additional facilities such as toilet blocks, barbecues,**
- **landscaping around the facilities,**
- **provision of shade trees, and**
- **education trail outlining the ecological importance of the wetland and fringing vegetation.**

A121 Repair eroded foundations of trees and reinforce with existing indigenous species (City of South Perth and SRT).

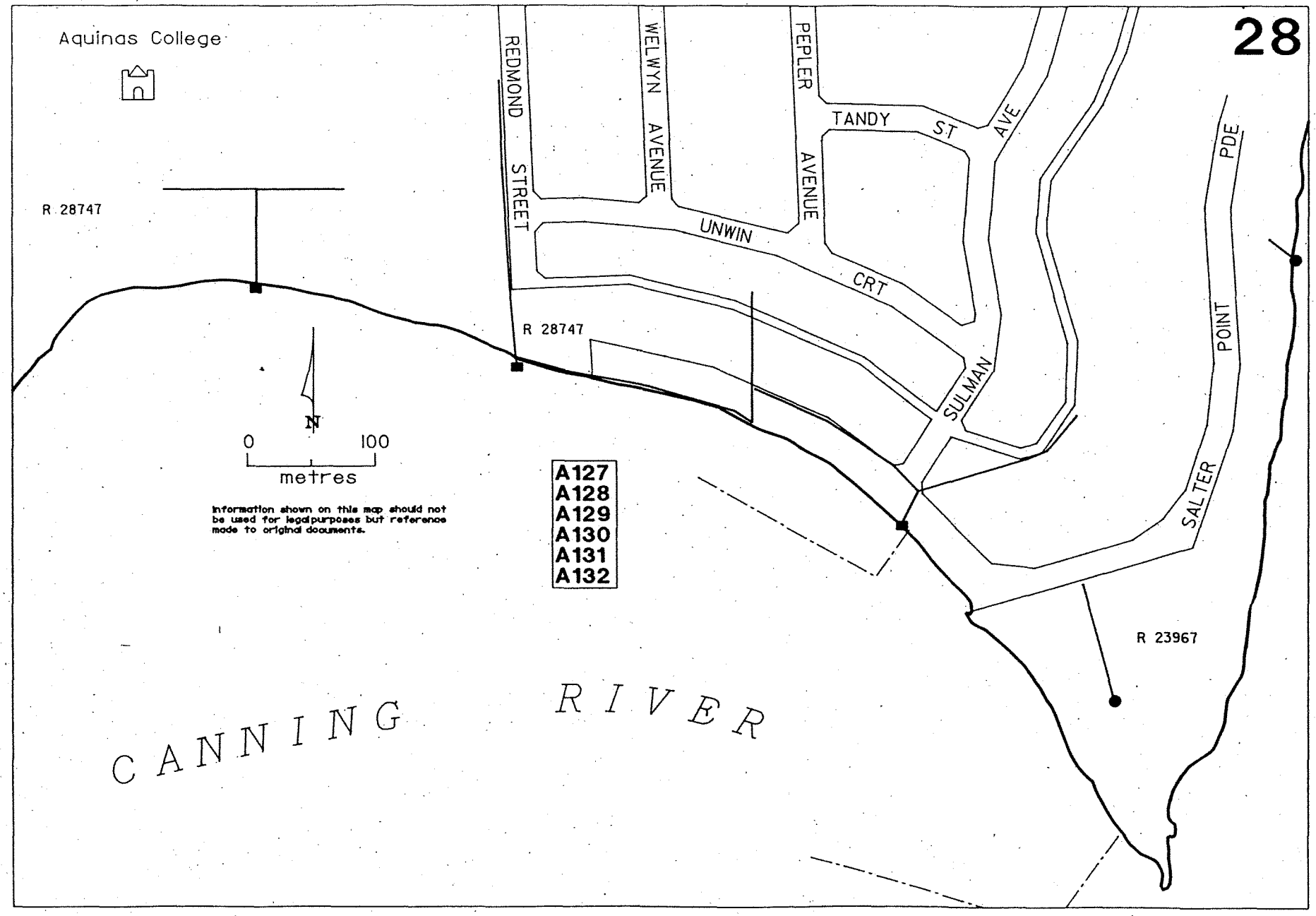
A122 Ensure Salter Point management plan is consistent with SRT requirements (SRT).

A123 Define access points for fishermen and prawners to reduce trampling of fringing vegetation (SRT and City of South Perth).

A124 Ensure that Sandon Park boat ramp is limited to small craft only (i.e. trailable dinghies) by putting pine bollards between the access way and adjacent sedges (City of South Perth).

A125 Establish effective demarcation of the boundary between native vegetation and grasses (City of South Perth and SRT).

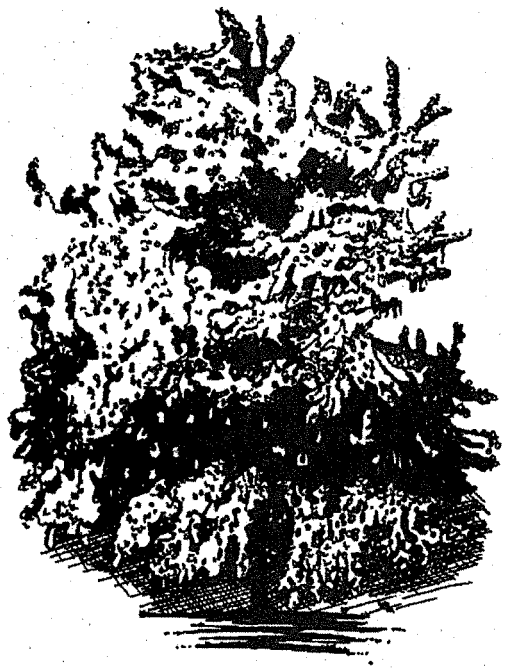
A126 Exercise weed control and eradicate grasses including kikuyu and buffalo grass, and other herbaceous weeds in accordance with General Recommendations 68-72 (City of Canning and SRT).


28
Aquinas College
R 28747
REDMOND STREET
WELWYN AVENUE
PEPLER AVENUE
TANDY ST
AVE
UNWIN CRT
SULMAN
PDE
POINT
SALTER
R 28747
R 23967
N
0
100
metres
Information shown on this map should not be used for legal purposes but reference made to original documents.
A127
A128
A129
A130
A131
A132
CANNING RIVER

5.16 Salter Point foreshore to Aquinas College (Map 28)

Planning and environmental considerations

- Identified as a System Six area
- Mount Henry management plan.
- Inadequately maintained, visually obtrusive drainage outlets and headwalls reduce aesthetic appeal of the foreshore.
- Access difficulties where the demarcation between foreshore reserve and private property is inadequately defined and due to steep slope.
- Extensive weed areas encroaching on adjacent wetland areas.
- The narrow nature of the foreshore reservation.
- Seasonal accumulation of algae on foreshores creates a nuisance.
- Visually obtrusive stabilising structures for private residences detract from the landscape.



RECOMMENDATIONS

A127 Reinforce existing stands of vegetation where regeneration is not occurring (City of South Perth).

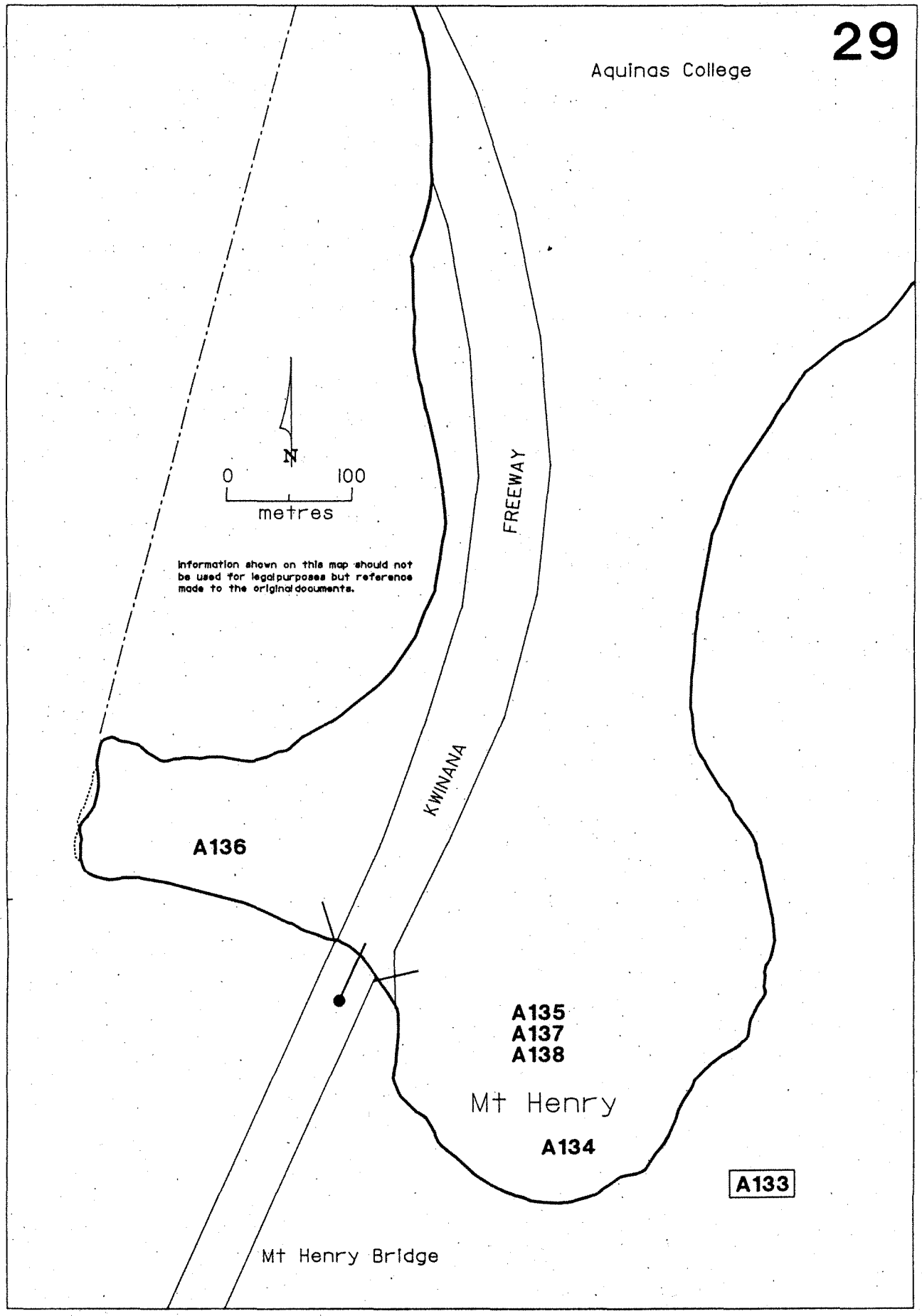
A128 Exercise weed control and eradication, concentrating on Japanese pepper, dock and grasses in accordance with General Recommendations 68-72 (City of Melville and SRT).

A129 Fence off large areas of remnant vegetation and rehabilitate with species characteristic of the area (City of South Perth and SRT).

A130 Survey and peg the area to determine the precise definition of the boundary between reserved land and private property (City of South Perth).

A131 Undertake investigations into the importance of the alga, *Gracilaria* to the ecosystem particularly its use as a food source for wading birds (SRT).

A132 Ensure the review of the Salter Point management plan is consistent with SRT requirements (SRT).


29
Aquinas College
N
0
100
metres
information shown on this map should not be used for legal purposes but reference made to the original documents.
FREEWAY
KWINANA
A136
A135
A137
A138
Mt Henry
A134
A133
Mt Henry Bridge

5.17 Mount Henry (Map 29)

Planning and environmental considerations

- Access to foreshore restricted by presence of the Kwinana Freeway and land ownership.
- Mount Henry management plan.
- Pair of ospreys inhabit Mount Henry and their nesting tree is deteriorating rapidly.
- System Six area of extremely high conservation and educational value.
- Significant landscape feature retaining exposed limestone outcrops, *Banksia* woodland and open scrublands.
- Vesting of Mount Henry Spit is inappropriate.
- Steep slopes eroding and revegetation efforts have to date been unsuccessful.
- Popular prawning and fishing spot.
- Frequent fires and human disturbance facilitating weed invasion, particularly veldt grass and erosion.
- Use of sandy cross country track by Aquinas students.

RECOMMENDATIONS

A133 Endorse implementation of Mount Henry management plan (SRT).

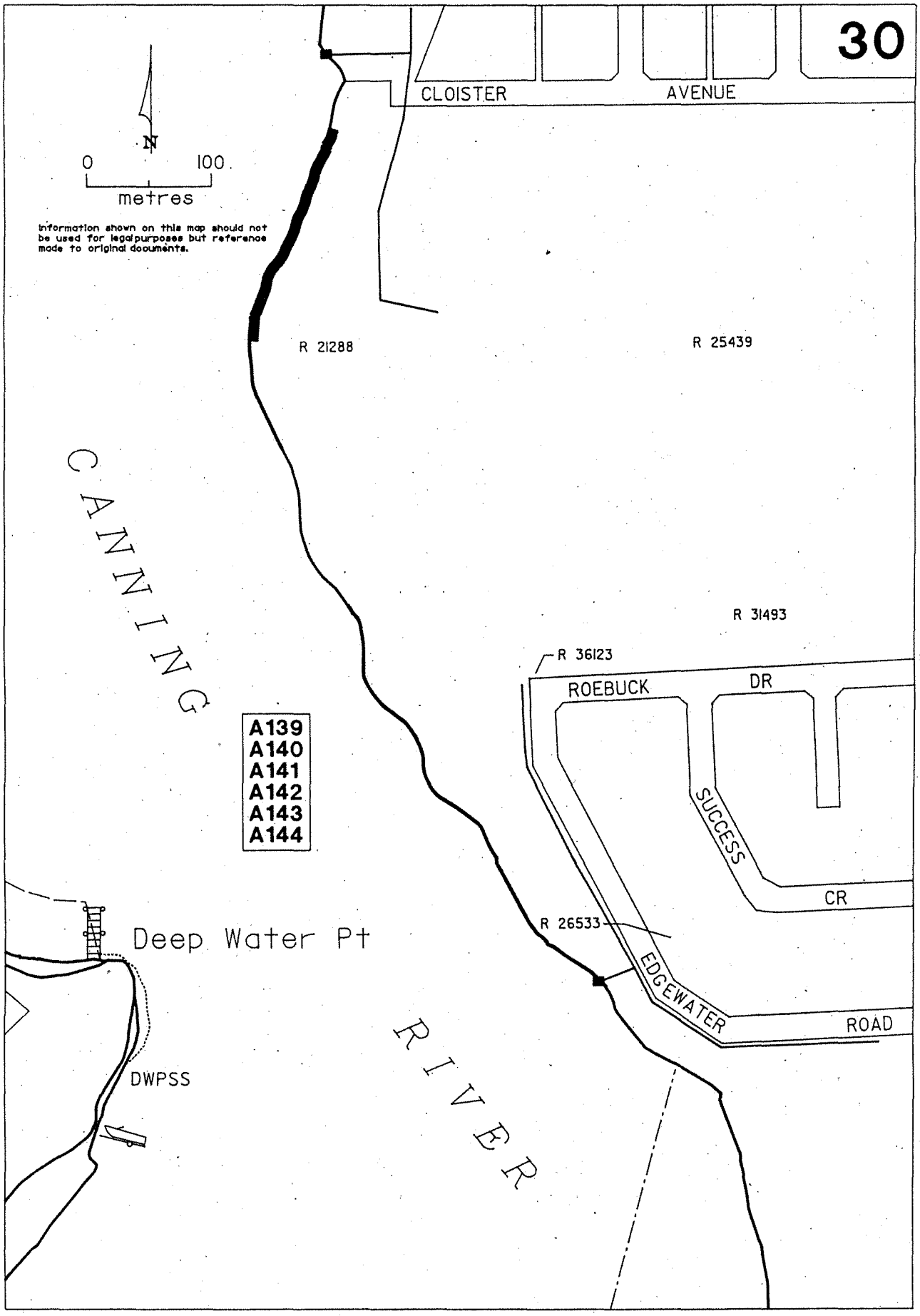
A134 Liaise with CALM and CSIRO to investigate the possibility of providing an alternative nesting site for the ospreys (Aquinas College).

A135 Support Christian Brothers rehabilitation of Mount Henry (SRT).

A136 Support change of vesting of Mount Henry Spit from DPUD to City of South Perth (SRT).

A137 Encourage Aquinas College initiatives to allow other educational institutions to use Mount Henry as an outdoor, interactive classroom whilst maintaining its integrity (SRT and City of South Perth).

A138 Formalise the crosscountry running track to reduce the level of disturbance and associated spread of weeds or, alternatively, fence the track off and define periodic access points (Aquinas College).


30
CLOISTER
AVENUE
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metres
Information shown on this map should not be used for legal purposes but reference made to original documents.
R 21288
R 25439
R 31493
R 36123
ROEBUCK
DR
SUCCESS
CR
R 26533
EDGEWATER
ROAD
CANNING
RIVER
A139
A140
A141
A142
A143
A144
Deep Water Pt
DWPSS

5.18 Edgewater Road (Salter Point) to Cloister Ave (Manning) (Map 30)

Planning and environmental considerations

- Access to foreshore restricted by presence of the Kwinana Freeway.
- Seasonal accumulation of algae on foreshores creates a nuisance.
- Important seagrass beds and functional fish and bird feeding/breeding grounds.
- Water skiers and jet skiers encroach into shallow mud flats.
- The boat launching area at Cloister Avenue overpass does not have a DOT navigation and safety sign.
- Popular prawning area.
- Dual-use path too close to river creating conflict between users.
- Weed invasion, particularly by grasses and creepers, enhanced by trampling and fire.
- Degradation of native foreshore vegetation through lack of regeneration.
- The foreshore and adjacent road reserve are narrow.
- Important remnant vegetation stands including rush stands with high diversity and dense *Melaleuca* complex.
- Unrestricted foreshore access.
- Inadequately maintained, visually obtrusive drainage outlets and headwalls reduce aesthetic appeal of the foreshore.
- Unvested road reserves comprising Kwinana Freeway.
- Mount Henry management plan.

RECOMMENDATIONS

A139 Create and fence off new vegetation nodes while regenerating (City of South Perth and SRT).

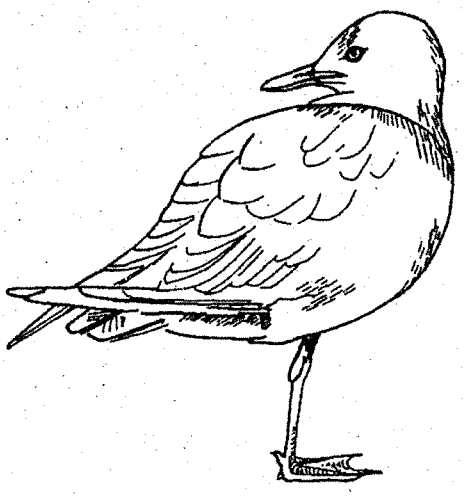
A140 Define access points for recreational users in areas of high usage by placing individual bollards between beach areas and rushes in accordance with Appendix 6 (City of South Perth).

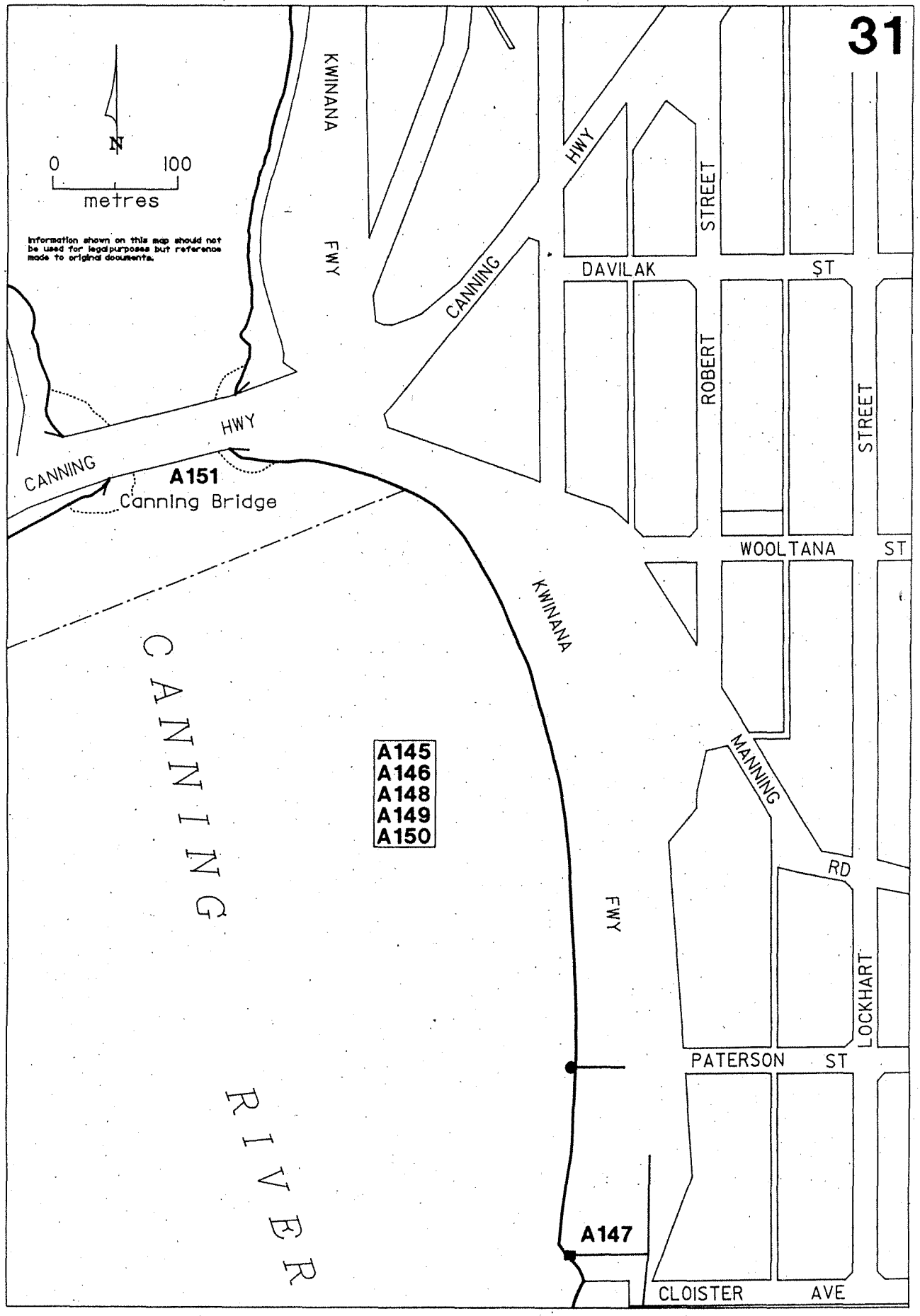
A141 Fence off and rehabilitate remaining healthy nodes of vegetation in accordance with Appendix 4 (City of South Perth).

A142 Encourage MRD to vest the freeway as a road reserve (SRT).

A143 Encourage community groups to manually remove vines and other weeds and use herbicide on the remainder (City of South Perth).

A144 Endorse and support the implementation of the Mount Henry management plan (SRT).




31
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metres
Information shown on this map should not be used for legal purposes but reference made to original documents.
KWINANA FWY
HWY
CANNING
DAVILAK ST
STREET
ROBERT
STREET
WOOLTANA ST
HWY
CANNING
A151
Canning Bridge
KWINANA FWY
CANNING RIVER
A145
A146
A148
A149
A150
MANNING RD
LOCKHART
PATERSON ST
A147
CLOISTER AVE

5.19 Cloister Avenue overpass to north of Canning Bridge (Map 31)

Planning and environmental considerations

- Access to foreshore restricted by presence of the Kwinana Freeway.
- Numerous vesting agencies and unvested areas for matrix of reserves associated with the Kwinana Freeway.
- Popular prawning area.
- Erosion control measures limiting access to water's edge for prawning activities.
- Inadequately defined access points to water.
- Degradation of native foreshore vegetation through lack of regeneration, uncontrolled pedestrian access and fire facilitating significant levels of weed invasion.
- Dual-use path too close to river creating conflict between users.
- Accretion under Canning Bridge.

RECOMMENDATIONS

A145 Support MRD proposed amalgamation of reserves into two reserves (SRT).

A146 Establish steps approximately every 50 m in existing areas of continuous gabions, to facilitate access for prawners (SRT).

A147 Determine the feasibility of establishing Cloister Ave overpass as a recreational node. Study to include:

- **demand for facilities,**
- **provision of toilets, barbecues, and**
- **additional shade trees and shrubs to block freeway noise and visual intrusion (City of South Perth).**

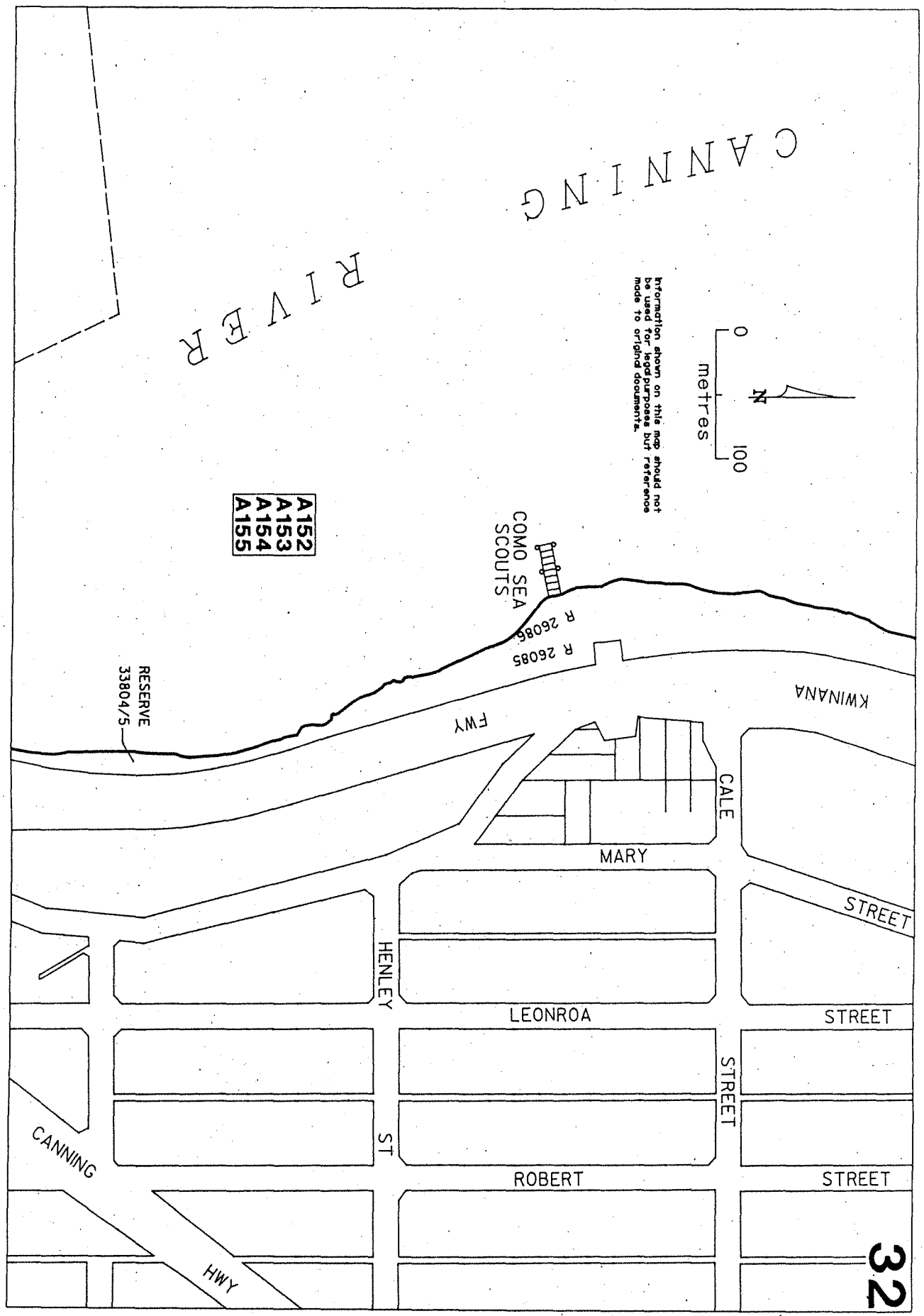
A148 Control and eradicate grasses and other herbaceous species in an environmentally sound manner acceptable to the SRT (City of South Perth and SRT).

A149 Ensure MRD landscape plan for foreshore reflects indigenous plant communities characteristic of this area (SRT).

A150 Define access points for prawners by placing individual bollards between beach areas and rushes (City of South Perth).

A151 Ensure navigable channels beneath Canning Bridge are maintained (DOT).

A152 Continue investigations into the feasibility of creating a lagoon in the large area north of Canning Bridge (City of South Perth).


CANNING RIVER
Information shown on this map should not be used for legal purposes but reference made to original documents.
0
metres
100
N
A152
A153
A154
A155
COMO SEA SCOUTS
R 26086
R 26085
RESERVE 33804/5
FWY
KWINANA
CALE
MARY
STREET
HENLEY
LEONROA
STREET
STREET
ST
CANNING
ROBERT
STREET
HWY
32

5.20 North of Canning Bridge to Como Sea Scouts (Map 32)

Planning and environmental considerations

- Access to foreshore restricted by presence of the Kwinana Freeway.
- Lack of native remnant species with weeds such as bamboo and grasses being conspicuous components.
- Extensive area of land fill with low planting success.
- Erosion control measures limiting access to water's edge for prawning activities.
- Dual-use path too close to river creating conflict between river users and path users.
- 1st Como Sea Scouts.
- Jetty extending into shallow water.
- Western foreshore management plan.
- Investigations into the development of a lagoon in the extensive area of land fill.

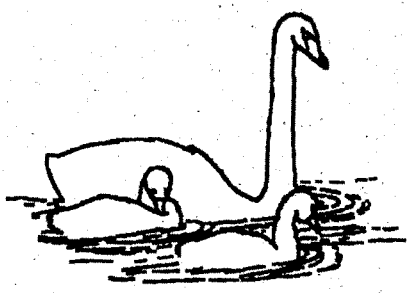
RECOMMENDATIONS

A153 Exercise weed control and eradication, concentrating on bamboo and grasses in accordance with General Recommendations 68-72 and replant with indigenous species (1st Como Sea Scouts, City of Melville and SRT).

A154 Establish steps approximately every 50 m in existing areas of continuous gabions, to facilitate access for prawners (SRT).

A155 Ensure MRD landscape plan for foreshore reflects indigenous plant communities characteristic of this area (SRT).

A156 Ensure Western foreshore management plan recommendations are in accordance with SRT requirements (SRT).



6. IMPLEMENTATION AND MONITORING

Successful implementation of management plans is determined by the willingness of participants to co-operate. Most catchment management measures are not usually integrated with changes in the biota of wetlands adjacent to, or peripheral to the river, but are considered separately.

Various methods of encouraging informed co-operation are used, and involve all levels of government and the community. Public education is essential to ensure awareness of management problems associated with the protection of the few remaining fringing wetlands and sandy rise vegetation of the Lower Canning River and the entire Swan and Canning River system. It is also essential to establish community support for the steps necessary to correct the problems.

Recommendation

110 Establish a committee to oversee the implementation of the plan. The committee to consist of delegates representing:

- **Swan River Trust,**
- **City of South Perth,**
- **City of Melville,**
- **City of Canning,**
- **Aquinas College,**
- **and two community,**

representatives.

6.1 Commitments for implementation

6.1.1 Funding

Commitments for funding can only be established following the public consultation period of three months. During this time Trust staff will liaise with the local authorities and community groups to develop priorities, requirements and budgets for implementation.

The agreements will be discussed in the final Management Plan.

6.1.2 Monitoring implementation

Monitoring the success of the strategy and the response of the environment of the Lower Canning River to the management measures is an essential part of the implementation of this, like any, management plan.

Should monitoring show that the agreed management objectives are not being achieved, then the plan should be re-evaluated and modified where necessary.

6.2 Conclusion

During the preparation of this management plan, it became apparent that the Lower Canning River is under threat from a number of uses which are facilitating weed encroachment and loss of indigenous vegetation, loss of faunal diversity, erosion of the foreshore and adjoining scarps and conflicting recreational demands.

This degradation is currently occurring throughout most of the study area and, with increasing development pressure close to the river, the demands on the river and adjoining foreshore set to intensify. Without the implementation of appropriate management strategies, restoration of the vegetation and faunal diversity it supports will not be possible.

In many cases management issues are the result of earlier management decisions, where the function and use were never identified or anticipated. Had these effects been recognised, the issues may never have arisen. Unfortunately it is very difficult to predict trends, demands or patterns of usage.

Broadly speaking it must be kept in mind that decisions having the potential to transform an area from its natural condition need to be considered carefully, because of the relative inability to reverse such decisions.

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APPENDIX 1 : FLORA AND FAUNA

1.0 Foreshore vegetation

The first community, characterising most of the foreshore, comprises an almost continuous band of salt water paperbark (*Melaleuca cuticularis*) with occasional swamp paperbark (*M. rhaphiophylla*) and swamp sheoak (*Allocasuarina obesa*) over a shorerush (*Juncus kraussii*) dominated understorey. The width, proportions and health of this fringe vary throughout the study area.

A number of understorey species occur in low densities in this community, including coast saw-sedge (*Gahnia trifida*), Austral seablite (*Suaeda australis*), two species of a native triangle-leaf thistle (*Chenopodium glaucum and C. album*) and the creeping brookweed (*Samolus repens*). Other associated species present in varying densities include salt marsh species, particularly beaded glasswort *Halosarcia* sp and samphire (*Sarcocornia quinqueflora*).

This community type also surrounds larger permanent and seasonal wetlands in Bull Creek, Salter's lagoon, Clontarf, Waterford and Shelley Basin. The dominant species in inland wetlands favour freshwater conditions.

The introduced bulrush (*Typha orientalis*) and the native bulrush (*T. domingensis*) occur in dense monospecific and combined stands, with the introduced *T. orientalis* particularly successful adjacent to local and Water Authority drainage channels.

A dominance of swamp sheoak (*Allocasuarina obesa*), with occasional paperbarks including saltwater paperbark (*Melaleuca cuticularis*), swamp paperbark (*M. rhaphiophylla*) and moonah (*M. preissiana*) characterises some areas of the Lower Canning River. The understorey is similar to that outlined above.

Another community occurs on Mount Henry and also persists beyond the estuarine fringing vegetation. These areas are characterised by high diversity, with more than 200 species being recorded on Mount Henry alone (C. Christie pers. comm.). The open *Banksia* woodland extends along the peninsula.

1.1 General description

There are a number of areas within the Lower Canning River region which have been subject to severe disturbance and have been denuded of vegetation in the recent past. All of the vegetation north of Cloisters Reserve, for example, was lost during construction of the Kwinana Freeway. The current species composition is the result of revegetation by the Main Roads Department and planting by community groups, with fringing *Juncus kraussii* in part the result of Swan River Trust sedge planting trials. It is important to note that most of the species planted in this region were selected for their landscape value rather than their ecological value.

Specific area descriptions for the larger wetlands and continuous tracts of vegetation are detailed in management plans undertaken for each local authority. The System Six report (DCE 1983) also provides information for Bull Creek, Mt Henry and Waterford foreshore.

1.2 Status of foreshore vegetation

There are relatively few large remaining areas of natural vegetation fringing the Swan and Canning Rivers. The Lower Canning River still retains some continuous unbroken tracts of native vegetation which have suffered less disturbance than many other areas characterising the river fringe. The formation of the foreshore vegetation consists of a matrix of wide bands of vegetation, with narrow degraded sections and occasional large wetlands. The area contributes to the open space of regional significance extending along the Canning River, because of its high conservation and recreation value.

The northern shore of the Lower Canning is characterised by a number of continuous tracts of native vegetation, whilst the south shore is characterised by a sparsity of remnant vegetation, with the vegetation being restricted to sections less than 10 m wide.

2.0 Aquatic flora

A wide diversity of animal life is found in the Swan and Canning River system which supports numerous aquatic invertebrates, vertebrates, insects and birds, including animals exploited by both amateur and professional fisher people such as fish and crustaceans.

The Lower Canning River is characterised by large expanses of mud flats and sand banks, shallow water and extensive mussel beds which provide important breeding grounds for many species. This system supports both permanent and migrant fauna which utilise the estuary as a nesting or nursery site, drawn by abundant food availability. Estuaries in general are highly productive, however the shallow banks covered with seagrasses, predominantly *Halophila ovalis*, are particularly important to the aquatic fauna.

Generally the Canning River estuary is prone to occasional phytoplankton blooms. Blooms have been recorded between Mt Henry increasing in frequency and magnitude towards the Riverton Bridge area. The blooms occur from spring to autumn. The species that dominate are *Cryptomonas* (autumn), *Heterosigma,* a mucus producing species (summer), and an unidentified dinoflagellate (autumn).

The potentially toxic marine dinoflagellate *Alexandrium minutim* occurs in low numbers in the Swan River estuary. It is expected that because of the salinity and nutrient status of the river, it could form toxic blooms in the Lower Canning River in summer under suitable conditions.

2.1 *Anacystis (Microcytis) littoralis*

A benthic species of blue-green alga *Microcystis littoralis* occurs in the Riverton Bridge area. This species was tested and found to be toxic to mice at high dose rates. This result is not conclusive and further tests on toxin profiles are planned. The alga does become part of the surface plankton and accumulate as a thick paste on the beaches. Small quantities have been found as far downstream as Mt Henry.

2.2 Bioluminescence

Bioluminescence at night caused by the dinoflagellate *Gonyaulax* spp. has been recorded in Shelley Waters during summer.

2.3 Seagrass

The seagrass *Halophila ovalis* grows in the undisturbed areas of the Canning River estuary. The density of the beds decreases as distance upstream increases. The growth can be decimated with prolonged freshwater immersion due to runoff displacing the bottom saline water. Seagrass beds are important fish nursery areas in estuaries.

2.4 Macroalgae

In the lower reaches of the Canning River the macroalgal composition is similar to that of Melville Waters with three species of Laurencia dominating. Upstream of Mt Henry, *Chondria* and *Gracilaria* (Rhodophyta) predominate. From Mt Henry area to Salter Point there are accumulations of 0.5 - 0.75 m deep banks of *Gracilaria*. Upstream of Salter Point the biomass of macroalgae decreases, and *Gracilaria* becomes increasingly scarce whilst *Chondria* becomes more prevalent.

Along the freeway side of the Canning River estuary and as far upstream as Salter Point in summer the prevailing south-westerlies cause accumulations of *Chondria* and *Gracilaria* in the shallows. The process of decomposition of these algae produces offensive odours which affect residents and road users. Nuisance accumulations of up to 2 m wide bands and 0.3 m deep of *Chondria* and *Gracilaria* also occur on the shorelines from Deep Water Point to Shelley. In spring the algae usually have attached brown coloured growths of epiphytic diatoms (*Melosira moniliformis*) and macroalga (*Giffordia*).

Recently annual summer blooms of the filamentous green macroalga *Rhizoclonium* have occurred in the sandy shallows between the Riverton and Shelley Bridges. A bloom of

Rhizoclonium was recorded around Fifth Avenue in Shelley. The blooms usually clear within a month without the need for intervention.

The SRT found that *Rhizoclonium* filaments are used by fish as a substrate on which to attach their eggs. The macroalgal banks of *Gracilaria* can contain up to 30 shrimp *Palaeomonetes australis* per 100 g of alga (wet weight basis).

3.0 Invertebrates

Estuarine systems generally support a high diversity of invertebrates. These include crustaceans (barnacles, copepods etc.), molluscs (bivalves, gastropods, chitons), annelids (polychaetes, leaches), coelenterates (jellyfish), foraminiferans (skeleton producing protozoans), platyhelminths (flat worms) and bryozoans (plant like animals).

Within these family groups is a wide range of genera and species. The distribution of species varies with the tolerance of organisms to estuarine or saline water. The greatest abundance of benthic invertebrates occurs in the shallow tidal mud flats, and provides the river's most abundant food source.

The undisturbed sandy shallows around the upper Canning River estuary can be very productive when compared with the dredged channels. Many species were absent in the deepened sites. The small bivalve *Arthritica semen* was found at densities as high as 9,500 per square metre in the sandy shallows between the Shelley and Riverton Bridges. The polychaete worm *Capitella capitata* and *Ceratoneis* sp. had densities of up to 9,400 and 4,300 animals per square metre respectively. The area would be attractive to fish for feeding (Hosja 1986).

Large edible mussels (*Mytilus edulis*) are rare in the Canning River because the extreme range of salinity does not permit the mussel to attain a large size in the short growing season.

Dredging has an enormous impact on the invertebrate fauna, as it removes habitat and alters the composition of the substrate. The distribution of invertebrates is partly governed by depth, sediment type and the abundance of macroalgae. The recovery of dredged areas is slow and incomplete if the sediments remain soft and muddy.

3.1 Jellyfish

Two species of jellyfish (*Phyllorhiza punctata* and *Aurelia aurita*) are common in the Canning River from spring to autumn, while the salinity is relatively high and marine conditions prevail. The population density of both species can become very high, making swimming unpleasant. The large brown species *P. punctata* is reported as capable of causing mild stings to the skin or even temporary blindness if stinging cells accidentally contact the eyes.

Occasional incursions of open water marine stinging species such as *Chrysaora* and *Carybdea rastoni* have been recorded.

3.2 Fish

Estuarine teleost fish, including species which typify the fish catch of the Swan and Canning River system, complete their entire life cycle within estuarine waters and are therefore able to tolerate seasonal variation in salinity. Despite increasing human pressure on fish resources, fish abundance has not appeared to decrease. Management of fish activity is necessary to maximise utilisation of river by potentially harvestable fish. Therefore it is imperative that the level of disturbance to shallow banks and the foreshores adjacent to wetlands is minimised.

Three areas in the Lower Canning River are important functional fish nurseries.

These lie in the shallow waters periodically fringing the foreshore immediately west of the Kwinana Freeway between Canning Bridge and Mount Henry Bridge, in Bull Creek backwater, and adjacent to the Waterford foreshore past Clontarf to Riverton Bridge. The continued survival of fish stock for amateur and commercial fishing depends upon the persistence of such nurseries.

The majority of the commercial catches are sea mullet, yellow-eye mullet and Perth herring.

Some sections of the Lower Canning are popular recreational fishing areas. Species caught include black bream, tailor (in summer), large mulloway and yellow-eye mullet, cobbler, flathead and yellowtail trumpeter. Crabs and prawns are also caught throughout the year although these activities are concentrated in the summer months.

Large holes have been observed in the sides of the sloping banks in deeper waters (>2 m) around Mt Henry. It has been suggested by professional fishermen that these features are cobbler holes or 'nests'.

4.0 Foreshore fauna

All animals form part of a food chain, consuming plants or animals and in many cases being eaten by other animals. Relationships between different food chains within aquatic and wetland communities form complex food webs. The invertebrate community is a source of food for vertebrate species including amphibians, reptiles and mammals. Some invertebrates (e.g. termites, slaters and amphipods) play a vital role in decomposing and releasing nutrients back into the system.

Foreshores and areas of peripheral vegetation are of particular importance for fauna. These areas represent a continuous corridor for movement.

The variety of vegetation and water bodies, including swamp and tidal marsh, provides several faunal habitats. There are many groups of species present throughout the study area, including invertebrates such as amphipods, copepods and water snails, vertebrate species including the native water rat *Hydromys chrysogaster*, numerous lizards, frogs and birds.

The foreshore of the Lower Canning River has high conservation value as it represents habitat for a number of species of invertebrates, amphibians and reptiles, birds and some mammals. Within the City of South Perth lies extensive continuous foreshore habitat, extending from Mount Henry Spit to Keaney Gardens (Waterford). Such a continuous foreshore habitat facilitates the movement of species and therefore assists in maintaining genetic diversity. There is no similar foreshore vegetation elsewhere on the Canning or Swan Rivers (DCE 1981), which means that fauna within this section of the Canning River are isolated from any other area with similar habitat and, with the exception of some bird species, cannot be recolonised.

Fauna surveys in the study area were focused on two reserves, namely Salter Point and Waterford Reserves (Orr 1986, 1987). The Salter Point survey identified 12 mosquito, one frog, 11 reptile and three mammal species, whilst the Waterford Reserve was found to support four mosquito, three frog, 11 reptile and five mammal species. A comprehensive list of birds was also established from a variety of sources including the Royal Australasian Ornithologists Union.

A recent investigation into the faunal composition of the three extensive wetlands in the Lower Canning River study area was initiated in early 1993 for the City of South Perth. This study covered the region between Keaney Gardens (Waterford) to the Mount Henry Spit (Manning). In total four frog, eight reptile and six mammal species were captured in this study. Further, 142 invertebrate species were identified (Brooker 1993 unpubl.).

Some locations within this region have extremely high conservation value as they contain rare and endangered species including a species of skink, *Lerista lineatus.*

Within the Cities of Melville and Canning lie Bull Creek Reserves C32563 and C29130, respectively. This region supports diverse fauna. The System 6 report (1983) identified this area as providing habitat for one of Western Australia's largest dragonflies, *Petalura hesperia*, which had been collected from the swampy ground alongside Bull Creek. At this stage this insect was classified as very rare and had not otherwise been collected for a number of years. It is unknown if this species still inhabits this region.

Not all faunal species are regarded as an asset, and in fact certain insect species, for example mosquitoes, are a nuisance. Mosquitoes are an important issue and their populations need to be controlled. Where this is necessary, control measures need to take into account not only their effectiveness on target species but also their effect on the other fauna in that environment.

Sixteen species of mosquito have been identified in the Perth metropolitan region, including species which breed in saltmarsh and freshwater environments. Only the female mosquito requires, and is capable of obtaining, a blood meal from vertebrates. Mosquito nuisance is prevalent during the feeding period. Two saltmarsh members of the genus *Aedes, A. camptorhyncus* and *A. vigilax*, constitute the greatest nuisance, whilst the remaining species may only cause occasional nuisance. Some fresh and brackish water breeding species constituting a nuisance in the Swan and Canning Rivers include species such as *Culex annulirostris, Anopheles annulipes* and *Coquillettidia linealis.*

Ross River virus is active throughout Australia, and *Aedes camptorhyncus* is the major vector (carrier) of this disease in the south-west of Western Australia. There is however, evidence to suggest that several fresh water species are also vectors (Wright pers. comm.).

Other invertebrates form the basis of the food chain which supports a wide variety of birds. RAOU indicated that approximately ninety bird species have been identified within the study area.

APPENDIX 2 : ROLES AND RESPONSIBILITIES

For more detailed information refer to Swan River Management Strategy (1988).

1.0 Minister for the Environment

The Minister for the Environment is responsible for the administration of the Swan River Trust Act 1988. The Minister:

- determines development applications in the Swan River Trust Management Area,
- sets conditions on other developments which may impact on the river.

2.0 Swan River Trust (SRT)

There are 28 State and local government authorities and numerous private individuals and companies which are involved in the planning, development and management of the river. The Swan River Trust was established to bring together all groups with a major interest in the Swan and Canning Rivers. The Trust is responsible for planning, protecting and managing the river system, and provides advice to the Minister for the Environment who is responsible for development control.

3.0 State Planning Commission (SPC)

The State Planning Commission is the regional planning authority for all areas in the State. It is the agency responsible for administering the Metropolitan Region Scheme (MRS) and the Town Planning and Development Act 1928-1979.

This agency is responsible for land use zoning at a regional scale. At a local scale, land use is guided by the local authority town planning schemes. These schemes have to be consistent with the MRS.

4.0 Department of Planning and Urban Development (DPUD)

The Department of Planning and Urban Development is the professional organisation which provides technical advice on issues relating to the Acts administered by SPC. DPUD also has a Parks and Reserves Branch, which manages land owned or vested in the SPC. Within the study area, DPUD is responsible for managing the Mt Henry Spit and a region adjacent to Salter Point.

5.0 Local Government Authorities (LGAs)

There are three local government authorities with boundaries including the Lower Canning River environment: the Cities of Canning, South Perth and Melville.

Under delegation from SPC, LGAs have responsibility for local planning and development control in accordance with the town planning schemes (TPSs).

The local authority is also responsible for the provision of recreation facilities and day to day management and maintenance of foreshore reserves under their control, within the study area.

When the Swan River Trust considers a development proposal which impacts on a local authority, that local authority automatically becomes a member of the Trust while it is deliberating the proposal.

6.0 Department of Transport (DOT)

The Department of Transport is responsible for safety and navigation in and on the waters of the study area.

DOT administers a number of Acts and Regulations which are relevant to the study area. The main ones are:

Jetties Act 1926-76. This Act relates to the construction and licensing of jetties.

Navigable Waters Regulations 1982. These regulations pertain to:

- control of speed on the river
- gazettal of swimming areas, waterski areas etc.
- organisation of regattas
- control of persons in charge of vessels
- use of public jetties
- silencers on boats
- closure of navigable waters for safety or in cases of emergency.

Under its legislation DOT is also responsible for the survey of commercial ferries and hire and drive vessels, registration and control of pleasure craft, enforcement of safe navigation, granting of mooring licences, closure of navigable waters, and limiting of boat speeds, and may set aside navigable waters for particular purposes.

7.0 Environmental Protection Authority (EPA)

The Environmental Protection Authority was established under the Environmental Protection Act 1986. Their charter is for:

- prevention, control and abatement of environmental pollution,
- conservation, preservation, protection, enhancement and management of the environment,
- matters incidental to or connected with the foregoing.

The Act makes it an offence to pollute.

The EPA's major objective in its protection of the river environment is to ensure that its existing environmental value is maintained and enhanced. This means that a full complement of biophysical functions must be retained in both the system and its catchment.

A report generated by System 6 Committee (DCE 1983) identifies locations of regional significance adjacent to or in the river, to be managed for the purposes of conservation and recreation. This report is widely known as System 6 Report or Red Book (DCE 1983). Cabinet accepted the general principles of the Red Book and approved of the progressive implementation of the locality specific recommendations as far as possible.

Public involvement was integral to the development of the System 6 program and, to maintain strong community participation, a working group of officers of the Authority and representatives of a number of Perth's conservation groups was formed to devise a strategy 'System 6 - Ecoplan'. This strategy, launched in April 1991, was designed to renew public awareness of the System 6 Report and its recommendations for urban conservation.

The System 6 Red Book recognised three regions within the Lower Canning River study area (M66, M67 and M74) as having significant conservation and recreation value. The recommendations associated with these areas were based around the development of management plans for each area, and in some cases changing the land tenure to a more appropriate allocation.

In February 1993, the Red Book Status Report was released by the EPA to establish the implementation levels of the recommendations for the Conservation Reserves for Western Australia. The level of implementation of the recommendations associated with the three recognised areas is outlined in Section 4.6 of this management plan.

8.0 Water Authority of Western Australia (WAWA)

The Water Authority of Western Australia is responsible for supplying water-related services to the State. Services supplied are public water supply, sewerage, irrigation and major drainage networks. WAWA also carries out assessment of water resources, planning and management of the allocation, development, use and conservation of these resources for the continuing benefit of the community.

As the major centre for drainage expertise in Western Australia, WAWA has the responsibility for formulating safe management practices for river flood plains.

WAWA works closely with other organisations in planning and co-ordinating the provision of services, the management of water resources and the use of catchment and flood plains.

Eight main drains discharge directly into the study area. These are depicted on Maps 4-12.

9.0 Department of Conservation and Land Management (CALM)

The Department of Conservation and Land Management's primary responsibility is to conserve Western Australia's wildlife, and manage public lands and waters entrusted to the Department for the benefit of present and future generations.

The Acts Amendment (Swan River Trust) Act 1988 requires that CALM consult with the Trust before creating or cancelling reserves within the management area, altering reserve boundaries or leasing any part of a reserve. CALM currently has no intention of creating any reserves within the study area.

CALM currently does not own, nor have vesting of, any land within the study area.

The Department is currently establishing a landscape plan for the Canning River Regional Park which extends from Shelley Bridge to Nicholson Rd Bridge. This overlaps with the area covered in this study between Shelley Bridge upstream to Riverton Bridge, encompassing part of Shelley Basin.

10.0 Department of Land Administration (DOLA)

The Department of Land Administration has no direct role or concern in respect to waters of the river but certain sections of the Land Act 1933, are relevant to foreshore reserves, high and low water marks, land below the low water mark and the beds of water courses. The Department's corporate objective is the administration of Crown owned land for present and future activities.

The Land Act 1933 allows DOLA to reserve lands above low water mark on the banks of tidal waters for whatever purpose is deemed fit in the public interest. Current legislation does not permit the reservation of land below low water mark on the banks of tidal waters. The Act also provides that the Minister may require an authority to submit management plans for any reserve which is vested in that authority.

Clause 8 of the Acts Amendment (Swan River Trust) Act 1988 requires the Minister for Lands to consult with the Trust before reserving any land in the management area, before cancelling or amending any reserve or altering a boundary of any reserve within the management area.

11.0 Fisheries Department

The Fisheries Department is responsible for management of the fish resources of the river system for the benefit of the community.

The Department administers the Swan-Canning Estuarine Fishery which was declared by Ministerial approval in 1976 and is managed as a 'Restricted Entry' type. This restricts the issue of new estuarine fishing licences and prohibits the transfer of individual licences. The Department also manages recreational fisheries.

12.0 Health Department of Western Australia (HDWA)

The Health Department is responsible for bacteriological water quality analyses and the possible impact of unacceptable water quality on human use of the river and environs. Standards for pesticide and heavy metal levels in food and drugs are also the Department's responsibility.

The principal Act is the Health Act 1911. Food and Hygiene Regulations are also applicable and may be administered by the Health Department or local government authority. These Regulations regulate licensing of commercial food outlets.

13.0 Aquinas College

The College is the land holders of most of Mount Henry (Map 29) and has maintained an active interest in the Mount. The College is establishing a comprehensive floral inventory of the Mount, and has currently identified 200 taxa in the reserve. The College has established a nursery in which are grown some of the species on Mount Henry, from local relic seed stock, for replanting.

A number of students commute to the College by boat, from the Brentwood/ Shelley/Rossmoyne foreshores.

Mt Henry is considered one of the best stands of remnant vegetation on the Perth metropolitan area. This is largely due to ownership by Christian Brothers, and their interest in the environment.

14.0 Community interests

Environment and heritage issues and concerns are increasingly important to the community. There are obvious benefits in concentrating available resources, especially human resources within the community.

The Canning River Estuarine Watercare (CREW) group identified a number of issues within the study area, and maintains strong interest in the conservation of this area.

Wetlands Conservation Society (WCS) plays an active role in the conservation and rehabilitation of Bull Creek.

Other community resources are the local schools and tertiary institutions, which could potentially be involved in the management of the study area. A number of educational institutions in the vicinity of the Lower Canning River are involved in Ribbons of Blue projects under the Waterways Commission. These are:

- Applecross Senior High School,
- Canning College,
- All Saints College,
- Aquinas College, and
- Shelley Primary School.

APPENDIX 3 : UPGRADING DRAINAGE OUTFALLS

Rip-rap is the most favoured energy dissipater at low flow drainage outfalls.

Rock rip-rap forms a flexible protective lining which is not as susceptible to settlement and undercutting as rigid linings since the small rocks can slide into the scour hole without damage. It is practical at storm and road drain outlets, and can assist the establishment of vegetation.

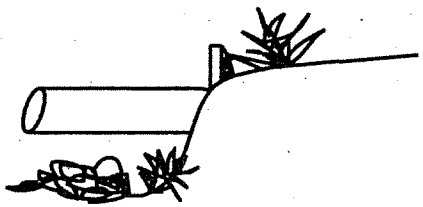
Establishing rip-rap at each drainage outfall creates crevices which can be planted with rushes. This planting not only masks the outfall but also reduces the maintenance costs for each outfall (Fig. 3).

Because only small quantities will be required for outfall enhancement manual transport and laying of the rip-rap is appropriate.

Rip-rap generally requires little maintenance, however inspections should be carried out following periods of extremely high flow. If there is any evidence of scouring beneath the rip-rap or any of the stone has been dislodged, then repairs should be undertaken immediately.

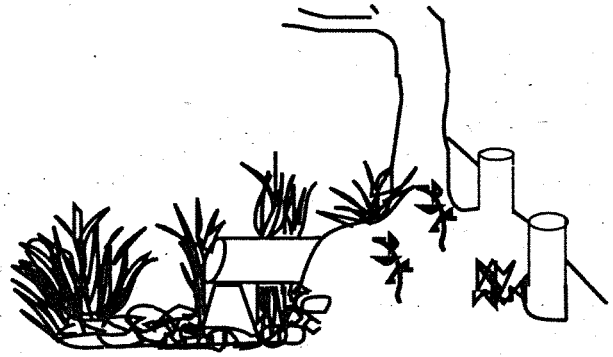
Figure 3: Upgrading drainage outfalls

CURRENT STATUS



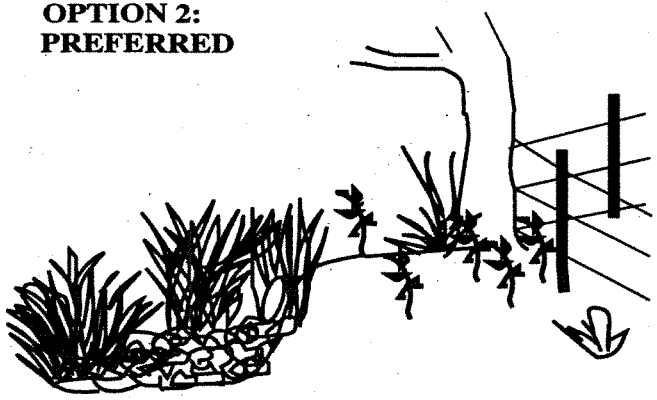
- denuded of native vegetation
- unsupported and poorly supported outfalls are a safety hazard
- dumped rubble including concrete is visually obtrusive
- conspicuous headwall

OPTION 1:



- headwall removed
- pipe shortened to ensure adequate support
- rip-rap buffer to minimise erosion
- rushes planted around pipe and interspersed through rip-rap
- slopes revegetated with indigenous flora
- bollards erected to discourage pedestrians.

OPTION 2: PREFERRED



- conspicuous headwall removed
- outfall cut right back to the bank
- rip-rap forms energy dissipating apron
- rushes including *Juncus kraussii* and sedges such as *Lepidospermum longitudinale* planted amongst rip-rap to reduce visual impact whilst improving stability
- slopes revegetated with indigenous species including paperbarks, sheoaks and flooded gum
- area fenced off until vegetation established.

APPENDIX 4 : REHABILITATION AND WEED CONTROL

Seed bank establishment

Seed banks are an important technique in the maintenance of genetic stock in specific regions. The process includes collection of seed from areas of remnant vegetation with subsequent germination and development in a greenhouse. The aim is to reinforce the local vegetation with locally derived specimens. In the long term each council could maintain a greenhouse from which Parks and Recreation officers, interested locals and consultants working on landscape plans in the area, could purchase plants for planting in collection areas.

It is important to recognise that seed collecting requires a permit under the Conservation and Land Management Act. It is difficult and expensive to get permits from CALM.

Joint funding between the three local authorities and SRT to employ a professional seed collector to cover all areas may be a more cost effective option.

Weed control

Eradication of pampas would be best achieved by slicing the foliage approximately 20 cm from the base, and subsequently applying a translocated herbicide to the transportation vessels in the plants. This would restrict faunal exposure to the herbicide.

Eradication of seedlings could be achieved by hand removal, however, larger plants would require eradication through implementation of a practice similar to that outlined for the pampas grass.

Additionally a number of weed species are prevalent throughout the study area. The removal of leguminous species such as *Lupinus* and *Trifolium* sp., and control of grasses including couch grass, veldt grass, kikuyu and Guildford grass should be first priority. Further problematic species include *Gladiolus*, cape tulip, sorrel, dandelions, *Watsonia*, arums and morning glory.

To prevent immediate re-colonisation of exotics where control measures have been implemented, it is necessary to re-establish native species in the areas. Genera such as *Juncus* and *Schoenoplectus* would be suitable for this procedure in areas where these two taxa are known to occur.

A number of tree weeds including Japanese pepper (*Schinus terebinthifolius*) and flame trees occur occasionally in the paperbark fringe. Other introduced trees such as plane trees do not pose a threat to the integrity of the foreshore vegetation, as they do not have the capacity to extend their distribution prolifically in this climate.

Planting native species immediately following the removal of exotics will minimise potential reinvasion by undesirable species. These areas will require comprehensive maintenance for a minimum of 12 months, followed by monitoring.

Bulrush control and eradication

In areas dominated by the introduced bulrush, the encouragement of *Melaleuca* regeneration will decrease the distribution of *Typha orientalis* which is achieved by the reduction of light penetration. Regeneration of the understorey should occur following the establishment of the understorey by natural propagation.

It is probable that *Typha domingensis* could dominate the peripheral stands without competition from the introduced bulrush. To establish a native *Typha* dominated stand would be extremely difficult. An associated problem with the persistence of *Typha orientalis* is the development of hybrids of the two species. This will decrease the distribution of the native *Typha* further. The use of contact herbicides for *Typha* control is strongly opposed.

In enclosed wetlands, it is important to control the spread of *Typha*, or a situation similar to that seen in Herdsman Lake in Osborne Park may occur. The nutrient loadings and freshwater input to isolated wetlands further facilitates invasion by *Typha orientalis*.

In regions where *Typha orientalis* is currently advancing into adjacent *Juncus*, the establishment of a *Melaleuca* border between the two communities can restrict further encroachments. By clearing away any *Typha* around the juvenile paperbarks and maintaining a vegetation-free zone it should be possible to encourage re-establishment.

Selection of species for rehabilitation

Riverine plants

The selection of plants for river edge planting should remain consistent with the species which characterise this section of the river. Appropriate species include:

Herbaceous/ rush species	**Tree species**
Schoenoplectus	*Allocasuarina validus obesa*
Juncus kraussii	*Melaleuca cuticularis*
Juncus pauciflorus	*Melaleuca rhaphiophylla*
Gahnia trifida	
Isolepis nodosus	
Suaeda australis	
Atriplex sp. possibly *A. hypoleuca*	
Sarcocornia quinqueflora	
Halosarcia spp.	
Samolus repens	
Baumea acuta and *B. vaginalis*	

Methodology of planting

Planting of rushes and sedges is outlined in Appendix 6. Note *Baumea* spp. should only be planted on both sides of the river from Clontarf to Riverton Bridge.

Planting methodology for salt marsh species such as *Sarcocornia* and *Halosarcia* is outlined below.

Salt marsh species may be established by first raking the sediment, sprinkling mixed segments of the required species into the area, covering the soil and compacting the substrate by foot. This should occur close to the high tide mark at the end of winter, although planting can occur at any time of the year. Collection of these species for planting must occur in a manner satisfactory to the Swan River Trust.

The planting regime should reflect the mosaic of homogeneous stands characterising the adjacent sections of the river.

Potential sources of riverine plants

The use of local seed stock and plants local to the rehabilitation area is desirable in all cases. Establishment of a seed bank and greenhouse for many species is appropriate. Difficulties arise with replicating sedges and rushes, with tissue culture being the only successful technique. If purchasing through a company specialising in rush growing, it may be possible to utilise plants specific to the rehabilitation site.

Floodplain vegetation

There are a number of opportunities for landscape plans to enhance the continuity of fringing and floodplain vegetation for this region of the Canning River. The species listed below characterise the sandy, relatively low-lying regions in this area and their inclusion in species selection would further enhance the natural landscape.

Most of the species listed above are readily available from nurseries except for the rare paperbark *Melaleuca leptoclada*. It is important to reiterate that the use of local seed stock is desirable to ensure the integrity of genetic material in the region.

Species should include a selection from:

Jacksonia furcellata
Acacia pulchella
Adriana quadripartita
Agonis longifolia
Astartea fascicularis
Allocasuarina fraseriana
Adenanthos cygnorum
Beaufortia elegans
Conostylis candicans
Conostylis setigera
Gompholobium confertum
Hardenbergia comptoniana
Hovea trisperma
Isotropis cuneifolia
Kenneda prostrata
Patersonia occidentalis
Regelia inops
Xanthosia huegelii
Jacksonia sternbergiana
Acacia saligna
Agonis flexuosa
Daviesia juncea
Dasypogon bromeliaefolius
Melaleuca leptoclada (rare)
Bossiaea eriocarpa
Conostylis aculeata
Conostylis juncea
Dampiera linearis
Gompholobium omentosum
Hemiandra pungens
Hypocalymma robustum
Johnsonia pubescens
Oxylobium capitatum
Petrophila linearis
Xanthorrhoea preissii

Areas where the above species are appropriate:

- the western foreshore of South Perth
- Mount Henry Spit
- narrow foreshore between Mount Henry and Salter Point
- landward margin of the Waterford foreshore
- Clontarf foreshore
- Centenary Park
- areas between Shelley and Riverton Bridges
- the foreshores of the City of Canning
- Yagan Park and adjacent sandy areas
- Deep Water Point.

The proportions of species plantings should reflect the current community composition or the composition of adjacent areas. Contact the Swan River Trust for further advice about planting programmes.

APPENDIX 5 : SHADE TREES FOR LARGE RECREATION RESERVES

Selection of shade trees in the past has usually involved choices such as plane trees, Norfolk Island pines and flame trees. These introduced species have wide leaves and dense branches providing extensive shade and aesthetic appeal in the park situation.

Most indigenous trees are adapted to limited water availability and have small leaves inverted to minimise water loss. These trees therefore do not provide adequate shade for recreaters.

There are a limited number of local species which do provide adequate shade. The list below provides a few options:

Agonis flexuosa	*Eucalyptus rudis*
Eucalyptus gomphocephala	*Acacia rostellifera*
Casuarina fraseriana	*Allocasuarina obesa*
Eucalyptus marginata	*Eucalyptus todtiana*
Nuytsia floribunda	

APPENDIX 6 : RUSH AND SEDGE PLANTING GUIDELINES

Planting procedure

- Individual plants should have their leaves cut off about 10 cm above the base just prior to planting to reduce post-planting stress and to stimulate new growth.
- Plant only on moist stable sediment at the upper foreshore level.
- Plant rushes and sedges about 50 cm apart.
- Plant rushes no closer than 1 m near existing shorerush tufts.
- If using seed stock, fill a pair of stockings with sand and seed mixture and bury approximately 5 cm beneath topsoil. Stocking usage restricts seed loss. May require baffle boards to reduce erosion until seeds germinate and the plants become stable (Fig. 4).

Planting time

- The best time to plant is in early winter, just prior to the maximum growth period from July to October followed by reinforcement in early spring.

Planting zones

Freshwater zones

- Relatively freshwater zones where groundwater or surface water flushes through the ground are indicated by swamp paperbarks, flooded gums or perennial grasses growing down onto the beach.
- Plant rushes at any time of the year, although early winter is best.

Saline zones

- Indicated by nearby samphire or saltwater paperbarks.
- Plant only in winter so that the rushes can capitalise on the relatively low salinity period between late-summer and autumn.

High erosion and wave energy zones

- Immediate planting - plant rushes in areas which are not being eroded and protect against waves and strong currents with buffers such as baffle boards (Fig. 4).
- Delayed planting - place buffers in high erosion or wave energy zones in the first year and return the following year to plant rushes where sediment has accumulated.

Fertilised zones

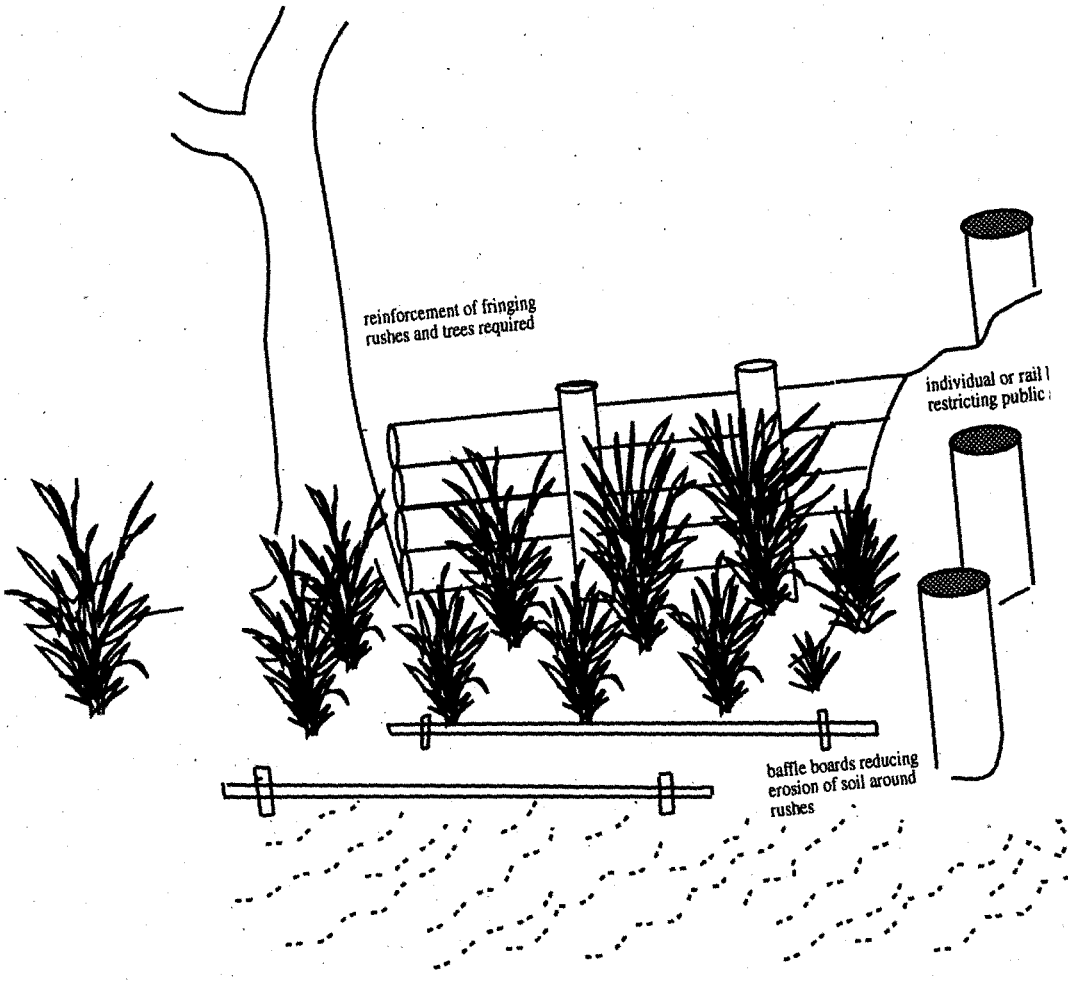
- Foreshore areas below reticulated sporting fields and parks are usually flushed with nutrient rich fresh water for most, if not all, of the year. Shore-rush grows extremely well under these conditions.
- Procedure - spray or clear grasses if necessary prior to planting. Plant rushes at upper foreshore level in a long strip parallel to shoreline, from which they will grow vigorously towards the water.

On occasion, the Trust has access to rush and sedge beds suitable for transplanting. Contractors undertaking the work should contact Barry Johnson of the Swan River Trust (327 9777) prior to commencement of operations to determine availability of such plants.

Transplants or seedlings may be planted directly at the water's edge provided a series of baffle boards are deployed to reduce the impact of boat and wind waves and strong currents.

It is important that the success of the seedlings is monitored. The Trust would be interested in results of the plantings.

Figure 4: Rush planting and protection guidelines

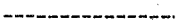


APPENDIX 7 : PROPOSED TIMBER BOARDWALK THROUGH BULL CREEK

ITEM NO	DESCRIPTION	UNIT OF MEASURE	QUANTITY	RATE $	RATE c	AMOUNT (to nearest dollar)	TOTAL
MATERIALS							
1	Piles 200*200*5000 long	m	1900	44	50	84550	84550
2	Halfcaps 125*75*1800 long	m	684	8	50	5814	90364
3	Stringers 100*75	m	1010	6	75	6818	97182
4	Decking 200*38*1800 long	m	4510	6	85	30894	128076
5	Kerbing 75*75	m	1010	5	10	5151	133227
6	Upstands 100*75*1150 long	m	590	6	75	3983	137210
7	Rails 100*50	m	2020	3	55	7171	144381
8	Fixings - bolts, nuts etc.	item				2000	146381
PLANT							
1	Truck	Day	120	100	00	12000	158381
2	Backhoe / FEL	Day	120	150	00	18000	176381
3	Pile Driver Small	Day	120	150	00	6000	182381
4	Minor Plant	Day	120	45	00	5400	187781
LABOUR							
1	Assume 4 men/ 8.5/hr/day * 145 days	HR	5000	25	00	125000	312781
1	Dept Charges 12.5%					39098	351879
BUND MATERIALS							
1	Limestone	m3	1500	17	00	25500	377379
2	Filler cloth	m2	1200	5	40	6480	383859
3	Plant/Labour	item				20000	403859
	Dept Charges 12.5%/51980					6498	410357

ESTIMATE BASED ON NO INFORMATION RELATING TO GROUND AND WATER CONDITIONS
IT COULD BE ASSUMED THAT $500,000 IS NOT OUT OF THE QUESTION

KEY TO SYMBOLS

R 30638	Reserve No.
	Jetty
	Wreck
	Boat Ramp
	Parking
	Public Toilets
	Playground
	Historical Feature
	WAWA Drain
	Subsoil Drain
	Road Drain
	Erosion / Accretion Areas
	Water Ski / Jet Ski Area
	Mooring Areas
	Convict Fence

ABBREVIATIONS

AHC	Australian Heritage Commission
BFB	Bush Fires Board
CALM	Department of Conservation and Land Management
CLAG	Contiguous Local Authority Groups
CREW	Canning River Estuary Watercare
CSIRO	Commonwealth Scientific and Industrial Research Organizati
DOLA	Department of Land Administration
DOT	Department of Transport
DPUD	Department of Planning and Urban Development
EPA	Environmental Protection Authority
FD	Fisheries Department
HDWA	Health Department of Western Australia
KPB	Kings Park Board
LGAs	Local Government Authorities
MRD	Main Roads Department
MRS	Metropolitan Region Scheme
SPYC	South of Perth Yacht Club
SRT	Swan River Trust
SSC	Shelley Sailing Club
WAWA	Water Authority of Western Australia
WWC	Waterways Commission