



AVON RIVER MANAGEMENT AUTHORITY

AVON RIVER MANAGEMENT PROGRAMME



WATER RESOURCE MANAGEMENT SERIES

WATER AND RIVERS COMMISSION REPORT WRM 11

1999



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COMMISSION



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Water and Rivers Commission
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Foreword

I have lived and worked by the Avon River all my life, as did my father, my grandfather and my great grandfather before me. As a boy I swam in the pools, and fished, hunted and explored along its reaches and rapids. Later, under the guidance of far-seeing people like Jim Masters, I came to learn about the river as a living part of our environment.

A healthy river is one of nature's greatest gifts. It is a source of fresh water, a haven for native plants and animals, a place for recreation, adventure and appreciation of natural beauty. It carried away the floodwaters and it provides a living, ever-changing element to the landscape of our towns and farms along its banks. This is the way the Avon River was in my youth.

In the 1950s I also learnt something else about the Avon River. It was a river in trouble. The waters became polluted with salt and chemicals, many plants and animals began to disappear, and the pools began to fill with sand and silt. The river began to change from a living ecosystem into a drain.

Luckily, these changes did not go un-noticed, and concerned people began to do something about it. The history of the community's response to the Avon River's troubles is described in this Management Programme. Many organisations and individuals have done wonderful work.

But the job has only just begun. It is a huge and complex job and will take many years. The problems of the river must be tackled at their source, in the towns and farms along the river and out on the wider catchment. Like the canary down the coal mine which warns of danger, the Avon River warns all of us of larger land management problems beyond the river banks and pools.

I have found over many years that whenever there is large and complex work to be done and many players involved,

the job is simplified if there is a blueprint for action. That is what this Management Programme sets out to provide. It is a statement of the Avon River Management Authority's plan for the next 20 years, laying down the things we think need to be done and in what order of importance. Our plans are based on the input of local government, ARMA members, the community, river managers, scientists, farmers and recreationists.

ARMA understands that it cannot work alone. Fixing the river means fixing a lot of other things as well. Cooperation among many organisations is therefore going to be essential.

I urge all interested in the future of our great river to read this Management Programme, to comment on it if you think it is deficient in any way and to support it in its implementation. It is a living document and will be upgraded as we learn by experience and study, and listen to what the community is telling us about the sort of river they want.

Finally, I thank the many people and community organisations who contributed to this document and the members of ARMA who put it together.

Doug Morgan
Chairman, ARMA





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1. Introduction

1.1 The purpose and aim of this Management Programme

The purposes and aim of this Management Programme are fivefold:

- To review the critical management issues associated with the management of the Avon River and its tributaries (see Map 1), and recent progress in addressing them;
- To provide a blueprint for management of the Avon River for the next decade;
- To clarify the priorities for action;
- To involve the community in river management decisions; and
- To meet statutory objectives. The Avon River Management Authority (ARMA) may, under Section 35 of the *Waterways Conservation Act 1976*, prepare a management programme for the area under its control, and to keep this plan under review.

Once adopted, ARMA is bound to ensure that its day-to-day decisions and advice are consistent with its Management Programme. The programme does not bind other government or non-government agencies, but having been prepared in close consultation with them ensures that the objectives and priorities adopted by ARMA are credible and achievable.

1.2 The process adopted in preparing this Management Programme

The following process was adopted in preparing this draft programme:

- Existing information was gathered together, and reviewed, including work carried out by the former Avon River Systems Management Committee (ARSMC) and ARMA;
- A draft management programme was prepared and debated/endorsed by ARMA and the Water and Rivers Commission;

- A stakeholder analysis was carried out to identify organisations and individuals with a special interest in the future of the Avon River;
- The draft programme was sent to major stakeholders, in particular LGA, for comment;
- Stakeholders were contacted and invited to make submissions;
- A notice was placed in newspapers circulating in the management area, inviting community input;
- On receipt of submissions the draft plan was revised to incorporate relevant changes; and
- The final management programme was prepared.

The final programme will be gazetted and adopted by ARMA as its blueprint for future work. The programme will be reviewed each year, with a major review at 5 yearly intervals in the future.

1.3 ARMA and its relation to the Water and Rivers Commission

The Water and Rivers Commission (WRC) is the government agency with overall responsibility for management of the water resources of Western Australia. The Commission operates under the headpower of the *Water and Rivers Commission Act (1995)*. The *Waterways Conservation Act (1976)* provides for the management of waterways by the declaration of management areas and the establishment of management authorities. The Commission's primary roles are policy direction and coordination, with policy implementation and planning, local liaison and overseeing works programmes being undertaken in the field by regional staff and Management Authorities, of which ARMA is one.

Under the Act, any waterway in need of coordinated management can be declared a Management Area, with defined boundaries. The powers under the Act then apply to the Management Area. The "inner catchment" of the Avon River has been declared a Management

Note: Appendix 1 contains an explanation of acronyms or abbreviations used in this document



Area under the Act (see Map 2), and the Avon River Management Authority has been created to undertake management of this area. The Authority is community-based and representative of local interests and expertise, and manages the river in accordance with the powers conferred by the Act, the State-wide policies developed by the Water and Rivers Commission and local management guidelines and priorities which it establishes for itself.

1.4 Background: introduction to the river and its catchment

The Avon River is one of the great rivers of Australia. The main channel (from near Wickiepin down to where it becomes the Swan River at Wooroloo Brook) is over 260 km in length. Above this channel there is a vast drainage basin stretching to Dalwallinu in the north, to the east beyond Southern Cross and to the south beyond Lake Grace. On the coastal plain the waters of the Avon eventually become part of the Swan Estuary, before flowing into the Indian Ocean at Fremantle.

This basin has an area of over 120 000 km², larger than the State of Tasmania.

The waterways feeding the Avon arise initially as seepages, soaks, small streams and salt lakes deep in the catchment. In the drier sections of the catchment, the waterways join up and discharge into the Avon River only in above-average wet years or when heavy summer rains (associated with a cyclone or rain-bearing depression) are followed by a wet winter. At other times, the inland sub-catchments drain internally into salt lakes or chains of salt lakes.

The river has a number of significant tributaries. The major tributaries are the Dale River which drains western sections of the middle catchment; and the Mortlock Rivers (North, South and East Branches), the Mackie River and the Yenyenning Lakes/Salt River valley system which drains catchments to the north and east.

A feature of the middle section of the main river channel (between Beverley and Toodyay) are the deep pools, which once had high aesthetic, nature conservation and recreational value. These pools have been filled, or are filling with sediment, and are one of the most threatened aspects of the Avon system.

From a geographic river perspective the Avon River is unusual in two respects: Firstly, in contrast to conventional rivers it arises in a broad, flat geologically ancient landscape and for most of its length has a very low gradient. As it leaves the areas of ancient drainage and flows downstream through the areas of mature and then rejuvenated landscape the river valley becomes steeper, more rugged and narrower. Secondly, the river flows only intermittently, with streamflow commencing in the autumn and continuing through to mid-summer, after which it dries up to pools and billabongs.

The Avon is a highly disturbed river, its hydrology, ecology and stream flow having been upset by the clearing of the catchment woodlands for agriculture, the establishment of urban populations in towns in several places along the riverbank, and the clearing of the river banks and deepening of the river channel for flood mitigation.

These factors offer a special challenge to river managers.

1.5 The natural values of the Avon River

Before and in the early days of European settlement the Avon River had many natural physical and cultural values.

The main river channel was originally braided, with many small channels interweaving between thickly vegetated islands, and punctuated by numerous deep, shady pools. The river and its adjacent woodlands abounded with animal and bird life. Further east in the catchment beautiful lakes were surrounded by wooded hills.

The river (like all rivers) did originally contain sediment and a bedload of sand and silt, but prior to settlement this material was in equilibrium with natural gains (through erosion of stream banks etc.) and losses (through downstream transport) being in balance.

The river was a prime food and a profound spiritual resource to the Aboriginal people, and it is still part of a significant songline or dreaming trail to the Nyoongar people.

After settlement, the river was used for domestic and stock watering, as a source of fish and game and as a source of recreational pleasure to local people. It was also an interesting feature of the ecosystem with



characteristic riparian and aquatic vegetation and wildlife. The river is a central landscape feature of the region and of the towns of Beverley, York, Northam and Toodyay.

The original values were largely intact until about the 1940s and 1950s, but have since been seriously degraded as a result of the impacts of settlement, river training, grazing and salinisation.

1.6 Impacts of settlement: major influences

Western Australia's first inland agricultural settlement was at York on the Avon River in 1830. Rapid development followed with the opening up of the Avon Valley and then the hinterland of the wheatbelt. The bulk of the catchment was settled within 100 years and was cleared within about 150 years.

The major influences on the river of this development have been:

The clearing of the woodlands and sandplains

The widescale clearing of the natural bushland and its conversion to pasture and cropland has resulted in a major disturbance to the natural hydrological cycle. The result has been rising groundwaters and the movement of salt from stores deep in the soil to the surface where it has entered streams and rivers. This has turned the Avon from a marginally fresh river to a permanently brackish to saline river.

It is estimated that over 75% of the original woodlands and heath vegetation on the catchment have been cleared, and most of the fringing vegetation along the river and around the major lakes has been degraded by grazing and rising salinity.

Farming practices which "leak" sediments and nutrients into watercourses

The broadacre cropping systems which have been employed over many years in the catchment of the Avon River result in (i) the erosion of surface soils by wind and water and the movement of these soils into watercourses; and (ii) the leaching of phosphate and nitrogenous fertilisers down the landscape to enter streams and the river. Nutrients can also leach in a more concentrated form from intensive agricultural pursuits

such as piggeries, cattle feedlots or market gardens, and in some cases agricultural herbicides and pesticides can also drift or leach into the river system.

Grazing the river flats and fringing vegetation

The bulk of the river environs has been heavily grazed over the last 150 years. Mostly this was by sheep, but also in some places by cattle, horses and goats. This has resulted in a gradual replacement of many native grass species by introduced grasses, a loss of regeneration of tree and shrub species, compaction of the soil and damage to river banks.

Drainage of agricultural land

Excess water on farmland is a problem, because of recharge of saline groundwaters, soil erosion and waterlogging of cropland. An approach to dealing with this problem favoured by some landowners is to construct deep drains which carry water directly into watercourses or lakes. If not managed carefully, this practice can lead to increased salinisation and sedimentation of streams, rivers and lakes, and to unsightly scars on the landscape. Deep drains and their management are becoming one of the most important issues in the catchment.

The development of towns and other urban settlements

Human settlements generate waste. Traditionally liquid wastes from settlements along the Avon River have ended up in the river (through direct delivery of waste water or by leaching); solid wastes have usually ended up in rubbish dumps and in many cases these dumps are located adjacent to the river, creeks or lakes of the Avon basin.

Towns, settlements and hobby farms are also a major source of weeds (escaped garden plants) and feral animals (especially cats). They often generate unsuitable recreational pressures on the riverine environment (such as uncontrolled trail bike and horse riding), or new grazing pressures by domestic animals and the release of exotic species.

Engineering works, including roads, railways and bridges

The Avon River is crossed by numerous road and rail bridges, pipelines, powerlines and other infrastructure crossings. In the upper catchment road and rail



embankments cut across natural drainage lines and act as artificial barriers to conductors of water. Gravel roads are a primary source of silt in waterways, especially where cut-off side drains are purposefully directed into streams and gullies.

The River Training Scheme

From the earliest days of observations the Avon River has been subjected to heavy floods about one year in ten. The largest flood ever recorded was in 1872, well before the impact of clearing in the catchment had become pronounced. With the growth of towns along the river, especially Northam, Toodyay and York, and also with the development of valuable agricultural land on the river flats, floods began to take a more serious toll of lives and livelihoods. Community concern climaxed after the great flood of 1955, which caused serious problems in Northam, York and Toodyay. This led to a decision to “train” the river — that is, to employ bulldozers to remove the braided channels, clear and deepen the main river channel and remove riverine bushland, so as to allow floodwaters to move more rapidly through the Avon valley. The River Training Scheme operated from the mid-1950s to the mid-1970s, and the bulldozing occurred from near Cobbler’s Pool (downstream of Toodyay) to Brookton.

It is not known whether or not the scheme has been effective in preventing a repeat of the 1955 floods, since rainfall in general has been below average over the last 25 years. It is likely that the scheme has been effective in mitigating the effects of minor flooding in some places. However, it has had disastrous effects on the river and riparian vegetation. Although in many places the banks of the river have begun to revegetate, the main impact was the speeding up of the river and the mobilisation of sediments along the riverbed; this in turn has resulted in the filling of most of the river pools.

Loss of wildlife, and the introduction of exotic weeds, and feral and pest animals

The Avon River and its fringing vegetation were once rich in native flora and fauna, especially birdlife. Over 90 species of birds have been recorded in the Avon valley alone, and of these 53 species breed on the river or lakes. Much of the mature habitat for animal life along the river has been lost, or greatly modified, and the aquatic habitat has been degraded by salt, nutrients and sediments. There is some evidence that birdlife and the macro and micro fauna of the river is changing to a

more salt-tolerant suite of species.

The narrow fringe of riparian vegetation along the river which remains represents the last refuge for birds and other fauna in many parts of the heavily cleared wheatbelt landscape.

A changed fire regime

No-one knows, or can accurately reconstruct the fire regime which would have occurred along the river and in the adjacent woodlands in pre-settlement times. Three things, however are certain:

- fires would have occurred periodically, either as a result of deliberate regular burning by Aboriginal people, or as a result of lightning strikes;
- it would be most unlikely for fires to occur in the one place more frequently than every three years; and
- although regeneration events along the river are closely linked to flooding, the flora and fauna of the bush were well able to regenerate after fire, or to recolonise burned areas from unburned areas.

There are now far more sources of fire, including arson and autumn stubble burning on adjacent croplands, and there is a far more hazardous fuel present, in the form of annual grasses such as wild oats. This has led to a situation where it is possible for parts of the riverside bushland to burn every year, so perpetuating the growth of weeds, and the progressive burning down of old trees without replacement.

Recreational use

The river (and many of the inland lakes) have always been an important resource for recreation, but over the years the form of recreation has changed. In the early days of the 20th century there were swimming clubs associated with every town along the river, and boating was popular on the pools. Duck shooting and fishing were also popular, along with more sedate forms of recreation such as picnicking, nature study, photography, walking and horse riding. Swimming scarcely occurs at all in the river these days, and the most popular forms of recreation tend to be motorised (water skiing on the lakes, power boating, motor cycling or 4-wheel driving) or white-water events such as canoeing and rafting.

Overall to date, recreation has not had a major effect on the river or its environment. Potential impacts, such



as those associated with powerboat use in the Avon Descent or skiing on the Yenyenning Lakes, are subject to special environmental management plans.

1.7 River management

Management of the Avon River is a relatively new phenomenon. In the early days, the river was expected to look after itself, or it was modified to fit human needs of the time. Often the river was regarded solely as a drain, or a dumping ground for unwanted waste products of urban or rural life. In the 1950s direct intervention in river processes took place in the form of the River Training Scheme, with the objective of flood mitigation. It was not until the 1980s that proper river management began. There have been three critical phases:

Phase I: The Avon River Systems Management Committee

Growing concerns about the condition of the river, especially in the light of the River Training Scheme, resulted in Local Government Authorities along the river and through the catchment forming a committee to identify the issues and develop a plan of attack on them. This committee became the Avon River Systems Management Committee (ARSMC) which was established in 1984 and was representative of all shires within the catchment of the river, each of whom were entitled to nominate a member. The committee had 12 members, and concerned itself both with the problems of the river and those of the catchment.

The ARSMC had no legislative base and no statutory powers. It therefore set out to achieve its objectives through advice, persuasion and education.

The committee's aim was "*To manage the Avon River System for social, economic and environmental reasons*" and its key objectives were to:

- reduce the rate of water discharge into the river system;
- encourage improvement in water quality;
- collect, collate and publicise existing information about the river system;
- seek financial and scientific assistance; and

- establish and review policies to implement the objectives of the committee.

In 1989, the Minister for the Environment suggested to the committee that they develop a management strategy for the river system. Funds were obtained from LGAs and encouragement and financial assistance was provided by government agencies (in particular the Waterways Commission) to do so. There was an extensive programme of public consultation. The result was *The Avon River System Management Strategy*, which was published in 1993. This followed an earlier release of a draft strategy and consideration of community input. The final strategy is professional, comprehensive and detailed, and spells out 116 separate recommendations relating to aspects of management of the river. The report and its recommendations were accepted by government.

A major recommendation of the ARSMC report was that the government appoint an authority with statutory powers to manage the river. This resulted in the formation of the Avon River Management Authority (ARMA). Several members of the ARSMC became foundation members of ARMA. In 1995, after ARMA had become well established, the ARSMC decided to disband, and now no longer exists.

The ARSMC's Management Strategy is the key document on which the current Management Programme is based.

Phase II: The Avon River Management Authority

After consideration of the recommendations of the ARSMC and community submissions, the government decided, in December 1993, to establish an Avon River Management Authority. The Authority was established under the Waterways Conservation Act 1976-1982, and is one of five similar bodies set up in Western Australia (for example the Peel Inlet Management Authority and the Albany Waterways Management Authority).

The establishment of ARMA brought into being for the first time a local body with powers to act to manage the Avon River. The Act provides ARMA with power to (i) act to protect and enhance the Avon River watercourse and its banks, and (ii) advise and cooperate with local government authorities, other government agencies, community groups and landowners over the management of foreshores and the wider catchment.



Although the Act allows ARMA to control a number of activities carried out within the river and (to some extent) on its foreshores, it does not empower the Authority to control activities on the wider catchment - for example to control farming practices leading to erosion and nutrient export. In this respect, ARMA may act only as an advisory and coordinating body, and in support of other agencies or groups acting to protect the integrity of the river system.

ARMA's principal area of interest is the western one-third of the catchment, or the Avon sub-catchment. This is designated as "the Management Area". This area was identified as being the part of the catchment most in need of initial attention. Furthermore, the problems of the Yilgarn and Lochardt sub-catchments are primarily related to land management, rather than to river management at this stage.

Map 2 shows the Avon River Catchment, and ARMA's Management Area.

The Authority originally comprised a local independent chairman, two representatives of Local Government, six community representatives and three State Government agency representatives. Members are appointed by the Governor on the recommendation of the Minister for Water Resources. (At the time of writing this Management Programme, these arrangements were under review).

ARMA met for the first time in December 1993. Since then it has developed its own mission, vision, objectives and priority strategies (these are described below) and has made significant progress with implementing the recommendations of the ARSMC and with its own agenda. Major achievements have included:

- a preliminary survey of the Avon River channel has been undertaken;
- a survey of all the major river pools has been completed;
- a computer data base has been developed delineating and describing all of the sub-catchments of the river basin;
- water quality monitoring sites have been established along the river;
- over 40 years of observations of birdlife on the river have been collated;

- ARMA members have undertaken a study tour of the eastern states and have made a number of study tours within the catchment; Authority meetings have been held at Northam, Toodyay, York, Beverley, Brookton, Wongan Hills, Quairading and Corrigin;
- a major river fencing project has been instigated, and has resulted in 101 km of new fence protecting the river, plus management agreements with landowners;
- rehabilitation work has commenced on Gwambygine Pool and Burlong Pool;
- ARMA has continued to support the Avon Ascent programme and assisted with the development of a management plan for Gwambygine Park;
- ARMA has assisted to develop and implement Environmental Management Plans for the Avon Descent and the Yenyenning Lakes, and Sediment Management Plans for Burlong and Northam Town Pools;
- dealt with numerous development applications and provided advice to planning authorities on the basis of improving river conservation;
- developed policies on fire, recreation, finance.
- a catchment water quality monitoring programme is being put in place;
- an information network facility has been developed;
- research into land use planning has been commenced;
- ARMA has taken a lead role in the formation of the Swan-Avon ICM Coordinating Group and continues to contribute to this group and to the Avon Working Group;
- raised awareness of the issue of rural drainage;
- a leaflet on River Management Principles has been published, and a workshop on River Restoration has been hosted;
- ARMA has introduced a new award, the Accredited River Manager, for positive contributions by members of the public to river conservation; and
- A Communication Strategy has been developed to assist ARMA in promoting the message of good river management to stakeholders and the community.



This Management Programme sets out ARMA's plans for the next 10 years.

Phase III: ARMA's involvement in the Swan Avon ICM and the Avon Working Group

In 1994 the Waterways Commission, ARMA and Agriculture WA pioneered the establishment of WA's first regional initiative aimed at the holistic management of a river system and its catchment. This is the Swan-Avon Integrated Catchment Management Initiative, funded jointly by the Commonwealth and the Western Australian governments, and aimed at recovery and good management of the whole catchment area of the Swan and Avon Rivers.

Within these new arrangements ARMA has played a highly significant role. Overall it continues to be the body with statutory powers with a specific interest in the recovery and management of the Avon River. What the ICM Initiative provides is a forum for cooperation and an opportunity for ARMA to have input to management of the broader catchment of the river.

Since its inception, the Swan Avon ICM programme has developed dramatically. The key developments are as follows:

1. An active programme of community consultation, involving workshops in the regions and surveys to determine community views on issues and priorities.
2. The establishment of a community-based structure to oversee the programme. This comprises the Swan-Avon ICM Coordinating Group and two Working Groups, one each focussing on the Swan and the Avon sub-regions. Membership of the groups is drawn from the communities represented and supporting agencies. The Chairman of ARMA is a member of both the Coordinating Group and the Avon Working Group (AWG).
3. Regional support staff have been put in place and a wide range of projects have been initiated on the ground. The primary impetus for this development was the injection of Federal and matched State funds which occurred in 1994.
4. A community information programme has been developed and is being put into place. This

encompasses the formation of two Catchment Centres, whose primary role is information networking for integrated catchment management in the Swan-Avon catchments.

5. The Swan-Avon ICM Coordinating Group have recently started to prepare a strategic plan in which their goals and priorities are set out for the years ahead.

1.8 Other contributors to management

There have been many individuals and groups in the community who have contributed to the protection and conservation of the Avon River over the years. Both the ARSMC and ARMA have strongly encouraged community input to river management.

Amongst the most important contributors are:

Local Government Authorities (LGA's). in the catchment have a significant input to land use decisions through their town planning schemes, management of refuse sites and road drainage. Several Shires have set a good standard over many years in the designation of foreshore reserves along the river at the time of land subdivision or amalgamation. The Northam Shire took a lead role in persuading other Shires along the river to cease the River Training Scheme.

The Toodyay Naturalists' Club (Inc). The Toodyay Naturalist Club has had a long term interest in the river and its wildlife and has promoted conservation based on sound knowledge and good observation. The Club was instrumental in raising community concern about the plight of the Avon River in the 1970s, and supported the formation of ARMA.

Jim Masters OAM. A major contributor has been Mr Masters, a Northam farmer and naturalist who has lived on the banks of the Avon River for many decades. Over this time he has studied river processes and wildlife, and has kept meticulous records. He argued against the River Training Scheme, and has developed a set of River Management Principles which have been published and adopted by ARMA.

The River Conservation Society. The River Conservation Society is a community group at York concerned about the river ecosystem and its physical



processes. The Society contributed to the ARSMC Report, and strongly supported the formation of ARMA. It has been responsible for river channel and biological surveys, river fencing, revegetation, education and for promoting protection of river values.

The Yenyening Lakes Management Group. The Yenyening Lakes Management Group is a committee of farmers, government officers, recreation interests and local government representatives concerned about the use and management of the Yenyening Lakes and surrounding lands. The Group has prepared and published a detailed and comprehensive strategy aimed at restoration of the lakes, protection of the Avon River and surrounding agricultural landscapes, and management of recreational use of the lakes, and has undertaken a range of conservation measures.

LCDCs and Local Catchment Groups. Every Shire in the catchment has a Land Conservation District Committee and there are many local catchment groups. These organisations comprise landowners committed

to the sustainability of agricultural production through improved planning, better farming practices and other conservation measures. This work ultimately contributes to the sustainable management of the Avon River.

State Government agencies. A range of State Government agencies contribute to management and conservation of the river, either directly or through management of land in the catchment. These include the Water and Rivers Commission (which has a primary function associated with waterways conservation, and which is the supporting agency for ARMA), Agriculture WA, the Ministry for Planning and the Department of Conservation and Land Management.

Numerous individuals. Too numerous to mention by name are the many landowners and community members who have contributed in a quiet and personal way to the well-being of the river and the lakes, by fencing, stock management, tree planting and landcare works.



2. The resource

The physical characteristics, water quality and wildlife of the Avon River are described in detail by Harris (1996) in his publication *“The Avon An Introduction”* and Kendrick (1976) in his paper *“The Avon: Faunal and Other Notes on a Dying River in South-Western Western Australia”*. The following draws on their work.

2.1 The physical characteristics of the Avon River

The Avon River and the Swan River are in fact the same river. There is no “confluence”. The two names simply represent an historical anomaly. The Avon is taken as that section of the river inland of the entry of the Wooroloo Brook at Walyunga. The main waterway of the river is discernible upstream to Wickepin. The South Branch of the Avon arises near Pingelly and flows through Brookton and joins the main river channel downstream of the Yenyenning Lakes.

Along most of its course down to Toodyay the gradient of the river bed is gentle, falling at only about 0.8 metres per kilometre. Below Toodyay the gradient steepens to 1.6 m/km. The river valley is very wide (77 km) near its source and narrows to 5 km or less below Toodyay.

The Upper Avon River (above Beverley) is a meandering watercourse with a very low rate of descent. This section of the river and its catchment lie to the east of the Meckering Fault, a line which separates the old landscape of low relief and broad valleys from the younger rejuvenated landscape to the west which is characterised by steeper valleys and swifter streamflow. The Upper Avon is connected to the Avon South Branch, which rises above Brookton, and the Yenyenning Lakes, which in turn are connected to the vast inland catchment via the Salt River Valley and chains of salt lakes stretching to the east and south.

The Middle Avon River (Beverley to Toodyay) is a well defined watercourse with numerous pools and braided reaches, flowing generally north and northwest. In this

section the river is joined by a number of significant tributaries:

- The Dale River (which takes the waters of the Talbot Brook);
- The Mackie River;
- Bland Brook;
- Spencers Brook;
- The Mortlock Rivers (North Branch, South Branch and East Branch);
- Wongamine Brook;
- Harper Brook; and
- Boyagerring Brook.

Of these tributaries, the Mortlocks are particularly significant in terms of their contribution to streamflow (especially in dry years) and salt load.

The Middle Avon River lies mostly to the west of Meckering Fault and is the first section with a sustained increase in rate of descent. This section of the river is crossed by numerous rock bars and narrow dolerite dykes.

The Lower Avon River (below Toodyay) flows westward through the Darling Range, with increasingly narrow gorges, rapids and waterfalls. This high rainfall area makes a significant contribution to river flow, especially from the main tributaries:

- Toodyay/Yulgan Brook;
- Jimperding Brook;
- Julimar Brook;
- Red Swamp Brook;
- Brockman River; and
- Wooroloo Brook.



2.2 River flow

As a general rule the Avon River has a continuous flow only in the winter and spring months. In discussing river flow, it is therefore necessary to deal separately with the winter Avon and the summer Avon.

River flow is determined by seasonal rainfall and evaporation patterns and events. The Avon River catchment falls within a typically Mediterranean climatic zone, with hot dry summers with very high rates of evaporation, and cool rainy winters. Most summers experience occasional intense thunderstorms or the passage of a rain-bearing depression originating from a cyclone crossing the State; both can bring intense rainfall events in the catchment. Otherwise, annual rainfall is determined by seasonal winter conditions, with rainfall occurring mainly in June, July and August. Winter rains can vary greatly. In the two years 1914 and 1940, winter drought resulted in no river flow.

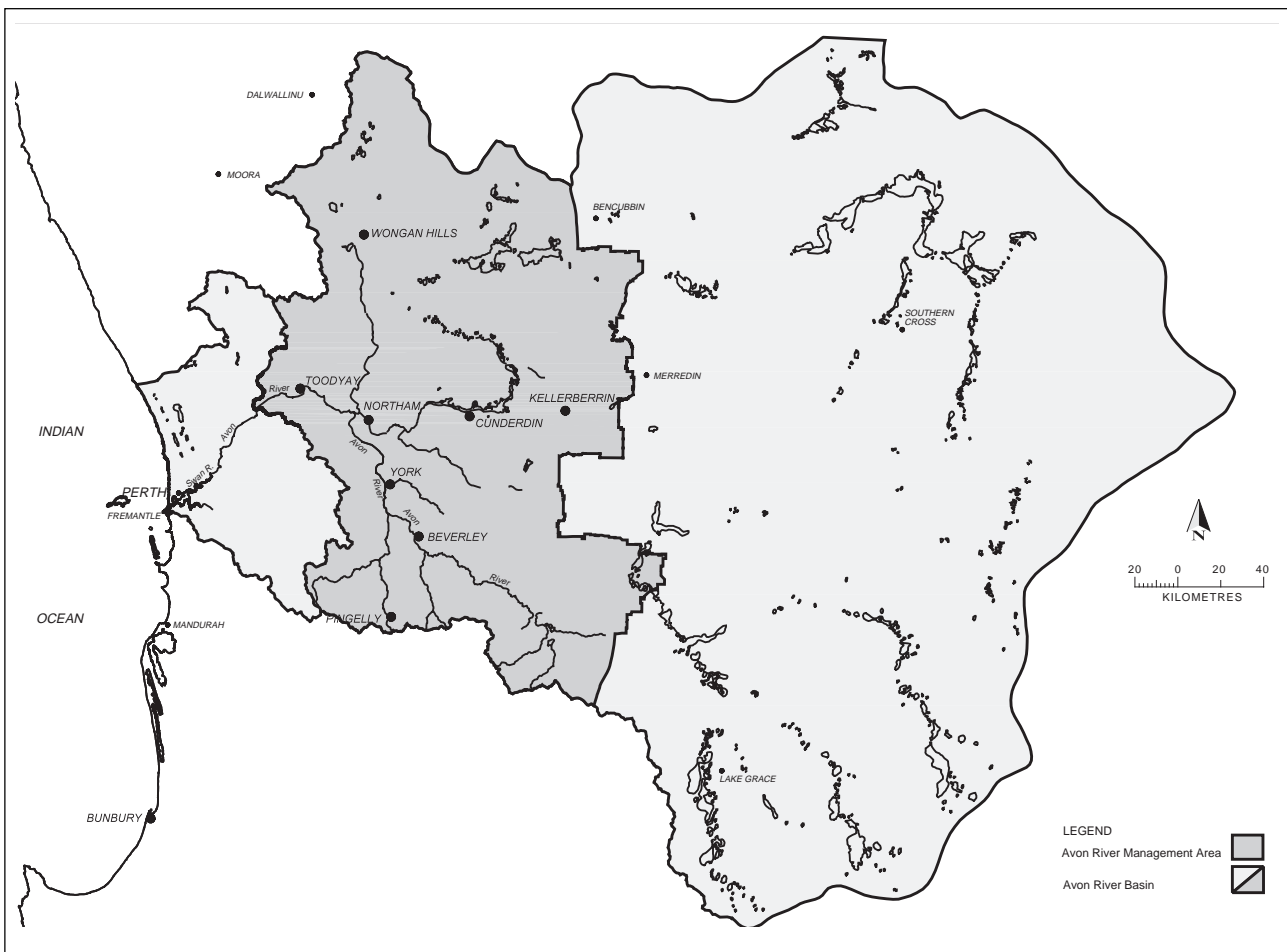
Throughout the Avon Catchment evaporation exceeds rainfall for most of the year.

The winter Avon usually commences to flow in April after the onset of winter rains and with falling temperatures and evaporation. In most years flow diminishes or ceases before Christmas. At Broun's Farm (between Beverley and York) the river flows on average for 286 days or 78% of the year; at Walyunga where the Avon becomes the Swan River, the average flow is 310 days or 85% of the year.

However, these averages do not reflect the extreme variability between years. In a dry year, the river above Broun's Farm contributes only 12% of river flow; in a wet year this can rise to over 40%.

The summer Avon sometimes flows strongly and briefly in response to heavy rainfall events. These events can have serious impacts in terms of erosion and delivery of sediment and organic material to the river.

The rate of flow of the Avon River is estimated to have increased by a factor of 3 to 4 since the River Training Scheme and the clearing of the catchment.



Map 2. The Avon River system



2.3 Floods and flood management

Flooding in the Avon River is the subject of a detailed report by Binnie and Partners (1985). Harris (1996, page 31) has summarised this information, and has developed a table which shows the major historic floods on the Avon River and modelled flows, since rainfall records began in 1877. The major flood years have been: 1910, 1917, 1926, 1930, 1945, 1946, 1955, 1958, 1963, 1964 and 1983.

Flooding of riverside towns (Beverley, York, Northam and Toodyay) and of agricultural land along the river was the principal concern which led to the River Training Scheme. This involved:

- removal of channel vegetation and debris to a width of 60 metres;
- removal of dead trees, logs and debris which impaired the river flow;
- ripping of the river bed to induce erosion of a deeper watercourse;
- removal of minor kinks and bends in the river.

This work was carried out along the whole river, rather than being restricted to the sections of the river flowing within the towns. The success of the scheme in ameliorating townsite flooding is unresolved. No floods have occurred in this time, because rainfall has generally been lower than average over this period.

2.4 The inland catchments

The central and eastern sections of the Avon River catchment are generally of low relief in which drainage is often internalised other than in times of well above normal rainfall. These areas are characterised by the following features:

- the river tributaries flow only intermittently, depending on rainfall;
- drainage lines usually comprise chains of shallow salt lakes;
- the contribution to water flow in the Avon River is generally less than 10%;
- the contribution of salt is very high as all tributaries carry hyper-saline water; and

- the bulk of the central catchment is cleared fringing vegetation along ephemeral watercourses and around lakes and swamps is usually degraded or has been killed by salt or waterlogging.

The significance of the inland catchments to the Avon River is related to salt-delivery and flooding. The main salt sources for the Avon are the Mortlock Rivers, the Mackie River and the Yenyening Lakes/Salt River system, all of which drain the catchments east and north (inland) of the river.

After exceptional rains, especially in the situation where the inner lakes systems are filled by widespread summer cyclonic rains, and these are followed by above-average winter rains, floodwaters will arise in the central and eastern catchments and eventually discharge into the Avon River. This is likely to be a 1:100 year event.

2.5 The river pools

Between Cobblers Pool to the west and the Yenyening lakes to the south-east there were originally (prior to the River Training Scheme) 26 major pools in the Avon River, some of which were said to be over 10 metres in depth. The pools are characteristically about 70 metres in width, and vary in length from 370 metres to 2 kilometres. Pools occurred at a spacing down the river between 16 and 20 times the width of the river. This is a low density of pools compared with many rivers elsewhere.

The reason for pool formation in the Avon River is not fully understood. There are several theories, but none explain all the pools. One view is that the pools appear to have formed where the river channel was constricted by both banks; another is that their location is related to the presence of dolerite dykes. Although sediments were always present in the river and the pools, they are no longer in equilibrium, and have become a threat to pool survival. Prior to the River Training Scheme (RTS), the pools were features of the river, being enjoyed for swimming and fishing and for their shady beauty.

Many of the pools are now filling with sediment as well as being subject to eutrophication as a result of nutrient enrichment.



The following pools are now **totally filled**:

- 3 Mile Pool • Egoline Pool • Muresk Pool
- Deepdale Pool • Cold Harbour Pool • Mt. Hardy Pool
- Burlong Pool • Fleay's Pool

The following pools are **almost filled**:

- Speldhurst Pool • Tipperary Pool • Broun's Pool
- Katrine Pool • Diving Pool

All pools are subjected to sedimentation. Gwambygine Pool and Beverley Town Pool have been recently excavated, and sand has been excavated from Burlong Pool for many years.

Table 1 below demonstrates the changes to the dimensions of selected pools since 1960:

In addition to sedimentation, pools are also threatened by the growing problem of eutrophication stemming from nutrient enrichment. Nutrient loads arise from fertiliser, sewage and organic matter entering the river and its tributaries. This problem is not well understood. Algal blooms associated with eutrophication have occurred regularly in the Northam Town Pool, Glen Avon Pool and Brookton Pool in recent years.

2.6 The lakes

The landscape of the inner catchment features numerous lakes. These are of varying sizes and depths, and mostly share the following characteristics:

- Lakes occur at the low point of inwardly-draining catchments. In most years evaporation exceeds input and the lakes do not flow. However, in wet years or above-average rainfall periods, the lakes will fill and overflow from one to the other down a drainage line. Eventually the discharge reaches the Avon River.
 - The natural hydrology of many lakes has been artificially disturbed over the last 50 years, as a result of road crossings or bars at the natural outlet; the construction of drains into the lakes, or the rerouting of natural drainage channels; and abnormal groundwater discharge since the clearing of the recharge areas higher in the catchment.
 - Most lakes are highly saline. Salinity varies with seasonal factors: it is highest at the end of summer, and lowest when heavy rainfall causes the lakes to fill with fresher water which dissolves salt from the lake floor and eventually flushes saline water downstream. The main sources of salt inflow into the inland lakes are (i) salt lakes upstream and (ii) saline groundwater moving beneath cleared farmland.
- Many lakes are also fed by freshwater soaks, springs and streams. These are usually found below high sand hills which collect and discharge rainwater without intersection with saline groundwaters.
- Fringing lakeside vegetation has become significantly degraded in recent years, especially since about the 1940s. The causes are increased salinity, higher water levels for longer in the year leading to seasonal waterlogging of bushland, and the effects of grazing by sheep and rabbits.

Table 1: Changes to pool lengths (metres) 1960-1996

Pool Name	1960 length (m)	1985 length (m)	1996 length (m)
Beverley Town	444	400	310
Broun's	610	610	500
Gwambygine	1 109	1 150	800
Cold Harbour	570	0 (filled)	0 (filled)
Tipperary	1 180	1 250	340
Burlong	855	0 (filled)	0 (filled)
Katrine	640	820	280

[Data from Jim Davies and Associates, and Ecosape, Avon River Pool Survey 1997]



- Many lakes are popular recreation areas, formerly for shooting ducks (now illegal), more often for water skiing, sailing and canoeing.
- Some lakes are used as rubbish dumps
- The fringes of some lakes are mined for gypsum.

In two areas, Management Plans have been prepared to cover lake management and recovery. These are the Yenyenning Lakes and the Baandee Lakes at Kellerberrin. For most other lakes, little attention is currently being given to conservation or management.

2.7 Flora and fauna

The Avon River system is geographically huge, and intersects an extensive cross-section of the southern part of the State. Gradients of rainfall, geology, soils and topography are reflected by the range of vegetation types and wildlife which occur along the river from its source to where it becomes the Swan. These patterns are overlain by seasonal changes associated with the different character of the summer Avon and the winter Avon.

Although the biological survey of the wheatbelt is ongoing no detailed biological survey of the river has ever been undertaken. Individual sections or features have been studied in detail and over time, a good example being the work of Jim Masters and other members of the Toodyay Naturalists' Club. This work is summarised in a publication by the club, which in turn is summarised by Harris (1996). A biological survey of Gwambygine Pool (1998) has also been completed.

In essence, the once diverse and well adapted wildlife which dwelt in and along the river and the lakes is now becoming more simplified in terms of species numbers (mainly as a result of a more saline and contaminated water body) and less abundant in terms of total numbers of plants and animals (mainly as a result of clearing, grazing, loss of habitat and breeding opportunities, and the advent of invasive weeds and feral predators). The River Training Scheme and rising saline groundwaters beneath or adjacent to the river have been additional significant factors in changing the ecology of the river system, principally through the bulldozing of old trees, which are important because their hollows provide nest

sites, and through the destruction and salinisation of the river pools.

Change associated with mismanagement of the river has not disadvantaged all species. For example, the dramatic replacement along many parts of the river of flooded gum (*Eucalyptus rudis*) by swamp sheoak (*Casuarina obesa*). Although both species are native to the middle section of the river, the latter is far more salt-tolerant and a prolific seed-producer, with the ability to recolonise sites rapidly after fire or flood. Unless a more salt-tolerant provenance of flooded gum can be developed and used in regeneration work along the river, it will eventually be totally displaced by swamp sheoak in many places.

Thorough biological survey of the river system as a basis for restoration of natural biodiversity and control of introduced species, is a high priority for management.

2.8 Subdivision of the river into 18 management sections

As a means of focussing river management, ARMA has subdivided the main river into 18 sections. The sections provide a way of taking a systematic approach to research studies, recovery planning and community relations.

The names, numbers, description and lengths of the river sections are shown in Table 2.

2.9 Recent research and surveys

ARMA has itself undertaken, or has commissioned a number of recent surveys or special studies along the river. The most important are:

- a high resolution River Channel topographic survey;
- a detailed description of the ecological characteristics of catchments within the Avon River basin;
- development of a land suitability analysis procedure for the identification of potentially polluting land uses;
- a River Pools survey;
- a major tributary water quality survey.

All the research studies have been written up, and are available in the form of reports from ARMA.



Table 2: The river sections

Section Name	Section Number	Description	Length (km)
Cobblers Pool	1	Upstream from Avon Valley National Park to confluence with Jimperding Brook	11.23
Deepdale	2	Confluence of Jimperding Brook to Crossing of Deepdale Road	8.14
Toodyay	3	Deepdale Road to Goomalling Road Bridge, including all of Toodyay Town upstream of the bridge on the south bank of the river	9.16
Extracts	4	Goomalling Bridge to Glen Avon Weir	11.30
Katrine	5	Glen Avon Weir to Northam Town Weir	17.45
Northam	6	Northam Town Weir to confluence with Spencer's Brook	10.13
Muresk	7	Spencers Brook to Wilberforce Crossing	8.75
Wilberforce	8	Wilberforce Crossing to Burges Siding	9.08
York	9	Burges Siding to Balladong Road Bridge	12.05
Cold Harbour	10	Balladong Bridge to Gwambygine East Road	11.40
Gwambygine	11	Gwambygine East Road to Oakover Crossing	5.83
Dale River	12	Oakover Crossing to Top Beverley Road	12.09
Beverley	13	Top Beverley Road to Beverley-Mawson Road	6.81
Kokeby	14	Beverley-Mawson Road Bridge to confluence with Avon River South Branch	21.67
Jurakine	15	Avon River South Branch to Johnson Road	5.51
Qualandary Crossing	16	Johnson Road to Qualandary Crossing	12.17
Yenyenning Lakes	17	Upstream from Qualandary Crossing	Indeterminate
Brookton	18	Confluence Avon River South Branch to Brookton Townsite	18.46



3. The management issues

During the preparation of this Management Programme members of the public, government agencies, Local Government Authorities and community and interest groups were invited to provide ARMA with their views on what constituted the most critical management issues for the Avon River. This input added to the considerable body of information gathered earlier by the Avon River System Management Committee.

The following key issues are identified. They are not presented in any order of priority.

1 Water quality

- *Salt*: preventing the river from becoming more saline, and over time, reducing salinity to acceptable levels and protecting fresh water inflows;
- *Sedimentation*: reducing the inflow of sediments into the river and lakes;
- *Chemical pollution and contamination*: stopping the use of the river for disposal of urban, industrial and agricultural effluent and leachates; and
- *Eutrophication*: ensuring that conditions conducive to algal blooms do not arise in the river.

2. Restoring the natural character and functioning of the river system

- *River pools*: protecting existing pools from degradation and restoring degraded pools;
- *River channel stability*: reducing downstream movement of the river bedload to acceptable levels; and
- *River speed*: reducing the speed of the river to something close to its original flow character.

3. Biodiversity within the riverine ecosystem

- *The fringing vegetation*: restoration of diverse and healthy woodlands along the waterways and around the lakes;

- *Aquatic biota*: conserving and rebuilding the biota of the waterbodies;
- *Birds and other wildlife*: conserving and enhancing habitat, food and shelter for the wildlife of the river system;
- *Weeds*: eliminating invasive and hazardous weeds from the river and its fringes; and
- *Feral and pest animals*: controlling animals such as the rabbit, fox and feral cat.

4. Human and industrial impacts

- *Grazing*: controlling grazing by domestic animals within riverine areas;
- *Fire*: minimising frequent uncontrolled fires;
- *Recreation*: managing recreational pressures on the river and its banks and floodplain;
- *Drainage*: managing drainage and pumping effluent into the river and lakes so as to minimise undesirable impacts;
- *Crossings*: ensuring road, rail, pipeline and other river crossings are engineered to minimise the environmental impact;
- *Water use regulation*: managing water extraction and diversion of water to and from wetlands; and
- *Flood mitigation*: minimising the impacts of floods on towns, farms and settlements and the impact of the latter on the former.

5. Planning

- *Subdivisions*: the need for consistent policy along the river, and recognition of threats to the river;
- *Urban design and wastewater issues*: the need to ensure new urban development (including sewerage from existing urban areas) does not degrade the river;



-
- *Integrated management*: the need to integrate management of the river with management of the catchment; and
 - *Foreshore management*: creation of reserves or binding management agreements to ensure conservation management of areas adjacent to the river.

6. Management of the catchment beyond the river and lake banks

- *Management of grazing and cropping*: introduction of sustainable farming practices on the catchment through the process of integrated catchment management;
- *Revegetation*: especially of floodplain, along the tributaries and of recharge areas;
- *Intensive agriculture*: management of activities such as piggeries or vegetable growing to ensure no undesirable impact on the river system; and
- *Protection of waterways*: within landcare programmes.

7. Research and education

- *Need for an ongoing* and wide-reaching research programme directed at river and lake conservation;
- *Education programmes* for school children, people in country towns and in the city about river problems, needs and solutions;
- *Education of landowners* about waterways protection and restoration, and the need for changed farming practices on the catchment so as to reduce nutrient and soil loss; and
- *Education of planners and urban managers* about need for urban design and waste-management systems needed along the river.

8. River management

- *Resources*: ARMA needs money and staff to do its job;
- *Community support*: ARMA needs to build a good image in the community, and win strong community support for its work; and
- *All work on the river* should be in accord with integrated management plans.



4. The basis of management

4.1 ARMA's mission

ARMA is concerned about the future of the Avon River basin, with particular emphasis on the Avon sub-catchment. ARMA's concerns include the social, economic, historical, ecological and biophysical resource values of the river and its catchment, as well as the downstream impacts of river and catchment management in the Avon River basin on the Swan River and its estuary.

In response to these concerns, ARMA has adopted the following mission:

To restore and manage the natural functions of the Avon River system, for the long-term benefit of the community.

4.2 Guiding principles

A set of guiding principles for river management has been developed by Mr Jim Masters OAM, a farmer and naturalist who has observed and studied the Avon River over his life time. His River Management Principles have been adopted by ARMA. They are:

- **Principle 1: Understand the nature of the river being protected.** The natural functioning of a river depends on a balance of interrelated factors in nature. All of these factors must be considered before contemplating any works for management of the river. This requires an understanding of the evolution and natural history of a river gained through observation and research.
- **Principle 2: Maintain the river's energy balance.** The energy balance of a river, as determined by nature, should never be tampered with. The balance relates to the natural rate of discharge and was the dominant factor in forming the river channel and floodplain, existing long before human interference with the river catchment.
- **Principle 3: Base management actions on long-term observation.** Use the river history, which is available from people who have observed the river carefully over many years, when developing management strategies.

- **Principle 4: Protect natural resources.** Management must be directed across the whole catchment, including the land and the waterways, so as to ensure the whole environment functions properly. A functioning natural environment is necessary for human survival.

- **Principle 5: Respect the forces of nature.** A river demonstrates all the natural forces of nature working together. Once the natural balance of time and energy is changed, everything will change.

4.3 ARMA's management philosophy

In seeking to achieve its mission, ARMA has adopted the following philosophy:

ARMA will work to...

- Adopt the principles of river management developed by Jim Masters;
- Base our plans and our work on good science;
- Involve the community in our decision-making and our work on the river;
- Cooperate with LGAs, the AWG and government agencies;
- Achieve long-term goals, but adopt sensible interim arrangements where this is the most practical approach to a particular problem;
- Plan before we act, and look back and reflect on completed works;
- Strive for integrity in our dealings with other people and organisations;
- Share our plans, our problems and our responsibilities with community groups and members who share our concerns about the river;
- Listen to advice;
- Publicise our successes and learn from our failures;
- Stay within our means, but strive to increase our means at every opportunity; and
- Provide leadership in river management in WA.



4.4 ARMA's 2020 vision for the Avon River

In the year 2020, ARMA's vision is that the following situation will exist:

The river and its tributaries have significantly improved as naturally functioning ecosystems according to measurable indicators. The main river channel from Brookton and Wickepin down to the Avon Valley National Park is fenced on both sides, and fencing of the major tributaries is well advanced. Management Agreements have been signed by landowners adjoining the river, and are being observed. Rehabilitation and recovery plans for all of the river sections are complete, and revegetation of degraded banks and floodplains is proceeding according to plan. All the river pools have been surveyed, and a recovery plan for each has been prepared; 75% of the original pools have been rehabilitated, and action on the remainder is being implemented.

Sustainable agricultural systems (ie, those that deliver minimum salt, nutrients or sediment to the river or its major tributaries or the inland lakes) are now firmly in place on 50% of the Avon basin. Remnant vegetation is being protected and managed for long-term sustainability; revegetation programmes and farming practices aimed at controlling discharge of saline groundwaters and protecting surface soils are being implemented in 100% of sub-catchments in the basin.

All point sources of pollution of the river have been identified and either eliminated or their impact minimised. New industries or developments with potential to pollute the river are approved only on the basis that river pollution does not, and cannot occur. Potential polluters are monitored and regulated effectively.

Town Planning Schemes and Rural Strategies are in place and are being implemented which ensure top priority to maintaining the quality and the recovery of

the Avon River ecosystem. Policies adopted by Federal, State and Local Government are integrated and complementary, and are aimed at minimising the impacts of development and maximising the opportunities for river recovery and health.

Recreational use of the river is managed so as to provide fun, as well as appreciation of the river, with minimal environmental impact. The town pools at Beverley, York and Northam are a source of pride and pleasure to local communities and an attraction to tourists. Recreational sites along the river have been chosen with care, are properly designed, and are managed to ensure the river environment is not degraded.

The river wildlife (including terrestrial and aquatic) has also recovered according to measurable indicators. Feral and pest animals, especially foxes, cats, corellas and rabbits, and invasive exotic weeds, have been largely eliminated from the riverine bushland. A fire management regime aimed at protecting both the environment and human assets has been developed and is being implemented.

Research and monitoring programmes continue to supply new information and progress reports on river recovery, both to ARMA and to the public.

Rural and urban communities have learned to respect the river, and to share responsibility for its recovery and conservation. Community interests are coordinated through an efficient communications network, based on resource centres and modern communication technology.

Finally, integrated purposeful management of the river and the catchment are accepted as the responsibility of all government agencies and community groups, and these parties share a common vision and goals, and enjoy working together to achieve them.



4.5 ARMA's key objectives

To achieve its vision and implement its mission, ARMA has set itself the following key objectives:

1. River care and recovery

To restore and protect river processes, functions and ecosystems, so that the Avon River system is healthy and self-maintaining; and to manage human impacts on the river to ensure they are not deleterious.

2. Conserving lakes and wetlands

To restore and protect the wetlands, wildlife refuges and lakes associated with the Avon River.

3. Integrated Catchment Management

To encourage the implementation of sustainable land uses on the Avon River catchment, and to form partnerships with other people who are engaged in this work, to ensure efficient and cooperative use of resources, wisdom and energy.

4. Preserving the amenity and beauty of the river system

To preserve the scenic quality of the river, lakes and pools, so as to provide pleasure to communities living in the area, and attractive features for visitors.

5. Research

To document existing information about the Avon River and its recovery and management, and to initiate new studies which will assist good river management.

6. Monitoring and evaluation

To establish a baseline description of the functioning and ecosystems of the Avon River, to develop indicators and measures which will allow progress to be measured, and to regularly review and evaluate progress towards our vision.

7. Community involvement and responsibility

To assist and encourage the community to be well informed about the Avon River, to become involved in its recovery and management, and to take responsibility for actions which impact on the river and the catchment.

8. Education

To provide local communities and the people of Perth with information about the river system and its management and needs which will enhance understanding of the job to be done, support for ARMA and feedback on plans and works.

9. ARMA's performance and image in the community

To be (and to be seen to be), a competent, strategic, hardworking and ethical organisation, with the capacity to attract resources, and to use them efficiently on river and catchment management priorities, and responsive to community needs and views.

To report on our work to the public, in particular to organisations with a stake in the quality of the Avon River, to publicise our successes and to listen to advice.

10. Plans and guidelines

To develop a strategic plan and management programme and a comprehensive set of management guidelines which will provide agency staff and the community with consistency and good sense in day-to-day river management, and to develop recovery plans for individual sections of the river and the lakes system.



5. The proposed Management Programme: strategies and priorities for action

ARMA has adopted a 20-year vision, within which it proposes to adopt the following strategies over the next 10 years.

The work will be organised into five main programmes:

- (i) River Recovery and Management;
- (ii) Community Relations;
- (iii) Research;
- (iv) Monitoring and Evaluation; and
- (v) Attracting and Managing Resources.

Each of these programmes have equal priority, and are not ranked. Strategies within each programme are ranked, as follows:

5.1 River recovery and management

ARMA wishes to restore the natural functioning of the Avon River system, and the riverine and riparian ecosystems, and to institute a programme of on-going management which will protect and conserve the resource. Eleven priority strategies will be pursued.

Priority 5.1.1: Creation of foreshore reserves or management agreements

Reserves are usually vested in either a local authority for recreation purposes, in CALM for conservation purposes, or in a waterways management authority for a mix of recreation, conservation and waterways management purposes. A spectrum of foreshore management options are outlined in the Water and Rivers Commission's draft (1997) *Towards a State-Wide Foreshore Policy*. They include reservation and management agreements. A process for determining the most appropriate management option and manager is currently being developed by the Commission. The Commission is working towards developing an "area of influence" to which the foreshore policy will apply. Specific guidelines will be developed to determine the

area for protection, mainly based on biophysical and geomorphic criteria. This area will be considered for best management option by planners, when proposals for a change in landuse are submitted.

Objective

The objective is to ensure that waterways protection is the priority purpose of land adjoining rivers and lakes.

ARMA will:

- Support and promote the creation of new foreshore reserves along the Avon River and the major tributaries whenever this is appropriate. The trigger to review the existing protection and management status will be urbanisation or other significant change in landuse. ARMA will negotiate with land managers before advising on the most appropriate level of protection and enhancement.
- Following the creation of foreshore reserves, ARMA will progressively put in place management to protect and conserve these reserves, including:
 - A management plan, including weed management, fire management, revegetation, public access and recreation options where required;
 - Fencing;
 - Works, as required;
 - Regular inspection; and
 - Signage.
- Where a reserve is not appropriate, seek to establish a management agreement with the landowner. Management agreements will be aimed at protection and rehabilitation of the river foreshore, and will be negotiated with the landholder.
- Seek to develop management agreements with landowners whose boundaries cross the river or extend onto the river, so as to encourage river recovery and protection. Private ownership of the river dates back to the earliest days of white settlement and can involve ownership of the land under the river, but not of the river water itself. In the case of the Avon River, which was proclaimed



under the Rights in Water and Irrigation Act 1914 in the 1950s (to enable Avon River Training Scheme), the ownership of the bed and banks has reverted to the Crown but only for the purpose of the Act.

- ARMA will ensure, whenever possible, that land within the river and foreshore land along the river reverts to public (Crown) ownership.

Priority 5.1.2: Fencing and associated management agreements

Objective

The aim is to minimise and control grazing of riparian vegetation and stock trampling of river banks and the riverbed. Secure stock-controlled areas can then be managed to encourage regeneration of native vegetation or replanting/rehabilitation of degraded areas.

ARMA will:

- Promote and (where possible) assist to fund the erection of stock proof fencing along both sides of the Avon River from the eastern boundary of the Avon Valley National Park upstream to Wickepin and Brookton, and all the major tributaries and major lakes.
- Seek to enter into a management agreement with the landowner aimed at protection and conservation of the areas fenced off where fences are placed on privately owned land adjoining the river, tributaries or lakes.
- Oppose uncontrolled grazing by stock along the river. It is recognised that controlled grazing may be needed to control herbaceous weeds in spring time, and in areas of heavy exotic grasses, to reduce a fire hazard. This can be covered in a management agreement.

Priority 5.1.3: Recovery plans

Objective

The objective is to develop a suite of site-specific plans for each of the 18 sections of the Avon River channel, to provide a blueprint for recovery action and subsequent management leading to a better river and a more stable and diverse riverine environment.

ARMA will:

- Develop and implement Recovery Plans for all sections of the river, the major river pools and lakes and the floodplains in the Management Area. These

plans will stipulate action and priorities for revegetation of riparian zones and floodplains, removal of sediments from pools, installation of riffles to minimise the movement of channel bed sediments, action to minimise new sediments entering the river and the pools, action to recover and conserve wildlife, requirements for recreation management and will also deal with site-specific pollution problems.

- Ensure that Recovery Plans are prepared by teams of skilled and experienced scientists, river managers, community and rivercare group members and local residents. All Recovery Plans will be approved by ARMA, and endorsement will be sought from the appropriate LGA and LCDC.
- Will look beyond the immediate river and riparian zone to create bushland corridors linking the river to other parts of the landscape, and to protect refuge areas for native birdlife. Where corridors or refuges are created or occur on private land, ARMA, in conjunction with other stakeholders, will seek to develop management agreements for the protection of these areas with landowners.
- Implement Recovery Plans according to a schedule developed by ARMA, and review annually. The schedule will take into account funding, relative urgency for the work, location and workload-sharing arrangements which can be developed with other organisations and the expectations of local communities.
- Promote the formation of rivercare groups, who will assist in both planning and implementation of Recovery Plans.
- Review Recovery Plans 5-yearly so as to incorporate new information, or to instigate full revision if required.

Priority 5.1.4: Flood mitigation

Objective

To minimise the impact of damaging floods on towns and settlements, and arable land adjoining the Avon River system.

ARMA will:

- Promote the preparation by Water and Rivers Commission of maps which demonstrate the impacts of 1:100 year and 1:50 year floods along the river.



- Ensure LGAs and residents close to the river are aware of the potential impact of floods.
- Encourage and assist LGAs to carry out Flood Risk Assessments within riverside towns. The aim will be to identify structures or features susceptible to flood damage, or places where flooding will be exacerbated by obstruction to flow.
- Cooperate with Local Government in the preparation of Flood Contingency Guidelines for each Shire along the river. These will aim to minimise the impact of flooding by appropriate design or remedial operations.
- Seek to influence the adoption of planning schemes which minimises new development in areas likely to be subjected to flooding, ie, the floodplain of the Avon River.
- Publicise past floods by placement of notices in towns and erect flood level signs.

Priority 5.1.5: Identification and elimination of point source pollution

Objective

The aim is to improve the quality of the water in the river, and to meet defined water quality standards.

ARMA will:

- Establish a set of water quality goals for each section of the Avon River. These will become the main performance indicators for this strategy and will encompass factors such as salinity, total phosphorus, nitrogen, suspended sediment, heavy metals and other toxic chemicals.
- Identify types of pollution occurring in the Avon River, the means of measuring pollutants and the strategies needed to reduce them.
- Identify all point sources of pollution along the river and its tributaries, and the individual or the organisation responsible. Action Plans will then be developed (as part of the river section Recovery Plans) to ensure the pollution ceases, and a time-frame for implementation established.
- Oppose all new developments, industries or activities which are not designed to ensure no potential of pollution risk to the river.

- Advocate the application of Water Sensitive Urban Design principles within all towns and settlements in the catchment.
- Work cooperatively with the DEP, State Planning Commission, Main Roads Dept, Westrail and Local Government to develop and implement plans aimed at preventing industrial spillage or leakage into the river or its tributaries.
- Review the relevance and application of WAHMEMS procedures for the ARMA Management Area.
- Seek delegated authority from DEP to license Avon River polluters.

Priority 5.1.6: Improved land management and farming practices on the catchment

Objective

The objective is to minimise the impact of agriculture, industry and urban development on the river system, and to maximise the care and good management of waterways throughout the catchment.

Although ARMA does not have direct powers in this area, clearly what happens on the catchment affects the river.

ARMA will:

- Promote and support catchment management and farming practices which are sustainable (ie, which minimise the volumes of salt, chemical pollutants and sediments entering the river, its tributaries or the lakes from adjoining farmland) through the Swan Avon ICM programme.
- Form partnerships with other bodies and landowners, for example by membership of and input to the Avon Working Group, by collaborative education and research, and by implementation of policies aimed at protecting waterways and recovering degraded areas.
- Encourage landowners to restore and care for all waterways and wetlands on their land, by working through LCDCs and catchment groups.
- Seek to influence land use and land management planning decisions, by liaison with Statutory Planning agencies and Local Government, so as to minimise the impact of urban and industrial development and subdivision on river processes and ecosystems and the protection and restoration of river floodplains.



Priority 5.1.7: Fire management

Objectives

To protect riverine ecosystems from the damaging effects of uncontrolled fire; to use controlled fire for regeneration in accordance with Recovery Plans; to manage the fire hazard along the river so as to minimise the threat of wildfires to adjoining assets and property; and to work cooperatively with Local Government Authorities, Bush Fire Brigades and neighbours with respect to fire management.

ARMA will:

- Undertake a Wildfire Threat Analysis as part of the Recovery Plans prepared for sections of the river. The purpose will be to identify important values threatened by fire and the steps which need to be taken to minimise threats.
- Identify potential sources of wildfire along or adjacent to the river and advise the site-manager when these become a problem (for example smouldering rubbish tip).
- Make a recommendation to restrict the use of open fires in recreation areas controlled by ARMA. ARMA will encourage the establishment of fire places, under conditions set out in the Bush Fires Act, or by the local Shire Council for the area.
- Aim to keep fire permanently out of the riverine system, except where controlled fire is used for regeneration or control of weeds or feral animals under the terms of a Recovery Plan, or to reduce grassy fuels adjacent to a high value site. When controlled fire is used:
 - a prescription must be prepared which specifies season and intensity of the proposed fire, and ensures that erosion does not result from burning operations;
 - the fire must be made safe;
 - old hollow trees must be protected; and
 - areas of regenerating vegetation must be excluded.
- Approved controlled burning that complies with the Bush Fires Act and meet Local Government requirements, and prescriptions.
- Permit mowing or slashing of weeds or grasses to reduce fuel load adjacent to high value sites, where the use of fire is inappropriate.

- Encourage and assist neighbours to make their own properties safe from fire, rather than rely on ARMA to reduce hazards along the river.
- Support the minimisation of stubble burning on paddocks adjacent to the river.
- Encourage research into fire management and fire ecology in the riverine environment.
- Maintain records of areas burnt in a wildfire or by a controlled fire, and monitor revegetation following fire.
- Support volunteer Bush Fire Brigades to ensure they are well equipped and organised.
- Work cooperatively with LGA's on all aspects of fire prevention and fire control.

Priority 5.1.8: Recreation management and development

Objective

To ensure that the recreational activities provided by the Avon River are able to be enjoyed by the public without deleterious impact on the river environment or its recovery.

ARMA will:

- Prepare a list of all recreational pursuits which are deemed by the Authority to be acceptable, if managed properly, along the river. Acceptable pursuits are those which do not degrade water quality, biodiversity or the riverine environment.
- Prepare a list of unacceptable recreational pursuits which are unacceptable along the river. These pursuits will be discouraged from the Avon River, and the community advised accordingly.
- Review the recreational pursuits lists periodically in the light of management experience, or new proposals.
- Delineate the river into activity areas to indicate where acceptable recreational pursuits will be allowed, with proper management.
- Develop activity area proposals in conjunction with Local Government Authorities, private landowners likely to be affected and representatives of recreation and conservation interest groups.



The initial activities area plan will be reviewed annually, and published in a local newspaper. Signposts will be placed at strategic access points along the river indicating activities which are acceptable.

- Consider the appropriate timing of recreational activities along the river. Many activities occurring after early spring will disturb breeding wildlife or result in an unacceptable risk of starting a bushfire. ARMA will develop a seasonal compatibility plan of the river showing location and times of the year when recreational activities along the river must be strictly managed.
- Encourage the development of recreational facilities at specific sites along the river. A list of these sites will be prepared. Recreational development of these areas may be carried out by Local Government, other authorised bodies or private developers.
- Develop recreational areas in accord with properly designed site plans and specifications, prepared by an experienced recreation planner. Only those complying with ARMA's objectives will be approved.
- Encourage the integration of education with recreation. Recreational sites should have interpretive material (signs, pamphlets, self-guided walks or drives) which inform site users about the river, its ecology, history, use, current management and recovery.
- Contribute to, and support the environmental management plans produced by other bodies with approved recreational interest in the river or lakes, such as the Northam's Avon Descent Committee and the Yenyenning Lakes Management Group.
- Require commercial recreational operators to obtain approval from ARMA.
- Seek sponsorship from recreational businesses or from corporations who benefit from recreational use of the river, to assist with the development and maintenance of recreational facilities.
- Include "recreational uses" as a factor to be considered when preparing foreshore agreements with landowners.

Priority 5.1.9: Control of weeds and feral and pest animals

Objective

The objective is to return the ecosystems of the river and the fringing vegetation along the river and around the lakes to a more natural condition.

ARMA will:

- Specify action for particular sites in Recovery Plans. Priority will be given to control of declared noxious weeds, environmental weeds, invasive species such as Bridal Creeper and Patterson's Curse and to species which are a fire hazard, such as wild oats.
- Participate in community weed and feral animal control programmes. Wherever possible, control of weeds, rabbits, foxes and introduced aquatic fauna and flora will be carried out in conjunction with neighbours and Agriculture WA.

Priority 5.1.10: Road management

Objective

To minimise the impact of roads on drainage patterns and delivery of sediment to waterways.

ARMA will:

- Seek to establish a working group of road managers in the catchment area. The role of this group will be to identify ways in which roads contribute to waterways degradation, and to design and promote preventative policies.
- Opportunistically monitor road construction and maintenance in the catchment and report on problem sites to road managers.

Priority 5.1.11: Bridges and other structures crossing the river

Objective

To ensure that bridges, jetties, viewing platforms, board walks, pipelines or other structures crossing the river do not impede river flow or affect the natural functioning of the Avon River.

ARMA will:

- Require that any organisation or individual who wishes to develop a structure crossing the river seeks permission from ARMA, and submits detailed plans.
- Licence approved structures in or over the river, after consideration of impact.



- Monitor the impact of structures on the river and its environs.

5.2 Community relations

ARMA wishes to establish excellent relationships with the Avon River catchment community. Six priority strategies will be adopted:

Priority 5.2.1: Maintenance of ARMA as a community-focused organisation

Objective

The aim is to ensure that ARMA is well informed about and is responsive to community views within the catchment.

ARMA will:

- Continue to seek to attract membership from within the local community of the ARMA Management Area, and wherever possible will ensure that members have strong cross-linkages to other community organisations.
- Hold meetings in different towns in the catchment from time to time, and encourage members of the local community to attend.
- Hold field trips in the catchment two or three times each year, at which it will seek to study issues in the catchment, to listen to the views of the local community and to take advice from other community organisations with an interest in landcare, biodiversity and the Avon River.
- Publicise the fact that ARMA meetings are open to the public, and encourage interested members of the community to attend.

Priority 5.2.2: Communicating with the public

Objective

The aim is to ensure effective communication between ARMA and all the key audiences in the community about the Avon River and its management.

ARMA will:

- Prepare a Communications Plan which identifies the audiences with whom we wish to communicate, the messages we wish to get across, the most appropriate media for each audience and a monitoring process to check the success of the plan.

- Establish mechanisms for the community to advise ARMA of its concerns, views, priorities and needs with respect to the Avon River.

- Continue to support the Avon Ascent Programme in the short-term. This programme is aimed at education of city people about land and river care in the Avon River catchment. ARMA's support currently takes the form of financial and technical assistance. A review of this situation will be undertaken in 1998, in conjunction with the Avon Working Group.

- Continue to support the Avon Catchment Network project. This has a computer-based network and data base which provides people in the catchment with up-to-date information about rivercare and land management, and which provides facilities for rivercare group development and coordination of monitoring projects.

- Continue to support the Ribbons of Blue and Waterwatch programmes, as a means of involving the community and schoolchildren in river management.

- Publish a Newsletter twice each year, for dissemination to Local Government Authorities, river neighbours and other stakeholders.

- Develop River Management Demonstration Areas as an example of excellence in river recovery and care. The first will probably be located on the river between Northam and the Muresk campus of Curtin University.

Priority 5.2.3: Maintaining good relationships with Local Government

Objective

The aim is to ensure ARMA is regarded by Local Government in the catchment as a credible and professional river management body, and at the same time to ensure that LGA develop policies which enhance the recovery and protection of the river.

ARMA will:

- Continue to have strong representation of Local Government on its membership.

- Hold meetings regularly with LGAs within the catchment during which local issues can be raised and wherever possible resolved to the satisfaction of both the LGA and ARMA.



- Keep LGAs in the catchment well-informed about its plans, progress and guidelines. Wherever practical, LGAs will be given an opportunity to make input to ARMA's policies and plans.
- Provide advice and direction as input to LGA policy in areas which impact on the Avon River, in particular Town Planning Schemes, refuse disposal and roading.

Priority 5.2.4: Establishing partnerships with other organisations

Objective

ARMA recognises that in the long run, the recovery and protection of the Avon River will depend on the management of the broad catchment beyond the river banks (both rural and urban) as well as on the more confined management of the river and its riparian zone. The aim is to establish cooperative arrangements with other organisations who can influence the recovery and conservation of the Avon River.

ARMA will:

- Identify other organisations who are working towards sustainable land management in the Avon River catchment, and will seek partnership arrangements (wherein partners seek to support and assist each other over matters of mutual interest) with them. These other organisations will include:
 - The Swan Avon ICM Coordinating Group and The Avon Working Group.
 - Agriculture WA Sustainable Rural Development Programme.
 - Local Government Authorities.
 - LCDCs and local neighbourhood catchment groups.
 - CALM.
 - The State Planning Commission.
 - The Department of Environmental Protection.
 - The Wheatbelt Development Commission.
 - Aboriginal groups representative of local Aboriginal people.
 - The Toodyay Naturalist Club.
 - The River Conservation Society of York.
 - The Avon Valley Environmental Society.
 - The Yenyening Lakes Management Group.
- Arrange to meet with these organisations and develop a framework for future partnership arrangements. These arrangements will involve such things as overlapping policies, shared applications for funding, support in dealing with common problems,

consultation over management plans, collaboration in works programmes to ensure efficiency on the ground and collaborative research and education projects.

- Continue to support the Avon Working Group of the Swan-Avon ICMG to assist them in continuing to provide an effective forum for joint deliberations.

Priority 5.2.5: Good neighbour policy

Objective

The aim is for ARMA to be a good neighbour, and to encourage good neighbourly attitudes from those people who live near the river.

ARMA will:

- Identify its neighbours along the river and the major tributaries, and maintain an up-to-date data base of names and addresses.
- Contact each neighbour at least once each year either through a personal visit from an ARMA member or representative, or through a personalised letter; the aim will be to encourage interest in and respect for the river, to update neighbours on ARMA's works programmes and policies and to seek advice from neighbours on issues of concern.
- Identify sites of cultural and historical significance within the river reserve or immediately adjoining the river and support the protection and good management of these sites.
- Acknowledge the contribution of good neighbours by erecting a sign on their properties signifying that they are a good river manager.
- Enlist the services of interested local people in a River Watch Programme. The aim of the River Watch Programme will be:
 - To provide additional eyes and ears for ARMA, and reports on issues of concern or emergencies;
 - To provide a visible and friendly "face of ARMA" in the public, particularly to river neighbours;
 - To pass on information about the river and ARMA to people who live by or who use the river;
 - A resource for monitoring programmes along the river;
 - To help provide local knowledge when annual works programmes are being compiled; and
 - River Watchers will not have a policing function.



Priority 5.2.6: Aboriginal Cultural and Heritage Issues

Objective

There are a number of Aboriginal sites which are in close proximity to, or part of, the Avon River itself. Waterways are often of mythological and cultural significance and this means that any direct impact on the Avon River or its tributaries is likely to be of concern to Aboriginal people. All registered sites are protected by the Aboriginal Heritage Act 1972-1980 and should not be disturbed without the prior consent of the Minister for Aboriginal Affairs. The aim of ARMA is to embrace the spirit of reconciliation and develop a harmonious relationship through consultation with the Aboriginal community.

ARMA will:

- Consult with the local Aboriginal community, Aboriginal Affairs Department and the Department of Aboriginal Sites at the WA Museum, to develop management actions that are inclusive of Aboriginal heritage values.

5.3 Research

ARMA wishes to ensure that work on the recovery and management of the river is based on good scientific information. This means that existing work over many years needs to be collected, collated and published, and a programme of new studies to assist good river management may need to be undertaken. In addition, ARMA needs to facilitate research by other competent organisations, and to assist with dissemination of research results.

Four priority strategies will be adopted:

Priority 5.3.1: Assembling and publishing existing information

Objective

To collect, collate and make available existing information about the Avon River system.

ARMA will:

- Prepare a literature review of all existing relevant information about the natural functioning and the ecosystems of the Avon River, about the history of river use and management and about changes which have occurred since European settlement.

Priority 5.3.2: Establishing research priorities

Objective

To develop, and regularly review, a “running list” of research priorities for ARMA, concerned with both biophysical and social aspects of river recovery and management.

The purpose of the list will be to assist decisions on research funding.

ARMA will:

- Develop a list of the most important research priorities relevant to river recovery and management. This list will be prepared with the assistance of scientists and experienced waterways managers, and will be reviewed and endorsed by ARMA each year. The research priorities list will be used to guide decision-making on future activities.

At the time of writing this plan, the following are the general research priorities:

- Improving our understanding of ecological and hydrological processes in the river and the catchment.
- Restoration and future protection of the river pools and the major lakes.
- Reducing streamflow velocity.
- Remediation of sedimentation of waterways.
- Reducing sediment bedload movement along the river channel.
- Regeneration of the natural aquatic and riparian ecosystems.
- Management of exotic weeds and the associated fire hazard.
- Nutrient stripping from effluent.
- Saline water disposal from farmland.
- Minimising flood impacts.
- The groundwater dynamics of floodplains, and potential for salinity.

When the Research Plan is prepared it will set out projects within the headings outlined above.



Priority 5.3.3: Collaborative research arrangements

Objective

To encourage organisations to undertake research studies on the Avon River system, and to collaborate with other research agencies.

ARMA will:

- Identify all the agencies and institutions which might carry out research on biophysical or social aspects of river recovery and management, for example government agencies, tertiary institutions and the CSIRO. These groups will be kept informed of ARMA's research priorities and invited to contribute to the work. In return ARMA will assist with access to the river and wherever possible, with funding or other support for researchers.
- Assist community organisations to make applications for funding for research projects associated with river conservation.

Priority 5.3.4: Dissemination and implementation of research results

Objective

To ensure that the results of research studies are made available to decision-makers about river recovery and management.

ARMA will:

- Encourage researchers to present to them a summary of their research results plus recommendations for implementation. Scientists working on aspects of the river system will be invited to participate in Recovery Teams and to advise ARMA on management of the river.
- Publish research results in its Newsletter.

5.4 Monitoring and evaluation

ARMA wishes to ensure progress in the implementation of its strategies is measured and the success of its work is periodically evaluated. This will allow ARMA to review achievements, to report to the community and other stakeholders, and to modify plans if necessary. Three priority strategies will be pursued.

Priority 5.4.1: Baseline characterisation of the Avon River

Objective

To describe the current condition of the river, in terms of its functioning and ecosystems.

ARMA will:

- Carry out a current condition analysis for the Avon River to provide a baseline against which future changes can be measured. This will involve collating existing data on the biophysical condition of the river, and undertaking new studies if necessary.
- Wherever possible, the measures used will be quantitative and all sampling will be designed to provide statistically valid data.
- Collaborate in this exercise with the Monitoring and Evaluation Team of the Avon Working Group.

Priority 5.4.2: Establishing success indicators and measures

Objective

To allow changes in the river system to be measured, and progress with river recovery and management to be gauged against quantitative expectations.

ARMA will:

Establish a quantitative set of success indicators for each of the following parameters:

- Cross sectional profiles at nominated sites, to allow changes in micro-topography to be documented.
- Stream-flow velocity at ten sites along the middle section of the river.
- The quality of the water in the river at nominated places and nominated times. Measures will be established for salinity, chemical pollutants, organic matter and suspended solids.
- The volume of sediment entry to the river at nominated key places.
- The movement of the sediment bedload in the river channel.
- The number of point sources of pollution identified and eliminated.
- The extent of the river system fenced.



- The number of management agreements with river neighbours.
- The number and level of activity of rivercare groups associated with the river.
- The number of Recovery Plans prepared and the number being implemented.
- The recovery rate of nominated species of flora and fauna.

These indicators will represent ARMA's target achievements.

Priority 5.4.3: Review and reporting

Objective

To ensure regular periodic review of progress against hard targets.

ARMA will:

- Review the actual status of each of the above measures at predetermined intervals from one to five years.
- Prepare a brief annual report demonstrating the actual situation as compared with the desirable target. Progress will be reported to interest groups and neighbours.

5.5 Resource acquisition and management

ARMA wishes to have a secure source of funds to apply to its rivercare, research, community relations and monitoring programmes, and ARMA is committed to managing its funds efficiently. The Water and Rivers Commission has indicated that it will support, in principle, the Management Authority's move towards self funding. The Authority is aware that at the time of the preparation of this programme, the Commission is preparing a policy on self funding. The resulting policy may influence the direction which ARMA would consider. In the meantime ARMA will pursue the following strategies:

- Prepare a consolidated statement of priorities taken from this Management Programme, and from this, a 3 year budget and staffing plan. This will indicate ARMA's priority annual requirement for funds, for the next three years.

- Estimate other expenses likely to be incurred during this period to cover cooperative/collaborative arrangements with other organisations and the cost of research, and combine these with those developed above.
- List all known existing sources of funds for the three year period, and by comparing expected expenditure with expected revenue, produce an overall Statement of Funding Required for Delivery of the Management Programme. This figure will be updated annually for the three years ahead.
- Seek support each year through the Water and Rivers Commission for funds from the State Government to cover operating expenses for river and catchment management and for the running of the Authority.
- Prepare a list of organisations or individuals who benefit directly from using the Avon River, including those using the river or resources associated with the river, for commercial gain.
- Prepare a detailed list of all potential sources of funds, especially grant providers, and use this list as a basis for making submissions for funds for specific projects.
- Seek grants from the Federal and State governments to implement the priorities set out in this programme. This will normally be done through the Water and Rivers Commission, and via partnerships with other agencies or organisations.
- Approach corporations, business and individuals for sponsorship of river recovery and management programmes, and advertise that ARMA is able to receive gifts, bequests and donations to rivercare programmes.
- Work with the DEP with a view to ensuring that the cost of the license to point source polluters is a disincentive, and that the revenue from a license fully recovers the cost of enforcement.
- Encourage and support community organisations who are seeking funds for river recovery or conservation projects which fit within ARMA's objectives.
- Encourage and assist tertiary institutions to carry out research projects on the Avon River which support this Management Programme.



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- Liaise with the Water and Rivers Commission and other waterways Authorities in the State to investigate and develop new sources of revenue.
 - Retain funds raised by ARMA and direct these funds to the delivery of this Management Programme.
 - Prepare an annual report on expenditure in the light of budget.



6. Implementation of the Management Programme

6.1 The structure and membership of ARMA

The structure and membership of ARMA is under review at the time of writing this Management Programme. In this process, ARMA promotes the following principles:

- That there be an independent Chairperson.
- That Local Government Authorities along the river be represented.
- That there be representation from community groups with a concern for river conservation.
- That there be representation from CALM and Agriculture WA.
- That there be representation of non-affiliated community members with experience in waterways and land conservation.
- That appointments be made by the Governor of Western Australia on the recommendation of the Minister for Water Resources.

ARMA believes that the Authority should continue to meet six times each year (i.e. bimonthly) and that membership structure should be reviewed every three years.

6.2 Working relations with Water and Rivers Commission

ARMA will seek a good working relationship with the Water and Rivers Commission. The respective roles are seen as:

ARMA's Role:

- Preparing, reviewing and updating the Management Programme for the Avon River System.
- Maintaining a high level of local knowledge about the river and its management, in particular monitoring the implementation of the Management Programme.

- Seeking guidance and advice from local experts.
- Providing local knowledge input to higher level policy and decision making.
- Ensuring good two-way communication between government and the local river-oriented community.
- Conducting education and community relations programmes at the local level.
- Conducting site-specific planning, recovery and investigative work on the ground.
- Providing the river conservation perspective on wider bodies, such as the Swan-Avon ICM.
- Liaising with other river management authorities to ensure good information is shared.

WRC's Role:

- Providing overall policy guidance and administrative and financial support.
- Providing technical and scientific advice and direction to ARMA and to other organisations impacting on the river system.
- Providing a force for upper-level interagency cooperation, focus and integrated planning.
- Approving/endorsing the Management Programme and overseeing its implementation.

6.3 Operational procedures

ARMA will adopt the following operational procedures:

1. Each year an annual operating plan will be prepared in advance, setting out the works and the budget proposed to be adopted in the coming year. Works and priorities will be drawn from this Management Programme. The budget will be determined on the basis of money available from government, grants or other sources.



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2. Each year ARMA will prepare a report on the implementation of its operations plan in the previous year, so that progress can be observed by members.

ARMA does not employ staff. Supporting staff are employed by the Water and Rivers Commission, and will be assigned appropriate roles such as ARMA Executive Officer and ARMA Environmental Officer etc.

6.4 Ideal staff requirements

ARMA believes the following represents the ideal staff requirements for servicing the Authority and implementing this Management Programme for the Avon River:

Full time staff:

- Executive Officer: with the role of programme coordination, budgeting, staff management, liaison with LGAs, LCDCs and Catchment Groups and representing ARMA on the Avon Working Group.

- Recovery and Rehabilitation Officer: for overseeing of recovery planning and implementation.
- Environmental Officer: for management of pollution control and water quality monitoring.
- Community Relations Officer: for management of the Community Relations programme, especially liaison with rivercare groups.
- Works Supervisor: to oversee river fencing, rehabilitation operations, reviewing management agreements, foreshore reserve management.

Part time support staff:

- Secretary and administrative support officer to the Authority.

The Authority will consult with the Commission on its staff requirements.



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Appendix 1

Acronyms or abbreviations used in this document

AgWA:	Agriculture WA	LCDC:	Land Conservation District Committee
ARMA:	Avon River Management Authority	LGA:	Local Government Authority (Shire)
ARSMC:	Avon River Systems Management Committee	PWD:	[the former] Public Works Department
AWG:	Avon Working Group of the Swan-Avon ICM Coordinating Group	RTS:	River Training Scheme
CALM:	Department of Conservation and Land Management	RLUP:	Regional Land Use Plan
CSIRO:	Commonwealth Scientific and Industrial Research Organisation	SAICMG:	Swan Avon Integrated Catchment Management Group
DEP:	Department of Environmental Protection	TPS:	Town Planning Scheme
DPUD:	[the former] Department of Planning and Urban Development	VCL:	Vacant Crown Land
EPA:	Environment Protection Authority	WA:	Western Australia
EMP:	Environmental Management Plan	WRC:	Water and Rivers Commission
ICM:	Integrated Catchment Management	WAHMEMS:	Western Australian Hazardous Materials Emergency Management System
		WAWA:	[the former] Water Authority of Western Australia



Appendix 2

Avon River Management Authority 1998/99 Membership

- Mr Doug Morgan (Chairman)
- Mr Alan Cole (Deputy Chairman)

- Ms Glenice Batchelor
- Mr Darrel Brewin (Agriculture WA) [to June '98]
- Mr John Carter (Conservation and Land Management)
- Mr Wayne Clarke
- Mr Laurence Don
- Mr Alan Gelmi
- Ms Jan Goodacre
- Ms Linda Leonard
- Mr Colin Liddle [to June '98]
- Ms Elizabeth Manning
- Ms Ray Paynter [to June '98]
- Mr Tom Richards
- Mr Roger Underwood
- Mr John Wilding [to June '98]

- Mr Martin Revell (Executive Officer)
- Ms Phyllis Graham (Acting Executive Officer)

