
AVON WATERWAYS COMMITTEE
RIVER RECOVERY PLAN
Section 13 – Beverley Townsite to Edwards Crossing

prepared by
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for
Water and Rivers Commission
and
Avon Waterways Committee

As of 31 December 2001 the name of the
Avon River Management Authority has
changed to Avon Waterways Committee

WATER AND RIVERS COMMISSION
RIVER RECOVERY PLAN
REPORT No RRP 4
JANUARY 2002

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This Recovery Plan was prepared under the direction of the Avon Waterways Committee, with the support of officers of the Water and Rivers Commission.

The following members of the Beverley community acted voluntarily on an advisory committee during the preparation of the plan:

Alan Ellis, Anne Behn, Anne Bolt, Belinda Foster, Bill Cole, Chris Mellick, Claudette Hidden, Di Congreve, Glenys Domeyer, Helen Revill, Henry Ugle, Isobel, Jenny James, Jim Alexander, Jim Hidden, John Barrett-Lennard, Judi Jenkins, Kate Badger, Lita Barrett-Lennard, Margaret Andre, Marion Alexander, Mitchell Henry,

Morag Whitney, Pat Smith, Peter Congreve, Phyllis Facey, Reg Behn, Rob Domeyer, Roma Paton, Shane Moad and Wally MacMillan

The group attended meetings, undertook a field trip and worked on drafts of the plan, and have already commenced some of the work listed.

The plan was edited and reviewed by members of the advisory committee, the Shire of Beverley, Phyllis Graham, Clare Taylor, Martin Revell and Bernard Kelly of the Water and Rivers Commission.

Roger Underwood of York Gum Services was the project facilitator and planning consultant.

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Avon Waterways Committee

We welcome your feedback

A publication feedback form can be found at the back of this publication, or online at www.wrc.wa.gov.au/public/feedback/

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Beverley Town Pool
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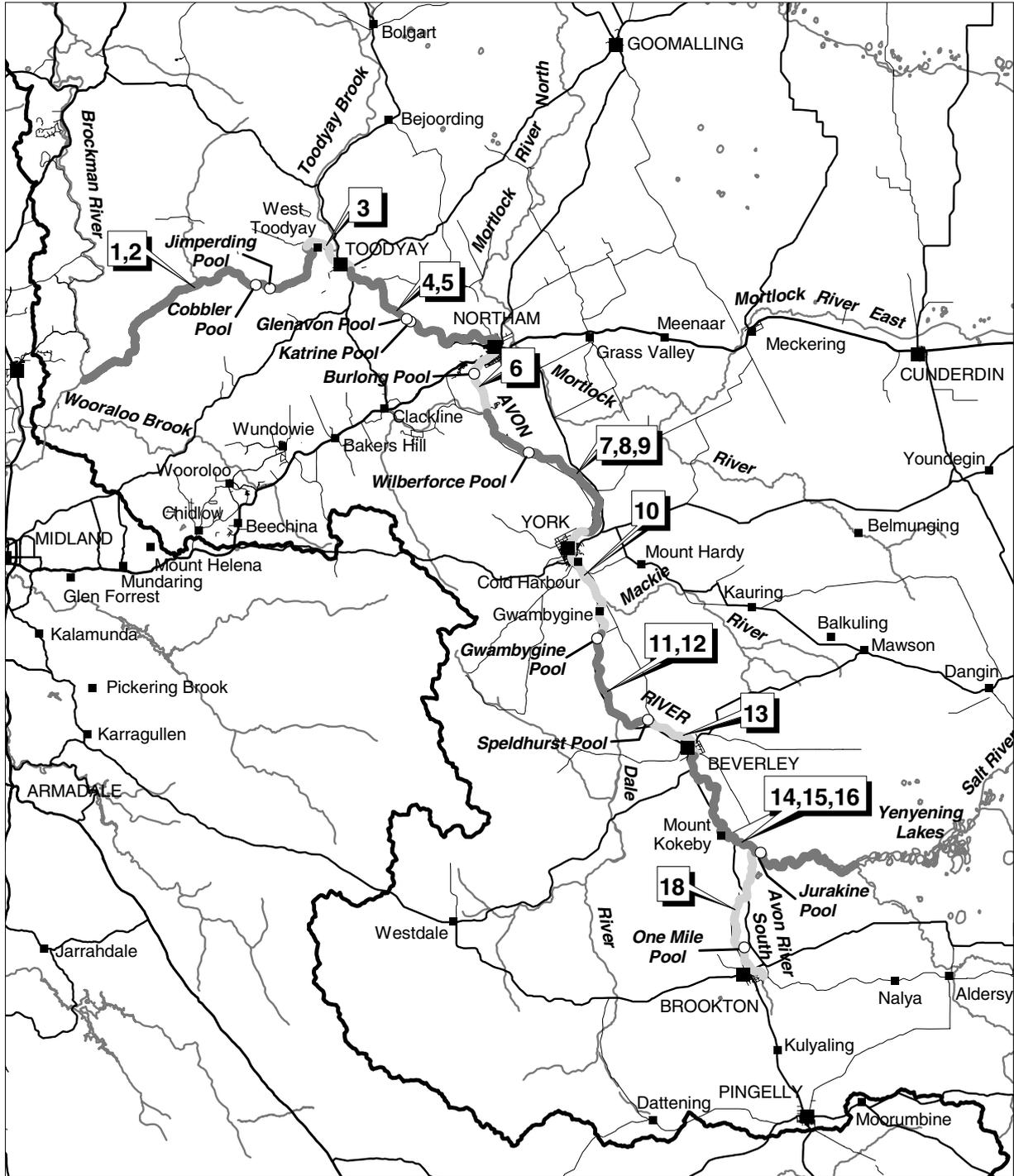
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AVON RIVER River Recovery Plan SECTIONS



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■ Towns	— Avon River Sections													
— Highway	12 Section Number													
— Main Roads	○ Pools													
— Minor Roads	○ Avon River Catchment													
— Rivers - Lakes	Avon													

Map 1: River Recovery Plan Sections

1 Introduction

1.1 The Avon River at Beverley

This Recovery Plan deals with that section of the Avon River which flows through the Beverley townsite downstream from Beverley to Edwards Crossing (see Map 2). Edwards Crossing is the bridge over the river near the junction of the Great Southern Highway and the Top Beverley Road.

The section of the river on which this plan focuses is designated as Section 13 of the 18 river sections for which the Avon Waterways Committee (AWC) is developing a recovery process in conjunction with local communities.

In this plan we refer to Section 13 as the Beverley section. It has a total length of approximately 6.81 kilometres, and encompasses the following features:

- the river channel entering at the upstream (southern) edge of Beverley townsite;
- the Town Pool;
- the river channel running downstream through the lower part of town and to the top of Speldhurst Pool;
- Speldhurst Pool and crossing; and
- the channel section running downstream from Speldhurst Crossing to Edwards Crossing.

Within the townsite, the river is adjoined by freehold townsite blocks and parkland vested in the Shire of Beverley. Beyond the townsite, the adjoining lands are broad-acre farming properties that have been in agricultural use for over 150 years.

The Beverley section of the Avon River is degraded, and both of its once deep and permanent pools are threatened. In addition to the river management objectives of AWC, there is significant Shire and local community interest and support in improving the river and its natural biodiversity and beauty.

1.2 Objectives of this Recovery Plan

The objectives of this plan are to:

- establish a vision for the river, which provides a picture of how the river might look and our attitudes towards it in the future;

- identify the key issues which need to be tackled to assist recovery of the river in this section;
- develop practical local strategies which address the key issues and which will guide recovery of the river in the Beverley area;
- assign priorities and responsibilities to proposed work;
- describe how it is intended that the plan be implemented, including the ongoing involvement of the Beverley community in rivercare work;
- achieve the endorsement of the final plan by all the other agencies and organisations which have the capacity to influence the recovery of the river. The key organisations are: the Water and Rivers Commission (AWC's 'parent' agency), the Shire of Beverley, Beverley bushfire interests, conservation interests, the Water Corporation of WA, the Beverley Tourist Bureau, Aboriginal interests, historical and heritage interests and the Avon Catchment Council.

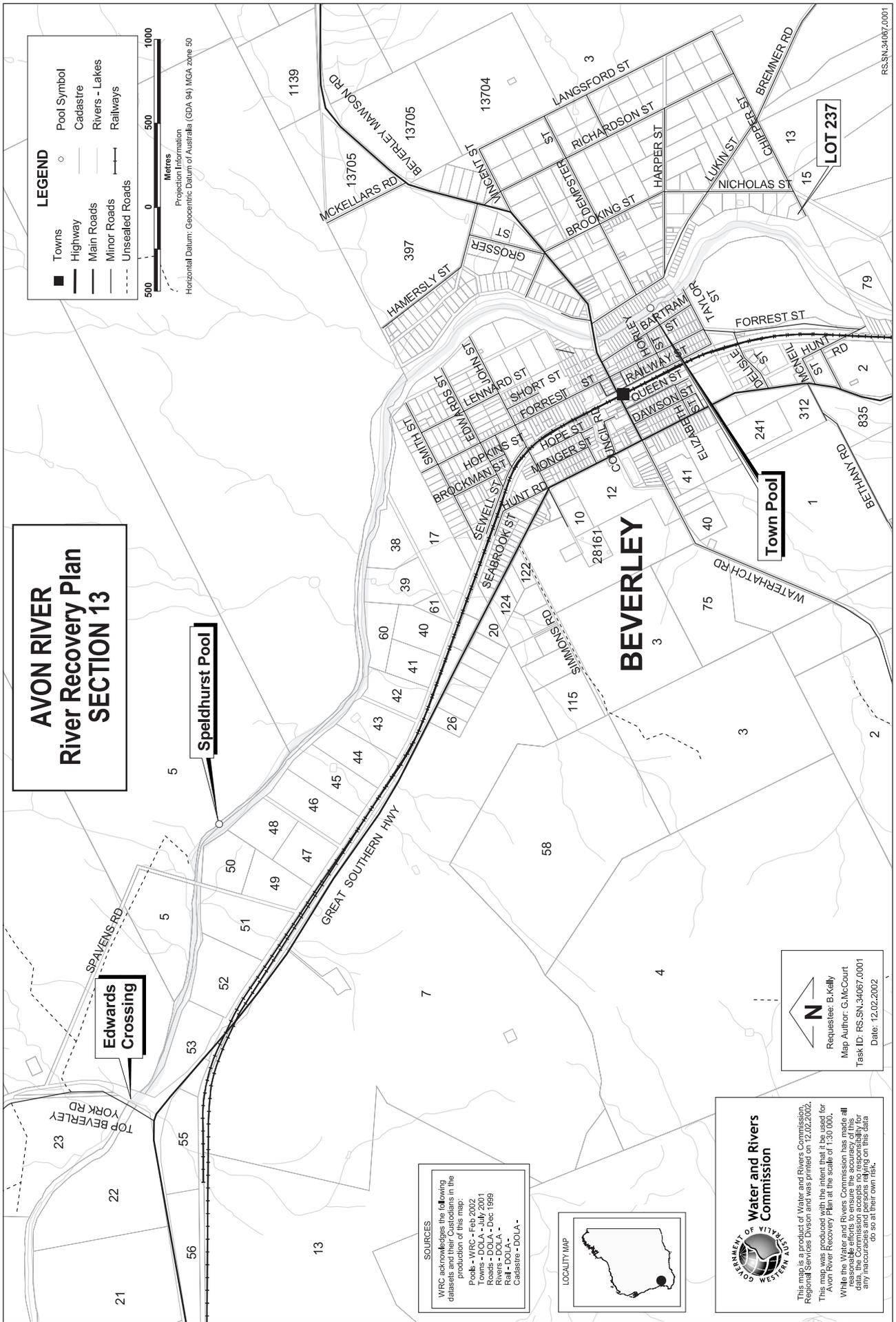
1.3 Why a Recovery Plan is needed

Before, and in the early days of European settlement, the Avon River at Beverley was mostly fresh, and was a place of beauty, teeming with animal and birdlife. The main river channel was braided, with many small channels interweaving between islands carrying thick stands of flooded gum and sheoak, and there were deep, shady pools at the townsite and downstream at Speldhurst.

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

After the settlement of Beverley in the early 1830s, the river was used for domestic and stock watering, for picnics and for fishing and duck shooting. The pools were used as swimming holes on summer weekends. The river was the central landscape feature of the Avon Valley and of the Beverley townsite.

These values were largely intact until the 1950s, but have since been seriously degraded by the cumulative impacts of settlement and unsound engineering practices. The two



Map 2: Section 13

most serious issues still affecting the river are the results of the River Training Scheme (RTS) undertaken from the mid 1950s to the early 1970s, and the inflow of salt and sediments from agricultural land upstream.

Other problems include: salinisation, pollution, loss of riparian and aquatic ecosystems, weeds, rabbits, foxes and feral cats, urban drainage entering the river, loss of the pools and the scouring out of the river channel. Symbolic of river problems is the fact that it is no longer safe to swim in the Town Pool because of the high level of pollution.

In addition, a new generation has grown up, and is being followed by newer generations who did not know or appreciate the way the river once was, and who take the existing degraded condition as normal.

The river will continue to degrade unless a new, shared vision is recaptured, and the Beverley community feels that something positive about achieving this vision is possible. This Recovery Plan is needed to help to promote and sustain this message, as well as to set out a practical blueprint for local action.

1.4 The Vision

The Vision that underpins this Recovery Plan is to have once again *‘a clean river, free of pollutants, lined by robust native vegetation. The pools are deep and shady, and alive with birds, and are safe for swimming. Weeds, foxes, feral cats and rabbits have been largely controlled and there is no rubbish. There are walking trails and interpretative information that provide pleasure and interest to visitors, without impinging on local residents. The river and its tributaries are fenced to allow careful stock management, and control fire hazards. The Beverley community takes pride and feels ownership of its section of the river and is involved in its recovery and ongoing care and management.’*

1.5 The planning process

In preparing this Recovery Plan, the following process was adopted:

- 1 A consultant was appointed to facilitate the planning process.

- 2 The Beverley Shire was briefed and their input obtained.
- 3 A public meeting was held in Beverley to outline the objectives of the plan, and to welcome community input.
- 4 An advisory committee was set up.
- 5 A draft plan was prepared and submitted to AWC and the local community for review.
- 6 Key organisations were identified and consulted during preparation of the plan. In addition to WRC/AWC, these included: the Shire of Beverley, Beverley bushfire interests, conservation interests, the Beverley Tourist Bureau, Aboriginal interests, and historical and heritage interests

Following endorsement by AWC and review by the Shire of Beverley, the Final Plan will be adopted by the Water and Rivers Commission, who will initiate implementation.

1.6 Terminology and abbreviations

Abbreviations and acronyms applying in river management in WA are:

AWC	Avon Waterways Committee
APP	Agriculture Protection Program (part of Dept of Agriculture)
CALM	Department of Conservation and Land Management
DEP	Department of Environmental Protection
FESA	Fire and Emergency Services Authority
ICM	Integrated Catchment Management
LCDC	Land Conservation District Committee
NHT	Natural Heritage Trust
RIWI (Act)	Rights in Water and Irrigation Act
SES	State Emergency Service
WAHEMS	WA Hazard Emergency Management System
WRC	Water and Rivers Commission

2 Background

2.1 The Distinctive Character of the Avon

The Avon River Basin is one of the major Australian river systems. It dominates the Central Wheatbelt of the Southern Land Division in Western Australia. The catchment of the Avon has an area of 120 000 km², which is larger than the area of Tasmania. It extends north of Wongan Hills, south of Lake Grace and east of Southern Cross. (See Map 3).

The Avon River Basin is also significant because it drains into the Swan-Canning Estuary, a central feature of Perth.

The Avon River differs to most river systems in other countries. Most rivers start in mountains or hills with high rainfall, and discharge to a drier coastal area with a low gradient floodplain or delta. On the contrary, the outer areas of the Avon basin have low rainfall and low landscape gradient. Both rainfall and gradient increase downstream.

The Avon River and the Swan River is 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 upstream of the Wooroloo Brook confluence at Walyunga. The main waterway of the river is discernible upstream to Wickiepin. The South Branch of the Avon River arises near Pingelly, flows through Brookton and joins the main river channel downstream of the Yenyening Lakes.

There are 15 major tributaries that flow into the Avon downstream from the Yenyening Lakes.

2.2 River flow

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 stream gauging station (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. In a dry year, the river above Broun’s Farm contributes only 12% of total river flow; in a wet year this can rise to over 40%.

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.

2.3 Floods and flood management

The major flood years last century were in: 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 that led to a River Training Scheme, undertaken by the State Government in the 1950s and 1960s. This involved:

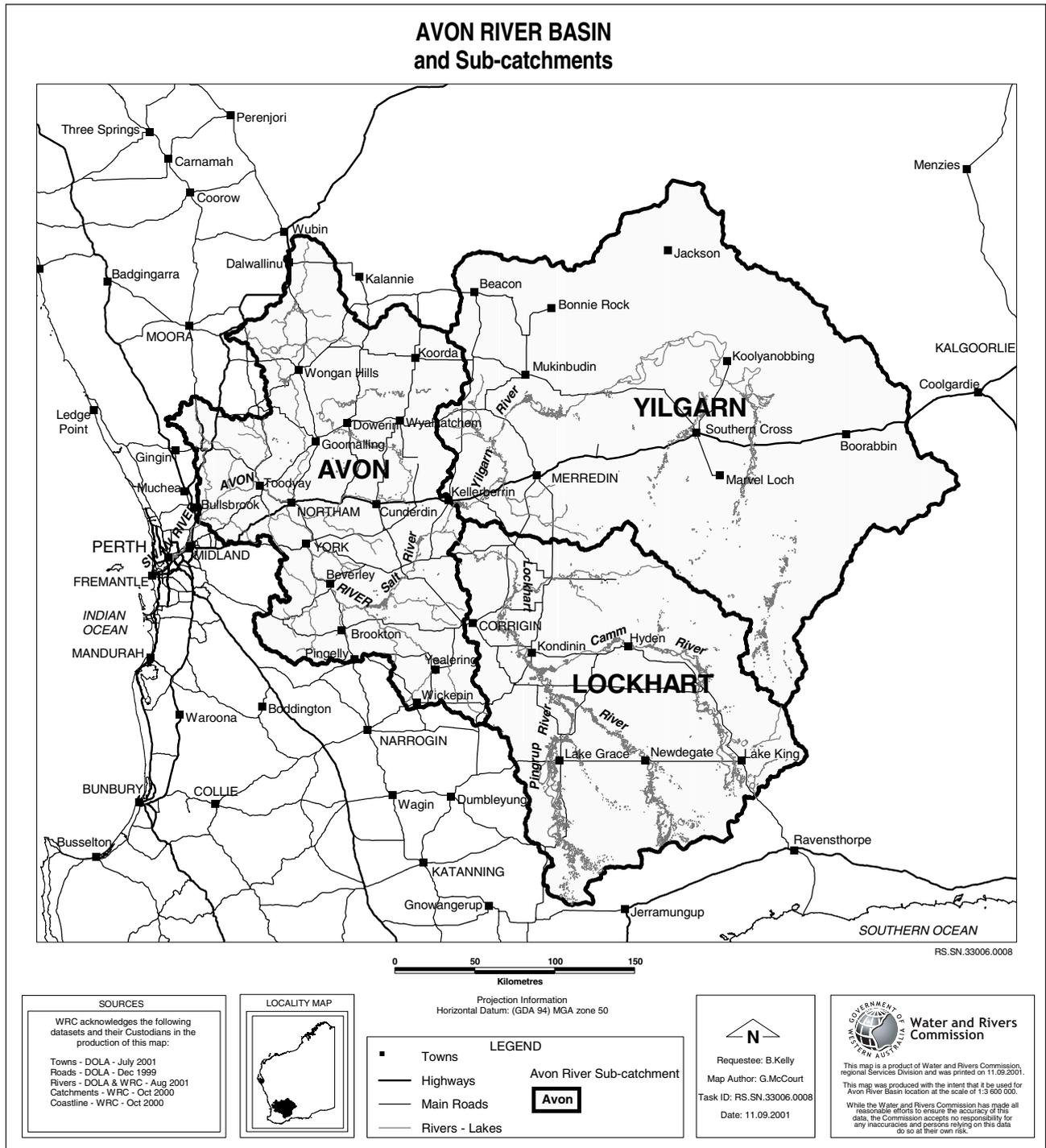
- removal of channel vegetation and debris to a width of 60 metres;
- removal of dead trees, logs and debris which impaired the river flow;
- ripping of the river bed to induce erosion of a deeper watercourse;
- removal of minor kinks and bends in the river.

A prolonged and significant flood, for example a 1:50 year event, has not tested the success of the scheme in ameliorating townsite flooding. However, townsite flooding at Beverley associated with lesser events has been reduced. No major floods have occurred since the works were undertaken. Rainfall has generally been lower than average over this period.

2.4 The inland catchments

There are three catchments that make up the Avon River Basin: the Avon, the Yilgarn and the Lockhart.

The Yilgarn and Lockhart catchments drain into the Avon through the Yenyening Lakes and have low or intermittent flow through drainage lines that usually comprise chains of shallow salt lakes. The contribution to water flow in the Avon River is generally less than 10% although the contribution of salt is high.



Map 3: Avon River Basin Catchment

2.5 The river pools

There were originally 26 major pools in the Avon River (between Cobblers Pool and the Yenyening Lakes). These were up to 70 metres wide, varying in length from 370 metres to 2 kilometres, and some over 10 metres in depth.

In addition there were numerous minor pools and deep billabongs.

Most of the pools are now filled or are filling with sediment and are subject to eutrophication as a result of nutrient enrichment.

2.6 Biological diversity

A very high proportion of the Avon River Basin has been cleared of natural vegetation for agriculture. The original ecosystems are now represented by patches of bush in reserves or on farms in agricultural areas. Fringing vegetation of the Avon River, its tributaries and lakes provide a thin corridor for connection of these remnants.

The river is also significant in this altered landscape as summer and drought refuge for wildlife.

The river, and in particular the pools, have ecosystems that have adapted to fluctuating environmental conditions. However, increasing salinity, sediments and nutrient enrichment, or a changing flow regime, threaten these systems.

2.7 River recovery and management

In the early 1990s, community concerns about the state of the river in the wake of the River Training Scheme resulted

in the creation of the Avon Waterways Committee (AWC). Subsequently AWC prepared and published a Management Programme for the river, which set out its strategies and priorities for river recovery and management.

One key strategy was to segment the river length into 18 sections, each of which could become the focus for detailed planning and recovery work. This Recovery Plan for the section of river from Beverley to Edwards Crossing arises from this strategy.

AWC is a community body, representing people and organisations along the river. The Water and Rivers Commission, a government-funded agency with professional staff and management resources undertake river management. A key objective of the Recovery planning process put in place by AWC is to build links between local communities, people living along the river, and government. Three more Avon River Recovery Plans are now being prepared, and are expected to be completed in 2002. This work is being funded jointly by the Water and Rivers Commission and the Natural Heritage Trust.

3 Key issues to be tackled in this recovery plan

During the preparation of this Recovery Plan, the following issues were identified as the most important for recovery of the Avon River at Beverley.

3.1 The river pools

There are two once-magnificent pools in this section of the river, the Town Pool and Speldhurst Pool. Both are filling with sediments. Unless this is halted, these pools will end up like the great pools downstream at Mt Hardy and Cold Harbour, both of which are completely filled.

Pool recovery and management requires attention to two things: putting in place mechanisms for preventing sediments from entering the river; and the removal and management of current deposits of sediments.

This work is complex and expensive, and needs to be done under the guidance of a well-designed plan.

3.2 The river channels

Related to the need to rehabilitate and protect the pools is the problem of the degraded river channels between the pools. These were scoured out and ripped by bulldozers during the River Training Scheme. This allows the river to flow rapidly between the channel banks (thus minimising the risks of floods), but prevents the trapping of sediments outside the pools, and the rebuilding of the riverbed.

Slowing river velocity within the channels can be assisted by the installation of ‘riffles’ (engineered rock weirs), by the protection/encouragement of vegetated islands, and by allowing the river to flow out onto the natural floodplain during high flood events, rather than be confined to a narrow channel.

3.3 Upstream entry of sediments

One of the key problems for the river at Beverley townsite is the entry into the river of sediments upstream. This is beyond the scope of this Recovery Plan, but is dealt with

in Recovery Plans for the Kokeby and South Branch/Brookton river sections.

3.4 Fire

There is a high risk of bushfire occurring within the river vegetation, especially in bushland within the townsite adjoining the Beverley District High School and the Beverley Golf Course. Because the river generally flows from northwest to southeast in this section, and the most serious bushfire winds are north-westerlies, there is significant concern about a fire starting in the river at the downstream end of the section and spreading into the townsite.

Access to the river for fire control is limited, with only two crossings, and difficult access through farmland.

3.5 Urban issues

Within the town, there are a number of issues of concern. The most important is the quality of the river water, which at present is unsafe for humans to bathe in due to pollution. The bulk of surface wastewater drainage from within the townsite is discharged into the river. Deep sewage is planned for part of the town; the remainder will continue to be on septic systems. Water Sensitive Urban Design and an integrated wastewater management program are needed.

Other river management issues associated with the urban situation are weeds (‘garden escapees’), rubbish dumping, and pet cats hunting wildlife in the bushland along the river.

Flooding is also an issue. Any work associated with river conservation, such as the construction of riffles, or recovery of natural vegetation, needs to consider the potential for flooding within the townsite and the impact on floodplain infrastructure.

Rubbish is found in many places in the river, but mostly within the townsite. This is unsightly and sets a poor example of community attitude to the river.

3.6 Stock in the river

The extent of this problem is no longer serious due to responsible fencing programs by some landowners and the supply of fencing material through the Avon River Fencing Project, an AWC/WRC initiative funded by the Water and Rivers Commission and the Natural Heritage Trust. At this stage only a small part of the river is still unfenced, although the tributaries are yet to be fenced.

3.7 Salinity

The river was once seasonally fresh and is now highly saline. Salinity threatens many aspects of the river, including its ecology and aesthetics. The salinity problem is huge and complex, and cannot be resolved within one small section of the river, but there are aspects of local land and river management which need to be considered.

3.8 Wildlife conservation

Bushland along the river provides habitat for native plants and animals. This habitat has been greatly reduced due to farming development in the region. Remnant species are threatened by feral predators and pests, weed invasion, grazing and fire. In particular we need to know whether there are any 'special' species present, i.e. species of plants and animals which may be rare or declared as 'threatened species'.

3.9 Education

It is important to continue to raise the interest in and knowledge of the river in the community (especially people

living in Beverley and along the river), and to encourage people to become involved in river conservation and recovery work and to take a pride in the outcome.

There is a need to develop packaged information for delivery to target audiences, for example, units on river science and conservation which can be taught in Beverley schools, and a Handbook for River Neighbours, setting out the goals and techniques of sound land and environmental management along the river.

3.10 Historic and heritage sites

There are a number of important historic and heritage sites in the town and along the river. No systematic survey has been undertaken. River management needs to take any such features into account, and ensure they are protected.

3.11 Tourism and recreation

The river, or parts of it, can be incorporated into wider plans for tourism development in the Beverley area, in particular the Beverley Townscape Plan, which envisages a network of walking trails linking parkland and bushland areas. This work needs to take into account concerns of river neighbours.

Some forms of recreational use are not appropriate in recovery areas. Examples are off-road vehicles and horse riding. Hunting should be restricted to exotic predators, such as foxes and cats.

The next section of the plan sets out the way in which these issues will be tackled.

4 Proposed actions

This section of the Recovery Plan describes the strategies that need to be implemented to address the key issues described above. Together with recovery work upstream in the catchment, these strategies will lead to the gradual recovery of Beverley's Avon River.

4.1 Recovery of the river pools

The goal is to rehabilitate and protect the two pools on the river. The pools are of major significance because they provide a summer refuge for wildlife, and because they are potentially a fine aesthetic resource in the district.

Both Town Pool and Speldhurst Pool were once deep, permanent and shady. Today they are silting up, are badly polluted and their ecological value, water quality and aesthetics have declined.

The Shire of Beverley has taken a close interest in the Town Pool over many years. Engineering surveys have been completed and there have been projects to assist summer water retention, and to create an attractive picnic area. A form of riffle has been constructed at the bottom of the pool, adjacent to the bridge. In March 2001 (at the time this Recovery Plan was being developed) a joint project involving the Water and Rivers Commission and

the Shire had commenced to install a new riffle upstream of the pool.

No work has been done on Speldhurst Pool, which now contains a huge slug of sediment, and has retreated back from its downstream boundary due to sediment deposition over the years.

Pool recovery and management is directly related to the management of sediment movement in the river, discussed under 3.2.

Action to be taken:

In addition to the strategies outlined under Sedimentation below, the following strategies will be taken:

- A management plan will be prepared for Speldhurst Pool. Water and Rivers Commission produced a sediment management plan for the Beverley Town Pool in June 1999. This will involve (where needed) detailed engineering surveys. The aims will be to increase summer water depth, improve water quality, establish and stabilise existing riparian vegetation and habitat, enhance the aesthetics of the pools and their environs, and to prevent the pools refilling with sediments.
- Sponsors for pool rehabilitation and protection will be sought.



Beverley Town Pool

*Photo courtesy
Jochen Franke*

- In the case of the Town Pool, a study will be made into the feasibility of installing a fountain to act as an attractive feature and to assist with oxygenation of the pool.
- The condition of the pools should be monitored over the years ahead, to document changes associated with their improved management and recovery.

WRC will plan and oversee pool restoration and management in consultation with the Shire of Beverley. WRC will provide the lead for all engineering work.

This work is high priority and is subject to the availability of funds. The project should commence as soon as possible and then be ongoing until the pools are restored and management procedures are in place to handle further sedimentation.

4.2 Sedimentation of the river

The goal is to minimise sediments entering the river, to reduce the movement of sediments along the river, to stabilise the riverbanks and channels, and to remove sediments from the river at selected places.

There are three parts to this problem: sediments entering the river from upstream of Beverley; the loss of natural bedload sediments from the scoured river channels which were ripped by bulldozers during the River Training Scheme; and the deposition of sediments into the pools. Entry of new sediment into the river upstream of Beverley is being covered in Recovery Plans for upstream sections.

Sediments comprise the bedload of heavy, coarse sands that are mostly rolled along by floodwaters; and the finer silts and clays, which are carried in suspension in flowing river water. Both are moving down the river channels to be deposited when the rate of water flow decreases, either at the natural pools, on meeting a natural obstruction, or when the river dries in summer.

A major cause of sediment movement is the higher velocity of the river in the wake of the Training Scheme. This problem is being tackled elsewhere in part by the installation of ‘riffles’. In the context of this plan, a ‘riffle’ is an engineer-designed low rock bar, or some other form of engineered structure, placed across the river at a strategic point with the aim of slowing flow velocity. These structures can also become places where coarse sediments will be deposited and the sediment can be later removed.

Each riffle is different, as it must be designed to fit the local situation. Riffles are most effective at low flow rates.

Movement of sediment into the river can be minimised by installing and maintaining ‘silt traps’ at the point of entry of a tributary, and by establishing/maintaining vegetative buffer zones along the banks of the river and its tributaries.

Actions to be taken:

- Priority will be given to stopping the downstream movement of sediment into Town and Speldhurst Pools. WRC will be requested to design and install riffles/silt traps to protect Speldhurst Pool, and to complete the new riffle upstream of Town Pool, to control sediment movement at these points.
- Sediments accumulating at the foot of the current riffle on the Town Pool and at any new riffles will be regularly removed.
- Landowners adjoining the river downstream of Beverley will be encouraged to maintain fences so as to assist revegetation and regeneration along the river and the main tributaries entering this section of the river. Riparian vegetation is an effective way of preventing new sediments entering stream channels.
- The Shire will be requested to review the engineering of gravel roads leading down to the river to ensure no movement of sediment into the river.
- Where sediments removed from the river have commercial value, AWC/WRC will seek to return any income to the river for conservation and management works. Wherever practical and cost-effective, and with river neighbour agreement, sediment stockpiles will be developed on private land, rather than within the bushland along the river.
- All engineering works will be discussed with the Shire of Beverley in the planning phase.
- Studies will be instituted into construction of minor riffles and other measures to slow the movement of water along the scoured channels, and enable the riverbed to be rebuilt.

Survey and engineering work will be undertaken by WRC with the cooperation of the Shire of Beverley and river neighbours.

Riffles will be installed and sediment traps and sediment removal organised, as funds become available.



Wild oats

Photo courtesy Trish Janssen

4.3 Fire

The goals are to minimise the threat of fire to the river environment and to neighbours, and to educate river neighbours and encourage them to take responsibility for protecting their own assets, especially in the urban zone.

Bushfire is a threat to the river environment and to river neighbours. Fire along the river can result in loss of habitat (especially old trees), loss of rehabilitation plantings, soil erosion and increased weed growth. Fire escaping from the bushland can threaten life and community assets.

Bushfires are hard to tackle and to prevent in and along the river because of poor access and heavy, grassy fuels. In addition, the river is a special problem because (i) it is a long linear line of bushland running through the town and rural areas; and (ii) lengthy sections are fenced off or are inaccessible to fire fighting vehicles.

High value assets adjoin the river and are potentially threatened by bushfire. These include residential areas within the townsite, the High School, golf course, farm

infrastructure, stock and cropland.

The principal fuels are wild oats and leaf and twig litter from native vegetation. Wild oats are enhanced by fire, but can be controlled (in the short term) by controlled grazing or spraying with herbicide and (in the longer term) by shading out by a thick tree canopy.

There has been at least one major fire in bushland along the river in the last 6 years. This killed a large number of mature trees, and allowed increased wild oat development where the canopy was opened out, but also resulted in good regeneration of York gum, swamp oak and flooded gum in some places. There are only three places with rapid access to the riverbank for firefighters: the townsite, Speldhurst Crossing and Edwards Crossing and only two vehicle crossing points (the old Speldhurst Crossing Bridge is no longer trafficable).

AWC has a fire policy that sets out the objectives for bushfire management in and along the river. A coordinated approach to bushfire management along the river in the Beverley area is yet to be developed.

Actions to be taken:

- A Fire Management review of the river will be undertaken, under the leadership of the Shire of Beverley, concentrating on the bushland area adjoining the river within the townsite. This will involve representatives of the Shire, the Fire Brigade, the Chief Fire Control Officer, AWC, FESA and WRC.

The aim will be to (i) develop and implement a Fire Management Plan for the river bushland which identifies and minimises the threat of fires entering and leaving the river; (ii) ensuring fire prevention work is properly carried out on properties neighbouring the river and (iii) ensuring that all concerned are trained in the need to protect river values. The Strategy adopted must be approved by AWC.

- The Shire will be asked to enforce the Bush Fires Act on properties adjoining the river, especially townsite blocks with heavy fuel loads.
- A Handbook for River Neighbours will be prepared by AWC (in consultation with appropriate groups including the Shire) and issued to all river neighbours. In the section on fire, this will stress the need for landowners to assume responsibility for protecting their own assets, and will explain the basis of fire management along the river.
- Landowners who wish to carry out controlled spring grazing of grass in the river will be encouraged to apply to WRC for permission.
- Landowners along the river will be asked to install gates on fences along and at right angles to the river, to assist access for firefighters. Where this is done a sign reading 'Fire Access Point' will be displayed on the front gate of the property.
- Landowners who opt to install firebreaks will be encouraged to keep them out of the floodway of the river and to construct them to be trafficable to fire trucks, rather than cultivated strips which bog vehicles in summer and erode in the winter.
- Western Power will be requested to review the safety of power lines running across river bushland.
- In the wake of a fire, prompt action will be taken to rehabilitate any new firebreaks and to ensure the burnt bushland is securely fenced to prevent stock grazing off natural post-fire regeneration.

- The Shire will be requested to upgrade Speldhurst Crossing for cross-river fire vehicle access during summer.
- WRC will commence and maintain a database of fires, so that an accurate fire history for the riverland bush can be built up over time.

WRC and the Shire of Beverley will be responsible for convening the Bushfire Review each year, or as required, and for following up to see that action occurs. The Shire will be responsible for fire planning, enforcement and fire management on its land.

River neighbours will be responsible for protecting their own assets.

These initiatives should be developed during winter/spring following the final approval of this Recovery Plan. Henceforth, the action will be ongoing annually.

4.4 Fencing and management of stock along the river

The goals are to have stock-proof fencing in place on both sides of the river along the whole length of the river from Beverley townsite to Edwards Crossing; to have a positive management agreement with adjoining landowners to ensure fence maintenance; and to extend river fencing upstream along the tributaries into farming properties adjoining the river.

Uncontrolled livestock grazing in the bushland along the river, or moving across the riverbanks and along the dry riverbed in summer can destroy native vegetation, introduce weeds, erode the river bank and river bed and pollute the river.

On the other hand, controlled grazing of bushland along the river can be used to reduce a serious fire hazard, and this can be approved by AWC/WRC. Controlled grazing requires fencing to confine stock to the approved grazing area and to control the intensity of grazing.

Fenced areas will regenerate naturally over time, or can be replanted with native trees and shrubs. The vegetation helps to control soil erosion along the river, and provides habitat for wildlife.

WRC/NHT provides fencing materials to qualifying landowners, in return for which the landowner is required to enter into an agreement about management of the



Fencing along the Avon River

Photo courtesy Martin Revell

fenced-off land which borders the river and management of the fence. This program is dependent on funding, and at the moment applies only to the main river, not to tributaries.

The current status of fencing along this section of the river was surveyed in March 2001. This survey found that of the 12.4 km of river bank outside the town boundary, only one short section was not currently fenced. Other unfenced areas adjoin the townsite or the golf course, neither of which is grazed. One area of farmland which is fenced is considered to need re-fencing.

Actions to be taken:

- WRC will contact landowners on the sections not yet fenced, or where fences may not be permanently stock-proof as identified in the above survey, and will seek to enter into arrangements with them to complete river fencing on their properties.
- Fencing materials will be provided to river neighbours prepared to fence the river and enter into a Fencing Agreement.

- Where landowners cannot carry out fencing themselves, assistance will be sought from service clubs, etc.
- Over time, fence condition and fencing needs will be monitored and new or replacement fences organised as funds are available.
- Once the fencing of the main river is completed, priority will be given to fencing the main tributaries.

WRC will be responsible for all the above actions, and landowners will be responsible for fence maintenance.

The aim is to complete the actions listed above within 18 months of finalisation of the Recovery Plan.

4.5 Weeds

The goal is to commence controlling the most serious weeds in bushland along the river.

Weeds degrade the bushland along the river. They are a fire hazard, replace native vegetation, or prevent the regeneration of native vegetation, and are often visually unattractive.

Some introduced species perform a useful role in rehabilitation and riverbank stabilisation, for example saltwater couch grass. These species will be tolerated in the short term. In the longer term they will need to be controlled and replaced with native species which perform the same function.

No detailed survey of weeds in the river has been undertaken, but the following weeds have been observed: wild oats, doublegees, dock, Cape tulip, caltrop, bridal creeper, African boxthorn, Spiny Rush. No aquatic weeds have been observed.

The most serious weed problems are the heavy stands of wild oats in the Shire reserve adjacent to the townsite, downstream of the bridge (an area opened up by a recent bushfire) and the expanding crop of African boxthorn along the west side of the river upstream of the bridge.

Action to be taken:

- Initially, weed control will focus on African boxthorn and bridal creeper. A survey will be undertaken on foot along the river, and a map of infestations of these species prepared. This can be done by a community group, under the direction of WRC. This map will be given to the Shire to undertake control measures.
- High priority will also be given to controlling small new infestations of weeds which are relatively easy to control, for example watsonia.
- Second priority will be given to species which are a fire hazard, such as wild oats. The infestation of wild oats in the Shire reserve adjacent to the townsite should be addressed within the Fire Review described above.
- The development of weeds into a fire hazard in the wake of river fencing will be monitored. Where this occurs, controlled springtime grazing will be permitted. Shading out of weeds by native trees and shrubs will be encouraged.
- The local community and other voluntary groups will be requested to assist with weed control.
- WRC will support research into the distribution and control of environmental weeds along the Avon River, especially invasive species.

Weed control along the river will be the responsibility of the Shire assisted by WRC, community groups and neighbours. Weed management should commence immediately.

4.6 Feral and pest animals

The goal is to minimise the number of feral and pest animals in bushland along the river.

Feral and pest animals are observed to be present in the bushland along the river. The main ones are foxes, feral cats and rabbits. Foxes and cats prey upon native fauna, while rabbits destroy native vegetation, or move out onto neighbouring properties as vermin, and make revegetation difficult.

Mosquitoes are a problem in urban areas adjacent to the river, especially in wet years, or years with summer rainfall which leaves temporary pools where they can breed.

Rabbits and foxes have been controlled on previous occasions, but have re-invaded and current populations are high. No systematic control of feral cats has occurred.

Action to be taken:

- WRC will assist to develop cooperative arrangements between the Shire, APP and landowners to institute ongoing control programs for feral and pest animals.
- The APP officer at Beverley will be requested to organise the initial fox baiting program along the river, as a matter of urgency.
- Community groups and neighbours will be asked to note and report problems, such as rabbit burrows and high fox numbers.
- The Shire Environmental Health Officer will be requested to maintain education programs on mosquito prevention strategies by home-owners.

Control of pest species is a community issue, requiring cooperative programs. There are also safety issues involved in the use of firearms and poisons, and control programs need to be responsibly organised and managed. The input of the APP to any control work is essential.

4.7 Salinity

The goal is to contribute to the minimisation of the salinity problem in the land adjoining the river in the Beverley area.

Historical records indicate that the Avon River was naturally brackish in some years, but was mostly a fresh or marginally freshwater river until about the middle of

the 20th century. Since then it has become highly saline. This is a result of land clearing and farming practices in the catchment, although in some years significant volumes of saline water have come downstream when the inland salt lake system has overflowed and flushed out a portion of their accumulated salt.

Salinity threatens flora and fauna and also destroys the beauty of the river landscape.

Salt water is entering the Beverley section of the river from upstream, and also from movement of saline groundwater beneath paddocks being used for cropping and grazing. Some salt is carried in tributaries entering the river, although these are short and mostly flow only briefly in late winter. Currently late summer salinities in the pools are significantly higher than that of seawater.

There are also some fresh water sources entering the river, including one from within the townsite, which has generated a relatively fresh spring about 100 metres downstream of the bridge.

The salinity problem is very large and complex, and cannot be resolved by isolated actions within the Beverley river section itself, but positive actions at the local scale can be undertaken.

Actions to be taken:

- The sources and salinities of tributaries to the river will be studied and a database developed and maintained.
- WRC will support salinity monitoring by the local community.
- Sources of fresh water (e.g. springs in or adjacent to the river) will be identified, and measures taken to protect them. In particular the Shire will be requested to review management of the fresh water flowing into the river near the tennis club.
- AWC and WRC will support projects along the river which are designed to address the salinity problem, in particular the revegetation of bare hills (recharge areas) and of floodplains (discharge areas) along the main river valley.
- Research into salinity management will be supported.
- WRC will encourage the LCDC and landowners to develop and implement a revegetation program for recharge and discharge areas adjacent to the river, and for the adoption of farming practices which minimise recharge of sandy soils along the floodplain.

WRC will be responsible for liaison with landowners to identify sources of fresh water and to institute protective management of fresh water sources

4.8 Rubbish

The goal is to remove existing rubbish and to minimise future rubbish deposition in and along the river.

Over many years, rubbish has been accumulating in the river and along its banks. 'Rubbish' includes discarded household or farm items, bottles, car tyres, plastic items and drums. The current situation is reasonable, with the worst areas being within the townsite, especially beneath the bridge. Farming areas are generally very tidy.

Up until the preparation of this Recovery Plan there was no local organisation to provide the initiative for a river cleanup or an ongoing cooperative approach to rubbish management. However, a spontaneous cleanup of the river areas within the townsite was successfully carried out in May 2001.

Action to be taken:

- A 'Cleanup The River' day will be organised each year. This aim will be to involve volunteers, service groups, schoolchildren, river neighbours. This could be organised to coincide with 'Tidy Western Australia Day' and could involve a community picnic.
- The focus will be the area beneath and around the bridge, and upstream along the banks of the town pool.
- The Beverley School Cadet Corps will be invited to help organise and assist with river cleanup days.
- The river Cleanup Day may need to be repeated annually.
- An education campaign will be conducted to promote a sense of pride in the river, and to change people's attitudes so that they do not discard rubbish in the river. This may include appropriate signage near the river.

The Friends of the River group, in conjunction with the Shire and community groups will be asked to organise the cleanup campaign, and local schoolteachers will be asked to conduct the educational program.

The main drive on cleaning up the river to be completed within 2 years.

4.9 River pollution

The goal is to identify sources of pollution and put into place strategies which will eliminate or control or minimise them.

The Avon River at Beverley contains a range of pollutants which degrade water quality and lead to eutrophication and health risks to swimmers. The most serious pollutants are phosphorous and nitrogen which derive from fertilisers and organic matter, e.g: sheep manure.

Other sources of pollution are urban and industrial wastewater and stormwater. Entry of sewage into the river is not regarded as a problem, despite all of Beverley being currently on septic sewage systems. About half the town will be on deep sewage soon. In an excellent initiative by the Shire of Beverley, the former rubbish dump (which was located adjacent to the river) has been closed and relocated to a safe area. Rehabilitation of the old rubbish dump is to be completed.

Monitoring, analysis and control of pollution is expensive and requires high technical skills. In general this will be a job for WRC and the DEP, with the role of local people to provide information and feedback.

Actions to be taken:

- Opportunistic water sampling by the community, or through the Ribbons of Blue/Waterwatch program will be continued and supported by WRC. The aim is to assess levels of chemical pollution.
- Sources of key pollutants will be identified.
- WRC will cooperate with the Shire and the SES to implement the contingency plan to handle a major chemical spill in or near the river, and to be part of the WAHEMS planning and operational network.
- WRC will request the Shire of Beverley to review stormwater discharge from the town into the river, and to progress improved systems of wastewater disposal.
- The Shire will be requested to provide plants and site preparation work for the revegetation of the former rubbish tip (in particular the former septic waste dump). Replanting of this area is a project which could be taken up by a Friends of the River group, and involve local schoolchildren.
- The Shire will be requested to increase the application of 'Water Sensitive Urban Design', in particular the

development of detention basins to strip sediment and other undesirable components from stormwater.

- AWC/WRC will seek to ensure that any new subdivisions or urban or industrial developments, or intensive agriculture adjoining the river, must incorporate the principles of water sensitive urban design.
- WRC will ensure weed and pest control programs carried out within the river bushland are done so responsibly, to avoid waterway contamination with pesticides.

WRC will be responsible for overseeing this work, and the Shire of Beverley will be responsible for urban issues.

4.10 Wildlife conservation

The aim is to determine if there are any special or valuable species of native plants or animals in the river, and if there are, to ensure their protection.

Although the area of bushland along the river is small, it is able to provide habitat for many native plants and animals. This is an important resource for the Beverley area.

Action to be taken:

- A biological survey of the river bushland will be made. This can be done over an extended period by the Beverley Naturalists Club, under the guidance of experts in wildlife surveys.
- If any rare, threatened or endangered species are discovered to be present, advice will be sought on their protection.
- This information will be passed to WRC and the Shire of Beverley for implementation of protection measures.
- Feral pests and predators will be controlled.
- Monitoring will be carried out over the years.

4.11 Recreation

The goal is to ensure that appropriate recreational activities along the river at Beverley can be enjoyed by the public without deleterious impact on the river environment or neighbours.



Passive recreation on Beverley Town Pool

Photo courtesy Fred Bremner

The river and its environs can be a source of pleasure to many people, and can be used for many forms of recreation. Some forms of recreation have little or no impact on the river; others are environmentally unsuitable. Recreational pursuits can also impact on river neighbours, through trespass on private land, noise or anti-social behaviour.

The main part of the river currently used for recreation is the Town Pool, where the Shire has created a pleasant picnic area, and the Avon Ascent has set up one of its interpretive pillars. Other activities include bushwalking and nature enjoyment, canoeing, boating, horse-riding and trail biking. As the bulk of the riverside land is privately owned, recreational development is inherently constrained. There are no public recreation areas on the river outside the townsite.

The Shire of Beverley has developed a Townscape Plan and a Beverley Trails plan. These are professional documents, and can easily be dovetailed with this Recovery Plan.

There is currently a poorly designed and maintained recreation site at Edwards Crossing (just outside the Beverley river section). This is close to an important historical site, and could provide an excellent point at which motorists could stop for a picnic, a walk and be provided with interpretive material about river management.

Action to be taken:

- Current plans to landscape and develop the surrounds of the Town Pool are supported. A further move may be the construction of a fountain in the pool, both to aerate the water, and to provide a scenic attraction.
- A new picnic site will be developed at Edwards Crossing, at the junction of the Top Beverley Road and the Great Southern Highway. This is just outside the section of the river covered by this Recovery Plan, but would serve both this and the downstream section of the river. It will be necessary to consult with the Main Roads Department over main road entry, should this be

necessary, and to ensure that the site was properly managed.

- At both sites, AWC will encourage the integration of education with recreation. Sites should have interpretative material (signs, pamphlets, self-guiding walks or drives) which inform visitors about the river, its ecology, history, use, current management and recovery. This could also be included as part of the Avon Ascent interpretive drive.
- Outside the townsite, only those activities consistent with river conservation and recovery will be allowed. These are: walking, picnicking (without campfires), canoeing, swimming, bird-watching, nature study, contemplation, art, photography, and dog exercising.
- Outside the townsite, the following activities will not be allowed in and adjacent to the river: overnight camping, power boating, horse, camel or donkey exercising or riding, off-road motor cycling or 4-wheel driving, shooting (except for exotic pest or feral animal shooting undertaken as part of a managed pest-control program), jet ski riding, or the release of exotic fish or birds.
- If walking trails are constructed along the river, this may only occur with the permission of the landowner where the trail needs to cross private land.
- The impact of recreational use of the river will be observed, and the above approach may need to be modified over time.

The Shire of Beverley is responsible for managing recreational activities within the Town boundary. WRC and the Shire will cooperate to develop the new picnic area at Edwards Crossing and to inform visitors about the river. Community group members and neighbours will be asked to keep their eyes and ears open to non-permitted uses and report these to the Shire or to WRC.

4.12 Education and communication

The goal is to ensure effective two-way communication between WRC and key audiences in the Beverley community.

The recovery of the river will be hastened if the local community understands the need to care for the river, shares a positive vision, and is prepared to contribute time, energy and funds to the needs of the river. Also, the

community needs a forum in which it can pass on its concerns and achievements and local knowledge to WRC.

Currently there is an inadequate understanding of Avon River issues in the Beverley community. Many young people or newcomers to Beverley accept the current degraded state as the normal state or have not had an opportunity to become better educated about the river. Many other people have deep concerns, but feel powerless to change things. There is a need to involve the youth of the community in positive work and landcare practices along the river.

There is a growing positive attitude towards the river among the farming community downstream of Beverley.

Actions to be taken:

- An appropriate message will be developed for key audiences in the Beverley area, to be followed by a program of communicating these messages over time. Key audiences and messages given in the table below:

Key Audience	Key messages for these audiences
Schoolchildren and young people	The natural history of the river, and the history of river use; the vision for the future; what is expected of them; what the rewards will be for them in the future; what they can do.
The Shire of Beverley	The expectation that they will incorporate this Recovery Plan into their overall planning schemes for the Shire; the need for water sensitive urban design; their responsibilities for high quality recreation and road management.
Aboriginal people in Beverley	Participation in this Recovery Plan and to include Aboriginal Heritage in all messages and signage
Riverside neighbours	Their responsibilities in the areas of fire, stock control, fencing, soil conservation, waste disposal and chemical use, and acting as 'eyes and ears' of WRC.
Fire authorities	The contents of this Recovery Plan with respect to fire.
Townsfolk	The ways in which they can help river recovery.
Tourist bureau and operators	This Recovery Plan.

- Packages of educational material will be developed for insertion in curricula at Beverley's schools, to enable teachers to deliver programs on river science, conservation and recovery.
- Wherever possible, the youth of the district will be invited to participate in river management projects.
- The Beverley District High School will be invited to undertake 'hands-on' projects relating to river restoration, including revegetation, monitoring, cleanup days.



Peak flow at Beverley, January 2000

Photo courtesy Fred Bremner

- WRC will liaise with TAFE to see whether students who undertake voluntary river restoration projects can obtain credit for appropriate certificate courses.
- AWC will continue to support the Avon Ascent Program. This program is aimed at education of city people about landcare in the Avon River catchment, but also helps to educate local people through the information pillars at Avondale and the Town Pool.
- Subject to the availability of funds, a Handbook for River Neighbours will be developed, covering issues in this recovery plan which are relevant to people living adjacent or near to the river. This will be distributed by WRC, and updated and redistributed from time to time. Cooperation will be sought from the Shire and real estate agents to help with distribution to new residents along the river.
- WRC will be asked to prepare a coloured wall map of the river, showing key features and actions, for supply to local residents and schools.
- WRC will be asked to supply technical support and classroom resources for teachers working to deliver the messages in this Recovery Plan.

WRC will be responsible for overall communication with key audiences, but will seek assistance from community groups and local people, including schoolteachers.

4.13 Flood mitigation

The goal is to minimise the impact of damaging floods on the town of Beverley, Infrastructure and houses on the floodplain, while maximising the environmental benefits of flooding in the bushland.

Almost every winter, the Avon River overflows its immediate channel, and about one year in three it floods across the floodway and beyond. Much broader flooding was part of the natural functioning of the river pre-1955, with a major flood occurring about once in every decade.

The town of Beverley and many houses and other items of property or infrastructure are built on the river floodplain and are potentially threatened by flood damage. Part of the town is within the 1:100 year flood level.

There has been no serious flood damage at Beverley for many years. This is due to (i) the River Training Scheme which increased the depth of the river channel (thus

increasing flood storage capacity) and opened up the bushland adjoining the river, thus minimising the frequency and duration of over-bank flood events and (ii) below average rainfall since the 1950s. Higher water levels and flooding of urban land is considered to be more likely in the future if average rainfall patterns recover, and the clearing and channel deepening caused by the River Training Scheme are repaired. On the other hand, the cleaning out of the river pools will increase the number and size of floodwater retention basins in the river.

It will be essential that these changes are preceded by improved flooding preparedness and flood management in the town.

Flooding has environmental benefits. Annual inundation of the floodplain revitalises the native understorey species, and helps to control grassy weeds such as wild oats, and stimulates the regeneration of native vegetation. Prolific regeneration of swamp sheoak usually follows a flood.

Action to be taken:

- WRC will liaise with the Shire to prepare a Flood Contingency Plan for Beverley. This will encompass prevention requirements and action in the event of a flood, and will be communicated to residents, so they are well aware of the action to take in the event of a flood.
- WRC will assist to develop and to see adopted an Avon River Flood Hazard Management Plan.
- All river recovery work, such as installation of riffles and revegetation, will be reviewed in the light of their potential effect on flooding of private and public assets.
- Natural flooding frequency and duration will be encouraged on floodplains where no assets are threatened, so as to encourage natural regeneration and discourage weeds.

Flood mitigation planning is the responsibility of the Shire of Beverley and WRC. River neighbours will need to keep valuable assets out of the floodplain, and expect to be subject to occasional flood events.

4.14 Historic and heritage sites

The goal is to identify and preserve historical and heritage sites or features along the river.

No survey of historic sites along and adjoining the river has been carried out. Sites could include the original townsite at Edwards Crossing, homesteads, and river crossings.

Aboriginal people have strong associations with parts of the river comprising songlines or dreaming trails, and there may be other significant sites along the river. Details of sites of importance to Aboriginal people are normally not made public, but the need to ensure protection through a consultative process is important.

Action to be taken:

- The Shire of Beverley will be asked to organise a survey of the river and environs to identify all historic sites. This could be undertaken by the Beverley Historical Society.
- WRC will seek ways of supporting landowners who wish to protect such sites along the river.
- WRC will take all care to avoid damaging historic and heritage sites during river management work.
- WRC will consult with Aboriginal people in Beverley and will cooperate in the protection of any sites or features of value to the Aboriginal people along the river.
- Aboriginal people will be asked to review proposed works, such as construction of 'riffles', before commencement, to ensure sites of significance are not disturbed.

5 Priorities

The priorities listed in this section were developed by the Beverley community members who assisted with the preparation of this Recovery Plan, and are submitted to AWC for their endorsement.

5.1 Over-riding priority

Most of the actions listed in Section 3 of this plan can be carried out in parallel, with different people involved. However, the over-riding issue requiring investment of resources is the rehabilitation of the Town Pool and Speldhurst Pool. These pools are regarded as river icons, and their recovery will help to inspire and encourage the local community.

This work will also involve management of sediment moving into and along the river.

5.2 Other priorities

The other high priority tasks relating to the recovery of Beverley's Avon River are:

- 1 Educating and enthusing the Beverley community about river values and the specific needs for river recovery, promoting the new recovery plan and its policies and implementation and reporting to the community on programs and progress.
- 2 Providing opportunities for the community (including our youth) to become involved in positive rivercare projects.
- 3 Putting in place a mechanism for dealing efficiently with the threat of bushfires.
- 4 Completing the fencing of the river.

- 5 Controlling invasive weeds and feral predators.
- 6 Biological survey to reveal if important wildlife species are present.
- 7 Put in place a flood management/mitigation program for Beverley townsite.
- 8 Institute trials to repair the scoured river channels
- 9 Review chemical pollution, and institute measures to control point source pollution.
- 10 Encourage the Shire to adopt the principles of Water Sensitive Urban design, and to manage stormwater and wastewater disposal in Beverley town so that it does not pollute the river.
- 11 Organise an annual Cleanup the River event, perhaps in conjunction with a River Picnic, and then put in place the strategies for continuing a rubbish-free river.
- 12 Carry out the survey of historical and heritage sites.
- 13 Develop a new recreation site at Edwards Crossing, and walking trails along the river within the townsite.

5.3 Priority ranking

In this plan the following terms apply:

- Very High Priority: important and urgent work; should commence at once.
- High Priority: important work but less urgent
- Medium priority: important and not urgent
- Low priority: less important and not urgent; can be deferred.

6 Implementation and review of the recovery plan

6.1 Primary force for promotion and oversight of the recovery plan

WRC, in conjunction with AWC, will provide the leadership necessary to drive the implementation of this recovery plan. They will do this through the development of positive, cooperative-operative arrangements between the following main groups:

- The Shire of Beverley
- River neighbours and ‘Friends of the River’ groups which might arise.
- Bushfire personnel
- Tourist Bureau
- The Beverley Naturalists Group
- Historical Society
- Aboriginal groups
- The Beverley school, including its Cadet Corps
- Funding bodies within the Avon catchment and beyond.

The key role of WRC/AWC will be to bring the right people together on projects, to assist them to work cooperatively, to help capture expertise and funds, to oversee standards, and to report back on progress.

6.2 Involving the Beverley community in plan implementation

WRC/AWC will assist to set up a Friends of the River group who can undertake projects arising from this

Recovery Plan. There could eventually be a ‘Young Friends’ group as well. The aim is to consolidate local pride and ‘ownership’ of the river, to widen the net of resources and energy available for recovery projects and to provide opportunities for members of the community (especially young people) to do positive rivercare work.

The WRC Rivercare Trailer will be made available for projects along the river. Registered volunteers will be covered by WRC insurance during this work.

At all times WRC/AWC will endeavour to keep the Shire fully informed about progress with river projects.

6.3 Plan review and reporting

Progress with the implementation of this recovery plan will be reviewed annually. Articles on progress will be published in the local newspapers from time to time.

Approximately 5 years after its adoption, the plan will be completely reviewed, with the purposes of:

- Marking off work which is completed;
- Adding in new work requirements, or amending strategies if needed;
- Reviewing priorities;
- Updating any other aspect of the plan.

The Beverley community will be asked to participate in this project. WRC/AWC will be responsible for triggering the review process and carrying it through to completion.

7 Summary of issues, actions, priorities and responsibilities

Note that all proposed actions are subject to availability of funds, and the internal priorities of the organisations nominated.

The Issue	Action to be taken	Priority	Who is responsible
Recovery of Town and Speldhurst pools	<ul style="list-style-type: none"> Prepare a management plan for Speldhurst pool to tackle (i) removal of sediments and (ii) prevention of further sedimentation. Seek sponsors for pool rehabilitation and protection Feasibility study of installing a fountain in Town Pool. 	Very High	<ul style="list-style-type: none"> WRC in conjunction with Shire of Beverley
Reduce the velocity of the river and decrease downstream movement of sediments	<ul style="list-style-type: none"> Design and install riffles/silt traps to protect Speldhurst Pool, and maintain the riffle upstream of Town Pool, to prevent sediment movement at these points. Sediments accumulating at riffles to be regularly removed. Maintain fences so as to assist revegetation along the river and the main tributaries Review the engineering of gravel roads leading down to the river to ensure no movement of sediment into the river. Return income from sediment disposal to the river for conservation and management works. Sediment stockpiles to be developed on private land, rather than within the bushland along the river. Trials of methods to slow the movement of the river along the scoured channels and rebuild the river bed. 	High	<ul style="list-style-type: none"> WRC/Shire WRC/Shire Land-owners Shire AWC Land-owners WRC
Conserve wildlife	<ul style="list-style-type: none"> Undertake biological surveys Control feral predators and weeds Develop species protection measures if necessary Monitor wildlife 	High	<ul style="list-style-type: none"> Beverley Nats APP and WRC WRC Beverley Nats
Minimise the risks of Bushfires	<ul style="list-style-type: none"> Fire Management review of the river, and development of fire strategy Enforce the Bush Fires Act on properties adjoining the river, especially townsite blocks with heavy fuel loads. Prepare Handbook for River Neighbours and issue to all river neighbours. Controlled spring grazing of grass in the river to control wild oats. Install gates on fences along and at right angles to the river, so as to assist access for firefighters. Where this is done a sign saying "Fire Access Point" will be displayed on the front gate of the property. The Shire will be asked to review its Fire Break Order for properties adjoining the river, to require firebreaks to be trafficable to fire trucks, rather than cultivated strips Where feasible keep firebreaks out of the floodway of the river. 	Very High	<ul style="list-style-type: none"> representatives of the Shire, the Fire Brigade, the Chief Fire Control Officer, FESA and WRC WRC/AWC WRC/AWC in conjunction with landowners Landowners Shire Landowners

Summary continued overleaf...

...Summary continued

The Issue	Action to be taken	Priority	Who is responsible
	<ul style="list-style-type: none"> Western Power will be requested to review the safety of power lines running across river bushland. Rehabilitate any new firebreaks and to ensure burnt bushland is fenced off. Upgrade Speldhurst Crossing for cross-river fire vehicle access during summer. Maintain a database of fires, so that an accurate fire history for the riverland bush can be built up over time. 		<ul style="list-style-type: none"> Western Power WRC Shire WRC
Fence the river and tributaries to exclude uncontrolled grazing in the river	<ul style="list-style-type: none"> Contact landowners on the sections not yet fenced, or where fences are not stock-proof, and seek to enter into arrangements to complete river fencing. Provide fencing materials to river neighbours prepared to fence the river and enter into a Fencing Agreement. Where necessary provide assistance to help landowners erect fencing, etc. Monitor fence condition, fencing needs and stock management in along the river Organise new or replacement fences as funds are available. Once the fencing of the main river is completed, priority will be given to fencing the main tributaries. 	High	<ul style="list-style-type: none"> WRC WRC and river neighbours Beverley service clubs WRC WRC Landowners, with assistance from WRC
Control noxious and invasive weeds in and along the river	<ul style="list-style-type: none"> Survey for Boxthorn and Bridal Creeper and map infestations Undertake control measures. Control small new infestations of Watsonia. Develop a control strategy for wild oats within the Shire reserve adjacent to the townsite Seek assistance from the local community and other voluntary groups to provide weed control. 	Medium	<ul style="list-style-type: none"> “River Friends”/ Beverley Nats Shire Shire Fire management group WRC/Shire
Minimise numbers of feral animals and pests in and along the river	<ul style="list-style-type: none"> Develop cooperative arrangements between the Shire, APP and landowners to institute control programs for feral and pest animals Note and report problems, such as rabbit burrows, high fox numbers. Maintain education programs on mosquito prevention strategies by home-owners. 	Medium	<ul style="list-style-type: none"> WRC/Shire River neighbours Shire Health Officer
Remove rubbish from the river, and maintain its cleanliness.	<ul style="list-style-type: none"> Organise a once-off “Cleanup The River” day. Repeat cleanup day as needed. Conduct education campaign to promote a sense of pride in the river, and to change people’s attitudes so that they do not put rubbish in the river. 	High	<ul style="list-style-type: none"> AWC “Friends of the river” (FOR)
Control/minimise pollution in the river	<ul style="list-style-type: none"> Identify sources of key pollutants. Implement (if required) the contingency plan to handle a major chemical spill in or near the river, developed as part of WAHEMS. Review stormwater discharge from the town into the river, and progress improved systems of wastewater disposal. Increase the application of “Water Sensitive Urban Design”, in particular the development of detention basins to strip sediment and other undesirable components from stormwater. Ensure weed and pest control programs carried out within the river bushland are done so responsibly, to avoid waterway contamination with pesticides. 	High	<ul style="list-style-type: none"> WRC/FOR WRC WRC and Shire Shire WRC, Shire, APP

Summary continued overleaf...

...Summary continued

The Issue	Action to be taken	Priority	Who is responsible
Develop appropriate recreational opportunities along the river	<ul style="list-style-type: none"> • Support the Shire Townscape plan and the Avon Ascent program • Develop a new picnic site at the junction of the Top Beverley Road and the Great Southern Highway. • Integrate education with recreation. • Outside the townsite, promote only those activities consistent with river conservation and recovery and discourage other activities. • Ensure new walking trails occur only with the permission of the landowner where the trail needs to cross private land. • Monitor the impact of recreational use of the river 	Medium	<ul style="list-style-type: none"> • WRC/AWC • Shire • Shire/ WRC • AWC • Shire/WRC • WRC
Ensure effective two-way communication between the community and WRC/AWC	<ul style="list-style-type: none"> • Develop a rivercare message for key audiences in the Beverley area, and communicate these messages over time. • Develop packages of educational material for insertion in curricula at Beverley's schools, to enable teachers to deliver programs on river science, conservation and recovery. • Continue to support the Avon Ascent Program. • Develop a Handbook for River Neighbours, covering issues in this recovery plan which are relevant to people living adjacent or near to the river. 	High	<ul style="list-style-type: none"> • AWC • WRC • WRC/AWC • AWC
Mitigate damage from river flooding	<ul style="list-style-type: none"> • Prepare a Flood Contingency Plan for Beverley. This will encompass prevention requirements and action in the event of a flood. • Develop and adopt an Avon River Flood Hazard Management Plan • Ensure river recovery work, such as installation of riffles and revegetation takes into account their potential effect on flooding of private and public assets. • Allow natural flooding frequency and duration on floodplains where no assets are threatened, so as to encourage natural regeneration and discourage weeds. 	High	<ul style="list-style-type: none"> • WRC/Shire • WRC • WRC • WRC/Shire
Protect historical and heritage sites along the river	<ul style="list-style-type: none"> • Survey the river and environs to identify historic sites. • Seek ways of supporting landowners who wish to protect such sites along the river. • Avoid damaging historic and heritage sites during river management work. • Advise Aboriginal people in Beverley of proposed work along the river. • Invite Aboriginal people to review proposed works, such as construction of "riffles", before commencement. 	Very High	<ul style="list-style-type: none"> • Historical Society • AWC • WRC • WRC • WRC and Aboriginal groups

Appendix one

Management sections of the Avon River

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	11.3
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	Spencer's Brook to Wilberforce Crossing	8.75
Wilberforce	8	Wilberforce Crossing to Burges Siding	9.08
York	9	Burges Siding to One Mile Pool	12.05
Cold Harbour	10	One Mile Pool to Gwambygine East Road	11.40
Gwambygine	11	Gwambygine East Road to Oakover Crossing	5.83
Dale River	12	Oakover Crossing to Edwards Crossing	12.09
Beverley	13	Top Beverley Road to Beverley Town Pool	6.81
Kokeby	14	Beverley Town Pool 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
Yenyening Lakes	17	Upstream from Qualandary Crossing	Indeterminate
Brookton	18	Confluence Avon River South Branch to Brookton Townsite	18.46

Appendix two

Major confluences and pools for each section of the Avon River

Section	Confluences	Pools
1	Julimar Spring (3.0), Mortigup Brook (6.5), Munnapin Brook (8.0), Malkup Brook.	Cobbler (9.0), Long (10.5 - 11.0).
2	Jimperding Brook (2.5).	Diving (2.5 - 3.0), Deepdale (8.0 - 8.5).
3	Toodyay Brook (5.0), Boyagerring Brook (8.5).	Nil
4	Harper Brook (aka Seven Springs) (2.5).	Lloyds (2.0), Millard (3.0 - 5.0).
5	Mistake Creek (4.0), Wongamine Brook (13.5), Mortlock River (17.5).	Glen Avon (0.5 - 1.5), Katrine (5.5 - 6.5), Egoline (7.5 - 8.5).
6	Spencers Brook (6.10).	Northam (0.5 - 1.0), Burlong (4.3 - 5.0).
7	Heal Brook (7.0).	Wilberforce (7.5).
8	Salmon Gully (5.0).	Mackie (3.5 - 4.0), Tipperary (8.5).
9	Nil	Tipperary (0.5 - 1.0), Meares (3.5), 5 Mile (?), York 1 Mile (9.5)
10	Bland Brook (0.5), Mackie River (6.5).	York Town (1.6), Mt Hardy (2.5), Cold Harbour (4.0).
11	Nil	Gwambygine (1.0 - 1.5), Oakover (also known as Fleays) (5.5).
12	Dale River (6.5).	Yangedine (aka Avondale or Broun's) (4.5), Seaton Ross (aka Robins) (10.0 - 10.5).
13	Nil	Beverley (0.5), Speldhurst (2.0).
14	Wannering (6.0).	Eyres (6.5 - 7.0).
15	Turkey Cock Gully (1.5), South and Eastern Branches of the Avon River (5.0), Monjerducking Gully (6.0).	Nil
16	Bally Bally Gully (6.0).	Nil
17	Separate assessment	Separate assessment
18	Mangiding Brook (8.5).	Nil

Note:

The number in parenthesis refers to the distance (in kilometres) at which the confluence or pool is located from the downstream boundary of each section.

Appendix three

Summary survey information for River Section 13

(Information contained in *Avon River Survey Volume 2: Section Condition Summaries and Condition Matrices*, an unpublished report prepared by Ecoscape (Australia) Pty Ltd and Jim Davies and Associates Pty Ltd for the Avon Waterways Committee, 1996)

SUMMARY FOR SECTION 13

Top Beverley Road to Beverley (length: 6.81 km)

Over the downstream cross-sections 13/0.5 and 13/1.0 large accretion bars on both banks of the main channel are stabilised by groundcover vegetation with no regeneration of *C. obesa* or *Melaleuca*. A low flow channel meanders across the main channel, within this channel there are no sediments deposited and the base is flat eroded to an indurated clay. At Spavers Crossing, 13/6.6, the wide accretion bars are not present and the trained channel has no distinct low flow channel. There are no bed features and the indurated clay bed is in a stable condition. There is evidence of salt related death among *C. obesa* in this area.

Speldhurst Pool at 13/2.0 has an alluvial clay bed and no surface sand deposits. Livestock access on the right bank has resulted in groundcover vegetation being heavily grazed and subsequently degraded with the prevention of overstorey regeneration. The pool has medium density overstorey conditions along the 600 m length. This pool requires fencing.

Over cross-sections 13/2.5-13/3.5 a distinct scour channel, to over 1 m deep, has been preferentially eroded through the indurated clay bed of the main channel. Areas of stabilised accretion on bed dunes and on erosional bar features cover 60% of the trained channel at 14/2.5 decreasing upstream. At 13/4.0, adjacent to Beverley Golf Course, the bed is uniformly flat with only isolated bed dunes. This cross-section is heavily salt affected and has algal matting across the bed indicating that a shallow pool exists at this location into summer. A central alluvial bar extends for 300 m between 13/3.7-13/4.0 separating the main channel from a large secondary channel. A stand of

C. obesa that vegetates the bar is dying due to salinity effects. At 13/3.5 there is death of *E. rudis* fringing the main channel.

From cross-sections 13/4.5-13/5.5 there is an increase in the number of secondary channels, these features are located on an extensive alluvial flat on the right of the main channel. Over this reach the main channel is eroded to an indurated clay bed with only minor areas of preferential erosion. Bed dunes cover 30-60% of the trained channel, most are stabilised by samphire. There are only low levels of sand accretion over these structures. At 13/6.0 a distinct low flow channel exists with a wide erosional bar feature on the right of the main channel. On this feature *C. obesa* is successfully regenerating.

No extensive areas of bank or bed erosion were recorded over Section 13. Salt weathering of the channel is extensive and has the potential to increase the volume of clay/silt sediments transported by the Avon. There is an area of saline bed adjacent to the Beverley Golf Course and an increase in the death of fringing vegetation compared to Section 12 downstream.

I Main overstorey species present

Casuarina obesa totally dominates every transect throughout this section, and the other two overstorey species are forming woodlands at most transects. Some of the transects showed complete absence of both *Eucalyptus rudis* and/or *Melaleuca raphiophylla* (13/0.5, 13/4.5, 13/5.0 and 13/6.0).

II Vegetation death

Approximately half of the transects surveyed in this section had a significant level of vegetation death recorded. These were transect numbers 13/0.5-13/1.6 and 132/4.0-13/5.0 inclusive. At these six transects where there was a significant level of vegetation death, it was always the individuals of *Eucalyptus rudis* which were dead or dying. At some of these transects there was also high percentage of dead and dying *Melaleuca raphiophylla* and at transect 13/4.0 there was also some death of *Casuarina obesa*.

III Fencing

Most of the transects in this section were fenced on both banks (13/0.5-13/1.6 and 13/2.5-13/4.5 inclusive). The remaining transects either had no fence present at all (13/5.5 and 13/6.0) or had a fence present on only one side of the riparian zone (13/2.0 and 13/5.0). Most of the fencing present was in good condition, except for transect number 13/5.0 which was fenced on only one side of the main channel and this fence was in a poor condition.

IV Other native species present

The native understorey species present which act to stabilise the rivers' banks are; *Atriplex prostrata*, *Frankenia pauciflora*, *Sarcocornia quinqueflora* and *Sporobolus virginicus*. *Juncus pallidus* is also present on the banks. The other species present composing the overstorey are *Acacia acuminata*, *Acacia saligna*, *Banksia prionotes*, *E. loxophleba*, *E. salmonophloia* and *Jacksonia sternbergiana*.

V Weed species present

Annual grass species were present throughout this section as well as: Tall Fleabane (*Conyza albida*), Corn Gromwell (*Buglossoides arvensis*), Spiny Rush (*Juncus acutus*), Sandplain Lupin (*Lupinus cosentinii*), Soursob (*Oxalis pes-caprae*), Sorrel (*Rusmex acetosella*), an unidentified species of Scrophulariaceae and an unidentified succulent weed in the Amaranthaceae species and a succulent weed (both to still id).

VI Vegetation condition

(according to the 1995 Pen and Scott assessment for the condition of river bank vegetation).

Half of the transects in this section were given a vegetation condition rating of B2-B3, indicating that the understorey vegetation was chiefly comprised of weeds but there were also some native understorey species growing amongst the weeds. The transects that were given this vegetation condition rating were; 13/1.0, 13/2.5, 13/3.5-13/5.0 and 13/6.0. The remainder of the transects were given a vegetation condition rating of B3-C1, indicating that the understorey was only weeds and there was no surface erosion present.

VII Regeneration

Eucalyptus rudis had nil regeneration at every transect in this section. *Melaleuca raphiophylla* had a low regeneration rate (1-100 plants/ha.) at half of the transects in this section (13/2.-13/3.0 inclusive and 13/4.5) and at the other remaining transects there was no regeneration of this species. *Casuarina obesa* was again seen to have the highest rate of regeneration of all three overstorey species. It was classed as having medium rate of regeneration (100-500 plants/ha.). All regenerating individuals at all transects formed mixed aged stands.

VIII Disturbance factors

Transect numbers 13/2.5 to 13/4.0 inclusive showed evidence of livestock in the river and grazing of the riparian vegetation. The livestock present were sheep only. The presence of feral animals (fox dens) was recorded at transect 13/2.0. Evidence of fire on both banks was observed at the final three transect sections (13/5.0-13/6.0) heading down towards the Beverley town bridge. The dumping of rubbish was recorded at transect numbers 13/4/5.0 and 13/6.0, and service corridors beside and across the main channel were present at transect numbers 13/5.0 and 13/5.5. The banks at transect numbers 13/2.0, 13/3.0 and 13/3.5 have had their overstorey vegetation cleared as evidenced by the remnant, dead, large tree trunks and roots masses, and also the high levee banks beside the main channel.

