WATERWAYS
COMMISSION

Local Government and waterways management

- considerations in the planning and management of land near waterways

Waterways Guidelines No 1
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1. INTRODUCTION

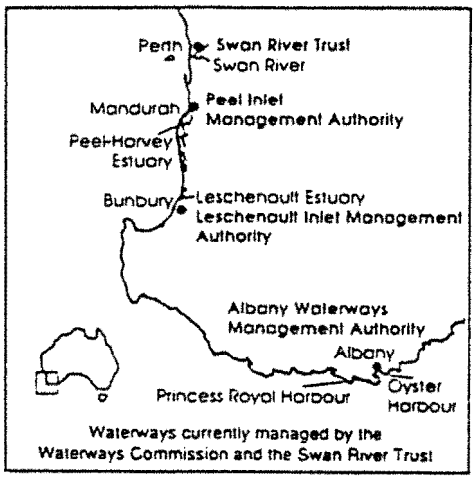
Local government clearly plays a vital part in maintaining the waterways of Western Australia in a clean and healthy condition. Local government is often the major planning authority in non metropolitan areas and has considerable power to guide waterway planning and management and maintain the integrity and function of the waterways.

Local government is in close touch with the community. Council is often the first point of contact for information or advice for local residents, and can help to promote a caring attitude towards the river environment, for example by encouraging appropriate recreational use, land management and water conservation. Local government authorities further away from the river also play an important part because of their role in planning and managing the wider catchment.

In the past many local government authorities have sought advice from the Waterways Commission on how they can improve their planning and management of the waterways. The following guidelines are designed to meet initial requests by local government authorities for advice on the protection and enhancement of rivers, estuaries and inlets.

1.1 Why do waterways need managing ?

Waterways are a major conservation and recreational resource for the people of Western Australia. Their waters and foreshores are highly regarded because of peoples' desires to live and recreate near water. The waterways are owned by everybody and used by everybody. However heavy demands are placed on our waterways and as a result foreshores may be degraded, native vegetation removed and water quality reduced. Waterways must be managed in order to balance all the conflicting demands and provide for the protection of the environment.



1.2 Guideline objectives

- To heighten awareness amongst local government for the need to plan and manage the State's waterways.
- To ensure that developments approved by local government authorities will not unacceptably diminish the quality of the State's waterways.
- To ensure that local government makes provision for:
  - protection and enhancement of waterways and foreshores;
  - land use within the catchment which recognises potential impact on downstream sources, and;
  - minimise adverse changes to the waterways and foreshores.
- Ensure that land use and development on or adjacent to the waterway maintains or enhances the environmental quality and amenity of the waterway environment.

1.3 Role of the Waterways Commission

The Commission's main area of interest is the protection and enhancement of rivers and estuaries, particularly those declared as management areas under the Waterways Conservation Act 1976. It specifically has the duty to:

- preserve or enhance the quality of the environment and amenities of the waters and foreshores;
- control and wherever practicable, prevent emissions which might cause pollution of the waters or surrounding land;
- provide advice and information on the conservation and good management of rivers, inlets and estuaries and associated lands;
- co-operate with local government authorities, residents and other persons affected by the operation of the Waterways Conservation Act .
- ensure that community access and enjoyment are enhanced while protecting the State's waterways important conservation values.
- provide advice on land use and development on and adjacent to waterways which maintains or enhances the environmental quality and amenity of the waterway environment.

1.4 How to use these guidelines

The three most common requests by local government are:

- to provide comment on the development and review of town planning schemes, rural strategies, structure plans etc.
- to provide advice on individual development proposals where technical advice is necessary for Council to make a more informed decision.
- how can the waterways best be managed using current legislation?

These guidelines have been designed to meet these requests. Section 2 details the mechanisms available to local government as well as a brief outline of the planning mechanisms used by the Waterways Commission. Section 3 outlines issues that Council may wish to consider when planning and managing the waterways and their catchments.

2. MECHANISMS FOR MANAGEMENT

Better waterways management can be achieved by local government through its planning processes. A second approach is through the establishment of an Authority under the Waterways Conservation Act or via the advice of the Waterways Commission.

2.1 Local government

Local government has a variety of options available to improve management and planning of the waterways. These are both statutory and non-statutory.

2.1.1 Town Planning Scheme

Local government has a strong planning tool at its disposal in the development of a town planning scheme. A town planning scheme which recognises the need for management of the catchment as well as the foreshore and waterways will go a long way to ensure the health of the waterways in years to come.

When reviewing or developing a town planning scheme it is recommended that Council look at the issues contained in Section 3 to determine how various land use zones may effect the waterway.

Alternatively Council may require something more binding and may wish to consider inserting a clause in the planning scheme which allows for the development of a management plan or policies aimed at protection of the waterways and foreshores.

Such a plan may involve a number of government and local government agencies. Successful management relies on the co-ordination of these agencies. A management plan should provide a blueprint for the operations to be undertaken by respective agencies in relation to waters and associated land. As such, the plan will contain Council's policies, objectives and strategies for managing the waterway environment. It may also be appropriate to designate desirable uses for areas as well as opportunities and constraints. The Commission is currently preparing more detailed guidelines on how to develop a management plan.

The plan may include working plans to be carried out for the improvement, development and maintenance of waters and associated land, the prevention and control of fires, public utilisation of the area, the study, care, and restoration of the natural environment and conservation of indigenous flora and fauna. Plans for particular foreshores should be jointly prepared by State government and local government agencies with full community involvement and co-operative working arrangements developed for implementation.

It is recommeded that local government should seek the advice of the Department of Planning and Urban Development to ensure that any provisions or policies are suitable for inclusion in town planning schemes.

2.1.2 By-laws

Where Council needs to control a particular activity it may be desirable to develop a by-law in accordance with the requirements of the Local Government Act.

2.1.3 Policies

In situations where Council frequently approves or provides advice on particular issues or developments it may be desirable to prepare policies. Again there is opportunity for local government to make provision in Town Planning Scheme's for the development of policies giving them a statutory basis.

The Waterways Commission and the various management authorities have prepared a number of policies that local government may like to use as a basis for its own policies.

2.1.4 Rural strategies

The Department of Planning and Urban Development has required a number of local government authorities to prepare Rural Strategies. When preparing these documents Council may wish to consider issues listed in Section 3 for inclusion in its Rural Strategy.

2.1.5 Structure plans

As part of the planning process for an area the Department of Planning and Development or Council may require a structure plan be developed. If the area includes or abuts a waterway it is recommended that the issues outlined in Section 3 be addressed during the preparation of the plan.

2.2 Waterways management - a broader perspective

While it is desirable that all local government authorities use the preceding strategies to improve management of the waterways within their boundaries it is also likely there will be a need by some local government authorities for a more formal approach. The main options are discussed below.

2.2.1 A waterways management authority

Under the Waterways Conservation Act 1976 a waterways management authority can be established to manage a declared waterway. The powers of the Act focus on management of the waterbody and its foreshores. It enables community based waterways management to be undertaken through local waterways management authorities.

The mission of a waterways management authority is to conserve, manage and maintain a functional healthy waterway for the declared range of beneficial uses as determined by the community.

An authority provides advice to State and local government agencies on planning and management of the riverine environment, coordinates planning and management activities and fosters cooperation between all responsible and interested bodies and the community.

The role of an authority in the catchment is to support catchment managers and landowners in their endeavours, including bringing a waterways perspective to catchment management.

2.2.1.1 Planning and management

One of the key functions of the Commission is to plan and manage waterways. Figure 1 outlines the process used by the Development and Management Planning Division of the Commission to plan and manage the waterways. An explanation of the terms used follows.

Management strategy

This is an overall guiding document on how a waterway should be managed. It looks at the issues facing the waterways and how these can best be resolved. Generally it prescribes a management framework, be it through existing legislation or the establishment of new legislation. It is not assumed that all waterways need management under the current Waterways Conservation Act legislation. It is a policy of the Commission to always advertise such documents for public comment.

Management programme

When a waterway management area is declared under the Waterways Conservation Act or Swan River Trust Act the legislation requires that a management programme be developed. This document binds the waterways management agency in its decision making. The programme should contain or make recommendations for the development of the components listed below. It is a policy of the Commission to always advertise such documents for public comment.

Management plan

This is a plan for how a specific area of the management area is to be managed. It could be specifically aimed at recreation or conservation areas, intensive horticulture, or new subdivision areas. These plans are usually undertaken in cooperation with land owners, community groups and or local government authorities. It is a policy of the Commission to always advertise such documents for public comment.

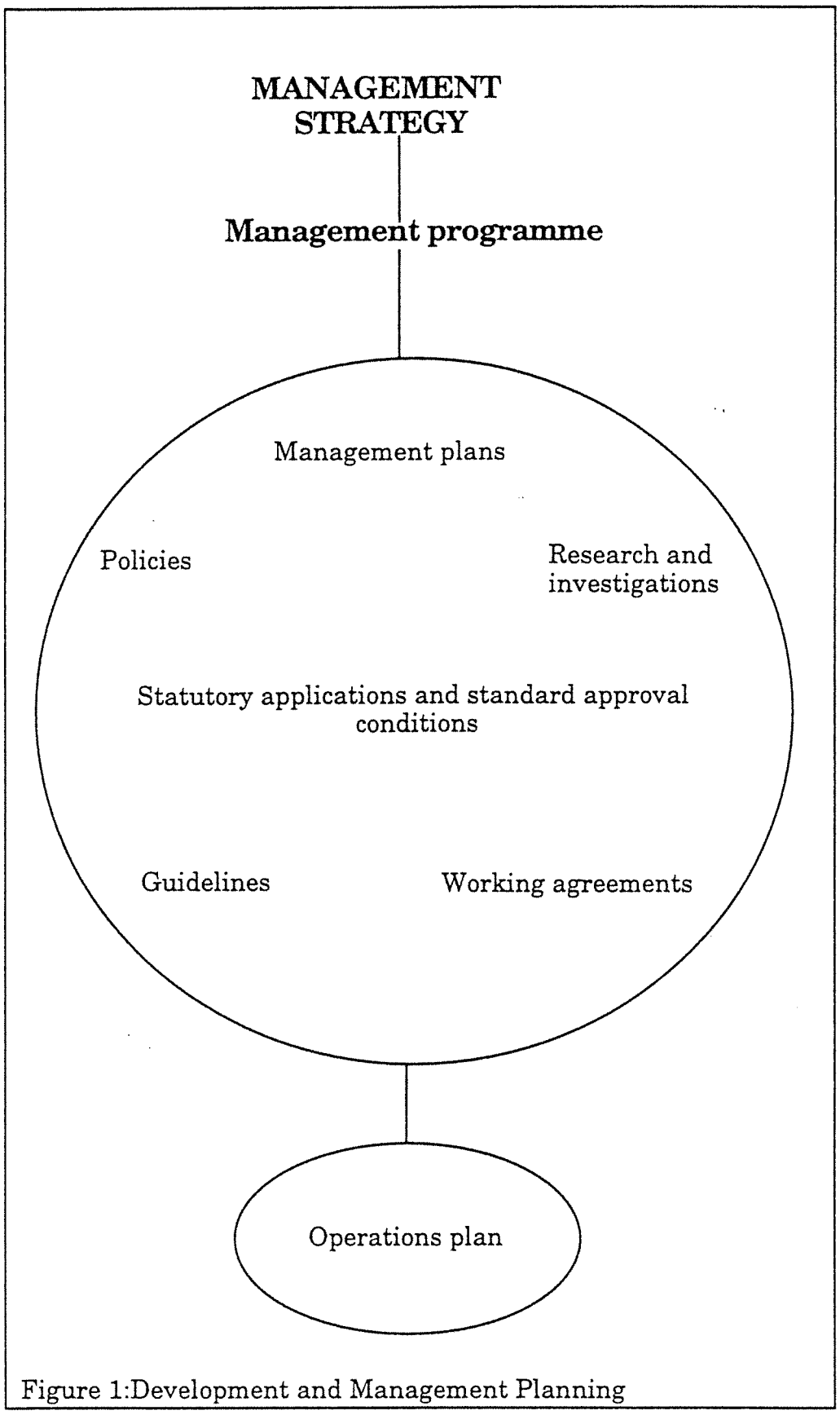


Figure 1:Development and Management Planning

Research and investigations

In order to prepare any plans, programmes, strategies etc it is often necessary to carry out a number of research projects beforehand. Past projects include recreation surveys, vegetation surveys, and herbicide use and vegetation rehabilitation trials. Separate 'technical' reports are prepared for these studies and the findings used as the basis for other management documents. Some of these technical reports form the basis for public information pamphlets that are prepared in co-operation with the Public Information Programme.

Statutory application and standard approval conditions

The various management authorities provide advice on proposed developments. In order to make this advice consistent and equitable standard conditions are developed. Mechanisms are also developed to ensure the various waterways agencies meet the statutory time requirements for responding to development proposals.

Policies

Policies are designed to guide an Authority's decision making on particular issues or developments which it must frequently approve or provide advice on. They give developers and land users a clear idea of the standards required by the Authority. It is a policy of the Commission to always advertise such documents for public comment.

Guidelines

Guidelines are designed to provide more specific advice to land owners, individuals, community groups and government agencies. They may be designed to show how particular policies may be achieved.

Working agreements

Working agreements are generally written between a management authority and an individual land owner or manager. It is usually for a particular issue such as installation of a fence or recreation facility, often it outlines cost sharing and ongoing maintenance arrangements for the facility.

Operations plan

This plan outlines the work to be undertaken by an individual authority on a yearly basis. It is based on recommendations contained within the various management strategies, programmes and plans. The plan is divided into four divisions reflecting the structure of Waterways Commission staffing structure.

Corporate Services - outlines services to be supplied to the Authority during the year to improve their efficiency and functioning.

Engineering, Works and Maintenance - outlines works to be undertaken during the year such as erosion control, weed harvesting etc.

Environment, Investigations and Assessment - outlines environmental investigations to be undertaken such as water quality monitoring, bird surveys, solutions to mosquito problems etc.

Development and Management Planning - outlines the various plans, policies and guidelines to be prepared, as well as implementation of those finished in previous years.

2.2.2 Advisory committees

In the past people concerned with the management of waterways in their community have formed a committee to lobby for better management of their waterways. Generally such committees approaching the Commission have been provided with assistance. Two examples are the Avon River System Management Committee and the Wilson Inlet Management Advisory Committee. These committees generally seek to find out more about their waterways, what the problems are and how they can best be resolved, as well as determining how the waterway can best be managed in the future.

2.2.3 More options

In 1989 the Commission undertook a review of the Waterways Conservation Act 1976 to determine if there were more alternatives to management of the waterways than by establishing a waterways management authority. Public comments indicated there was a need for more options and the Commission has since sought to change the legislation to provide greater scope.

2.2.4 Integrated catchment management

Integrated catchment management is the co-ordinated planning, use and management of water, land, vegetation and other natural resources on a river or groundwater catchment basis.

It provides a means of co-ordinating land use planning, water resource planning, water resource planning and conservation at a regional (catchment) level which is based on the natural links between the land and water resources.

Where only part of the waterway falls within the municipal boundary it is important for Council to recognise that what happens in the upstream section of the waterway may have more serious ramifications on the waterway within another local government authority area.

It is also important to look at land use and zoning in the upper catchment to ensure protection of the waterway and foreshore. Catchment management is a complicated issue and it may be worthwhile establishing a technical committee to assist in looking at environmental issues within the catchment. The Office of Catchment Management can assist with this matter.

3. ISSUES

A variety of issues relate to the protection and enhancement of the waterways. Many of these are discussed below together with suggestions on how Council may deal with such problems. This short list of issues is based on previous requests by local government for assistance. If further information is required please contact the Commission or authorities listed at the back of this document.

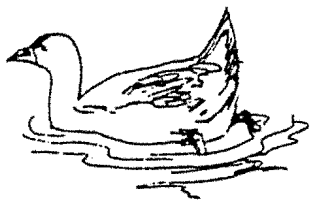
3.1 Land use and waterway planning

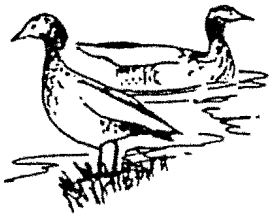
This section addresses issues to ensure that land use and development on and adjacent to the waterways maintains or enhances the quality and amenity of the waterway environment.

3.1.1 Foreshore reserves

The foreshores are an integral part of the waterway system providing recreation and conservation opportunities. There is a strong case for the establishment of foreshore reserves for conservation, preservation of the waterway environment, vegetation protection, species diversity and sanctuary areas for fauna. Reservation should occur where there is presure for public access. However in many rural areas this may not be necessary and other options to ensure protections of these areas may be desirable.

Local government has the opportunity to develop rivers and foreshores as a 'greenbelt' for the community providing a focus for tourism and recreation. Foreshore reserves should be created when subdivision occurs adjacent to a waterway. The Waterways Commission's Foreshore Management Policy outlines the development and management of foreshore reserves. Vesting and ongoing management are two issues which should be carefully considered. Development of foreshore reserves should consider the creation of nodes, or centres of activity, where a clustering of activities will occur. These nodes should be connected by relatively narrow reserves along the waterways, wide enough to permit the passage of pedestrians/cyclists, and encompassing where necessary valuable wetlands, topographic features and places of interest.





The State Planning Commission and the Water Authority of WA have developed additional guidelines for protecting watercourse reserves. These consider the protection of foreshore areas without the need for reservation.

3.1.2 Commercial development

Commercial development can enhance the community's use of the waterway. However, it should not affect its living systems or public access and amenity. Generally commercial developments on a waterway should be associated with recreation and tourist facilities. A wide range of facilitates that may be considered include a limited amount of tourist accommodation and high standard (in terms of structural appearance) restaurants, tearooms and kiosks associated with small boats and bicycle hire outlets. Such developments should be confined to already modified areas of the waterways and foreshores.

(rezoning or development) of foreshore areas include:

- availability of essential services required including water, sewerage, electricity and telephone.
- impact on adjacent land uses because of noise, traffic and parking.
- intent of the town planning scheme as it relates to adjacent areas.
- impact of the development on the amenity of the existing landscape and natural environment.
- effect the development may have on the hydrology of the floodway and flood plain, and risk of flooding to the development.
- the cumulative impact of a series of similar developments.
- impact on public access to the foreshore.
- proposals for advertising associated with the development. Often the attractiveness of a foreshore area is one of the reasons a commercial development is proposed. In such cases outdoor advertising may not be acceptable.

3.1.3 Canal developments

The Waterways Commission considers that many of the waterways of Western Australian are not suitable for residential canal developments. The waterways are often nutrient enriched and experience abundant macro algal growth and microscopic algal blooms. Such conditions could lead to water quality management problems in artificial waterways connected to these waters.

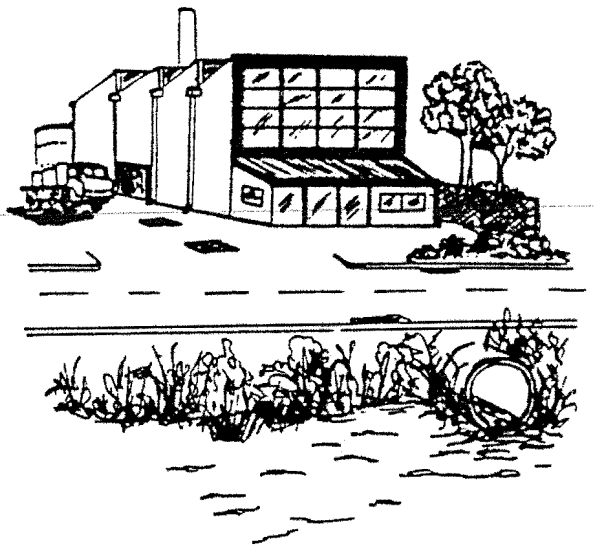
Canal developments are generally located on low-lying land adjacent to the waterways. This land is mostly wetland (either rush marsh or samphire marsh). Throughout the State agricultural and urban development works have removed a large amount of wetland from the foreshores. The remaining wetlands are an important part of the waterways and their protection is important.

The following guidelines should be applied as minimum environmental criteria for the assessment of canal developments.

- The proposal should not increase nutrient loading to the estuarine system and should where possible, reduce nutrient loading. A nutrient management plan should be required detailing the current situation, anticipated loading, fertiliser practices, water quality monitoring, future management of the land and associated.
- The proposal should provide for public access through the development particularly along the foreshore.
- The proposal should not involve land of environmental value such as wetland habitats, backwaters, areas identified in the EPA Conservation Through Reserves Committee Recommendations, flora and fauna reserves or conservation areas.

Should a development be proposed then the criteria for approval of canal developments, as set out in the Canal Steering Committee Report (Steering Committee on Canal Development, 1984) should be strictly adhered to. It should be noted that the Government is currently revising this report and is likely to release new guidelines shortly.

3.1.4 Industry



Industry does not in itself pollute the waterways environment. However the inappropriate use of water and disposal of industrial wastewater can. General issues local government need to consider when assessing a proposal for industry (rezoning or development) include:

- the proximity of the proposed industry to the waterway, particularly in relation to soil types, groundwater flow, stormwater disposal and flooding. This will avoid problems of groundwater and soil contamination in the long term and leaching of pollutants into the waterways.
- means of containing accidental spills and other pollution loads from entering the waterway via stormwater networks.

Section 3.2.2 discusses water quality and the sources of pollutants in more detail.

3.1.5 Flooding and flood plain management

The Commission considers that development within the floodway should only occur on the recommendation of the Water Authority of Western Australia. It is also recommended that environmentally significant areas of the flood plain (as opposed to the floodway) be preserved as flora and fauna habitat. Without such areas the river would become purely a channelled drain losing much of its visual and recreational qualities. Private landowners are often sympathetic to restricting development within the floodplain provided the reason are clearly explained. It may also be beneficial to provide landowners with advice on what parts of the flood plain are environmentally significant and how a development may be designed to fit in with the landscape.

Preliminary scientific research indicates that sea levels could rise between 0.3 metres and 1.6 metres in the next 20-30 years due to global warming. The proximity of development to the river and possible changes to flooding patterns due to the 'greenhouse effect' should be considered by Council. Advice should be sought from the Water Authority of Western Australia.

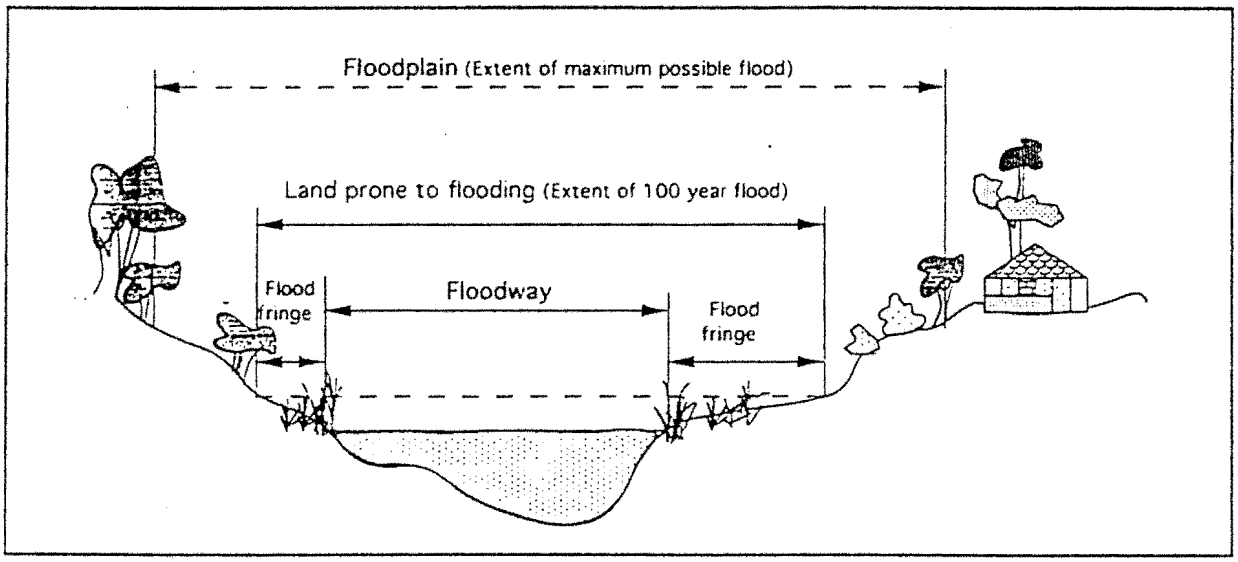


Figure 2 Terms used to describe the foreshore and areas prone to flooding

3.1.6 Urban development

Attention should be paid to residential density codes selected for land abutting the waterways. Where foreshore include environmentally sensitive areas such as wetland and wildlife habitats a trend towards higher densities could be detrimental to the integrity of the foreshore.

Problems may occur as a direct result of increased 'people pressure' (for example, lighting and noise, trampling and intrusion, rubbish dumping and litter, dogs and other pets, introduction of exotic species of vegetation, insecticides and other pollutants).

Where foreshore are predominantly recreation areas, increased densities in adjoining residential areas may be compatible and desirable, enabling many more residents to enjoy an enhanced level of access to the foreshore. A further benefit is that pressure is directed away from sensitive areas. In considering the appropriateness of residential densities in town planning schemes, Council should be aware of the implications of high density developments on adjoining environmentally sensitive waterways and foreshores.

Urban development in foreshore areas should have regard for:

- the nature of the foreshore, whether conservation or recreation based;
- the degree of modification to the foreshore;
- the ability of the foreshore to sustain added usage;
- the predominant characteristics of adjoining residential areas; and
- the degree of protection afforded to the foreshore particularly to conservation areas.

3.1.6.1 Water Sensitive Residential Design

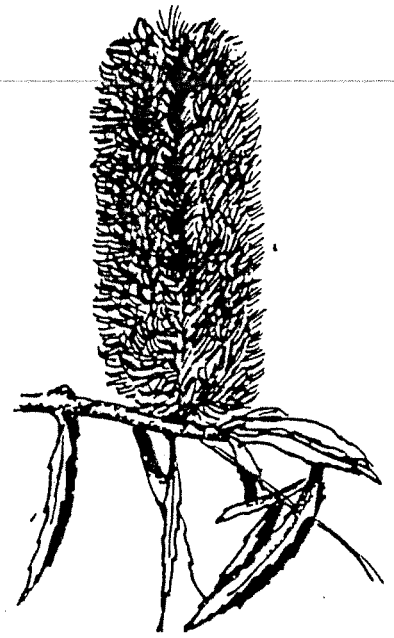
The water sensitive design of urban areas has been the focus of considerable study in recent years. It is appropriate that local government consider this issue before rezoning from rural to urban. The following points are taken from a report by the Water Sensitive Urban Design Research Group (1990) entitled 'Water Sensitive Residential Design'. Additiional advice is contained within the State Planning Commission's policy DC 6.3 'Planning considerations in the Metropolitan Region for sources of public water supply and sensitive water resource areas'.

Residential subdivision design and development should be co-ordinated with water planning and management in a manner that will:

- minimise changes to the local and regional water balance
- achieve water conservation,
- maintain wetland ecosystems
- protect water quality
- produce cost effective residential development, and
- enhance recreational opportunity,

Essential design characteristics include:

- Maximise in situ recharge in situation where runoff is unpolluted and soil capacity permits.
- Stormwater drainage systems to be designed in a manner that enhances the environmental quality of the site.
- No direct drainage or stormwater discharge to natural wetland systems. Associated sedimentation traps and vegetation buffers to be designed to achieve nutrient stripping.
- Minimise the negative impact of possible nutrient enrichment.
- Where appropriate public open space should be designed, developed and managed using plant species suitable for dry climates.
- The boundaries of public open space areas incorporating wetlands to be planned to incorporate vegetation nutrient stripping buffers.
- Urban form and density to be designed in a manner that reduce private open space water demands.



Parameters which influence design should include consideration of:

Water Balance - assessment of likely changes in water balance associated with urbanisation in terms of both impact on surface and groundwater. Minimisation of changes to the natural water balance in terms of volume and rate of discharge and recharge.

Water Quality - identify potential water quality contamination sources and, where appropriate, locate to minimise impact. Stormwater systems to be designed in a manner which minimises pollution potential to surface and groundwater. No direct discharge into wetlands and the maximisation of dispersion of stormwater in infiltration systems so as to reduce contamination potential.

Water Conservation - increase urban density and range of housing options. Identification of acceptable levels of groundwater extraction. Where influence over landscape design is possible develop a landscape theme to incorporate water conservation features. Ensure that rainfall is directed to landscape features by using water harvesting techniques where possible.

A water sensitive approach needs the latitude to limit the amount of urbanisation within an urban zone in the early stages of development particularly in relation to drainage considerations, wetland buffers and natural vegetation retention. Urban deferred zoning allows the opportunity for negotiation on environmental and water issues without the spectre of the 'rights of certainty' argument that urban zoning implies.

3.1.7 Rural Use

Agricultural production is of great importance to Western Australia but problems of land degradation are affecting productivity and in some cases greatly restricting the continuation of traditional agricultural pursuits. Issues vary from catchment to catchment and can in turn affect the waterway system. For example:

- saline water flowing from salt affected areas can enter the waterways. This can affect both the flora and fauna of the waterways and surrounding foreshore vegetation.
- a rise in water table can increase the level of a waterway and inundate surrounding land. This may again lead to the degradation of surrounding foreshore vegetation.
- land clearing and tillage practices can increase the rate of topsoil entering the waterway through rainfall runoff.
- land clearing and agricultural practices can reduce water infiltration, this in turn increases run off to the waterways.
- water repellent soils may develop in sandy soils due to a high level of organic matter coating sand particles. Again this increases surface runoff to waterways.
- soil degradation due to soil acidification, soil structure decline and subsoil compaction can result in a reduction in rainfall infiltration, restrict crop emergence and reduce plant growth. This in turn increases surface runoff to waterways.
- nutrient enrichment of waterways may result from fertiliser use or high effluent output agricultural activities such as piggeries. An increase in nutrients may upset the ecological balance of the waterway resulting in algal blooms.
- pesticides used in agriculture may also pose a threat to the water quality of waterways.

It is the aim of the Commission to encourage the linking of catchment management issues with waterways management issues. In rural areas the Department of Agriculture is encouraging Land Conservation District Committees to prepare local catchment management plans for their individual area. It is considered that this is an ideal forum for local government to promote the issue of waterways management.

3.1.7.1 Intensive agriculture and horticulture

Intensive agriculture generates large amounts of solid and liquid waste. Similarly intensive horticulture also has its own set of problems. Often large amounts of nutrients are used and depending on soil type these can leach into the waterways. Without adequate controls both these land uses can result in considerable nutrient input to waterways. It is important that proponents develop a nutrient irrigation management plan which details use of fertilisers, irrigation practices, effluent and waste water disposal and possible pesticide use. The Commission is currently preparing guidelines on how to prepare a nutrient irrigation management plan.

3.1.7.2 Stock access

Restrictions on stock access in some locations may be desirable to prevent erosion of the banks, siltation of the river and localised eutrophication. The Town of Bassendean for example has a by-law restricting horse grazing in close proximity to the river bank.

Drainage of water across paddocks into the river can also result in animal effluent and soil particles entering the waterways. Where stock require access to the river for drinking water it may be appropriate to fence a small area to restrict access to one location. The bank may need to be graded to permit easy access. Similarly replacing the muddy river bed with sand may stop 'pitting' of the river bank and bed.

3.2 Conservation and environmental protection

Issues in this section relate to the conservation, protection and rehabilitation of the waterways and foreshores.

3.2.1 Conservation areas

There is a need for the provision of conservation areas for flora and fauna both within the waterways and on the foreshore. This will ensure the functioning of the waterway as a biological unit and provide a valuable scenic resource for the town enhancing its tourism and recreational potential. Fringing vegetation provides food and shelter for birdlife and traps nutrients and pollutants in land drainage, slowing their passage to the estuary. It also stabilises the banks of the waterway.

Tidal flats within the waterways are also an important biological unit often functioning as fish nursery areas, seagrass meadows rich in invertebrate fauna. Generally fish and shellfish taken from a waterway depend on the shallow banks for essential food and shelter.

Provision of conservation areas is a responsibility that should be undertaken by local government and not left solely to state government agencies such as the Department of Conservation and Land Management.

Local government should work towards the development of a strategy to rehabilitate and protect the foreshore and waterways margins. It should address issues such as:

- identification of fringing vegetation;
- controlled eradication of declared plants and animals;
- current ownership and management;
- public access, and
- work to protect and rehabilitate areas of vegetation. Wherever possible vegetation enhancement schemes should be undertaken. Revegetation will improve the flora and fauna habitat, enhance the recreational value of the area, aid in nutrient uptake and reduce erosion of the bank of the waterway.

It is not essential that all foreshore areas be in public ownership as often appropriate management can be achieved with the support of individual landowners.

Commission officers and other government agencies can provide further advice on how to determine areas suitable for protection.

3.2.1.1 System Reserves

The Department of Conservation and Environment (now Environmental Protection Authority) has identified areas throughout the state worthy of conservation. These are listed in the Conservation Reserves for Western Australian System Reports Nos. 1-12. These reports are commonly known as the Red Books. Wherever possible local government should encourage the protection of these areas.

3.2.2 Water quality

Water from right across the catchment eventually finds its way into the waterway system. This means that pollutants from all land uses in the catchment can also end up in the system. Often, poor water quality is the result of the combined effects of a variety of activities across the catchment. Pollutants can be divided into four types: nutrients, toxins, pathogens and physical pollutants.

Key sources of these pollutants and considerations for local government are discussed below.

3.2.2.1 Nutrient Enrichment

Nutrient enrichment is an issue which affects many of the rivers and estuaries of Western Australia, with perhaps the most well known case being the Peel-Harvey Estuary at Mandurah.

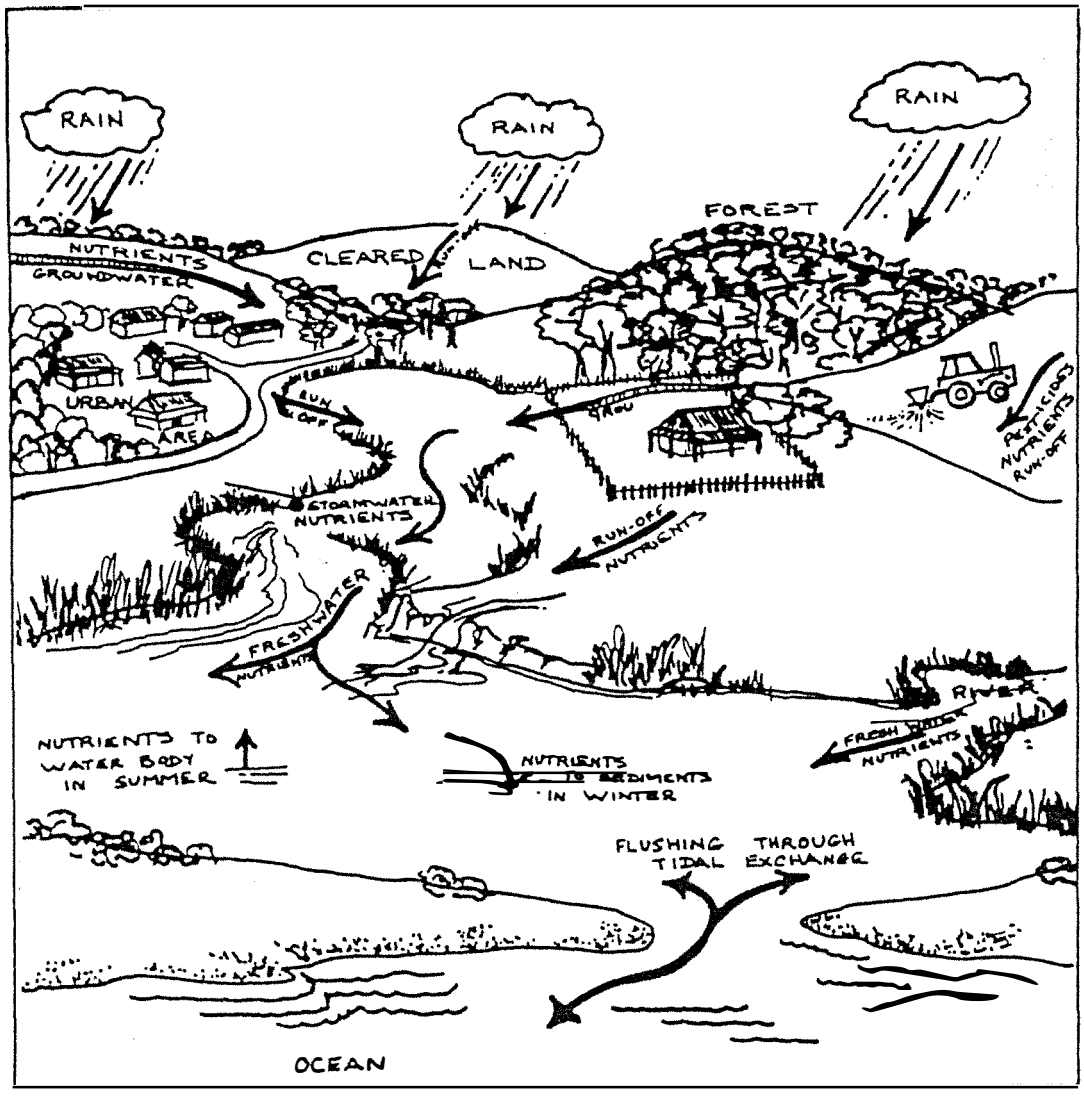


Figure 3 Transportation of nutrients to waterways via ground and surface water flow

Nutrients can reach the river from a variety of sources. In fact these nutrients are what makes the waterways such biologically productive areas for birds, fish and algae. Too much however, can result in algae blooms which cause odours, and often result in the death of fauna dependent on the waterway.

Nutrients are required by plants and animals for growth. Algae take their nutrients from the water. When excessive amounts of nutrients, especially nitrogen and phosphorus, enter the waterway it is called 'eutrophication'. Large stores of nutrients can build up in the sediment of the waterway floor, forming a nutrient 'bank'. Under certain conditions these can be released for use by algae.

The amount of nutrients leaching from an area is heavily dependent on the type of soil on which the particular land use is occurring. coastal soils such as the deep grey sands have the least capacity to retain nutrients followed by soils with sand over clay. The clay loam soils and brown and yellow sandy soils with a high iron content have the greatest ability to bind phosphorus.

Nutrients entering a waterway may come from the following sources:

- Stormwater drainage,
- Fertilisers from parks and gardens,
- Sewage,
- Septic tank leachate,
- Agricultural and horticulture runoff containing fertilisers and animal wastes,
- Phosphate detergents,
- Leachate from rubbish tips and septic tanks, organic industrial wastes,
- Sediment banks in estuary.

3.2.2.2 Rubbish Disposal

Rubbish disposal sites have the potential to leach contaminants into the groundwater and into the waterways. This depends on the water table, soil type and maintenance of the site itself.

The location of sites should be considered in relation to the flood plain, disposal of hazardous materials such as pesticides etc, groundwater flow and the possibility of nutrient enriched leachate reaching the river. The location of individual farm rubbish sites as well as Council sites may need to be addressed or reviewed. As a genral guide the Commission would not support the use of the flood plain for rubbish disposal.

3.2.2.3 Toxins

Toxins are substances which are poisonous to living organisms. Sources of toxins are:

- Pesticides and herbicides in runoff from urban areas, agriculture, horticulture, forestry.
- Spills of industrial waste discharges of petroleum products or toxic chemicals.
- Anti-fouling paint from boats.
- Leachates from tip sites.

Pesticides and herbicides may enter the waterways via the drainage system. Spraying of verge side vegetation to control weeds also has the potential. Some heavy metals could enter the system from extremely high fertiliser use.

The use of pesticides and other toxins on the foreshore and inappropriate disposal of these products and containers can result in contamination of the waterways. Potential impacts of using toxins in close proximity to waterways include toxic effects on fish and aquatic invertebrates. Indirectly they can affect birds through a reduction in food source. Toxin residues may also impact on water users.

The Health Department has developed guidelines on pesticide use and disposal of containers. It is suggested that local government adopt these guidelines.

3.2.2.4 Effluent disposal and septic systems

Septic systems have the potential to leach phosphorus, nitrogen and some bacteria into groundwater and into the waterways. Again this depends on the water table, soil type and maintenance of the system itself.

Sewering of all areas is financially prohibitive. Where an area is unsewered the location and operation of leach drains is important to reduce nutrient enrichment of the river system. All on-site disposal systems must be located such that there is:

- a minimum 2 m vertical separation between the base of the leach drain or soakwell and the highest known groundwater level or bedrock;
- a minimum 100 m horizontal separation between the disposal system and nearest waterbody; and
- appropriate soil permeability, and slope.

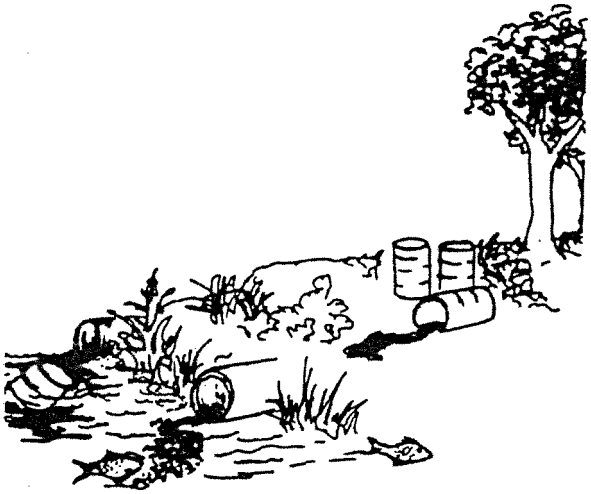
Where an area is sewered the location of the treatment plant is an important consideration particularly in relation to discharge into waterways unless substantial environmental assessment has occurred. The advice of the Environmental Protection Authority and the Water Authority of WA should be sought on this matter.

3.2.2.5 Alternative treatment units

In recent years alternative effluent disposal techniques have been developed. A number of these have been approved for use by the Health Department of Western Australia. Units suitable to remove and reduce nutrients are important for waterway management. The Commission is currently preparing guidelines for alternative treatment units.

3.2.2.5 Stormwater drainage and disposal

The rivers and estuaries form the major ocean outlet for surface and groundwater drainage of most catchments. The river system and the many associated brooks, creek and artificial waterways form an intricate arterial drainage network which drain large areas of agricultural land as well as urban areas.



The waterways are a natural drainage line for the surrounding area and as such there is the potential for any contaminated stormwater from developments to reach the river. Land uses where stormwater may be polluted or nutrient enriched include stock holding paddocks, industrial areas, golf courses and rail shunting yards. Care should be taken in zoning for such uses. Good housekeeping in these areas is essential, particularly prior to the onset of winter rains. Stormwater systems, particularly those connected to these areas should include structures to minimise pollution loads.

Drainage systems should be designed and maintained to minimise the impact on the waterways of substance in drainage waters. It may be appropriate for Councils to develop a stormwater network which addresses environmental considerations. These may include:

- Wherever possible stormwater should be disposed of on-site.
- Use of fertilisers on gardens and parklands should be minimised in order to reduce the amount of nutrients entering the waterways via the stormwater system of groundwater leachate.
- Stormwater systems should be designed to minimise hydrological changes to peripheral vegetation. Vegetation should be located around the drain in order to trap nutrients before entering the waterways.
- The visual impact of stormwater outlets should be minimised by incorporating them into the design of other facilities such as jetties, bridges, etc, locating them away from major recreation areas, minimising vegetation removal from around the drain.
- Outlets should be located and designed to minimise erosion and siltation around the mouth of the drain.
- No direct drainage or stormwater discharge to natural wetland systems should occur. Associated sedimentation traps and vegetation buffers to be designed to achieve nutrient stripping.

The Commission is currently preparing more comprehensive guidelines for stormwater disposal.

3.2.2.6 Parks and gardens maintenance

Local government are often responsible for maintenance of considerable areas of parks, gardens, bowling greens, golf courses, etc. Nutrients from fertilisers used on these areas may enter the waterways via surface or groundwater flow.

One technique to consider is the development of a nutrient irrigation management plan which identifies a suitable fertiliser and watering regime. Aspects to consider are soil type, fertiliser type, time of fertiliser application, watering application and vegetation type. Such a plan does not need to be extensive and can be implemented quite simply. The plan can also result in financial savings by reducing the amount of fertiliser and water required. The Commission is currently preparing guidelines on how to develop a nutrient irrigation management plan.

3.2.2.7 Other pollutants and sources

Pathogens are microscopic organisms (bacteria and viruses) which cause disease in plants and animals. Sources are:

- Sewage and septic tank effluent.
- Animal wastes.
- Organic wastes from industry (eg. food processing).
- Runoff from stock holding areas.

Use of septic tanks has the potential for bacteria to enter the waterways. However if systems are constructed and maintained to Health Department of Western Australia standard such problems should be negligible. Animal wastes flushed into the drainage system during winter and heavy summer downpours also have the potential to introduce bacteria into the system.

It should be noted that bacterial contamination from these sources is extremely uncommon in any waterways in Western Australia.

Physical pollutants include rubbish, litter and sediment (soil particles) from dredging activities and erosion. Sources are:

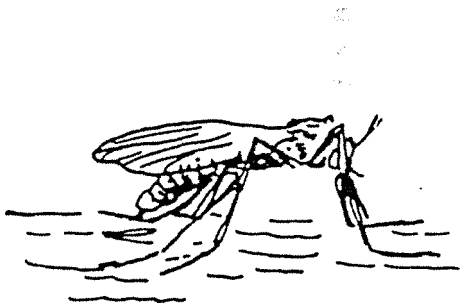
- Rubbish and litter dumped or blown into waterways.
- Sediments from erosion of foreshores, catchment soil loss, dredging, mining, building, road construction.
- Suspended solids in industrial wastes.
- Oil spills.

Local government can reduce the amount of physical pollutants entering the waterways by:

- Encouraging better land use practices;
- regularly cleaning foreshore areas of litter; and
- developing and maintaining a stormwater system which traps these pollutants before reaching the waterways.

3.2.3 Mosquitoes

Mosquitoes live and breed around waterways. In Western Australia a number of mosquito species are known to carry the disease 'Ross River virus' which can result in 'flu and arthritis symptoms lasting up to 12 months in extreme cases. Where facilities such as housing and recreation are provided for people it often creates an expectation of a mosquito free environment. Mosquito control will therefore always be an issue for local and state governments.



Siting of developments away from mosquito breeding areas would be desirable. Unfortunately because of the distance mosquitoes fly it is not possible to identify a set distance that development should be away from the waterways.

If the waterways are to be managed a healthy functional ecosystems it is also not desirable to eliminate mosquito breeding. It is therefore recommended that mosquito control should focus on control not eradication.

Management recommendations include:

- Ensuring that mosquito breeding is not aggravated by further development. All wheel ruts and artificial depressions around the foreshores should be filled in.
- If a biological filter or compensating basin is established to strip nutrients from the water table then it should be designed to minimise mosquito breeding. There should also be a buffer around it and housing should be located as far away as is practical.
- Council should conform with mosquito control strategies already prepared by the Health Department of Western Australia.

3.2.4 Landscape protection

The character of waterways and foreshores are a major attraction to residents and visitors. Where opposition arises to a development on the foreshore it is likely one of the key reasons is the perceived loss of landscape value.

The views to and from the waterway, river, coastline should be carefully considered. It may be desirable to ensure protection of such views and to ensure viewing corridors down streets, etc. Both the City of Nedlands and Town of Claremont have provisions to control the scale and appearance of buildings on the foreshore to ensure they fit in with the landscape.

In the past protection of the waterway landscape by purchase of private property has been a common approach as has the requirement for a foreshore reserve to be given up free of cost as a condition of subdivision. Subdivision however may not be appropriate in many areas and the cost of purchase and ongoing maintenance of foreshore areas often use of these mechanisms. The development of a landscape protection zone in town planning schemes may be appropriate. Such a zoning would restrict certain activities and developments in an area. Tree clearing restrictions is another method commonly included within Intensive Rural zones.

3.2.5 Fire management

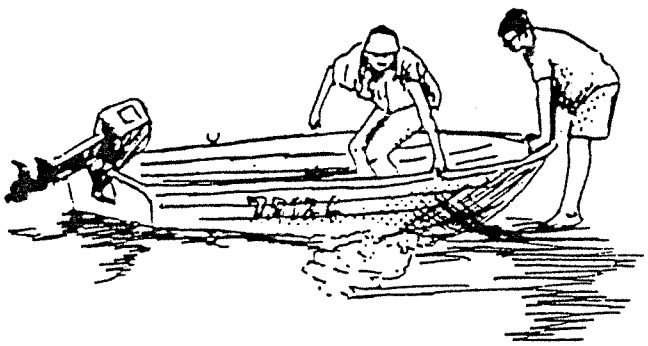
Foreshore rushes and vegetation provide an important habitat for fauna as well as well as bank stabilisation, a filtering system for nutrients and pollutants, and protection against erosion. In order to protect foreshore vegetation control of fire in these areas is required. Where properties abut foreshore areas it is desirable that clearing be limited. Modification to fire management practices may be desirable. The Shire of Manjimup has a restriction on burning off road side verges for similar reasons.

The Department of Planning and Urban Development has developed in conjunction with the Bushfires Board guidelines for 'Planning for better bush fire protection. These should be used as a basis for developing fire management practices.

3.2.6 Heritage and cultural sites

In the past the waterways have provided a valuable environmental resource to the Aboriginal people which ensured a permanent supply of fish and water, and supported a wide range of edible plants and animals. There are many sites of Aboriginal significance around the waterways and legislation protects these sites. Similarly since the early 1800s the waterways have provided a focus for European settlement and many of these areas are of cultural significance.

The identification of Heritage Protection Areas within a town planning scheme may be desirable. Areas that should be considered are those affected by State or Federal legislation and are consequently of regional significance. Also areas which contribute to the lifestyle of the local community should be considered. This could include pools in the waterway, significant areas of foreshore vegetation or historic buildings. The Town of Mosman Park and Shire of Harvey have introduced such areas into their Town Planning Schemes.



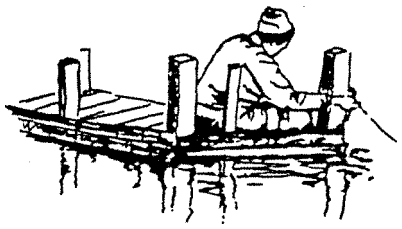
3.3 Recreation and tourism

This section addresses issues to ensure a range of recreation and tourism opportunities are developed which reflect and complement local heritage, life style and the natural environment.

3.3.1 Recreation

The rivers, coastline and lakes provide the greatest potential for recreational use. In providing recreational opportunities and facilities on or adjacent to the waterway it is important to recognise that people have a variety of expectations about the waterway's capacity to provide for their recreation. Planning must consider these desires and expectations, and then determine priorities .

The following aspects should be considered when developing recreation facilities:



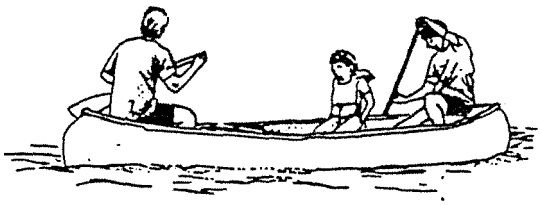
Preference should be given to recreational developments dependent on a waterside location.

Recreation activities should generally be directed into recreation nodes where appropriate facilities and site modification can be developed.

Nodes least prone to erosion and environmental degradation should be identified.

Nodes should be connected by linear foreshore reserves.

Recreation facilities should provide opportunities for locals as well as tourists.



Nodes should supply a range of recreational opportunities appropriate to the local environments.

Problems often arise from noise generated by boats and the impact on adjacent residents. Before approving such uses local government should review its noise abatement laws to determine if it is able to adequately control such problems.

3.3.2 Tourism

Tourism can provide every community with important income, however, without guidelines and management, the very qualities of the area people come to experience can be lost. Tourism is in part a combination of both recreation and commercial development. Local government should consider issues raised in Sections 3.1.2 and 3.3.1.

3.3.3 Public access

Public access to scenic areas or recreation reserves is desirable in most foreshore locations. Access may be by foot, cycle or motor vehicle. Roads should not be located too close so as to reduce the size of foreshore available for recreational use. Provision of walk trails, cycleways and perhaps in some locations bridle tracks may be desirable. Such facilities may be used to link the

town and the foreshore. The Waterways Commission has developed environmental guidelines for the development of dual-use paths. It should be noted there will be occasions where access to conservation areas needs to be restricted in order to protect the flora and/or fauna.

3.3.4 Use of the river

Councils are often asked to consider applications for the operation of commercial recreational activities on the foreshore and water. These may be paddleboats, jetskis or canoes. Such crafts are rented out to users. These activities must be approved by the Department of Marine and Harbours under Section 51 (C) of the Marine Act and are termed Hire and Drive Vessels. Approval may also be required from a waterways management body such as the Swan River Trust. It is suggested that Council consider the following issues when determining such applications:

- current use of the area and possible conflict with existing users,
- added pressure on existing facilities such as parking,
- noise generation and impact on residents, birdlife, etc
- commercial use of public areas and
- problems of erosion and pollution

It may be appropriate for Council to develop a policy or guidelines for determining such applications. A similar strategy should be applied to applications for one-off events such as boat races, etc.

4. CONCLUSION

The Waterways Commission believes that local government has a vital and positive role to play in the protection and good management of the State's waterways. It is hoped these guidelines will help the various Councils as they review and prepare town planning schemes, enact by-laws, approve developments and plan and manage foreshore areas.

The Commission is always willing to provide help and support on waterways matters and can be contacted by phone or in writing for further information and guidance.

REFERENCES

Department of Conservation and Environment (1983) Conservation Reserves of Western Australia. System Reports 1-12. Department of Conservation and Environment (now EPA) Perth Western Australia.

Environmental Guidelines for Dual Use Paths (1988) Waterways Commission Perth Western Australia.

Steering Committee on Canal Development (1984) Recommendations for the Development of Canal Estates. Waterways Commission Perth Western Australia.

Water Sensitive Design Research Group (1990) Water Sensitive Residential Design. Western Australian Water Resource Council Perth Western Australia.

Waterways Commission (1989) Foreshore Management Policy. Waterways Commission Perth Western Australia.

State Planning Commission (n.d.) Guidelines for porotecting watercourse reserves. State Planning Commission, Perth Western Australia.

State Planning Commission (n.d.) Planning considerations in the Metropolitan Region for sources of public water supply and sensistive water resource areas. State Planning Commission Policy DC 6.3 Perth Western Australia.

State Planning Commission (n.d.) Planning for better bush fire protection. State Planning Commission, Perth Western Australia.